TRANSACTIONS

of the

ELEVENTH NORTH AMERICAN WILDLIFE CONFERENCE

March 11, 12 and 13, 1946

Hotel Pennsylvania
New York, New York

Edited by Ethel M. Quee

Published by the
AMERICAN WILDLIFE INSTITUTE
INVESTMENT BUILDING
WASHINGTON 5, D. C.
1946

Additional copies may be procured from
AMERICAN WILDLIFE INSTITUTE,
Investment Building, Washington 5, D. C.,
for $1.00 Postpaid
(*U. S. Currency or its equivalent*)

PRINTED IN
U. S. A.

Printed by
MONUMENTAL PRINTING CO.
Baltimore, Md.

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PART I

GENERAL SESSIONS

GENERAL SESSION

Monday Morning—March 11

Chairman: FREDERIC C. WALCOTT
President, American Wildlife Institute, Washington, D. C.

Vice-Chairman: HAROLD TITUS
Chairman, Michigan Conservation Commission,
Traverse City, Michigan

PUBLIC PROJECTS AND WILDLIFE WELFARE

The first general session of the Eleventh North American Wildlife Conference convened in the Grand Ballroom of the Hotel Pennsylvania, New York, N. Y., at 10:10 a.m., Frederic C. Walcott, President of the American Wildlife Institute, Washington, D. C., presiding.

ADDRESS OF WELCOME

Frederic C. Walcott

We are all pleased to see so many people in attendance at this Conference. The enthusiasm manifested by the large attendance at this opening session is invigorating. It is gratifying to see so many of the Canadian provinces and practically every state represented. You will be pleased to know that some of the foreign countries, France for example, are also represented.

They say that conservation is a state of mind. That is an expression that I have borrowed from Nash Buckingham. If it is a state of mind, this audience is solid for conservation. We are just beginning to learn and we have got a great deal to learn yet, that conservation starts from land, air and water. We have got to learn how to till our fields. We have got to learn to keep the erosion out of our streams, so that the water will not be polluted, so that the dams will not fill up and become useless. We speak glibly of flood control. Flood control cannot exist if we use the water for power. Power and flood control are en-

emies. You can't make power from falling water unless you have the water impounded and that defeats flood control.

Now, then, we have a very interesting program. We have eminent speakers. We have deliberately delayed the starting of this meeting for half an hour in order to register the large number of delegates.

I want to introduce first a man who has been always present at these Conferences and who represented Canada for many years. He goes way back into the American Game Association years—years when we first started this annual assembly, away back thirty-odd years ago, in the old Waldorf Hotel. Now, we have graduated and the conference has become large. We used to be guided by the technical explanations of the men who would come from England, Ireland and Scotland. They were the result of hard experience and inheritance. They inherited their knowledge from their fathers, some of them from their grandfathers and their great grandfathers, but they never knew the science of biology, they never knew zoology.

Now, then, we have made a beginning, a very successful beginning. For the past 10 years, we have had cooperative research units that are training young men along the lines of sound game management, research and field work. Consequently, we are now facing a bright future. We have in the near future a tremendous pressure being borne by the returning soldiers. They have lived out of doors from one to three years. They have learned how to live out of doors; they like it, and they want to be back here camping, fishing and hunting. So that there is going to be an additional pressure on our game reserves. Therefore, we must be studious, careful and watchful and protect our renewable assets.

Our first speaker, a man from Canada, always has some news for us. He is going to introduce Mr. Vogt, who will speak to us on what we are doing in Mexico, what we are proposing to do in Chile, Guatemala and Venezuela.

I call on our dear friend, Hoyes Lloyd.

PAN-AMERICAN CONSERVATION

HOYES LLOYD

Chairman, International Committee for Bird Preservation, Pan-American Section, Ottawa, Ontario, Canada

and

WILLIAM VOGT

Latin American Representative, International Committee for Bird Preservation, Pan-American Section, Washiington, D. C.

MR. LLOYD: I was to have given you some account secondhand of what the Pan-American Section of the International Committee for Bird Preservation had done in Pan America, just to tell you accomplishments, not what we plan to do. I do not have to do that. We are very fortunate at the last moment in getting in touch with William Vogt, who happened to be in this part of Pan America. He is going to speak to us this morning and give you firsthand instead of secondhand information.

Here is the latest report prepared by Mr. Vogt. Mr. Vogt's talk, which follows, will be in elaboration of this report.

REPORT

I submit herewith brief report of my recent activities as Latin American Representative of the Pan-American Section of the International Committee for Bird Preservation.

In my capacity as Chief of the Conservation Section of the Pan-American Union, I have been traveling most of the last two years in Latin America. The fact that I was also representative of the International Committee for Bird Preservation has been of great assistance to me, especially in organizing or making contacts with national groups.

In the course of my work I have reorganized our National Sections in Mexico and Chile, and the Chilean Committee has been given official governmental status and will presumably receive a subvention from the government. A National Section has been organized in Guatemala and arrangements have been made, subject to the approval of our Executive Committee, for a newly formed Conservation Committee in Venezuela to be the representative in that country of our Pan-American Section.

Largely through my efforts, Cape Horn National Park, extending from Cape Horn to the northern tip of the Wollaston Islands and including an area of some 750 square miles, was set up.

In Mexico I initiated and have helped organize a new section in the Ministry of Education that has begun to teach conservation in all

public schools of the country. At the request of the Minister of Education I wrote a 100-page booklet on conservation which has been distributed in two editions totalling 75,000 copies.

In Mexico, with the financial support of the Pan-American Section, a series of thirty radio broadcasts on conservation was arranged. It is expected that these will be published in Spanish in an edition of about 50,000. I made conservation surveys in Chile, Mexico and Guatemala, and rendered reports to the governments of those countries covering such matters as bird and mammal protection, preservation of national parks, soil conservation, etc. As an indication of the progress that is being made I have been invited to return to Mexico soon to lead a round table on natural resources in the Second Social Sciences Congress. Others leading round tables include cabinet members, former presidents of the National University, etc. This is the first time a foreigner has ever been invited to participate in such a congress. This, of course, gives an unparalleled opportunity to present to most influential Mexican citizens and the Press the importance of protecting birds, mammals, national parks and other habitats. I also organized a two-year wildlife survey[1] of Mexico now approximately half finished, which was generously supported by the Pan-American Section. I am advised that information supplied to Venezuelan conservationists was instrumental in blocking a market hunting concession in that country. Numerous lectures and broadcasts have been given and articles published.

In connection with my work for the Pan-American Union the help of the Pan-American Section is absolutely invaluable, since it makes it possible for me to organize conservationists and to leave a nucleus of interested people to push activities while I am away.

Considerable material has been assembled for the new conservation news letter, which will be published in Spanish by the Pan-American Section and will be sent to National Sections of the International Committee and to conservationists interested in wildlife. This will fill an almost complete vacuum since such material is available in only about two countries in all of Latin America.

Sincerely,

WILLIAM VOGT
Latin American Representative
Pan-American Section

[1]A major expenditure of the Pan-American Section has been the sum of $4,000 which was contributed to finance the cost of a two-year ecological and wildlife conservation survey in Mexico. The following organizations also contributed to the financing of this important investigation: American Committee for International Wildlife Protection, New York Zoological Society, American Wildlife Institute, Boone and Crockett Club and the Camp Fire Club of America.

Mr. Vogt, as many of you know, was Editor of *Bird Lore.* He left some years ago to become the ornithologist of the Guano Company of Peru, where, as a famous ornithologist said, he worked for the increment of the excrement, a most important subject for any of us who like good things to eat and who want to grow things and see them grown in a hungry world.

From there he became Chief of the Conservation Section of the Pan-American Union. He is going to tell you of things that he has seen and things that our section has done. He represents both the Union and our Pan-American Section of the Committee of International Bird Preservation. It is a pleasure to call on Mr. William Vogt.

MR. VOGT: The Latin Americans, like the North Americans, are very well characterized by a story I heard a few weeks ago about a large family Christmas dinner. The mother of the family was eating an oyster cocktail and she noticed Henry sitting across the table with no oysters. It occurred to her he never tasted them, so she took her fork, picked up an oyster and pushed it over at him and said, "Henry, try this oyster," and she put it right into his mouth.

She went on talking and eating her oysters and she got down to the last one on her plate. She thought she had better be generous again, so she picked up the oyster and passed it across the table and said, "Henry, wouldn't you like another oyster?"

Henry said, "I don't like this one."

Conservation implies restraint either from without or from within. There is no need for restraint perhaps when populations are very low, when the pressure on the land, on the natural resources is so small that the depletion is less than the reproduction. But in this world of sanitation, vaccination, typhoid shocks (I am full of those bugs at the moment getting ready to go south, so I speak very feelingly), populations are going up and in a phrase that is familiar to every game manager, the human race is exceeding the carrying capacity of the land. There are now less than 2 acres per person to feed the population of the world.

Latin America is thought of as the great untouched continent able to absorb millions of human beings. Actually this is far from the truth. If you will remember what a relief map of Latin America looks like, you will recall that except for a very few regions, Latin America does not have level land. It has very little land with a slope of 8 per cent, land that can be tilled without special practices. True, it has the great Amazon Valley, but that is an area of such extremely heavy rainfall and such extreme heat that it must be virtually written off agriculturally. The high plateau northwest of Rio in Brazil has a great deal of level land, but that is an area of deficient rainfall and,

again, it has a very low carrying capacity like our own Southwest, and thus it goes for most of Latin America, except for the Argentine pampas. There you have land that is very much like our own Iowa.

Latin America has approximately the same population as the United States. It was settled by Spanish people, by Iberians in whom the urban tradition was exceedingly strong. They were not country people. The ruling classes particularly lived in cities. They thought as city men and they have never developed the countryman's approach to the land that is so characteristic of many North Americans, British, Scandinavians, and so on. So they have very little feeling of what is happening to the land. They are very much in the exploitative stage in their economy. They clean up and get out, which, again, is part of the Spanish tradition. They have grafted that tradition onto the Latin-American Indian tradition of the Inca, the progressive agriculture in which the Indian would hack down some trees, burn them, raise three or four crops and move on to a new piece of land. That worked fairly well when populations were low, but with rising populations the land wouldn't stand it. People have been forced more and more off the little level land there is between the mountains or in areas where the rainfall is suitable up onto the hillsides. There is no part of the world today, I think not even Australia and South Africa, that more generally suffers from soil erosion than Latin America. Forests have been devastated largely by the rotating agriculture of four hundred years. Latin America has been lived in for nearly two hundred years more than North America, that is, all of it. The Jesuits produced excellent maps of the river systems of Latin American in the Seventeenth Century, really amazing maps.

Wildlife, naturally, has taken a tremendous beating along with the destruction of its habitat. With the soil going, floods mounting, water tables falling, with the forests going, with normal plant associations that support wildlife disappearing, the wildlife can't survive.

Now, along with the Spaniard urban attitude towards the land goes a very considerable lack of interest in wildlife itself. The sportsman as we know him is almost nonexistent south of the Rio Grande. Hunting is a practical thing. We think of pragmatism as a North American philosophy, but the Spaniard would have given William James cards and spades on how to get along in a harsh world. Hunting is for the pot and no one worries very much. They don't value what they get enough so that they care about perpetuating it. The people are extremely poor over much of Latin America. They lack protein in their diet and they will shoot anything. It is very striking how the habits of even common birds like robins change when they get into Latin America. Here they are tame, they are approachable; down there it

is almost impossible to get within gunshot of them. It is literally difficult to collect them.

Therefore, conservation of wildlife even more than conservation of resources that can be seen to have a greater economic value is a long tough job. It must be looked at from the long-range point of view. We can't hope to do very much in a hurry. As far as the wildlife itself is concerned, there is not the hunting pressure in the South that there is here and trapping is almost nonexistent except in the extreme southern part of South America. Consequently, that particular drain is not something to worry about. The chief concern is apathy. The whole conservation problem there must be approached from the educational point of view.

That is what the Pan-American Union has been trying to do. An inter-American treaty on protection of wildlife and natural beauty was signed by 18 governments in 1940 and subsequently has been ratified by 8. It came into force in 1940 and in 1943 the Union organized the new division with a grant from the Nelson Rockefeller Office, the Coordinator of Inter-American Affairs, to operate for 3 years. It was a sort of pilot project to see how it would be accepted.

I was fortunate enough to get the job and worked on it. It has a good many headaches but they are interesting headaches. It became obvious that wildlife conservation, national parks and so on, must be approached as an aspect of the total land-use problem. If we can make them see that wildlife and its habitat represent the highest production, the highest use of the land in various parts of Latin America, there is a good chance we can arouse and sustain interest in conservation. So that has been our guiding principle.

The most interesting attempt to put that into operation has been in Mexico. There, with the financial help of the American Wildlife Institute, the International Committee for Bird Preservation and several other organizations, we have had a research man in the field for over a year and a half. What he is trying to do is to get enough of a picture of Mexican wildlife so that we can sell to the Mexicans themselves the value of that resource and also to get the basic facts that can be used to set up an administrative program. A great deal of the land in Mexico is virtually useless. It is quite useless for anything except wildlife. Used for wildlife, it can produce considerable wealth for the country and, incidentally, save the wildlife, save the sport of hunting, and so on. We have tried the same tactics in other Latin American countries, but most other countries certainly are not yet ready for a research program; if we carried it out, they wouldn't do anything about it. I should add that the funds from the United States were augmented by Mexican Government funds. It is the first time I think

in the history of Latin America that such a project has been tackled.

In Chile we have been able to get national parks set up. We are getting similar cooperation in Venezuela and the prospects look very good in Guatemala. Education has been taken up by a number of governments, notably Mexico, which recently passed a rather sweeping law on conservation of soil and water, which included wildlife and which required the teaching of conservation in every school in the republic from the elementary one-room country school up to the university. So we do see signs of progress. However, there is a great resistance. The fact that a law is passed does not necessarily mean that anything will be done; they don't have funds, they don't have money for textbooks, they don't have trained people to work with them.

The standard of living, the well-being, the political stability, the purchasing power, the potentiality for industrialization, all things that are of very great interest to us here in the United States are so influenced in Latin America by destruction or commercialization of natural resources that this whole problem is of serious concern to North Americans. It is very properly something for us to work on here. I hope that as the years go on and as we are able to report additional progress, more definite things accomplished, that we shall be able to count on further support from North Americans south of the border.

MANAGEMENT OF CANADA'S WILDLIFE RESOURCES

HARRISON F. LEWIS
Superintendent of Wildlife Protection, Department of Mines and Resources, Ottawa, Ontario, Canada

The theme of this Conference, as we all know, is "The Place of Wildlife in a Changing World." My subject, "The Management of Canada's Wildlife Resources," is to be considered in relation to that theme.

Many changes that are taking place in the world in which we live are forced upon the attention of everyone. They flaunt themselves, they shout, they thrust into our lives. Yet, amid the welter of change, it is well to be aware of the unalterable nature of many basic relations. We have at all times a most solid foundation for our thinking and our acting, and much that passes for change is merely our discovery or rediscovery of additional tracts of this foundation.

Application of this view to Canada's wildlife resources throws into clear relief the fact that these resources are always important in the economic life of the Dominion. Throughout temperate North America wildlife resources, especially fish and fur, were from the earliest arrival of Europeans a leading incentive to exploration and development; in both Canada and the United States, despite the growth of other great interests, wildlife is still of much importance to a large part of the population. We are sure of the continuing prominence of wildlife in Canada in the future, for more than 90 per cent of the area of the Dominion produces wildlife and on about two thirds of the country's area wildlife is the most valuable permanent crop and, because of natural conditions, is likely to continue to be so for as long as we can foresee.

Canada, which has an area equal to that of the continental United States and Alaska, comprises nine provinces, the Northwest Territories and Yukon Territory. The wildlife within any province is the property of the province, which therefore has the chief responsibility for administering or managing it. The Dominion Government has, however, a number of important responsibilities with respect to Canadian wildlife. These may be stated briefly as responsibility for wildlife resources in the territories and in national parks and other federal reserves, responsibility for administration in Canada of The Migratory Birds Treaty and the Dominion statute that implements it, responsibility for fishery regulations, and responsibility for that element of the national welfare that is dependent upon wildlife and its utilization.

This division of responsibility is, of course, reflected in the adoption and enforcement of conservation legislation. It is also becoming

readily recognizable in respect to scientific research, an essential activity. In research with respect to migratory birds and to special problems of wildlife in the territories and the national parks, the Dominion Government must take the lead. As far as mammals, game fish, and nonmigratory birds are concerned, we must expect the Dominion Government to carry on basic research on problems that are general or widespread, while on the foundation thus provided each province builds a superstructure of wildlife research especially related to provincial or local needs.

That successful wildlife management must include scientific application of the results of scientific research has become a truism. In Canada, as elsewhere, development of such a policy involves employment of personnel highly trained in appropriate divisions of biology. A number of men who possess this qualification are now engaged on various kinds of wildlife work in the service of the Dominion Government. Much scientific assistance with respect to wildlife problems is also obtained through various suitable arrangements with able scientists on the faculties of Canadian universities. Nevertheless, we feel keenly at present the restrictions of Canadian wildlife management that result from an extreme shortage of men with adequate scientific training in the wildlife field. We recognize that, as a result of the recent war and of other historical factors, such a shortage at this time is inevitable and we are confident that it is only temporary. The situation has been brought to the attention of all Canadian universities, so that, from among the multitudes of demobilized personnel and other students who now throng their halls, those with a special innate interest in wildlife and its management may be selected and trained. Only those who have that innate interest should enter this field; all others, no matter how much training they receive, are of unsatisfactory quality; but those who have the natural interest, the ability, and the desire for scientific training should be given the green light.

This is an appropriate point at which to express Canadian appreciation of the invaluable work in the wildlife field that is carried on in this country. We recognize our indebtedness to United States universities, in which Canadian wildlife scientists often receive specialized graduate training; to the Fish and Wildlife Service, the National Parks Service, and other United States federal agencies concerned with wildlife, who exchange information with us and cooperate heartily on every occasion; to wildlife agencies of the various states, who share with us the results of activities in many lines of common endeavor; and to various private wildlife organizations and workers in the United States, who are ever ready to give practical proof of their recognition of the unity of wildlife problems everywhere. Canadians are pleased when

they have opportunities to demonstrate, by extending cooperation from the northern side of the border, their appreciation of such invaluable help.

Much of the Dominion Government's work in connection with wildlife is carried on through the Department of Mines and Resources, while fish and various marine forms are, in general, under the jurisdiction of the Department of Fisheries.

The Department of Mines and Resources includes in its organization the National Parks Bureau, the National Museum, the Dominion Forest Service, the Indian Affairs Branch, and the Bureau of Northwest Territories and Yukon Affairs.

The National Parks Bureau administers Canada's national parks, of which there are now 25, with a total area of 12,404 square miles. This Bureau also administers, in conjunction with the Royal Canadian Mounted Police and in cooperation with the provinces, The Migratory Birds Convention Act. In addition, the National Parks Bureau attends to those aspects of wildlife that have to do with the national welfare as a whole.

An important unit in the Dominion Government's organization for dealing with wildlife is the Advisory Board on Wildlife Protection. This Board consists of government officials representing the various departments and branches of government that have special concern with wildlife. At the Board's meetings important wildlife problems are fully and informally discussed by experienced men, including both scientific specialists and administrators with other backgrounds. The Board is an advisory one, without authority to enforce its views, but the well-balanced conclusions that it reaches have proved, through the years, to be most important and useful foundations for government action.

The Department of Mines and Resources also maintains close and helpful relations with the Bureau of Animal Populations, at the Museum of Oxford University, Oxford, England. This Bureau has made special studies of animal population cycles, which are conspicuous and very important wildlife phenomena throughout most of Canada, particularly in the more northern parts of the country. So important are these cycles in Canada, that every effort must be made to learn more about them, not only that they may be forecast accurately, but also in order to explore all possible means of controlling them.

There is some ground for believing that the increase in numbers of certain predators, such as foxes, coyotes and wolves, which in recent years has attracted attention in Canada, as well as elsewhere, is a cyclic phenomenon. This increase demands serious attention, which is being given to it in Canada, but long experience has made clear that

mere payment of an increased bounty is no cure for the situation. There is every reason to expect relief in due course from the continuation of the natural cycle, which necessarily includes decrease as well as increase, but in the meantime all possible means of ameliorating the situation are being considered and explored.

Another subject that receives close attention at all times is the safeguarding of wild mammals and birds whose numbers are so low that they are in a precarious situation. Brief comments on some of these animals may be of interest at this time.

The trumpeter swan, our largest waterfowl, has been the object of special protective measures in Canada for more than 25 years. Special wardens have guarded the flocks of trumpeter swans, special sanctuaries have been set aside for them, grain has been fed when natural food was inadequate, special investigations have been carried on, and the interested cooperation of the public has been sought. There have been repeated setbacks, especially from starvation, when exceptional cold sealed winter-feeding grounds with ice, and from poisoning caused by swallowing lead shot. Only last month, in mid-February 1946, a flock of 13 trumpeter swans, wintering on Vancouver Island, British Columbia, lost at least 11 of its members from lead poisoning, a scourge against which protective measures are useless. Our chief difficulties in conserving trumpeter swans in western Canada arise in winter, when natural conditions restrict the birds' feeding and resting grounds. Reproductive success of these swans is reasonably good and we have therefore had no occasion to resort to artificial measures of assistance in the breeding season. I am pleased to be able to say that we now conservatively estimate the Canadian population of trumpeter swans at 900 birds and that at the numerous nesting territories that have been located there is practically no human interference with them.

Another species that causes much anxiety is the whooping crane. It has not increased under complete protection as the trumpeter swan has done, but has gradually decreased. At present, Canadian and United States wildlife authorities are intensifying investigation of this great crane, with a view to helping it in any way that may prove to be practicable.

It is a pleasure to report that the pronghorned antelope, which was reduced in Canada, 20 years ago, to such a small population as to give rise to fear that it might not persist, has now a Canadian population of more than 30,000 and is not viewed as being in special danger. The trend of the eastern woodland caribou population, on the other hand, is downward, in spite of protective measures.

Special preserves for beaver, most of which are under the supervision of the Indian Affairs Branch, contain some 50,000 square miles,

and continue to achieve solid and satisfactory success. The beaver population on the preserves increases, controlled cropping yields revenue, water storage is improved, and various other forms of life, such as muskrats and ducks, benefit incidentally.

In various parts of Canada, especially in the Province of Manitoba, the development of large marsh tracts for muskrat production is meeting with similar success. Projects of both of these types are so managed as to be of material benefit to local aborigines and to the nation at large.

A small eiderdown industry that, for some years past, has been carried on, under government supervision, in the region of the Gulf of St. Lawrence, has demonstrated its value as an influence for conservation of eider ducks. Extension of the industry to more northern coasts is planned.

Some large ungulates, such as the elk, the white-tailed deer, and the bison, have in certain areas, including some of the national parks, become so numerous as to give rise to problems connected, not with scarcity, but with overabundance. The problems that these overpopulations create are usually urgent and, if not promptly curbed, inflict severe and lasting damage on the range on which the browsing and grazing animals depend. Under the conditions existing in Canada's national parks, we have found it imperative to reduce some of these surplus populations by carefully organized slaughter. Care is taken to utilize to the best advantage the meat and hides that result from these management operations.

In the Northwest Territories, the cold climate and the relatively limited soil resources are not favorable to heavy or rapid production of wildlife. Consequently, although the wildlife of these territories forms an impressive total, it could be reduced quickly by overuse and is sparse when considered in relation to the area over which it is distributed or in relation to the population of Indians and Eskimos that is dependent on it for the necessities of life.

As a result, it has been found necessary to restrict very closely the privilege of hunting and trapping in the Northwest Territories.

Five large preserves, with a total area of 917,194 square miles, have been set aside for hunting and trapping by aborigines. In the remainder of the Northwest Territories white persons may hunt and trap only under authority of appropriate licenses, which are issuable only to the following classes of individuals:

1. Residents of the Northwest Territories who, on the 3rd day of May 1938, held hunting and trapping licenses and who continue to reside in the Northwest Territories.

2. Those British subjects who are children of persons who have

had their domicile in the Northwest Territories for the past 4 years, provided such children continue to reside in the Northwest Territories.

3. Such other persons as the Commissioner of the Northwest Territories may, in exceptional cases, decide are equally entitled to licenses under the Regulations.

It will be seen that it is practically out of the question to grant licenses for hunting and trapping in the Northwest Territories to persons not already established there.

In the Yukon Territory, where there are some significant differences in local conditions, hunting and trapping licenses may be obtained by all comers on payment of the required fees.

Many of those present will, I am sure, wish me to say a word about the waterfowl, which are produced in such large numbers in Canada, especially in the west. In recent years much has been done to aid the wild ducks of the Canadian prairies. The organization in the Canadian Department of Agriculture that is known as the Prairie Farm Rehabilitation Administration has, since its inception in 1935, spent $20,000,000 of public moneys of Canada in the construction and development of more than 25,000 water projects, including 5,500 dams, on the Canadian prairies. In spite of this substantial assistance and of aid from numerous other sources, the ducks of western Canada did not have a very encouraging year in 1945. The spring was abnormally cold and late, but a much greater hindrance to reproduction was a very large drought area that covered southwestern Saskatchewan and southeastern Alberta and extended far north along the boundary between these two provinces. In many parts of western Canada ducks were unexpectedly scarce in the hunting season of last fall and the hunting was correspondingly poor. Very likely this is in part a reflection of extensive drying up of important northern breeding grounds, in the region of the Athabaska Delta, where the water table has been falling for some years past. Very careful consideration will have to be given to the management measures that the continental stock of ducks and geese will require in 1946.

During the recent war, the efforts of the National Parks Bureau to develop its limnological service made little progress because adequately-trained limnologists were practically unobtainable. One who joined the Parks Bureau for a time subsequently enlisted in the armed forces and was killed in action in Europe. With the employment of another competent limnologist in the latter part of 1945, the Parks Bureau has again begun to make substantial advances in the development of its services relating to fresh-water game fish in the national park.

At the North American Wildlife Conference in Chicago in 1944, I

spoke of the anticipated expansion of civilian air traffic in the less thickly settled parts of Canada and of its potential threat to the stocks of game, fish and fur bearers in places hitherto considered remote. The expected expansion of civilian air traffic has now begun. It will doubtless be very painful at various points to those charged with the responsibility of conserving wildlife resources, but it is believed that the technical difficulties and the hazards involved in operating air craft in undeveloped country away from established routes and airfields will make the rate of growth of this new hunting and fishing service slower than was once feared. This condition, it is hoped, will provide the time needed by administration to devise and apply, in the light of increasing experience, such controls as the situation will require.

In brief, the years immediately ahead may be expected to be a period in which, with the aid of highly-developed and ever advancing scientific techniques, we must engage in greater and more intensive economic utilization of our wildlife resources and, in spite of that increased utilization, ensure preservation of adequate breeding stocks and maintain reasonably large wilderness areas.

GAME PRESERVATION AND REGULATIONS IN FRENCH COLONIES (AFRICA)

FRANÇOIS EDMOND BLANC
Secretary, Committee of Colonial Sportsmen, Ministry of Colonies, Paris, France

Before speaking of the game situation in Africa, a few words on the present position in France may be of some interest to you.

At the time of liberation, the position of the various kinds of game was essentially different according to species. While some of them had sharply decreased in numbers as a result of poaching and of lack of vermin control, others had increased greatly because there had been no hunting or shooting for 4 years. Except in a few districts, the Germans did very little shooting in France, particularly during the last 2 years, as they had little time to spare.

One species has increased tremendously—the wild boar. In 1943 and '44 these animals had become a real menace to farming. In the autumn following liberation, their number had to be reduced in order to protect the crops. In one department (Marne) some 14,000 were destroyed in the winter of 1944-45. In spite of this there still are many more of them than in 1939, and some can be found as near as 25 miles from Paris.

Unfortunately, the situation is reversed for the red deer and the roebucks, which have greatly diminished in number and have even almost disappeared in certain areas, as in the Normandy forests, close to the coast, where soldiers were always numerous. The Germans have killed large numbers, as they are their favorite game. The arrival of allied troops has made the situation worse.

For the chamois the situation varies in the Alps and in the Pyrenees. They have increased much in the Pyrenees, owing to the fact that poaching had become difficult on account of the strict German policing of the Spanish border and of the lack of firearms in Spain. In the Alps the border was poorly watched by the Italians and poaching was prevalent. A dead chamois was sold for three to five thousand francs, so they were much sought for.

The few bears still living in the Pyrenees breed regularly and hold their own. The number is estimated at about 300. At certain seasons they prey mostly on sheep, so control is necessary.

The situation is very bad for the lesser game. Pheasants have almost disappeared through poaching, or have been decimated by vermin. So have partridges, particularly in the Paris region. On one large preserve where, for instance, 1,200 partridges had been shot on the opening day of the shooting season in 1938, only 12 were shot in 1945. The very cold winter of 1944-45, when snow remained long on the ground, had something to do with this tremendous decrease.

Hares are abundant, for no apparent good reason, as they were badly poached and much shot by the Germans.

Rabbits have disappeared in certain districts, where they had been extremely abundant and had first increased beyond all proportions. Epidemics, caused by overpopulation, wiped them out.

The situation of the migratory wildfowl is satisfactory, as no shooting has taken place on the Channel and Atlantic seashore for 4 years.

All told, the position of the game in France is bad, but it is not desperate. Proper protective measures can soon restore it to normal if they can be enforced quickly.

FRENCH AFRICAN COLONIES

In the French African Colonies the situation of the game is not bad, as far as we know. In spite of lack of control, difficulties in transportation and shortage of ammunition have resulted in a good deal of rest for the animals. As far as the future is concerned, we have high hopes as great changes have been made recently in the reorganization of the protection of natural resources and the shooting regulations in the French Colonies.

Main object of my visit to the United States is to report to you on

this subject. So far we have been rather backward in protective measures and national management of the game resources of the Colonies. I believe the new system of measures recently decided upon, on the recommendation of the Comité des Chasses Coloniales, is entirely new and shows great progress over the old regulations. Here is a brief outline of these measures, which were issued in June 1945, and have come into force.

The first ordinance determines the conditions under which game can be hunted, and the organization of the protection of nature in the French Colonies. The governor of each colony is requested to make an inventory of the natural resources, and also to prepare a plan for their national exploitation. Two different types of areas have been defined: First, those with a dense human population, where agriculture is prevalent, and where wild animals have to be kept in check accordingly by appropriate regulations. Second, those unfit for intensive cultivation and with few inhabitants, where proper management of natural resources for sport and tourism, as well as for their scientific interest, should be the dominant purpose.

The same bill creates, within the Ministry of Colonies, a body of game wardens and inspectors of natural reserves, who are completely independent from the forestry service. They have charge of the enforcement of the game regulations and the organization of touristic sport, and also of the management of national parks, wildlife preserves and refuges.

A second bill sets up a Colonial Council of Sportsmen (Conseil Supérieur de la Chasse aux Colonies), the object of which is the study of all questions concerned and the suggestion of proper measures to the Minister of Colonies. They consist of: (1) game laws for each colony; (2) measures for the enforcement of regulations, and (3) creation and management of reserves and parks. In a few words, all that refers to nature preservation and sport in the Colonial empire comes within their scope.

This Council consists of 23 members: 15 are chosen from among sportsmen, including representatives of the main federal and colonial associations; 3 representatives of the National Museum of Natural History, and 5 officers of the Ministry of Colonies.

It has been thought that regulations for the preservation of the game could only be effective if colonial sportsmen themselves would approve of them and help in their framing and enforcement. That is why the largest representation is given to them in the new Council. These delegates are elected by the local associations of sportsmen in each colony so that they truly represent the local opinion in each case.

The present Chairman is Colonel C. H. de Boislambert, a well-known

big-game hunter. Among the members are our friend Jean Delacour, who represents the Comité for Bird Preservation; Prof. A. Urbain, Director of the Paris Museum; Prof. C. Rivet, Prof. R. Heim, Mr. M. Ducrocq, Chairman of the Conseil International de Chasse; Count A. de la Chevasnerie, myself as the representative of the C. L. C. F., and several other well-known naturalists and sportsmen.

A third bill has set up a Council for Nature Protection (Conseil Supérieur pour la Protection de la Nature). Its purpose is the study and proposition to the Minister of all projects for the creation and management of nature reserves, taking into account the three aspects of science, technicality and economics. The majority of the members are scientists, but sportsmen and colonials are also represented.

As the United States has long been leading in the world movement for the conservation of natural assets and resources, we have thought that you would be interested to hear of the new organization set up for the French Colonial Empire.

American scientists, sportsmen and tourists who want to visit French colonies will now be able to deal with well-informed representatives, who will welcome them and help them efficiently. They will have to apply first to the Inspecteur Général des Chasses at the Ministère des Colonies, in Paris, Colonel P. Bourgoin, a well-known army officer who has organized the French Airborne corps after the pattern of allied paratroopers units. He is well-known to his American colleagues and you are certain to find him most helpful and cooperative.

WHERE ARE WE AND WHAT TIME IS IT?

E. SYDNEY STEPHENS
Chairman, Missouri Conservation Commission, Columbia, Missouri

The First North American Wildlife Conference was held just 10 years ago. During the decade that has intervened progress has been made in wildlife conservation, but in some respects ground has been lost and mistakes have been made. Many evils have persisted. Meanwhile, we have been through the most devastating war in history. As we face the future, with the certain prospect of increasing demands on our natural resources, it is well to pause and ask ourselves: WHERE ARE WE AND WHAT TIME IS IT IN WILDLIFE CONSERVATION?

What is the current status of our natural resources—our game, our fish, our forests? Have they increased or have they diminished? That is the test of our progress. There have been gains here and there. Most conspicuous is the restoration of migratory waterfowl—a very definite improvement despite the disappearance of 20 or 30 million ducks. Occasional improvements in game and fish in this or that quarter have occurred, but I do not know of a single hunter's or fisherman's paradise anywhere in America, unless the pheasant extravaganza of the Dakotas may be so regarded. But if ever the land-use practices in those states change, or if exploitation overtakes them, and/or disease plus a succession of bad hatchings, the curtain will fall on that magnificent spectacle.

There are ugly spots in the wildlife picture. The standard of sportsmanship in this country may be improving, but it is far from perfect. We still read and hear about exploitation, commercialization, game hogs and violators, and we all know that they exist despite education and law enforcement. But we are inclined to think of them in terms of uncouth, uninformed and sometimes criminal individuals. There is no doubt that such gentry are with us, but we are prone to overlook the organized and well-heeled predators of special privilege. By "reason of strength" they gobble up the choicest shooting grounds, to the detriment of the G.I. hunter. They frequently ask to be exempted from restrictions which they insist should be placed upon others less fortunate. We can't have such pre-emptions and exemptions if we expect conservation to click—not in a democracy. Too many hunters and fishermen regard bag and creel limits as goals to be attained rather than deadlines beyond which they may not go.

What about the administrative agencies—those that may be regarded as efficient? None of them is perfect and no agency, state or national,

is completely secure. There is danger that we may "lose the common touch." Whenever we take refuge behind Civil Service or Constitutional Amendments; whenever we become smug or complacent, not to say callous to informed public opinion or friendly and sincere conservation cooperation, we shall be, in the words of the late and unlamented Schicklgruber, Kaput.

I am assuming that you all appreciate the vital importance to society and to wildlife of soil conservation and of its major objective—the prevention of soil erosion. Wildlife's biggest stake is in soil conservation. By taking away the food and cover of game and by silting the streams, erosion has destroyed more game and fish than all the shooting, trapping, casting, dynamiting, and gigging combined. And erosion continues. If you want to know where your wildlife has gone, read Louis Bromfield's great book, "Pleasant Valley." If you want to know how to bring it back, read the book again!

Wildlife has a big stake in dams, whether designed for flood control, navigation, irrigation or electric power, and regardless of whether they are built under the jurisdiction of the Army Engineers, the Reclamation Service, or valley authorities. Many dams have been proposed, a number have been authorized, some are under construction, and some have been built. In no instance with which I am acquainted have the wildlife interests been given more than mere passing consideration. The most that they have received has been lip service. The Army Enginers say that natural resources deserve attention; that soil conservation is an important activity, but not for them. The advocates of valley authority give it but scarce attention. All of them place the cart before the horse. They deal with the effect rather than the cause. As a matter of fact, soil conservation is basic to the solution of flood control, navigation and irrigation, to say nothing of the fundamental economy of the Nation. Unless and until that vital premise is recognized, grave mistakes will be made and irreparable damage will be done. The temporary truce which has been established between the conflicting agencies is not likely to result in the solution of land and water problems. As presently conceived, it is certain that wildlife will suffer at the hands of these projects. Whenever the people as a whole realize what most dams will do to their natural resources, and to their way of living, there will be radical changes.

The function of conserving our natural renewable resources, and protecting them from damage and exploitation, is performed by organizations and agencies, national and state. Of organizations we have a plenty, all directed at a common goal. Perhaps we have too many! This is a list of them, though an incomplete one: The American Wildlife Institute, sponsor of this Conference, the National Wildlife

Federation, the International Association of Game, Fish and Conservation Commissioners, the Izaak Walton League, Camp Fire Club, the American Forestry Association, the Sportsman's Club of America, Ducks Unlimited, the American Fisheries Society, the Wildlife Society, the National Grange, the Farm Bureau Federation, the National Audubon Society, the Farmers Union, the Friends of the Land, the Outdoor Writers Association of America, and some 35,000 state, county and local organizations.

These are the agencies, federal and state: The U. S. Fish and Wildlife Service, the U. S. Forest Service, the National Park Service, the U. S. Department of Agriculture, and 65 state departments, including two in Pennsylvania, two in the state of Washington, and 16 in the state of Nevada, all actually, or presumably, devoted to the conservation of our natural resources and the soil which produces them.

What have all of these groups and agencies accomplished during the decade just ended? What have been their weaknesses and their failures?

The answer to the first question is easier because it is shorter, much shorter. In the national field outstanding progress was made by the passage of the Pittman-Robertson Federal Aid to Wildlife Act, by the fabulous recovery of migratory waterfowl and by the projection throughout the Nation of soil conservation. All have contributed or will contribute substantially and effectively to the welfare of wildlife. The Federal Aid program has provided the states with funds with which to acquire areas for habitat, to develop them, and to carry on essential research. The many projects in research made possible by that aid have contributed immeasureably to improved wildlife management and to the abandonment of outmoded and wasteful practices. The Act, however, has not been put to its maximum use. The Congress should appropriate more of the 10 or 12 millions of dollars now lying unused in the Treasury; the law needs to be amended to permit the use of a portion of the funds for the maintenance of areas acquired under it.

The activities of the Soil Conservation Service during the past decade have constituted one of the outstanding benefits to the economic and social well-being of all of the people, as well as to wildlife. Conserved and protected soil and its improvement are vital to the preservation of civilization. If sound land management is achieved, fish and game will be one of the beneficiaries. Conspicuous in the progress of soil conservation has been the enactment by 47 states of soil conservation district laws which will carry good land management to the very doors of the farmers of the Nation.

These concrete examples of conservation progress are gratifying, but

they are not the most significant. Of far greater importance and value has been the progress in basic thinking. The fundamental concept that "all land and all products of the land must be considered in building a balanced civilization" represents the longest step forward that we have taken. For this we are indebted principally to the biologists and soil technicians of the Nation. The sad fact, however, is that that conception has not reached far enough. While the federal and a few state agencies have accepted it and are attempting to practice and to project it, too many state agencies have not, and too many people, rural and urban, don't yet know anything about it. Somebody ought to tell them. Who is going to do it? It could be done by any one or all of the multifarious national and state organizations dedicated to the task of conservation. Is it being done? The answer is "no." Despite the zealous and sometimes consecrated efforts of their designated leaders, I know of no group which can claim to be even halfway successful.

Ten years ago there was an upsurge of enthusiasm among conservation leaders throughout the Nation. That was when, under the evangelistic exhortation of our beloved "Ding" Darling, the National Wildlife Federation was created. It was hailed by all of us as the "happy issue out of all of our afflictions." As a confederation of 48 state groups, it was to strike the spark of conservation in the minds of two million hunters and fishermen; it was to aid them, through local, state and national organizations, to secure better state administration, to rescue it from the lethal hand of partisan politics; it was to secure better federal legislation for wildlife, and it was to conceive, project and establish a system of education in conservation and offer it to every child in the Nation. But it has not succeeded. Its failure has not been the fault of its author or of those who have struggled to develop it, not to say keep it alive. Nobody knows why it has not been successful, but at the end of 10 years "Ding" has been constrained to appraise the present situation thus: "Conservation is a sissy, with ruffled pantalettes, a May basket in her hand and a yellow ribbon in her hair."

We are not concerned here as to who is to blame, but rather where the weakness lies. It lies principally with state administration. Since upland game management and inland fisheries are the responsibilities of the several state departments, let's look at that picture. It's not pretty; in too many quarters it's ugly as hell! While there have been some changes in state setups, several of them have been badly bungled and will be of doubtful value. At best, there has been no transformation or metamorphosis in those agencies which are supposed to perform the principal function of wildlife conservation in America.

An appraisal of state administration can be made by applying a few simple and reasonable standards. Here they are: Adequate legal au-

thority, employment of trained personnel, the development of wildlife environment, education, practical research, cooperation with landowners, and the support of citizen organizations.

Judged by these standards, here's how the states rate—how they rate on the basis of their own statements: Twenty-five are lacking in adequate legal authority to administer wildlife resources or to regulate their use. Regulation is essential to conservation; the two are inseparable; to divide them would be like trying to build a savings account and giving a second party a book of blank checks. There is a lot of false phobia about wildlife regulation in the hands of state departments. It is not dangerous; it affects no property right; it invades no private right; it is nothing more than rationing the annual crop; it is an essential administrative function. Sixteen states employ no trained technicians whatever, or are not better than 20 per cent equipped or manned. Fourteen give no attention to the improvement or development of environment. Twenty-one carry on no cooperation with any group or individual. Fourteen make no effort whatever in the field of education, and twenty others do not claim to be more than 50 per cent efficient in that vital field; none is more than 70 per cent efficient. Twenty-three, or practically one half of the states, do not carry on research of any kind. Nineteen do not cooperate with any landowner or land-use agency. Five states maintain no forestry departments or agencies and six states have no cooperative forest fire prevention and control programs—all this despite the fact that forests are inextricably related to wildlife, that trees prevent soil erosion and thus contribute to flood control; and the further fact that the value of standing timber in this Nation is about 10 billion dollars. Twenty-three complain of the absence of adequate support of organized groups. The turnover in directors is faster than a jet-propelled plane. Their average tenure in office is 5 years and 25 days. Only eight, including the perennials—Seth Gordon, E. Lee LeCompte and Mack Hart—have been on the job as long as 10 years. Fifteen have served 3 years or less.

By these standards, the departments of 12 states are less than 25 per cent efficient, and 30 rank below 50 per cent; and only 5 have a "passing" grade of 60 or better. The 12 states which rank less than 25 per cent efficient collect from sportsmen and expend $2,345,100 annually. Since they are so pitifully deficient in the application of so many sound practices; since they are expending expending money for outmoded and even detrimental practices; since they are dominated by politics, the money which they expend is wasted—all to the detriment of wildlife. They should be painlessly but promptly put to death. The next 18 might be given a stay of execution on their promise to reform.

What are we to do about it? Nobody knows the complete answer. But we do know that there are a lot of people interested in more wildlife and better living, and that includes just about everybody—everybody who eats, wears clothes and lives in houses. They can be expected to do something once they are aroused.

The greatest opportunity at the moment for such an arousal lies in the lap of the outdoor writers of America, if only they know it and know how to seize it. The 600 members of that group, located throughout the country, can write a lot of copy which will be read by a large number of people and which will do a vast amount of good.

If the outdoor writers learn what conservation is and what it takes to fill creels and bags, they can do more right now than any other group or agency. The trouble is that about 98 per cent of them apparently don't know what it's all about. They either clip and paste, or they write glowing accounts and publish pictures of what Joe Doakes killed or caught last week end, which only invites and incites millions of others to "go and do likewise." But "nary a word" about what it takes to put fish in streams or birds in fields. Too often they preach the heresy of promiscuous restocking of fields and streams and keep alive in the minds of hopeful and greedy nimrods and fake state departments the vain hope of more game from incubators and brooders, and they completely ignore Mother Nature, who can do a vastly better and bigger job. Speaking of restocking, pen-raised birds, etc., read Nash Buckingham's latest gem, "Game Bag."

Their defense is: "We must have news; we can't get by the front office with encyclopedic and high-brow stuff." Well, taking them at their word, I ask them, wouldn't it be interesting and intriguing, not to say news, to tell their readers that foxes which live alongside deer don't rob chicken roosts; that deer shed their antlers, from which moles and mice extract the lime; that, once saturated with calcium, these rodents (the choicest food of the fox) satisfying Reynard's craving for calcium and leave him content not to risk his life by invading the farmer's chicken house? Wouldn't it be news to a lot of people that Bob White is a lonely bachelor seeking a mate; that bachelors in the quail family outnumber the Benedicts; and that by combining those two well-established facts game managers inventory the quail in the nesting season? Which is more thrilling, more sensational, not to say more newsy, that old Bill Jones killed his limit last Saturday in two hours on the old Smith place, or that every five minutes in flood times, the top soil of 100 acres of land floats down the Missouri River; that that top soil contains beefsteak and potatoes, roast duck and broiled quail, and bread and butter with jam on it—more groceries annually than we exported to all our Allies during the biggest year of

the war. Wouldn't managing editors prick up their ears at copy about political exploitation, the practicing of outmoded, futile methods of "game management," waste of sportsmen's money, and other malfeasances of the game departments in the states where outdoor writers know they exist?

This Conference, particularly through its technical sessions, will provide more copy than the outdoor writers can use until the next one rolls around. Unless they take it and use it, no great good will come out of this meeting. All of us here, it can be assumed, know the stake which wildlife, indeed human life, has in sound conservation, but the rank and file of the people, and especially the "sportsmen," don't know it. Unless that story is "carried to the people" this gathering and hundreds of others like it will be "just a bunch of self-styled experts talking to themselves." Yes, there's a lot of copy and it's not high-brow stuff or encyclopedic! How many outdoor writers are producing this type of copy? Not more than a dozen in the whole United States. Here is an inspiring challenge to the outdoor writers of America and a plain and solemn responsibility.

No, the conservation picture is not altogether pretty; indeed it's mostly ugly: it needs a lot of brightening up.

And so, my friends, as we stand "amid the encircling gloom" and when we examine our compasses and our watches, we find that the hour is late, "the night is dark and we are far from home." The least we can do is to pray for a "kindly light" to lead us. The case is not hopeless; it can be cured. That has been sufficiently proved. What we need is light—and LEADERSHIP!!

WHAT IS COMING FOR WILDLIFE?

IRA N. GABRIELSON
Director, U. S. Fish and Wildlife Service, Washington, D. C.

After two years we are again gathered together at a North American Wildlife Conference. It is well that this opportunity has come to those concerned with the important renewable natural resources to consider the many problems that are sure to be met in a confused postwar world. From other speakers you have already heard or will hear of some of the better things to come. It is indeed fortunate that both good forestry and good soil-conservation practices fit into the needs of certain wildlife species. This Nation has a tremendous job to do in restoring the forestry resources that were heavily over-utilized during the war. It is a good omen that forestry agencies, both federal and state, are keenly aware of wildlife's place in an over-all forestry program. This should help to assure the future of big game, fur animal, small game and fish species which utilize forest habitat. All intelligent conservationists believe that an enlarged soil-conservation program is imperative if we are to retain the most vital of all basic resources—a fertile and productive soil. The fact that good soil-conservation practices are also good wildlife practices is again a good omen for the future of the species that are advantageously affected by sound soil conservation.

It seems desirable to outline again the present position of wildlife management and the problems that can be foreseen. There are many worthwhile advantages at the beginning of this postwar period as compared with past conditions and it may be well to mention some of the more important as a background for discussing these future problems.

First, the general public is better informed. While much of the publication and educational work of federal and state agencies was necessarily curtailed during the war by lack of man power or by direct governmental action in reducing the amount of effort not directly connected with the war, private conservation agencies did yeoman service in carrying the burden. Now the public agencies are again resuming their share of the work but they are starting with a public that, on the average, is better informed than it has ever been before. Even under the stress of war, interest was not lost. In fact, because of the tensions that developed, more and more people turned to the out-of-doors for mental rest and physical recreation. The fact that the public is better informed is shown by the increasing correspondence from individuals and local conservation groups and by the more intelligent questions and points of view that are expressed. This is like-

wise impressed upon everyone in the course of individual conversation in attendance at meetings. This is a healthy condition and one which should be used to full advantage in presenting new and improved programs and practices in the years ahead.

The second advantage that comes readily to mind is the fact that better-trained and more numerous wildlife technicians are available. This again is the result of the educational programs that were inaugurated by a number of schools and universities in this country. While there had been a few schools which gave some training in wildlife work, the real impetus to this type of training began in 1935 when the 10 cooperative wildlife research units sponsored by the American Wildlife Institute, the U. S. Biological Survey (later, in part, the Fish and Wildlife Service), the agricultural colleges and conservation departments in the states in which the units were established. Five hundred well-trained men have come from their doors to find employment in the state and federal conservation agencies. Most of them left to go into the armed services but they are now returning to civilian life and the vast majority are coming back to the work for which they were educated. This gives the country an increasingly effective staff of trained men working in the wildlife field and few can estimate the cumulative value of such a force.

The third advantage is the return from the armed services of many of the key men in the various conservation agencies of the Nation. These are in addition to the technicians who have returned. In connection with their military service, many of these men have had field experiences which have broadened their vision and understanding and intensified their interest in conservation programs. Because of this very fact, these men can be counted on to give added impetus to the work.

Another present advantage, though one difficult to estimate, is the permanent effects of previous wildlife development work. Within the decade immediately preceding the war American conservationists had for the first time the opportunity to effect environmental restorations or improvements on a scale large enough to have permanent effect upon wildlife populations. The benefits of this work continued to be felt during the war even though very little additional activity was possible because of the shortages of man power and materials. This cumulative value is found in every field of wildlife management. Upland game species have benefited particularly by forestry practices which have included the purchase and restoration of land to the growing of forests that should never have ceased to grow trees. In some states additional winter range purchased with conservation funds made avail-

able by the Pittman-Robertson program has provided a better balance between the summer and winter food for big game and has made possible the carrying of larger herds than under previous conditions. Forestry and soil-conservation activities, as well as the work of the several state conservation departments, have resulted in the development of many projects that have brought permanent improvement in both the big game and small upland game conditions. From this, the Nation will continue to benefit for many years to come.

The continental waterfowl-conservation program, which includes the development of new marshes and the restoration and improvement of marsh land by public and private agencies in both the United States and Canada, has been an outstanding success. The waterfowl population is more than four times as great as it was in the period when it reached its lowest point in the middle 1930's. While development work on waterfowl environment was generally curtailed during the war, the areas which had been developed continued to produce feeding, breeding and resting grounds for the continental flights of these important species. There is some evidence to indicate that waterfowl breeding conditions will be somewhat less favorable during the next few years. Evidence indicates another drought cycle is developing. If not this year, it will be by good fortune alone, since sooner or later the drought conditions that prevailed during the '20's and '30's are bound to return with some degree of intensity. The very fact that these developments are now in existence makes it possible to get the most out of available waterfowl marsh and thus to cushion the effects of drought upon waterfowl and related forms of wildlife. In other words, it is the best possible form of insurance against the disastrous conditions that prevailed 10 years ago.

In the field of the other major aquatic resource, the fisheries, improvements of various kinds suitable to the needs of the streams and the fish inhabiting them, have been installed in ever-increasing numbers. Farm ponds have been developed by the thousand, many of which are excellent for the production of pond fish of various types. As a result of research, better management practices are gradually being introduced and used on public waters, important to both river and lake fisheries. Even in the worst years, assuming that drought and unfavorable conditions may re-occur with all of the intensity of the previous drought cycle, these various development programs and habitat restorations will produce some wildlife and to that extent will be a floor underneath the decline in populations which should prevent conditions deteriorating so far as they did between 1915 and 1935. This means, of course, that these areas will operate in this fashion provided the Nation does not get hysterical and do things that would

upset the well-balanced and established programs that have made so much progress during the last 15 years.

However, everything is not all rosy in the field of wildlife. I have enumerated some of the outstanding advantages at the beginning of this postwar era. Nevertheless, there are some disadvantages, perhaps they should be called additional problems, that are staring conservation agencies squarely in the face. The first of these is the great increase in hunting and fishing pressure. I need only cite the figures that are available for the sale of duck stamps. For the fiscal year July 1, 1944 to June 30, 1945, duck stamp sales totalled $1,487,029, an all-time record. This represents an increase of approximately 300,000 stamps after 2 years of slowly declining sales. While the final 1945 figures will not be available until September 1, 1946, a comparison of the records of the sales show that in the period July 1 to December 31, 1944, sales totalled 1,283,466 while for the corresponding period in 1945, 1,540,468 stamps were sold, or an increase of 257,002. On a comparative basis, this means that somewhere in the neighborhood of 1,700,000 stamps were sold during the last waterfowl season. It seems obvious that only a fraction of this increase can be credited to stamp collectors. Hunting license sales during the 1944-45 season so far reported soared to 8,190,901 in numbers and to $15,512,252 in revenue. The increase in licenses amounted to 685,643 while the fees were augmented by more than two million dollars. Although travel restrictions and the rationing of gasoline and tires were still in effect during the last hunting season, nonresident hunting license sales jumped from 107,686 in 1943-44 to 154,363 in 1944-45. These figures tell the story. The latest fishing license figures, those for the fiscal year ending June 30, 1945, tell the same story. The purchasers of 8,280,232 fishing licenses paid a total of $10,580,311 into state conservation funds, an increase of 449,755 licenses and $740,238 in money over the previous year. All this means that an increasing number of people are seeking the out-of-doors for rest and recreation and that there is an increased pressure upon all of the species of wildlife that are hunted or taken with a rod and line.

Another serious problem to be faced is the fact that exploiters and those who are always ready to take selfishly as much as they can get are becoming much bolder. This also follows the pattern of the last war when in the postwar period many vicious battles were fought against the exploiters out to raid the resources that were still left. This type is always with us waiting to take advantage of the slightest relaxation of vigilance on the part of public and private organizations or of the slightest letdown in public interest. Therefore, more legislation of the type of H. R. 4362, a bill to abolish the Parker River Refuge in Massa-

chusetts, may be expected. This proposed legislation represents the latest effort of a small group of exceedingly selfish sportsmen to destroy a refuge. When these men started their opposition, the Service was told that they were not opposed to refuges but merely wanted them placed elsewhere with the plain implication that the conservation of waterfowl populations might be practiced for their benefit at the expense of other communities. Long after the refuge purchase had been started, I was told personally by one of those who began the agitation that they had the money to keep it up and that they fully expected eventually to destroy the refuge. It remains to be seen whether this attempt to impose locally selfish desires over the advantages and necessities of the national program to which every community could well contribute profitably on a much greater scale than is asked of those affected by the Parker River Refuge will succeed. Very little of the land in the refuge is at present of value for migratory waterfowl. However, it can be made to produce much more food than is now available and to add some acreage of additional breeding grounds that are so desperately needed in the Atlantic Flyway. The bill has been reported out favorably in the House. Conservation forces without delay should align themselves against it and against any similar bills either state or national designed to destroy the integral parts of an environmental restoration and management program which still has far to go before it accomplishes the maximum results possible.

I am citing this as a typical example of the tactics that may be expected from those who have an ax to grind and who are willing to go to any lengths in misrepresentation in order to establish their position.

An additional problem for those interested in wildlife is posed by the development programs in various stages of planning by both federal and state agencies. These include plans for super-highways, plans for scores of additional landing fields and plans for the building of seven or more billion dollars' worth of dams for irrigation, flood control, navigation, or hydroelectric power. If carried out, all of these will affect wildlife populations in some way. Looking forward, it may confidently be expected that highway development will ultimately open up many of the areas that have served as reservoirs of game populations, particularly the big game species. Likewise, it is possible to visualize a time in the not too distant future when a network of landing fields will cover this entire continent, providing quick and easy access at reasonably moderate costs to the more remote parts of the land. The continent already has been spanned in less than five hours and the development of jet-propelled planes is still in its infancy. Possibly within only a few years we may expect to see landing fields for this type of plane so spaced that every part of the continent will be acces-

sible to centers of population while local fields for smaller planes will be available to distribute hunters and fishermen to every desirable spot. Needless to say, this will pose many problems for the managers of these renewable resources and I doubt that anyone has yet thought far enough in advance to visualize completely the effect of this type of development nor the type of regulations and control that may be necessary if the wildlife populations are to be maintained.

The dam construction program is an immediate problem. Many of these structures have been authorized and money has been appropriated for them. It is useless for conservation forces to expect to block all such development. As a matter of fact, few would care to be in a position of total opposition to all future construction. It is possible that some of these projects can have a beneficial effect upon both local and migratory forms of wildlife in the communities in which they are placed. The construction of a dam for navigation reduces certain fish populations and may build others. Where valuable species of migratory fish are involved, they pose a major problem for those responsible for their protection. Sometimes it is possible to work out methods of salvage so that both the construction and development program can go ahead and the run of fish can be preserved. Sometimes modification of the proposed projects can be made that will reduce the bad effects of the original proposal, or even to develop some definite advantages for fish or wildlife. At other times it is impossible and it is then necessary to weigh carefully the comparative values and decide which is of the greatest permanent value to the communities concerned and to the Nation. Dams also profoundly affect other types of wildlife. The impoundment of water often destroys the most valuable upland or waterfowl areas of a community. It might be assumed that water, regardless of its depth, is of value to waterfowl. It has some value as a resting place, but unless there are available nearby shallow areas with more or less stable levels during the growing season, which will produce the plant growth necessary for the protection and food of waterfowl, it will have only small value. Needless to say, this enormous program for the dam construction poses profound problems for all who are interested in the conservation and maintenance of wildlife.

As a fourth problem, it is pertinent to call attention to the increasing amount of pollution in American waters. Considerable progress was made in reducing pollution from municipal sewage in the years immediately preceding the war. This progress has not been lost but increases in population, both around sewage disposal plants and in communities that had no treatment facilities, have increased the flow to the point where in many areas the pollution problem is more serious than ever. New industrial plants are using new types of chemicals, and

producing new pollutants about which little is known. These wastes are often discharged in waters previously undefiled. The fight to control this increasing menace at its source must be carried on vigorously. It is one which could occupy the entire attention of the conservation forces of this country for many years to come. As populations increase and industrial developments proceed, we may expect an increasingly difficult problem in the proper disposal of waste material that necessarily accompanies concentration of population and growing industrial production. Some progress has been made in studying new pollutants and for the first time there are sound standards by which waters can be tested from a biological as well as from the public health standpoint. It has been stated many times that pollutants dangerous to wildlife might or might not be dangerous to public health and vice versa. Now there is in process of publication a series of such standards, which is the result of the work of a small pollution unit that operated just prior to and during the war. This information is soon to be available to all officials having enforcement authority in this important field. Here again, no sensible person can expect that all pollution will vanish. There are some pollutants that defy treatment to render them harmless while other treatments are so expensive that it will be economically impossible to utilize such methods until they are improved still further. Nevertheless, all conservation forces can unite in a determined effort to see that no new waters are polluted and that there is a concentrated effort to clean up those streams that are now unproductive or are producing below the normal quantity of aquatic resources possible if the pollutants were not present.

These, and many other problems are facing conservationists today. Those enumerated are alone sufficient to keep everyone busily engaged if the gains of the past two decades are not to be lost. The Fish and Wildlife Service is anxious to contribute its share to the program of restoration and maintenance of wildlife in as favorable a position as possible. It does not expect to oppose all development but it does expect to use its utmost efforts to influence the development programs so that they will do the least harm and the most good to the various forms of life that may be affected by them. It expects to work cooperatively with the agencies carrying on the development works to the greatest extent possible. It may oppose certain projects because of their large destructiveness to wildlife. For many of them, it may be possible to suggest modifications which will reduce the ill effects and expand the good effects. On the other hand, there may well be some developments where none of the values will be on the productive side of the ledger so far as wildlife is concerned and yet so important to the Nation that it should be built.

Appropriations are now available for carrying on biological studies in cooperation with the engineers on the Columbia River, the Central Valley project in California and the Missouri River project. There is carried in the current appropriation bill now being considered by the Congress an item of $150,000 to enable the Fish and Wildlife Service to carry on similar cooperative studies with the engineers in a number of smaller river systems that are not included in those mentioned above. It is hoped that this appropriation will be granted and that it will then be possible to cooperate with the state conservation agencies in making a careful appraisal of these proposed impoundments and to suggest modifications of the plans prior to the time when construction is actually authorized and the money appropriated. If this can be done, the effect upon the fish and wildlife populations can be made much less serious than has often been the case when uncoordinated studies and efforts have been carried on. Unintelligent opposition to all development cannot help much in this postwar era. America cannot be put in a straight jacket to prevent any further progress but it can be persuaded to use more intelligence in that development than it has used in the past. By keeping our thinking flexible and by making use of the constantly improved techniques becoming available through research, much can be done to see that development programs do not unduly interfere with the national restoration and management program.

The conservation forces represented here today have a big job in a somewhat confused and hectic world if past progress is to be maintained and further gains registered in the effort to obtain a wiser management and fuller utilization of our renewable natural resources.

FORESTS AND FOREST WILDLIFE IN THE POSTWAR ERA

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It is a pleasure to participate in another North American Wildlife Conference. At the Ninth Conference, held in Chicago, I spoke on "Some Federal Functions in Wildlife and Forest Management," and outlined the general forest situation and some of the programs favored by the Forest Service.

Events since that time have focused attention on the importance of the forests as one of the arsenals in the world-wide conflict. Today we stand victorious, but with the sobering knowledge that the cost in human and material resources has been heavy. We face the future with diminished merchantable stands of timber, but with a clearer concept of problems and opportunities in the field of forest conservation and management. It is from this viewpoint that I shall approach my topic of forests and forest wildlife in the postwar era. Perhaps a logical order would be first to explore the forest situation, second to touch on a forest program for the United States, and to conclude with some thoughts on forest-wildlife relationships.

The forest situation.—I'm sure most of you know the general character and distribution of the American forests, but in order to direct attention to the magnitude of the forest area a few statistics may be in order. There are 630 million acres of forest land in the United States. As a cold figure this may not be impressive, but it means that one acre out of every three in this country is classified as forest land. Of the total forest area, about one fourth is not of commercial character. It includes such types as some semidesert areas of the Southwest, the elfin forests of southern California, and the alpine and subalpine sections of our higher mountains. Not ordinarily managed for their wood products, these noncommercial forests commonly possess high watershed values. They are of particular importance to wildlife since habitat conditions are enhanced by natural openings and a variety of cover types.

The 462 million acres of commercial forest is the land to which the Nation must look for its timber products. It is the land capable of growing commercial timber crops and available for this purpose. I want to direct your attention to the condition of the forest cover on this commercial forest area. About a fifth of it is in old-growth stands of which the Douglas-fir forests of the Pacific Northwest support the major timber volume. About one sixth of the commercial forest area is now in a virtually nonproductive condition and must be planted by

hand if a worth-while crop of timber is to be started in a reasonable period. This is the result of mismanagement, including overcutting and fires. These lands constitute a great burden on local economy and a challenge to the Nation. The remaining 285 million acres of commercial forest land has all been cut over or burned. Although a portion of it is well stocked and in a productive class, much of this forest land is not yielding growth in proportion to its growing capacity. This breakdown indicates beyond any reasonable doubt that an unjustifiably large proportion of the Nation's commercial forest land is not in a satisfactory condition.

Now for a few facts as to the ownership of the commercial forest land. Approximately 120 million acres are in public ownership and 341 million acres in private ownership. About two fifths of the private forest is in farm ownership, another two fifths in small nonfarm holdings and a fifth in large holdings of 5,000 acres or more. But the significant thing is that these private forest lands constitute probably 90 per cent of the potential timber-growing capacity of United States. Consequently, it is obvious that the Nation must depend primarily on private lands for its timber supplies.

American forests are still being progressively depleted. The drain is heavy. Over the past 30 years the total stand of saw timber in the United States has declined about 40 per cent. At the present rate of cutting and loss from insects, disease, and fire, the forest drain is at least 50 per cent greater than the forest growth.

The Nation is facing a critical shortage of timber products at a time when abundant supplies are urgently needed for peacetime building. Lumber stocks are at an all-time low. At the same time there is a crying need for a vast housing program, of possibly 1¼ million units annually over a 10-year period. The magnitude of the housing problem is apparent when it is realized that the greatest number of residential units completed in any one year was 937,000 in 1925. Obviously the heavy drain on our forest land will not be of short duration.

A forest program.—I think many of you know the main features of the Forest Service's plans and proposals. Although these have not been materially altered since presented to the Joint Congressional Committee in 1940, they have been subject to constant development and adjustment. Three main categories are involved: (1) public aid to private owners, (2) expansion and development of public forests, and (3) public regulation.

The importance of raising the level of forest management on private lands is apparent when it is recalled that about 90 per cent of the potential timber-growing capacity of the United States is on private

forest lands. Consequently, public aids and services to private owners will be especially helpful.

The program includes the continuation and expansion of existing aids as well as authorization for additional aids and services. Under the first of these would be such measures as advice and assistance to farmers in forest management and marketing. There are at present about 150 projects of this nature, covering 500 counties and 39 states. In order to reach the 3½ million farm woodland owners, and 1 million small nonfarm forest owners, this service would have to be broadened and extended to all of the 2,000 forest counties.

Federal aid to states for the production and distribution of planting stock should be expanded. There is also a distinct need to expand and strengthen cooperative fire control on state and private lands. In addition to improving the effort on areas already under protection, the advantages of this type of aid and service, handled by state foresters, should be extended to the 130 million acres still lacking organized protection.

A very important field in which the Forest Service works, and one which should be expanded, is forest research. Projects which seek to add to our knowledge relating to range, forest, and watershed management, though inadequate, are being carried out in all forest regions. Research results are made available to all forest landowners and operators as an aid in improving the productivity of American forests, both public and private.

There are other existing and proposed programs which could be mentioned, but the ones already referred to are sufficient for this discussion.

The second part of the program embodies expansion and development of public forests. Our proposal includes acquisition by municipal, state and federal agencies. There are certain lands needed to round out existing units, and lands which are unsuited for private ownership or possess values which may not be adequately safeguarded except by public ownership. Within the existing national forests and purchase units there are 35 million acres of land which have been given high priority in our acquisition plans.

To meet the critical demand for forest products, we need to bring more of the national forest acreage under active timber management. Last year the timber cut on national forests exceeded 3 billion board feet. If it were possible to achieve sustained-yield production over the entire area, the cut could probably exceed 5 billion feet a year. As an immediate step toward better utilization and management, the national forests should have many more miles of timber access roads. Under an adequate system of roads to open new areas, the cut could be in-

creased to 4½ million board feet in a few years. This does not mean invasion of wilderness areas. We want to plant 3¼ million acres of unproductive national forest land within the next 15 years.

I want to touch on the recreational value of the national forests. Before the war we had 18 million recreational visitors a year. A significant increase over wartime numbers was apparent in 1945, so much so that campgrounds, water systems, and other facilities, which in wartime had little or no maintenance, were inadequate. It is clear that the demand will outrun facilities, now that travel restrictions are removed and people have more time for recreation. Hunting and fishing use has followed a similar trend. In some regions there was no appreciable reduction even during the war years; locally there were increases. At least two national forest regions reported about 25 per cent more fishermen and hunters in 1945 than the previous year.

On several occasions during the past 3 years, I have talked on the need for public regulation of cutting and other forest practices on private lands. Therefore, my remarks on this part of the program will be but a brief summary.

Public regulation visualizes requirements that will stop forest destruction and deterioration and keep forest lands reasonably productive—practices that are being attained or surpassed by many private owners. It contemplates basic federal legislation which would give every reasonable opportunity for states to enact, and with federal financial assistance, administer regulation under state law consistent with federal standards, but would provide for federal administration in states which fail to do so.

I want to emphasize that the Forest Service would like to see the states do an effective job of actual administration in accord with the proposal. We feel that the job must be done on a nation-wide basis, and that without undue delay.

Forest wildlife relationships.—Now, where does wildlife fit into the proposals I have discussed? Frankly, I think that forest management has a great deal to do with forest fish and game. As more intensive forest management is applied to greater areas, there will be a need for the closest coordination and correlation of forest wildlife with a more stabilized forest environment. The future of hunting and fishing for sport is tied in closely with land-use planning. Wildlife can, with a reasonable amount of forethought and coordination, be an important additional crop on forest land.

Something like 16 million hunting and fishing licenses were sold last year. It is not known what proportion of these millions of people hunt and fish in forest areas but it is a very large number. The immediate

future gives promise of heavier public pressure for hunting and fishing than we have ever before witnessed.

In anticipation of the growing public interest in forest wildlife, the question of what might be done to maintain or increase the resource becomes pertinent. A program to go hand in hand with advances in forest management is needed. Obviously, local conditions and public preferences largely direct the form a program might take, but broadly speaking three approaches might be considered, namely: (1) Where understocking exists, increase wildlife populations in proportion to the carrying capacity of the forest habitat; (2) strive for a better utilization of existing supplies of forest fish and game, particularly in areas where game numbers constitute a threat to their habitat and other legitimate forests uses, and (3) improve the food and cover conditions through greater effort in habitat management.

Deer are being restored in many areas of the South and Midwest and in the last 2 years or so hunting has been brought back in forest sections of Virginia and Missouri and other states where the seasons have been closed during the memory of most living men. It seems probable that turkey, like deer, can be restored to much of their former range. Certainly there is room for more fur bearers in large sections of our forested country.

With the mounting demand for hunting and fishing, it will become increasingly necessary to make better use of the resources at hand. The deer are an example of this situation. At present the deer harvest in the United States is about 10 per cent of the estimated herd population. Under intensive management, it has been demonstrated that a higher percentage can be harvested each year. Consequently, it is entirely possible to maintain the present kill of deer in the United States even with a reduced population.

A better use of game crops ordinarily requires more intensive game management. It may call for the application of two steps: determination of the amount of game surplus or crop, and application of proper hunting effort so that the predetermined crop will be removed. This type of management requires intimate knowledge of wildlife and habitat conditions combined with flexibility in bringing about proper utilization of game. During the restoration periods limited license and other procedures can be used to insure the development of an adequate breeding stock. It is equally important to transfer emphasis to increased harvesting of game when carrying capacity is reached or environment threatened. This type of management is gaining wide acceptance and it has resulted in more effective use of the forest wildlife resource. It has been applied to the 30 cooperative wildlife management areas on the national forests in the Southeast and has been

used by many states on state forests and other lands, especially in the management of deer and turkey.

In addition to increasing game or making better use of the game crop, there is a promising opportunity in the field of habitat management. It is here that the real future in forest wildlife management may be found. It is so well recognized that an animal must have a satisfactory place to live that I need not expand this principle here. As forest management is intensified on all lands, both private and public, a conscious effort should be made to weave the habitat requirements of game and fish into the broad fabric of forest-land management.

Better forest management is certain to reflect favorably on the fishing resource. Improved water relations always follow reforestation. This results in stabilized stream channels, more regular flows and clear waters. Obviously, the restoration of productive capacity to fishing waters is one of the important results of good forest-land management.

The need is for practical techniques to coordinate wildlife requirements with forest management. It is well known, for example, that a dense, dark forest is not highly productive of game. Under careful coordination, cutting practices might be of such frequency or so dispersed that desired forest openings are brought about as a natural result of removing the forest products. But there may also be a need for permanent or semipermanent wildlife clearings. These occur naturally in the Rocky Mountains and in many of the western forests, but are not so common in the East. Therefore, it may be necessary on public lands to preserve old fields or to create forest openings in the interest of wildlife. In the case of farm forests and woodlands the openings may occur as a result of the land-use pattern.

There is opportunity for good work in providing food plants for wildlife. This involves the retention of appropriate quantities of wild grape, greenbrier, persimmon, sumach, dogwood, and other forest species which provide much wildlife food. Fortunately white oak, shagbark hickory, and many other species are favored by both timbermen and game men. Forest Service nurseries are now being utilized to produce seedlings and transplants of species primarily valuable as food and cover for game.

In closing I should like to emphasize again the proposition that one of the main avenues for progress in forest-wildlife management will be in the correlation of wildlife measures with forest-management programs. There are many men in this audience who have already blazed the trail and are every day exercising influence along this line. The Forest Service, because it manages about one tenth of the land area of the United States, feels a particular responsibility in this field. These lands are dedicated to a multiple-use management and in the

years to come we hope to make significant progress on national forests in the challenging task of coordinating wildlife production with the other jobs of managing the land.

WILDLIFE GAINS THROUGH SOIL CONSERVATION

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It is a particular pleasure for me to have the opportunity to take part in today's program of the Eleventh North American Wildlife Conference. All of us here are conservationists, and conservation is one of the most important and most widely discussed subjects before the Nation and the world today. You of the wildlife groups have pioneered in the conservation of our fish and game resources. We in the soil conservation field likewise have done some pioneering in saving and making best use of the basic soil and water resources on the country's farmland. We are therefore on common ground.

Without ample stores of soil and water there can be no sustained plant or animal life. Without productive soil and clear water in our lakes and streams there can be no wildlife—no birds, fish, fur bearers or big game. I think it is scarcely necessary to remind you that all but a rather small part of that life-giving soil is found on our farms and ranches; likewise, all but a comparatively small part of the water which feeds our lakes and streams drains from or across those same farms and ranches.

As soil conservationists, our business is to work with the owners and operators of this cropland, pastureland, and farm woodlands in order to conserve their soil and make the best use of their water for maximum economic production today and in the years to come. It follows, then, that everything the soil conservationists does to that end automatically benefits wildlife. The soil conservationist is as a matter of course a wildlife conservationist. Those practices include, on the one hand, protective measures against insect, rodent, and weed pests that jeopardize soil and water conservation and, on the other, measures to encourage the productive wildlife use of parcels of land that are best adapted to yielding wild plant and animal "crops."

We soil conservationists work, meanwhile, on the theory that all farmland is wildlife habitat. That isn't just theory; it is fact. As an example, I am informed that about 70 per cent of our wild fur is produced on such farmland. It is clear, then, that every acre we allow to

become sterile and unproductive through soil erosion means that much less wildlife. I could cite you numerous examples, both at home and abroad, of how water and wind erosion have driven birds and game from farms, watersheds, and larger areas; and how revegetation and other good land-use practices have restored wildlife to once deserted countrysides.

The relationship between improper land use and animal life is strikingly noticeable, for example, in parts of Latin America, where steep lands have suffered severely from erosion and where careless cultivation, overgrazing, burning, and deforestation have dried up perennial streams. I am thinking of the badly eroded Andean section of Ecuador, between Loja and Quenca, and of the state of Lara in northern Venezuela. In those localities, a few birds and mammals are to be seen occasionally; but there is such a scarcity of food and cover that there is little chance for local reproduction, and wildlife there has become exceedingly scarce.

In many parts of South Africa, a once great abundance of wildlife has been practically wiped out in large areas, such as Orange Free State and parts of the Transvaal. There are towns, cities, and localities in South Africa carrying the suffix name "fontein" (such as Bloemfontein, Bultfontein, and many others) which means fountain, pool, or other living bodies of water. Today, these sources of live water are largely dried up and gone. Place names in other localities indicate the former presence of hippopotamus pools. You occasionally run across people who still remember when these animals were abundant in places where existing conditions resulting from erosion and the drying up of streams and watersheds make them absolutely unfitted for such animal life today. Sometimes you hear also reports that in parts of the Karoo, where baboons, formerly existing in considerable numbers and feeding normally on insects and other natural food, have become sheep killers as the result of land, water, and vegetative depletion.

We certainly don't want such conditions to spread any farther than they already exist in our own country. But—there is no use shutting our eyes to it—our good productive land here in the United States has been shrinking. And every gully, every dune of wind-blown soil, every silted-up lake or reservoir or mud-polluted stream reduces our United States wildlife habitat by that much and cuts into our yield from that important "crop." Let's just stop and think back for a moment. When the Pilgrims first settled in America, and still much later when the fur company trappers paddled and portaged northwestward across the continent, what did they find? They found virgin forests, seemingly endless grass-covered prairies and plains, and countless clear streams. Through those timberlands, in those clear streams and lakes,

and across the prairies and plains, there abounded fish and game in numbers to stagger the imagination.

But what do we find today—after we have charged across the continent with our herds and our steel plows? You of the Izaak Walton League, of the Fish and Wildlife Service, of the Audubon Society, of Ducks Unlimited, and the rest, know the answer best. You know that many a farm boy, even today, doesn't know actually what a bobwhite looks like; that we have to go to a zoo or western state park to see a "buffalo"; that big-league baseball players and movie stars spend big money traveling to South Dakota and other states to hunt pheasants in the farmers' stubblefields; that duck shooting wouldn't be what it is had it not been for "Ding" Darling's cartoons and the duck stamp.

What *else* do we find? Well, for one thing, we find that at least a fifth of the original area of tillable land in the United States is now ruined for further practical cultivation—thus damaged chiefly by erosion. We find that about one third of the present remaining tillable land already is badly damaged by erosion, and that more than half of the remainder is subject to erosion. That means in approximate figures 50 million acres of cropland we have ruined for further practical cultivation (mostly in the last 150 years), another 50 million acres in almost as bad shape, and still another 100 million acres definitely impoverished by erosion, with yet another 100 million acres on which erosion is actively underway. That is just cropland. All together, half of our land has been damaged by soil erosion; and, of the staggering yearly cost we are paying, an important part of it is represented by damage to our wildlife.

I think it is clear that there is a definite relationship between this pillage of the land and the abundance of our wildlife, or the lack of it. This being the case, it is equally apparent that we are going to get the most effective wildlife improvement, both in quantity and distribution, by keeping this vast farmland habitat in its best producing condition. There is no other way to assure our over-all wildlife populations of the future—just as there is no other way to guarantee our future production of food and other crops except by preserving our good lands which bear them. That means treating every acre according to its individual needs, and using each acre for the type of crop it is best suited to produce. Some of those farmland acres are best fitted to produce wildlife crops.

I am not discounting, you understand, the great importance of our wildlife refuges, national forests or other important central areas where wild fowl and game migrate, breed and multiply. But we don't hunt inside those refuges, nor can the average hunter or fisherman from Smithburg or Pleasantville afford to travel long distances to

even the best of shooting or fishing grounds. The point I want to emphasize is that we must rely on our farmlands and ranchlands for our everyday, year in and year out hunting and fishing. The farmer is our principal game manager. The way he operates his land determines what he has to offer the man with rod and gun. Every single one of us can and should help him in that important undertaking.

We have seen certain wildlife species become extinct, or nearly so, from the passenger pigeon to the American bison. Others, like the bald eagle, are threatened, until states have to take such action as Maryland's recent regulations making it unlawful to kill or catch one of these great birds—our national symbol. Man with his guns and traps is largely credited with such final wiping out of individual species. But man with his ax and plow also must shoulder his share of the blame for the decimation of various beneficial wildlife species, including game birds and waterfowl, fur bearers and fish life.

Fortunately, the farmer doesn't have to take any of his good land out of cash crop production in order to encourage and benefit wildlife. I have already mentioned how it is that erosion-controlling vegetative practices, water-conservation measures and so on all improve the farmland wildlife habitat. A little later we shall look at some of those specific practices. But do you realize that there is a total of approximately 33 million acres, within the agricultural area of the country, that are unfit for producing cultivated crops, hay, pasture, or trees? It is made up of such parcels as land so badly eroded that even trees won't grow on it; of banks of streams, drainage and irrigation ditches that ordinarily can't be farmed; of marshland that cannot be drained economically; and of usually small soggy, rocky, alkali or other spots.

We all know that conservation does not mean *disuse;* it means wise *use.* The soil conservationist accordingly believes that these apparently worthless areas should not be idle—not when simple planting or other conservation treatment will enable them to produce valuable crops of wildlife. Moreover, the very fact that this 33 million acres is scattered through our good agricultural lands is an advantage. It makes it possible to develop, where they are needed, birds and mammals which are of incalculable value to agriculture by destroying insect and rodent pests. It also puts game within convenient reach of local sportsmen, to say nothing of adding directly to the farmers' income and food supply.

"Very well," you ask, "but how are we going to get the job done?"

I am happy to report that we are making a good start toward getting that job done. The farmers are doing it, through their own soil conservation districts that already cover more than half of the Nation's farmland. Soil conservation technicians are helping. They are working

with the districts at their request and cooperating with various agencies and groups, including the Fish and Wildlife Service and the state conservation departments. There are now about 1,500 soil conservation districts, organized by landowners and operators themselves under state laws, and managed by their own elected farmer supervisors. These districts take in approximately 800 million acres of land in three fifths of the country's 3,000-odd counties.

The soil- and water-conservation practices being put on the land in these soil conservation districts run into huge figures. They range from crop rotations to water-management and irrigation-system improvements, from terracing and strip cropping to woodland management, from range and pasture improvement to farm-pond developments. They are applied under farm conservation plans worked out together by the farmers and the soil conservation technicians, who are trained in various technical fields including biology. These trained men go out on the land and work right in fields, pastures, and woodlands along with the farmers and ranchers. They don't attempt to do the job by sitting back in an office handing out advice by telephone or letter or by filling out questionnaires. The farm plans and the practices made for every farm are based on careful conservation surveys. These surveys tell the farmer just what kind of soil he has, the slope of the land, the degree of erosion and susceptibility to erosion—the capability of every acre on his place. Then he fits his cropping, pasture or woodland operations to the capacity to produce this or that crop, according to his needs, equipment facilities and financial conditions.

Though all of these conservation farming practices improve our wildlife conditions, there are a number of specific things we do on the land which are of direct, measurable benefit to wildlife. There is marsh management, for example. One of the nearly 60 major conservation practices we use in combination for better land use is farm-drainage improvement. It brings significant acreages of good Class I and II land, through good water management, into production of intensively cultivated crops. At the same time, this drainage makes it possible to take out of such intensified cropping equivalent acreages of lands that should be used for grass or tree crops, because they are too steep, too badly eroded or otherwise unsuited for cultivation. However, there are considerable acreages of wet lands that we know are better adapted to wild plant and animal production than to any other use. Under conservation planning, they are set aside and developed for that wildlife purposes, for producing fur-bearing animals, waterfowl and the like. In soil conservation districts in Maryland, Virginia, and Nebraska, for instance, level ditches are being tried in marshlands as a land-management measure to increase muskrat production.

Farm ponds have been increasing by leaps and bounds in popularity and in the use made of them. Even during the war, the number of ponds that farmers and ranchers in soil conservation districts have put under management for fish production has about doubled each year. The number of such ponds for which Soil Conservation Service technicians alone have given assistance in building, planting, stocking and fertilizing totals around 10,000. During 1945, more than 4,300 ponds were carefully stocked with more than 6 million fish, with cooperation of the Fish and Wildlife Service and state game commissions.

Farm ponds, of course, serve many valuable purposes, such as providing water for livestock, water for irrigating gardens, water for orchard spraying and for fire control, and recreation in the form of swimming, boating, and fishing. Under the kind of management I am talking about, they will produce something like 250 pounds of edible fish a year for every surface acre of pond water. They literally bring fishing even to "dust bowl" areas. Such ponds, as you know, also help increase fur bearers and waterfowl. Some 40,000 farm and ranch ponds, all together, have been built by farmers and ranchers through their soil conservation districts and allied conservation work.

The report of Adolph Habrich of Pawnee City, Nebraska, on his pond is typical. He said it has added a thousand dollars to the value of his farm, and that the value from his irrigated garden below the dam, plus the enjoyment his family gets from fishing and boating, would be hard to estimate.

Each year, field and woodland borders become more conspicuous on the farm that is well designed for soil and water conservation. In the Northwest, once trashy fence rows now are clothed with a thrifty cover of alfalfa and bromegrass, useful for wildlife food and cover as well as for weed and erosion control. Borders of native shrubs along woodland margins are used to similar good purpose, especially in the Northeast, where considerably more than 300 miles of shrub borders have been planted. In the Southeast and Gulf Coast regions, field borders of *Lespedeza sericea* and *Lespedeza bicolor* are becoming more and more popular among farmers and sportsmen. Last year enough bicolor seed was made available to soil conservation districts to seed more than 1,000 miles of such field borders. This plant continues to hold a primary place for bobwhite food and cover, and it also is an excellent honey plant. I sampled some of the honey just last week, and I can tell you it is *good*.

A well-planned hedge of carefully selected shrubs likewise is a wildlife asset on the farm. We may say the same thing for tree windbreaks, or shelterbelts, which have been planted so extensively in the wind erosion areas of the Great Plains. Hundreds of miles of these tree and

shrub plantings are providing wildlife food and cover while at the same time providing some protection to fields from soil blowing, affording livestock shelter, yielding fence posts, and contributing otherwise to farm convenience and profit.

We have searched the countryside for new plants for combating erosion and providing forage for domestic animals and food and protection for wildlife. Seed catalogs are now listing about 20 native plants that 10 years ago had never been cultivated anywhere, along with many other plants that had not been used for these purposes.

When I was talking about farm ponds, I probably also should have mentioned plantings and other erosion-control measures used along stream banks. You don't need for me to remind you of the importance this part of the farm plays in our wildlife ecology. I am sure most of you have followed 'coon tracks along the edge of a muddy creekbank when you were younger, or have sat on a cottonwood root fishing with that unexplainable patience a boy displays when he has a fishin' pole in his hands. You probably also remember going down and watching great chunks of the bank tumble into the creek when the spring high water turned your peaceful summer swimming hole into muddy torrents.

Well, soil conservation practices—from bank riprapping to planting of trees and shrubs and channel straightening—are protecting these valuable bottomland acres today from such needless damage on thousands of our farms. At the same time, they are providing ideal wildlife cover and food.

I could keep right on talking through the lunch hour, listing the soil and water-saving practices being applied on our farmlands today which are helping our animal, bird, and fish life. But maybe these I have mentioned will bring out the point I have been trying to make. In making that point, though, I certainly don't want you to get the impression that we have everything under control—that the job has been done. Quite to the contrary, our biggest job is ahead of us.

Almost a billion acres of our United States farmland still needs soil-conservation treatment to protect it from soil erosion, maintain its fertility, and put it to its most efficient use—including use for wildlife. More than 43 million acres now under cultivation should be changed over to grass or trees—natural wildlife habitat. To illustrate, many hundreds of thousands of acres of land still need that marsh management I mentioned earlier, as shown by a nation-wide conservation needs survey the Soil Conservation Service has made. That job alone will require nearly 3,500 man-years of skilled and unskilled labor, 325 equipment-years, 190 tons of seed and more than 7,500,000 trees, shrubs and plants. Take wildlife borders: more than 3 million acres remain

to be treated with this important wildlife measure, and 830,000 acres of streambank management are needed. Those are just random examples.

That will give you a general idea of what we are up against. But we can lick the problem—and we will. One of the great conservation problems ahead of this Nation in the peaceful period we are now entering is to see to it that conservation is applied on the land. The key to the application of conservation practices is the farmer. If the farmer —our principal game manager I mentioned earlier—does not apply to the land the measures it requires for wise use and permanent productivity, conservation will not be achieved.

The farmer now has the best known means through which to achieve conservation, in soil conservation districts. For my part, I am more confident today than I ever was before that this soil, water and wildlife conservation will be realized. Soil conservation improves the bounty of the land. The challenge is ours together.

GENERAL SESSION

Tuesday Morning—March 12

Chairman: A. WILLIS ROBERTSON
Chairman, House Select Committee on Conservation of Wildlife Resources, Washington, D. C.

Vice-Chairman: P. J. HOFFMASTER
President, International Association of Game, Fish and Conservation Commissioners, Lansing, Michigan

WATERFOWL FORUM

REMARKS BY THE CHAIRMAN

While we have the full day before us, I understand we have a long journey to make, so, like the general when he ordered the retreat, I am going to say "As I am a little lame, I am going to start now."

The conference will please come to order.

Before I present to you the first speaker on the program for this morning, may I take a moment to express to you my very sincere appreciation of the honor conferred upon me to preside over this session of the Conference, where we are to discuss how many ducks we have, who is responsible for our having them, who is going to kill them, if any, and how.

This meeting brings back to me happy memories of other conferences in the years past that I have attended at this hotel and elsewhere in this country, and in our adjoining country of Canada. As some of you know, I served for 6 years as Chairman of the Virginia Commission of Game and Inland Fisheries. I have often said that of my 30 years of public service, commencing with my service in the State Senate of Virginia in 1916, those 6 years were the happiest of them all. I miss some of the faces that were familiar to us at these conferences 20 years ago. I am happy, however, to see present some whose service antedates mine at these national conferences and I am also happy to meet leaders in the state-wide work with whom I have had corre-

spondence from time to time during the past 10 years as Chairman of the House Committee on Wildlife Conservation and whom I have not had the privilege of personally knowing. I want to say to all of them that I am deeply grateful for the support they gave me some years ago when I was sponsoring the distinguished Senator Pittman Bill to earmark an excise tax on guns and ammunition for grants-in-aid to the states, and I am very grateful for the support they are giving me in my present effort to amend and improve our Coordination Bill to the end that in future years, when the Federal Government embarks upon some great construction project that might thoughtlessly or needlessly injure our wildlife resources, it must first make a careful and detailed study of what is involved in the project from the standpoint of fish and game and cooperate in that study along the lines of helpful amendments suggested by the Western Game Commissioners with the state agencies and with the national conservation agencies.

You have heard yesterday, and will probably hear in your technical conferences again today, that we face a very serious problem growing out of the increased demand upon our wildlife. I think that there is no doubt about it if we can maintain our economy, to say nothing of exapanding our standard of living, on the basis of a 40-hour week or maybe, as some propose, a 35-hour week or less, there will be a lot of leisure time that people will wish to devote to hunting and fishing; and the 12 million men who have been trained in the use of firearms, only 10 per cent of whom knew that use before their military training, will want to participate with us older hunters and fishermen in the joys of the outdoors.

So we may anticipate with assurance for the next few years a tremendous demand upon our wildlife resources and we must plan to meet that. I may pause here to say that it is a big industry from the standpoint of money, the manufacture and sale of hunting equipment and fishing gear, the transportation involved, the guide service and the hunting licenses and duck stamps that are bought. It all adds up, I think, to more than a billion-dollar industry and I think our state governments as well as our Federal Government have been shortsighted in not making more attractive from a remunerative standpoint the job of administering this great resource in the states and in the Nation.

When I first took over the work in Virginia, the Chairman of the Commission received no salary at all. It was supposed to be a labor of love in the interests of a small group of sportsmen handling a project that didn't really amount to much from the standpoint of those who thought they had serious business to do.

One of my first acts when I found that our fishing streams had been depleted from the pollution, overfishing, dynamiting, bagging and

every other mischievous device, was to make a search over the country for someone who knew how to raise trout and smallmouth bass. After making full inquiries, I decided that the man that would best fill our needs was a man who had been born at a fish hatchery in Pennsylvania, whose father had been Fish Commissioner of that commonwealth, whose brother had been, and still is, the head of the work in Pennsylvania, and then who had made a success, especially of restocking the streams of that state with trout. So I brought G. W. Buller to Virginia, at a salary of $5,000 a year and a free house which at that time I think was top salary paid by any of the states for a technical man.

We have got to recognize the importance of this subject and not treat it as the fleeting interest of a group of sportsmen or of nature lovers and remunerate the men who are to handle it on a basis commensurate with the responsibility of their jobs and on a basis that will attract to this service some of our best young men.

Now, in our federal service it is very difficult for a man to get beyond a salary of about $300 a month and to enter the service he must be a college graduate and perhaps have specialized in some technical branch of the service.

It has not been easy for me during the 10 years that I have attempted to speak for you in the Congress to make my colleagues in the House realize the importance of what was involved. I wish all of them could have heard that illuminating address yesterday by our friend from Missouri, Mr. Stephens, when he talked about the T-bone steaks and the ham and eggs that are washing down into the Missouri River through the neglect of soil conservation, which ties in so fully with all of our game activities.

When we have a bill before us, even to allocate a portion of the trust fund to the credit of the Pittman-Robertson Act, we have opposition on the floor of the House, although the sportsmen have paid this money, although the law says definitely that funds shall be earmarked for that purpose, and that purpose alone, although we want to credit to that fund over 12 million dollars of conservation money. We have difficulty, I say, in getting members of Congress to let the states have their own money that the Congress has promised to give them.

I fear when we come up with the Interior supply bill in the next week or two, carrying the budget recommendation of three million dollars this year for grants-in-aid to the states, we will have some difficulty in getting the House to let us have that full appropriation.

I want to take this occasion to impress upon the state representatives and all interested in the promotion of wildlife conservation, the importance of communicating with your Representatives and friends

in the Congress and to urge them to let us have that full appropriation of three million dollars. We will certainly need it. I know that many of the state game departments (and I hope others will) have already communicated with us. I hope others will communicate with members of Congress to give us support for the Coordination Bill and also for the bill on which I think there will be no real opposition, namely, the bill I introduced to allow the states to use up to 25 per cent of their grants-in-aid for maintenance purposes. We find that some states don't want to put more in the acquisition of land than they can properly administer and maintain and they would like to use some of their grants for maintenance purposes.

Going back to the demand that will be made, I think the Fish and Wildlife Service has estimated that possibly it will increase 20 or 30 per cent but your distinguished representative from Maine and my old friend, Mr. Stobie, told me this morning that the increase in Maine was already about 75 per cent and that nearly all of the summer camps were booked now to capacity, a most unusual thing for this time of the year.

I recently had the privilege of spending a few days in Florida. I wanted to do a little sailfishing out in the Gulf and all I caught was a tiger shark and a barracuda, but I was out there where the sailfish were and where the sun was nice. Well, Florida is just teeming with people. They seem to have an unlimited supply of money. It is hard to get a boat, even a rowboat. It is almost impossible to get into any hotel down there, unless you make reservations far in advance. If Florida had to furnish the fishing for that multitude in the inland waters, even lakes like Okeechobee, for instance, would soon be depleted. Because there are a lot of fish in the sea, as I say, not everybody that goes out to sea comes back with a sailfish or a pompano or even with a dolphin.

I want to say just one more word of encouragement to those of you who have made financial sacrifices to promote the cause of wildlife conservation. I can tell you from experience of 30 years in public life that the greatest personal satisfaction that I have gotten from any of my public work has grown out of a feeling that I perhaps was making some small contribution to the happiness and welfare of others and out of the friends that I have made who share with me the love of the great out-of-doors, and who want to do something to prevent us from passing on to posterity what was a rich heritage in the shape of a sucked orange.

If you become discouraged with the high cost of living—and I think it will probably go still higher—and if you feel that your efforts have not been properly remunerated, please bear in mind the truth

of the saying that all that you can grasp in your cold, dead hand is what you have given away. You will find when you come to the end of your career, your happiest memories, your deepest satisfaction will be built around the unselfish service that you have rendered to make of this a cleaner, greener world and a happier place for your fellowman.

Now, we have to proceed to a subject that some have warned me may be a bit controversial, but it is an important subject and we have two very fine and competent men to discuss it. I understand that the first speaker will speak from the standpoint of a government official, and, I may say, a good government official. I have known him mighty well because he was selected first to administer the distribution of the Pittman-Robertson Act funds and I had many contacts with him, and I congratulate him, as I know you have already done, upon being moved up to the head of the Fish and Wildlife Service to succeed Dr. Gabrielson whom we all regret to see leave that Service. Dr. Gabrielson has done a great work.

As I say, this duck problem is a big problem and growing bigger every day. It is important for us to know how many ducks we have got. It doesn't do any harm to debate who is helping to increase supply, because I think there is plenty of credit for all. It would be well enough to discuss what limitations should be placed upon the killing of ducks if we are to preserve an adequate supply. So I have the pleasure and honor, ladies and gentlemen of the Conference, of presenting to you as the first speaker of the morning, Albert M. Day, Assistant Director of the Fish and Wildlife Service, whose subject will be "The Problem of Increased Hunting Pressure on Waterfowl."

THE PROBLEM OF INCREASED HUNTING PRESSURE ON WATERFOWL

ALBERT M. DAY
Assistant Director, U. S. Fish and Wildlife Service, Washington, D. C.

The topic assigned me for discussion on this panel is exceedingly timely. In the years immediately ahead, the wild game of this country, not only waterfowl, but all other kinds as well, is going to face the greatest army of hunters in all history. The onslaught, in fact, has already begun. We felt the added pressure last fall when more duck stamps were sold than ever before. We're going to feel it a lot more next year. The push is on, and we might just as well brace ourselves to meet it.

It is easy enough to figure out WHY the numbers of gunners and anglers have suddenly increased. Millions of our boys have now learned how to use firearms. They have learned how to live in the out-of-doors. In a recent survey conducted by the American Legion magazine, 70 per cent of the servicemen said they wanted to hunt; 62 per cent said they intended to go fishing. So do the homefolks. With new cars, new tires, plenty of gasoline, and with the war jobs all done, there is going to be more vacationing. America is going to move out into the open. Sportsmen are going to be searching out every bit of wild country they can find. Ducks, rabbits, bass, trout, and *game administrators*—look out!

The war gave fish and game a little rest in the seasons of 1942 and 1943. Hunting and fishing license sales fell off a little during each of those years. Restrictions on gas and tires, and the shortage of ammunition and fishing tackle helped hold the take to less than normal. But that situation changed before the war ended, much to everyone's surprise. During the fiscal year of 1944, which included the fall hunting season of 1943, the states sold slightly more than 7½ million hunting licenses. During the next year, or the fall of 1944, they sold almost 8,200,000 licenses, an actual increase during the last year of the war of 685,643 licenses. All signs point to an ever greater proportionate increase during the season just closed.

We have definite knowledge of the increase in duck hunters. The duck stamp sales tell this story quite accurately. During the fall season of 1943, 1,169,352 were sold. In 1944, the number jumped to 1,487,029, an increase of about 27 per cent. During the first six months of this fiscal year, which included the last hunting season, more stamps were sold than during all of the year before. In fact, on last December 31, the duck stamp sales had reached the highest point in history, 1,540,468. It looks as though they might total 1,700,000 when all the

sales reports are in. This matter of increased hunting pressure is not mere fiction. It is here now, and it is going to take the best kind of management possible to see that we do not cut into the breeding stocks of game.

The Fish and Wildlife Service has long predicted that there would be an increase in hunting pressure as soon as the war was won, but we didn't look for it to come before that time. After World War I, there was an immediate increase of 30 per cent in the number of hunters, and that increase was never lost. This time, we predicted that the increase might be as much as 50 per cent, and it looks now as though that prediction may come true.

We have resisted great pressure during the past 2 years for more relaxations in the hunting privileges. Bills have even been introduced in Congress to permit the return of baiting and live decoys, and we have been deluged with petitions asking for various special relaxations for different parts of the country. Our philosophy has been to hold the line so we would not be faced with the necessity of tightening up just as the boys come back. But now it looks as though this very path may be the only one open for next year.

We all like to be optimistic, and I am afraid we have been too much so. It has been less than 15 years since the dust bowl days when the season had to be cut to 30 days and was almost closed completely. Yet we seem to have forgotten the significance of that experience. No one wants to stop and think of that. Yet, the Southwest is right now experiencing a severe drought, with dust storms similar to those which marked the beginning of that other disastrous period. The prairie states and the prairie provinces of Canada have had two spring seasons now that have been much drier than the preceding five lush breeding years. It is easy to forget that it was during the wet years of 1939 to 1943 that the birds really staged their recovery, and that it has been during these last two seasons that they have been dropping in numbers.

I think that even we proverbial pessimists in the Fish and Wildlife Service let ourselves become overenthusiastic as we saw the population climb from a low of less than 30 million in 1935 to around 140 million in 1943. The public began to take it for granted that this could keep on forever. Certainly, the effective propaganda campaign of Ducks Unlimited convinced many duck hunters that all that was necessary to have an unlimited supply was to contribute to that organization to build more "duck factories" in the limited area of the North American continent in which they operate. Little heed has been given to the occasional cautious warnings of federal and state administrators and a few of the outdoor writers.

Now, with this increased hunting pressure upon us, and with all of

our best observations pointing to a decline in waterfowl numbers during the past two seasons, I think it is time for us to take a good, honest look at the situation. I know many of you will not agree with my analysis, but in the good old American tradition, that is your privilege and I'd be delighted to be convinced that I am wrong. Here are the cold facts as I see them:

We have overshot our annual increase during the past two hunting seasons.—During the fall of 1944, when there were all the gripes about "where are the ducks?" the kills in many states were heavy. North and South Dakota, Nebraska, Minnesota, Arkansas, Colorado, Michigan and some others definitely killed more birds, in some cases as much as 40 per cent. While the results of the 1945 season are not all analyzed as yet, such data as we do have indicate that in 60 per cent of the hunting areas last fall, the total kill was either heavier, or as great as it was during 1944.

The population has declined in those two years.—Last year, the annual inventory showed a loss of some 20 million birds. This year's inventory is very apt to show an additional decline. And, although the Service has been criticized roundly by some writers for having the temerity to release such information, it is surprising how many duck hunters over the country are beginning to agree. They haven't found the birds either.

The annual regulations provide the only quick means of adjusting hunting pressure to supply.—No one can control the weather, but the hunting pressure can be controlled. Back in the early '30's when the waterfowl population was on its way out, the regulations saved the day. The season was cut to 30 days, baiting and live decoys were eliminated and several species given complete protection. Rigid law enforcement by state and federal wardens did the rest. The birds were well on their way upward at least two years before the marsh restoration programs of the American and Canadian Governments had much effect and before Ducks Unlimited had even started. As much as we hate to tighten up this year, just when the servicemen are able to take to the field again, I fear that a shorter season or reduced bag limit, or both, is going to be in order.

Marsh restoration and protection are highly important.—Past experience clearly indicated that law enforcement isn't enough. Ducks and geese must have places to rest and eat, and nest. Some 100,000,000 acres of marsh have been drained in this country in the last 50 years, and that largely in the flight and wintering range of the birds. The Service has spent upwards of 20 million dollars in acquiring and restoring about 3½ million acres in the United States, much of it for breeding areas in the northern tier of states. The Canadian Govern-

ment, through the Prairie Farms Rehabilitation Administration, has built over 5,500 dams, many of which are major reservoir areas. Counting dugouts, it has completed more than 20,000 water-restoration projects. I do not have a record of what Ducks Unlimited has done in actually restoring marshes, but they report 155 projects. All of this work by all agencies is highly important. By wisely impounding, husbanding and managing the spring runoff and the permanent streams, man can look ahead and ease the shock when the next drought comes. That is when these projects will prove their real worth.

Mother Nature is the prime factor in production.—Regardless of the efforts of the United States and Canadian Governments and of American sportsmen, the cold fact remains that the good Lord pretty well determines the success or failure of the duck and goose crop each year. Only Nature can see that the myriad potholes hold water long enough for the birds to get through the flightless stage. Man can build dams, but he cannot keep water behind them. Even with the most sincere effort, the areas that can be so improved are only a fraction of the vast *breeding range*. We can influence but little the breeding conditions in those vast wilderness tundra and muskeg areas of northern Canada and of Alaska where the bulk of the waterfowl are raised.

We can do much to improve wintering conditions.—Here the conditions are reversed. Food and protection can be provided for the birds while they are spending their six months' stay in the South. This should be done now. Oil exploitation is pushing farther and farther into the southern coastal marshes. In some spots, the federal refuges are about all that are left to provide suitable winter feed. The whole development of the United States with its drainage, its agriculture and its human activity, has cut squarely across the wintering range of the birds. Only fragments of this once vast area can be salvaged and restored, but these are highly essential. The Service has been taking advantage of the river impoundment programs of the Army Engineers, Reclamation, and Tennessee Valley Authority to create new refuges. Three of these have been put under administration within recent weeks. The great Mingo Swamp in Missouri is now being acquired with duck stamp funds and will be restored. Many others are needed.

Better public understanding is essential.—I have often said that this business of game management is about one-half managing game and one-half managing people. It matters not so much what we learn about new techniques and new approaches. If the public does not accept and go along with the recommendations of the administrators, the best laid plans will fail. It is for this reason that we must always have an alert group of outdoor writers giving sound, solid and accurate in-

formation to the reading public. We must have better teaching of the principles of conservation in the public schools. We must have a more effective integration of conservation education in textbooks, magazines, and the daily press. And *authentic* publicity is highly essential.

As outstanding examples of what I consider, let us say, erroneous publicity and that which is doing a downright disservice to American duck hunters, I want to cite two recent publications. One is the new book by S. Kip Farrington, Jr., *The Ducks Came Back, The Story of Ducks Unlimited.* The other is a brief article by Mr. Farrington published in the February issue of *The Reader's Digest* entitled, "Quacker Comback," which was condensed from an article in *Maclean's.*

Ducks Unlimited has thousands of earnest, sincere members who have contributed liberally to restore breeding marshes in Canada. The organization has done some excellent work. Some marshes have been restored, a great deal of conservation education has been disseminated among the school children and adults of Canada, and the highly effective publicity campaign in the United States has made the American public more conscious of the basic philosophy that we must restore marshes and provide nesting grounds if we are to perpetuate the sport of duck hunting. I fully approve of the sound and constructive part of their program, although many of us have long felt that the publicity agents for Ducks Unlimited have exceedingly active imaginations.

The Reader's Digest article states boldly and baldly: "The quackers owe their comeback to an organization called Ducks Unlimited, which since 1938 has boosted the continent's duck population by 500 per cent." It claims for Ducks Unlimited the entire credit for the waterfowl restoration program. It boasts of the 155 Ducks Unlimited projects in Canada, but says not one word of the 20,000 projects completed by the Prairie Farms Rehabilitation Administration. No mention is made either in the *Digest* article nor in Mr. Farrington's book of the waterfowl restoration program in the United States by the Fish and Wildlife Service with duck stamp and other funds—$20,000,000 worth —3½ million acres. The author does rather grudgingly attribute "part of the credit to God."

Not a single line in the book is devoted to the wintering needs of the birds, although the author must know that they spend six months of their lives each year on southern marshes. Not a word is spoken of restraining the evergrowing army of duck hunters to keep the kill within the limits of production. Protection under the Treaties with Great Britain and Mexico is given no mention. Instead, the author positively recommends the return of sink box and battery shooting, feeding, baiting, and the use of live decoys. He belittles the refuges

and sanctuaries set up to feed and protect the birds in this country. He blames a liberal portion of the poor shooting in 1944 to his assertion that the birds were on the sanctuaries where the hunters could not reach them. He says the refuges are run with duck stamp money so they should be opened up for our returning servicemen to shoot in. The entire tenor of this book is that all anyone needs to do to have all the ducks he wants to shoot is to contribute to Ducks Unlimited. Come on, boys—step up! It's just like buying clay pigeons. There's nothing to it—to Hell with all restraint!

And what is the public reaction? Exactly as one must expect. Listen to these excerpts from Mr. Arthur Van Pelt's column, "All Outdoors," in the February 3 issue of the New Orleans *Times-Picayune:* "Startled surprise mixed with a liberal portion of indignation has been expressed by sportsmen during the past few days since publication of a hint by the Federal Fish and Wildlife Service that reduced bag limits for waterfowl may be put in force before the next shooting season. The statement . . . has stirred the wrath of the hunters.

"It seems certain, from every angle, that no definite knowledge of the kill in the South can possibly have been arrived at but as surely, some real data will be gotten together in the very near future by Ducks Unlimited, the organization *more directly responsible than any other,* for the actual production of the wildfowl," etc.

Thus, we as honest officials charged with administering this resource under the terms of treaties with two other great countries, and under mandates from the Congress, are to be berated and held up to scorn if our findings run counter to Ducks Unlimited propaganda. That, ladies and gentlemen, I resent, as every thinking conservationist must also. Whether you agree with the federal regulations or not, there is no better way to tear apart the waterfowl program that has worked so well during the past 10 or 12 years. I agree with Ducks Unlimited propaganda in one respect. The waterfowl restoration program has been the "conservation miracle of the century." I say, however, that it has been accomplished by many agencies, many groups, aided liberally by the hand of God, and that Ducks Unlimited has contributed only its small share.

I cite this example of publicity, not as an attack on Ducks Unlimited, but rather as an example of why we need sound, sane publicity, based on facts, and not fiction, if we are to have the intelligent support of the hunting fraternity.

And so, in looking ahead into the next few years that will tax the patience and the ingenuity of all game administrators I think we must face these grim realities:

There is going to be a heavy increase in hunting pressure.

We have grown overoptimistic about the highly satisfactory gain in waterfowl populations.

The increase has coincided with a series of exceptionally good breeding seasons.

We have overshot our annual increase during the past two hunting seasons.

The population has declined in those same 2 years.

The annual regulations provide the only quick means of adjusting hunting pressure to supply.

Marsh restoration and protection are highly important.

Mother Nature is the prime factor in production on the *breeding grounds.*

We can do much to improve *wintering conditions.*

We need authentic publicity to create better public understanding.

DISCUSSION

MR. A. M. BARTLEY (New York): Mr. Day has mentioned the many earnest, sincere supporters of Ducks Unlimited and as I am rather responsible for enlisting most of that support, I feel that it is up to me not to enter any controversy; but possibly in fairness to them I should elaborate a little on some of Mr. Day's remarks which might hurt Ducks Unlimited.

To save time and keep within that three minutes, I have prepared certain elaborations of the remarks made by Mr. Day.

Ducks Unlimited is not averse to criticism. Constructive criticism will keep us on our toes and help make us do a better job.

Mr. Day has mentioned the anticipated increase in the sale of duck stamps which means an increased demand on the duck supply. Ducks Unlimited is keenly aware of this future increase in demand and is hopeful that it can be taken care of not only by management of the supply but more important, by increasing the production to meet the demand. That sounds like good business to us. In fact, we a month or so ago sent out a letter calling the attention of our state chairmen to the increased demands that are facing us.

Mr. Day has stated that an effective propaganda campaign of Ducks Unlimited has convinced many duck hunters against the warnings of the federal and state game administrators. I would like to take this opportunity to impress upon all those present that the Board of Trustees of Ducks Unlimited has specifically resolved that no activity of Ducks Unlimited shall be carried on that might influence the waterfowl shooting regulations as prescribed by the federal authorities. I believe Dr. Gabrielson will admit that at no time has Ducks Unlimited as an organization made any request to him for a change in shooting regulations.

Mr. Day has stated that the ducks were well on their way upward at least 2 years before the marsh-restoration programs of the American and Canadian Governments had much effect and before Ducks Unlimited had even started. I agree that the ducks were on their way upward before Ducks Unlimited started field operations in 1938. I do not, however, agree that the ducks were on their way upward before breeding-ground restoration was started in the United States. The upwards of 20 million dollars Mr. Day mentions as having been spent on breeding-ground restoration work was the result of a plan submitted by More Game Birds in America, the parent organization of Ducks Unlimited, to the President of the United States in 1933. Work on this over-all plan started in 1934 when Mr. Day was appointed to head up the refuge program. The duck population reached its low, according to Biological Survey estimates, in 1934. There was a slight increase, again according to the same estimates, in 1935. The curve leveled off and

further noticeable increases were not observed until 1938 when breeding-ground restoration work on the Canadian prairies was started by Ducks Unlimited.

I can't quite agree with Mr. Day when he says "the cold fact remains that the good Lord pretty well determines the success or failure of the duck and geese crop each year." The same might be said of our corn, potato and any other crop. However, if we depend entirely on the Lord, I am very much afraid we won't get much to eat. While it is admitted that the prairie breeding grounds cover a vast area, it must also be admitted that the duck population fluctuates with what happens in this area. When drought occurs, the duck supply declines. When water returns, the ducks increase. The fallacy of depending entirely upon Nature's whims for our duck supply is proved entirely by the fact that with each drought the duck populations become smaller and smaller.

It does not seem like too starry-eyed a dream to say that permanent water can be located strategically throughout the duck breeding areas that will provide water to carry an increased brood stock through until the return of the next wet cycle. I might say now that if it is not done, another drought such as we experienced in the early 1930's could reduce our duck population well below the 27 million we saw in 1934 to a point from which it would be impossible to restore it to any suitable numbers.

Mr. Day mentions a book written by a well-known author and a magazine article by the same author and uses the enthusiasm of this independent writer as an example of Ducks Unlimited's publicity policy or propaganda. That's absolutely unfair. We can no more control the opinions of independent authors and the free American press who write in our favor than we can control the opinions of the writers who do not agree with us.

And I might mention in passing that seldom in the whole history of our efforts has the Fish and Wildlife Service mentioned the work of Ducks Unlimited in a manner that might make our job a little easier.

Regarding Mr. Day's statement of, I quote, "Thus we as honest officials charged with administering this resource under the terms of treaties with two other great countries, and under mandates from the Congress, are to be berated and held up to scorn if our findings run counter to Ducks Unlimited propaganda." At this point, I would like to repeat that Ducks Unlimited has a definite policy against doing anything to influence the writing of the federal waterfowl shooting regulations. We cannot control the press and the Wildlife Service certainly cannot expect us to do it for them.

I am glad Mr. Day agrees with Ducks Unlimited propaganda in one respect. The waterfowl conservation program "has been the conservation miracle of the century." I agree that it has been accomplished by many agencies and Ducks Unlimited is only one, and possibly a small one, of them. However, if I were Chief of the Fish and Wildlife Service and had an agency such as Ducks Unlimited, I would use it to further the interests of waterfowl restoration and conservation. Without being boastful, it is my honest opinion that Ducks Unlimited has done more to make the duck hunter in the United States and Canada waterfowl conservation conscious than any other nongovernmental agency.

CHAIRMAN ROBERTSON: I gave you a Gene Tunney count because I realized you had a red-hot problem, and sidestepping the crossfire for myself, I want to tell you how a friend in Washington suggested to me last fall we would relieve the pressure on the ducks. He said, "Bring the coots back to kill and give them to your city friend who doesn't know a coot from a duck."

He said, "I tried it out on my janitor and the next day I said, 'John, how did you like that duck I gave you?' He said, 'Boss, that duck was fine. You know, I likes both ducks and fish, and it's the first time I got them both together at one time'."

The Chair will be glad to recognize the lady.

MRS. C. N. EDGE (New York): I rise to a point of order.

CHAIRMAN ROBERTSON: Mrs. Edge doesn't have to tell us what organization she is connected with. The lady will state her point of order.

MRS. EDGE: I would like to ask you whether your watch stopped during the gentleman's speech.

CHAIRMAN ROBERTSON: No, it kept running, but it was out of my line of vision.

The Chair will recognize another speaker now, either pro or con, or in the middle position.

MR. G. M. SPARGO (Alberta, Canada): I am a representative of the Yukon Fish and Game Association, the Alberta Fish and Game Association, and I speak for my colleagues in western Canada.

I wish now to say this: I want to pay tribute, a very earnest tribute, to the cooperation that has been, I think, most unfairly attacked by Mr. Day. I mean Ducks Unlimited. I know whereof I speak. I know the progress well. I heard Mr. Day and others speak about the P.F.R.A. project. They are very good, but they were never intended to be duck-producing elements. They were dugouts for animals and all the animals in the areas fed around them and, therefore, they raise no ducks. Of all the 20,000 projects, 19,000 are merely dugouts.

Now, you come to Ducks Unlimited and I have seen two of the best projects that I have ever seen from a duck-producing point of view. I speak of the Louisiana Lakes and the San Francisco Lakes in Alberta. I thank the gentlemen in California, as well as those in Louisiana, for the fact that they have given that money towards such excellent projects. These two projects in themselves have more than justified the existence of Ducks Unlimited in Canada.

I say this, too, where could the Fish and Wildlife Service of the United States build projects in Canada with public funds belonging to the United States? It would be impossible, and we would resent it; but a private corporation like Ducks Unlimited can do so and very fortuitously, too.

I must say, representing as I do 15,000 sportsmen in Canada, in the West, that it seems to me to be most unfortunate that this should have been brought up at a Conference of this kind. We are all together trying to do one thing; we are trying to benefit the wildlife of this continent, and we should pull together.

MR. ALBERT HOCHBAUM (Manitoba, Canada): I think we are confusing the issue. I want to go on record, first, as saying Ducks Unlimited has done and is doing a wonderful job. It has done a wonderful job of propaganda, too. There are many things about the program that we learn that are not as they should be. I grant that Louisiana Lakes and the Lake San Francisco area just mentioned are wonderful areas. I also am sure that the acreages mentioned re extravagantly exaggerated, that that exaggeration goes through the whole plan of the Ducks Unlimited program. Never in this country has a lily been more needlessly painted. They have done a splendid job, but the work they have done is buried in the propaganda that comes out.

We talk about propaganda. I am just going to mention one thing. We hear about the marvelous programs of salvaging ducks, thousands of ducks must be salvaged on the prairies. Money must be raised for the salvage work and so Ducks Unlimited has a salvage program. They move to Louisiana Lakes, collect a group of ducks from a good pond, remove them to the bald prairie, start their cameras grinding, take pictures of the birds being rescued, put them back from whence they came, except those birds having been killed in accidents, and that movie now is being viewed by American sportsmen all over the country as the truth. At the same time that those pictures were being made, there were thousands of ducks which could have been saved in organized rescue work. I think that Ducks Unlimited must go on. There must be a program. I am behind it with everything I have got (I know that the others of us on the prairies are), but we want to see the truth, but to see the things that are printed is sickening. Part of the technique which we have heard this morning is not being able to take the blame. When anything is said about Ducks Unlimited, the fault is shifted some place else. Ducks Unlimited is never responsible for anything it says.

Mr. Bartley said that Ducks Unlimited accepts criticism. Ducks Unlimited has had the finest constructive criticism, the finest critics, the friendliest critics from the beginning of its program. We have all been their friends. I know them and I know many of their friends who have criticized Ducks Unlimited and I can

say criticism in many respects has rolled off its back like water off a duck's back.

I know that there is, even within the organization of Ducks Unlimited, a situation whereby many important, substantial and reliable internal suggestions concerning the program from a natural standpoint are not taken into the program as just criticism.

CHAIRMAN ROBERTSON: I may say I don't feel that in justice to the next speaker we can recognize more than two more in this forum discussion. Then when they complete their remarks, somebody may have something to say about what they had to say and finish up on the first speaker.

MR. LEONARD HALL (Missouri): I would like to ask Mr. Bartley or Mr. Main three friendly questions, because I have always been a friend of Ducks Unlimited.

CHAIRMAN ROBERTSON: Mr. Bartley is going to answer them, provided they are friendly.

MR. HALL: I have read many statements from Ducks Unlimited. I read Barton's article. I haven't yet had a chance to read his book. I would like to know what percentage of the Canadian breeding grounds are covered by the Ducks Unlimited projects. I would like to know how many of the projects, what proportion of the projects listed in your movies as duck factories are completed and functioning. I would like to know what of Mr. Kip Farrington's statements you do stand behind.

MR. BARTLEY: I will answer the first one, but I might say here that I thank Al Hochbaum for his criticism, that is constructive criticism. I promise you it will be given consideration.

The area of the breeding grounds that the Ducks Unlimited plan calls for covers about two-thirds of the prairie area which has been destroyed by agriculture. Now, I think I am going to ask Tom to tell you about the completed project because, frankly, I am not up there enough to know.

MR. TOM MAIN (Manitoba, Canada): I am Tom Main from Canada, General Manager of Ducks Unlimited, Canada.

The question asked by Mr. Hall was: What proportion of the projects that we have discussed are completed and how many of them are functioning? We now have 168 projects that safeguard duck nesting on 1,300,000 acres of water, marsh and upland nesting ground. Thirteen of those projects were built last year and will not function until the spring weather. I can assure you they will be functioning when the spring runoff comes. Of the remaining 155, 147 are functioning. I think that is a pretty good record.

I am just going to go a little further while I have the opportunity because the remarks of Mr. Day are going to cause a little discord up in Canada, and I don't like it. He has mentioned the P.F.R.A. and he has told you the P.F.R.A. has 20,000 projects and Ducks Unlimited have 155 projects. Of course, that comparison is just ridiculous. If Mr. Day will compare two of our projects with the 20,000 projects the P.F.R.A. have constructed, then he will have a pretty fair comparison.

I helped to organize the Prairie Farm Rehabilitation Act. I had it passed. I was loaned by the Canadian National to the Dominion Government to organize the Engineering Department of the P.F.R.A. For 2 years, I worked with them. I know what they are doing. I am still consulting engineer for them. I ought to know something about them. Their work was designed for agriculture and they have done a fine job for agriculture.

Our work was designed for ducks and we have done a fine job for the ducks. It is true that their work has also helped the ducks. It is true that our work has also helped agriculture. Now, I want to keep friendly with that group up there. We are working closely with them. They have given us a great deal of land. Now and again they lend us engineering parties; they give us plans, prepare plans for us. Their community pasture men are our key men. We want to get along with them. I don't want to go any further. I think comparing their projects to ours is just absurd.

One more thing, if I have time, Al Hochbaum, about a picture. I salvaged my first ducklings in 1897. Now, you will have some idea of how old I am. Ever

since, I have known the school boys, ranch boys like I was then, salvaging ducks. We are trying to encourage that sort of work. We have done a lot of salvaging of ducks, but in order to get a good picture on a good day, we did stage a salvage shot for educational purposes, and I am not ashamed of it. We didn't happen to get pictures of many other salvage jobs we have done. I think that answers Al Hochbaum, and I think that is all I have time to say. Thank you!

QUESTION: How about Mr. Hall's third question? What statement of Mr. Farrington does D. U. approve?

MR. MAIN: Well, I am general manager of Ducks Unlimited, Canada, and I don't interfere with anything that goes on in the United States.

MR. BARTLEY: I will try to answer that—I hope satisfactorily—because Kip Farrington is an independent writer. We didn't pay him to write his book. It is pretty hard to tell an author what to write. Of course, on the record we can agree that what he says—the sole reason for the comeback of the ducks in Ducks Unlimited we have already stated—we are not the sole reason, so to that extent, and only to that extent, as far as I can remember, we disagreed with Kip Farrington. I think the rest of the book and the article (incidentally they were both written during my absence from Ducks Unlimited) is pretty factual. That answers the question.

MR. LOUIS ROCK (Ohio): I am President of the Outdoor Writers Association. I have had 21 years of military service to which I want to address myself. It is probably presumptuous for me to stand up here owing to the short service I have had among you, but I would be derelict in my duty and derelict in my mission in joining the Outdoor Writers Association, if I didn't call attention to one statement Mr. Day made. His talk was very instructive to me. I am one of those who maybe doesn't know very much about the difference between a coot and a duck, but I am making a plea to the government and suggesting to you that you think in large on the statement of Mr. Day's, that is, the thought of the serviceman. When we were overseas, you told us by display advertising, you wrote us letters, you painted the picture to us, you told us of the homes that we would have when we came back. You didn't tell us about the housing shortage. You told us about the G. I. Bill of Rights, you oversold it to us. You made us think a lot of things.

Now, I think you should give priority in your thinking and I say this not in a spirit of criticism but just to remind you and keep in your thoughts and when it comes to the pressure on shooting in the outdoors, let's continue to think of the serviceman, so it isn't Tommy this and Tommy that and throw him out, the brute, but the thin red line of heroes when the guns begin to shoot. Let's keep that in mind in all phases of our thinking.

CHAIRMAN ROBERTSON: Thank you for speaking for those to whom we are so richly indebted for the preservation of our freedom.

The Chair would not undertake to pass judgment on the merits of this debate as to what contribution Ducks Unlimited has made or what contribution our friends from Canada have made. I think we are all appreciative of the efforts Ducks Unlimited has made to increase the duck supply and so far as our friends in Canada are concerned, I feel about them like the Negro preacher in Richmond felt about the white folks in Virginia. He went down to Mississippi for a General Baptist Association and the Mississippi preacher got up and started reading the scripture lesson for the morning. He said: "Now, the Kingdom of Heaven is like unto ten Virginians who went forth to meet the bridegroom and five of them were wise and five were foolish."

The Virginia preacher said: "Brother, would you be so good as to recapitulate that scripture lesson for me?"

He read it over, "The Kingdom of Heaven is like unto ten Virginians that took their lamps and went to meet the bridegroom, and five were wise and five were foolish."

"Now," he said, "brother the scripture lesson do sound familiar and I don't want you to think I challenge anything in the Good Book, but it does seem to me the percentage of foolish Virginians is too high."

Al Day wants to close the debate with one word, so I will have to give him one word.

MR. DAY: I want to make it perfectly clear that I had no intention of attacking Ducks Unlimited as such. I think the work they are doing is fine and more power to them. Perhaps we have fallen down in giving them the assistance that we could have. I will pledge my cooperation and help to them in every way we can for the solid, sound things that they are doing. The thing that I was trying to point out is that some of this propaganda—and whether they are responsible for it or not, I don't know, they will have to take the credit for it in the public mind, I am afraid—and publicity, that overselling, builds a resistance in the minds of the American hunters against any regulatory restraint. That is the situation that we must face and that you must face, because you can't do this whole job by only building duck factories in Canada. There are other things that enter into it. That is more than one word, excuse me.

PROBLEM OF COMMERCIALIZED WATERFOWLING

NASH BUCKINGHAM

Chairman, Wildfowl Committee, Outdoor Writers Association of America, Memphis, Tennessee

I will rather have to grope my way through this speaking.

After Mr. Stephens spoke yesterday and Mr. Day this morning, I am not going into any of the proceedings ahead or behind me. I have a great admiration for the basic principles of the program of Ducks Unlimited. I saw it written 3 years before it was ever Ducks Unlimited. If its publicity got ahead of it, then perhaps there might have been better publicity in other sources.

Somewhere I seem to remember a couple or three years ago a statement in the exuberance of our growing waterfowl resources that waterfowl shooting was no longer a question "of production but one of management." We seem to have gotten our business in a jam, and I am going on with the topic that has been assigned to me, to wit, the Commercialism of Our Waterfowl Resources.

I want it distinctly understood that I speak as a representative of the Waterfowl Committee of the Outdoor Writers Association of America. It is a six-man committee and no one-man army. It has its head in the Arctic and its feet in the Gulf, one hand in the Pacific and one hand in the Atlantic. We have been wide open. What I say here this morning stems from that, but it has my own personal endorsement as a sportsman and a hunter. I can go back tomorrow to the place where I killed my first duck at the age of 9 years, which was 57 years ago, and the chances are that I could kill a duck there the next open season, thank God.

Last night at the Outdoor Writers' dinner, our chairman said that

he expected to be jumped on by Mr. Buckingham tomorrow, along with this topic. To the contrary, I am very grateful to him on behalf of the Outdoor Writers' Committee, because perhaps inadvertently, but with great fairness, he yielded to include the topic that has been disturbing a great many of us in duck shooting for many, many years.

I was at the House Select Committee hearing in Washington last summer and I hadn't read H. R. 3461 until the night of the first day of the proceedings. Reading it that night in its form, I found, among other things, that it prescribed perhaps regulated feeding for commercial places. That was the first time I had ever seen an admission or a statement of the fact that our waterfowl resources are or have been in a state of commercialization.

We have been operating, for instance, since 1918 under the Migratory Bird Law. So I went back and wrote a query directed to the Select Committee. The next day I met Chairman Robertson at the door, as I am sure he remembers, and asked him if it would be in order for our Committee to ask his Committee if a state of commercialization of the waterfowl resources of the country does exist. As I recall his reply, it was, he was just leaving to attend another meeting and he said, "By all means, it is a very hot question; let her go."

So I let it go and there it stands today.

The basic content of my discussion stems from just three words contained in the body of the Migratory Bird Act itself.

It took about 14 years and 8 months for the brave and brainy conservationist-sportsman who somehow "found a legal approach" and eventually put through the Treaty Act with Great Britain and the Migratory Bird Law, ratified by the United States Supreme Court, 1916-18; the document under which we operate today. It was aimed at "spring shooting" and "market gunning sales of migratory waterfowl (and today) the sale of migratory and game birds." That the Act sought to end "commercialism" of waterfowl and contributory wildfowling practices is evidenced by three words in the body of the Act. It says, in effect, "ducks and geese shall not be killed, taken, etc., other than as legalized, sold nor offered for sale in any manner."

Why were those three words "in any manner" put there? A not unnatural supposition occurs that those approving such utterance figured that there would be (just as there have been for the past 27 years) evasions. But they were sincere in decreeing, in so far as the will of the Act itself and its guarantors, the Courts, could make it plain, that they intended to end the commercialization of wild fowl, then a precariously balanced and self-evident declining economic and recreational natural resource.

From the purely physical aspect of the Migratory Bird Act's original intent to stop spring-shooting (or too early shooting) and market-gunning sales, we still have such defiant violations of original regulations to contend with. No one will admit this more quickly or willingly than officials of the Fish and Wildlife Service. They maintain a division of enforcement for just that. That such enforcement has been, and is to this good day, undermanned is neither here nor there. But it is something to be improved—and by ourselves.

But when spring shooting and market hunting per se supposedly went out, a new form of commercialism infiltrated duck shooting—at a time when prohibition's easy virtue began an eroding influence upon national morale and character from which we suffer today. And it was done as subtly as its racketeers and gangsters infiltrated the labor movement. It was about this time, apparently, that those three words in the Migratory Bird Law, "in any manner," dropped quietly from official thought, much less scrutiny. The depredations of bag limit violators and game sellers in several of the Nation's most open and notorious slaughter pen and river bottoms and coastal areas were reduced in volume of crime. But it was easy enough for such commercialists to adopt a more sportingly genteel way of selling more ducks and making far more money off wild fowl—and faster than in market growing days. They leased, bought, fenced or fought protectively over natural or synthetic potholes and sloughs, which, until the law further forbade, they baited; some are still. Relays of hunters at stiffish per diems crowded these trenched mop-ups. This all culminated back in 1928-29, in what was inevitable. The great drought struck and Nature handed in her bill. Drought caught the major blame, but men who knew the truth, knew that the gun and rank commercialism plus ineffective enforcement of the Act itself, was accessory before the fact.

It is common belief among competent correspondents that for years commercialism has killed more wild fowl in proportion than old-time market gunners did. What the loss in dead and crippled ducks has been, heaven only knows. What the loss in potential income taxes has been from these, in most cases "fly-by-night" businesses because of lack of supervision or plain bad handling, is equally incalculable.

Now, I will get out on my own. Four years ago, the Waterfowl Committee began studying this problem. We had been after it for years, but when you approached officials of the service, when you approached conservation groups, you always got the same answer, "Yes, it is all wrong, but we cannot find a legal approach to it."

Where did those superb men find a legal approach to the Migratory Bird Law itself? They battled it for 14 years and 8 months before it

was in the Congress and ratified by the Supreme Court. So it reminded us finally in our failure to get light on the matter, the light about which Sydney Stephens spoke yesterday as being so necessary to the whole conservation movement, of the old song, "We will love you when you have no money, but will not be with you."

So today the Outdoor Writers of America are simply asking for light. How are you going to get it? Two years ago at Columbus, Ohio, we proposed a program to the state wildlife service. We are not telling anybody; we are asking for information for a problem. It affects tremendously the very G.I.'s that Colonel Rock spoke about a while ago. How are you going to find the true picture of what is going on in America to end such squabbles and controversies as appeared this morning, to set conservation on a tremendous scale of forward thinking and progress and quit acting like a lot of high school fraternity boys, each engaged in some little thing that affects his or their immediate person?

For many years Mr. Fred Lincoln has endeavored to get the picture of what is taking place under the migration. I have known him for many years, worked with him, believe in his methods. He has done the very best he could and has the support of perhaps 2,500 or 3,000 observers who try under the migration to get the picture and report back to him what such people can see and tell him. That, however, was one side of the picture, because very many of those people are not the people who see what is going on in the United States as to duck shooting itself. They are not, to put it baldly, the killers, like you and I are.

The question is how to get that picture. So we suggested that the Fish and Wildlife Service, as the competent authorities for such matters, get from the states, over which they have the immediate right to ask such matters, a legal description of every form of duck shooting in the United States. By that I mean the private preserves owned by an individual or group, the duck clubs of the country, from the little fellows to the big fellows who shoot for pleasure strictly, and don't think it doesn't cost them a pretty penny to do it. Then they should get a legal description and location of every commercial place in the country, get the names of that fine body of men, the good, honest, hard-working guides on public water and anybody else that wants to send in a report; license them, tell them to send into the Fish and Wildlife Service a legal description of who they are and what they are, license them. As Dr. Gabrielson wrote in acknowledging the qualifications of this plan, it will almost pay for itself. I believe it will.

When do you get that picture? Issue them a license for that season,

but require of them, under penalty of forfeiture perhaps of that license, that they make a complete return to you at the close of that season, tell you about their feeding problems, tell you what is going on; but when a man operates or an association operates a commercial placed let him tell how many ducks were killed there, who killed them and how much money he made off those ducks. Perhaps the authorities would like to know. We don't even know where they are, who they are or what they are; but when you set in motion a businesslike handling which is the basis of management of duck shooting in this country, those are the men who see the ducks. They can tell you the other side of that picture and should be made to tell it accurately. It is not very difficult. It would be comparatively easy once it got rolling.

That was the plan we suggested to them. When you get that picture, you will then find out just to what extent commercialism has infiltrated our field. It is not my purpose to take you on any gory bus tour of commercialism. When you see 75 men in line slip up behind the levee and in three onslaughts on 3 ponds put 750 ducks in a truck and go back and form a line like in front of any cafeteria and get 10 ducks for 10 bucks, the question comes into your mind: "This has been going on within sight of the authorities for years. In what manner are the ducks being taken—a perfectly natural resource?"

Do you suppose there are returns in income tax of what he made off a free resource, off some poor G.I. sweating down in the bottoms to even get a shot? Don't make me laugh. And it is so easy to find out.

What do those words mean, "in any manner"? To whom are we to ask for light to tell us? Are we actually commercializing the ducks that Ducks Unlimited is trying hard to get back, the Fish and Wildlife Service? In the last two seasons the Fish and Wildlife Service and the Outdoor Writers of America have sought to abate one of the most nauseating examples of commercialism that has ever come before public attention. To the credit of the Fish and Wildlife Service they have done a good job of it.

What the Outdoor Writers Association of America wants is a businesslike program, for three reasons, and mark this very carefully, when you get it: In the first place, you find the true picture of what is going on in duck shooting. If you ask them to tell you water levels or drought or why they need to feed the places, they will tell you. That is a matter of public relations. If there is one defect more serious than any other, it has been the public-relations policy of our Fish and Wildlife Service. They make your regulations, they have regional meetings, and when we want to get anything attended to or passed or they want to talk feeding or baiting or duck shooting, it has been a pretty diffi-

cult proposition. I even remember that it got down to a point of where some poor fellow wanted to plant a dove field and brought me four or five letters, and he was forbidden to plant wild millet, but was told that he could plant tame millet, with the Latin name. He is still in a fog somewhere. I think he went off and committed suicide, I don't know.

Once you get the program that the Outdoor Writers have suggested, you will then find out who are the duck shooters of the country, the men who pay for it, work for it, pray for it; invite them to their conferences, deal fairly with them in your public relations. That will tell you where they are. They hold meetings around the country, to which the state game and fish directors come to discuss the problems of wildfowling. I have talked to outdoor columnists and writers in my part of the country and I have been there a long time and I don't ever remember receiving an invitation to come to any such hearing between the states and the federal waterfowl people. Then they go back and put forth the regulations.

I think they believe in the suggestion that we have made to them, get the picture. We also suggested an increase in the price of duck stamps, to get the funds to do with and give us better enforcement, to make investigations, to conduct better and more amicable public relations.

After all, gentlemen, what is the duck stamp? When you reduce it to its least common divisor, what is it? It is a legalized request by the duck shooters of the United States to be permitted to tax themselves to shoot ducks. Not one mill of it comes from the American pocketbook. So if it is going to take more funds to get facts to give us better shooting, better work in the country, we are going to have to grab the check and we should do it, and gladly.

Why should perhaps 40,000 altruistic gentlemen in the United States have to contribute $400,000 to a fine organization like Ducks Unlimited, when this past season there were 1,700,000 duck stamps sold, many of whom, practically all of whom, benefit in one way or another. That in effect is the basis of something the Outdoor Writers Association of America passes on to our Select Committee. We are not jumping on them. They have given us a great break.

Test the thing, find out what "in any manner" means. If you are going to turn the duck shooting of the United States over to commercialists to put fences around places and charge $10 or $15 a day to come in there when some poor fellow hasn't got the price, are you going to license them to bait and use live decoys? Why, they will shoot you down so fast you won't know what it is all about. So let's think this thing over seriously, let's go to headquarters and find out of whom

you should ask that question, who is responsible for it. Sydney Stephens said yesterday what we need is light. That is all the Outdoor Writers Association of America wants.

Of whom do we ask such questions as that? We will pass it on, if you want to hash it out, but when you surround a small state sanctuary full of thousands and thousands of geese, for instance, and one family's line of demarcation along the edge of that place yields an income of, allegedly, $35,000 a year, where they had to stop it in three days this season when they killed 6,000 geese, at the rate of five geese a minute, it is time for the Outdoor Writers of America to ask where we are going in this country in the commercialization, and where it sharply differentiates from the natural game bootlegging horrors that we see down in our part of the world and are going on all over.

I am standing up here this morning and asking—I am not jumping on anybody. The Outdoor Writers of America want to know these things; we are entitled to qualified replies. If there is a decision to be made, let the proper ones make it. I am a club member, yes. We would be tickled to death to be licensed, to be taken out of the welter of commercialism, even to know where we are going. We will tell you who we are or what we are. We will be satisfied with anything that these fine gentlemen entrusted with the destiny of our shooting give us; we can take it.

A fine Irishman said that it requires great wisdom for the governments of the nation, but it can't exist without beauty. When you turn this country's wildfowling areas into a shambles of commercialism, it is going to go pretty quick.

If there is any comment on what I have said, why—I hope there won't be, I hope there will be a lot of thinking, because we are asking that question: What do those three words mean—"in any manner"? License the country for duck shooting, find out, get the facts; that is what we need. Then I think the duck shooters of the country will be a whole lot better off.

DISCUSSION

CHAIRMAN ROBERTSON: Thank you, Mr. Buckingham.

I can assure you that our Select Committee on Wildlife Conservation will welcome suggestions from your Association and from all other groups that will help us to bring legislation that will put the hunting of migratory birds on a higher, ethical plane. We have no law now, as you know, to license and inspect anybody. In including the commercial clubs in the bill I introduced for regulated feeding, I was providing more or less on the theory of the Methodist preacher who went to the prize fight and one of his members saw him there and said, "Parson, I am surprised to see you at a prize fight."

"Well, now," he said, "I just came to see what they did here."

He said, "Yes, and that is what the rest of us came for."

I wanted to give authority to the federal agents really to get into these commercial clubs because when I told you that it is a hot question, I had in mind the fact that there is a twilight zone where the only shooting that some poor people can get is through commercial guides. When we go into what many of us call a slaughterhouse proposition, it is difficult to frame a law that will permit one type of hunting of that kind and prohibit another. We will welcome suggestions. I think you touched on one important thing and that is the opportunity of the outdoor writers to better educate our people on the subject of ethics in hunting, because we must bear in mind there are many people in this country who do not view the program from our standpoint.

I often think of the American writer musing in the little French cemetery of Pere la Chaise at the tomb of Heloise and Abelard, who said, "He who sins in the darkness of a benighted intellect sees not so clearly through the shadows that surround him the countenance of an offended god."

We have offended but some have offended in ignorance. It is our privilege, it is, I think, our duty, to hold up to the millions who wish to enjoy the out-of-doors the highest program of ethical practices.

GENERAL SESSION

Tuesday Afternoon—March 12

Chairman: FAIRFIELD OSBORN
President, New York Zoological Society, New York, New York

Vice-Chairman: LOUIS BROMFIELD
Farmer, Conservationist and Author, Lucas, Ohio

EDUCATION IN WILDLIFE CONSERVATION

URGENCY OF CONSERVATION EDUCATION

FAIRFIELD OSBORN
President, New York Zoological Society, New York, N. Y.

There are two major threats in the world today, either one of which would cause incalculable loss of human life, if not the breakdown of the entire structure of our civilization. The first is the misuse of atomic energy. Everybody everywhere knows about that now so presumably steps will be taken to ward off that perilous danger. The other is the continuing destruction of the natural living resources of this earth. This great Conference of conservationists from all parts of North America is being held in order to help ward off this second incredible threat to everything that is alive on the earth. Human beings, wildlife, forests, soils, water sources, are all in the same basket. Let's not fool ourselves. The Good Earth may be able to get along without man—as a matter of fact, it did successfully for many long ages, and could again today. But man cannot get along without the Good Earth, and when I say Good Earth, I mean all the natural living things on this earth, the things that conservationists refer to as renewable resources—forests, animal life, soils and waters. Every conservationist knows that these are one and all interrelated and interdependent. But the public does not know this fact; the industrial corporations don't know this fact; the legislators don't know this fact—except

for a few of them. The truth is our government and other governments give no evidence that they actually realize what is doing on, or, let us say, realize the extremity of the seriousness of the situation both here and in other countries. I never thought I would stand up anywhere and criticize a man whose name is Winston Churchill, but I am certainly going to take the opportunity. Ten days ago in Missouri, he talked about soil; he mentioned it, and quoting an excellent, sometimes inebriated, brilliant Irish author of 50 years ago he said, "All we need to do is use soil in justice and peace."

He didn't say anything about contour plowing or erosion, and it wasn't in his mind. I am just wondering whether Winston Churchill could have talked about soil without dealing with the basic problem that in itself is causing his empire one of its greatest headaches, and they wouldn't have them, presumably, had they dealt with that basic problem.

The third of the Four Freedoms—"Freedom from Want," Dumbarton Oaks, the San Francisco Conference, the U.N.O. meetings—all of these teachings of the human mind and spirit for a better world can well prove futile efforts unless the conservation of renewable resources becomes a cornerstone of cooperative effort, of governments and people alike. Time is running out—increasing human populations on the one hand, decreasing life resources on the other. How much longer have we got to go? Not very long.

Wonderful efforts are being made in this country—through certain federal departments such as the Soil Conservation Service, the Fish and Wildlife Service, the Forestry Service, the protective influence of the National Park Service—all these activities, combined with those of state governments and many private agencies, are magnificent, but truly they are not enough. All of you here today in your heart know that to be a fact. One widespread cure not only for this Nation but through its influence upon other nations, is to be found from education in all channels of our life. Perhaps it is the only cure. In any event, we all know it is one of the major cures. That is why we are met here today—to help provide formulas for widespread processes of education on this most vital of subjects.

CONSERVATION AND INFORMED PUBLIC OPINION

NICHOLAS ROOSEVELT
Assistant to the Publisher, The New York Times, New York, New York

I suspect that what Mr. Osborn would really like me to do this afternoon is to give you a wildlife version of how to make friends and influence people.

As you know, an entire profession has grown up in the last two or three decades which has as its objective the influencing of editors, writers and radio commentators to devote as much space as possible to the particular cause in which the advocates are particularly interested.

As one who has been bombarded for nearly a quarter of a century with pleas for publicity both good and bad—let me interject that every newspaper editor has to have a scrapbasket which is at least 3 feet high and 2 feet in diameter and which usually has to be emptied at least twice a day due to the fact that it gets rapidly cluttered up with pleas for publicity for causes which are of little interest to the bulk of the newspaper readers—I think that the first rule, if you want to get support for a cause or a project, is that this cause must have a sufficiently wide potential appeal and must be sufficiently sound to carry itself by the weight of its own inherent interest. In brief, it must be a good cause. No press agentry, no high pressure of public relations councils can put over a cause which doesn't have an intrinsic appeal to the people to whom it is addressed. I don't mean to suggest that the press and radio are without influence in the shaping of public opinion. What I mean is that it is the *facts* which the press and radio disseminate rather than the *opinions* of editors, commentators or persons trying to push a particular cause, which do the work. The press and radio offer excellent channels for bringing facts before the public. This in turn makes it easier to bring the facts to the attention of individuals who can do something about it. These may be members of the state legislature or members of Congress, if a new law or a change in a law is required. They may be men and women of wealth, if contributions are necessary for the financing of some kind of organization devoted to drawing public attention to particular causes. But the press and the radio are little more than the vehicles of communication. The people whom you want to reach will ignore you unless what you put before them appeals to them as really deserving of their support. Contrariwise, they will give you unstinted aid if your case is sound and good.

Perhaps if I tell you an experience of my own some eighteen years ago you will understand what I am driving at.

In the early spring of 1928, when I was a member of the editorial staff of *The New York Times,* I went out to California on a prolonged vacation with the express purpose of seeing the Coast and Sierra sequoias. I got to the Yosemite in the middle of February and found that the annual meeting of the directors of the national parks was about to take place under the leadership of those two great friends of conservation, Mr. Stephen T. Mather, then head of the National Park Service, and his assistant, Mr. Horace M. Albright, who, as you know, succeeded Mr. Mather as director of the National Park Service. By chance, I went on a snowshoeing trip the day after my arrival with one of the park rangers and learned from him that a project was on foot to cut out a substantial area along the western border of the Yosemite National Park which contained a particularly fine stand of sugar pines, and that this land was going to be turned over to one of the lumber companies in exchange for land owned by this same lumber company farther inside the park boundaries.

Like most of you in this room, I had always assumed that the purpose of a national park was to set aside an area particularly distinguished for its natural beauty so as to preserve this area unspoiled for all time, for the enjoyment of future generations. It had never entered my head that inside the boundaries of parks there might be areas belonging to private individuals over which the park had no jurisdiction. I learned that in Yosemite Park alone there were tens of thousands of acres of the best forested land in private ownership.

When I got back to the Ahwanee Hotel on the floor of the Yosemite that afternoon, therefore, I hunted up Horace Albright and told him that I thought this was an outrage, and that something should be done to prevent it. He said he did not see what could be done, but suggested that we talk to Mr. Mather. Mr. Mather explained that this was the lesser of two evils; that there were important areas still privately owned and belonging to lumber companies which the Park found it was unable to buy up, but that by exchanging some of the Park holdings on the extreme western border which the lumber companies wanted, and which could be easily lumbered, the Park could get the lands farther inside, and thus save them from desecration. He showed me a map and explained that along the western border of the Park, a border which, incidentally, was very irregular, was one of the finest stands of sugar pines anywhere in the Sierras.

I told Mr. Mather that I thought that if, instead of entering into such a trade, he would make a public statement to the effect that the Park was threatened with the loss of this important area and that the lumber companies were prepared to cut both inside and outside the Park, he would get such widespread support that it would not be

difficult to push through Congress a bill for enlargement of the Yosemite Park area, and that, instead of cutting down the Park, he could add to it and save the stand of sugar pines. I checked with the office of *The New York Times* and found that, if Mr. Mather wished to make such a statement, the paper would be glad to print it. He and I accordingly worked over the text of an interview, and two days later it appeared in *The Times*.

The response was, as I had known it would be, immediate. From all over the country we began to get expressions of indignation that the Yosemite was being threatened and, at the same time, expressions of support for the proposal to enlarge the area of the Park and to save the sugar pines from the lumber companies. Horace Albright, who was experienced in these matters, reminded me that, if favorable action was to be obtained in Congress for a bill enlarging the area of the Park, we would have to have the support of the California delegation in both houses. He warned me that the influence of the lumber companies was very considerable and that the best way of counteracting this influence and of getting the support of the members of Congress was through publicity in their home papers. He suggested that, if, when I left the Park, I could stop off in some of the towns in the valley below the Yosemite and talk with the editors of the local papers, it would surely be of help. I did this in a number of places and, although there was opposition, the reception in the main was favorable.

In the meantime, the original story in *The Times* had come to the attention of Mr. John D. Rockefeller, Jr., in New York, who expressed so much concern about the threat to the Yosemite that he offered to give a sum of $1,750,000 for the acquisition of lands privately owned within the borders of the Yosemite and other national parks provided Congress would match his gift dollar for dollar. The National Park Service, through friends in Congress, saw that a suitable bill was introduced. The upshot of it was that, within about a year, Congress appropriated the money, Mr. Rockefeller gave his generous gift, a law was passed facilitating the acquisition of privately-owned lands within all the national parks (with the exception of Glacier) and the boundaries of the Yosemite National Park were enlarged instead of being cut down.

I don't flatter myself that this was more than in a very small way the result of my own activities. I happened to be the channel through which the condition was brought into the open. The cause was a "natural." All that it needed was to focus attention on it. Support for the cause piled up as knowledge of the condition spread.

You may ask: What is the moral of this tale? To my mind it is simple—to have a good cause and to bring it to the attention of people

who can do something about it. If I may offer a little advice, may I say that those of you who are interested in obtaining publicity for special causes in conservation will find your work will be made easier if you will decide upon your target. If what you are after is to obtain funds for an organization, you've got to frame your publicity so as to appeal to people with money. If you need state legislation, you have to aim primarily for the support of local assemblymen and senators—of those most immediately affected by your proposal. This means that you should concentrate on them and on the newspapers in their district. If you are after Congressional action, don't forget that your first objective must be the support of the Congressmen and Senators most directly affected by your project. These men are more influenced by their home papers than by the metropolitan press. It is true, of course, that the home papers are likely to be interested in, and perhaps will reprint from, metropolitan newspapers, but your target should be the local papers. This means, incidentally, insuring that the home town newspapers of the particular members of Congress on the committees considering the legislation which you advocate are informed about your project and are sympathetic to it.

You are fortunate in being devotees of a cause which has a wide public appeal. Your problem as I see it is, therefore, primarily that of being at the same time watchdogs and advocates—watchdogs to see that selfish interests do not undermine the conservation movement, and advocates of particular measures through which wildlife in this country and wilderness areas and national parks and state parks and other similar beauty spots can be preserved for the enjoyment of future generations. The public is with you. So, also, will be most of the newspapers. It's up to you so to present your pleas that busy editors, whose main headaches arise from the daily competition for space in their columns, and who are calloused from tossing into wastebaskets mountains of material which has no interest for their readers or no claim to space, will mark your copy for the front page, and call you up to ask for more material. It's got to be good to get by—but when it does get by, you may rest assured that you are on the road to victory.

CONSERVATION EDUCATION IN THE UNIVERSITY

ROBERT C. CLOTHIER
President, Rutgers University, New Brunswick, New Jersey

In reviewing the program for this meeting I am not too sure of the appropriateness of the remarks which I have prepared. They are related more to conservation in general than to the conservation of wildlife. Like most college presidents and professors, too, I find my remarks overlong for the time assigned me. With your consent, consequently, I'll discard the customary introduction and the usual alleged humor.

The war which we have just fought to a successful conclusion has done two things. First, it has thrown away and burned up the material resources of mankind at a rate unprecedented in human experience. Second—as a corollary of the first—it has impressed upon all of us the dread realization that conservation has become, not just an interesting theory, but a desperate necessity if mankind is to survive.

It has become increasingly clear that man's use of his environment presents problems of ever-increasing difficulty. On the one hand, he must consume natural resources in order to live and the rate of consumption must increase as standards of living rise. On the other hand, consumption reduces the supply of resources; the rate at which consumption takes place depends upon whether it takes place at a reasonably needful minimum or with extravagant recklessness due to ignorance or willful wastefulness. Unhappily we have been guilty of that kind of recklessness and wastefulness which has expressed itself in many forms of economic, political and social maladjustment.

The results of this trend may be seen on every hand, even here in our own country. Each of us is familiar with eroded lands and we know of the social and economic ills which come to the fore as erosion eats into our farmlands. Erosion impoverishes not only the farmer whose soil is carried away by wind or water; it blights the economy of entire areas. We have seen the forests cut, burned and burned again until, in many areas, they are now useless wastelands. We are familiar, too, with abandoned mines and the ghost towns of the mining districts. Our mineral resources are being depleted at an accelerated rate, especially iron and petroleum, two substances which are basic to our industrial economy. Exhaustion of our mineral resources has reached the point where some authorities insist we have become a "have not" nation. We are familiar with the scarcity of fish, game and shellfish; we know the growing list of species which either have become extinct or which totter on the verge of extinction. Abroad we are familiar with

the poverty, ill health and insecurity of such nations as China, Mexico and Chile where erosion has been allowed over centuries to destroy the land men live on, countries where men live on a scale of scarcity which we cannot even imagine and where growing hunger threatens our hope for future peace.

These considerations have vast significance for our schools and colleges. It is imperative that our faculty members and our students have a broad conception of the whole over-all problem of conservation—in terms both of time and of world area. They must come to realize its significance and its importance. It is important that they be able to relate such things as soil erosion, deforestation and the extinction of species to this over-all problem. Out of such knowledge they must be prepared to evolve a working principle and a plan of procedure to conserve the remaining assets which are our collective legacy—just, as still hopefully, we in this country hope some day to find ourselves restored to a balanced national budget. I throw that in half fun and half seriously too, for it too is part of the over-all picture of what we are discussing.

Our approach to the problem of conservation—I speak now of our schools and colleges—falls into two natural channels, instruction and research. It is the function of the university, particularly, both to impart existing knowledge to inquiring minds through instruction and to expand the frontiers of knowledge through research. The first puts existing knowledge to work. The second increases our store of knowledge—to put to work. The two are supplementary.

With reference to instruction, we find ourselves confronted with the task of setting up curricula which will first make the student conscious of the problem of conservation, its nature and its seriousness, and second inform him how to go about doing his bit in the over-all conservation program, both the *why* and the *how*. It would be manifestly absurd to set up "courses in conservation" with the hope that they could do more than lay the foundation for more specfic study for, as I have said, conservation is infinitely broad in its implications and reaches into practically all branches of knowledge. Such so-called courses in conservation might indeed serve to make the student conscious of the problem and tell him the *why* of it. But when it comes to the *how* of it, the practice of the principles of conservation, it seems to many of us that the prineiples must be recognized and made fundamental in all courses of study—in some, naturally more intensively than in others. It is my belief, by way of attempting to set forth an illustration, that the teachers of all subjects have more to teach than the subject matter of those courses themselves. Unless the student of mathematics, for instance, is a better man as well as a better mathema-

tician when he finishes his course in mathematics, there has been less than fully adequate instruction in his course. The student should have derived from his course a better grasp of logical thinking, a better understanding of ethical and moral principles, a better ability to express himself in written English, a better understanding of his responsibilities as a citizen of the world. The same thing holds good, of course, in economics, in history, in languages, in the sciences. It may be said, I think with justice, that a course of study which does not yield the student something over and above the specific content of the subject matter itself is fundamentally lacking, either in the work which has gone into its preparation or in the manner in which it is taught. Assuming, however, that most courses of study do impart to the student, over and above their specific content, the broader intellectual and social benefits to which I have alluded, it seems reasonable to entertain the conviction that the good teacher, in whatever field, will relate his teaching in his course to this broad subject of conservation which, if our premise is true, is essential not only to man's advancement but, in the end, to his actual survival. My first proposition, consequently, is that all teachers in practically all courses, have the responsibility of conveying to their students, through the vehicle of the course content and through their presentation of their subject, some understanding of the principle of conservation in its broad aspects.

Let us regard that as fundamental. In addition, of course, many curricula are more directly related to the subject of conservation. Such courses as those in economics, history, political science, forestry, wildlife management, geology and geography, soil science and irrigation, petroleum engineering and animal and poultry husbandry have a very direct relationship with the conservation of the resources which are at the disposal of the human race. I have no doubt that many other curricula are potentially available for our purpose. The levels at which this instruction can be given vary all the way from that of our 4-H Club programs for youngsters through the normal college years to that of graduate study in which such projects as planning and supervising of reforestation projects are carried out.

I have the feeling that an opportunity awaits us to think further and deeper than we have yet thought in the development of specific curricula of this nature and in the further development of existing curricula to serve adequately the ends we have in view. At a meeting like this of ours today, it would not be timely to attempt to go into detail. Any such discussion, too, would call for the participation of men who are expert in many fields. My part, as I see it, is merely to point to the opportunity and the responsibility.

My third proposition is that our universities, particularly, are

charged with the responsibility for research in the field of conservation. What I have in mind is illustrated, in a sense, in the experience of the institution with which I am associated and with which I am most familiar. Many years ago geological surveys of New Jersey were housed on our campus. Through them Dr. George H. Cook, State Geologist and teacher of chemistry and the natural sciences in general at Rutgers, made studies of mineral resources, soils and fertilizers which still have value after almost eighty years. The vision of this early conservationist finds expression today in the activities of our still new Bureau of Mineral Research, and of our College of Agriculture and Agricultural Experiment Station. The Bureau has the cooperation of the State Geologist, the State Department of Conservation, and the Natural Resources Committee of the New Jersey State Chamber of Commerce. Objectives of the Bureau are to bolster up New Jersey's declining mineral production, to augment known reserves of minerals and to encourage wide use of low grade minerals as substitutes for imports.

In our Agricultural Experiment Station, investigations of the problems of erosion control and soil improvement underlie much of the entire research program. I entertain the belief that there is some correlation between the results of this conservation research and the fact that in New Jersey gross farm income, on an acre basis, exceeds that of any other state. To digress briefly, it may interest you, also, to know that our researches in soil microbiology led to the discovery of streptomycin. This new antibiotic substance, according to spokesmen for the medical profession, holds great promise of proving to be a specific for certain types of tuberculosis, for typhoid, dysentery, tularemia, and certain other diseases which do not yield to penicillin or to the sulfa drugs. This product of the soil science laboratory will one day be as plentiful as penicillin. It has an exciting potential for conserving and advancing human health, another aspect of our over-all proposition of conservation.

For more than 50 years the University has maintained a marine laboratory for doing research on the propagation, protection and improvement of oysters. Time was when our natural oyster beds were "mined" with no thought of tomorrow's supply. But research has demonstrated that we can eat our oyster and have it, too; out of research has come a conservation program which has greatly enlarged the natural seedbeds and pointed the way to increased commercial production of leased grounds.

We take satisfaction, too, in the achievements of our entomologists in the field of mosquito control. It was not so long ago when New Jersey rightly was called the mosquito state. But not today! New

Jersey is now recognized as a leader in the field of mosquito-control work. Benefits of this activity can be translated in terms of the improved health of our people, and the conservation and development of industrial, residential and resort areas in sections once blighted by heavy infestations of mosquitoes.

Our scientists have long been making important contributions in such varied fields as the development and improvement of potable water supplies and the abatement of stream pollution, the replanting and management of farm woodlands, the control of diseases in game birds, and the utilization of waste products in industrial development.

I have used Rutgers by way of illustration only because of the opportunity I have had at first hand to observe its work in conservation education and research. All of us realize that colleges and universities throughout the country have made, and are continuing to make, outstanding contributions to the conservation of our natural resources. We have only to think of the contributions to our knowledge of aquatic biology made by the University of Wisconsin and the University of Illinois in cooperation with their respective State Natural History Surveys; of the work of the New York State College of Forestry at Syracuse and of the School of Forestry and Conservation at the University of Michigan; and of the achievements in wildlife conservation and management of Cornell, Pennsylvania State College, and Ohio State University. This list could be expanded indefinitely.

I entertain the belief that these and other institutions of higher learning will devote more (rather than less) time to conservation education and research. The record clearly shows that the problem is recognized. It is clear that the development of more comprehensive programs on the part of our colleges and universities awaits only the funds needed for additional personnel, equipment and facilities.

We may be sure that the pattern of expansion in conservation education and research will find our educational institutions giving appropriate recognition to problems of the regions and states which they serve. Fundamental research will receive increasing attention. Increased recognition will be accorded the need for giving all students, irrespective of their special interests, an understanding of conservation in its broadest implications. As this is done, we shall have taken an important step in the direction of developing a citizenry well equipped to discharge its collective responsibility for the conservation of the natural resources which are essential to our continuance as a great nation. When one views the contemporary international scene, with its hates and hungers and fears and suspicions and, with it, our advance in science so dramatized by the discovery of atomic energy, he senses anew how vital it is for mankind as a whole that America shall

be strong. When we allow ourselves to think in such terms as these, the importance of conservation is thrown into still more brilliant focus. It is my hope, and my faith, that our universities and colleges will not be found wanting in shouldering their share of the responsibility.

DISCUSSION

CHAIRMAN OSBORN: I don't know whether we all realize what we have heard. We have heard a university president and just to record this meeting accurately, I would like to have it on the record. I understood Dr. Clothier to say that he was going to guarantee the teaching of conservation in all the curricula at Rutgers University.

DR. CLOTHIER: Well, I wouldn't express it just that way, but it is all right.

CHAIRMAN OSBORN: He wants me to qualify that a little bit. He wants me to say he is going to guarantee the teaching of conservation in all the—no, almost that.

Truly, you know, it is a funny thing, but 10 years ago such a thing as Dr. Clothier's speech, I don't think, could have happened because this actual consideration that Rutgers is giving to direct conservation teaching in other causes, other than conservation, is certainly a very revolutionary thing. We wish you great good fortune in pursuing ways and means, Dr. Clothier, for your university in accomplishing this objective. I think every one of us here in this room would agree that if Rutgers will do that and if some other university (perhaps it is Cornell) will do it, it will go through the teaching and colleges and universities in this country like wildfire.

CONSERVATION EDUCATION IN THE SCHOOL

F. OLIN CAPPS
Missouri Conservation Commission, Jefferson City, Missouri

Remarkable progress is being made in the teaching of conservation in some states and in individual schools in particular. It must be admitted however that at the present time only a small percentage of the boys and girls enrolled in our schools are receiving adequate instruction in this important area of education. By adequate instruction I mean that we have a program covering not just soil conservation, or forest conservation, or wildlife conservation, or any of the other divisions as more or less isolated fields but one which presents a unified or integrated coverage of all phases of the subject. Such a program should, in my opinion, emphasize conservation from the citizenship point of view and should be broad enough to include all of the major conservation problems beginning with those dealing with human resources and continually pointing out the interrelationships which exist between our soils, water, forests and other vegetative cover, wildlife, and minerals and the ultimate well-being of our people and the future of our country.

I think that there are a number of reasons why we do not have such

a program at present. Time will not permit a detailed discussion but I would like to present three which I consider most important.

It is the classroom teacher who will ultimately do the job if it is done. My experience with them indicates clearly that many are ready and willing to assume the responsibility but they want and need guidance in what to teach and when and where to teach it.

We must face the fact that very few of them have had the opportunity of receiving instruction in conservation in the courses which they have pursued in preparation for the teaching profession. By this I do not mean to infer that every teacher should be required to take one or more specific courses in conservation. In fact, many such courses as taught at present would not likely be of very great value to the average classroom teacher. If properly organized and taught, courses of this type would be desirable and justifiable but I realize that the many other requirements and administrative difficulties tend to make this procedure impractical at present. I do mean, however, that those charged with the responsibility of training teachers, especially those who are preparing to teach in our rural, elementary, and secondary schools should place particular emphasis on the problems of the conservation of our natural resources in all courses which naturally provide or can be made to provide the opportunity without appearing to set up obviously artificial situations. These courses include history, geography, sociology, economics, civics, American problems, biology, general science, chemistry, agriculture physics, English, literature, art, and other such traditional subjects and especially the methods courses in these subjects.

I am sure that most of the really effective teaching of conservation today is being done by those teachers who have been fortunate enough to receive this type of training or who have been made so aware of the importance of conservation that they have been willing to work out programs for their schools through reading, attending conservation conferences, workshops, and tours, and through the help being provided by state departments of education, state conservation departments, and other agencies actively interested in conservation education. The lack of properly trained teachers is undoubtedly our number one bottleneck.

Many of the teachers who do recognize the importance of conservation education and who are doing a very effective job at times become bewildered and confused because of the great amount of printed material which is available, much of which is entirely too technical for use in the schools and which in some instances presents conflicting ideas. It seems to me that a second reason why we are not getting as complete and as effective instruction as we desire is due to the fact that we con-

servationists have not agreed upon what we consider are the fundamentals of such a program of instruction. We find groups especially interested in soil conservation, forestry, water, wildlife, minerals, and human resources. In many cases, depending upon which group or groups do the best jobs of selling, the conservation education program becomes one centered largely around one or the other of these rather than on a unified program designed to teach that each is not independent of the other but that all are a part of one big problem which must be successfully solved if we are to be able to continue in this country the way of life for which we have just finished fighting a second world war and for which we have spent thousands of lives and billions of dollars worth of our supply of other resources.

Therefore, if we are to achieve our objective we conservationists and those responsible for the curricula in our schools must get together and agree upon these fundamentals. By this I mean the broad areas which are to be included, the desirable attitudes, appreciations, and understandings which the average citizen should have in connection with each area, and the content or subject-matter which should be learned to secure these desirable outcomes.

Those charged with the job of educating our youth will then be in a position to develop for their particular unit or region the type of curricula best suited to the needs of that unit or region keeping in mind, however, that such curricula must at the same time be broad enough to give the national or even the international picture. It would then become the responsibility of the many conservation agencies specifically interested in the educational aspects of conservation to assist by preparing, or by helping to prepare, materials dealing with their special fields of interest, and by making available to the local units such other assistance as they are able to provide which would contribute to the achievement of the goals set up for the total program.

When such agreement has been reached we are then in a position to go to the various educational groups such as the National Education Association, the U. S. Office of Education, the Department of School Administrators, the Department of Secondary School Principals, the Department of Classroom Teachers, the Department of Rural Education, the National Science Teachers Association, the National Association of Biology Teachers, the Vocational Agriculture Teachers, the national and state 4-H Club Leaders, the American Association of Teachers Colleges, the Association of Schools of Education, and others, most of whom already recognize the importance of such a program, and secure their cooperation in channeling it down to their respective groups through State Departments of Education, City and County

Superintendents of Schools, and other local agencies engaged in educational projects with boys and girls.

If I correctly sense the feeling on the part of conservationists and on the part of many of our educational leaders the time for such action has arrived and I hope that steps may be taken to implement such a program. Its failure or success depends largely upon how well we conservationists, with varying interests, can cooperate as a group and upon how well we can and will cooperate with our educational leaders.

MUTUALLY ESSENTIAL CONSERVATION EDUCATION AND RURAL EDUCATION

E. LAURENCE PALMER
Professor of Rural Education, Cornell University, Ithaca, New York

Whether one's interests or background are rural or urban, the fact remains that wildlife is a product of rural areas. Its fate may be determined in the centers of population but it survives only if in some rural areas there is present adequate food, water, protection and other basic necessities and to a large extent it can be harvested only with the consent of the rural landowner whether that owner be the government, a nonresident city landowner or the farmer who depends on the land for his livelihood possibly even more than does the city man depend for his existence on the real estate he may hold.

It is essential because of these conditions that those who determine the practices employed in the development of lands be informed as to the techniques known to yield a maximum wildlife crop, that they recognize any advantages associated with the production of a maximum crop, and that commensurate recognition be made to them for the contributions they may make to the production of this crop that may be harvested variously.

We are insisting with justice that when some of the major federal engineering projects be undertaken that wildlife specialists be given the opportunity at least to advise how the interests of wildlife may best be preserved along with such developments. We cannot be so insistent that the rural landowners who determine what goes on on their lands should conform to any fixed practices. Our best technique under these circumstances is to show those who are responsible the advantages of encouraging wildlife and how this may be done.

In part because of my belief in the strategic importance of sound rural education to a happy national prosperity I have enjoyed spend-

ing most of my life engaged in developing a rational appreciation of the values of the rural life. And I rather think that a national policy that is dependent on the development of a rural asset such as wildlife must recognize the importance of having an informed and cooperative public in rural areas. Without such cooperation it is quite possible that the public's opportunity to enjoy the benefits of wildlife researches such as are presented at this meeting will be progressively restricted.

At a meeting of the New York State Rural Policy Committee held the first of March a series of eight recommendations for improving conditions for wildlife were presented. These follow:

"Encourage practices that recognize fish and wildlife as a crop to the end that ordinarily unproductive areas may add their share to the economy of farm areas.

"Recognize that practices in wildlife management parallel those accepted for the management of existent standard resources in that they consider: (a) an assessment of the amount of the available resource; (b) an intelligent harvest of available surpluses; (c) protection of adequate seed stock; and (d) reasonable marketing of the asset in terms of good will, money or other valuables.

"Carry on management for wildlife production in part because it is more or less identical with good management to avoid soil loss, water loss and woodlot use and recognize that soil loss, fire damage, some kinds of pollution are evidence both of poor general management and poor wildlife management.

"Encourage a more general recognition of the fact that many so-called destructive species such as skunks and hawks and other birds and mammals may carry on highly valuable useful functions.

"Discourage those sometimes popular practices of wildlife control whose effectiveness are seriously questioned by professional wildlife specialists. Among these are general vermin hunts, bounty systems, promiscuous den gassing, den tree destruction, slash burning and ill-considered marsh drainage.

"Recognize that since wildlife is a crop of the land, the landowner who may have contributed considerably to its production or may have suffered from its presence is entitled to a legitimate and commensurate reward for the part paid in raising the crop. Among the promising sources of income that may mark the difference between profit and loss on some farms are trapping, fish-pond management and some sort of landowner-sportsman cooperative project that recognizes the rights of all.

"Encourage a more general education of the public in both rural

and urban areas as to the values associated with wise wildlife management."

It may be significant that the conservation subcommittee of New York's Rural Policy Committee felt that the first and the last two of these recommendations were the most important for emphasis.

For furthering these ideals I have been responsible for producing 108 little manuals in the last 27 years in New York State. These have gone to an average of 100,000 rural folk during that time and a fair proportion of them have emphasized conservation problems. The material in them has represented the pooled judgment of technicians on our college staff, of practical conservation department diplomats and of experienced classroom teachers. We have deliberately avoided flash-in-the-pan tactics in preference to a sustained effort. Our program could have been financed for a quarter of a century for what one state spent in a year or so on vermin bounties. I may be wrong but I still believe that persistent, moderate attacking of a problem yields greater results than unsustained efforts to smash the public consciousness by some spectacular effort. I could illustrate my reasons for this if necessary.

With the help of funds over many years from the American Nature Association and with additional funds this year from the American Wildlife Institute we are furthering the adoption of this philosophy in states other than New York. We have trained workers who for some years have held strategic positions in colleges, teacher training institutions and state conservation departments from coast to coast and this year we are extending those contacts to Canada more specifically than we have in the past.

Various devices have been developed in different parts of the country for furthering this same general philosophy. We have tried most of them and to some extent still use most of them but we feel that with a limited budget it is hard to compete with the effectiveness that results from the publication of simple, widely distributed cheap guides. We might try to keep rural leaders in line by legislation or by the use of traveling museums and itinerant instructors. We could bolster the situation with short-term workshops or by the incorporation of useful material in existent curricula for the schools. We could write texts that could be sold at a profit to the schools. But somehow we feel that each of these has serious limitations either as to permanent value, limited contacts or expensive maintenance though they may very well be most effective in certain situations where specific accomplishments are to be desired.

We believe that one of the most needed contributions to the solution of this problem now centers around the training of qualified leaders,

men and women of experience, ability and inclination who can join existent institutions and help along the lines here outlined. We may have expansion of emphasis on conservation education facilities but it will be fatal if we try to staff these developments by the crony system or by delegating educational responsibilities to someone who for physical or other reasons cannot stand the rough and tumble associated with some wildlife conservation work but because of civil service or sympathy cannot well be thrown out on an ear. Workers in this field must understand not only the techniques of wildlife problems but the techniques of education as well. Workers must be able to speak the language not only of the fish and game club, but the language of the farm, the elementary school and the teachers' meeting.

It is possible that some of the problems of advancing education in rural and urban centers as they concern conservation may be furthered by the passage of federal legislation supporting a National Science Foundation. If such legislation is to be used to further our interests it would seem that we should insist at this time that conservation work be more specifically mentioned than it now is. The latest Kilgore-Magnuson Bill states in its declaration of policy that it is designed to "promote the conservation and use of natural resources." It then goes on to set up within the foundation a "Division of Mathematical and Physical Sciences, a Division of Biological Sciences, a Division of Social Sciences, a Division of Health and Medical Sciences, a Division of National Defense, a Division of Engineering and Technology, a Division of Scientific Personnel and Education, a Division of Publications and Information and *such additional divisions, not to exceed three in number,* as the Administrator may . . . establish."

I should like to propose here that this Conference pass a resolution that the number of additional divisions be reduced to two and that a "Division of Conservation" be added at the start to the specifically established divisions. I hope that such a division might recognize the importance of developing a close connection between rural education and conservation education because of the fact that wildlife at least is basically a product of rural areas.

I am hopeful that things are shaping up so that given a little time, a little patience, some honest cooperation and freedom from political intrigue we may be able to solve the problems here developed. I like to think that eventually we will have a rural population genuinely interested in the cause of conservation, properly informed as to how it may contribute to its advancement and an urban population truly appreciative of the contributions rural folk may have made in this field.

DISCUSSION

MR. HORACE ALBRIGHT (New York): I take it Dr. Palmer's proposal was deserving of consideration, with a view to passing it on to the Resolutions Committee, or whatever organization crystallizes the thought of this convention. Therefore, I would like to second that as a proposal to go to whatever committee or body will present the conclusions to Congress, with a view to having that bill amended.

CHAIRMAN OSBORN: This looks like a big opportunity that is unfolding itself out of the blue this afternoon unexpectedly. I think we all understand Dr. Palmer's proposal. You have this federal legislation establishing a National Science Foundation and the science of conservation is omitted. That is one of the major fields of research and study and action.

You have heard a motion made, you have heard the motion seconded. Before you vote on it, I would like you, if you will, to listen to this proposal from the Chair, that we will put the motion to a vote in a moment, but before we do, I think that it is possible that out of this meeting here today, we can get the signatures and the endorsements of not only the American Wildlife Institute and the North American Wildlife Conference, but the individual signatures of all of the constituent parties here at this meeting which should be a very powerful message to send by telegram tomorrow to Washington, if we can effect this before we close up business tonight.

I am taking over a little for Fred Walcott, but I know he won't mind. I would like to suggest that every man in this room who can say that he represents an organization, be good enough, to facilitate the matter, to give me his name at the dinner tonight. They have been very kind and put me at the speakers' table.

We don't want to hurry this, because, obviously, a number of individuals will need to go back to their organizations. But we might from the very warmth and heat of this general meeting get very rapid action and then that might be supplemented by later endorsements of other organizations. But it seems to me that we are dealing with a very potent and powerful possibility here.

With that interruption, which is not entirely Congressional in its method, may I call for a vote of all of those who are in favor of the resolution embodying Dr. Palmer's suggestion and seconded by Mr. Horace Albright. All those in favor, please signify by saying, "aye"; all those opposed. It is unanimously carried.

The following resolution was unanimously adopted:

WHEREAS, legislation is pending before the Congress of the United States to establish a National Science Foundation, and

WHEREAS, this Foundation among other things includes as one of its major objectives the promotion of conservation, and

WHEREAS, a recently introduced bill known as the Kilgore-Magnuson Bill states in its declaration policy that it is designed to "promote the conservation of natural resources," and then goes on to set up within the Foundation, "a Division of Mathematics and Physical Science, a Division of Health and Medical Science, a Division of National Defense, a Division of Engineering and Technology, a Division of Scientific Personnel and Education, a Division of Publications and Information and *such additional divisions, not to exceed three in number* as the administrator may . . . establish," and

WHEREAS, the citizens, conservationists, fish and game administrators, technicians and educators in meeting assembled believe that conservation and restoration of the renewable resources of the nation is as important to future public welfare as the sciences above enumerated;

THEREFORE BE IT RESOLVED, that the Eleventh North American Wildlife Conference in meeting assembled in New York City, March 12, 1946, urges the Congress of the United States to include in any enactment establishing a National Science Foundation, a specific Division of Conservation, and that the number of additional divisions as provided in the Kilgore-Magnuson bill be accordingly reduced;

BE IT FURTHER RESOLVED, that although the assembly does not favor or endorse the Kilgore-Magnuson or any particular bill, it does respectfully request that a Division of Conservation be specifically established and made an integral part of any National Science Foundation that may be created.

EDUCATION AND EMPLOYMENT IN THE FISH AND WILDLIFE FIELD

DAVID B. TURNER
Nature Study Department, Cornell University, Ithaca, New York

Defined by the above title, a study is being carried on by the writer under the direction of Professors E. L. Palmer (Conservation Education), A. A. Allen (Ornithology and Game Management), and C. H. Guise (Forestry) of Cornell University. This study will be completed September-October 1946.

Cornell University, The American Nature Association and The American Wildlife Institute are supplying the funds necessary for the investigation. The Wildlife Society has endorsed the project and offered full cooperation. Individual members of other societies such as The American Fisheries Society, The American Society of Mammalogists and The Ecological Society have indicated that the groups to which they belong also are greatly interested and are willing to cooperate in making the study a success.

Purpose.—The purposes of the study are:

1. To gather and organize a body of information which can be used to define the functions in the fish and wildlife field of the groups represented in this survey.

2. To present data which will permit the groups in question mutually to assess each other.

3. To acquaint the individual who is considering a career in wildlife work with the education and employment possibilities involved.

Values of the study.—To fulfill the main purpose, basic data on the facilities possessed by each educational institution that offers training in the fish and wildlife field will be obtained for the report. From the various employers information concerning the conditions and possibilities of employment will be gathered.

From a study of the information procured, both employers and students will be able to evaluate the universities dealt with, in so far as their individual needs are concerned. The faculties of the institutions in turn will have a comprehensive source of information concerning opportunities, possibilities and trends of employment for federal, state, provincial, or private fish and wildlife work.

Data on the academic training and other qualifications requisite for the phases of fish and wildlife work will be gathered from several thousand biologists now holding fish and wildlife positions. Their judgments, when summarized, should be of value to those preparing

and employing biologists. Further, the data should be helpful to the student whose interests and efforts need direction.

Other values that will accrue from the study include: (1) A picture of the distribution of fish and wildlife training centers over the United States and Canada; (2) a summary of positions in fish and wildlife work in the United States and Canada; (3) the employment situation in each state or province; (4) an indication of the trends in employment that exist today and which will probably govern employment in the next 5 to 10 years.

Method of investigation.—A large part of the investigation will be carried out in the field, by personal visit to most of the universities which offer training in the fish and wildlife field and to many employers in federal, state, provincial, institutional, organizational, and private agencies. Field work will be supplemented by correspondence and questionnaire.

Source of information.—1. Institutions. Investigation of facilities in colleges will be exhaustive and will cover such topics as degrees granted, faculty, enrollment capacity, budgets, buildings, laboratories, equipment, libraries, study collections, field facilities, plans for expansion of the training program, statements of courses and credits required for graduation in fish and wildlife work.

Dr. Gustav A. Swanson of the U. S. Fish and Wildlife Service has done a large part of the work involved in this section of the investigation. The use of his data will reduce appreciably the amount of research required for this part of the study.

2. Individuals. It is felt that biologists now engaged in fish and wildlife work can make an important professional contribution to this study by stating what courses are considered requisite to thorough preparation for the various phases of the work. This information will be sought by questionnaire of which at least 3,000 will be circulated. With cooperation from individuals and employers the number of returns necessary to furnish significant data should be obtained. The same data will be useful in helping to determine what are the professional standards of fish and wildlife work. The utmost cooperation is essential in this part of the study, and a special plea is made at this time for that cooperation. The importance of the information to be derived from carefully-answered questionnaires has been demonstrated by Dr. H. J. Deason (1940).

3. Federal Agencies. Employment possibilities and conditions of employment are being determined by conference and correspondence with the agencies concerned. Preliminary work has been carried on with most of the United States federal groups including the U. S. Fish and Wildlife Service, the Soil Conservation Service, the U. S.

Forest Service and the National Park Service. Ottawa will be visited shortly for a study of the federal picture in Canada.

4. State and Provisional Agencies. Fish and game officials of states and provinces will be visited as time and finances permit. Twenty state capitals have been covered to date, and the majority of the remainder will be visited in the next few months.

The information sought for this section of the research will cover such subjects as the administration of resources in the state or province, the operations of divisions, bureaus or departments employing fish and wildlife personnel, the categories of personnel, the employment trends and postwar plans.

5. Educationists. The employment possibilities in the educational branches of fish and wildlife work will be examined in conjunction with some of the other investigations. A considerable number of trained men are employed in universities, in state and provincial departments and in organizational and private capacities.

6. Organizations. Employment possibilities with such groups as The Audubon Society, Ducks Unlimited, etc., will not be large in comparison with federal and state or provincial requirements, although such organizations provide a number of opportunities in fish and wildlife work. Their place in the employment picture will be studied.

7. Private. Landowners, companies, corporations and the like, in increasing numbers are engaging biologists. It is planned to explore this source of employment of trained fishery and wildlife technicians.

SUMMARY

1. This presentation may be considered as a progress report. The study was started in June 1945 with three months of field work. Further field work will be carried on through March, April and May of this year.

2. The study will be completed September-October 1946. The purpose of the study is to secure information and present it in a form that will prove useful to those charged with training wildlife biologists, to those employing such trained men, and to those considering a career in the fish and wildlife field.

4. The information will be gathered through personal visit, questionnaire and correspondence.

5. With cooperation from the individuals who have the necessary information, a valuable compilation of data should result from this study. The information obtained should provide an integrated, comprehensive picture of education and employment in the fish and wildlife field in North America.

LITERATURE CITED

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DISCUSSION

CHAIRMAN OSBORN: I want to make a brief announcement of two enterprises the Zoological Society hopes to undertake this year, one through the cooperation of Clayton Seagears—stand up, please! The fact of the matter is it is an exciting business. The Legislature in Albany last week passed legislation which will provide $275,000 for the construction of a conservation exhibit in the Zoological Park in the Bronx.

This really wonderful opportunity is a child of the Conservation Department of New York State and our Zoological Society. We believe that we have an opportunity of spreading the word of conservation in this tremendous center to a degree that we can barely measure. There is far too little time for me to describe it. It will be different. It will be all-inclusive. It is fauna and forest and soils and the whole shooting match. Nobody can get in unless they are exposed to the facts of conservation and we expect between 300 and 500 visitors a year. We are going to have it filled with organized school classes and, we hope, college classes, and nobody is going to be allowed to get out of the exhibit unless he passes an examination. We are really going to run it.

The other thing is this—the Jackson Hole conservation plan, the Jackson Hole Game Park. I am sorry that through misunderstanding certain people who are entirely, as free Americans, entitled to their opinion are criticizing that project. Fortunately, they are extremely few in number. From what we can gather, they are criticizing because they don't understand its purposes.

There was a magazine being distributed here yesterday, National Parks Magazine, that refers to it as a zoo. Well, it has no more to do with a zoo than a dirigible has. Its purpose is conservation, the better understanding of the public of the great wildlife of the West. It is going to be staffed by technically-trained men, and we hope out there, as we hope in the Bronx, to make that a center of information regarding conservation of wildlife, of forests and of water sources, I might say also of wilderness areas. The attack that has been made on it is a fear that it is a defoliation of the wilderness area.

I might point out, according to my own understanding, the wilderness area is what we all know it to be. The locale of this is in the beautiful Jackson Valley and it is along a highway and within sight, among other things, at the end of Jackson Lake with a dam, and there is a town and the place is a wonderful valley of movement of people up to the wilderness areas.

We believe we are working in concert with the Fish and Wildlife Service. Mr. Newton Drury, Director of National Park Service, is arranging to let us use some of the lands in the national parks and we are hopeful through this project, which again is different, to gain great values, the understanding of conservation of wildlife in the West. I would love to argue more, but there isn't time.

CONSERVATION EDUCATION AND THE SPORTSMAN

HERMAN FORSTER
President, New York State Conservation Council, New York, New York

A short while ago, I sat in the Grand Ballroom of the Waldorf-Astoria Hotel, at the annual meeting of the New York Zoological Society, and heard the voice of truth. It came from the lips of Dr. Alan Gregg of the Rockefeller Foundation.

In broad, sweeping strokes, he told a spellbound audience that man, that most destructive of all animals, is the one reason why we concern ourselves with fish, game and fur scarcities. In terse, pungent phrases he pointed out that "we have permitted soil erosion to ruin more acreage of useful farmland in the United States than is represented by the whole State of Georgia. Two hundred million acres out of our entire nineteen hundred and forty million acres have been found, upon survey, to be seriously eroded, leached or depleted by overcropping without proper replenishment or care." He emphasized that "when the soil fails, everything fails, including human nutrition and resistance to disease."

He asked: "Need anyone say it is sound and sage and rewarding to work with Nature and not against her?" He stressed: "The mark of sanity is a comprehension of the realities of existence."

What are the realities? The realities, in so far as hunting and fishing are concerned, are beclouded by fogs of misunderstanding and misinformation. The genesis of this situation lies, I think you will agree, in the reluctance of some of our public officials to speak the truth lest it hurt them politically—in the failure of some of those in posts of leadership to say bluntly—"it is not a question of what you want; it is a question of what, under existing circumstances, you can have." They are utterly blind to the suggestion that "good conservation is good politics."

As man begets man, and more and more land is occupied by human habitations—as we cut the forests faster than the timber can grow—as we mine our soil and tolerate leaching and erosion—as we permit our rivers to be polluted—as we develop chemicals for the destruction of all insect life—as we blindly work against Nature rather than with her, our constantly diminishing wildlife is constricted and compressed into ever smaller areas.

Fishes need moderately-clean water, and creatures need land. You cannot compress existing wildlife populations into smaller and smaller areas, as you would pump air into a tire. This inevitable continued restriction and compression, by a process of simple mathematics,

means that for us in New York State, at least, there will be less fish and game for the fisherman and the hunter to pursue.

And if conservation, as I understand it, means "wise use"—a use which involves the taking of a surplus and no more—and by this change of land use these surpluses tend to diminish steadily, there is but one answer. During the war we called it rationing. The answer lies in the self-imposed restriction of the greatest predator that confronts wildlife—man himself. I say "self-imposed" because you can legislate to your heart's content but unless man himself supports that legislation it becomes ineffective.

If, through conservation education, we can teach man that the killing of a hen pheasant is comparable to the killing of the goose that lays the golden egg, we will have made progress. Parallel situations, as you well know, are common with respect to other kinds of game and fish. If, through conservation education, we can get sportsmen to understand that it isn't all of fishing to catch fish, that the success of a hunting trip is not measured wholly by the amount of game killed, we are on the right track. If our hunters and our fishermen can be taught to use the same logic, the same care in the harvesting of their wildlife crops that they use in the maintenance of their farm herds, we shall have gone far toward a comprehension of the realities.

I, for one, am firmly of the opinion that the sportsmen, at least in this State, will follow any leadership so long as they are convinced that the leadership is sincere and nonpolitical, and that the policies advocated by it are based on sound, scientific principles.

During the past two decades, technical developments in fish and wildlife conservation have been enormous. Because these developments are so recent, and because many of the answers have been kept hidden on the shelves of the scientific laboratories, and because there is a definite scarcity of reports and pamphlets written in a popular vein, our sportsmen, generally speaking, are ignorant of the progress that has been made in this field. Our public school systems are not now equipped to dispense this new-found knowledge.

The problem has been appraised in two different ways throughout the country. First, there are those who take the negative view that it is too late to do anything with the present crop of sportsmen, and the only thing that can be done is to placate them with a substantially increased production program, although production alone, as we all know, answers nothing.

Then there is the other view that it is possible to educate sportsmen who, after all, are reasonable men, and give them at least some concept of the fundamentals involved in this business of providing harvest-

able crops of fish and game or, in simpler terms, of providing fishing and hunting.

Within the limited time allotted to me, I should like to report to you how the organized sportsmen of New York State are reacting to this serious problem.

The New York State Conservation Council represents over 500 associations, federations, clubs and organizations of folks who find recreation in hunting and fishing. By vocation, they come from all walks of life. Their bread-and-butter interests tinge their outlook on the outdoors. Each individual strengthens and modifies the mass viewpoint by bringing to bear upon it the experience gained in his own business.

The Council was born about a dozen years ago and, under the careful nurturing of Karl T. Frederick, developed into a state-wide organization with representation in 58 of the 62 counties of the State.

The Council holds two annual meetings, the first in early December, at which time its members are exposed to the thinking of the best conservation minds in the country, and the second, in Albany toward the end of the legislative session, at which time its views on pending conservation bills are recorded publicly for the information and guidance of the legislature.

To our annual December meetings, for the past 2 years, we have invited leaders in conservation fields from without our own State, to add to and strengthen the same viewpoints expressed by those within our boundaries. The viewpoints of Dr. E. Laurence Palmer of Cornell, Professor Ralph T. King of Syracuse University, J. Victor Skiff, the career Deputy Commissioner of our Conservation Department, Clayton B. Seagears, the brilliant Superintendent of Conservation Education, Dr. William Senning, Director of Research, Karl T. Frederick and others, have been materially strengthened by men like Dr. Ira N. Gabrielson, Senator Frederic C. Walcott, Dr. William Beebe of the New York Zoological Society, Dr. James L. Clark of the American Museum of Natural History, Seth Gordon of Pennsylvania, George Stobie of Maine, George Davis of Vermont, Ollie Fink of the Friends of the Land, and a host of others.

The Council properly takes pride in having originated some of the following matters, developed and amended others, and supported all:

1. The Present Conservation Law.
2. The State purchase of stream fishing rights, wild-fowl sanctuaries, and the purchase of lands for public shooting grounds, with a long-range management.
3. The creation and maintenance of the Conservation Fund, into which all license monies go, and which, with minor contributions

from the General Tax Funds of the State maintains the Bureau of Fish and Game.

4. Legislation giving the Department the right, either permanently or temporarily, to fix seasons and bag limits on grouse, beaver, otter and pheasants.
5. A uniform opening date for all upland game—this in cooperation with the Fish and Wildlife Service.
6. The Bureau of Soil Conservation in the Conservation Department, in the realization that "when the soil fails, everything fails, including human nutrition and resistance to disease."
7. Continued pressure for research, in the realization that to continue to spend hundreds of thousands of dollars to dump fish and release birds for purely public relations purposes is futile and wasteful.
8. The need for the publication of the answers as soon as they are found, because all the conservation knowledge on earth won't do one speck of good on the dusty shelves of some library.
9. The need for an intelligent, adequate and comprehensive conservation education program in all the public schools.
10. The building of a splendid conservation exhibit in the Bronx Zoo, notwithstanding the fact that such an exhibit may cost the sportsmen of the State up to $10,000 a year.
11. A forthright pollution-control program. (We look with envious and wistful eyes at the progress of the vigorous anti-pollution campaign in the Keystone State.)
12. The need for continued restatement of the relationships and obligations between the landowner and the individual who uses that land in pursuit of recreation; and
13. A continuing campaign to maintain Constitutional guarantees that the "lands within the forest preserve shall be forever maintained as wild forest lands." (In New York, the wolf, the mountain lion and the wolverine are extinct, and the fisher and marten are on the way out. Only the retention of the wilderness character of the Adirondacks will maintain these remnants within our borders.)

It must be obvious to all of you that this record of accomplishment would have been impossible without first having developed an understanding of the fundamentals among our members.

The Council issues quarterly bulletins which are sent to every club in the State, whether or not such club is affiliated with the Council. The Council, in this way, attempts to develop conservation sentiment among all the sportsmen of the State, and not only among its own members.

On Wednesday, February 27th, at our annual Legislative Hearing in Albany, the Council inaugurated and supported unanimously two important bills: (1) to prohibit the use of military auto-loading firearms; and (2) to prohibit, under Department regulation, the landing of aircraft in the small square-tailed trout lakes of our Adirondack forest preserve. As Doctor Gregg put it: "The greatest protection hitherto of all plant and animal life has been geographical inaccessibility to man, the destroyer. . . . Does not the airplane, too, which needs no road but can land on any remote lake, reduce to tragic absurdity, the isolation that has heretofore protected wildlife? . . . Only efforts on behalf of protection can substitute for the blessed, but now vanished sanctuary of inaccessibility."

And finally, let me point out that the Council, during a crash decline in pheasants, coupled with the most serious eruption of foxes in the recorded history of this State, has prevented surrender to the bounty nightmare under which many of our friends in neighboring states are suffering. No small part of the credit for holding the line must go to Clayton Seagears for his numerous brilliant speeches before sportsmen's gatherings all over the State, and for his outstanding treatise on "The Fox in New York."

Talking of Seagears, reminds me that last week while dictating this report, there came to my desk a Cornell Rural School leaflet prepared by him, under the direction of Dr. E. Laurence Palmer, entitled "The Story of Conservation in New York." In simple language, and beautifully illustrated by the author, it tells the story of conservation and maintains the high standard that Seagears has set for his Bureau ever since the late John White appointed him Superintendent of Conservation Education several years ago. I commend it to you.

My time is up. Let me leave you with the thought that the organized sportsmen of New York will continue to carry the fight for more and more conservation education because, as Dr. Alan Gregg put it so beautifully . . . . "conservation is sane and alert and wise, and a beautiful part of the delightful business of finding out how eminently livable life is."

CONSERVATION EDUCATION THROUGH THE VISUAL AIDS

FRANK DUFRESNE
Chief, Division of Information, U. S. Fish and Wildlife Service, Chicago, Illinois

The value of visual education in any teaching program is, of course, well established and widely recognized. There is nothing new about it. Long before the photographic arts were developed—when the hand-drawn sketch was the best illustrative material available—a Chinese proverb declared that "one picture is worth a thousand words."

Today, when the science of picture-taking has progressed to the point where color, motion and sound may all be registered on film; when the camera lens has been given telescopic and microscopic vision; when the whirring of bird wings becomes leisurely and needle-sharp before the high speed shutter, the wisdom of that old proverb is certainly apparent to all of us. Today, the camera, and especially the motion picture camera, is rising to new heights as an instrument for teaching. In California, for instance, it was found that the armed forces' training pictures stepped up learning processes by 35 per cent. Facts were remembered 55 per cent longer. In Ohio, a state film supervisor declared flatly that English was the only subject that could not be taught better by sight than by any other method.

Animals of all kinds—especially birds, mammals and fishes—are ideal subjects for photographic teaching. They are in the first place entertaining. They are excellent "actors." They demand attention. And to those who teach, this is an essential ingredient.

The combined experiences of many noted wildlife photographers and lecturers bring to light a wide variety of observations bearing on the value of conservation education through the visual aids.

Alfred M. Bailey, Director of the Colorado Museum of Natural History, and a man of extraordinary ability with the outdoor camera, makes this important point: "In trying to teach any subject, it is essential that the speaker have an audience. It has been demonstrated to me time and again that lectures draw only half a crowd if we advertise a talk not illustrated with film. I receive invitations to speak solely because of my wildlife pictures."

W. J. Breckenridge, Curator of the Minnesota Museum of Natural History, makes the striking statement: "I am becoming more and more convinced that a natural history museum will succeed better in creating and developing interest in this subject by devoting more time and effort to securing good series of moving pictures than by devoting the same time and effort to permanent exhibits."

Ben East, field editor of *Outdoor Life* magazine, quotes from his

wide experience: "Few persons have seen my films of the Alaska sea otter without wanting instinctively to contribute to and support any reasonable program for his restoration. Few have seen the sequences of the Alaskan brown bear without wanting to be reassured that their future is safe. Few have seen my film of young eagles training for flight without feeling an accelerated interest in the American eagle.

"I have in mind a film on game and fish law enforcement produced a number of years ago by the Michigan Department of Conservation. Making skillful use of sentimental appeal, it probably did as much to enlist public support for an enforcement program as any single effort ever made in that direction."

This viewpoint of picture values in practical game management is supported by Livingston E. Osborne, Director of Conservation for Illinois, who says, "By far the greatest part of the educational work at our Conservation School at Lake Villa, Illinois, is accomplished through visual education."

Cleveland P. Grant, well-known photographer and public lecturer, is in agreement with Director Osborne. He states: "I firmly believe there is no medium to compare with motion pictures for a wildlife manager to use in presenting his side of the case. Once his audience is seated and relaxed, and a good picture showing, he has an unparalleled opportunity to tell his problems."

Bert Harwell, western representative of the National Audubon Society, presents still another angle. "Motion pictures," he declares, "focus attention to the one story unfolding on the screen. They make far places easily available. They present wildlife in close-ups seldom experienced by people otherwise. They allow unlimited possibilities of subject groupings. They speak to people pleasantly but forcefully. They teach new appreciation of beauty and wildlife values. They build toward a better conservation. Colleges, schools, clubs, and churches are all clamoring for more and better conservation films."

Owen J. Gromme, Curator of Zoology, Milwaukee Public Museum, further builds up the case for visual teaching with these words: "There are certain situations in which the naturalist finds wildlife subject matter that defies description by the spoken or written word. But if the naturalist is a motion picture photographer, his camera will record the event scientifically accurate and it can be shown again and again."

Corroboration of Mr. Gromme's statement comes from Jack Van Coevering, wildlife editor of the Detroit *Free Press,* "The spectator is treated to phases and details of outdoor life which he never thought existed," observes Mr. Van Coevering. "The other day we were sitting around the table, and one of the boys said that he saw birds better

in some of the films than he ever saw in the wild. This is true because the wildlife photographer spends hours and days getting a picture which takes only seconds to flash across the screen."

And then Mr. Van Coevering makes a statement and a prophecy: "It seems to me that those of us who work with motion pictures have only scratched the surface. I can see great possibilities for the encouragement of better sportsmanship, of methods of hunting and fishing and handling game, of game management—in fact, the entire gamut of conservation offers ideal material for screen treatment."

Limited time will not permit the inclusion here of many other valuable comments from men whose business, or hobby, is that of spreading the gospel of wildlife conservation through the use of the camera and screen. But they are all enthusiastic. They who have had the broadest experience in evaluating audience reaction, do not hesitate to place the highest possible rating on visual information.

And while the motion picture is most highly lauded, several lecturers take occasion to point out the unquestioned value of colored slides, particularly when the subject is one requiring close examination or lengthy description. Both these mediums have prominent places in conservation education. We shall be seeing more of them. With these visual aids, learning is as painless as we know how to make it.

THE RADIO AND CONSERVATION EDUCATION

JOHN KIERAN
Naturalist, "Information Please," New York, New York

In the matter of the use of radio as a means of spreading conservation information of all kinds—news, feature stories, educational propaganda or whatever it may be—I can suggest only the most obvious things. I don't know to what extent the radio is being used now for conservation purposes. It seems to me that, in general, there should be a regular schedule of broadcasts by the various federal and state conservation agencies—and municipal conservation agencies where there are such bodies. These agencies were established for the dissemination of beneficial information in this particular field and radio is merely an extension of their methods of operation. At first they could issue only pamphlets or books, or have representatives make speeches or give practical demonstrations. Along came the moving picture industry and the conservation forces had another effective outlet for educational propaganda. I merely mention in passing that only recently, in a news reel theatre, I saw a beautiful "short" of forest fires in the Canadian woods; what causes them, what damage they do and how the fires are fought by the forest rangers. To me, this looked like conservation propaganda at its best. It was attractive to the eye; it was absorbingly interesting; it was dramatic; and the lesson to be learned was clear to anyone who saw the film.

It isn't possible to duplicate that over the radio just now, but it may be possible in the near future with television. However, the same general idea may be put on the air waves by conservation broadcasters. They can make their stories interesting and even dramatic, because we know that the forces of Nature are all too often dramatic in action, and even melodramatic at times. I believe that such broadcasts should be as nontechnical as possible. The language should be plain and the style simple in order to hold as wide an audience as possible and obtain maximum effect among listeners. Scientific terms frighten the ordinary citizen as well as his heirs, assigns, executors and residuary legatees. Women and children flee from the technicalities of science, economics or politics. They want personalities—and humor—and drama. There's no reason why conservation agencies can't supply these three things in large quantities picked from their own field. There are interesting personalities in the field of conservation—not only men, women and children, but animals and birds and fish—and I'm tempted to throw in trees and flowers and rivers and mountain ranges and dozens of other things we find outdoors. If the dramatic action in the field of conservation is a little slow at times, it is often

on a tremendous scale. But it can be swift, too, as in the forest fire or the spring flood. As for humor, it's found in every field and surely there is no lack of it in the wide field of conservation.

Aside from regular broadcasts by official conservation agencies of federal or state government, another radio outlet for conservation material is through the radio programs conducted by rod and gun or fish and game editors, or any radio program that has Nature or the outdoors as its main theme. I believe that most rod and gun or fish and game editors must logically be interested in conservation, because if conservation fails, it will not be long before there will be nothing in the way of fish or game, nothing to take with rod or gun. So their problem ties in with conservation, even though the conservationists and the rod and gun or fish and game editors do not always see eye to eye on particular problems.

In addition to regular broadcasts of feature stuff and educational propaganda, I think there is a chance to work in news broadcasts of practical value at definite periods. For instance, when the leaves of shade trees are being eaten by those confounded little caterpillars, everybody who lives in the affected area must notice the unsightly damage. At such times people are curious. They wonder what the pest is, where it comes from and what can be done to stop its career of crime. That would be the right time for a radio broadcast on the subject. Spring floods, so common in many parts of the country, are another topic that ties in with spot news broadcasts with a conservation message.

The New York Zoological Society established an information booth service in Bronx Park and has found it astonishingly popular. Visitors want to know more about things they see in the zoo. and they get the added information at the booth. Perhaps there is room on the air for an information service of some kind on conservation. Another suggestion is that there might be programs in which men with opposing ideas in the field of conservation would stage a debate something like the Town Hall of the Air. And that brings my last—or at least closing—thought on this topic, which is that there is always the chance of working in a conservation authority on programs that have guest artists, amateur or professional. Conservation news or feature articles should be sent to regular news commentators. Even if they don't use much of it, whatever they use would be clear gain for the forces of conservation, and we would be educating the news commentators on the side. These are my rambling thoughts on the radio as an outlet for conservation news and propaganda. I'm sure many others present have many more ideas on the same topic, and probably better ones than any that I have offered.

GENERAL SESSION

Wednesday Afternoon—March 13

Chairman: I. T. BODE
Director, Missouri Conservation Commission, Jefferson City, Missouri

Vice-Chairman: H. D. RUHL
In Charge, Game Division, Michigan Conservation Commission, Lansing, Michigan

MODERN DEMANDS ON WILDLIFE

ADMINISTRATIVE PROBLEMS INVOLVED IN MEETING INCREASED WILDLIFE DEMANDS

SETH GORDON
Executive Director, Pennsylvania Game Commission, Harrisburg, Pennsylvania

With the conclusion of the most devastating war in the recorded history of man, another horrible chapter in human relationships and conflicting ideologies has been written. To safeguard our North American way of life for posterity, the blood of many thousands of our illustrious sons was spilled around the globe.

While the smoke of battle has cleared away, various problems incident to national and international unity now come into sharp focus. Temporarily, our mass thinking seems to be befuddled and uncertain. This applies to wildlife restoration and management as well as to other public matters.

The many pressing issues of the moment make it difficult to evaluate objectively the prospective demands on wildlife, or to visualize clearly the administrative and management requirements involved in meeting those demands.

American system must prevail.—Unfortunately, there are a few in our midst who fear that our long-standing concept of public wildlife

ownership must be revised radically. They hold that public ownership and management has failed; that private ownership and hunting and fishing for the few rather than the masses will ultimately be adopted. This, to say the least, is rank heresy.

The many thousands of our sportsmen who have had an opportunity recently to observe old world hunting ideologies at close range will not only help to defend the North American system to the last ditch, but they will demand that more intensive management practices be applied to produce larger wildlife crops. However, the programs and grooves of thought of the old horse and buggy days won't suffice. The mountain climber who is confronted by new difficulties takes time to size up the situation critically before going ahead. This is a period when we in the wildlife field also must take a breathing spell and appraise every phase of the obstacles ahead.

There is no question whatever as to greatly increased wildlife demands. We all know what happened after the first world war when a 30 per cent increase in the number of hunters and fishermen occurred. The annual issuance of licenses continued to climb steadily thereafter, and during the highest prewar year (1941) a total of 8,500,000 hunting licenses were issued, with something like 8,000,000 licensed anglers. Our Canadian neighbors experienced like increases. Those who have studied the problem now predict that the percentage of increase will be much greater. It is believed that within a year or two the total number of hunting licenses issued in the United States alone will exceed 12,000,000, and fully that many anglers.

American Game Policy concepts cited.—It seems wise to review briefly a few important events of the past. For example, 15 years ago the Seventeenth American Game Conference (of which these conferences are merely a continuation), meeting in this very hotel on December 1 and 2, 1930, adopted the American Game Policy as a guidepost for the future. Incidentally, let me remind you that the gentleman who is currently serving as the President of the Pennsylvania Game Commission, Honorable Ross L. Leffler, was the Chairman of that notable gathering.

The Committee, headed by Professor Aldo Leopold, in the introduction to the American Game Policy, among other things said:

"Demand for hunting is outstripping supply. If hunting as a recreation is to continue, game production must be increased. . . . Game is not a primary crop, but a secondary by-product of farm and forest lands, obtainable only when the farming and forestry cropping methods *are suitably modified* in favor of the game. Economic forces must act through these primary land uses, rather than directly. . . .

"We urge frank recognition of the fact that . . . *game conserva-*

tion faces a crisis in many states; that it is only a question of time before it does so in all states. . . . We are convinced that only bold action, guided by as much wisdom as we can muster from time to time, can restore America's game resources. Timidity, optimism, or unbending insistence on old grooves of thought and action will surely either destroy the remaining resources, or force the adoption of policies which will limit their use to a few."

The first paragraph of the Policy itself is significant: "Game can be safely hunted only when the stock on each parcel of land is protected against overkilling *and provided with cover, food, and some protection from natural enemies.* These provisions constitute game management."

Later on the Policy included two important definitions now commonly used: "*Game Management* is the art of growing game crops for recreational use; *Game Administration* is the public function of fostering and regulating the practice of game management."

Programs need revision periodically.—Further review of the American Game Policy itself, and especially the advances that have been made during the intervening 15 years, would be of value but time does not permit. Many of the basic steps recommended have become operative, but if game conservation faced a crisis 15 years ago I wonder what phrase each of you would now use to describe the prospective situation. With the changed conditions which confront us today we must take the breathing spell mentioned earlier, critically size up the problems ahead, and plan our course accordingly. It is recommended that each of you take time to restudy the Game Policy; the fundamental concepts therein enunciated are still sound.

We as conservation workers should analyze our programs periodically in order to profit by the msitakes we have made. In other words, an inventory about every 2 years would be most profitable. Such a procedure in conservation is just as important as in any successful business venture.

New programs launched nationally.—During the past 15 years a number of new programs have been launched throughout the United States and the Dominion. The Federal Governments, the states and provinces, by legislation and otherwise, as well as privately-financed groups, have struck out on uncharted courses and developed programs which only a few years previously were deemed too visionary or impractical to merit consideration. One of the most important of these is the recognition that conserving soils and waters is vitally essential to wildlife programs, and unless these basic resources are conserved and used intelligently, a Nation ultimately will become bankrupt.

No single agency has done so much to impress upon the people of

the United States, especially our farmers and ranchers, the vital importance of a comprehensive conservation program as the U. S. Soil Conservation Service. This agency has aided tremendously to assure a place for wildlife in our agricultural operations. Since 75 per cent or more of our future hunting in thickly settled states will be done on private lands, we as wildlife workers must help to promote and expand the application of soil and water conservation practices. This is an administrative problem which confronts each one of us.

Another new venture that deserves special mention is the Pittman-Robertson Federal-Aid Program, enacted in 1937. This law has not only supplied funds to the several states, but in its application a more uniformly efficient approach has been made toward solving important wildlife needs. Even though the war interrupted this work at a critical period, fine progress has been made under the guidance of the U. S. Fish and Wildlife Service. Approximately one third of the Federal-Aid money so far appropriated has been used for research and other fact-finding work; another third for the acquisition of wildlife management lands and waters; and the remainder for the development and application of management techniques.

Had it not been for the interruption necessitated by the war, we would now be using these Federal-Aid funds more efficiently, and devoting a larger share of them to the application of intensive management practices to produce larger annual game crops. However, a new venture of this magnitude requires time to adjust operating processes and the establishment of sound procedures. So far we have done a lot of exploration with Federal-Aid Projects, and a better operating pattern can hereafter be applied. This constitutes another administrative problem.

Research work must be down to earth.—The mention of research raises another point. Due to interruptions of the war it is probably unfair to evaluate too critically the quality of the research work done so far, but it appears that some of our early projects did not constitute the kind of down-to-earth jobs necessary to supply the know-how for effective management techniques, or to aid in discharging regulatory responsibilities. However, from the time Pittman-Robertson funds became available (July 1939) until most of the research workers joined the military forces some important fundamental work was done.

We need to know right now what intensive management plans can be justified on public as well as privately-owned lands; to what extent we can cooperate with private landowners in the development of acceptable programs, including the construction of farm ponds where soil conservation districts have not been established; how we can best

develop cooperative farm-game projects near large centers of population to assure well-stocked public hunting grounds; and just how far we should go in the improvement of our streams and lakes.

In almost every state and province there are large acreages in public ownership. Every unit of such lands, regardless of its custodianship, should be developed to give wildlife its proper place in the sun so that the ever-increasing army of hunters and anglers can be accommodated thereon. Until that is done private landowners have a good argument against the uninvited guests who annually overrun their property.

In the eastern half of the United States there are enormous tracts of second growth timber in public, as well as private, ownership which today are producing only a fraction of the game crop they did 30 years ago. Food and cover conditions for all species, except squirrels, are at a pitifully low ebb. Most of this timberland is covered with even-age stands of trees which are just beginning to approach merchantable size; they provide a very unsatisfactory home for wildlife. Where this condition prevails one of three things happens: Either the game cannot produce a normal crop of young, or it moves to better feeding grounds, or much of it perishes during severe winters. Extensive studies and experimentation in the application of management techniques to determine how to increase forest wildlife crops quickly, without materially interfering with the primary purposes for which the lands are being managed, are vitally important.

We also must know far more about restocking programs for both game and fish; under what conditions favorable results will be assured; and many other things of like character. We have only scratched the surface in the application of research findings to large-scale management techniques and stocking programs. Deciding what to do, and how to do it promptly, constitutes another administrative problem which must be faced courageously.

Future field administrative needs.—Law enforcement will always be essential, but daily it is becoming more and more clear that in the past we have put too much emphasis on negative rather than positive field operations. However, numerous administrators with whom we have conferred are concerned about the law enforcement requirements in the immediate future. Among the questions they ask are: Can we expect an increased attitude of respect or disrespect for all law and order? What will be the attitude of returning veterans toward observation of fish and game laws and regulations? What will be the attitude of the courts? Will they be sympathetic toward returning veterans?

Unless, through mass educational efforts, we can obtain a far greater

measure of individual cooperation than has been evident so far, it is obvious that as the numbers of hunters and fishermen increase more personnel will be required to do a satisfactory field administrative job. The tendency on the part of the average license buyer is to shirk individual responsibility. In many states, including our own, additional help can be obtained by employing part or full-time deputies during the rush seasons.

As to the attitude of the returning veterans, more than 30,000 men in active military service hunted in Pennsylvania last fall with free licenses; also thousands of discharged servicemen (who were required to purchase licenses) hunted game instead of enemies for the first time in several years. We are proud to report that their conduct on the whole was fully as good as that of their fellow hunters who had not been with the armed forces.

As to the attitude of the courts, undoubtedly in some instances those hearing game and fish cases involving returned servicemen were inclined to be sympathetic. However, the vast majority of the veterans do not encourage such indulgences; they don't want to be coddled but wish to be treated in exactly the same manner as their brothers who served on the home front.

Recently you have probably observed an attitude of confusion and a general tendency to disregard law and order. The veterans certainly can't be accused of responsibility for this disrespectful attitude.

I shall deal further with future field administrative needs later.

Financing problems need attention.—The question of finances has arisen in the minds of many of you. Most of the states have accumulated a large reserve of game and fish revenues during the war. These funds will be a constant source of temptation until they are expended. While most of us have planned postwar programs to put these accumulated monies to good use, it will require everlasting vigilance to prevent diversion of them to purposes not even remotely connected with wildlife benefits.

The terrific increase in hunting and fishing pressures will necessitate the launching of programs that cost money, and lots of it. Whether your state or province finds it necessary to conduct annual heavy restocking programs or not, those of us who do so will for a number of years find the pressure so great that stocking in excess of prewar levels will be absolutely necessary, at least until intensified management programs can be applied on a large enough scale to produce the necessary annual crops of game and fish to accommodate the greatly augmented army of nimrods and anglers.

The increase in licenses sold will provide extra funds; so will larger appropriations from the Pittman-Robertson reserve. If the proposal

to utilize the tax on fishing equipment to benefit the anglers under a similar plan is adopted by Congress, additional resources will become available to help the fishermen. However, with all these anticipated increases it is predicted that the demands cannot be met in many of the states and provinces without still more funds. Sportsmen themselves will sponsor proposals to increase license fees if they are convinced additional money is essential.

In some states it is feared there will be a tendency to angle for the soldier vote by sponsoring proposals to issue free lifetime hunting and fishing licenses. Veterans as a group are fully as public-spirited as any other. They are fairminded, and realize that the game and fish resources of the Continent cannot be maintained unless the work of these departments is properly financed. They will resent proposals to put them on a "preferred level" when it comes to fishing and hunting.

Personnel training must be expanded.—As to other administrative problems, one of the most important is personnel. The first phase of this problem involves the re-absorption and re-training of men returning from the battlefronts. Our experience indicates that practically all of the employees returning from military service are eager to get back into the harness quickly and require comparatively little training to bring them up-to-date on the programs launched during their absence. Certainly it will take time for re-adjustments, and there may be a few "problem children" among them. But an analysis of the latter will invariably show they were always in that category.

Under the G.I. Bill of Rights ex-servicemen are entitled to their old positions, and in Pennsylvania we are glad to report that such employees who function under the merit system are given all the advantages which their brother officers enjoyed during their absence, including annual merit increments and cost-of-living increases.

As most of you know, the Pennsylvania Game Commission in 1936 established its vocational Training School to develop men capable to administer all phases of our field work. A new class of 25 students will be enrolled in June, for a training period of one full year. Our Commission has had a most encouraging reaction because returned veterans will be given advantages over those who followed civilian pursuits during the war.

The Game Commission's Training School has been approved as a recognized training institution under the G.I. Bill, and any difference between the compensation we will pay the student veterans plus subsistence and the $1,728 beginning rate of compensation for field officers can be collected from the Federal Government under the provi-

sions of this bill. Competition for admission to the fourth class of students will be extremely keen.

In several states arrangements have been made with colleges and universities to enroll veterans for short courses which will fit them for wildlife administrative work, the departments contributing funds in addition to those available to servicemen under the G.I. Bill. This very wholesome step will pay big dividends, but don't overlook training programs for men already in the work.

Work judged by representatives.—It is obvious that conservation workers in the future must not only be better trained but better paid than they have been in the past. The rate of compensation should be on a par with earnings of men of required equal ability in industry. In many states this is not yet true, but if we hope to build the kind of an organization that can cope with the administrative problems involved in meeting increased wildlife demands, we must give our field employees a broad basic vocation training, compensate them well, and increase their pay at regular intervals *on the basis of performance.*

As we all well know, the work of every conservation department is judged largely on the quality of its field representatives; therefore they must be the best timber obtainable. If men are selected on merit, properly trained, and adequately compensated; we can hope to develop and administer the programs necessary to meet the challenge of increased wildlife demands. We cannot do this by the old outmoded methods of bygone days. Game restoration is no longer a job for a man whose sole qualification is his ability to make arrests. The field representatives of our conservation departments in the future must be capable to function in much the same progressive manner as have the extension workers in agriculture, poultry husbandry, etc.

If wildlife faced a crisis 15 years ago, then we are confronted with a much more difficult problem today. By taking full advantage of the things we have learned during the past decade we should be able to cope with the increased wildlife demands if we make an honest effort to apply the knowledge gained and to assemble additional essential information to fill in the gaps.

We are not pessimistic about the future, even though some of the problems in the offing appear to be insurmountable. We in Pennsylvania believe that hunting and fishing for the masses is the only sensible way to help maintain the American way of life, and we evaluate our future needs from that viewpoint.

LAND USE AND MODERN PRESSURES ON WILDLIFE

LEONARD HALL
St. Louis Post-Dispatch, St. Louis, Missouri

When Mr. Bode asked me to present one of the papers at his section meeting this afternoon, I could not help but be flattered. My subject, falling into the general classification of land use and its relationship to our changing wildlife picture, is a vital one in which I am tremendously interested. I got a scare when Mr. Bode sent me a long memorandum of instructions for the preparation of technical papers; but at the end of his note was a postscript saying, "Of course, yours is not a technical paper, so you needn't worry about this." I was considerably relieved. Then I started to review the proceedings of earlier North American Wildlife Conferences and wondered what I might possibly have of interest to say to a group of scientists in a field where I am—and will always remain—an amateur.

At about this juncture I recalled a story told last summer by my friend, Ira Moss, who lives down at the mouth of Rocky Creek on the famous Current River in our Missouri Ozarks. Rocky Creek joins the Current about 3 miles below Owl's Bend, where the Powder Mill Ferry runs back and forth on its long steel cable. Ira sometimes runs commissary boat for us when we go fly fishing in the summer for smallmouth bass. He lives in a country where "grandma-in" timber is a reputable occupation of many years standing. And Ira is, finally, a storyteller of the highest order. In case you don't know what "grandma-in" is, I'd better explain. Much of our Ozark timberland has been owned and harvested by big operators who cut crossties and the white-oak stave bolts without which Kentucky could not properly age its most famous and fragrant product. Thereafter, whenever a tree comes to proper size along the high ridges or down in some deep "holler," it is not unusual for a native to slip in along a dim-tracked road late of an evening and harvest that tree from the "company" land. Later when the crossties are hauled in to the mill and the buyer asks, "Where did you cut the timber?" the answer is invariably the same: "I cut it out on grandma's place."

It seems that Ira had a lad working for him in the timber who was not considered too bright. It was doubtful, however, that he could be committed to an institution in a county where the criterion for commitment is whether or not you can hack a railroad tie. Yet finally the boy stole a horse, more or less casually, and his folks thought that was pretty bad. They went to the prosecuting attorney, swore out a warrant and sent him away to Farmington. Here the doctors also

found there was doubt as to the boy's weakmindedness, with the result that a few weeks later he showed up again at home.

"How was it up there at Farmington?" asked Ira.

"Not bad," said the boy. "They took me into a big office and asked me my name. I told 'em. They said, where did I live. I told 'em. Then they wanted to know what I done for a livin'. You know, Ira, I guess I couldn't have told 'em 'grandma-in' stave bolts, could I?"

So I expect I'm something like that Ozark lad, up here in New York "grandma-in" a little more knowledge about wildlife and wildlife problems from you fellows who know the answers!

Actually, there are two groups of men in this business to whom I really listen. One is the field man—the young technician out there digging away for the answer to some problem which may not look very big from a distance yet which may be the key to unlock a whole new storehouse of knowledge. Or he might be a man of less schooling who is in the game because he loves it. You find these latter in our enforcement divisions particularly—and some of them are mighty wise. The second kind of man to whom I listen is the scientist-philosopher, whose knowledge is wide and deep and whose mind constantly ranges far out ahead of the problems we see today. We've all known such men and we know that their projections serve as trail-markers—the blazes on the tree or the bent willow stem—which the rest of us follow at a more pedestrian pace. As for fellows like me—our job is to understand all we can and to interpret this understanding to that vast, uninformed yet interested public without whose support our wildlife research work would be impossible and our opportunities for applying it lost.

Unlike the engineering and dirt-moving agencies, we have no powerful lobbies to help us get the appropriations we must have to attain our ends. Often because the public lacks even the simplest possible understanding of conservation fundamentals, wildlife men find those who should be our best friends and firmest supporters doing their best to "cut our throats" in the most important areas of our work. So we—the informed laymen who write of the outdoors—hammer away at this public which includes the sportsman as one of its ingredients. We take your story and tell it over and over again. You say, sometimes, that we oversimplify. We do! You may accuse us of taking your speculations and drawing from them conclusions that you, yourselves, would be unwilling to draw. But if the simplification and errors are on the side of the wildlife—my answer would be that neither you nor we have yet erred too often in that direction. Three hundred and one trumpeter swans may constitute a proud record,

but Horseshoe Lake with its flock of tame Canada geese killed down from 60,000 to 20,000, which we are still allowing to be slaughtered, is a record we're not so apt to brag about. In fact, I think both are tainted with the curse of "too little and too late" which has marked so many of our wildlife efforts.

Don't get the idea that I am not cognizant of—and, indeed, proud of—the job being done today by the Fish and Wildlife Service, the Wildlife Units of our state universities and the best among our state conservation agencies. It is my opinion that because in this field we must work with the land managers in such other fields of agriculture, grazing, forestry and water management, wildlife men are making the greatest strides of any of them. Progress may be made in those other fields, although not for long, without too much regard for the over-all ecological picture. In wildlife management, this ecological point of view is of the essence. Without it, there is no basis upon which to build; with it, wildlife management moves forward at a pace which may well outstrip in knowledge, if not in practice, its allied agencies. I make the exception "if not in practice" for four reasons:

1. In our modern and constantly changing world, wildlife men cannot control the use which is made of the land except in rare and isolated instances.

2. Land use in the vast majority of cases rests with the private owner who is just now beginning to be affected by the sum total of effort of all the interested public agencies.

3. The immediate human need will always be the controlling factor in land use—and wildlife will always come second except on such lands as can be put to no better primary use.

4. As a result of these factors, such controls as the wildlife manager can establish on the majority of our lands will always depend upon the understanding and cooperation of allied agencies, of the private landowner, and of the public. This is very clearly indicated by the chart (Figure 1).

The idea that the use we make of our land is basic to the very health and life of our whole people is comparatively new. It requires, first of all, an entirely new conception of the word "land." This is the ecological concept of the biota—of all those seemingly diverse yet intimately related elements which make up the sum total of life in a given environment. Fortunately for wildlife, this concept got much of its early impetus from men in this field—men like Leopold of Wisconsin, Bennitt of Missouri, and others. They had seen the pioneer attitude disappear—that wildlife could be classified as useful, harmless, and harmful; to be used, ignored or destroyed accordingly. They had grown past the "take some, leave some, put some back" school

of conservation popular at the century's turn, because they found it didn't work. Gradually they had come to realize the inseparable, interlocking relationships which exist between sun and soil and water, all forms of plant life and the narrowing layers of animal life which carry the energy circuit upward to its peak and return it from each level to the soil. In this new concept, the word "land" takes on new meaning, for it is the aggregate of all the forces which play a part in creating the energy circuit. We are also given a new yardstick for

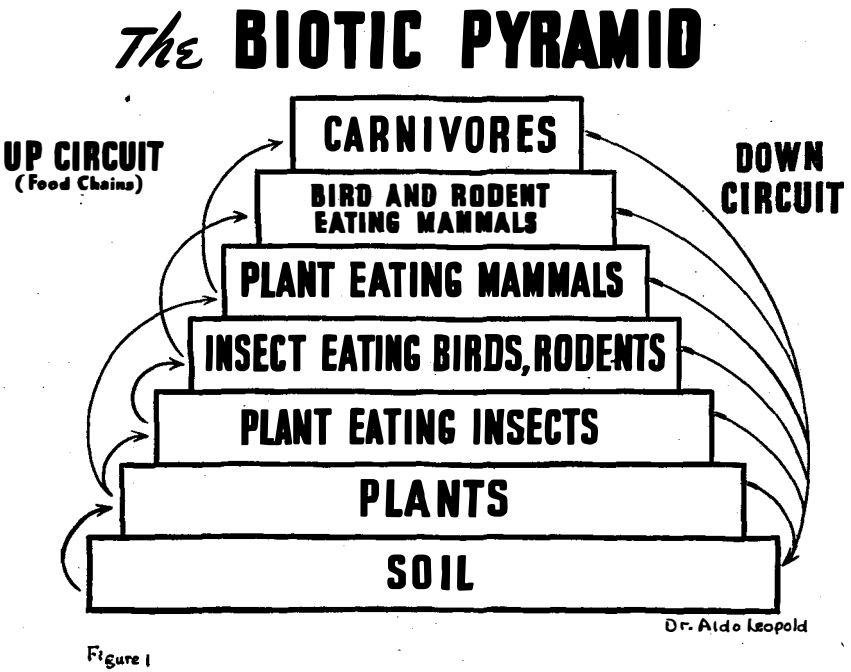


Figure 1

land use. Good land use for the ecologist becomes, if I may put it this way, a matter of producing the greatest possible sum-total of energy with the minimum of violent dislocation in the energy circuit.

Agencies operating within the field of natural science—agronomists, nutritionists, foresters and the like—are arriving at this ecological point of view at a fair speed. It is unfortunate—and no one feels the impact of this more than the wildlife technician—that other agencies such as, let us say, the engineers, have not caught up. It is easier to understand, yet not always easy to sympathize with, the almost totally uninformed public attitude on this matter so vital to public well-

being. Even among sportsmen I think there is an almost equal division between those whose concept of the wildlife problem dates back to about 1820, those who will fight and die for the "take some, leave some" idea and those whose only thought is to kill a limit, even if they have to shoot it in a barrel. We cannot particularly blame them for this; today's scientific knowledge postdates the time when many a hunter's mind became ossified for life. Sometimes we have a hard job keeping up ourselves! Again I give you the example of that so-called refuge for Canada geese in Illinois where we're at least 5 years behind. Still, we must keep plugging away and fortunately there are more and more folks helping us. Science has been at fault here, I'm afraid, in not being willing to stick its neck out, or at least in criticizing too severely those who try to do a sincere job of translating the language of the technician into plain and interesting talk for the people. It would be better to pick the men who can really do this job and keep them buried under a stack of factual ammunition.

Now I want to go back to that matter of types of land use mentioned earlier and carry it somewhat further. We all know the next step is land classification. Here the land manager, whether his field be wildlife, crops or forests, digs in a little deeper. He takes each land type and breaks it down as to its capabilities for supplying the needs of man. Present use or the skill of the individual who now holds this land or the economic circumstances at a given time are not the criteria here used; but rather, the matter of how this particular land can be developed to its highest energy potential. New considerations are constantly entering into land-use classification. In addition to such factors as slope, erosion under various kinds of cover, either from wind or rainfall, leaching of food elements due to soil consistency, runoff, underlying soil and rock structure, and climate—we are constantly learning more about the nutritional value of plants under varying climatic conditions and other matters of this kind.

But even after such classification is complete, it is not easy to apply this knowledge to actual land use. The land is managed, except for small percentages, not by the combination of agencies who have compiled its use-potentials, but by private individuals. Thus we have drained and planted to crops millions of acres of marshland which might well have yielded a richer harvest of fish, fur, and waterfowl than of hay or grain. We have over-cut our private forest land and then burned and grazed it until no young trees grew and the wildlife habitat had been totally destroyed and the grazing potential cut to the minimum. We have plowed the light prairie soils under stress of war or merely through ignorance and greed, until the dry years came and the wind blew the soil away. This is what private owners have

done—not realizing any more than have some other owners of capital that they were using up irreplaceable assets.

I asked Hugh Bennett of the Soil Conservation Service one day why he did not employ, in addition to his technicians, a dozen good salesmen well-grounded in this field to go around selling his idea and creating soil conservation districts. If I remember rightly, his answer was something like this: "They'd call us a bunch of bureaucrats—and moreover this movement must come from the grass-roots if it is to succeed and survive." I suspect Dr. Bennett was right—but to realize the need for conservation requires interest, intelligence, and knowledge. Many farms will be depleted forever before 51 per cent of the farmers on every American watershed realize their responsibility toward the land they farm and decide to do something about it. There are more than a quarter million farms operating in this country today—dairy farms, ranches, orchards, cotton plantations. Some are rich and some are marginal. Some are operated intelligently by their owners, others unintelligently by absentee owners and tenants. In the fields and woodlands and grazing lands which make up these farms lies the future for our wildlife. Experience shows that, in this field at least, if we wait for purely voluntary action, the battle will be lost. That a big job lies ahead of us in selling our land-use program—and in tying the job of wildlife propagation, restoration, and conservation into that program—there can be no doubt.

The public forester knows that browse for deer depends on control of fire, grazing, and management of the deer herd. These measures generally work into his forestry program; but how teach them to the private timber operator or the farmer with his woodlot? The refuge manager knows the value of border plantings between field and woodland to serve as food and cover for the small wildlife species. How convince the farmer that such a measure is both good farm and wildlife practice? All of us know that reforestation, terracing, stream bank planting and similar measures help prevent floods and increase yields from forest and field, as well as preserve the fishing in a given watershed. But can we make the sportsman realize this to the point where we can spend his money to accomplish it? These are some problems that lie ahead of us in the matter of land use. And only if we solve them can there be any hope that the game carrying capacity of the land, whether it be farm or marsh, lake or stream or wilderness, will stay abreast of the steadily increasing pressure on all our wildlife species.

Fortunately there are signs in both agriculture and forestry that a better day lies ahead. The tendency of farms under mechanization

is to grow bigger and fewer, particularly in the areas of good land classification. For a time this meant "clean farming" and a general program which prospered temporarily but boded eventual ill for farmer, crop yields and wildlife. Today the trend is reversing—not as to size of farm or mechanization, but as to land use. The tractors that once plowed clean and up and down the hills, right up to the fence rows, are today building terraces and riding the contours and shovelling out ponds. These latter—and the farm woodlands—are more and more often fenced against the livestock which would eventually destroy their usefulness. Today, on more and more farms, hedges take the place of the woven wire fence. Timber operators know that the day of "cut and get out" is gone and are thinking in terms of scientific forest management, of reseeding and better utilization of their product through selective harvesting of mixed stands which keep the young timber coming. Under these conditions, there is far greater opportunity for the wildlife manager to "sell" his story to the private landowner and to win his cooperation for subsidiary land-use measures which will once again create a natural and healthy habitat for native wildlife species or for exotics which stand the test of scientific proof. If this trend continues, more and more marginal land will be abandoned to the uses for which it is best fitted—the growing of timber and wildlife. And there is hope under these circumstances that, with a growing understanding on the part of sportsmen and a better quality of sportsmanship, of which too little exists today, the wildlife carrying capacity of our land may be able to keep pace with the increasing pressure. That the pressure can decrease—with more hunters and fishermen, better roads and cars and planes, a mounting quantity of leisure—is too much to hope. So the balance, if it is to be held, must come through scientific management of the wildlife resource, education of the public, regulation and strict enforcement.

There is one other area of land use on which Mr. Bode has suggested that I touch and then I will be finished. In an age of giant engineering projects—many of which are undertaken by the people through their government—it is inevitable that the acreage of public lands will increase during the decades which lie ahead. It is not for me to say here whether all of these projects will solve the problems which they seek to solve. I come from a state where thousands of citizens are fighting against the despoilation of this continent's most beautiful streams, with consequent loss of irreplaceable recreational values, against the destruction of millions of acres of fertile soil with consequent loss of trade and tax revenue, to save smaller acreages downstream. Nor am I speaking of the proposed Missouri Valley

Authority which may be good or bad, but of an older and wholly vicious plan to spend a half billion taxpayers' dollars in damming the clear, cold-water Ozark rivers in the name of "conservation."

There are certain to be many of these great public projects—some of them good and some of them bad. The thing which is vital to us here is that, as the land is acquired for them, our wildlife agencies shall be called into consultation—and that the use of such lands shall be reserved to the people for purposes of recreation. Here will be, in the end, millions of acres better suited to the propagation of wildlife than to any other purpose. In the past there has been little thought given to such purpose so that the value of the land is largely lost. Even today, we must look askance on offerings which are made of certain lands such as those along the navigation pools above our great river dams. Having made watery deserts of these impoundments, the engineers now say "here is land you may use for your waterfowl refuges and public hunting areas." But they fail to guarantee the water levels for us and worry even less about the fact that their impoundments have already destroyed the wildlife habitat, and especially that for waterfowl. I am reminded of the ancient saying, "Beware the Greeks, bearing gifts!"—and I think that in the future we must be better publicists and better politicians so that we are in on these things from the beginning.

In closing, it is not land use which worries me in considering tomorrow's wildlife picture, for land use is on the upgrade. It is not even the pressure—though this seems certain to increase. It is whether we can awaken the public to the importance of conservation so that the people will provide the funds which you men must have for your research and restoration programs. It is whether we can awaken in the hunters and fishermen of today a sense of sportsmanship now almost nonexistent—a job which I believe can only be done by driving home again and again this story of the dependence of wildlife upon the land and the use which is made of it by private or public owners. If we can accomplish these two things—and only if we can accomplish them—America's wildlife can hold its place against today's pressures in a rapidly changing world.

DISCUSSION

MR. ADAMS (New York): Under ordinary circumstances I would agree to that whole-heartedly, but the question that has come up here as to the activity of the Conservation Department of the State of New York in reference to Horeshoe Lake in the southern part of Illinois, should be answered. I want to assure the conference here that the Conservation Department of the State of New York did not send any two or anybody to Horseshoe Lake in the last year for the purposes of studying conditions, in the hope of duplicating them in the State of New York.

MR. HALL: Mr. Adams, I am delighted to hear it.

MR. ADAMS: We are familiar with the conditions of Horseshoe Lake and deplore them as much as anyone. The only representatives that we had of our Department in the State of Illinois were the Superintendent of our Game Park and his assistant who were there in the month of November to discuss the breeding of pheasants at game farms with the boys in Illinois.

MR. HALL: Thank you for bringing that out.

CHAIRMAN BODE: Mr. Hall wishes me to thank you for bringing that point out and clarifying it, because he says he certainly does not want to be responsible for the distribution of any false information.

I think it is hard to conceive of a consideration of this topic of demands, modern demands on wildlife, without considering the tools and the mechanics of pressures that are exerted on our wildlife populations and certainly the gun is one of the outstanding, if not the outstanding implement or tool.

I remember not so long ago I had a teacher tell me that it was improper to teach the use of the gun to children of school age because it taught them to kill and the objective of that type of education should be to conserve. My reply was along this line: The youth is going to go hunting and fishing anyway. That is the history of mankind since anybody knew anything about it. If you are going to inculcate into that young mind the same principles with regard to wildlife conservation and its use as you are all other things, the time to teach him is when he is a boy and not bring him up to 17 and 18 years old and leave him hanging up in the air, not knowing what to do with a gun when he gets it in his hands. Certainly, I imagine the heavy bulk of fatalities affecting human welfare occur by the man who doesn't know anything about a gun.

I think in considering the problems that we have to face, it is entirely proper that we should consider the use of the gun and what its effect is going to be and what we face along that line.

MR. R. A. BROWN (Missouri): The Missouri situation is analogous to some others. I would like to suggest one question which I am very much interested in and which has not been presented to this particular gathering.

As a Missourian living on the Missouri River and faced with both the Dick Sloan Plan and the M.V.A., I am very much interested in certain aspects of land use connected with that and also with more important economic questions which are not mentioned and which probably should not be brought up here unless a controversial subject is to come up. The only question I have to ask, and it is one that does not appear in print, is if either the M.V.A. plan or the Dick Sloan Plan is to be put into operation and we are to have a deep channel in the upper Missouri River for the purpose of providing navigation, are railroads to be taxed so that they will furnish competition to themselves and be ultimately destroyed or pauperized when, in my opinion, the economy of the country is tied up intimately with the railroads. I don't mind asking the question. I don't mind admitting before somebody takes it out, I am an attorney and I represent railroads. I am also on the Missouri Commission and my sole interest is in seeing that the question is aired. I think the people of the country should realize that if we are to tax the railroads to destroy them, at least it should be discussed. I don't come here as a lobbyist for any railroad and I don't want anybody to say I do.

CHAIRMAN BODE: That brings up a very important question surely, and one that I would not be in any position to comment on one way or the other, but I think Mr. Brown's intent is to bring forth any comment or idea that anybody else may have on the question. Is that right, Mr. Brown?

MR. BROWN: That is correct, sir.

CHAIRMAN BODE: So if anyone has any viewpoints they would like to express or any discussion they would like to offer, we will be glad to hear it.

Apparently, Mr. Brown, they are all a little timid of the question. Do you have any additional thoughts of your own?

MR. BROWN: I have a number of thoughts but this isn't the place for me to express them, sir. They would be out of place.

INCREASED HUNTING PRESSURE AND HUMAN WELFARE

COLONEL FRANCIS W. PARKER, JR.
President, National Rifle Association, Washington, D. C.

The National Rifle Association is deeply interested in conservation, especially the conservation of the hunter and the gun lover.

We have heard throughout these meetings many discussions about the demands to be made on game, emphasized throughout this afternoon's meeting by the word "pressure." You have heard figures pointing toward at least a 50 per cent increase in the number of men who want to get out in the field. These are no exaggeration—a conservatively estimated 26 million licensed hunters and fishermen, 13 million licensed hunters. Not so long ago, one of our outstanding N.R.A. members made an actual survey of a redeployment center which he commanded, and from a group of some five thousand veteran Marines back from the Pacific fighting, he found 73 per cent of them indicated a keen desire to hunt birds and other game; 83 per cent said they wanted to get into some form of organized competitive shooting. Your emphasis on the word "pressure" is borne out by these figures for this is a representative group, I would say, although we must admit that their interests may well go astray under the pressure of normal business pursuits.

Nevertheless, the trend for which you are planning is characteristic of every war. Popularity of the outdoor sports jumped tremendously after the First World War. We can expect the same this time. But in these figures just cited, there is considerable consolation in the fact that the percentage is higher among those who want to take up some form of organized competitive shooting over those who will be going afield with the gun. I say consolation because there is considerable hope in practice and familiarity with the gun as a deterrent to gun accidents, which I take it, is our main consideration in the topic assigned, regarding human welfare.

This practice and familiarity, we believe, is the answer to the safety problem. Here is where the conservation of the hunter comes in. I am not going to take much of your time here in pointing out the accidents we can expect as the number of hunters increases. The average, under present circumstances, is quite likely to remain at the present level; that is, unless some educational program is devised which will reach the millions of casual hunters.

In a few minutes, we would like to present a movie on firearms safety education which will, we hope, be a partial answer to this educational program. The story of safety with guns is portrayed there in

picture and in narration. More specifically, however, than any movie can ever hope to do, we must get the actual practice with the gun. The most concentrated practice, of course, can be obtained in organized competitive shooting, but the National Rifle Association realizes the fact that this, by no means, will reach the casual class. The rifle clubs, skeet and trap clubs can serve as a training center, however. A concentrated program, backed up with publicity, might well be put on each fall before the hunting season to encourage these casuals to practice sighting their guns and receive expert instruction in handling them. I believe this is a most important function by way of public service for every club.

So far as the 22 hundred senior clubs of the National Rifle Association are concerned, we can pledge their cooperation. The success of the program, however, depends on publicity from all angles—outdoor writers, conservation groups and conservation departments in encouraging prospective hunters to make use of these opportunities. It is unfortunate that such practice cannot be required before a hunting license is approved. Such requirements are characteristic of the State Departments of Vehicles when they issue drivers' permits. It is only logical that some day we come to the same thing in the hunting field, but perhaps at the moment that is too idealistic.

There is another form of education which can be undertaken by conservation departments and I would like to cite you the example of a program carried out in the State of Michigan. Progressive-thinking state officials have arranged for a comprehensive firearms training program for their own conservation officers, including many hours given over entirely to the problems of junior shooting. These officers are now equipped to teach the lessons of safety, to improve the breed of hunters who go into the woods and fields of Michigan. It is planned that each of these conservation officers will each year teach safety and basic small arms instruction to at least one hundred youngsters between the ages of 14 and 17. By simple arithmetic, you can see that as this program expands over a period of years, a good part of Michigan's firearms education problem will be solved.

We must face these facts, gentlemen, in any consideration of the human welfare angle. While in comparison with other sports, firearms show a very creditable record, so far as accidents are concerned. Nevertheless, in a sample year of 1940, there were about 2,400 deaths from firearms. These 2,400 deaths make up part of an over-all total of nearly 100,000 fatalities in the United States during that year which were termed accidental. On the basis of all the accident claims filed with the accident insurance companies in 1940, baseball was responsible for four times as many accidents as hunting. Winter sports

—sledding, tobogganing, skiing, and ice skating—caused three times as many acidents as hunting. Golf was responsible for three times as many as hunting, but this is beside the point. If there were 8 million licensed hunters in 1940 and we can expect 13 million in 1946, then there might well be a forecast of better than 3,000 fatalities in 1946. The number of hunters afield may increase this figure disproportionately. Therefore, it behooves us to consider seriously means of prevention.

I am sure you here need little introduction into the steps taken by the National Rifle Association to prevent firearms accidents and preserve the game for the gun lovers, nor do you need proof of our major efforts along this line and the certain success which has been attached to these efforts. Conserving the hunter we believe to be our responsibility toward the conservation question. We assure you you can depend on our cooperation. At the same time, we would like the cooperation of all you leaders represented here. I said earlier that the movie you will see is one part of our educational program. The facilities and expert instruction of our membership is another important phase, but it takes a direction of thought on your part in order to bring the prospective hunter to a realization of his responsibility. That education will work in developing gun safety habits is proved by the safety record of our junior division. In 20 years, we have taught more than a million and a half American youngsters to shoot. We have never had an accident in the course of this organized shooting and, so far as we have been able to ascertain from surveys, none of these youngsters have been involved in a firearms accident anywhere.

You may feel that the National Rifle Association is speaking with some authority on only rifles and pistols. If that is your thought, I might state here parenthetically that the actual figures show shot guns year after year cause from 65 to 85 thousand of all gun accidents. But we are interested in all types of firearms. While we do not have the actual physical contact with the many specific shotgun users, we believe that the same safety rules apply to all. That is why we have taken pains in this movie to include five basic principles which apply to all guns—(1) Point the Muzzle in a Safe Direction; (2) Is That Gun Loaded? (3) Be Sure of Your Target; (4) Be Sure of Your Backstop; (5) Know Your Gun and Ammunition. And, incidentally, these five cardinal principles, at the risk of oversimplification, nevertheless are well to tie to. They are presented in this movie you are about to see—each of the five points in cartoons which will be duplicated in posters soon, we hope, to be made available for posting in the hunting fields. This movie and the posters and the literature is

all a part of a new program we have instituted since our staff men came back from the war and got on the job.

At the present time, means and methods of distribution have not been worked out fully, but you can be sure they will be publicized within the course of a few months so that all of you here who are interested can make use of them before the hunting season comes around.

Safety is usually a function of experience. Men familiar with firearms do not have many accidents. Hence the necessity if we are to avoid accidents, of making it easy for the right kind of people to have access to and practice with all kinds of guns. That is why the National Rifle Association has strenuously opposed at all times the registration and licensing of firearms. Experience in other countries has proved that when firearms are licensed and registered, that is the first step toward confiscation, and even if confiscation does not immediately follow, it tends to decrease knowledge of firearms, experience with firearms and as a result invites accident and danger.

We know what happened in France. When the German army invaded France, the first thing they did was to get out the registration records and the next thing they did was to go to the house of each individual who had a registered gun and take it away from him. Following registration, the next step is confiscation because registration gives no right to use or own. In that respect, it is totally different from automobile registration. If the sportsmen of this country ever stand for registration, they may be assured that the first thing that will happen as the use of firearms is discouraged will be an increase in accidents, and the second thing will be confiscation in those areas where it is desired to change the fabric of our Government. Interestingly enough, the Communist party, especially in California, has gone on record as favoring registration and other anti-gun laws. Obviously they have a reason!

Without taking more of your time and since the educational program we have in mind is pretty well summed up in the movie, I should like now to present this to you.

LEGISLATION AND MODERN WILDLIFE DEMANDS

CARL D. SHOEMAKER

Secretary, Special Committee of the United States Senate on the Conservation of Wildlife Resources, Washington, D. C.

Most of us have an appreciation of the wildlife round about us. How many of us, however, realize that it is one of the great financial assets of our country and that it has a capitalized value of 14 billion dollars? Waterfowl, fur bearers, big-game animals, commercial and game fisheries are the only wildlife species taken into consideration in this capitalization. If we add other forms of wildlife and their benefits to mankind, such as the control features of insectivorous birds, the Fish and Wildlife Service places a capitalized value of this resource at 140 billion dollars. This is greatly in excess of the prewar national income.

How are we taking care of this vastly important asset? Who is looking after it? And what kind of a job is being done?

For the purpose of this discussion we shall limit wildlife to those species which are desirable from the point of view of the sportsman.

Over wildlife we have a multiplicity of agencies exercising some form of jurisdiction or management. Except for waterfowl, the states have supreme jurisdiction over the fish and game within their borders. A long line of court decisions favors this conclusion. Yet it is challenged from time to time and efforts are made to override it .

Federal agencies which have jurisdiction over various types of land have at times undertaken to manage the wildlife on those lands. The conflict between the Forest Service and the states, and the Grazing Service and the states are instances in point.

In continental United States we have just under two billion acres of land and water. About 25 per cent of this is under some federal control, as follows:

Forest Service lands	158,000,000 acres
National Park Service lands	15,094,000 acres
Grazing Service lands	145,777,000 acres
Indian Service lands	56,000,000 acres
Fish and Wildlife Service lands	9,750,000 acres
Total	384,621,000 acres

Let us take up the Forest Service situation first. Within these forests we find 90,000 miles of fishing streams and 1,400,000 acres of lakes and ponds. Thirty-four per cent of the big-game population of the country have their home on these lands. In the Western States

70 per cent of these animals live in them. It is easy to understand the extreme interest that the Forest Service takes in this wildlife. As a landlord it has the same interest that the farmer has in the game on his farm. From this interest to the assumption of jurisdiction over the game is a step that is fraught with many difficulties, and, while it has been attempted in several instances, it has always resulted in some kind of a cooperative arrangement for the management of wildlife.

The Park Service, while it houses only 1 per cent of our big-game animals, exercises complete jurisdiction over them. Hunting is banned on park areas, although fishing is permitted.

The Grazing Service, comparatively young as a federal agency, started off with wordy battles over game on the range. While it has calmed down, it is not completely settled into a policy, although much headway has been made through cooperation which is more than one-sided. Only 5.6 per cent of our big-game animals find their home on the lands under the Grazing Service.

Indian Service lands are in a class by themselves. These lands are set aside as reservations for the tribes and over them there exists a benevolent protectorate which goes to all kinds of management and use. Only 0.8 per cent of our game animals live on these reservations.

Fish and Wildlife Service lands take care of 0.9 per cent of our big-game animals and offer little trouble to the states.

Jurisdiction over waterfowl rests with the Federal Government by virtue of the treaty with Great Britain. There has been general acceptance of this move to protect ducks, geese, and other migrants by means of the treaty. It is not conceivable that any such arrangement can be invoked to give other federal agencies control of our other species of wildlife.

Thus it is seen that there are only two sources of real conflict over the management of wildlife. Because of the vast domain under their jurisdiction the Forest Service and the Grazing Service—which together control over 300,000,000 acres of land in continental United States—loom at times as challengers to the management of our game resources. With better state game management this seems now to be a matter of cooperation. Game on the western range has increased by over three hundred per cent in twenty odd years. This takes more food from the range. The sheep and cattlemen feel that too much of it is taken for game and that not enough of it exists for livestock. Actually there should not be any great conflict between the two, except where there are too many of either for the particular kind of food available on the range.

Buried in the hearings on the Agriculture Appropriation Bill, L. F.

Watts, Chief of the Forest Service, just 6 weeks ago made a statement which reflects the sincere and honest viewpoint of his agency. It is worthy of repeating here. He said:

"Closely related to recreation is the work in wildlife management. As you know, the greater part of our big game—particularly in the West—spends at least part of the year on the national forests. Wildlife is a major resource on the national forests, but it can easily compete with other equally important uses. On the one hand we want to have all of the wildlife we properly can on the national forests. On the other we must not permit wildlife numbers to reach the point where they are destructive to the forest, where they are liable to excessive death loss due to short winter food supply, or where they compete unduly with grazing of cattle and sheep. The problem boils down to the fact that wildlife, like any kind of animal, requires management if it is to be kept in balance with its own food supply and with other uses of the forest."

The wildlife carrying capacity of any area depends upon the available food supply. Too much game means too little food and results in starvation and death to the species involved. This becomes a matter of management. If the states do not see these problems then the federal agencies on whose lands they exist want to take a hand, either directly or by suggesting cooperation.

These are academic problems now. Over the years there has grown up a fine sense of responsibility in state management and the future should hold little trouble from this source.

There are other problems, however, which merit the attention of game managers and the sportsmen who furnish most of the needed revenues to carry on state wildlife work.

The American people, faced with a situation, too frequently say that there ought to be a law "agin" it. They beseech their state legislators or their Senators and Representatives in Congress for relief. Bills are drawn and referred to Committees. If there is need for the legislation, or the pressure is heavy enough, hearings are held, after which the Committee may report the bill or hold it back. If reported, it goes to the Calendar where it may or may not be passed. During the present Congress 180 bills were introduced from January 3, 1945 to January 21, 1946, which affected land, water, forests or wildlife. Only 28 of them have had any action taken. Less than 10 of them have become the law of the land.

For convenience in classification, I have made 11 categories of subject matter.

Two bills concerning the taxation of conservation lands have been introduced—one in the Senate, one in the House.

Three bills having to do with firearms, their registration and regulation, have found their way into the legislative hopper—two in the Senate and one in the House.

Covering various aspects of fish, game and wildlife, 40 bills have found their way to Congressional Committees—7 of them in the Senate, 33 in the House.

Irrigation and reclamation accounts for 17 bills—7 in the Senate, 10 in the House.

Into the Senate went 8 bills relating to forests, while 10 more were introduced in the House.

A national policy for natural resources accounts for three bills—two in the Senate, one in the House.

Interest in national parks, monuments and historic sites is shown in 12 bills in the Senate and 22 in the House.

Matters affecting public lands and federal real estate account for two bills in the Senate and seven in the House.

Rivers, harbors and flood control matters show up in 5 bills in the Senate and 35 in the House.

Soil conservation affairs account for one bill in the Senate and three in the House.

Water pollution has had its inning in this Congress through five bills in the Senate and five in the House. It is probable that the Rivers and Harbors Committee will report on this subject this week as it held an executive session yesterday to consider the extensive hearings held on these bills last November.

Most of these bills have been introduced because of the demands made upon Congress by pressure groups, either local or national, organizations, or individuals.

In the brief span of the time allotted for this paper it will not be possible to analyze fully any of these bills. I do want, however, to make some general statements about the underlying effects of some of them.

Let us take up briefly those bills which provide for river valley authorities. No matter on which side of this fence you may be—whether you are for or against such authorities—you must recognize that the state's right to manage the wildlife within the scope of the authority will be narrowed and limited. The life of the individual, himself, who lives under the authority will be regulated to some extent. There are bills for a Missouri, a Columbia, an Arkansas, a Munkingum, and a Savannah Valley Authority. And there is still another which blankets all of the nine major watersheds of this country under as many valley authorities. At this time, with the present complexion and feeling of the Congress, it does not appear that these

authority bills will be favorably reported. Yet there are powerful influences in each section of the country backing these proposals and, while for the moment they seem to be sidetracked, conditions may change and the feeling in Congress might be reversed. If these bills should later have a chance of passage, state wildlife administrators should insist that adequate language be inserted to protect the right of the state in its jurisdiction over fish and game in the areas covered by these valley authority proposals.

At long last the efforts of those groups—particularly the Izaak Walton League—favoring the control and elimination of pollution within our waters seem to be reaching a head. There was a time a few years ago when there were two schools of thought on this vitally important matter. All agreed that pollution should be controlled, but one group favored state and local control while the other group wanted federal control. Today most all groups want pure waters, most of them feel that it is a federal responsibility, and the only divergence is the degree of control and enforcement provisions. The Mundt-Myers bill and the Spence-Barkley bill offer two roads for control. The former imposes enforcement provisions while the latter becomes an administrative project. The proponents of both agree that pollution has become a national menace, a stench and a disgrace to our citizenship. Whatever bill is reported will be a long legislative step forward and if passed will be a start on the program to clean up and purify our waters.

A group of bills has been introduced which go to the very roots of state control over its aquatic resources. In the House some twenty-odd bills have been introduced to quiet the title of the states to the land beneath their navigable waters. One of these is H. J. Res. 225, introduced by Congressman Hatton Sumners, of Texas. It was favorably reported in and passed the House nearly six months ago. The background of this bill is an interesting legislative study.

Up to 1937 no one ever questioned that the state owned the land under its waters. The coastal states owned out to the 3-mile limit beyond shore line. The states granted deeds to these lands and thousands of landlords base their ownership upon deeds which run to some point or line in the water. The Supreme Court in a number of decisions has held this conclusion.

In 1937 Senator Nye introduced resolutions in which this long settled rule of property was challenged. It was claimed that the United States owned these lands and the deposits under and within them. The Interior Department reversed its age-old policy and threatened to assert proprietorship over them. The resolutions failed of passage but a cloud settled over these submerged lands. Last spring Attorney

General Biddle started suit against the State of California to determine the question. If the Federal Government should prevail, California, Texas, Louisiana and Mississippi would lose control over these lands and the Interior Department would obtain the right to lease or dispose of them. And if this claim should be substantiated, why not take all the land under all of the navigable waters of all the states? The Committee in its report stated: "Nor is there any more basis for claiming oil than for claiming coal, iron, or oysters, or shrimp?" And, I might add, if oysters and shrimp, why not all fisheries? This situation has within it graver danger for the states than any other.

The Sumners Resolution is pending in the Judiciary Committee of the Senate, of which Senator McCarran is chairman. He has a somewhat similar resolution pending in the same committee.

There are, as I have already reported, 40 bills affecting fish and game. Some of these seek to alter the waterfowl regulations, others to amend the Coordination Act of 1934. The latest Robertson bill (H. R. 4503) is an honest effort to give substance to the old Act. Amendments have been agreed to, which should insure its passage.

The bill to make maintenance a project under the Pittman-Robertson Act should be passed. It would carry out the original thought back of this excellent legislation. Congressman Robertson introduced it, and it is referred to as H. R. 3821.

Bills to pay damage for waterfowl depredations to farm crops out of refuge money are unwise and very likely are so regarded by the Congress.

At least four separate approaches have been made to abolish the Jackson Hole Monument. There does not seem to be any unanimity on how to bring this about, and for the time being this legislation seems to be pigeonholed.

In this rather sketchy review of legislation, I have tried to point out some of the danger signs. In direct legislation affecting wildlife there is little to worry about. There the issue is clean-cut and stands or falls on its own merits.

It is in other legislation where wildlife is an incident that the pitfalls lie. In legislation with public lands, forests, minerals, reclamation, flood control, and navigation, wildlife only gets consideration if and when conservationists and wildlife administrators are able to impress upon the Committee the extreme need for such consideration. This is not because Congress is hostile or opposed. It is because, in the major problem involved in the proposed legislation, the wildlife concern is momentarily lost sight of. To me it would seem that we

must try to get these wildlife considerations written in when the bill itself is being drawn. I suggest that the state wildlife authorities study some basic legislative needs—a section that can be inserted in these bills as they are being drawn, or before they are reported—so that future legislation will safeguard wildlife, its habitat, and its administration by the responsible state agencies.

I do not want to close without saying a word or two about the excellent work that is being done by the Soil Conservation Service. Here is a very youthful federal agency which is dealing directly with the farmer on private farmlands.

Fifty-seven per cent of all game is found on privately- or state-owned lands. Soil Conservation works on the farm, improving the soil, and its uses, making better and larger crops for the farmer. In doing this soil conservation improves likewise the habitat for wildlife. In this respect this Service is and will contnue to be of vast benefit to wildlife crops.

The Wildlife Division of the Forest Service is coping with the problems of 34 per cent of big-game animals on the national forests. Its funds are inadequate for this purpose. They should be increased. The appropriation bill is now in the Senate Committee where an amendment should be offered to give this agency sufficient funds to carry out its difficult problem.

A federal aid to state fishery projects should be introduced and passed. This should be similar in form to the Pittman-Robertson Act for game.

A bill to provide a plan for wildlife extension service so that the Fish and Wildlife Service can do supplemental work with farmers in increasing habitat for wildlife should be introduced.

Bills for these purposes have heretofore been introduced but due to war pressure were not considered. With the war at an end, we should now press our claims for consideration.

These are just a few of the things that occur to me as I study the subject assigned me for this talk.

It can all be summed up in a very few words—wildlife administration must go to the Congress and state legislatures to obtain its basic laws. Conservationists must be united or their efforts will fail. If groups are divided, if they are at loggerheads over needed proposals, if they spend most of their time fighting each other, then how can a Senator or a member of the House know which course to follow. There is need for a clearing house—for more understanding, and for more shoulders pushing on the same wheel in the same direction.

DISCUSSION

MRS. REED CARY (Pennsylvania): I want to ask Mr. Shoemaker whether, because the Parker River Refuge Bill has been now released for voting, there is any hope of killing the bill.

MR. SHOEMAKER: Well, the bill is on the calendar, on the unanimous consent calendar of the House. An effort is being made by its proponents to have the Rules Committee give it a rule for consideration, and if this is obtained the bill then goes on the regular calendar and there may be passed by a majority vote of those present. If it passes the House, it will go to the Senate and be referred to the Committee. I doubt very much whether it will ever come out of Committee in the Senate. I am just giving you my reaction.

MR. HOWARD ZAHNISER (Washington, D. C.): It occurred to me when Carl was giving us the statistics on the game animals that are in the various federal lands, it would be interesting to note that although the Fish and Wildlife Service refuges and the national parks have the small percentage of the game animals in the country as a whole, if you limit the consideration to those animals that are very rare or threatened with extinction, then you will find that a very large majority of those animals are on these areas. I just thought that would be an interesting thing to point out, that the importance to us is preservation of rare species of these areas is far in excess of their per capita of taking care of the total big game populations.

CHAIRMAN BODE: I might report that the Executive Committee of the International Association of Game, Fish and Conservation Commissioners had a meeting this morning. They have had a special committee studying this problem of legislation and the very point that Mr. Shoemaker brought out of attempting to determine what is necessary to get attention for these things in the beginning was considered. They have taken certain steps to attempt to coordinate some of that work, so that all of the states will be better informed and so that they may take more united action.

The thing that stood out in that meeting, I think, was this, that there is legislation such as this House Bill 4503 and several other pieces of legislation that will not await a meeting of the International in the fall and the biggest need there seems to be to have the Congressmen understand what the people back there want on several of these pieces of legislation. I think very often we sit back and we blame our Congressmen and we cuss legislation after it is passed, but we haven't done very much to express ourselves on it. I think that was one of the biggest needs that we felt come out of that meeting this morning.

EDITOR'S NOTE: *A summarization of the Conference was presented under the direction of the Wildlife Society by Dr. Rudolf Bennitt at the close of this session, but since it also includes the technical papers it will appear on page 511.*

SPECIAL ANNOUNCEMENT

MR. SETH GORDON: I have been asked to read an announcement. There was a committee directed to prepare this yesterday. I am going to read it to you at this time. I am sure it will be of intense interest to everyone of you here and to all wildlife workers throughout the country.

"At a meeting at the Hotel Pennsylvania, New York City, the Board of Trustees of the American Wildlife Institute unanimously voted to merge its public activities with a new organization to be known as the Wildlife Management Institute.

"It was announced that Dr. Ira N. Gabrielson, retiring Director of the U. S. Fish and Wildlife Service, will become president of the Wildlife Management Institute. This new Institute will absorb all present activities of the American Wildlife Institute, and in addition will set up a complete service and research organization better to correlate and advance the activities of cooperating agencies in the field of wildlife restoration and conservation. The new Institute will sponsor the annual North American Wildlife Conference.

"A Foundation has been formed to be headed by Frederic C. Walcott, now President of the American Wildlife Institute. The purpose of this Foundation is to render moral support and financial assistance to wildlife restoration and conservation in much the same manner as existing foundations are advancing the cause of public health and education.

"This evolutionary step will assure to the conservation movement the continued service and leadership of both Doctor Gabrielson and Senator Walcott.

"As soon as Doctor Gabrielson is released from his government responsibilities he will begin active work on a program and organization for the new Wildlife Management Institute."

PRESIDENT WALCOTT: I have no intention of enlarging upon this announcement. I helped draft it. I am enthusiastic about its possibilities. I think it will put conservation of our renewable natural resources on a much broader base. While we are not ready to answer detailed questions, because we do not have the plan perfected, this organization will be effected as quickly as possible and you will get the details as the program develops. I am enthusiastic about it myself, and I am perfectly confident that as the result of this action conservation will be on a much broader base and be very much more efficient.

ACKNOWLEDGMENT OF APPRECIATION

CHAIRMAN BODE: Now, as we come to the close, I think it is fitting that we call on Mr. Gutermuth, the Secretary of the American Wildlife Institute, to officially close our Conference.

SECRETARY GUTERMUTH: Friends, in closing I think it appropriate to refer back to one of the papers in the opening session and here, again, I quote the old man of the Ozark Mountains, Mr. Stephens. I believe the title of his paper was, "Where Are We and What Time Is it?" Well, it is time to adjourn the Eleventh North American Wildlife Conference and in so doing, I hope that you will bear with me long enough to express the sincere appreciation of the Institute and my personal thanks to all of those who cooperated in making this one of the largest and most successful Conferences to be held to date.

I believe that the banquet last evening was, with the possible exception of the Conference in 1936, which was called by the President of the United States, the largest annual dinner ever held. We do not have comparative figures on the 1936 conference because there was such a jam in Washington that they couldn't even tell how many people were there, so they don't have an official record of those in attendance that year, but this one came near breaking a record last evening.

I want to thank the Wildlife Society. I wish time would permit me to elaborate. I am going to pay a special tribute to Dr. Edward H. Graham, of the Soil Conservation Service, who acted as the Program Chairman of the Technical Sessions of this Conference. He did a marvelous job. Without his cooperation we never could have had a successful conference. At the same time, this expression of appreciation is passed on to all those along the line, to the officers of the Wildlife Society and the chairmen of the different sessions, the members of the Conference Program Committee and the Special Ladies Committee, to Lowell Thomas, Carl Shoemaker and the others who contributed to the success of the banquet program.

Mr. Bode has thanked Dr. Rudolf Bennitt, but, again, I want to say thanks, Doc, we know we wished a tough job on you and you came through in excellent fashion.

We had the Outdoor Writers Association with us again this year, and we are pleased that they see fit to hold their annual meetings in conjunction with this North American Wildlife Conference. It is an excellent idea. It brings these two important segments together. We are working hand in hand for the same purpose and we are glad to have them with us. We hope that they will continue to meet with us each year.

Dr. Bennitt said (or inferred) that following precedent it was a mistake to summarize a conference because there might not be one next year, but I can assure you that there will be. It will be bigger and better than ever.

In closing, let me thank the New York Zoological Society for its splendid cooperation, the displays and the motion pictures; the Hotel Pennsylvania who during this critical period, in my opinion, did a marvelous job. It is true that we disappointed a lot of people, but the hotels have had a tough row to hoe and I think the Pennsylvania came through splendidly with all we dare expect.

Thanks to the New York State Conservation Council, to all the state agencies and the federal agencies. Now then don't forget tomorrow morning at nine-thirty, although this is the official closing of the Conference, we still have one joy ahead of us—that is a trip to see that conservation demonstrational area at the New York Zoological Gardens.

Thanks very much for coming. I hope you feel well repaid.

PART II

TECHNICAL SESSIONS

TECHNICAL SESSION

Monday Afternoon—March 11

Chairman: DURWARD L. ALLEN
Rose Lake Wildlife Experiment Station, East Lansing, Michigan

Vice-Chairman: WARREN W. CHASE
University of Michigan, Ann Arbor, Michigan

AGRICULTURAL LANDS AND WILDLIFE

AN APPRAISAL OF PHEASANT ABUNDANCE IN NEW YORK STATE DURING 1945 AND SOME OF THE FACTORS RESPONSIBLE FOR THE RECENT DECLINE

ROBERT F. PERRY
New York State Conservation Department, Rochester, New York

A review of the history of the pheasant in New York following initial stockings during the latter part of the last century shows that it gradually spread, stimulated by liberated stock until during the 1920's pheasants could be found over most of the better farming territory of the State. Using the recorded take each year since the collection of these data was begun in 1919, a rather steady increase through 1927 was shown. In 1928 the take fell off sharply, after which there was a period of gradual increase until 1935. A season of scarcity occurred in 1936, followed again by a period of increase through 1938 when the take reached an all-time high. The trend for 1939, 1940 and 1941 was gradually downward, and since 1941 the downward trend has been sufficiently severe to be classed as a "crash decline." The situation had become sufficiently acute in 1944 that the open season was shortened and the bag limit reduced.

Just how far down the scale the population had dropped by this time was not clear. It was evident, however, that pheasants had almost entirely disappeared from extensive areas, particularly in the hill country and many of the narrow valleys which used to produce

satisfactory hunting populations, while populations in the best parts of the range comprised only a fraction of their former numbers and even here tended to be somewhat spotty.

It is of the utmost importance to realize that the best range in this State is probably of low quality compared to that found in the corn belt of the Middle West. Apparently the soil, the climate, the flatness of the terrain, and the agricultural practices of that region are well adapted to pheasant needs. New York, on the other hand, is primarily hilly. Even its best range is largely devoted to general farming or fruit growing. Therefore, to hope for pheasant populations in New York comparable to those of the Midwest is wishful thinking.

Following the restricted season in 1944, it was imperative that some action be taken. Increased effort was first directed toward appraising the degree of overwinter survival. Then the 1945 Legislature gave the Conservation Commissioner the responsibility for declaring the open season last fall on the basis of direct knowledge of conditions at the end of the breeding and rearing season. This necessitated setting up a system of inventory to get the required data.

Pheasant survival during the winter 1944-45.—Winter weather is generally believed to have a direct bearing on the abundance of many wildlife species, especially ground feeders such as the pheasant. Two of the more important factors in winter weather affecting such species are temperature and amount of snow. Low temperatures result in a greater expenditure of energy to maintain body heat, while deep snow reduces the availability of food. Over the years, however, numerous field investigations have been made in New York in localities where starvation conditions were reported to prevail. The findings of these investigations were negative and, almost without exception, showed that birds reported to be suffering from lack of food actually were in good physical condition. Nevertheless, the low status of the pheasant population in 1944 warranted further study.

During the winter of 1944-45 weather of unprecedented severity was experienced throughout the central and western New York pheasant range. The U. S. Weather Bureau reported an average December snowfall for the State of 182 per cent of the monthly normal and stated that this amount had been exceeded but twice since 1890. Similarly the total snowfall for the month of January (29.2 inches) had been exceeded only twice since 1890. Weather Bureau reports also indicated that temperatures throughout the storm period were generally subnormal, especially as regards the month of January which was the coldest January since 1920 and the fourth coldest on record. Weather conditions moderated, however, after the first week in February and by February 16 snows had melted in many places

sufficiently to expose the ground, marking an end of the critical nature of the situation for pheasants. By the last week of February pheasant concentrations had completely dispersed.

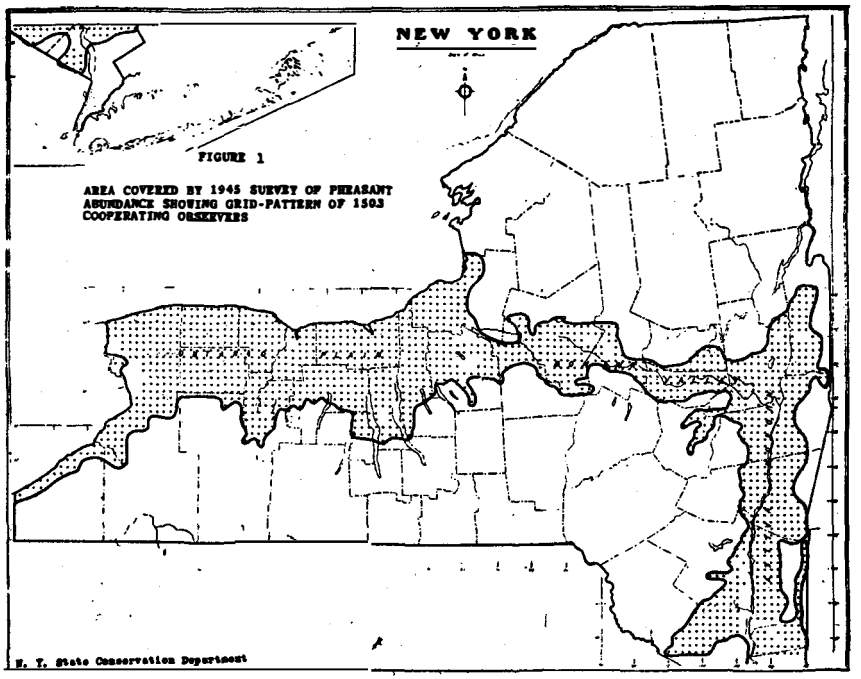
Throughout the winter as close a check as possible was kept on the effect of the severe weather on pheasant survival. An airplane was used on several occasions to observe flocks in areas which were inaccessible because of snow-blocked roads. The majority of the work, however, was done by car and on foot. No evidence of seriously increased losses as a result of this unusual winter season was noted. This conclusion was further corroborated by the examination of a series of pheasants collected under as seemingly critical circumstances as could be found. Although several of them appeared to be in poor condition only one showed any signs of starvation. These data, therefore, substantiate previous indications that winter pheasant mortality is not excessive over the primary range of the species in New York.

Inventory of pheasant abundance during 1945 breeding and rearing season.—The need for an inventory of pheasant abundance with respect to the fall of 1945 has been pointed out. To furnish as complete a picture as possible, work was begun during the spring and continued throughout the breeding and rearing season. Inasmuch as pheasants are farm game, probably no available source of information on a large scale is potentially more reliable than the observations of farmers who are abroad on their land at all seasons of the year. A plan of procedure to organize a survey system incorporating this source of field information was therefore decided upon.

Basic plan of operation.—New York's primary range lies in the Erie-Ontario Lake Plain and the Mohawk-Hudson River Valleys (Figure 1). It includes roughly one third of the State's total area of about 31 million acres. To survey such a large area some sampling method was required. Accordingly, it was decided to carry out a series of questionnaire checks by mail, necessitating the building up of a mailing list of reputable landowners uniformly located throughout the territory to be covered.

Establishment of sample to be taken.—In general, land lying above 1,000 feet in altitude in New York State is comparatively low in pheasant productivity. A line roughly following the 1,000-foot contour bordering the Erie-Ontario Plain and the Mohawk-Hudson Valleys was used to delimit the territory to be studied.

To randomize the sample to be taken, a geometric grid was laid out over this area at an interval designed to constitute one intersection for each 5,000 acres. The calculated interval for this grid was 2.795 miles. The resultant pattern is illustrated in Figure 1. Because the average size of the farms proved to be 194.3 acres, the data obtained repre-



sented nearly a four per cent sample of the total area. The grid was laid out on a master map and transferred to county U.S.G.S. maps to facilitate handling.

Organization of field observers.—To assist in locating the best qualified observer at each point, the aid of the Farm Bureau was established with the County Agents, who were asked to furnish names and addresses of qualified farmers living near the intersections of that part of the grid falling within their respective counties. A mailing list of 1,503 names was thus established constituting a sample coverage for approximately 7,500,000 acres of pheasant territory.

In a few instances the County Agents could not recommend names of reliable farmers living near the points where observers were desired. In all these cases local game protectors were able to suggest names of cooperators.

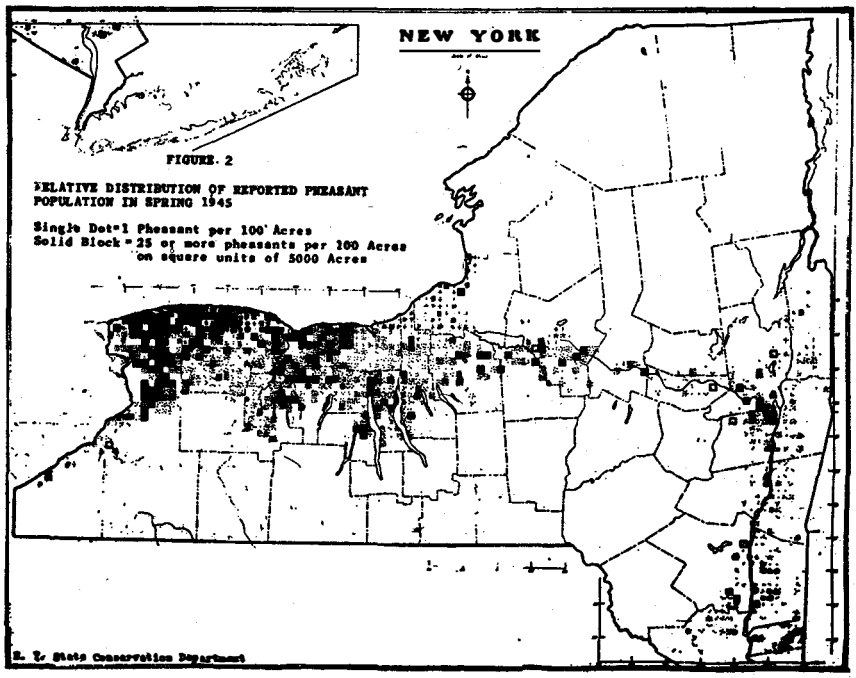
Spring survey.—The first questionnaire was designed to appraise the breeding population, to analyze differences in agricultural practice in various parts of the range, and to obtain information regarding early nesting. It was mailed to the list of 1,503 observers on May 24. As of June 4, approximately 60 per cent of the questionnaire

cards had been returned. A list was compiled of the delinquent 40 per cent and distributed to local game protectors over the survey area with instructions to contact each cooperator and to fill out the questionnaire form from information furnished by him. As of June 15 approximately 98 per cent of the cards had been returned.

The results of this survey proved that farmers could be organized into a force of primary field observers for the purpose of carrying out surveys of farm game conditions. Data obtained was in a form which would serve as a comparative basis on which to draw conclusions from similar data obtained in subsequent years.

Of particular interest are the indices of abundance and relative distribution of the birds reported. Using the figures received, the calculated breeding population for the area surveyed was approximately 480,000. Similarly, the calculated number of crowing cocks was roughly 122,000 or one for each 2.9 hens.

To obtain a picture of the relative distribution of the breeding population thus reported, these data have been plotted on a map (Figure 2). In analyzing the data for this presentation it was necessary to reduce each report to an acreage basis. Each dot on the map,



therefore, represents a calculated abundance of one bird per 100 acres for the entire block of 5,000 acres which each report represents. Calculated populations of 25 birds or more per 100 acres are shown as solid blocks. This map illustrates relatively high concentrations of breeders in parts of the Lake Plain section of the range, and relative scarcity of breeders in the Mohawk-Hudson Valleys.

Plotting the location of the crowing cocks reported also revealed much heavier concentrations in the Lake Plain section than in other parts of the range.

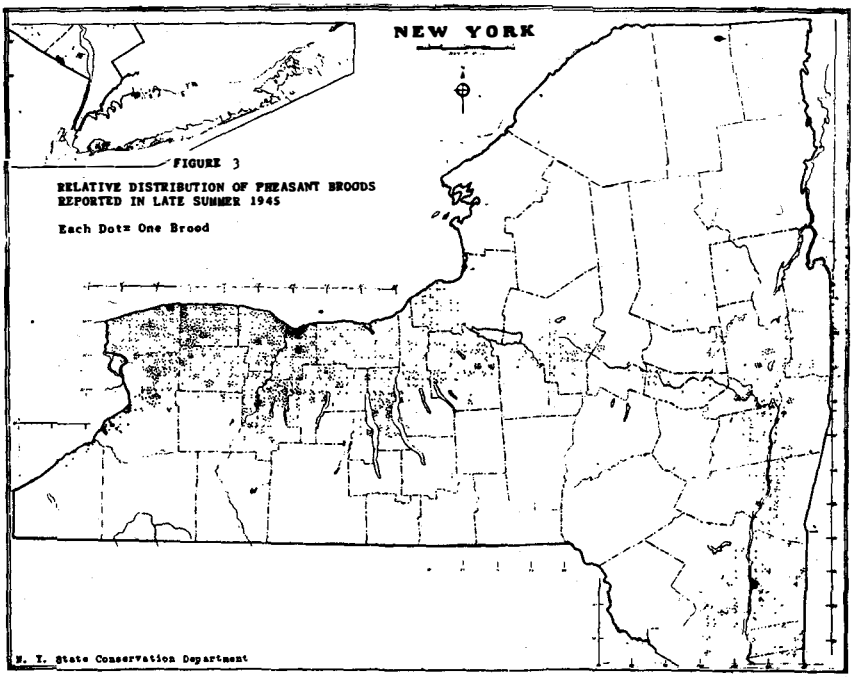
Early summer survey.—The early summer survey, timed to correspond with the time of year when most farmers were completing their first cutting of hay and also with the height of the nesting season for pheasants, was mailed to the 1,503 observers on July 7. This survey was originally scheduled to be mailed a week earlier but was delayed because wet weather had interfered with normal farming activities. Continued wet weather resulted in less satisfactory returns than would normally be expected. Nevertheless, 775 or approximately 51 per cent of the observers had returned their completed reports by the deadline set for August 1.

Again, maps plotted to show the relative distribution of the nests and broods reported indicated relatively heavy concentrations in parts of the Lake Plain region compared with conditions elsewhere over the range. The data also indicated that the crop of pheasants for 1945 would be extremely small and that the major proportion of the crop would be confined largely to a part of the Lake Plain section of the State.

Late summer survey.—On August 20 the third survey, designed to measure the relative abundance and distribution of the prehunting season pheasant population, was undertaken. In order for these data to be used in arriving at a decision as to the regulations to be declared for an open season, September 15 was set as the time when the analysis of the information reported would have to be completed. The same list of 1,503 observers was circularized with a return date set for August 27. As of September 1, 52 per cent of the reports had been received. To get as complete a picture as possible, the names of the remaining 48 per cent were again distributed to the game protector force for personal contact with a deadline set for completion of the assignment as September 10. As of that date, 96 per cent of the reports were at hand.

The results of this survey represented an appraisal of the prehunting pheasant population. Based on the replies received, the calculated number of young birds produced for the area surveyed was approximately 453,000. Adding to this the figure derived from the

spring survey for the breeding population gave a calculated total of roughly 932,000 or 12.4 birds per 100 acres. This indicated that the fall population was less than twice the number of breeders, whereas it has been shown by several students of the species (Errington, 1945; Randall, 1941) that in years of good productivity, it should be at least three times as great. Comparing 1945 with 1944, a majority of the reports stated that pheasants were less numerous this past fall.



Mapping the location of the broods reported (Figure 3) placed 76.5 per cent in the Lake Plain section and only 23.5 per cent in the Mohawk-Hudson Valleys, while the extent of the pheasant territory surveyed is almost equally divided between these two sections.

The total calculated population of cocks included approximately 200,000 young birds plus a surviving proportion of some 100,000 mature breeding males, or a total population for the survey area of roughly 300,000 cock pheasants. Furthermore, about 70 per cent of these were concentrated in the Lake Plain counties (Niagara, Erie, Orleans, Monroe, Livingston, Wayne, Ontario, Cayuga, Seneca, Oswego, and Onondaga). While the counties named comprise the major part of the Lake Plain pheasant range a very high proportion of the

pheasant population in these counties was concentrated in Niagara, Orleans, Monroe, and the north half of Erie, Livingston, and Seneca Counties. Abundance in the balance of the Lake Plain region was similar in general to that prevailing in the Mohawk-Hudson Valleys. That a general decrease in abundance as compared with 1944 had occurred was further supported by the fact that approximately 66 per cent of the observers throughout the whole area surveyed agreed on this point.

This was the discouraging picture with which the Department was confronted at the time it was necessary to make a decision on the season for 1945. On the other hand, the sex ratio of the remaining population was such that a limited take of cock birds would not impair the productivity of the flock.

Furthermore, unlike grouse or woodcock, pheasants can be successfully propagated and released artificially in large numbers.

Also, a vast number of clubs had, at their own great expense, reared thousands of birds for release in the expectation that they would have some opportunity to hunt them.

As previously indicated, the survey had disclosed that in large sections of the State, where pheasants were particularly scarce, environmental conditions are so unsuitable for pheasants that future hunting must rely on liberated birds rather than natural reproduction.

These and a number of other factors of lesser importance were carefully weighed and the decision reached to continue the curtailed season and bag limit of 1944, namely 5½ days with a limit of one cock bird per day and four per season.

Discussion of limiting factors.—The fact that pheasants are farm game is of prime importance in considering the "whys and wherefores" of trends in pheasant abundance. Like any other crop, pheasants are a product of the land and the degree of productivity generally can be expected to conform with the quality of the particular territory concerned. The most important factors controlling the quality of the environment are shelter, food, and weather. The whole structure rests on the soil which basically determines the vegetative cover (food and shelter), and on the climate. These, to a large extent, condition the effect of the other factors.

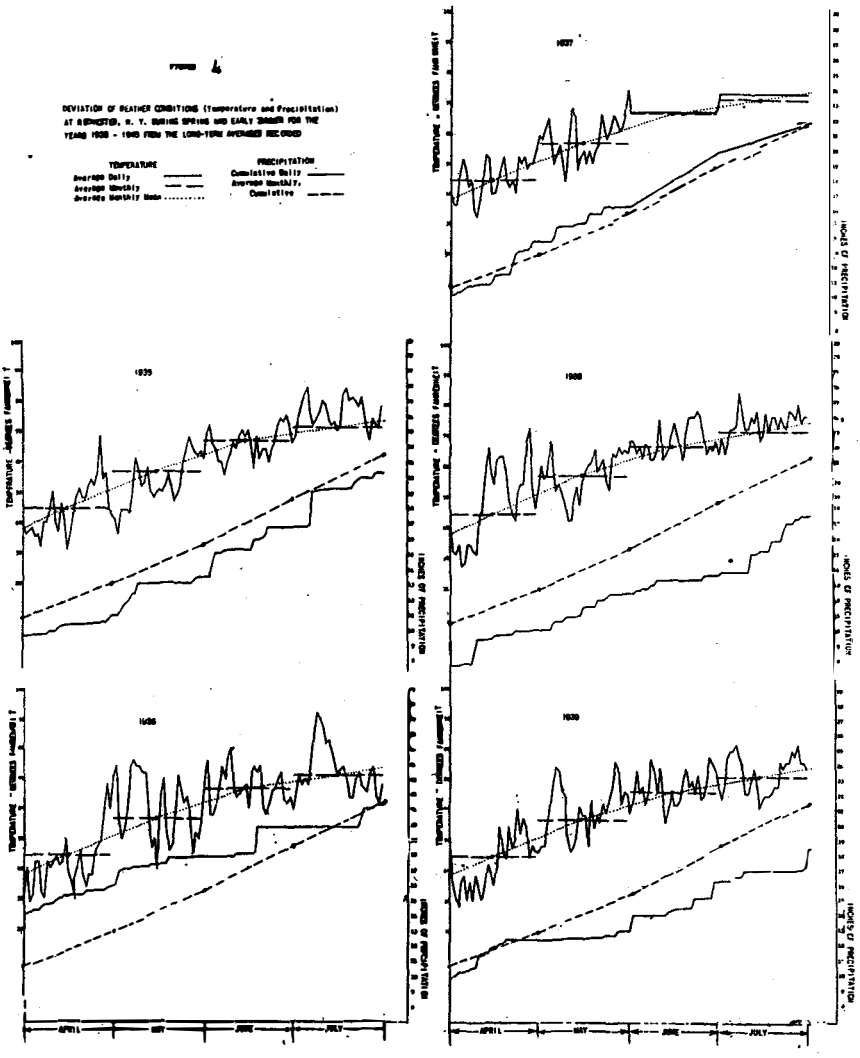
Surveys and field observations have indicated that whatever forces that caused the sudden decline in pheasant abundance since 1941 have been operative principally during the spring and summer period. This fact has been particularly obvious in areas where appreciable breeding populations failed to produce expected numbers of young. Observations during this period for the past several years have shown

that unusually cold, wet weather has often been associated with such failures.

In an attempt to illustrate the possibility of a correlation between these climatic factors and the degree of pheasant abundance observed a series of graphs (Figure 4) has been prepared from records of the U. S. Weather Bureau Station at Rochester, New York. This station was chosen because it is located in the heart of the best pheasant range of the State and it is believed that any correlation of weather with pheasant abundance at this point would be representative. These graphs have been prepared on the basis that birds in the wild are exposed to the elements at all times and might be adversely affected by relatively short periods of particularly unfavorable weather, even though averages for the same period might show conditions to be generally favorable.

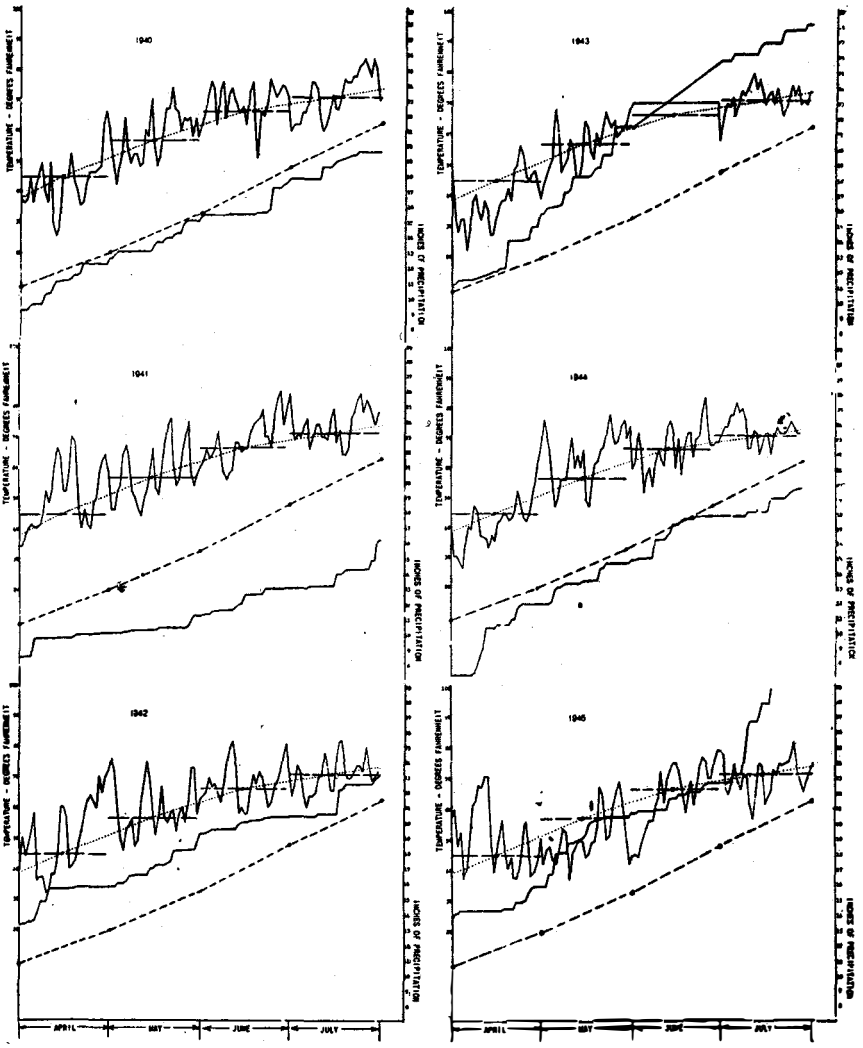
This series of weather graphs covers the months of April, May, June and July (or the nesting and brood period) for each year since 1935. The upper graph for each year represents daily fluctuations in temperature. For comparison the long-term average monthly temperatures have been plotted for each month and their mid-points connected by a dotted line. The lower graph for each year illustrates the cumulative precipitation day by day for the period covered. The average cumulative precipitation for the same period is shown as a dash line. On the latter graph in both instances the starting point is the total precipitation for the winter months of December, January, February and March which had accumulated as of the first of April.

In analyzing these graphs it is found that known seasons of poor pheasant hunting coincide to a marked degree with years which were abnormally cold and wet during the breeding and rearing season. This comparison is especially true of the precipitation graphs. By examination of the graphs since 1941 it appears quite possible that adverse weather during the spring and summer may have been to a large extent responsible for the recent "crash" in pheasant abundance. The graphs for 1942 show that the daily accumulation of precipitation during April, May and June was extremely high, although temperatures were above normal. In 1943 temperatures were far below normal during a large part of April and May, and, beginning in the last half of April and extending through the rest of the season, precipitation was far above normal. In 1944 daily temperatures were erratic and, although there was a deficiency of 10 inches of precipitation at the beginning of the breeding season, the amount of rainfall had risen to normal by the middle of June. Actually,



therefore, an excess of about 10 inches of precipitation fell during this period of about two months which represents the height of the breeding and nesting season. In 1945 both temperature and precipitation conditions were extremely adverse during the entire period.

In conclusion it seems probable that the present low abundance of pheasants is mainly the result of forces beyond the control of man. At the same time it is probable that these forces will again become



more favorable in the next few years and result in a greater natural productivity of pheasants in New York State. On the other hand, it has become clear that New York has only a comparatively small area of even moderately good pheasant range. In view of this, the stocking of artificially propagated birds will play a paramount role in any program designed to maintain satisfactory hunting opportunity for this species.

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DISCUSSION

CHAIRMAN ALLEN: Mr. Perry's paper will be open for discussion now.

I think we should put our finger on something here that is very important over the Midwest in particular. This paper indicates that the decline in pheasants has been due primarily to climatic factors, namely, precipitation and temperature, is that correct?

MR. PERRY: That is right.

CHAIRMAN ALLEN: And not to the fact that pheasants have been eaten by foxes or that they have been killed off by overhunting or that they have died from winter starvation, or that someone failed to propagate and turn loose breeding stock, but climatic factors.

We would like to have some comment from other states.

DR. CHARLES A. DAMBACH (Ohio): Just a little information which may throw some light on the subject here. Last week we had a group over at the Ravenna Game Farm in Ohio. We were interested in finding out something about the time the pheasants laid their eggs and the period they were laying under game farm conditions. The game farmer showed us the figures. The thing that attracted my attention, however, was not so much the period during which pheasants laid their eggs as the weather conditions during that time. As I recall the figures, roughly, the birds began laying the latter part of April and continued well on into June. Throughout that whole period from the spring of 1945, there were only four days when the observer did not record rain, that is, at least light rain or heavy rain, a very heavy precipitation during the periods when the pheasants were actually laying.

MR. PERRY: That is the story as far as New York State is concerned, too, and it is particularly applicable to the entire season of 1945. An analysis of the weather graphs (I wish we had a little more time with them) shows that the same indication probably applied to a large degree for '44, '43 and '42.

MR. JIM KIMBALL (South Dakota): Do you have any information that would indicate whether it is egg destruction or high mortality of the young or just when and how this bad reproduction situation occurs?

MR. PERRY: I wish we had had time and personnel to look into those things. We haven't, frankly, as yet. My personal opinion is that it is largely a matter of the pheasants just having no place dry enough to make a nest. It has been common observation of a lot of us who have been in the field these past few springs that there just isn't any place for a pheasant to make a nest. The moment you step off the paved highway you are in water up to your ankles and that has been our common observation, but the question as to whether it is a mortality of eggs or chicks or whether the pheasants just fail to make nests, we don't have the information on that.

MR. JOSEPH P. LINDUSKA (Michigan): We were faced with very serious shortage in Michigan as well as most of the Midwest. I think there it was quite clear that the shortage was not due to elimination of eggs or young or any one particular factor, but rather a combination of several. We apparently had repeated series of unfavorable weather conditions. We had frequent reports of the finding of eggs, for instance, floating down streams, heavy flood stages during the height of the nesting period. Later in the season, about the time the birds were coming off the nest, we had combinations of cold and wet that accounted for a good number of young birds.

The continuation of the unfavorable situation apparently was responsible in Michigan—I don't doubt but that it was similar elsewhere—rather than one particular factor at any one particular time in the spring.

MR. ALBERT R. SHADLE (New York): I would like to say for Mr. Perry's information that we have noticed on the University campus—which is around 164 acres and which, say, 15 years ago had quite a little bit of cover on it—at the present time the cover is limited to the south side of the campus, but the cover is very good there. At that time, say 15 years ago, you could go out and flush 40 or 50 pheasants very easily. That has gone down within the past 5 years. The pheasants have gone more into the south side. As many as 12 or 15 could be seen wintering there. You would see them every day. The number decreased until now there are probably about four or five hens and about two cocks. It has been a steady decline. To my knowledge, there has been but one brood, and I think only three or four of those were raised in, I would say, 5 or 6 years. We have attributed that partly to dogs and cats on the campus.

MR. JOHN P. LEONARD (Connecticut): I was wondering if the production of young has any relationship to the type of food that the chicks get in their early stages. Does anybody have any information as to the requirements or what availability there is of food for the chicks after they have hatched, even with the weather, water and all; if the chicks hatch out whether or not they have the type of food or can get the type of food they need for those first few weeks?

MR. PERRY: New York has made no study of that subject; perhaps someone else has.

MR. LINDUSKA: Prairie Farm in Michigan and various others who worked on that project found in the spring of the year the young pheasants fed very heavily on insect life. I don't know if the particular series of conditions we have had this spring was destructive of insect life or whether it might have occurred, but there is a period in the life of young pheasants when they do apparently either depend or at least accept very readily insects as the main item in their diet.

MR. C. G. SHELMANDINE (New York): I would like to ask a question in regard to the pheasant insect food containing poisoning. In our particular territory, especially where I live on my own place, I raise pheasants for a hobby. Last year through the rainy season I had two hens come off in the orchard, one with nine and one with eleven day-old chicks. I sprayed the orchard and in two days' time, I had no young pheasants left. After we had several rains, I took two more hens with day-old chicks, turned them loose in the same orchard and those birds came through.

Now, it is possible in these apple orchard sections which we have that the use of some arsenate and lead in poisons to kill those insects do the young birds harm. Do the young birds eat that? I would like to hear somebody else's opinion on that.

MR. PERRY: New York has made no study of that.

DR. DAMBACH: I can just report again on the work done in Wisconsin, feeding pheasants on grasshoppers poisoned with arsenate bait and they found no deleterious effects. The birds got along very nicely feeding on those poisoned grasshoppers.

MR. SHELMANDINE: Day-old chicks?

DR. DAMBACH: No, they were not day-old chicks; they were adult birds.

MR. PERRY: Any other questions?

MR. KIMBALL: We were talking about this apparently poor condition over the country. In checking close to 6,000 birds in Hunters Bay, South Dakota, this fall, we found that there was only approximately one young bird for each adult, where ordinarily, of course, we expect three. So apparently reproduction was very poor there, too, in spite of the fact that a tremendous number of birds were killed and there still seem to be a lot of them left.

MR. PERRY: Gross observations in New York State are in accordance with your observations.

MR. W. N. WANDELL (Illinois): I believe there is one other factor that should be considered here and that is the number of hours of bright sunshine you have during the months of May and June. In some sections, it is possible to have a good brood survival with fairly heavy precipitation if the rain comes in showers

and is followed by bright, clear weather. If the season is extremely rainy, you probably get the results we have had.

MR. PERRY: There are doubtless many associated factors. Your suggestion is in accordance with that of the relative importance of evaporation, water table levels, and so forth.

MR. HAYDEN OLDS (Ohio): Regarding the use of this poison spray, we did have this experience in Ohio. We had a number of large greenhouse owners who requested 4-week-old pheasants, which is part of one of our distribution programs, to be placed in their greenhouses. We did it experimentally giving them approximately fifty birds. They had excellent results with those birds.

Now, to what extent they used poisonous spray in the greenhouse, I do not know.

In Ohio we have some cause to believe perhaps that an intensified agriculture during the war period has had something to do with a drop in pheasant levels. Then coming back to your statement in your paper that you would have to rely in the future on game-farm-reared birds for stocking in undesirable territory, I would like to know at what time of the year, that is, how shortly before the hunting season those birds are released, what percentage the hunter actually takes and upon what figures or methods you base your figures.

MR. PERRY: We had an opportunity over a period of about 5 years in the course of our so-called landowner-sportsman program in New York State to study just such questions. We found—and this applies to the better sections of our pheasant range—that 8- and 10-week-old birds liberated in late August and in September probably would produce a take of not to exceed 20 per cent. Birds reared to mature size and liberated just prior to and during the pheasant season on those controlled areas resulted in a take of upwards of 50 per cent. That has been our experience.

MR. BEN GLADING (California): Could you tell me the price of those birds to the State of New York and the license fee of the State of New York?

MR. PERRY: The license fee in New York State is $1.65 for a hunting license or $2.25 for a combination hunting and fishing license. I don't have the figures on cost of the birds. I can refer you to our Superintendent of Game Farms, Mr. Holm, who might be able to give you some lead.

MR. EARL R. HOLM (New York): Unfortunately, we don't have the cost as of this year. Prior to the war when we were keeping production cost figures on all of our game farm operations, the birds, varying between 8 to 12 weeks of age, cost us slightly over a dollar. We never did in our cost analyses figure on the production cost of adult birds because the adults were held over simply for breeders to produce eggs, chicks or young birds that would be released in the fall. What the price on those birds would be now, I don't know. That was one of the activities necessary to drop during the war. Possibly someone has accurate cost indices covering the increases in prices during the war and those could be supplied.

MR. PERRY: Does anyone else have any data on the cost of production of 8- or 10-week-old birds or adult birds?

CHAIRMAN ALLEN: I will say those birds did cost a dollar apiece, Mr. Perry. I think the point was this: Your license cost $1.65, we will say, and if you keep those birds until it is time to shoot them, is that going to about double the cost?

DR. DAMBACH: It will make it about five times those figures if they take 20 per cent of the birds.

CHAIRMAN ALLEN: If half of your birds are hens and you take 20 per cent of the cocks of those turned loose, it is easy to see that the cost is going to be pretty high. I think that is the point that was being made there. The question here is: Can you afford to raise birds and turn them loose to shoot?

MR. PERRY: That, of course, is entirely a matter of policy.

CHAIRMAN ALLEN: Isn't anybody going to answer that question?

MR. WANDELL: My pheasant business has been in Massachusetts and there we have a situation whereby our pheasant range is relatively poor. We have extremely heavy hunting pressure. Pheasants are in great demand and we have a

stocking policy whereby acre for acre probably as many birds are stocked in Massachusetts as on any extensive area. We have run checks and we have found that in spite of the fact that the pheasant range was poor and that stocking was heavy, natural reproduction explained 86 per cent of the total shooting.

MR. G. M. SPARGO (Alberta, Canada): What is the mortality in the transportation of 10- to 12-week-old pheasants, at least a percentage?

MR. PERRY: I believe Mr. Holm could give you some idea as to that cost.

MR. HOLM: The mortality in transportation?

MR. SPARGO: Yes.

MR. HOLM: That varies considerably. Almost all of our birds are shipped by common carrier, that is, by American Railway Express, some shipments up to 1,000 birds. We have had records of no mortality. In other small shipments, there is considerable mortality. It seems to depend largely on the temperature of the day or weather conditions or day the birds were trapped and the conditions in the express cars and the method by which they are handled after they reach their destination.

MR. A. O. HAUGEN (Michigan): I would like to say something regarding the turning loose of pheasants and being able to shoot them shortly after turning them loose. We stocked something like 800 birds at Swan Creek Wildlife Experiment Station, and those weren't stocked immediately for a gun; but the return on that was only something like 4 or 5 per cent. As I see stocking for shooting, if you stock them one day and shoot them the next, from my experience in a check-up on the day following releasing the birds, even my 10-year-old boy with a good slingshot could have killed a good many of them sitting under the trees. They didn't have the same percentage throughout the country.

MR. OLDS: Mr. Chairman, could we have some discussion as to the relative merits of stocking immature birds, 10 and 12 weeks old, in the fall, in August and September, as against carrying them over to February and March the next spring?

MR. PERRY: We have had no experience in New York in carrying them over for spring liberation. Our primary experience has been in the liberation of 8- and 10-week-old birds with the experience I mentioned on a landowner's and sportsman's area with mature birds released just prior to the hunting season, but we have had no experience with the older groups.

COLORADO'S DUCK-DAMAGE, GRAIN-CROP PROBLEM

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The seriousness of Colorado's duck problems involving damage to grain crops is attested by such measures as the order from the Secretary of the Interior creating a special mallard season from December 24, 1942 to January 31, 1943. These problems will multiply as duck populations are increased through management to satisfy the demands of sportsmen, and as irrigated lands are augmented through transmountain water diversions and through other irrigation projects contemplated or under actual construction. It is my purpose to describe conditions responsible for the damage and to discuss remedial measures.

The agricultural areas concerned with duck damage are two. The first lies upon the plains of eastern Colorado, along the South Platte River system flowing from central and northern Colorado northeasterly into Nebraska, and along the Arkansas River which drains into Kansas the water from southeastern Colorado. The irrigated area lies between elevations of 3,350 and approximately 5,500 feet, within the Upper Sonoran Life Zone.

Fluctuating level reservoirs built for water storage supplement the rivers and natural lakes. These and the numerous ditches which distribute the water form ideal resting places for ducks. Dependence upon gravity distribution of water and the favorable disposition and quality of soils nearest the streams bring croplands and water areas into close proximity.

Upon the plains areas the principal crops damaged by ducks have been corn (maize) and sorghums which are attractive to ducks and which are harvested later than sugar beets, oats, wheat, and alfalfa.

The second duck problem area is the great mountain-rimmed basin that is San Luis Valley, lying just north of New Mexico in south central Colorado. This, too, is an important irrigated crop area, with reservoirs and ditches augmented by artesian wells responsible for numerous ponds or seeps. Though higher in elevation and marked by cooler summers, it shares with the eastern plains winters that are dry, sunny, and comparatively warm, with little snowfall.

The relatively cool summers of the San Luis Valley are especially favorable for raising potatoes and, of great importance in respect to ducks, field peas.

The mallard duck is ideally constituted for taking advantage of these agricultural and climatic patterns. Often nesting at a distance

from water edges, this duck is not disturbed by fluctuating water levels. A well-fed, heavy-bodied, heavily-feathered duck, it finds even the colder periods of Colorado winters entirely tolerable. By habit chiefly vegetarian the mallard can loaf safely through daylight hours far out upon iced-over reservoirs, and after dark and before dawn for its sustenance can raid unharvested corn or other grainfields, or glean spilled wheat and barley from harvested fields. Other mallards that rest upon open stretches of rivers or unfrozen centers of the larger lakes or spring-fed ponds also prefer to do most of their feeding in fields. The result has been great numbers of overwintering mallards long after practically all other species of ducks have flown farther south. Sperry and Imler (1942) have reported as many as 300,000 mallards on a single reservoir, and less official reports give an airplane census of 1½ millions of ducks upon the Arkansas and Platte drainages, within Colorado, during January 1945.

The obvious solution for the problem is to harvest all grain crops before mallards become dependent upon them. But unfortunately farm practices and labor situations do not always favor this sensible solution.

Ten years ago in the San Luis Valley it was a practice to leave ripe field peas standing and to harvest them by turning in hogs or sheep. Duck damage naturally occurred and was greatly resented, but Kalmbach (1939) found that damages were not accurately measurable. Peas scattered by animals during the day would be eaten by ducks at night. Some would be trampled into the soil. Still others would be consumed entirely by ducks, but no one could estimate the percentages concerned. Losses to ducks, experimental studies showing deterioration of food values through exposure to weather, the growing realization that less feed was wasted when harvested and trough fed, and growing emphasis upon other crops reduced this practice.

During the war the acreage of peas grown within the San Luis Valley was greatly increased to meet demands for dried split green peas, but since these are carefully harvested when ripe, duck damage has been negligible.

In eastern Colorado, sugar beets must be harvested before the ground freezes. With limited labor corn harvesting is left until later. In some years, as in 1945, the corn was slow maturing and had to stand until it had dried to a satisfactory moisture content. Farmers who had mechanical corn pickers lacked labor with which to glean the ears always left by machinery. Still others, farming upon a less intensive basis, prefer to leave corn standing until they can find time to pick and husk it in the field. Under any of these conditions pheasants and ducks take a considerable toll.

Because of the sporadic nature of duck movement and depredations, it is difficult to predict or determine damages. In a meeting later described, an expert from the U. S. Fish & Wildlife Service estimated that the 1½ million ducks might eat as much as $4,500 worth of corn daily. This was based upon one pound of corn daily for each five ducks, but while the crops of some mallards are filled exclusively with corn, others contain wheat, barley, or other seeds wasted during the harvest. Sperry and Imler (1942) have reported fields 42 per cent damaged, but over greater areas, percentages seldom exceed 2 per cent. If the loss were spread uniformly over the grain-producing area, as pheasant damage tends to be, it would be tolerable, but when several thousand ducks alight within one farmer's field, he faces ruinous losses.

During the first few days of the Colorado duck season, ducks are found upon small ponds, but after a few days of shooting they raft up out of reach upon the larger lakes and reservoirs. River shooting continues good, for overwater flights are often within shooter range, and the hunter without decoys, blinds, or duck calls can sneak upon ducks concealed by curves in the stream and jump them for successful shooting. With recent extensions of shooting hours until sundown, some hunters are able to kill ducks within cornfields, though most of the larger flocks do not leave their reservoirs until after sundown. Nevertheless some shooters do well in certain cornfields near water areas, and their shooting tends to disperse duck damage.

The special 1943 January mallard season permitting shooting in grainfields only was enthusiastically welcomed by Colorado farmers and hunters alike. Experienced hunters known to farmers suffering damage were invited to fields regularly visited by ducks and did well for a few nights. Less experienced hunters crippled more ducks than they secured. The ducks were scattered and heavy losses in individual fields averted. The kill, however, was not great. Poley (1943) found that the take per hunter averaged but one duck per hunter-trip, and Day (1944) found that this type of control used elsewhere was quite similar.

As might be expected, some violations occurred. Some hunters bought corn shocks to place along rivers. Few ducks other than mallards were killed, however, during that time of the year.

During the recent years special permits have been issued landowners suffering duck damage, and hunters may exceed regular hunting hours upon farms under such permits. These have afforded protection to unharvested fields, but because the permits could not be obtained locally some owners would not expend the effort to obtain them. In some instances, too, farmers suffering no particular damage,

or located along waterways affording good shooting, obtained shooting permits.

To consider the entire problem Director Feast of the Colorado Game and Fish Department called together a special duck committee for a meeting last November. The committee included two successful corn farmers, a member of the state A.A.A. office, the assistant state director of the Extension Service, two business men who were lake gun club members, two other hunters who used the rivers, the resident game management agent of the Fish and Wildlife Service, and the professor of game management from Colorado A. & M. College. Present in an advisory and consulting capacity were the director and assistant director of the Colorado Game and Fish Department and three nonresident officers of the U. S. Fish and Wildlife Service. The meeting was devoted to fact finding and the drafting of recommendations and was highly effective. I am permitted to pass on the conclusions reached.

1. Following Gabrielson's (1945) suggestions liberalizing the limit on mallards in the central flyway, a limit of 15 is recommended, provided 5 or more are mallards. This will reduce the population of ducks most responsible for crop damage.

2. A 90-day season with a compromise opening of October 1 is recommended, to provide sustained pressure against the ducks.

3. Controlled rallying by airplanes, tracer cartridges, and mortar bombs, which the Fish and Wildlife Service has found highly effective in clearing the larger lakes of ducks, is recommended.

4. More public shooting waters are needed in the vicinity of damage areas. Management refuges are more sorely needed than inviolate refuges. Control of ducks is at present prevented when ducks herded from reservoirs adjacent to cornfields take refuge upon posted sections of nearby rivers.

5. The issuance of damage control shooting permits should be expedited through county A.A.A. offices, following public information provided by county agents of the Extension Service. A.A.A. offices through their records of crop acreages can quickly check claims for damage and county agents know both farm situations and hunter desires.

6. Through a survey, possibilities should be investigated for establishing a system of leased low-quality grainfields for food refuges into which ducks are herded by airplane.

7. A cooperative damage appraisal experiment should be established between the Game Department, the U. S. Fish and Wildlife Service, Colorado A. & M. College, and the Extension Service.

A survey studying crop damage areas, farmer cooperation, the

status of shooting grounds, and hunter success is already under way and augments studies of particular problem areas made by the Fish and Wildlife Service. Other studies dealing with sampling methods to determine crop production and wildlife damage are getting under way.

The need for cooperation between the several agencies interested has been clearly demonstrated. Citizens of the state turn readily to the state game and fish department whenever property damage results from wildlife. This is because all save migratory and national park game is the property of the state, because wardens and other representatives of the state game and fish department are easily contacted within each community, and because the state has been highly effective in controlling property damage from the deer, elk, and beaver under its control. Yet it is generally believed that the over-all control of migratory waterfowl must rest with a federal agency having interests exceeding the boundaries of one state, even though citizens by habit speak of suing the state for all wildlife damage, including that caused by ducks. Officials of the A.A.A., Extension Service, and land grant colleges can be helpful in this problem because they have long been concerned with farm difficulties.

Experience has shown that no one control will eliminate damage done to crops by Colorado's mallards and still maintain a desirable mallard population. It is increasingly apparent, however, that if all agencies with effective interests can cooperate in the use of all available controls this problem can be reduced to comparative simplicity and then completely solved.

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DISCUSSION

CHAIRMAN ALLEN: Many states have this problem and we must certainly admit in Colorado the ducks mean business. Mr. Wagar's paper is now open for discussion. We would like to have some remarks from other states where duck damage has been a problem.

MR. J. K. MAHONEY (Saskatchewan, Canada): We have very much that same problem in our province, the crop damage feature. We have recently had a crop damage insurance feature arranged, where ducks are damaging a farmer's crop close to a resting place. That crop damage is assessed and the farmer is com-

pensated for his apparent loss. I notice Mr. Wagar mentioned herding with airplanes, breaking up concentrations of birds. That is something that we in Saskatchewan are very definitely opposed to.

We have had, unfortunately, some difficulty in this past shooting season when American hunters have come to our province by air and herded geese and ducks off their resident places and out into areas where they were shot. They have given them no opportunity whatever to feed or rest, with the result that the geese and ducks are leaving their resting places. We now have arrangements with the Provincial Government to be very severe with anyone caught herding either ducks or geese from their resting places.

MR. WAGAR: May I ask, is your herding all done by the hunters? I am speaking of official herding by those who are responsible for moving.

MR. MAHONEY: Yes, our herding so far has been only hunter herding. We have no official herding regulations.

MR. WAGAR: We have these areas very much under observation and so there can be no illegal herding, but in some instances it is very advisable and has proved very helpful to push them off one place, especially if their reservoir is close into a large grainfield, and get them in another area where they can rest and not do so much damage.

MR. MAHONEY: Perhaps your water situation is entirely different than ours, Mr. Wagar, in that we are almost considered a desert area. We have very small water resources in the southern part of Saskatchewan.

MR. WAGAR: Our Commonwealth, too, is very restricted. We have only 7 inches of rain, but, as I pointed out, we have these problem areas very much restricted along the two rivers with the rivers themselves adjacent to storage reservoirs and the cornfield all together, so they are very easily policed and put under management once we decide upon a management scheme.

MR. JOHN M. ANDERSON (Ohio): I entertain a suspicion in many of these areas where we have reported duck damage that the ducks aren't actually eating much more corn and grain than they did 10 years ago, but in recent years of higher prices for corn and, I might add, propaganda to the effect that the ducks have increased to a level which they didn't supposedly reach 10 years ago, there is a lot more emphasis being placed on it. I think it wouldn't be amiss when we undertake a study of duck damage to look into the past history of the thing and see how much (if you can get that information) ducks were feeding on corn 10 years ago.

MR. WAGAR: I might say in response to that we have figures which I did not give due to lack of time, covering more than 10 years back. These studies are not just surmise; they are very carefully authenticated.

MR. HARVEY E. HASTAIN (California): Do you have a widgeon problem in Colorado similar to ours in California and if so how do you plan to handle it?

MR. WAGAR: No, we do not have widgeons to the extent you do. These flocks, I may say, are 100 per cent mallards. There is a negligible percentage of anything else during December and January. We get widgeons early in the season, but they go on through.

MR. HASTAIN: We have a widgeon problem where I have seen 40 acres of lettuce cleaned off in one evening, which is quite an expensive proposition in so far as the farmers are concerned and a very serious problem with us, and one that is going to be rather difficult to iron out, but we have done some herding with the planes. We haven't found a satisfactory solution to replace the feed for our birds when they are taken away from the lettuce. That is our chief difficulty.

MR. WAGAR: Is that the Imperial Valley?

MR. HASTAIN: That is right.

MR. W. C. GLAZENER (Texas): I would like to ask for one thing, the duration of the herding effect on your ducks. After you move them from one area to the other, is there a tendency for them to settle and remain there indefinitely or must they be herded again and again?

At the beginning of the war, the installation of flying fields for our training

service all up and down the Texas coast had us alarmed as to the possible effect on ducks and geese in our winter concentrations, but subsequent developments proved that much of our fear was unfounded. Those birds after some rounding and herding by cadets particularly settled down, paying little attention to the planes by the time the war was over.

MR. WAGAR: We usually herd for about three or four nights, just enough to make them change their feeding place. By the time they are spread a little more, the trouble is abated somewhat from one particular area.

PRIMENESS, CONDITION AND FUR VALUES

W. J. HAMILTON, JR.
Cornell University, Ithaca, New York

and

DAVID B. COOK
New York State Conservation Department, Albany, New York

The fur crop ranks high in monetary value. It needs no plowing, no seeding, no cultivating; yet the harvesting alone is sufficient to bring $75,000,000 annually to the trappers of the United States. Most furs are taken from agricultural lands by farmers and their boys. This harvest comes at a season when other farm work is slack. The income from fur is often enough to pay part or all the taxes or to buy needed clothes or equipment. The value of the crop depends in large measure on the primeness and condition of the fur. Both of these are strongly influenced by the time of year when the animals are taken. Fortunately, most states now have trapping seasons which coincide with the period when pelts are prime. But we have long neglected condition in fur; certain factors which tend to lower the market value of furs even when they are prime, and which have nothing to do with the condition of the flesh side. They are conditions over which man has little control. They should be pointed out to the uninitiated who are charged with fixing open seasons and advising both the tyro trapper and those others who gain a part of their living from the trap line.

Among trappers and fur dealers, the term primeness refers to the condition of the *flesh* side of the hide. When animals begin to grow their winter coats, there is a great density of pigment granules in the hair roots. This gives the leather a blue color; such pelts are considered to be unprime. As the hairs become longer and finally mature, the pigment cells move up into the hair shaft, with a resultant blanch-

ing of the roots. Eventually, the lack of pigment in the hair bulb produces a white, cream-colored, or in the case of the muskrat, a red leather on the flesh side. The pelt is then said to be prime. When such occurs, the underfur is dense and fully developed, holding the guard hairs upright. Such a condition shows prominently in a February-caught New York muskrat.

Condition is the character of the pelt other than its primeness. Certain terms used in the fur trade to describe condition are generally understood and accepted by trappers, fur buyers and dealers. During late winter, many species commence to lose the underfur; the long guard hairs, no longer held erect, then tend to lie flat. The term applied to this condition is "springy." During late January and through February, many pelts of raccoon, skunk and particularly mink, become "singed." This comes about through a breaking of the tips of the guard hairs and lends a dull, flat appearance to the pelt. December-caught otter from the Adirondacks were singed in 1945. Better pelts could have been obtained in November.

"Rubbed" pelts are those from which large patches of fur are missing, leaving bare areas on the flanks or rumps and occasionally on the shoulders. This condition usually appears from late January to the close of the trapping season. It is brought about by poor den entrances and possibly by movements within the den during the quiescent period. We have noted that skunks emerging from their "holing-up" period after a month or longer often show "rubbed" spots. "Curling" and "sunburn" are two phases of the same condition and are brought about by a combination of factors. The tips of the guard hairs become curled and brittle, the guard hairs, and to a lesser extent, the underfur, fade perceptibly and the glossy luster of January pelts is lost. The action of the potent late winter sun quickly causes "sunburn" and appreciably lowers the value of the pelt. All New York fur bearers are susceptible to this trouble. During the rut, even a few hours of daylight activity may be sufficient to "sunburn" pen-raised or wild mink, with consequent serious reduction in quality.

"Fading" is an actual change in the color of the fur. After denning, raccoons lose the richness of color that characterizes their late autumn and early winter coats, the fur tends to redden or become yellowish and its value is measurably lowered. Black skunks take on a brownish hue; cannot be used natural and hence must be dyed. Red fox pelts lose their brilliance and are notably more yellow in late January and February than are those taken in December.

Pelts command the highest prices when they are prime and before

any wear or deterioration of the fur has begun. In brief, the New York species are at their peak during the following periods:

Mink—November 10 to January 15
Skunk—November 1 to January 1
Foxes—November 10 to January 10
Raccoon—November 15 to January 1
Muskrat—January 1-15 to March 15
Beaver—February 1 to April 1

Water mammals—the muskrat and the beaver—prime up notably later than do most land species. The mink, which leads a partially aquatic existence, secures its prime pelage at the same time land species become prime. Weather plays only a minor part in determining the dates of primeness. Over a period of 20 years we have attempted to correlate the temperatures during October and November with incipient primeness in several New York fur bearers. It is apparent that only an unusually mild autumn will delay the period of primeness and then only a few days or at most a week. Excepting the water animals, the hair begins to deteriorate after mid-January, even though the hide may still be prime.

Figure 1 indicates the period, in New York, when pelts, in so far as primeness is concerned, are at their best. It also shows the time when furs commence to decrease in value due to causes other than lack of primeness, that is, rubbing, fading, curling and the like.

It is thus evident that a combination of factors determine what

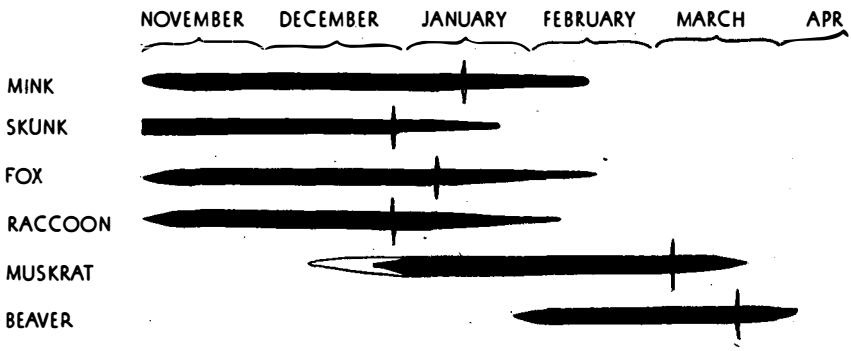

FIG. 1 RELATION OF PRIMENESS TO OTHER CONDITION FACTORS IN SOME NEW YORK STATE FUR-BEARERS. THE VERTICAL LINES ON THE BLACK PRIME AREAS INDICATE THE PERIOD WHEN PELTS COMMENCE TO DETERIORATE PHYSICALLY.

price a pelt will bring. When the underfur is dense and the guard hairs have attained their greatest length and luster, the pelt is in its finest condition. Generally, pelts taken at the beginning of the season, even before they are fully prime, command a better price than those fully prime pelts, trapped toward the close of the season, in which the fur has suffered physical damage. If a pelt be prime and in top-notch condition, it will grade as a No. 1. An equally prime pelt on which the hair is in poor shape might be classified as No. 2, No. 3, or even No. 4. Primeness is not the only measure of value in fur.

As an example, muskrats begin to prime about December 1, are not fully prime until some time in January. They remain prime until late March. But they do not come into best condition until February. Mechanical deterioration, due to sunburn and later to cuts received in fighting, materially reduce the value of late winter pelts. It may be, then, that an early winter pelt not fully prime will fetch as good or perhaps a better price than a fully prime but damaged late winter pelt. The price difference may be as much as 20-40 per cent. An early season on muskrat might permit a larger harvest by man, and a higher proportion of high-quality undamaged fur.

Many factors, such as stormy weather, fluctuating water levels, trapper competition and changes in demand militate against all pelts being taken at the time when they would bring the highest prices. If a larger share of the animals could be trapped during the period of their primeness and before the fur had commenced to deteriorate, millions of dollars could be added to the income of the trapper with little or no additional effort. It seems desirable to open some seasons earlier than is now done, and to close them before the inevitable damage to the fur occurs. If state departments, Extension Services and the Farm Bureau Federation would give more publicity to these facts and proper advice to the young trappers of the country, considerable additional money would be taken in by the farm trapper. Most of the difference between a good skin and a poor skin is largely the fault of man, not that of the animal that grew it. It is possible to remedy this situation.

DISCUSSION

MR. FRANCIS H. BEZDEK (Ohio): I would like to report an observation made in the past few years on the fox, both red and gray, in Ohio. For several years we have had a professional fox trapper in southeastern Ohio near Marietta, which is a somewhat warmer climate in general than you find in the northern states, except along the lakes. By professional, I mean in an area 5 acres square he has been able to trap personally well over one hundred animals per year for the past 7 or 8 years and these are accurate records which have been compiled.

He, being a close friend of the local game warden and more or less doing a lot of trapping on the side, has trapped foxes in many years before the season was opened, on a year-around basis—on a creditor basis before the season was

regularly opened by law. There are some interesting observations in connection with that. His pelts have all been sold ordinarily in a group. When he gets a rather satisfactory bid from a fur buyer, he sells them, each one of course bringing the same price, but he sells them as a lot. On the average he starts his trapping around October 15, which is in his firm opinion not too early. He gets foxes, really a rush of them, from October 15 to about December 10. He traps most of those animals, or at least 90 per cent of them in that period. Those animals bring as much then as they have ever brought on the market at any later time during the season, in fact he keeps them until he gets the highest price for them.

I am wondering, and I notice that Dr. Hamilton brought it out in his paper, if he doesn't think it is a good idea to encourage states and individuals in general to foster the idea of earlier trapping of many of our fur animals because it apparently seems that they are just as good or better earlier in the season, taking them as a general group of animals, than they are if trapped later when they are deteriorated.

DR. HAMILTON: Since in most states there is no closed season for foxes, people trap them when it is easy to do so and that is in late October to early November. In New York State, I think Dave Pollock will agree, 90 per cent of the foxes are taken before mid-December. The pelts have a good quality. Sometimes people trap the foxes and keep them alive in closures for a period of 10, 15 or 20 days. I had a friend who had 30 reds and grays trapped alive and kept in closures until they became a little more prime. Most states, unfortuately, consider foxes as burglars. We certainly have a problem in New York of too many foxes. The time to trap foxes is when you can get them, that is from late October to early December. They are prime during November.

MR. KENNETH A. WILSON (Maryland): We started to trap foxes about October 15 in Allegheny Plateau, in Wooster, Maryland, and we got most of them in the next two weeks in the theft period. This last year the weather was very warm, it was almost summerlike. I thought probably those foxes weren't going to have any primeness at all. In fact, I didn't send out any that I thought would bring practically nothing, but when it came time to sell those foxes, the fur dealer came down from Penusylvania and gave me the top price of $3.50 apiece on 11 red foxes and $2.00 apiece on two young red foxes which he said did not prime up as quickly as some of the adults. He also gave me the level price, or the ceiling price, of $2.25 on a gray fox.

He explained that the red fox in that section primed up earlier than the gray fox. He was a professional trapper. He had caught gray foxes in Georgia in early April and those foxes were prime.

A friend of mine at the other end of Maryland, on the Eastern Shore, caught red foxes in March which brought the top price while those same red foxes caught in the Allegheny Plateau at that time were not considered prime. I think there is rather a complicated question to be answered there. Some people say, "Is it the season? Is it the temperature, the cold weather at any season of the year, or is it the number of hours of sunshine which has a bearing on primeness of fur?"

Last week I got a few muskrats. Two of the muskrats were prime and two others caught close at hand to the first muskrats, about 100 feet away, were not prime.

I wonder if the Doctor could give us some light on that.

DR. HAMILTON: All I can say is everybody is buying fur. Furs throughout the northeastern United States are bringing unprecedented prices. I do not know why. Everyone wants fur, mostly short fur. A friend of mine, Joe Buff, in Syracuse, and Dave Book and I have seen in the neighborhood of 250,000 pelts over the past 20 years, pretty well divided over the years. Pelts are bringing unprecedented prices here at the present time. The red fox is prime now, but every female, every vixen taken has a swollen udder which makes the belly fur of little or no value. Yet people are buying because if they do not pay the price, someone else will pay so much and take the trade away from them another year.

That seems ridiculous on the face of it, but that is exactly what is happening in our states.

So far as primeness is concerned, this muskrat question that was brought up, one animal prime in one area, one in another, we have upstate New York and all through the lake states tremendous areas of marshland and streams which enter into the marshes. Two miles away a rat would be unprime, would weigh two pounds or two pounds and a quarter. In the great Montezuma marshes of New York, muskrats will exceed, the largest, 5 pounds in weight which may seem incredible to some of you people who have trapped muskrats as kids. Those animals prime up 2 or 3 weeks earlier than stream rats. It is a question in a measure of water level and food and I am not in a position to go nor do I have the time nor the ability to discuss the physiology of primeness.

What we attempt to bring out here is condition in relation to primeness and the fact that we can increase the value to the trappers of the country by taking fur not necessarily when it is at its peak of primeness but when it is most easily taken, prime and not physically damaged.

MR. JOHN M. ANDERSON (Ohio): Perhaps I misunderstood Dr. Hamilton, but it is my observation in Ohio that the value of muskrats especially is determined more by the time they are sold than the primeness or their condition. The same pelt that will bring $2 at the opening of the season will bring approximately 50 per cent more later. I use that as an illustration; I don't want to become involved in ceilings. But it is the time of selling over there that seems to determine the price of the pelts. Do you find the same thing is true?

DR. HAMILTON: It depends to whom you sell. If you sell to the small buyer and the small buyer sells to the larger buyers and traveling buyers through the area, at least in upstate New York the small buyer will pay for the primeness and condition and the larger buyer will buy in large lots to take down to 27th Street, just below us here, and sell to still larger buyers such as I. J. Fox and Becker Brothers, and Hershkowitz and the other big buyers. It depends in large measure on the type of buyer to whom you sell. They will pay—the small buyer, the farm buyer—for the condition and primeness. The large buyer will pay for large lots. At least that is our conception in New York.

MR. ANDERSON: Muskrats were higher during January than they are now. Without doubt they are in better condition now than they were in January.

CHAIRMAN ALLEN: One more remark, if you want to make it, Dr. Hamilton.

DR. HAMILTON: No.

UPLAND GAME BIRDS IN RELATION TO CALIFORNIA AGRICULTURE

BEN GLADING
Game Biologist, California Division of Fish and Game, San Francisco, California

California has representatives of most groups of upland game birds. Of these, seven species are on the open hunting list, namely, mourning dove, white-winged dove, band-tailed pigeon, Chinese pheasant, and valley, mountain, and Gambel quail. This paper will be devoted primarily to discussion of pheasants and valley quail, species which are intimately related to agriculture and lend themselves to management.

The varied topography and climatic conditions found throughout California give rise to an extremely diversified agriculture, and to a similarly diversified set of habitats for pheasants and quail. These types of agriculture run the gamut from sheep and cattle grazing on most of the foothill lands to specialty truck farming and flower seed production in the richer irrigated valleys. In the middle are such types as dry farming grainlands, irrigated and nonirrigated orchards and vineyards, field crops such as alfalfa, sugar beets and cotton, permanent irrigated pastures, and heavily-irrigated ricelands. In many cases, extreme variations in agriculture occur in short distances; local fertile, irrigated valleys are found adjacent to rolling foothills of value only as low-grade grazing land, or, as occurs in parts of southern California, extremely high-priced orange and avocado orchards abruptly join steep mountain lands of absolutely no agricultural value.

Pheasants occur in significant numbers only in the irrigated valleys in the vicinity of grain crops. Much remains to be known of pheasant management under California conditions. To date, specific knowledge of pheasants bearing on life history and management under our conditions dates from the spring of 1945, when exploratory experiments were set up in the Sacramento Valley. In February 1946, a Pittman-Robertson research project was started to unravel some of our problems concerning this bird.

Preliminary studies and other field observations have given us some tentative generalities:

Attempts by the California Division of Fish and Game to plant pheasants date from 1889. Up to about 1925, the only planting that could be construed as successful existed in the flat lands to the south of San Francisco Bay; this colony has never supported a sizable hunting effort. During World War I, rice was planted in the Sacramento Valley and in the ensuing years became an important crop. This change in agriculture caused a marked change in habitat conditions

as far as pheasants were concerned. Our present huntable crop of pheasants in California is largely tied up with ricelands and other grainlands in irrigated areas and dates from the introductions made in the 1920's. It now seems evident that pheasant distribution in California is dependent on two factors: the presence of a grain crop and summer moisture. Since there is no summer rainfall over most of California, this summer moisture is supplied largely by irrigation.

Populations capable of standing any degree of hunting pressure are located primarily in ricelands, although milo, wheat, and barley in moist situations appear to be able to support huntable populations (Figure 1). The main part of our pheasant population lies in the

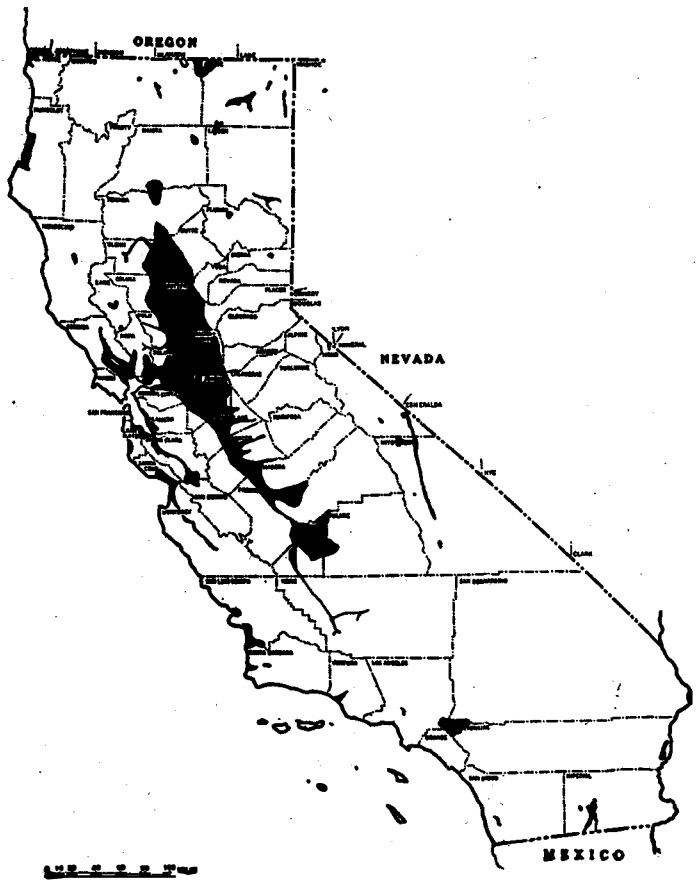

Figure 1. Established pheasant populations, in California, 1946. This map was prepared in conference with experienced field men of the California Division of Fish and Game and is not the result of intensive survey. Areas in black represent areas where pheasants are or are reasonably presumed to be established.

Sacramento Valley north of Sacramento, although isolated concentrations exist south into the San Joaquin Valley in favorable conditions. Small coastal plains and valleys that have a grain crop support low populations of this bird. Similar small colonies are found in some moist mountain valleys where grain is grown.

Some of the apparent problems pertinent to management of pheasants in California are: (1) how to adapt irrigation methods and other agricultural practices to the advantage of pheasants, (2) how best to modify our policy of pheasant restocking, and (3) in summation, how to stretch a limited pheasant hunting area to supply the demands of an extremely large population of avid hunters.

One agricultural practice in particular has come to our attention as being possibly deleterious to pheasants. Various species of blackbirds cause considerable damage to the rice in the Sacramento Valley. It has been the practice of the State Department of Agriculture and individual rice ranchers to poison these blackbirds with strychnine-coated rice or rice cleanings (water grass seed in the main). This practice has caused much alarm on the part of sportsmen and gave the original impetus for the above mentioned pheasant study.

Preliminary studies conducted in the summer of 1945 by Stanley Piper of the State Department of Agriculture and David Savage of the Division of Fish and Game indicate that (1) damage to rice is considerable and demands control of blackbirds, (2) proper choice of bait and dosage of strychnine, plus placement of the bait in checks in the center of flooded, newly-planted rice fields reduces the hazard to pheasants to practically nil. There remains, however, the fact that some of the blackbird poisoning is done by individual ranchers on their own initiative, and the above mentioned precautions are not uniformly observed.

Our early work indicates that something can be done to reduce pheasant nesting losses by modification of irrigating and mowing practices. In addition to the usual farming hazards, riceland pheasants are subjected to the burden of irrigation flooding during the nesting season. It is hoped that some compromise procedure suitable to ranchers and sportsmen can be found.

Since the start of pheasant plantings in California, game farm birds have been planted in virtually every conceivable habitat. We are now at the stage of determining what areas are practical for pheasants. It is hoped that the knowledge we are gaining from the present Pittman-Robertson study will illuminate this problem and that wise recommendations can be made that will be supported by sportsmen's groups.

Hunting pressures are great on pheasants in California. Hunters

from the San Francisco Bay Area, Sacramento and the larger valley towns, and even large numbers from Los Angeles far outnumber local hunters in the riceland hunting. In a personal interview of 41 hunters picked at random in the rice fields in 1945, 9 hunters were locals (that is they traveled less than 100 miles to the hunting ground on which they were interviewed), 14 came from 100 to 250 miles distant (primarily from San Francisco), and 18 came from more than 250 miles away. Many in this latter group came from Los Angeles, a road distance of roughly 500 miles. This round trip of 1,000 miles for the opportunity of shooting at a few pheasants is the best illustration that can be given to impart an idea of the fervor and intensity of pheasant hunting in California. All local hotels and auto courts in the valley are booked for days in advance and local merchants look on the influx as manna from heaven.

Naturally, this intense hunting effort on a fairly limited, good pheasant area has led to many rancher-sportsmen problems. It would be unwise at this time to make decisions regarding the best way of solving these problems.

In regard to the other prime upland game bird of California, the valley quail, more research has been completed and our knowledge of this bird's habits and management is considerably in advance of our knowledge of pheasants. Several papers have been published on the habits and ecological aspects of management and others are in preparation. A practical management bulletin has recently reached the public, outlining the results of roughly 10 years' research sponsored by public agencies.

In brief, management of valley quail is accomplished mainly by local manipulation of cover, food, water, and predators. Since practically all valley quail range, north of the Tehachapi Mountains and in the southern California coastal area, is on private land, management becomes a farmer-sportsmen problem. Public domain land in the desert areas support valley quail and Gambel quail. Our management problems here are simple; it is the function of the California Division of Fish and Game directly to produce game on such lands. We know the technics; management is merely a question of getting money and manpower.

On the privately-owned lands which are the range of the majority of valley quail, the problem is not simple. The rich valley lands are high-priced and cleanly cultivated to a degree not generally found in the East. The retirement of any portion or function of this land for game management means that the farmer is losing cold cash. Truck land rentals run in excess of $50 per acre per year; rice and other grainlands run from $5 to $10 per acre; range lands 50 cents per acre

and up. While it is not necessary to retire lands completely from production in order to increase game, the use of any portion of the higher priced valley acreage causes a real loss of revenue that cannot be regained in any reasonable measure by returns from game. The same is true to a lesser extent on field crop and grainlands.

It is only on low-priced foothill range lands where game can be produced without serious cost to production. Even on these grazing lands ranchers are loath to cooperate with hunters generally.

One arrangement for managing upland game on private lands has been agreements between groups of hunters and large ranch owners working under a hunting rights lease. The ordinary $2 license buyer considers such arrangements too costly.

In rare instances, hunting land is actually owned by wealthy clubs; management is practical under this system but again the costs are beyond the general public's purse.

There is the possibility of ranchers charging trespass or car parking fees. Management could then be accomplished by the ranchers, using the money so acquired. To my knowledge this plan has not been tried in our state on quail or pheasant lands. Whether sportsmen would pay the additional fees necessary for quail or pheasant management by private owners is a matter of conjecture.

On Gambel quail areas in the Mojave and Colorado Deserts, the Division of Fish and Game is actually developing areas for shooting.

Management by the state on private lands, however, is fraught with political difficulties and has been undertaken only on an experimental basis. It is hoped that some state-sponsored management may be done through cooperation with Soil Conservation Districts, but to date these Districts occupy only a fraction of pheasant and quail lands.

Perhaps the greatest hurdle is the large proportion of posted land in the state. Rancher attitude is generally hostile to the hunting public. At present the Fish and Game Commission and state-wide sportsmen's groups are endeavoring to find means of opening this private land to shooting and to management.

In summary, our knowledge of methods of encouraging upland game in California is far in advance of our means of getting this management into practice. We will sincerely appreciate any suggestions that may come from other states which have had more experience with the problem.

DISCUSSION

MR. G. A. AMMANN (Michigan): On the basis of your present information, what would happen if you totally discontinued the rearing and releasing of game farm birds in your state?

MR. GLADING: Well, I think you could in the main answer that question with one word; the effect would be none in my opinion. However, there remains a possibility that there are some areas in the state which are capable of stocking with pheasants and there also remains the possibility that there are some areas in the state that due to some local catastrophe such as local overshooting or heavy snowfalls, where planting the valley quail could be continued; but I think in the main the answer to your question, in my opinion, is that we could cut the whole thing out and work on habitat improvement and get much better results.

CHAIRMAN ALLEN: You mentioned there were areas where some local catastrophe such as overshooting might occur. Have you had any evidence that overshooting reduces pheasant populations?

MR. GLADING: Not in pheasants. The statement I made was particularly in regard to valley quail. There are some areas close to large centers of population, for instance near Riverside, that is near Los Angeles, where tremendous numbers of hunters work on a very small area. We found that in these areas it is possible by setting up checkerboard refuges after the country has been shot out and doing some restocking that results might possibly justify the cost.

CHAIRMAN ALLEN: We are back on this pheasant subject. I know a lot of people present are interested in this and will welcome a good thorough discussion here.

MR. A. O. HAUGEN (Michigan): What policy are you following in stocking pheasants? Are you stocking immediately for the guns or are you trying to stock for breeding purposes or what?

MR. GLADING: The stocking policy has been various, apparently without a whale of a lot of planning, largely at the demand of sportsmen's groups. Somebody gets the bright idea that pheasants might go on their ranch. In general, I would say that they have tried to keep away from planting them for immediate shooting, although personally I agree with the statement I heard you make over there, that the greatest benefit of those birds is when you turn them out of the box and shoot them right then.

MR. J. P. LINDUSKA (Michigan): This reduction that we are hearing so much about that took place in the last year has apparently occurred over most of the pheasant range and was probably true to a lesser extent of quail. I know in Florida they dropped down quite noticeably. Do you have any indication that pheasants in California or any of your other game birds were set back similar to the pheasant in the past year?

MR. GLADING: Yes, probably our prime year in pheasant hunting in California was 1943. There is not much question but that '44 and '45, although I have no definite figures to go by, except that during both '43 and '44 we had a pheasant system—'44 was considerably below '43 in returns on that and it is our feeling that '45 was not as good as '44. What the reasons for that were, I couldn't say, but it is the general feeling among our wardens that the poaching problem reached an all-time high in this area. Pheasants are pretty easy to get and meat rationing was on.

LT. ROLLIN H. BAKER (Washington, D. C.): Did I hear you say your pheasants were restricted to areas where irrigation occurred?

MR. GLADING: That is it exactly. To get the picture, there is no rainfall whatsoever from May on through October in this part of the state. The pheasants are strictly limited to irrigated areas, with very few exceptions, and those are areas of heavy fog, which seem to supply some moisture that is necessary. We have the opposite situation from that which was discussed here in the East, where you get too much water. In other words, we have humidities out there running down to 10 per cent in nonirrigated areas. The membranes just become so dry the chicks can't get out. Some of us suspect that there is a minimum moisture requirement. They require a certain amount of moisture in order for the eggs to pip. Whether it is that or whether it is a supply of insects for the young chicks, I wouldn't want to say, but it is possibly one of those two factors, or maybe a combination.

LT. BAKER: I was wondering about that. In Texas we have had pheasants remain, at least establish colonies in two areas, one area in South Central Texas where a lot of rice farming has occurred. The pheasants, however, are on the edges of the rice, more in the corn and upland crops of that type.

MR. GLADING: This area is by no means solid in rice. It is a mixture. In fact, our best pheasant concentrations are mixtures of one field of rice and some barley nearby and alfalfa, but rice seems to supply the grain requirements necessary.

LT. BAKER: We have another area near El Paso. In that area I think the pheasants are there because of the irrigation. I am not up on the subject so well, as to the relation there.

MR. GLADING: It is interesting that you mention those southern areas. I was talking with Elliott McClure from Nebraska and he wanted to know where our pheasant concentration was. I said it was here. He said, "Well, that is the same picture." The northern cold climates have the pheasants. They grow oranges in Chico and Oroville and they put it in the newspapers when they have a frost there. So the answer is not strictly a temperature one, because down where Mr. Hastain comes from, in Imperial Valley, they even have some pheasants down there. You notice I put that spot on the map.

There, again, they are tied intimately with irrigation and there is some rice growing down there. Even Mr. Hastain, I don't believe, would call that a shootable population. By shootable I mean areas that attract hunters from outside. The only shootable populations we have are Tule Lake, Owens Valley and the Sacramento-San Joaquin system. People take them out of their back yards in other areas, but that is not what I mean.

MR. W. B. BARNES (Indiana): In Indiana we have carried on several experiments with banding pen-reared birds; in fact, we banded several thousand birds. Back in 1942, we had a return of cocks of about 6.5 per cent. For every 100 cocks released at 8 weeks of age, about 6½ were bagged by hunters. A little later, in fact a few months ago, we made some releases, about the 25th of October, prior to the opening of the hunting season on November 10. Our present results have just about doubled. In other words, our return is about 12 per cent.

As far as the hunter is concerned, it certainly goes to show with about 6½ birds returning for every 100 cocks released, at a price of 50 cents per bird, it makes each bird back worth about $8 as far as the Department is concerned.

MR. GLADING: Will Indiana sell birds to California at 50 cents apiece?

MR. BARNES: Well, our 50-cent figure is only the price which is paid to our conservation clubs for rearing the bird from the time it is 1 day old until it is 8 weeks old. The 50 cents does not include the price of carrying over the brood stock or any other cost incidental to game farming. For the coming year the program is to carry our pen-reared birds over to an age of 12 weeks, with a payment of 75 cents. In other words, it is a matter of releasing them as close to the opening of the hunting season as possible. If we could release them on the day before the hunting season opens, probably we might get a fairly good return.

MR. R. E. TRIPPENSEE (Massachusetts): Mr. Glading, do you have any idea of the actual relationship of the area to birds? Do you have any idea of actual population in terms of area and birds on those rice areas?

MR. GLADING: A very poor idea. On a comparative basis, the best of our pheasant land is probably as good, if not better, than exists any place in the United States. I have that on the word of Elliott McClure who has been more places than I have and I have also some bird dog trainers who work the South Dakota area in the fall and then work our Chico area in the winter. They claim our local concentration, which is just a small part of even this area I have indicated, exceeds that probably found any place else in the United States. In these better areas, better than one male per acre, is taken off. That is absolutely the tops. That is not the whole works by a long way. The margin is much bigger than the center.

MR. TRIPPENSEE: This is very interesting in connection with a letter I have from a former student now in Korea. He describes that country as being quite a lot of upland, but with many rice paddies and no shooting. He estimated the pheasant popualtion was double that which he had ever seen in South Dakota and perhaps three or four times as high. It gives very great promise for that type of country, the rice area.

MR. GLADING: If we could spread the area out, it would solve our problem, but we can't because rice is of necessity grown in the lowest parts of the valley where irrigation is an inexpensive matter. It takes tremendous quantities of water, and water is scarce in California. We probably now have just about as much acreage under rice as we will ever get. When the rice crop drops, it will probably be less.

MR. TRIPPENSEE: Do you know what the habits are in relation to rice? Is there much damage by the pheasants and just when do they use the rice?

MR. GLADING: Not much damage. There is a little taken by ranchers. There is quite a bit of damage by ducks to rice but not so much on pheasants. You see, the fields are irrigated before seeding and seeding is done by airplanes, and then water is kept on the fields until the rice emerges several inches, then it is taken off and put on again at intervals throughout the whole season and immediately before harvesting it is flooded up to about 3 weeks before harvesting so that the pheasants do not get into any extent at all on the standing rice. The water is taken off just about three weeks before harvesting and the land allowed to dry so they can get the harvesters in, and that is the only period they have a chance actually to get at the rice as it stands. Of course, the gleanings are considerable. They are present from September on through until April. They are just starting to plow for rice now.

MR. TRIPPENSEE: Do you feel their use of the mature rice is great?

MR. GLADING: That is on gleanings almost entirely.

CHAIRMAN ALLEN: It sounds, then, as though the most productive pheasant areas in California are those that are naturally productive, is that right?

MR. GLADING: If you want to call rice natural, I will go with you.

MR. JEFF F. KENDALL (Oklahoma): A few years ago we inherited some pheasants from our neighbors, Colorado and Kansas. Since then we have been raising some birds, and the question is asked me most every day from the quail shooter what effect the pheasants are going to have on the quail shooting population—our quail that we have. I would like some of the states that have had pheasants for a number of years to say something that I can take back to my people.

MR. GLADING: As far as California is concerned, there is very little overlap. The Sacramento Valley used to be a good valley quail area, in fact one of the best, but intensive agriculture has destroyed all brushy cover which this bird needs. The only place you find quail in the Sacramento Valley is right along the water courses where willows remain, around houses where they use rolls of barbed wire as a substitute for brush, and that is the only place where they come in contact to any considerable degree.

That question has been brought up, has the pheasant driven the quail out? I would say no, that the habitat changed from quail to pheasant habitat in California.

MR. KENDALL: Of course, our bird, the bobwhite, is not the quail. I understand it is different, but I will agree with you on that.

MR. GLADING: Incidentally I saw a male valley quail whip a male bobwhite.

VITAMIN A, VITAL FACTOR IN THE SURVIVAL OF BOBWHITES

RALPH B. NESTLER
U. S. Fish and Wildlife Service, Patuxent Research Refuge, Bowie, Maryland

The importance of vitamin A in the nutrition of upland game birds was brought to the attention of the writer 5 years ago by an outbreak of trouble among quail chicks on a local game farm. The symptoms indicated vitamin A deficiency with secondary bacterial infection of low virulence. Administration of additional cod-liver oil in the feed corrected the condition (Nestler and Bailey, 1941).

Later, during the war, when feedstuffs were hard to obtain, poor hatches and high chick-mortality developed among quail on a state game farm where a popular commercial mash was being fed. Again the trouble resulted from insufficient vitamin A.

That wild game birds can also suffer from vitamin A deficiency as well as can pen-reared stock, is indicated by a recent report of Cowan and Fowle (1944) regarding visceral gout in wild grouse. This malady is now considered a symptom of vitamin A deficiency (Nestler, 1945). Thus there seems to be a good possibility that a scarcity of vitamin A may have a significant bearing on the survival and increase of bobwhites in the wild as well as in captivity.

Vitamin A is a colorless fat-soluble nutrient found solely in the tissues and products of animals. It is synthesized by the liver from reddish-yellow carotenoid pigments of plants, and stored in the liver until required by the animal. Of the more than 30 such plant pigments, only 4, namely, alpha, beta and gamma-carotene, and cryptoxanthin, are known to have a vitamin A activity.

Ewing (1941) lists 12 functions of vitamin A in the diet of domestic fowl: "(1) promotes growth and health; (2) promotes appetite and digestion; (3) aids tissue formation; (4) acts as a regulating substance; (5) prevents infections, notably of the eyes, sinuses, air passages and lungs; (6) increases resistance to many infectious diseases; (7) increases resistance to some parasites; (8) is necessary for good fertility and hatchability; (9) increases vitality and livability; (10) probably affects length of life; (11) strengthens tissue and membrane formation; and (12) maintains normal functioning of epithelial and nerve tissues." The same writer maintains that "vitamin A deficiency among poultry seems to be quite common in all sections of the country."

Inasmuch as no work on the vitamin A requirements of game birds has been found recorded in the literature, studies were initiated by

the Fish and Wildlife Service in 1944 at Patuxent Research Refuge to determine the bobwhite's vitamin A requirements for breeding, growth, and maintenance. The author is indebted to the following administrators and fellow-scientists for their valuable unstinted assistance that helped to make the study possible and successful: A. L. Nelson, Assistant Chief, Division of Wildlife Research, U. S. Fish and Wildlife Service, for his guidance, helpful suggestions and encouragement; Dr. Hugo Nilson and Dorothy Darling of Fisheries Laboratory, College Park, Maryland; Mr. N. R. Ellis, W. Kauffman and H. Bastron, Animal Husbandry Laboratory, Beltsville Research Center, Maryland; and R. Stow of Patuxent Research Refuge for spectrophotometric assays of feedstuffs and livers; Dr. Don R. Coburn, Disease Investigations Laboratory, Patuxent Research Refuge, for pathological examinations; Katheryne C. Tabb, U. S. Fish and Wildlife Service, Washington, D. C., for preparation of graphs; Executive Director Seth Gordon and R. Latham of the Pennsylvania Game Commission; C. O. Handley of the Virginia Cooperative Wildlife Research Unit; Dr. A. Pearson and R. Allen of the Alabama Cooperative Wildlife Research Unit, as well as various personnel at Patuxent Research Refuge for their collection of wild birds.

PROCEDURE

Three generations of pea-reared bobwhites, totaling 2,244 birds, were used in the studies, and the research was conducted in such a manner that the effect of a deficiency in the first generation might be traced through the third generation. For every new experiment, approximately an equal number of quail with the same nutritional history were distributed on each diet.

All necessary nutrients for production, growth, and maintenance, with the exception of vitamin A, were furnished in all the diets in such quantities as to meet the known and assumed requirements of the game bird. The basal ingredients were devoid of vitamin A or carotene, or contained only negligible quantities. The only dietary variable in each experiment was vitamin A.

In the breeding experiments, vitamin A levels of zero to 8,000 I. U. per pound of feed, were compared, and in growth and maintenance experiments, levels of zero to 5,000 I. U. were studied. Also vitamin A was compared with pure carotene (90 per cent beta, 10 per cent alpha) and the carotene of several feedstuffs.

For determination of vitamin A storage in the birds, livers of sacrificed pen-reared quail, and wild bobwhites from Pennsylvania, Maryland, Virginia and Alabama were assayed spectrophotometrically.

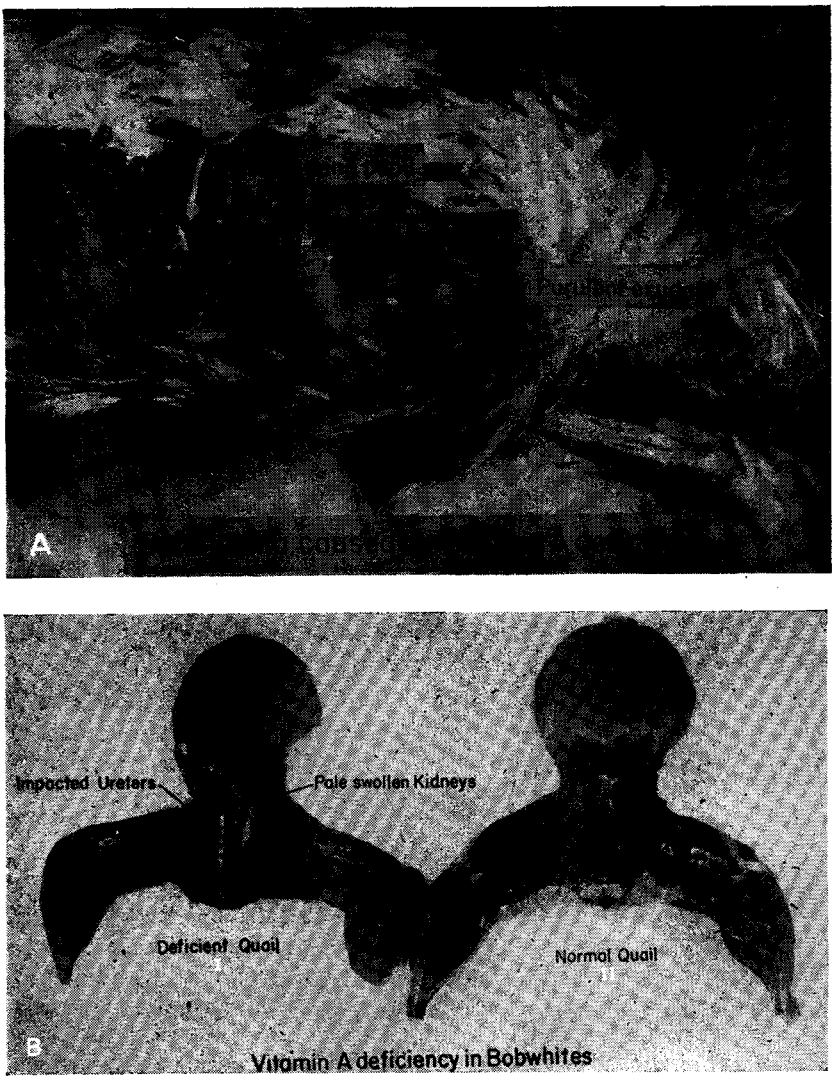

Figure 1. Symptoms of vitamin A deficiency in bobwhite quail. (a) Opthalmia, showing film covering pupil of eye, and purulent exudite in corner. (b) I, deficient bird with pale swollen kidneys and ureters engorged with urates. II, normal bird.

RESULTS

An early manifestation of vitamin A deficiency in quail (Figure 1a) was the development of weak, watery eyes. Sometimes gray spots appeared on the pupils. Victims became ruffled and droopy, often as-

sumed an unsteady gait, and defecated thick urates. Later one or both eyes would close and ooze purulent material from between the lids. Starvation, emaciation, and death of the birds quickly followed blindness. During the winter, however, these external symptoms were not manifested as at other times, but birds often died in good flesh and with full crops. Post-mortem revealed pale and often swollen kidneys Figure 1b), and enlarged impacted ureters. Severe visceral gout with urates flecking or thickly coating the heart, liver, gizzard, and sometimes all viscera, occurred in many cases. Gizzard contents generally were bright green from bile. Rhinitis or common cold was especially prevalent among deficient quail, but in no cases were diphtheric patches found in the pharynx and esophagus as occur commonly in domestic fowl suffering from avitaminosis A. A great deal of individual variation was found to exist among quail in their storage of vitamin A, and consequently in their ability to survive a deficiency. Such variation no doubt depends on the consumption and selection of food, liver size, assimilation of vitamin A or carotene, hereditary factors, and environmental conditions.

Breeding stock.—(Figure 2a) Survival of the breeders of both years, their production and hatch of eggs, and the survival of their offspring to 10 weeks of age, increased in direct proportion with the

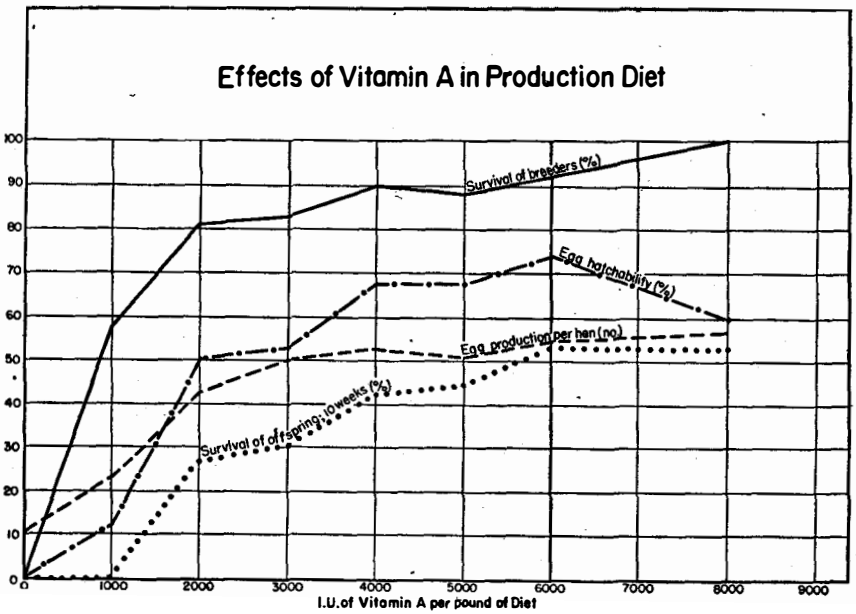

Figure 2a.

increased quantity of vitamin A in the diet, whether from fish oil, pure vitamin A, or carotene. The optimum level, in the cases of egg production and hatchability, and the survival of the offspring, was at 6,000 I. U. per pound of feed; but for survival of breeders the highest level of 8,000 I. U. gave better results. *Regardless of the growth diet,* only 30 per cent of the offspring survived from parents on 3,000 I. U., 42 per cent from those on 4,000 I. U., and 54 per cent from those on 6,000 I. U.

All of the hens, save one, on the diet containing no vitamin A, started production in May and laid an average of 12 eggs each before avitaminosis stopped activity. The first death from vitamin A deficiency occurred 2 weeks after the removal of the nutrient. Five survivors (3 females and 2 males) were brought back virtually from death by oral administrations of 10-30 drops of fish liver oil (3,000 I. U. per gram). All had severe ophthalmia, and one hen was totally blind, but all recovered completely, and the hens resumed production 17-35 days after the first treatment.

Storage of vitamin A in the livers (Table 1) of the breeders was also in direct proportion to the level of vitamin A in the diet. Carotene (Table 2) was not utilized as efficiently as true vitamin A. Hens stored less of the vitamin than cocks, undoubtedly because they were

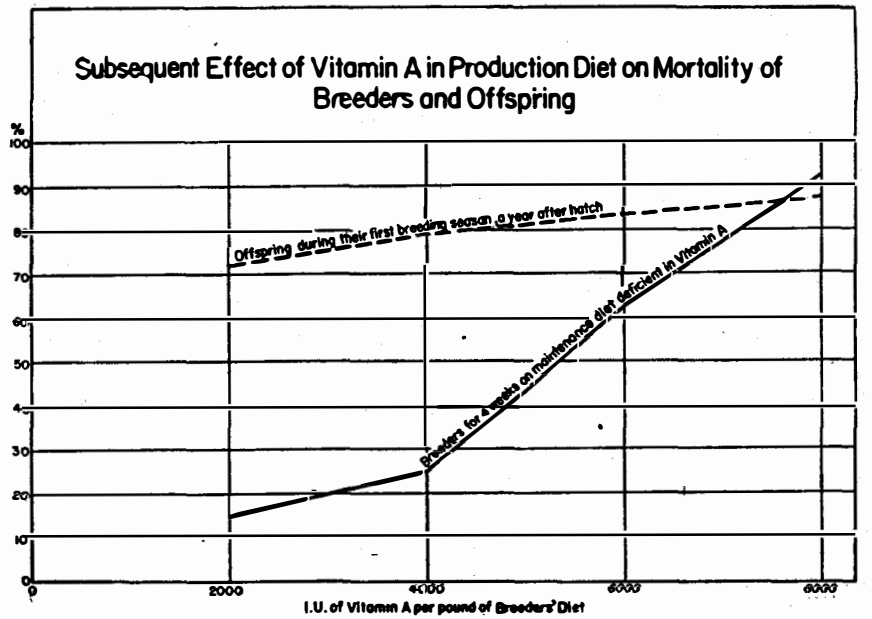

Figure 2b.

TABLE 1. EFFECT OF VITAMIN A IN PRODUCTION DIET OF QUAIL, ON WINTER SURVIVAL, OFFSPRINGS' LIVABILITY DURING THEIR BREEDING SEASON, AND STORAGE IN LIVERS AND EGGS

International units of vitamin A	Survival (per cent)		International units of vitamin A stored per gram of				
	Breeders (during winter)	Offspring (during 1st breeding season)	Livers of breeders		Yolks	Livers of chicks when hatched	
			Cocks	Hens	1st eggs	1st hatch	Last hatch
None	0	0	0	0	7	76	0
2,000	14	73	11	6	12	82	27
4,000	25	79	164	29	14	121	29
6,000	63	83	190	102	23	104	50
8,000	92	87	639	171	20	146	66

TABLE 2. TRUE VITAMIN A COMPARED WITH ITS PRECURSOR CAROTENE IN THE DIETS OF QUAIL

	Vitamin A.	Carotene
Production diet:		
Per cent hatch of eggs	62	53
Per cent survival of offspring 10 weeks	64	50
Growth diet:		
Grams weight end of 10 weeks	157	150
International units of vitamin A stored per gram liver	133	39
Maintenance diet:		
International units of vitamin A stored per gram liver	442	29

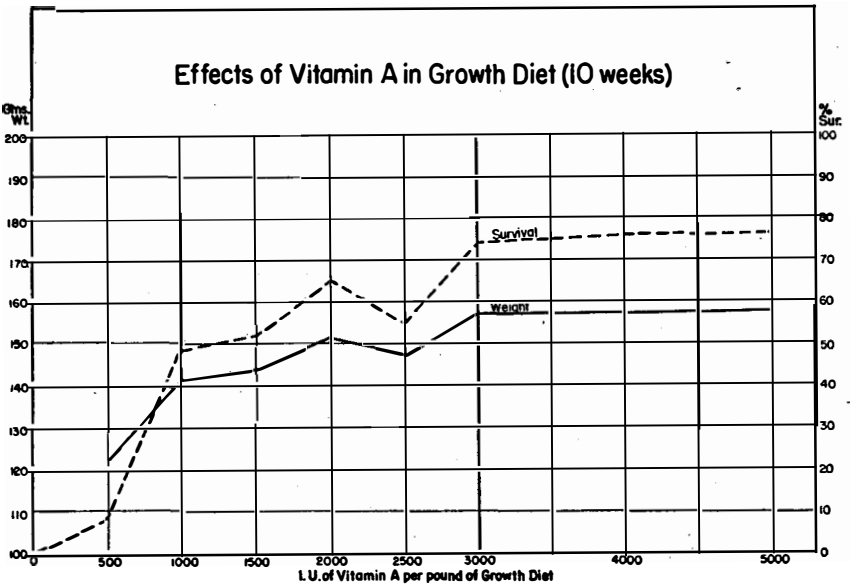

Figure 3a.

supplying the factor to their eggs. The deposition of vitamin A in the eggs (Table 1) and subsequently in the chicks was also in direct proportion to the level of vitamin A in the production-diet. On all levels of vitamin A less of the vitamin was supplied to the last hatch of chicks than to the first hatch. In fact, there was less of the nutrient in the livers of the *last* chicks from parents on *8,000 I. U.* of vitamin A than there was in those of the *first* chicks from parents *without vitamin A*. This fact may account for the reputed poor success of second and third clutches of eggs from quail in the wild.

During the following winter (Figure 2b, Table 1), when vitamin A was removed for 4 weeks from the maintenance diet of the first generation of birds, survival was in direct proportion with the quantity of the nutrient that had been in the production diet. Only 14 per cent of quail that had been on 2,000 I. U. of vitamin A in the summer survived, in comparison to 92 per cent of those on 8,000 I. U.

The effect of the parents' diet on the offspring was apparent even during the latter's breeding season a year later (Figure 2b). Survival even then was directly influenced by the parents' diet. When true vitamin A was compared with carotene in the production-diets, the former gave better hatchability of eggs by 9 per cent units, and greater survival of offspring by 14 per cent units.

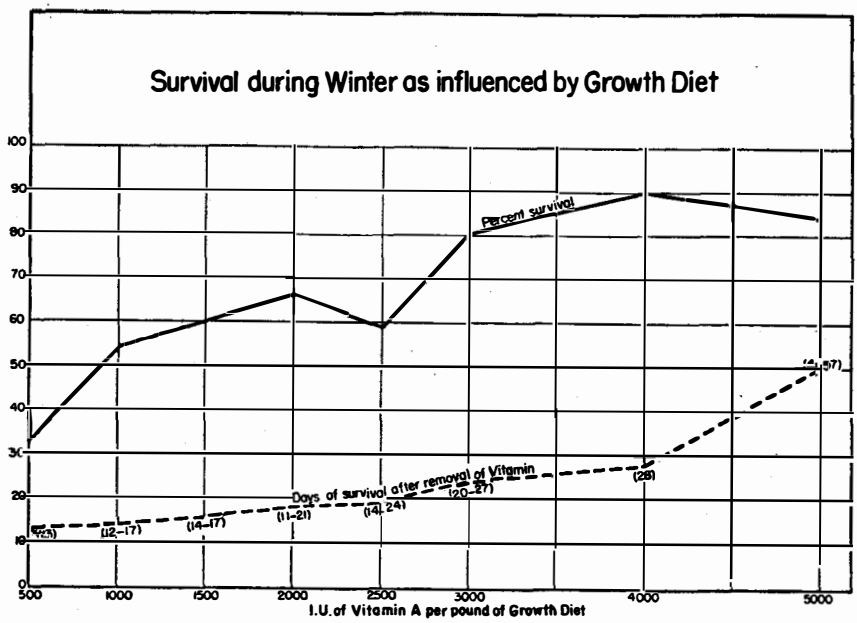

Figure 3b.

The breeders' weights, feed consumption and egg fertility were unaffected by either the levels of vitamin A in the diet, or the source, whether true vitamin A or carotene.

Growing stocks.—(Figure 3a) Chicks without access to vitamin A, although from parents that received a high level, were all dead from avitaminosis within 3 weeks after hatching. Both survival and growth increased in direct proportion with the increase of the vitamin A content of the growth diet, until they reached a maximum at the 3,000 I. U. level per pound of feed. Higher levels of 4,000 and 5,000 I. U. produced a slight but not significant increase. True vitamin A in comparison with carotene gave slightly better growth (Table 2), but not better survival, at all levels from 500 to 2,500 I. U.

The young stocks' survival during the winter (Figure 3b), regardless of the level of vitamin A in the maintenance diet, was in direct relationship with the level of vitamin A in the growth diet. When all vitamin A and carotene were eliminated from the winter diet, the average number of days that the birds survived increased in direct proportion with the vitamin A in the growth diet. This variation ranged from only 13 days for those that had received as low as 500 I. U. of vitamin A to 50 days for birds that had received ten times

that quantity, or 5,000 I. U. Death from avitaminosis struck quickly (Figure 4a), only 6 days after the removal of the vitamin, and claimed 93 per cent of the birds before the end of 4 weeks. When a small quantity of vitamin A, only 500 I. U., was incorporated in the maintenance diet, mortality was delayed to some extent and only 32 per cent of the birds succumbed in the first 4 weeks.

During the period of growth less than 20 I. U. of vitamin A per gram of liver were stored by the birds (Figure 5a), except where the quantity of the factor in the feed exceeded 2,000 I. U. per pound. Storage increased heavily in direct proportion with the level of vitamin A in the diet as the latter rose from 2,000 to 5,000 I. U. Birds from parents on low levels of vitamin A stored less than did those from parents on high levels of vitamin A. Quail on 5,000 I. U. of true vitamin A (Figure 6a and Table 2) stored significantly more of the vitamin than did those on 5,000 I. U. of carotene.

The level of vitamin A in the growth diet had no significant effect on subsequent production, fertility, and hatchability of eggs, except that low levels resulted in no production consequent to death of the birds.

Quail during winter.—(Figure 4b) One thousand units of vitamin A per pound of maintenance diet gave optimum livability during the

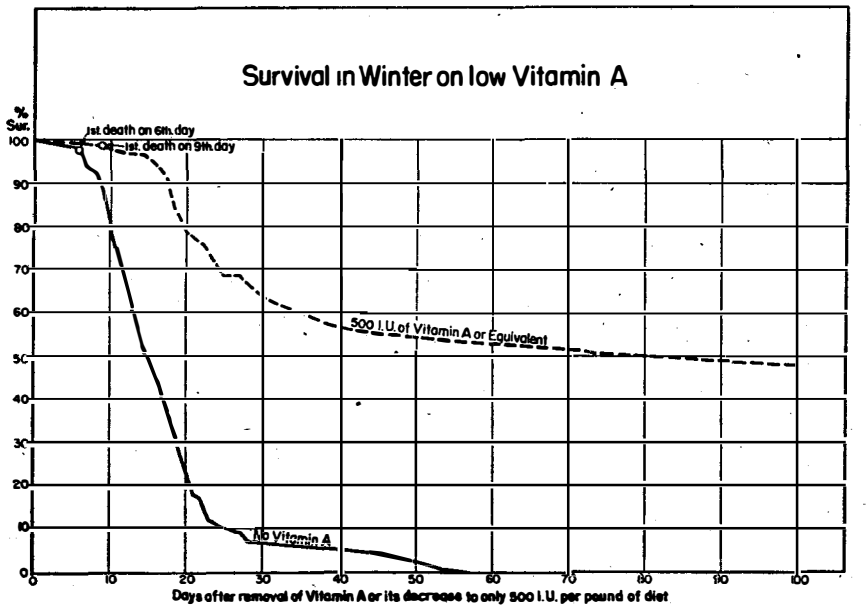

Figure 4a.

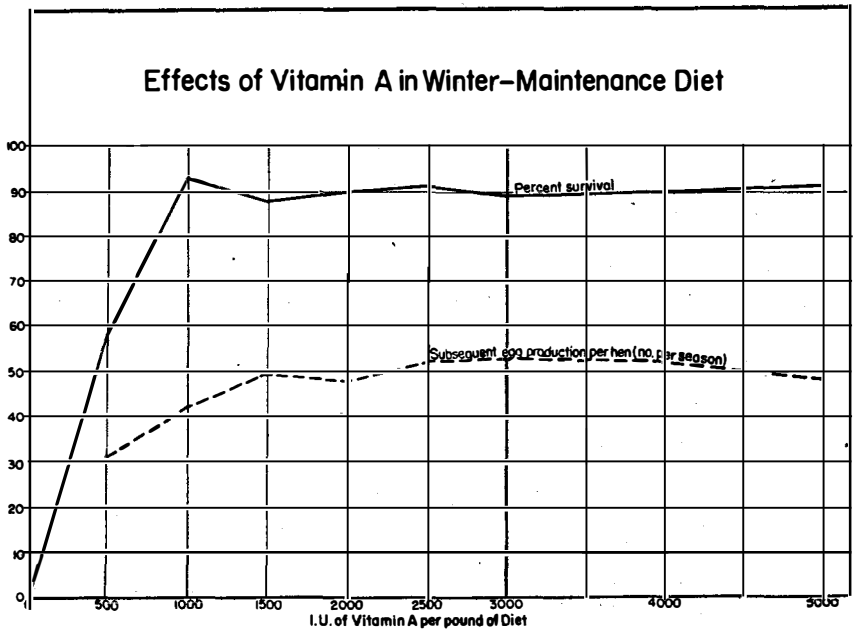

Figure 4b.

winter, and kept the birds in good condition, but was insufficient for subsequent egg production which was markedly affected by the vitamin A potency of the maintenance diet. Optimum production occurred among birds that had received 2,500 or more units of vitamin A. Apparently the reason for this effect on production is that no appreciable quantity of vitamin A was stored (Figure 5b) until the level of the vitamin in the diet reached 2,500 I. U. per pound. This fact indicates that, despite appearances, the body's requirements for maintenance were *not met by 1,000 I. U. per pound of feed.* Birds that received low levels of vitamin A in their growth diet stored proportionately less vitamin A than did those that received high levels in the growth diet. Likewise (Figure 6a), at 5,000 I. U. there was significantly greater storage from true vitamin A than from carotene. In fact the storage from carotene was no greater than that from the levels of vitamin A below 2,500 I. U.

Birds on 5,000 I. U. of carotene showed greater increases in weight during winter than did those on the equivalent quantity of true vitamin A.

At the low vitamin A level of 500 I. U. per pound of maintenance diet (Figure 6) survival was more than twice as great on true vitamin A than on carotene.

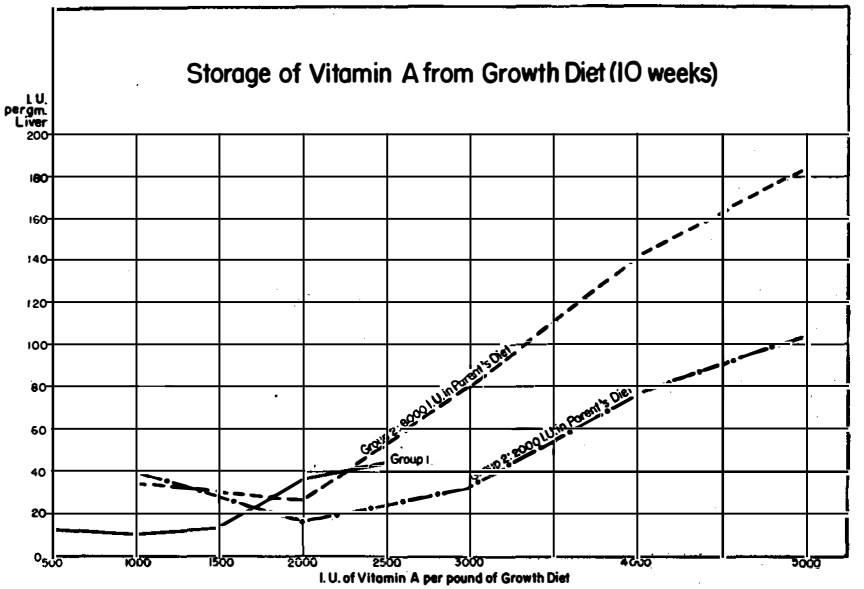

Figure 5a.

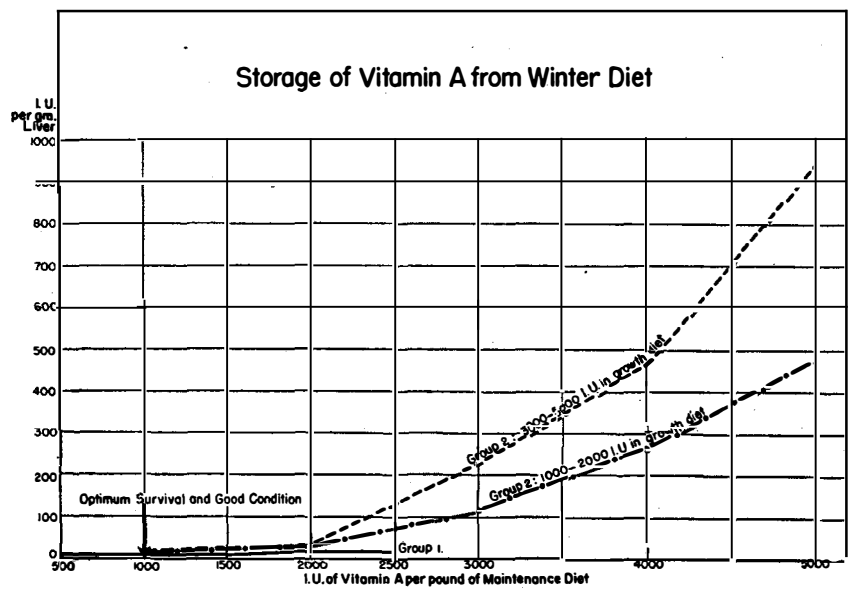

Figure 5b.

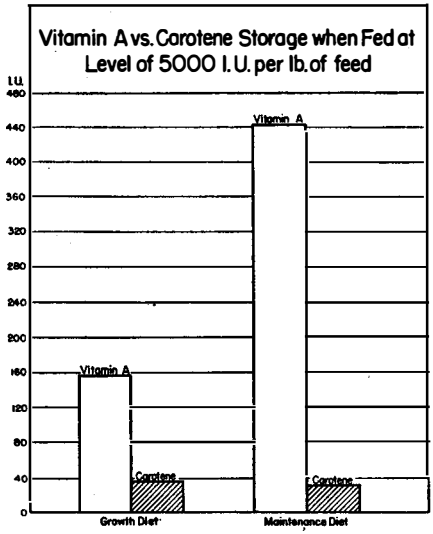

Figure 6a.

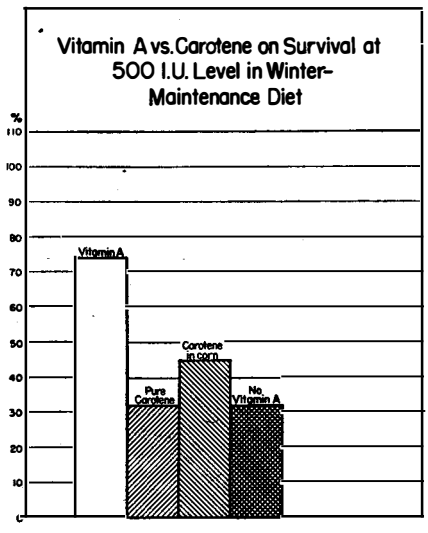

Figure 6b.

The quantity of vitamin A in the maintenance diet had no effect on food consumption, maintenance of weight, or subsequent fertility and hatchability of eggs.

Wild quail.—Forty-five shot and trapped wild quail showed storage of vitamin A ranging from 20 I. U. to 756 I. U. per gram of liver and averaging 243 I. U. Thirty-one per cent had only enough vitamin A stored in their livers to permit survival about 4 weeks. As one might easily suspect—no cases of very low storage were present because such stock had probably fallen victims of predation or inclement weather and so were not available.

DISCUSSION

This investigation, in the author's estimation, strongly emphasizes the value of fundamental research in the solution of wildlife problems. Carefully-controlled studies that endeavor to uncover underlying principles are as important in the development of a sound conservation program as they are in successful health, agricultural, or military projects. The practical application of such fundamental knowledge as presented in this paper, may be applied to game in the wild as well as that in captivity. For wild birds, of course, final confirmation of results is obtainable only from controlled studies *in the field.* Islands are strongly recommended for such studies (Nestler, 1946). In the

meantime, proceeding primarily on the basis of laboratory research, let us see how vitamin A may fit into the conservation picture.

Consider first the pen-reared quail. Most of these are raised for restocking depleted areas. In 1940 (Nestler and Nelson, 1942) there were 711 licensed quail breeders and more than 387,000 bobwhites were propagated and purchased by the states. Quite a sizable industry! However, as pointed out recently by Nestler and Studholme (1945) many game managers are now of the opinion that this enterprise has been largely unsuccessful in its primary objective of increasing quail populations in the wild. Four possible reasons are discussed—one being that of food. Might not a deficiency of vitamin A be involved? Surely if the vitamin A content in the production diet affects the survival of the breeder's offspring *as long as a year after hatch,* then it is a factor that must be given careful consideration.

Both vitamin A and its precursor, carotene, are easily destroyed in storage by oxidation or rancidity (Fraps and Treichler, 1933; Fraps and Kemmerer, 1937; Baird, Ringrose and MacMillan, 1939). It would seem wise, therefore, from a practical standpoint, for quail propagators to incorporate high enough levels of vitamin A in their rations to compensate for the many variable factors that tend to cause destruction of vitamin A in feeds, and to avoid long storage of gamebird mashes, especially at high temperatures. Likewise, it would be highly desirable to build up a large reserve of vitamin A in the livers of birds by feeding more of the vitamin than the requirements demand. In the light of our present knowledge, 0.5 per cent of fresh vitamin A and D feeding oil, fortified (3,000 I. U. per gram) in the production diet, and 0.4 per cent in the growth diet (and maintenance diet, if birds are held through the winter) should be satisfactory.

Before birds are liberated, they should be made acquainted with carotene-containing feedstuffs in the wild. It has been found that, although pen-reared stock when liberated quickly make use of wild unfamiliar foods, (Nestler and Langenbach, 1946), yet they are not very discriminating in their selections, a weakness that is only natural in the light of their inexperience. Pen-reared quail apparently cannot be trusted to select foods having vitamin A from those which do not. In tests where quail were given a choice of a vitamin A-deficient diet and one rich in carotene from one of three sources, pure carotene, alfalfa leaf meal, or yellow corn, the results were disappointing. At first no preference was shown, then in all groups the birds ate so much more of the deficient diet than the other that heavy mortality from avitaminosis resulted. Several weeks of such unwise dietary selection in the wild would be disastrous to a restocking program.

When acquainting quail with food common in the wild, one should keep five things in mind regarding the feedstuff: (1) total food value for quail; (2) carotene content; (3) preference by quail; (4) presence and abundance in locality where liberation is to be made; and (5) accessibility, especially in time of snow. Although we have chemical analysis of most quail foods (King and McClure, 1942), unfortunately practically nothing is known about their digestibility, or their vitamin A potency. The Fish and Wildlife Service plans an investigation of these factors in the near future, but at present our total store of knowledge regarding vitamin A content of quail foods, includes only the facts that *yellow* corn is the *only* commercial cereal that contains an appreciable quantity of carotene; willow oak (*Q. phellos*) acorns (King and Titus, 1942) contain about 180 I. U. of vitamin A activity per gram; Wilson black soybeans, unlike many other varieties of soybeans, are a good source, and fresh greens are very rich in the vitamin.

Now let us consider the naturally-reared bobwhite, the one native to the wild. Is he affected by vitamin A deficiency, and can he be helped by our knowledge of vitamin A?

One mystery of the wild that has intrigued scientists for many years is that of periodic fluctuations in animal population. Although climatic variations are considered by many to be the underlying cause, nevertheless Elton (1924), proponent of the sun-spot theory, and the 30 scientists at the Matamek Conference (Gowanloch, 1931) recognized the fact that migration of animals and variations in their numbers are *often due to the food supply.* From intensive studies on bobwhites, Errington (1934, 1935, 1936, and 1939) and Errington and Hamerstrom (1935-1936), realized that the quality and distribution of food is one of the main factors affecting survival of quail and the carrying capacity of quail lands. Kalbfus (1918) in a report to the Pennsylvania Game Commission declared: "The question of an adequate food supply for game of all kinds during the time when our state is covered with ice and snow, is the paramount question for consideration, and that without this food supply more game by far will be lost each year than is destroyed by forest fires or is taken by hunters, legally or illegally." Gerstell (1942), however, maintains "that the bobwhite quail is the only species which suffers serious decimation because of the lack of winter foods."

The 1945 wildlife survey (Leedy, 1946) in northwestern Ohio showed an alarming decline in both pheasants and quail over 1941. Total snowfall for Ohio during the winter of 1944-45 was the greatest since 1926, in some sections lasting for 10 consecutive weeks. A serious drought which started in the fall months continued throughout

the winter, with the result that natural food supplies were considerably curtailed.

Thus, food scarcity, whether caused by climatic vagaries or human mismanagement, apparently is a vital factor in population fluctuations of quail, and may also be a deciding factor in shrinkage of the natural range. Certainly food high in caloric value for heat and energy is necessary, especially in winter, but what about a factor like vitamin A? In our experiments we have found that quail can survive and gain weight in winter on *simply yellow corn,* supplemented only by additional vitamin A in cottonseed oil, or by 2 per cent of alfalfa leaf meal. Likewise (Nestler, Bailey, Martin and McClure, 1945), bobwhites have been maintained successfully on diets containing 50 per cent of a variety of wild foods, even sumac, wax myrtle, and bayberry fruits, and 50 per cent of corn *plus a vitamin A* supplement. Nevertheless they will die within 2 weeks on more palatable, better-balanced diets of cereals, soybeans, minerals and other wholesome foodstuffs high in food value but deficient in the one factor, vitamin A. *Thus during winter especially, vitamin A apparently stands on a par with carbohydrates as a factor that decides the fate of quail.*

Of 45 wild quail shot or trapped this winter in Pennsylvania, Maryland, Virginia and Alabama, at least 31 per cent, or nearly one third, had not enough vitamin A stored in their livers to help them survive more than 4 weeks of a deficiency of this factor in their diet.

Imagine the effect of a thick blanket of snow lasting for a long period. Most of all, sources of vitamin A would be made unavailable. While carnivores can obtain their vitamin A from the tissues of other animals, quail, in winter at least, depend largely on carotene in plants. Unless they have stored away a plentiful supply in their livers their case would become desperate. Our data indicate that the storage by quail of vitamin A from carotene is much less than that of true vitamin A. All but 15 per cent of an adult quail's diet is vegetable matter; the rest consists of insects and grubs. Do insects and grubs store vitamin A like higher-type animals? Only further research can prove that point. If they do not contain vitamin A, then quail must trust entirely to carotene of plants.

Less carotene is manufactured in plants during a hot, dry period than during a cool, wet season. Combine a droughty summer and fall with a severe winter of prolonged snow, as was the case in Ohio in 1944-45, and the result is an ideal condition for vitamin A deficiency. Birds will die either directly or indirectly from avitaminosis. Weakness, impaired eyesight, lack of alertness, and loss of speed causes them to succumb quickly to predation and severe weather. Thus, submarginal, or even marginal, intakes of vitamin A, while suffi-

cient to keep birds from dying from avitaminosis, yet many undermine their constitutions to such an extent that death results anyway from other causes. Also death of a part of a covey from vitamin A deficiency may so reduce the size of the group that the survivors may perish from lack of protection from cold during huddles.

SUMMARY

Studies on the vitamin A requirements of bobwhite quail for breeding, growth and maintenance were conducted at the Patuxent Research Refuge with three generations of birds, totalling 2,244 quail.

The optimum level of vitamin A for breeding quail was 6,000 I. U. per pound of feed; for growing stock, 3,000-4,000 I. U.; for maintenance in winter, 2,500 I. U. In the case of growing stock, and adults on maintenance diets, there was little storage of vitamin A in the birds' livers until the levels in the diet exceeded 2,500 I. U.

A lack of vitamin A for 3 weeks was fatal to all chicks; for 4 weeks, to 93 per cent of adult birds, depending on the quantity of vitamin A they had received and stored previously.

A deficiency of vitamin A in the diet of the breeders affected their own survival, their reproduction, and the survival of their offspring; a deficiency in the growth diet affected the growth-rate and survival of chicks and their livability during winter; a deficiency in the winter-maintenance diet affected winter-survival and subsequent production.

The vitamin A content of the breeders' diet affected the storage of vitamin A by their offspring; and the vitamin A content of the growth-diet affected the storage of vitamin A during winter.

Pure carotene (90 per cent beta, 10 per cent alpha) was not utilized as efficiently as true vitamin A; neither was it stored as vitamin A in the birds' livers in as large quantities as was true vitamin A fed at the same level.

Submarginal and marginal intakes of vitamin A or its precursor, carotene, were often sufficient to prevent death from avitaminosis, but lowered the birds' vitality and alertness, affected their eyesight, and in general undermined the physical condition, so that there was less ability to resist disease, adverse weather, or predation.

The results indicate that vitamin A deficiency may be a potent factor in the frequent lack of success with pen-reared quail in restocking programs, and also in the mysterious periodic fluctuations in populations of wild quail as well as the shrinking of their natural range.

The fact is recognized that vitamin A, important as it is, nevertheless is only one factor in the great nutritional complex of proteins, carbohydrates, fats, at least 14 necessary minerals, and at least 17 other vitamins, and holds only a niche in the greater biological com-

plex of heredity, environment, climatic conditions, predation, disease, et cetera, that affects our game population.

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DISCUSSION

CHAIRMAN ALLEN: I wonder if there is anyone here who isn't convinced.

MR. KENNETH A. WILSON (Maryland): What wild food would contain vitamin A?

MR. NESTLER: Well, that is work yet to be done. I will say this much. We recently analyzed the crop contents of one of our wild quail that had been feeding on *Lespedeza striata, Chamaecrista nictitans,* and it contained an appreciable amount of carotene. We have, also analyzed Wilson black soybeans and found them to contain about four times more vitamin A, that is carotene, than yellow corn.

MR. WILSON: In other words, vitamin A is very important to the winter survival of the bobwhite quail and yet all vitamin A foods in the wild are not necessarily of a high palatability rating. Like ice cream and some other food to us, we take the ice cream rather than the other food, although the other food might contain the necessary and very important vitamin A.

You mentioned that green grass, I believe, contained a high content of vitamin A. I remember a couple of winters ago in the Green Ridge Forest in western Maryland, the crop of acorns and other foods which are supposed to be very necessary to the survival of wild turkey during the winter months were lacking entirely. I noted by study and analysis of their droppings that the wild turkey on that particular area fed almost throughout the winter entirely upon green grass, green vegetation. So I imagine they came through all right, after all, because of that vitamin A content which grass has.

MR. EDWARD K. LOVE (Missouri): We have been pushing lespedeza. Did I understand you to say that was a good food to plant in the wild, for instance, for the wild birds and the farm birds?

MR. NESTLER: What I did say was we analyzed the crop contents of a bird which contained a mixture of lespedeza and partridge pea. Now, which one of those two contained the vitamin A, I wouldn't be able to say. We will have to conduct more work along that line. However, there is this much to be said about any of these species of plants—soybeans for instance, in the main, are devoid of carotene. The illini soybean, the mammoth yellow, and a number of others are not carriers of appreciable quantities of carotene, yet the Wilson black is a potent source of vitamin A. We cannot just blanket the statement, lespedeza is a good source of A. It may be lespedeza of one type is a good source, whereas the other lespedezas are not. That remains to be proved.

MR. O. E. FRYE (Florida): You mentioned these wild birds that collected in Pennsylvania had enough vitamin A stored in their livers to last only about 4 weeks. What vitamin A storage could you expect?

MR. NESTLER: We are governed by the work on birds in captivity, I will grant you that. We have compared the birds that died on certain levels of vitamin A with the content of A stored in the liver of similar birds on the same level. We have taken these wild birds and compared their liver storage with the storage of A in the pen-reared stock.

MR. FRYE: With the great excess of vitamin A, do you think you can get birds to live without vitamin A or on vitamin A deficient diets for a considerable length of time?

MR. NESTLER: That is true. We have carried birds throughout the entire winter on diets completely devoid of vitamin A, because they have had good diets prior to that time that permitted high storage of A in the livers.

MR. FRYE: Is there much? Is animal life a good source of vitamin A? In Florida they will eat insects, frogs, crawfish and everything else all winter.

MR. NESTLER: That remains to be tested. The only indication we have of what insects may contain in the line of vitamin A, we analyzed an earthworm just before I came up here. That earthworm had enough true vitamin A in its body to keep a quail alive for one day. That is all we know about it so far.

MR. KENNETH A. WILSON: What is the vitamin A rating of that important quail food which they are now experimenting with in the South, *Lespedeza bicolor?* I think it is a shrub. What is the vitamin A rating of that?

MR. NESTLER: That awaits our examination.

MR. WILSON: It rates all right?

MR. NESTLER: No, we don't know. It is something that is yet to be found out. The only things we know about are yellow corn, black soybeans and the other varieties of soybeans that have been tested and the earthworm. So there is a big field ahead of us for examination.

Incidentally, along the line Mr. Wilson mentioned, we received word from Canada of trouble with Hungarian partridges dying during heavy snow storms and in the letter by Mr. Tufts there was a statement that around bogs where the ground is warm the grass is green. These Hungarian partridges tended to congregate around the green spots. It is very interesting to me. I hope some day to get up to Canada and find out whether it is the grass that is keeping the Hungarians alive, those that do survive, or some other factor.

MR. G. M. SPARGO (Alberta, Canada): Your statement about the Hungarian partridge is extremely interesting to me. We were the ones who originated the Hungarians in 1908. I would like to know the name of the gentleman who mentioned that.

MR. NESTLER: The Hon. R. W. Tufts, District chief, Dominion migratory bird officer of Maritime Provinces.

MR. SPARGO: From where?

MR. NESTLER: From Nova Scotia.

MR. SPARGO: Of course, they imported them from Alberta.

MR. E. LEE LECOMPTE (Maryland): I have been familiar with this subject the past three years. At the Gwynnbrook State Game Farm in Maryland, the superintendent has been raising bobwhite through the winter months instead of the summer months. In the winter of 1943, we received a shipment from Mr. Nestler and placed them in our pens to prove the theory they would lay eggs; they did. I think Mr. Nestler will admit that fact. The birds were offered to be returned to him, if he wanted the young ones. We raised as many as 3,000 birds in one brooder house, with 215 hens.

I was wondering if they had vitamin A and B also added to make them lay in in the wintertime.

MR. NESTLER: I couldn't answer that Mr. LeCompte. That is a subject for deep study.

MR. LECOMPTE: I don't think you believed it and you went over to the farm and saw it with your own eyes. The young were being hatched out in the wintertime.

MR. NESTLER: Perhaps that was vitamin E.

MR. HARVEY E. HASTAIN (California): How would the carotene content of your grain and dry grasses compare? Have you run tests on that?

MR. NESTLER: They have been run with hays. It depends on the treatments; rapidly-cured hays under special conditions will be high in carotene content. Ordinarily sun-cured hays are low. So that might answer the question regarding grasses that are out in the open—dried grasses.

MR. HASTAIN: I was familiar with the hay, but I didn't know about the plants in the natural state. What would happen when they dried up?

MR. NESTLER: So far as I know, no tests have been made on that. Also, young grass is higher in carotene than old grass. The older the grass, the lower the carotene content.

MR. W. B. BARNES (Indiana): We analyzed crops of birds killed during the hunting season during November. In Indiana, we found that yellow corn was the most important one single food in their diet. Ragweed was second, smartweed third, and I believe soybeans and then in southern Indiana, where we have more or less of a deficiency of corn, Korean lespedeza takes the place of some of the other weed seeds down there. We don't grow very much lespedeza in northern Indiana. So apparently our wild birds are following that diet.

MR. NESTLER: Thirty-five per cent of the yellow corn in the diet of a bobwhite quail will keep it alive; white corn, wheat, oats, barley, rye, will not. Quail will die in 2 to 4 weeks on any of the other cereals, but 35 per cent of yellow corn in the diet of a bobwhite quail will keep it alive.

MR. LOVE: Will you say that again, please?

MR. NESTLER: Thirty-five per cent of yellow corn in a quail's diet will keep it alive. It is just a marginal level.

MR. LOVE: What is the rest?

MR. NESTLER: Well, the other cereals named do not contain any appreciable amount of carotene.

MR. LOVE: Barley or wheat?

MR. NESTLER: That is right; rye, wheat, barley, oats, white corn, are no source of carotene, and so unless there is another source of carotene brought in, the quail will die on those cereals for want of carotene.

A FOREST MAMMAL MOVES TO THE FARM—THE PORCUPINE

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When the white man moved into the animal association of the North American continent, the balance between species and numbers necessarily had to change. Gradually, and then with increased tempo, this adjustment took place. Four factors have a bearing on this modification of our wildlife association. Hunting pressure, first restricted to the need of obtaining food and furs, has more recently been augmented by the more drastic requirement, recreation. At first only edible species were taken, but now "target species" have increased the scope of this hunting. Furthermore, do not assume that "target hunting" is restricted to the small boy and his .22 rifle. The second pressure factor was that for personal protection. This was not merely protection from physical attack but against diseases transmitted from animals to man, such as rabies, plague, and tularemia. It can include not only the large predators but many small fur bearers, rodents of many species, and even birds such as gulls that occasionally contaminate water supplies and carry infection between poultry yards. Protection for man's domestic livestock, poultry, and crops may call for the control of reptiles, birds, and mammals. Even his soils need protection, his levees along the rivers, the irrigation ditches or terraces in his fields, against burrowing animals.

While the two aforementioned factors bringing pressure against wildlife are serious, they can be relaxed or intensified by intelligent legislation and public education. The pressure from habitat changes, however, has brought more widespread modification of wildlife relationships than any other, and from this relief is practically impossible. Forests have been cut back, millions of acres placed in cultivation, range lands closely grazed, meadows repeatedly cut, marshes drained,

and a considerable area blanked-out from any vegetative cover by man's homes, installations, and roads. His domestic pets, the dog and cat, by their individual effort make still another considerable area less habitable for wildlife. The highway system and its fast moving traffic take a heavy toll. Powerful lights, overhead wires, and other tall obstructions take their toll of birds. Pollution of streams and bays kills fish and crustaceans and reduces aquatic food plants of waterfowl.

Lastly, pressure by disturbance is likewise no small factor in influencing the composition of the animal association. Without intent, man is driving certain species into oblivion by his mere presence, for example ivory-billed woodpecker.

Confronted with this ominous array it is a wonder that wildlife exists at all in much of these United States. But certain mammals and many birds have not only survived but also increased both in numbers and range. The coyote is an outstanding example. This predator has increased its range and maintained a high population despite the fact that its pelt has sold for as much as $22.00; that many localities have paid bounties on it; that organized control programs using traps and poison have been conducted; that it has served as a target for every rancher and hunter, and what might be termed "wild lands" has been drastically reduced in area.

The porcupine (*Erethizon* sp.) is another member of the wildlife association that is doing well in the face of man's pressure. While the coyote has had to make certain adjustments in habits to meet man's challenge, the porcupine has not been compelled to change fundamentally. The porcupine, though an item of food among the Indians and in the Canadian North, is not so considered in the states. His quilled hide has no value. Thus, he is relieved from all pronounced hunting pressure for economic reasons. The pressure exerted by the need to protect crops, livestock, and man's installations is locally very real, but the nocturnal habits of the porcupine limit the effectiveness of hunting by gun or club. Dogs may not be used to aid in hunting for there are few indeed that can be trained not to tackle the porcupine either before or after it is killed. Trapping is laborious, time consuming, and applicable only to local infestations. Poisoning is difficult and often ineffective because of the porcupine's erratic feeding habits. In other words, man's suppressive measures against the porcupine to date are none too effective. As for the effect of habitat changes, this paper hopes to show that porcupines have been benefited rather than harmed.

The porcupine is generally considered a forest mammal, because for 6 months out of every year, during the time snow and freezing weather

hold sway, it feeds on the foliage of certain conifers and the xylem and phloem layers of trees and shrubs. During the other 6 months it feeds largely on herbaceous plants and fruits. Since herbaceous plants are not at their best in a heavy forest stand, the porcupine is accustomed to move each spring into more open areas, along streams and ponds, and bordering meadows. After lumbering operations that left a stand of seed trees, or following hurricane damage or a burn that opened the forest, it was only natural that porcupines would increase for it provided both summer and winter food in close association.

As agriculture developed in the northeastern United States and in the Rocky Mountain area the fields and orchards extended like fingers into forested areas, and with the advance of time, this condition perpetuated and even emphasized the likelihood of conflict with the porcupine. For example, it is particularly important that orchards in the northern sectors be planted on the sides rather than the floor of the valley to obtain air-drainage, thus lessening damage by frost. Under such conditions the porcupine is in close contact with agricultural enterprises. The crops and fruits raised are perhaps new to him, but nevertheless much to his liking. Though the porcupine is not averse to traveling a half mile each day from his forest retreat to reach this source of summer food, he is equally willing to spend the day closer by in a road culvert, a vacant shed, a stonewall, or some cut-bank.

More recently, the farmer planted new crops that further enticed the porcupine from natural forested areas. On low value land and marginal crop areas he planted the small "farm forest," ofttimes not exceeding 5 acres. Here, through management and thinning, fuel and lumber are produced in fast-maturing tree plantations. The farmer is also entering the market in growing Christmas trees. The raising of nursery stock, fruit and ornamental, also duplicates some forest conditions, and the maple-sugar orchard furnishes an important part of the farm income in certain sections. Thus, the porcupine has fallen heir to man-made habitats not too different from the natural . . . and he has proceeded to move in on a semipermanent basis.

Under natural forest conditions the porcupine is rarely found in excessive numbers. In most of our national forests the visitor encounters them only on infrequent occasions—partly due to their nocturnal habits. The populations increase but slowly, as they have but one young a year. To compensate for this low-breeding rate, however, man has reduced the natural predators of the porcupine to a point where man himself is the only effective enemy remaining. Populations of porcupines therefore are tending to increase, aided by man-made food supplies. But increased populations or not, this rodent

has the little known habit of seasonal movement and concentration in favorable feeding areas. Therefore, locally it may become quite numerous and destructive without the phenomena of a generally dense population being present.

Although the fruit orchard is closely akin to the porcupine's normal habitat, the bark and leaves of the apple tree are not particularly relished. Aside from feeding on the ripening fruit, the damage to the tree consists in the breakage of limbs in small trees and the deliberate pruning of branches to make ascent easier and to reach fruit clusters. Thus, porcupines are rarely present in these orchards except in the fall when they sometimes appear in considerable numbers. On a 35-acre apple orchard at Cornish, Maine, the owner took 63 porcupines during the fall of 1936 in steel traps set near the tree bases. In succeeding years, using the same method, he took 48 in 1937, 42 in 1938, 26 in 1939, and 18 in 1940, or a total of 167 porcupines.

One of the most widespread complaints is that of damage to ripening sweet corn. Relatively few porcupines may do considerable damage, for the 10-20 pound rodent has a real appetite for corn-on-the-cob.

A farmer near Winchester, New Hampshire, reported that his cornfields looked as if a tractor had been run through them the morning after a foray of a group of porcupines. At Otisfield, Maine, another family makes a practice of hunting nightly with flashlights and clubs in their sweet cornfield during harvest time, and even then an appreciable proportion of the crop has been lost.

In the Mancos Valley in southwestern Colorado porcupines are reported to "wallow-down" ripening wheat in their feeding thereon. As many as seven porcupines have been killed by the cutter bar of the mowing machine in harvesting a single field of alfalfa. A variety of garden crops also attract the porcupine's attention. And so it goes.

The farm forests seem particularly attractive to porcupines. Because of management and thinning, the trees are vigorous and thrifty. It can be demonstrated that porcupines select dominant trees of any given species for feeding, and to have a large grouping of thrifty trees can only constitute ideal feeding conditions. Undoubtedly, taste is a factor. At Cabot, Vermont, a 12-year-old Norway spruce (*Picea abies*) plantation of 5 acres suffered an 84 per cent loss in 3 years through porcupine feeding, despite the presence of natural timber stands in the immediate neighborhood. Such examples could be quoted by the score. Since the hard maple (*Acer saccharum*) is perhaps the most favored food tree, it takes no stretch of the imagination to picture the concern of the maple-sugar grower over the activities of this rodent.

Crops are not the only things that suffer. Livestock is often too in-

quisitive for its own good. A cow may sniff at the strange prickly form dozing in a corner of the rock wall of the pasture, only to receive a muzzle and tongue full of quills driven hard-in by a slap from the porcupine's tail. Dairy cattle because of their daily inspection at milking time can be treated for this injury, but range cattle without attention occasionally develop such sore mouths that they are unable to eat properly. Farm dogs are common victims of this intruder which does not hesitate to approach farm buildings. One Vermont veterinarian informed the writer that no small part of his income was derived from treating dogs suffering from "porky encounters."

In other ways, the invasion of farmlands by the porcupine is proving a great nuisance. He has a taste for summer cabins, camps, and outlying farm buildings, probably drawn by the salt and grease spilled on the lumber. For the same reason the porcupine will gnaw the wooden handles of tools and farm implements left where he can get at them. More recently his fondness for the new synthetic rubber tire has come to our attention.

Yes, unquestionably the porcupine has moved to the farm. Fortunately serious losses are entirely local in character, and control should take the same pattern. Control over large areas will rarely prove economically feasible or desirable, whether by bounty payments —as exemplified in New Hampshire by the State expenditure of $127,-081.50 over a period 26 years, or by trained crews employing modern control techniques.

EDGE EFFECT AS IT APPLIES TO SMALL MAMMALS ON SOUTHERN MICHIGAN FARMLAND

J. P. LINDUSKA
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In the past quarter of a century we have become increasingly conscious of the need to stabilize agricultural lands and to maintain their fertility. Agricultural research has shown that in most instances soil- and water-conservation practices are not only practical, but almost immediately profitable to the farmer, and adoption of recommended changes has been rapid and widespread. Over considerable areas farm habitat is being greatly modified, and the change is certainly to be reflected in wildlife and insect populations. A growing appreciation of the multiple land-use concept recommends that the many interests concerned with land management evaluate these possible effects and interpret them in terms of all those affected.

At the Rose Lake Wildlife Experiment Station in Clinton County, the Michigan Conservation Department is attempting to evaluate many of these new developments in land use and farming in terms of their effect on wildlife. While the major emphasis in these studies is on game species, consideration is being given to other wildlife as well. In this connection, some incidental work is being done on small mammals.

One of the most apparent changes in farmland following the application of soil-conservation principles is in the considerable increase in edge. Realigned field boundaries, strip-cropped fields, wooded gullies, hedgerows, et cetera, contrast sharply with the large areas of clean cultivation characteristic of conventional farms. The proper interspersion of types is usually considered basic in management for game (Leopold, 1933) and the general farm picture following adoption of these currently recommended land-use practices suggests a pattern favorable to most game species. However, few studies have been made which show the true consequence of such changes for game or other wildlife. Evidences of conditions favoring an increase in song bird populations in areas of strip farming have been found by Dambach and Good (1940) and Good and Dambach (1943), and other indications that strip cropping might have value in limiting numbers of some harmful insect pests have been obtained by Marcovitch (1935). Some preliminary observations on the importance of edge to another animal group of considerable economic importance will be given here.

The area of these studies is in general, second-to-third-class agricultural land. However, the soil pattern is highly complex and fertility,

of course, equally variable. Soil-conservation measures on the farm fields were begun with the establishment of the station in 1939, and most of the basic changes in land use required for sound farming were completed at the time rodent studies were started in 1941. Since the full impact of such major habitat changes will not likely be reflected in animal populations for several years, the present status of all wildlife is being looked upon with reservation. It should also be mentioned that the period of the work (1940-42) from which these data have been drawn was, by present standards (1946), one of very low mouse populations. Meadow voles (*Microtus p. pennsylvanicus*) in particular were down in numbers, and colonies of this species were uncommon in the area (Linduska, 1942). Prairie deermice (*Peromyscus maniculatus bairdii*), also at a comparatively-low population level, were of general distribution, and even though the actual number of individuals handled was small, the extent of trapping was great enough so that comparisons of the sort presented here are felt to be valid in spite of the low trapping returns.

Analysis of general trapping data for evidences of edge response.— To establish comparative population levels of small mammals, a standardized procedure of live-trapping and marking has been one of the methods used. A straight-line system of trapping was followed which involved 25 live-traps placed at 22-foot intervals beginning at the field edge and extending for 528 feet in the direction of the field center. Traps so located were operated for three nights, and the individual catch used as an index to actual abundance. Using this means of determining comparative population levels a variety of situations and crops were trapped. This general program of trapping was for purposes other than to determine any response of small mammals to edge. However, the data offer an opportunity for measuring the possible value of edge, since an appreciable attraction of such situations for these animals would likely be reflected in a greater number of catches in traps located near field margins. An analysis of returns from over 5,000 trap-nights of operation is made in Figure 1 where the distribution of the catch of all small mammals taken in connection with straight-line trapping is shown. Although the total catch includes individuals of house mice (*Mus musculus*) and meadow voles (*Microtus p. pennsylvanicus*), the great majority of the catch (over 90 per cent) was prairie deermice (*Peromyscus maniculatus bairdii*), and interpretation of the results should be made largely in reference to that species.

It will be seen from Figure 1 that the density of mice, as evidenced by live-trapping, was essentially uniform from the field edge to a point 528 feet in the direction of the field center. Many field edges

were bounded by a woody undergrowth of fencerow or roadside cover, and it is of interest that the apparent number of mice near to these situations was actually somewhat lower than in the general vicinity of field centers. It is possibly of further significance that fall and winter trapping in harvested fields practically devoid of cover, showed the same general density of mice at the field center as was found at field margins where heavy ground cover was present.

Rodent numbers near brushy field margins and in field interior.— During the summer of 1940 several crop fields having dense herbaceous and woody margins were trapped for a period of one week using 440 small-mammal live-traps. These were distributed over the greater

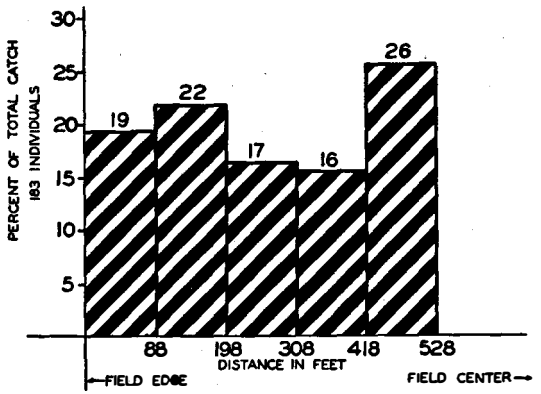

Figure 1. Distribution of 183 small mammals taken in a variety of habitats in over 5,000 trapnights of study. Lines of trap located vertical to the field edge and extending for a distance of 528 feet in the direcioion of the field center showed the density of mice to be essentially uniform over the length of the 25 trap line.

parts of the fields without particular reference to desirability of location. An analysis of trapping records from these fields, which had been selected for well-defined edges, gave no indication that the diversity of habitat furnished by "grown up" field boundaries encouraged greater mouse production. For traps located over an area from the nearest field margin to a distance of 132 feet from the nearest edge, an average catch of 1.8 prairie deermice per trap was made. Among 316 traps located more than 132 feet from the nearest margin, the average catch was 5.2 mice per trap, or nearly three times the take in traps located along field edges. The general trend indicated by trapping in these several fields characterized by an abundant marginal cover was one of higher mouse populations at the interior of fields.

Additional evidence of what appears to be a neutral or possibly even a negative response of small mammals to edge was obtained in connection with efforts to plot the approximate distribution of rodents

inhabiting a portion (approximately 2.5 acres) of a large cornfield. The segment selected for trapping was bordered on two sides by swale cover and on a third side by heavy roadside cover. The site was trapped for a period of five days using lines of traps at the junction of the cornfield and swale cover; additional rows of traps paralleling each of the marginal lines were located 66 feet toward the field center; and a third line was placed through the field center which was 166 feet from either edge of swale cover. The catch of what was presumably the resident prairie deermouse population in this small sample area was distributed as follows: marginal lines, 18 per cent of total catch and one individual per 13 traps set; 66 foot lines, 52 per cent of total catch, and one individual per 4 traps set; and center line, 30 per cent of total catch and one individual per 4 traps set. Obviously the small size of the area used for this particular observation places many limitations on the information obtained, and the average range of an individual prairie deermouse might, in fact, approach in area that of the entire plot. The results which are offered only as a supplementary observation do, however, indicate the same tendency towards distribution noted in the studies described above.

Population indices in strip-farmed and conventionally-grown crops. —In redesigning farms for soil- and water-conservation, the use of strip-cropping is frequently a prominent feature and one which serves to increase edge considerably. At the Rose Lake Station upwards of 70 acres of erosion-susceptible land has been converted from solid fields to strips, and although it was not possible to determine the importance of the change to rodents by following year to year population trends, an attempt was made to evaluate the effects by comparing population levels on this area with those on adjoining or nearby crops, comparable except for the shape and size of fields. Using identical systems of trap-placement, seven strip-covered fields of mature oats and two of wheat were trapped concurrently with seven fields of oats and three of wheat which had been planted to solid fields at about the same time. Indices to the rodent population in seven strip-cropped fields of alfalfa hay and eight solid fields of hay, all in comparable stages of growth, were similarly obtained. The comparative densities of mice found in situations farmed by these two methods are shown in Table 1. It will be seen that for both the small grain and hay habitats, the numbers of mice in fields farmed by strip cropping were apparently fewer than in the very similar and concurrently trapped solid stands of the same crop. Prairie deermice were predominant in both habitats and indices to the numbers of these mice are shown separately. In the tabulation for all species, catches of meadow voles and house mice are included in the total catch.

TABLE 1. COMPARATIVE POPULATION LEVELS OF SMALL MAMMALS IN STRIP-CROPPED FIELDS AND IN THE SAME CROPS CONVENTIONALLY FARMED AND TRAPPED CONCURRENTLY

Crop	Type of farming	No. of fields trapped	Trap-nights	Individuals per 100 trap-nights	
				Prairie deermice	All species[1]
Small grain: (oats and wheat)	Strip cropped	9	1,823	2.8	3.3
	Conventionally farmed	10	1,831	4.3	5.5
Hay: (alfalfa)	Strip cropped	7	1,019	3.3	3.7
	Conventionally farmed	8	895	3.8	4.6

[1]Prairie deermouse, meadow vole and house mouse.

SUMMARY

The foregoing methods of testing for possible effects of edge obviously represent a rather indirect approach to the problem, and one which may or may not accurately indicate what the final result would be in terms of population changes. There is, of course, no good substitute for a thorough-going, long-term study which would follow along with such habitat changes as are currently resulting from new ideas in land use. An understanding of the real effects on harmful wildlife of these new trends in agriculture, and opportunities for control of undesirable species by ecological methods will depend on studies existent over sufficient period of time to distinguish man-made population trends from normal periodic fluctuations. As for the present evaluation of the importance to certain farm rodents of one consequence of good farming, that of increasing edge, the results appear to be favorable. The prairie deermouse, one of the most important mouse species on Michigan farmland, was not observed to have the positive response to edge type of environment that is usual for most game species, and in fact, was taken with less frequency in this situation than it was at points distant from habitat intersections. Similarly the net effects of edge increase through strip cropping appeared not to favor an increase in mouse numbers by comparison with otherwise nearly identical situations represented by the large fields of conventional farms. The data, in general, point to these animals as being tolerant of uniformity in habitat and not highly responsive to conditions associated with edge situations.

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TECHNICAL SESSION

Monday Afternoon—March 11

Chairman: DANIEL MERRIMAN
The Bingham Oceanographic Laboratory, Yale University, New Haven, Connecticut

Vice-Chairman: WILLIAM C. HERRINGTON
North Atlantic Fishery Investigations, U. S. Fish and Wildlife Service, Cambridge, Massachusetts

MARINE HABITATS AND WILDLIFE

SOME EFFECTS OF THE WAR ON THE WILDLIFE OF MICRONESIA

LIEUTENANT ROLLIN H. BAKER, H(S), USNR
Research Division, Bureau of Medicine and Surgery, United States Navy, Washington, D. C.

There has been a growing interest in the status of wildlife of the Pacific islands where war efforts have been centered. The small oceanic islands are of particular interest since available habitat for wildlife utilization is limited and invasion and bombardment operations, or minor defensive constructions, may seriously affect the resident animal life. Most of the following remarks refer to islands in Micronesia, including the Marianas, Carolines, Palaus, and Marshalls, and in most cases are based on personal observations made when on duty as a mammalogist for U. S. Naval Medical Research Unit No. 2.

The islands of Micronesia, which number in the thousands, are scattered over some 2,400 miles of ocean in an east-west direction, as shown in Figure 1. Most of the islands are in the form of coral atolls, with individual islands measuring not more than a mile or two in length and rising just a few feet above the surface of the water. Kwajalein, Eniwetok and Ulithi are typical coral atolls. A few of the

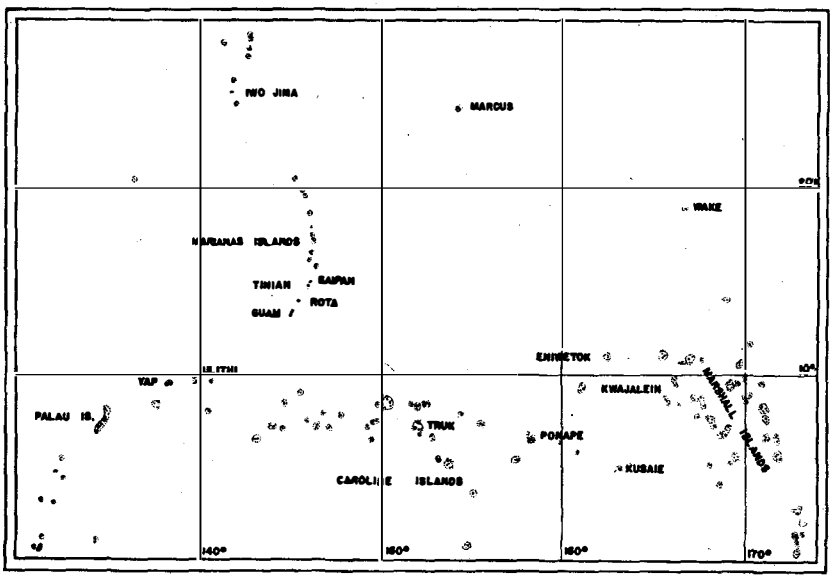

Figure 1. Map of Micronesia (including Iwo Jima) showing islands which were affected by war operations.

islands are partially or entirely of volcanic origin, measuring as much as 30 miles in length and rising to elevations of 1,000 or more feet. Guam, Saipan, Tinian, Ponapé, Truk, and the Palaus are examples of volcanic islands.

Effects of the war on islands.—During the progress of the war, some of these islands have been utilized for defensive and offensive operations. As a result, the topography has been altered in a number of ways to fit war plans. At Eniwetok and Kwajalein in the Marshalls, much of the land has been cleared for air strips and other installations. At Iwo Jima, which is north of the Marianas, invasion operations removed or damaged most of the vegetation. At Ulithi Atoll in the Carolines, some of the islands were totally cleared except for cocoanut and breadfruit trees, which were carefully left for native use. At Angaur and Peleliu in the Palau Islands, combat operations removed large areas of jungle, swamp, cocoanut grove, and open woodland as shown in Figure 2. At Guam, Saipan, and Tinian in the Marianas, the fighting and later the construction of air strips and other units changed considerable areas. By-passed islands were not affected as much. Rota, located between Guam and Tinian, was bombed frequently, but the island vegetation was relatively undisturbed. The same was true at the enemy-held bases of Koror and Babelthuap in the Palaus and

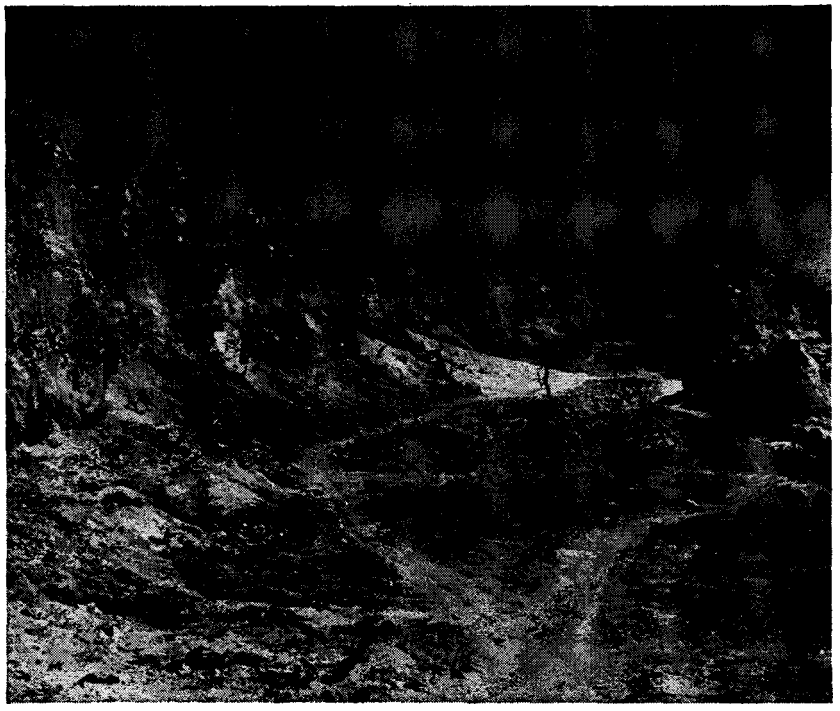

Figure 2. War battered ridge at Peleliu, Palau Islands. The picture, taken shortly after the end of hostilities, shows the devastation to an area that was covered with vegetation and once the home of a varied and interesting fauna. (U. S. Navy photograph.)

Truk and Yap in the Carolines. On all of these islands, however, the isolated enemy forces apparently placed much land in cultivation and also utilized the island fauna and flora for food.

Bird life.—Micronesian islands have a fauna considerably less varied than that found on the Philippines, Solomons and other large island groups to the west and southwest. The Palaus, which are located nearest to these larger islands, have the richest fauna. Birds are the most conspicuous animals. The smaller islands, especially the coral atolls, are usually inhabited only by sea birds and migratory shorebirds. About 38 varieties of sea and shorebirds have been reported from Micronesia. The larger islands, offering more extensive and varied habitats, have a number of resident land and fresh-water birds, many being endemic as to subspecies, species or even genus. About 58 land and fresh-water birds have been recorded at the Palau Islands. At Guam about 32 kinds are known, while Saipan, Tinian, Truk, Yap, and Ponapé have almost the same number (Mayr, 1945a).

On many of the larger islands are found such interesting species as pigeons, ducks, rails, gallinules, and megapodes.

Sea and shorebirds.—It is difficult to evaluate the effects of the war on the birds, as well as on other wildlife populations in the Pacific, since little is known regarding the prewar status of these islands. However, a comparison can be made between undisturbed and occupied islands or between different areas on the larger ones, where only a part has been affected by the war. Apparently sea birds, including noddy terns, white terns, tropic birds, frigate birds, and boobies, were not disturbed considerably by the war activities. Perhaps the birds would move away during combat operations, to return later. Other species found to the north and east of Micronesia, including albatross and petrel, are reported to be affected more because of their nesting and roosting habits. Stories of the conflict between some of these birds and occupational activities are well known. On the other hand, the white tern has been so compatible on occupied islands that as long as a few trees are present, this beautiful bird has remained.

Land and fresh-water birds.—Land and fresh-water birds have not fared as well as the sea birds. Mayr (1945b) has pointed out many of the dangers that threaten the bird life of Pacific islands. On Guam, Tinian and Saipan, clearing has reduced forested areas used by pigeons, flycatchers, kingfishers, honey-eaters, white-eyes and other birds, but owing to the large size of the islands, there is much suitable habitat remaining. According to reports of natives, during the Japanese occupation of Guam (1942-44), there was little disturbance to the natural areas. The Japanese allowed no firearms among the people; however, the shortage of food was an inducement for increased bird trapping.

When the American forces landed on Guam in the summer of 1944, organized enemy resistance did not extend over a long period, and as a result only small sections were devastated by the fighting. Following the securing of the island, large areas were converted from jungle and cocoanut grove into military establishments. However, much less than one half of Guam has been disturbed. The clearing may actually be beneficial to the introduced Philippine turtle dove (*Streptopelia bitorquata*), which appears to prefer the open country to jungle. The Marianas mallard (*Anas oustaleti*), which was uncommon on Guam in prewar days, is now either very rare or totally gone.

At Iwo Jima, bird life apparently suffered greatly during the invasion period. An observer reported few birds on the island one month[1] after the end of hostilities; three kinds of land birds and one

[1]Lieutenant George W. Wharton, Jr. H(S), USNR.

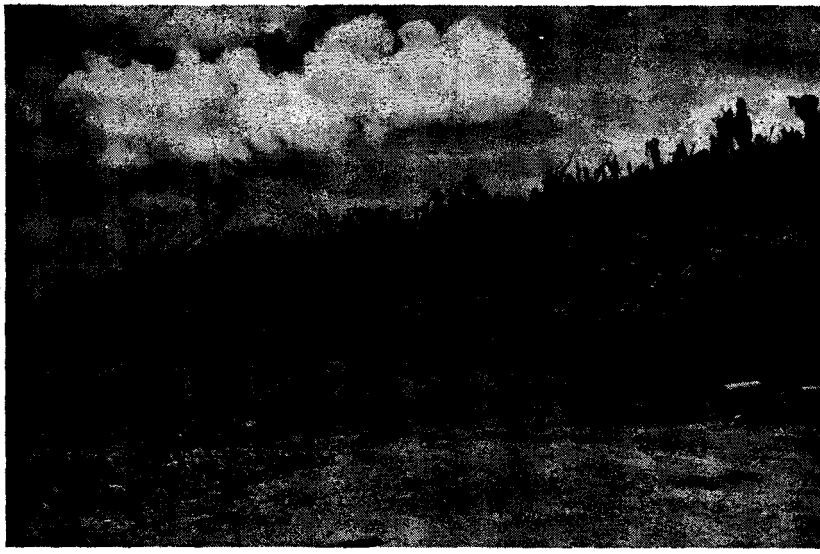

Figure 3. War battered ridge at Peleliu, Palau Islands, one year after hostilities. A heavy tangle of vines and shrubs covers the ridge and most of the dead trees inviting the return of animal life. (U. S. Marine Corps photograph.)

shorebird were all that were seen. When collected, some of these birds had healing, or recently healed, wounds which may have been inflicted during the fighting. At Ulithi there is an unconfirmed report that a small rail was present during the early days of occupation, but the filling in of taro swamps to construct installations apparently eliminated the species. Starling (*Aplonis*) and white terns (*Gygis*) were the only birds observed to inhabit the main occupied islands of Ulithi, while on nearby unoccupied islands, 10 or more sea birds were found.

On Peleliu and Angaur in the southern Palaus, bird life was considerably affected by the battle operations. This was well demonstrated by the difference in bird populations in the disturbed areas as compared with untouched jungle. Service personnel reported finding few birds during the fighting, and after the end of hostilities, it was several weeks before the birds began to appear. The battle areas, one year later, were green under the advance of vines and shrubs, as is shown in Figure 3. A number of jungle-dwelling birds, including flycatchers (*Myiagra* and *Rhipidura*, warblers (*Psamathia*), rails (*Rallus*), and megapodes (*Megapodius*), were found to be moving into this association. The megapode or brush turkey was observed to be fairly numerous at Peleliu. The large fruit pigeon (*Ducula*) was also ob-

served though it was restricted to places where tall trees remained. The Nicobar pigeon (*Caloenas*) was not seen at Peleliu in September 1945, but it was found at offshore islets nearby. British Indian prisoners of the Japanese, liberated after V-J Day from Koror and Babelthuap, which are located a few miles north of Peleliu, reported extensive utilization of pigeons, rails, and megapodes by the people on those islands.

Mammals.—There are few kinds of mammals in Micronesia. Rats and mice of several species are found on most of the islands, having been brought in by the islanders and the ships of commerce. Most interesting are the fruit bats (*Pteropus*) which are present on many islands of Micronesia. On some islands these large-winged mammals apparently have been driven away or reduced in number either by the elimination of breadfruit trees and other plants on which they feed, or possibly by the local disturbance caused by occupation. On Guam and Rota the sambar deer (*Rusa unicolor*), which was introduced by the Spanish from the Philippine Islands, is present in sufficient numbers to offer limited sport to garrison forces. The native hunters on Guam use a leaf call to attract the game. They informed me that deer increased during the Japanese occupation.

Plant life.—The plant life, which is more varied on the larger volcanic islands, is of great importance, especially in the case of cocoanut, breadfruit, pandanus, papaya, and other trees and shrubs utilized by the islanders for food, clothing and shelter. As mentioned previously, war operations have made it necessary to remove this vegetation from large areas on strategic islands. In addition, little-known endemic plants may have been greatly reduced or exterminated by occupational activities. As yet, there is little knowledge of the relationship between these plants and the island animal life. The return of vegetation to battle-cleared areas may likely produce significant changes in the plant associations.

Pest control.—The operations of war not only include the destruction of wildlife and its environment but also include the often serious aftermath—the introduction of unwanted insects, rodents, weeds and other pests. The armed forces have made every effort to keep potential disease-carrying insects and rodents from being spread. They deserve much credit for their work. This never-ceasing vigilance must be continued in the future. A good example of what can happen is the presence of the destructive Norway rat (*Rattus norvegicus*) on Saipan. The large amount of Japanese shipping in the prewar days is probably the reason for its presence. On Guam, where this animal does not occur, there was less commerce before the war and ships usually anchored offshore. Now that docks are present on Guam and

shipping has increased, there is greater chance for this pest to be introduced.

The use of DDT and other insecticides by epidemiology and sanitation units has been an effective means to reduce the disease hazards that come from high populations of flies, mosquitoes and other insects. Sprays and dusts have been applied both by hand and by plane as frequently as once a week in some instances. However, the effects of this liberal use of DDT on the other animal life of Pacific Islands have not been determined.

Introduced species.—Game animals introduced by the Spanish have flourished on Guam and Rota, possibly because of little competition from native forms. Besides the sambar deer and the turtle dove already mentioned, a small quail (*Excalfactoria*) was introduced at Guam from the Philippines. In July 1945, 57 Mongolian pheasants were liberated at Guam by the U. S. Navy in cooperation with the California Fish and Game Commission. Some of these were released in an area where corn and other field crops were being cultivated. Exotic game animals may become established and offer sport for the hunter and food for the people, as in the case of deer; however, the addition of new forms often leads to disaster for native species. The Japanese successfully introduced a Formosan drongo (*Dicrurus macrocercus*) at Rota about 1935. This long-tailed, black bird was released for the purpose of preying on destructive insects. A toad (*Bufo* sp. probably *marinus*) has also been liberated in the Marianas. It is abundant on Guam. A large African land snail (*Achatina fulica*) was brought to Rota, Saipan and Tinian, apparently to be used as food by the people. A small colony was discovered at Guam in 1945,[2] probably being introduced there during the Japanese occupation. Efforts have been made to eliminate the snail at Guam, since it is a very serious hazard to agriculture. There is also danger that the snail may be accidentally transported to other islands.

Need for survey and protection.—Now that the war has ended and our government may have jurisdiction over some of the recently won islands of the Pacific, a survey to determine the status of the wildlife resources of these islands seems most advisable. Such a program would be in line with biological work that is now going on, including rodent and insect control, fisheries management and agricultural development. Some investigations have already been started on islands of the Hawaiian group by the U. S. Fish and Wildlife Service and the Territorial Board of Agriculture and Forestry. A very thorough survey of the bird life at Midway Atoll has been made by Fisher and

[2]Lieutenant Tucker Abbott, H(S), USNR.

Baldwin (1946). Recommendations for the protection of oceanic birds are proposed which may apply to any Pacific island occupied by our service personnel.

On these new island bases it is important that efforts be made to protect species which have been reduced as a result of the war, to increase species utilized as food by the native peoples, and to bring wildlife, as well as marine life, forward as a means of recreation for our garrison forces in the Pacific.

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DISCUSSION

CHAIRMAN MERRIMAN: I would like to know more about the matter of DDT. I notice that you remarked on its wholesale use as regards insects. Would you care to go further than you did in the paper—off the record?

LIEUTENANT BAKER: I didn't say much in the paper because I think it is a touchy subject in some ways, but I wasn't directly connected with DDT work. We had several entomologists with our unit that worked on DDT and insect spray. However, on the particular island of Peleliu, for one, there was a very thorough spraying of DDT. They had a biting gnat on the island which bred in the mangroves and the commanding officers and other people wanted that eradicated almost immediately after getting there. Apparently the gnat reproduced according to the tides. If you had a low tide, the main population emerged and that was every 2 weeks or so that it occurred. So, they really poured on the DDT to eradicate that pest.

Whether that did damage to the fish population in the mangrove swamp area or damaged the birds or other insects, I don't know, but it would be a good project to try to evaluate as to the results. Of course, you don't know what the conditions were formerly and it may not be an easy matter to evaluate those experiments, but I would like to see some of that work done.

CAPTAIN EARL S. HERALD (Florida): I am from the Orlando Army Air Forces Committee on the Air Control Dispersal of Insecticides—in other words, we are DDT. I happened to be in Hollandia in November 1944. Captain Hall came in there that month. He had just come from Saipan, where he had charge of spraying.

We were interested in what he was doing because this other officer and I had been doing the job of expediting the DDT program in the South Pacific. The equipment which they used on Saipan was something entirely new. It was developed in that area, and was entirely different from what has been used here.

There was quite a bit of talk about it because there were claims that it entirely cut down the epidemic of dengue which they were having in that area. It did reduce, to a marked degree, the number of insects they had, but as for actually cutting down the amount of dengue they had, it wasn't responsible for that. We have been running tests at Orlando as to the question of toxicity to wildlife.

In enclosed area, the DDT will have a marked effect in reducing the population of fish. Military spraying requirements, that is, three to six tenths per pound of DDT per acre, has very little effect on the higher vertebrates. On the aquatic vertebrates, however, it can have a deleterious effect. That is why our organization at Orlando has been setting up requirements and laying out procedures which will

be carried out this coming year in the interior, that is, the United States, on the plane spraying, which will be conducted by the Army this coming year.

MR. H. SIEGLER (New Hampshire): I heard you mention something about a starling in one of the islands. Is this a European starling?

LIEUTENANT BAKER: No. It is the old world starling. It is related to the genus Apolis. It isn't a bird that we have in North America.

MR. SIEGLER: You said very little about reptile life in these islands. Was there a variety?

LIEUTENANT BAKER: Yes, there is. I didn't say much about that. We have some good collections of reptiles from all these islands. I think next to the birds, the reptiles are the most numerous vertebrates—much more numerous than mammals.

THE BIOLOGICAL EFFECTS ON FISH, SHRIMP, AND OYSTERS OF THE UNDERWATER EXPLOSION OF HEAVY CHARGES OF DYNAMITE

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and

JOHN E. McDOUGALL

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The experiments herein reported were conducted to ascertain the effects of underwater explosions of dynamite on three important aquatic resources, viz: marine shrimp (*Peneus setiferus* (L.)), croakers (*Micropogon undulatus* (L.)), and oysters (*Ostrea virginica* (Gmelin)). Great confusion exists in popular ideas of effective damage by dynamite and other explosions.

The problem became imperative when the seismographic exploration of the Gulf of Mexico was undertaken. Examination by the authors of all available published researches and consultation by the authors with Army, Naval, and other governmental officials of the United States, Great Britain and Canada revealed surprisingly that no comprehensive investigation of effects of such heavy dynamite charges on these economically valuable aquatic organisms had, evidently, been undertaken.

The Louisiana Department of Wild Life and Fisheries maintains a strict supervision of all seismographic explorations whereby departmental inspectors whose services are paid for by the oil companies

concerned must, by law, be present whenever explosives are discharged. This program has proved to be efficient.

Rapid exploration of marine oil resources of the Gulf of Mexico involved a shift from reflection to refraction shooting. The previously allowable 50-pound charges used in reflection shooting were inadequate for refraction shooting. In reflection shooting, the oil company buries a charge that often weighs only 5 pounds of 60 per cent gelatin dynamite and it serves their purpose well to bury that charge deeply. We permitted them to use a charge of up to 50 pounds and we compelled them to bury that charge 50 feet in the ground. That suited them perfectly well because they could get better reflection waves by that means, but when refraction shooting was undertaken, they petitioned that we permit a charge of 800 pounds. Since the operation of a seismographic crew costs about $40,000 a month and since refraction shooting permits a speed-up of oil exploration fourfold or even more, it became necessary to ascertain the biological results that could be reasonably expected.

The first series of experiments involved the firing of one 200-pound charge and two 800-pound charges of 60 per cent gelatin dynamite unconfined and placed on the ocean substratum in 18 feet of water.

The experimental animals were confined in 30-inch, cubicle cages suspended midway between surface and bottom in 18 feet of water. Animals were held in their definitive positions for 48 hours before the charges were fired, were examined immediately before the shot, immediately after the shot, and subsequently at 24 and 48 hour elapsed intervals.

Adequate controls were established located far beyond any possible influence from the dynamite blasts.

Briefly stated, these experiments revealed the startling fact that 800 pounds of dynamite capable of jarring an oyster lugger 10 miles and explosively flinging water into the air 300 feet did not harm shrimp at a distance of 50 feet and did not kill fish at a distance of 200 feet. Some fish survived at a radius of 150 feet.

Since oysters constitute a highly valuable aquatic resource, damage to which was not apparent, when the experimental oysters were suspended as individuals in cages it was decided to re-examine effects of dynamite blasting on oysters where the oysters were part of an integrated reef. A comprehensive series of experiments was executed involving the discharge of up to 400 pounds of dynamite wherein one series the top of the dynamite was 50 feet below the oyster reef and in the second 400-pound shot the top of the dynamite was 25 feet below the oyster reef. The results revealed that no mortality ascribable to the effects of the explosions occurred. Additional shots ranging

down to 25 pounds were used. Oysters collected at various radial distances were transferred immediately to a marine laboratory where they were held for 6 weeks. Oysters remaining at the site of the explosions were also subsequently re-examined to establish any possible effects due to release of gases from the substratum. I should like to interrupt myself and indicate that these measures are utterly drastic and under no circumstances would our Department, and I am sure that under no circumstances any other department, contemplate permitting any oil company or anybody else to go into any oyster producing area and shoot off 400 or 800 pounds of dynamite, but we wanted to do it in the worst way and see what happened. Controls were provided for both these sets of observations.

The compression wave created by submarine dynamite explosions travels with the speed of sound, its velocity differing with the medium in which it is transmitted. Salinity is a negligible factor. The speed in water is approximately 4,940 feet per second while the speed in a granite substratum reaches 18,000 miles per hour.

The explosion compression wave in the first experimental series was picked up and recorded by especially designed geophones which registered photographically the deflection of a string galvanometer.

Subsequent additional series of charges were fired (without the use of experimental animals) for the purpose of establishing the curve of decrement of the shock wave.

It was found that the decrease in the force of the impact (evidently a function of friction among the water molecules) was surprisingly rapid.

No direct value could be obtained at shock point because of the violence of discharge but sufficient additional points were registered so that the curve developed could be extended to indicate the probable shot point value. Using purely arbitrary units this decrement may be stated: Shot point (estimated) 100,000 units; 50 feet 10,000 units; 100 feet 1,000 units; 150 feet 4 units; 300 feet 1.5 units; 450 feet 1.0 units. This wave, represented by the flattened part of the curve, travels at the above indicated velocities and, evidently incapable of damaging aquatic life beyond a remarkably short radius, nevertheless provides the desired seismographic record.

The speed with which this compression wave is built up is extreme. Data indicate that this compression wave has a duration of five one thousandths to eight one thousands of a second, with a following negative pressure phase lasting about twenty-five one thousands of a second.

Bureau of Ordnance research developed a formula thirteen thousand multiplied by the cube root of W, this sum divided by D, giving

the pressure in pounds per square inch for TNT where W is the weight of a charge in pounds and D is the distance in feet. The 60 per cent gelatin dynamite used in the experiments here reported had an indicated value of approximately 4 per cent less than the explosive force of TNT.

Examination of earlier data reveals important, but not always relevant, results. Hooker (1924), during the first World War, used frogs and dogs in testing physiological damage affected by heavy artillery fire where the shock wave was airborne. Haldane (1938) and Kretzschmar (1940) analyzed the results of observations during the Spanish Civil War. Zuckerman (1940) reported studies of the bombing of British cities. Atkins (1940) gave the first report of waterborne blast injuries based on observations carried out during the evacuation at Dunkirk. Breden, d'Abreu and King (1942) reported on 10 cases of injury due to torpedo and depth charge explosions. Greaves, Draeger, Brines, Shaver, and Corey (1943) reported a careful experimental study of underwater concussion using rats, guinea pigs, and goats. Captain Draeger, by the way, is the officer in charge of the Medical Unit, a very able man, which is conducting the investigations of Operation Crossroads. Their conclusions were far different, indeed, from the usual popular opinion of depth charge and torpedo damage since they indicated that a man without any protection from life jacket or other device would be uninjured by a 500 pound depth charge at a distance of 165 feet or a 600 pound depth charge at a distance of 220 feet. I read recently in that not always reliable scientific journal that an American medical officer said that a small depth charge would kill a man a half mile away. You can see how absurd are such statements.

The available data reveal that the physiological damage occurs when a critical compression pressure of 500 pounds to the square inch is reached and this compression wave passes a phase boundary such as, for example, from the fluid tissues of a fish to the gaseous interior of the fish's swim bladder. A phenomenon, termed "shredding" occurs at this pressure and causes histologically demonstrable lesions. This shredding produces some very peculiar physical result too. If you oberve the sea in these experiments, you will find there comes a moment when, instead of having the water rise as an elevated promontory cubical from the bottom, suddenly it becomes completely and instantly black and it remains so—we never timed it, of course, as we weren't interested in that fact particularly—but what happens apparently is a certain relationship and pressure is reached where, instead of the medium acting as a unit, it breaks down into an infinite number of separately operating particles.

It is the conclusion of the writers that pressure waves set up by the discharge of even 800 pound charges of dynamite lose their force so rapidly radially that damage to aquatic resources, under the conditions wherein these charges are used, is negligible.

Acknowledgment is made for the invaluable cooperation extended by the Magnolia Petroleum Company and its contract crew, the McCollum Exploration Company, who contributed use of a five-boat fleet and their crews and technical staff to the carrying out of the first series of experiments, and to the Gulf Oil Corporation through their Research and Exploration Division, who contributed $20,000 and the use of their dynamite boat, crew, and technical staff for the conduct of the second series of experiments which were specifically concerned with oysters.

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DISCUSSION

SENATOR FREDERIC C. WALCOTT (Connecticut): This is quite significant because it is in line with the experiments that are being prepared now on the atomic bomb. They are all surface at first. About the first of May, we will be setting off the surface charges. A year from now, we will be setting off depth charges and I wanted to ask the speaker if he got any effect like an inverted cone. Did the pressures go up to the surface in the form of an inverted cone?

DR. GOWANLOCH: I couldn't answer that at all. We did not have the equipment to localize any geometrical pattern. Of course, the atomic bomb experiment is wonderful, but here in the dynamite explosions dealing with a purely chemical equation, it is completed and you are dealing not with heat effects so much as with the expansion of gases. I am looking forward earnestly, of course, as we all are, to those results. I couldn't answer that question at all. We are not prepared to say anything here at this time.

MR. HAROLD PILLSBURY (New Hampshire): I would like to ask if that last chart would be at all applicable to fresh-water pressures? Did I hear you say you started with a variance or did you say there wasn't too much difference?

DR. GOWANLOCH: There would be no difference. The thing that confuses so many people is the fact that the illegal use of dynamite is such a good way of catching fish if the game warden were not there, but it does a great deal of damage. The point is that it is very localized and a lot of those fish are not dead at all. Their hydrostatics are merely disturbed and it makes them available for capture temporarily.

MR. PILLSBURY: We have had that condition exist in reclaiming some ponds. We thought we would take a few samples by dynamite and we dynamited most of the pond and didn't get any fish, but we proved later there were plenty of fish

there which died from the poison. That is why we are particularly interested in this talk that was given us.

SENATOR WALCOTT: Do these explosions give any radioactive effect? That is a moot question now. There are a lot of scientists who say they are going to set up a chain of circumstances and they will involve a vast area, which I have always doubted.

CHAIRMAN MERRIMAN: Are you asking a question of Dr. Gowanloch?

DR. GOWANLOCH: The friends of the atomic bomb say it affects terrestrial life, so it probably affects some fish too. It is different there because, in the first place, the action so far as it can be ascertained is not complete and, therefore, unpredictable. In the second place, you have the terrific outburst of radiant heat and that is immediately picked up by the water and the water is enormously expanded. In the third place, you have this residual of radioactive effect. I have discussed the matter with the gentlemen concerned with these researches on radioactivity and they are prepared to wait until it happens before they predict it. It is so difficult to do.

CHAIRMAN MERRIMAN: I think that is the way everybody feels about it.

DR. GOWANLOCH: In the atomic bomb, of course, we got the heat from magnesium and not from uranium. The question is whether there is any radioactive effect from the uranium.

MR. LOOSANOFF: I would like to ask two or three questions. I think that, of course, these problems from the standpoint of the organisms may not be sufficient. I wonder what happens to oyster larva if there is sufficient force.

DR. GOWANLOCH: I think nothing would happen beyond what would happen to the adults because apparently there is no change in the physical boundary in the animal. We retained the shrimp for 6 days and I see no reason for surmising that there should be more effect upon an oyster larva than upon a shrimp. The situation there is that the impulse just draggles through without affecting any lesions, but that is a surmise.

MR. LOOSANOFF: Any observations on plant life in general?

DR. GOWANLOCH: Oh, yes, indeed. The situation down there made that particular aspect important as it might be elsewhere but it was not critical because of the vast movements of water that we do have in the Gulf of Mexico which far outweigh any lunar tidal movements—wind movements, of course, in the relative shelter of the Gulf. We know nothing of the after effects of that, but I should surmise that even had that been in a reasonable radius, they would be replaced by general current movements.

MR. LOOSANOFF: These experiments were confined to a certain period of the year?

DR. GOWANLOCH: No, they were not.

MR. LOOSANOFF: Physiologically, oysters do not behave exactly the same.

DR. GOWANLOCH: We chose deliberately the worst period of the year when they were in the poorest physiological condition.

MR. LOOSANOFF: The last question is, is it possible there is going to be an accumulative effect?

DR. GOWANLOCH: I do not believe it could be accumulative because I have examined some areas where explosions have occurred and where the oysters were not damaged and I have examined such areas over a period of some two years—I didn't examine those oysters when the explosion did occur, but they could have, perhaps, some relation inasmuch as those animals could be related in space very definitely with explosions that had occurred up to 2 years previously.

MR. LOOSANOFF: No. I mean when a series of explosions are made.

DR. GOWANLOCH: The explosions were not accumulative. They were only fired once. If I may make one statement, there is no doubt in the world that successive dynamite explosions will destroy oysters and that is why, like Dr. Davison described this morning, I too am on the hot seat because I fought for the oyster man before and would be compelled to stop him if illegal, undisciplined firing of dynamite were practiced down there. One man, for example, showed me 37 eighteen-foot pipes, the lower third of each pipe having been blown to bits. These

men were supposed to have fired one charge there and to have fired that charge every 40 feet and those oysters were killed.

I correlated the mortality in space and time. I correlated it by deliberate lineal radial accounts with those explosion activities and I thought that probably the result there was due to constant firings, but I am not sure. It wasn't an experiment. It was just an observation.

CURRENT WORK OF THE ATLANTIC STATES MARINE FISHERIES COMMISSION

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Members of the North American Wildlife Conference who read the Transactions of 1945 may recall the summary of the work of the Atlantic States Marine Fisheries Commission presented therein (Heydecker, 1945). For those who did not, I shall devote one paragraph to explaining the origin and composition of the Commission before proceeding to pick up the story where the report in last year's Transactions left off.

After several years' study and debate the Fourth Eastern States Conservation Conference held in Boston in 1941 recommended the creation by compact of a joint study commission to promote the conservation of the fisheries, marine, shell and anadramous, of the Atlantic Coast and the prevention of waste in them from whatever cause. Seven state legislatures that year adopted the Compact which was assented to by the Congress by Public Law 539—77th Congress and signed by the President May 5, 1942. Since then seven additional states have joined. These 14 include all the Atlantic Coastal States except North Carolina. Each member state has three representatives on the Commission, namely, the head of the department having jurisdiction of the marine fisheries, a member of the legislature appointed by the Commission on Interstate Cooperation, and a person "having an interest in and a knoweldge of the fisheries" appointed by the Governor. Funds for the Commission's work are appropriated by the states on a pro rata basis—namely, the percentage which the value of the catch of each member state bears of the total value of the catch of all member states. This fluctuates with fishing effort and prices, but is a fair way of prorating costs. The Commission is a cooperative study agency. It has no power and wants none. For its effectiveness it depends on voluntary cooperation.

Now let us examine the current work of the Commission to see whether or not it is making progress towards its goal. Restated, the purposes of the Commission may be said to be the common goal of all good conservation programs, namely, the prevention of waste and the promotion of wise use on the basis of maximum sustained yield consistent with preservation of the brood stock. This is trite but it is sound doctrine.

Has the Commission made any real progress towards this goal? Let the reader judge for himself on the record. First, the Commission reports that the habit of cooperation is growing in spite of disappointing setbacks here and there. The facts that the Commission exists, that it is putting forth special efforts to bring about interstate cooperation in particular cases where friction has arisen, that it is alert to spot troubles and begins work on them early, before they become serious interstate conflicts, and the fact that the Commission is functioning continuously to achieve and maintain harmony, would justify its existence if it did nothing else.

During 1945 it held numerous meetings by sections of the coast—similar to those employed by the U. S. Fish and Wildlife Service for its administrative work. These are four in number:

1. North Atlantic Section—Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut.
2. Middle Atlantic Section—New York, New Jersey, Pennsylvania, Delaware.
3. Chesapeake Bay Section—Maryland, Virginia.
4. South Atlantic Section—South Carolina, Georgia, Florida.

Each of these sections in 1945 took up problems of particular interest to its component states. Thus the South Atlantic Section discussed problems of their common shrimp fishery, pollution, the utilization of trash fish, war wreckage, shad, crab, uniform catch statistics and educational programs. Sanitation was emphasized, and it was agreed to seek funds in Georgia to set up a state testing laboratory and to support projects to provide adequate sewage treatment where such sewage constitutes a hazard to the fisheries. The Navy's program for the removal of war wreckage endangering fishing boats and gear was endorsed and hope was expressed that it would be extended to other affected areas. The section asked the U. S. Fish and Wildlife Service to assist the states in a cooperative study for the restoration of the shad in southern waters. On the crab it was agreed that as soon as possible Georgia and South Carolina should initiate a tagging program to determine range of migration, rate, growth, et cetera, with a view to developing later a joint conservation program.

The Chesapeake Bay Section through a committee of technicians from the two states and the Fish and Wildlife Service has been studying the fluctuations of blue crab abundance, seeking to determine whether further conservation measures by either or both states would assist in building up the supply. To date, although production has increased, such studies have been inconclusive, but they are being continued in the hope of solving this vexed question about which there has been much friction because of differing beliefs held by the two states.

A more difficult problem arises in connection with the badly-depleted oyster fisheries of the Potomac River which once produced upwards of 1,500,000 bushels annually and now produce only a small fraction of that amount. Under the compact of 1785 only concurrent statutes of the two states as to Potomac fisheries have validity. In 1945 a move was initiated by the Governors to review and perhaps revise the Compact of 1785. The Maryland legislature authorized a commission to revise the Compact, and recently the Governor of Maryland named three new Commissioners to consult with a similar Commission from Virginia should one be authorized by the General Assembly of Virginia now in session. In the meantime the Commissioners from these two states serving on the Atlantic States Marine Fisheries Commission, believing that this was a matter entrusted to them under the Marine Fisheries' Compact, continued their study of the same matter. After many meetings of the Chesapeake Bay Section they agreed on January 11, 1946 to recommend to their respective legislatures amendments to the Compact of 1785 which if adopted would:

1. Constitute a permanent joint commission, composed of the three commissioners of the Maryland Department of Tidewater Fisheries and three members of the Virginia Commission of Fisheries designated by the Governor of Virginia for the regulation and development of the oyster fisheries in the waters of the Potomac River in which under the Compact of 1785, both states have a common interest. It would not affect the tributaries of the River.

2. Grant to such commission, after due notice and hearing, authority to publish and enforce regulations relating to every aspect of the oyster fishery with no exceptions, that is, to regulate opening and closing of public rocks or beds, regulate seasons, character and number of gear, character, number and cost of licenses, how they may be issued, suspended and revoked, what taxes are to be collected, et cetera. To do this it is proposed that the joint commission have power to employ a director, clerks and enforcement officers, buy and oper-

ate patrol boats, and so forth. When the joint commission publishes its regulations, previous concurrent statutes would be superseded.

3. Grant to such joint Commission power to prepare and put into practice joint stocking programs, purchase and plant shellstock, seed oysters and small and mature stock and plant mature oysters for propagation;—in short, to develop and operate a complete plan for a joint management program within the common waters of the Potomac.

To accomplish all this the Commissioners from the two states proposed that each state shall appropriate equally to the support of the commission.

Opposition from oyster interests in Virginia up to the present time, apparently has blocked the introduction of the proposed amendments, but it is believed that there is some likelihood that the Section's recommendations may be introduced and may be favorably acted on by the General Assembly of Maryland in 1947 in which event they would naturally be submitted to Virginia for concurrence in 1948. Perhaps before that time comes Virginia may have appointed special commissioners to join the new special commission from Maryland in a joint study. Whatever may be the outcome, it appears likely that the conclusions of the section arrived at after long study will receive due consideration by official groups. They have been widely publicized in the daily press and trade papers and have focused public attention on the problem and the proposed solution which is in accordance with sound procedure in a democracy. Ultimately there can be no doubt that a solution will be found. It is hoped that it will follow in the main the Section's basic proposals for a flexible joint management and rehabilitation program for the once great oyster industry of the Potomac.

Meantime it is encouraging to note that the limitations on fishing effort effected under the statute authorizing the Maryland management plan have resulted in gratifying increases in the supply of striped bass or rockfish and in shad in Maryland waters.

The Middle Atlantic Section has concentrated on catch statistics, channel bass, shad, fluke and sanitation in the industry. New appropriations in New York are expected to result in greatly improved catch statistics, and it is hoped the other states will make funds available for such purposes within the next few years.

The Uniform Channel Bass bill has not yet been adopted in any state but has been considered by the legislatures in New York, New Jersey, and Delaware. Until it has been adopted by states more directly concerned farther south, it will not be pressed in these states.

The joint study for the restoration of shad in the Delaware River by New York, New Jersey and Pennsylvania and Delaware with the

help of the Fish and Wildlife Service is progressing slowly. Wartime demands on the staff of the U. S. Fish and Wildlife Service have prevented the completion of certain investigations on which the next steps depend. It is hoped that these can be completed in 1946 so that a joint program can be presented to the legislatures of the four states when they meet in 1947. The shad run in the Delaware once produced as much as 13,000,000 pounds per season. When the tolerance of shad fry to sewage and lack of oxygen in the water is determined, the four states will know to what degree sewage must be treated to bring about the restoration. They can then proceed through their other joint agency, the Interstate Commission on the Delaware River Basin, to bring about the cleanup of pollution in the river to such a predetermined point, as the economics of the situation may justify. If the run can be restored as this Commission believes, it will be a great achievement both biologically and economically. The experience of New York and New Jersey with the shad run in the Hudson which has been restored to an all time high lends support to this belief.

In the Delaware Bay area, the Middle Atlantic Section has asked the Chief of Engineers, U. S. Army, to direct the District Engineers to enforce more effectively the federal statutes prohibiting the discharge of mixed bilge water and oil. In response the Executive Assistant, Director of Civil Works, Corps of Engineers, has made available and the Commission has distributed to all its members the list of such district engineers and the waters under their respective jurisdictions to facilitate the prompt transmissions of complaints and requests for help in controlling such violations.

Farther north New York and New Jersey have continued their established pattern of cooperation through the Commission's office with respect to the shad run in the Hudson with gratifying results and complete harmony. New York and Connecticut Commissioners have met to discuss an incipient conflict between the fishermen of these two states in the matter of the fluke fisheries off Montauk. By acting promptly the Commissioners believe they can solve the question amicably. Certainly the attitude of both states is most commendable. Even while the discussion of their differences as to fluke continues, the advisory committee members from Connecticut voted recently to request their Commissioners to introduce in the next session of the Connecticut legislature measures to fix the minimum size of fluke at 15 inches and to adopt the uniform minimum size limit of 3⅛ inches (carapace measurement) for lobsters for the avowed purpose of giving evidence of their desire to cooperate with New York which had adopted and desired Connecticut to adopt both measures.

In the Delaware River and Bay as in the Potomac River, fisheries

are governed by concurrent statutes enacted under a compact. The Delaware compact however goes back not to 1785 but to 1905. Oddly enough both states after enacting concurrent legislation in 1907 forgot the compact and in the years that followed enacted statutes without the approval of the other state and proceeded to enforce them, notwithstanding the provision of the compact that only concurrently approved statutes have validity. To clear up the resultant chaos commissioners from New Jersey and Delaware in 1945 introduced amendments to the statutes of both states embodying agreed upon changes. So great has been the confusion, however, that the fishing interests in Delaware secured the defeat of the measure in the Delaware Senate. It had passed the lower house in New Jersey. Curiously enough the principal objections of the Delaware fishing interests were not directed to the new amendments but to matters that in fact have been law for over 30 years, but which they believed had been superseded. To overcome this confusion the conservation and legal authorities in both states are now engaged on the task of determining what is actually the concurrent law. Next they will consult their respective fishing interests to ascertain what changes are desired by the interests in both states, whether such proposals represent sound conservation measures and if not to develop a satisfactory substitute program that will be both sound and acceptable. Out of such practical, commonplace details is progress made. It takes time, patience, and understanding and it also requires governmental machinery to facilitate understanding, agreement and cooperation. This is one of the significant if not spectacular functions of the interstate commission.

In the North Atlantic Section the New England States are seeking to find an explanation for the greatly increased production of lobsters and the possible contribution thereto of various conservation measures like the uniform lobster act heretofore adopted. It explored the possibilities of a spring shrimp fishery in the Gulf of Maine and joined with the Middle Atlantic Section in requesting the creation by the Commission of a Committee on Sanitation in the Industry. The Section also requested the Fish and Wildlife Service to continue its excellent predator-control program by spraying the eggs of herring gulls and cormorants on the New England Coast.

Both the Middle Atlantic and North Atlantic Sections devoted much attention to pollution and joined in asking the creation of a Committee on Sanitation and Pollution control later authorized by the Commission at its annual meeting in New York in September 1945.

As an outgrowth of these discussions commissioners and technicians from Maine and New Hampshire met in October and agreed upon a joint study of the sources of pollution in the Piscataqua River Basin,

their nature and extent and ways of correcting them. Maine, as evidence of her interest, had already begun her part of the study. The New Hampshire commissioners promptly asked the Governor to appoint a special Pollution Commission and to make available to the State Department of Health $10,000 for a state-wide study and asked that it be begun in the Piscataqua and Great Bay areas. Within the last few weeks reports have been received from New Hampshire commissioners that the Governor has apointed the Commission and allocated $10,000 as requested by them, following their conference with the Commissioners from Maine.

It will be observed that nearly all of the matters cited above relate to the commercial fisheries. The Commission however has not been unmindful of the interests of the sports fishermen. Mention has been made of the Uniform Channel Bass Bill developed by the panel on this fish created by the Commission because of the interest of the sportsman and for no other reason, because this fish figures only to a slight degree in the commercial fisheries of the Atlantic States. This Uniform Channel Bass Bill limiting the daily take of sports anglers to two fish above 14 inches in length and fixing 14 to 32 inches as the legal size limits for fish taken commercially, and limiting channel bass to human consumption failed of passage in New York, New Jersey and Delaware. These states are awaiting action of the states farther south where the channel bass are more important before pressing for the adoption of this measure.

The minimum size limits for striped bass suggestion by the Fish and Wildlife Service, sponsored by the Commission and adopted by Massachusetts, Rhode Island, Connecticut, New York, New Jersey, and Pennsylvania have helped the angler as well as the commercial fisherman. The results of the Maryland management plan have likewise helped to build up the supply of bigger fish for the angler even though Maryland and Virginia still adhere to relatively small legal size limits (Maryland 11 inches and Virginia 12 inches) in the nursery area of the Chesapeake Bay.

It is in the field of work for the Atlantic salmon that the Commission has probably done the most for the angler. From the very beginning of the Commission in 1942 this fish has been a concern of the Commission. A report on it was presented to the Annual Meeting in 1943. The interest of the Executive Committee member from Maine in 1945 resulted in the passage of a bill, with the Commission's endorsement, in the legislature of that state to create a Salmon Study Commission with an appropriation of $5,000. Excellent preliminary work had been done by the Salmon Research Committee composed of representatives of the Fish and Wildlife Service and the Departments

of Inland Fisheries and Game, and of Sea and Shore Fisheries. The Salmon Study Commission with the cooperation of this Commission is now seeking to find ways of bringing back the salmon in increasing quantities in Maine, in the hope that later on the former runs in rivers farther south through New England can be restored.

If biological and physical obstacles can be overcome and this fishery restored, it will be a great boon to the angler. It may be necessary and desirable to close the fishery for a limited time, to forbid entirely the small amount of commercial fishing still going on, and to limit the season's bag for anglers. All these matters will in due time be studied and reported on by the Salmon Study Commission, whose reports the other states farther south in New England await with great interest.

The illustrations of interstate cooperation cited above are none of them breathtaking or spectacular. Progress in the conservation field, like the movement of a wave, is the resultant of many smaller movements in the same direction. Acting upon one another they assume recognizable shape and under the wind of informed public opinion gather force as they move along. So it is in the special field of conservation, which is the province of the Atlantic States Marine Fisheries Commission.

The Commission claims no special credit for all the specific bits of progress recorded. It is true that for many of them it has served as the catalytic agent in whose presence combinations take place. But behind it lies the work that others have done over the years, devoted scientists, educators, and plain folks, fishermen and conservationists. Recognizing this, the Commission has paid special attention to the work of its Committee on Fisheries Education whose excellent report presented at the Third Annual Meeting, September 1944, has been studied in the several states during the past year. Time does not permit more than the briefest summary. Interest in fishery education as part of a wider program of conservation education is being manifested up and down the coast. Noteworthy work has been done in Maryland, Virginia, Rhode Island, and Georgia and other states are beginning to study the possibilities. At some future meeting of the North American Wildlife Conference a special paper on this topic may well be justified. It is sufficient for the present to say that the subject is an important one and full of interest and that more and more attention is being given to it, but the results are not yet ripe for critical appraisal. Meantime the Commission at its Fourth Annual Meeting in September 1945, directed its executive to undertake the task of stimulating interest in and helping to develop programs in the several states for more intensive conservation education with emphasis on the fisheries, with a view to achieving part of the program recommended by

the special committee on Fisheries Education referred to in the Commission's report for 1944 (pp. 6-7).

Although it relates more particularly to the commercial aspects of processing and marketing than to conservation, the authorization by the Commission of a large Committee on Sanitation and Pollution Control is worthy of special mention. The Committee now in process of formation is to devote itself to developing recommended sanitary practices to assure to the public the highest practicable quality in fisheries products, ways and means of attaining such objectives and the parts to be played respectively by the industry and government agencies, state, interstate and federal, in attaining such goals. For further details readers are referred to the Commission's latest report (1945, pp. 11-13).

The Commission has recently taken steps to bring into closer collaboration with it, and with each other, leading fishery scientists and technicians in the service of the states along the Atlantic Coast and in the educational institutions, museums, marine laboratories and the industry located in them. This new Technical Advisory Committee includes in its membership many who are attending this conference. They are specially invited to gather after the session in a room to be announced by the presiding officer to consider a scientific problem which has been referred to them by the Commission.

The Commission has also undertaken to crystallize sentiment among the Atlantic Coastal States for several important measures pending in the Congress. One of these, S. 924—Cordon, would require that as part of the investigations and surveys for public works on rivers and harbors for flood control and other purposes there shall be investigations by the Fish and Wildlife Service of the Department of the Interior to insure that adequate provisions shall be made for the preservation and protection of the fishery resources and other biological uses of such waters, and that the reports and recommendations of such Service with respect thereto shall constitute a part of all the engineering survey reports submitted to the Congress or any committee thereof by the Secretary of War. A committee substitute for Senator Cordon's bill, H.R. 4503—Robertson, appears to be the measure most likely to pass. It differs slightly in form but the Commismission believes it would accomplish the same basic purposes as the Cordon bill and urges its support as a sound conservation measure.

Another bill, H.R. 3972—Bailey, is a practical measure designed to encourage the adequate treatment of industrial wastes for the purpose of reducing pollution that now harms or threatens to harm natural resources such as the fisheries, or make public waters unsafe or unsuitable for other public uses. The Commission believes that it is

in the public interest and fitting and proper to allow industrial taxpayers in computing net income for tax purposes to deduct amounts spent for the elimination of wastes under the supervision and with the approval of the applicable state or interstate authority having jurisdiction. The Commission therefore urges the adoption of this salutary measure.

The Commission is also supporting the McCarran-Sumners resolution, S.J. Res. 48—H.J. Res. 225 to "quiet titles of the respective states and others to lands beneath tide waters and lands beneath navigable waters within the boundaries of such states and to prevent further clouding of titles."

While the Commission realizes that the question at issue in this controversy does not affect directly the jurisdiction of the states over fisheries within territorial waters, the Commission feels that the fishery interests of the states are concerned in two respects. First, many of the states which are members of this Commission now lease state lands under water for the commercial production of shell fish and it is possible that leasing of such lands may in the future be extended for the commercial production of other localized species. The effect of any shift of ownership of such lands from the states to the nation or the clouding of the title of the states with respect thereto by the threat of such shift, would have the effect of confusing the present esablished policy of those states. Second, the attempt of federal officials to secure jurisdiction over submerged lands despite the long series of court decision upholding state title may well be followed by a similar assertion of the jurisdiction over the control of the fisheries within territorial waters which by court decision are now similarly under the jurisdiction of the states. The Commission would, of course, be compelled, as the joint agency of the Atlantic Coast States to oppose vigorously any such attempt.

The possible extension of state jurisdiction beyond the traditional 3-mile limit and implications in the proclamation by President Truman on September 28, 1945 are discussed at some length in the Commission's latest annual report (1945, pp. 19-20). The complexities of these jurisdictional matters preclude their treatment in the limited space of this paper but it is important to note that the Atlantic States Marine Fisheries Commission is taking the lead in asking the cooperation of the Council of State Governments in the calling of an intercoastal conference of all exterior coastal states and the Great Lakes States in Washington, May 16-17, 1946 to discuss these matters and to discuss the advisability of creating similar coastal commissions for the Pacific and Gulf Coasts.

Moreover the Commission has presented by committee and by reso-

lution to the State Department of the United States a formal request for the creation of a permanent channel of communication within the State Deparment by which the states may be kept informed of pending international treaties dealing with conservation matters of importance to the states, with the further suggestion that provision be made for state participation on international bodies concerned with the enforcement and administration of international agreements. Time does not permit more than a brief reference to these important matters of policy, but interested readers will find a full discussion of the implications of these measures in the Commission's latest report to the Congress and to the Governors of the compacting states (1945, pp. 16-18).

In conclusion, the Atlantic States Marine Fisheries Commission represents a new concept in interstate relationships in the fishery field on the Atlantic Coast. It has no power and wants none. It works quietly through conference, and correspondence to explore common problems that affect several states, to find solutions that are sound and acceptable. It searches out points of friction between states and provides a common meeting ground in which such conflicts are studied and discussed in friendly fashion until an acceptable solution is found. It attempts to crystallize opinion and develop leadership that gives promise of ever widening influence in coastal and national affairs. Those who brought about its creation believe that states on other coasts of our nation may find in its record a useful example and may wish to organize in similar fashion. In short, they believe that the record cited, though consisting in large part of details of progress here and there, when viewed as a whole constitutes a record of progress that has real significance and that gives promise of continuing achievement.

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PRELIMINARY STUDIES OF THE SHAD (*ALOSA SAPIDISSIMA*) CATCH IN THE LOWER CONNECTICUT RIVER, 1944

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The problem with which this report deals is to investigate the possibility of predicting any succeeding year's shad run in the Connecticut River within satisfactory limits of error for management purposes.

The recorded history of the shad run in the Connecticut River, taken from reports of catches made by commercial fishermen to the State Board of Fisheries and Game is complete from 1890. Although these data may not be entirely accurate as to the exact numbers taken by these fishermen, it is thought that the yearly totals will at least show when shad were abundant and when they were scarce. If this is assumed to be true, the shad fishery is characterized by succeeding periods of scarcity and abundance.

An angler's fishery located upriver from the commercial fishery has yearly yielded information since 1941 on total anglers per day, total hours fished, and total fish caught (Table 1). From these data

TABLE 1. SUMMARY OF RECORDS OF ANGLERS CHECKED BY PARTROLMEN AT ENFIELD DAM ON CONNECTICUT RIVER FOR THE YEARS 1941, 1942, 1943 1944

Year	Total number anglers	Total hours fished	Average hours per angler	Total shad caught	Average hours fished per shad taken
1941	3,449	10,190	2.95	6,859	1.49 (1 hr. 29 min.)
1942	5,172	15,472	2.99	5,395	2.87 (2 hr. 52 min.)
1943	2,340	8,033	3.43	6,519	1.23 (1 hr. 14 min.)
1944	5,110	18,913	3.70	9,370	2.01 (1 hr. 1 min.)

graphs were constructed to test a possible correlation between catch per hour and river volume, water temperature, and available fishing room. Little or no correlation could be detected between catch per hour and any of these three factors.

Scale samples, total lengths, and weights, and sex of 4,724 shad specimens were collected from anglers during the 1944 angling season. Length-frequency curves of specimens collected on chosen dates throughout the season showed a change in the average length of the fish as the season advanced and a progressive change in the sex ratio. They also showed that the average length of females was greater than the average length of males, but age classes were not defined. A length frequency curve of the entire collection gave an almost perfect bell curve. The peak of this curve contained 999 specimens at 18 inches in length.

The following report is based on the assumption that Connecticut River shad return to their parent stream to spawn.

It has been noted (Cable, 1943) that the Fish and Wildlife Service of the Department of the Interior had worked out a method of determining fishing intensity through the study of spawning marks on the scales of shad. An invitation was extended to the State Board of Fisheries and Game to send the writer to the Experiment Station at College Park, Maryland, for the study of this method. The theory of using spawning marks as an index to fishing intensity is based on the assumption that certain specific marks found on shad scales are formed only during the spawning migration into fresh water.

A reasonable hypothesis accounting for the formation of these marks during the spawning season is presented below:

It is believed that adult shad eat but very little or not at all while in fresh water. During this period, they expend a great amount of energy in their migration and spawning. It is also believed that growth of the shad ceases during the spawning migration. Much of the material required for last stages of ripening of the reproductive organs is thought to come from the body of the fish since it does not seem to be derived from food.

Annuli can be recognized on the scales of some species of fish and are thought to mark a time when the growth of that fish was impeded due to lower temperature or lack of food. It seems probable that a conspicuous mark would be found on shad scales due to cessation of growth, borrowing of materials from the body, and erosion of resorption of material from the scales. This mark, it is believed, should appear on the scales of all shad which undertake the spawning act. Minor crises apparently leave minor checks on the scales. (It has been noted by several authors that shad scales are difficult to read, often because of false annuli.) However, the spawning migration and act is a major crisis in the shad's life which is manifest by the large number of shad that die during or after the migration. Therefore, this major crisis should show on the scales as a conspicuous scar.

This mark should not appear on the scales of all fish caught but only on those which had spawned previously. If it appeared regularly on all fish caught, it could be interpreted as a winter mark. It is possible, but not necessary, that it should appear on the terminal margin of the etched portion of the scale of fish caught on the spawning run.

A mark has been found on shad scales that fits all the above requisites and, although it cannot be proved, as yet, that this is actually the spawning mark, it is probable that such is the case. On the basis

of this hypothesis, these marks will be interpreted as spawning marks and so referred to hereafter.

Parts of this hypothesis are supported by the work of other authors. Leim (1924, pp. 22 and 23) states that "The energy required for migration and the materials for the ripening of the reproductive products must have been largely supplied by the tissues. The fats had decreased notably in the spawning fish as compared with those taken in salt water during late summer." Again he adds that, "The substances which entered into composition of the reproductive organs during their rapid development previous to spawning must have been in a large measure derived from materials already stored up. This drain on the tissues, together with that occasioned by active migration which the fish undertook, would be sufficient to explain why the spawning fish lacked the fat which was so characteristic of the shad while in salt water during late summer."

It seems possible that scales of shad should be absorbed slightly along the margin during the spawning run, because apparently scales of other species may be so affected. Van Oosten (1929) quotes the following references: "H. Thompson (1926), 'Some haddock were so poor that the scales were absorbed slightly.' Miss Clark (1925), however, found that as a result of the long protracted spawning season, growth of the fish, *Leuresthes tenuis,* ceases during the months of May, June, and July and is resumed again in the fall. This cessation of growth during the summer months results in the formation of a breeding annulus on the scales. Growth continues during the winter and a winter annulus was formed only in rare cases."

Impressions of 848 scales were made at College Park and read by the writer and Miss Cable. It was found that 555 of the impressions

TABLE 2. MORTALITY AND ESCAPEMENT PER YEAR OF 1,000 FISH AT DIFFERENT MORTALITY RATES WHEN EACH RATE REMAINS CONSTANT OVER A PERIOD OF YEARS

Years	40 per cent Mortality		50 per cent Mortality		60 per cent Mortality		70 per cent Mortality		80 per cent Mortality		90 per cent Mortality	
	40% Die	60% Live	50% Die	50% Live	60% Die	40% Live	70% Die	30% Live	80% Die	20% Live	90% Die	10% Live
1	400	600	500	500	600	400	700	300	800	200	900	100
2	240	360	250	250	240	160	210	90	160	40	90	10
3	144	216	125	125	96	64	63	27	32	8	9	1
4	86	130	62.5	62.5	38	26	19	8	6	2	0.9	0.1
5	52	78	31	31	16	10	6	2	1.6	0.4		
6	31	47	15.5	15.5	6	4	1.4	0.6				
7	19	28	8	8	2.4	1.6						
8	11	17	4	4	1.0	0.6						
9	7	10	2	2								
10	4	6	1	1								
11	2	4										
12	1.6	2.4										
13	0.96	1.4										

had no spawning mark, 210 had one, 70 had two, 11 had three and 2 had four.

Any constant percentage decrease can be calculated. It can also be assumed that the mentioned decrease can be a mortality rate. Starting with 1,000, ideal mortality rates have been computed for various percentages and are found in Table 2. These constant percentage decreases may also be plotted as in Figure 1. The totals of each spawning class in the 848 specimen samples from the Connecticut River were

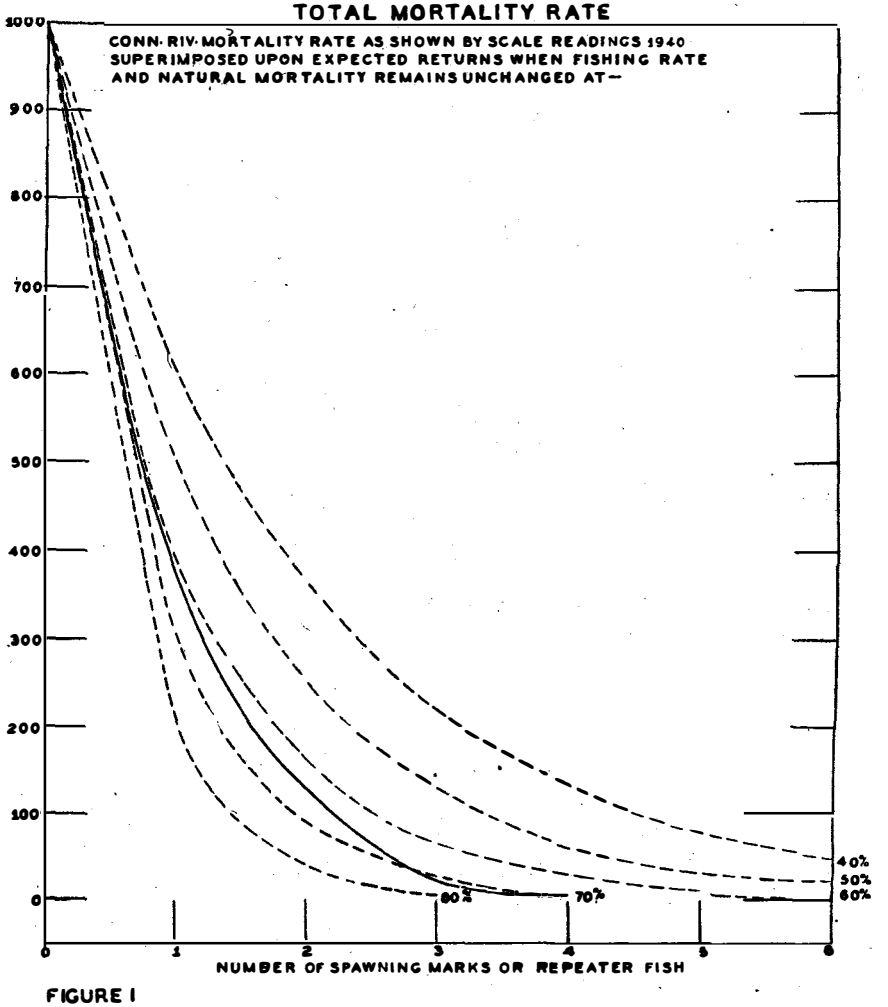

FIGURE 1

each multiplied by the factor that would transform the 555 virgins to 1,000. On this basis the sample would be represented by 1,000 virgins, 378 first mark spawners, 126 second mark spawners, 20 third mark spawners, and 4 fourth mark spawners. These figures, represented by a solid line, were plotted superimposed over the calculated rates of decrease in Figure 1. Greeley (1936) is of the opinion that shad spawn each year. If this is assumed to be so, then all surviving classes of adult shad are found in the spawning run. Through scale reading, a sample from the spawning run may be separated into its component parts of virgin fish, those that have spawned once before, those that have spawned twice, et cetera. It would be expected that any true sample would contain fewer individuals in each succeeding older spawning class because each class has been reduced by a yearly mortality rate the number of times indicated by the number of spawning marks on the scale. The sample of the Connecticut River shad does show a nearly constant reduction in numbers of individuals within each class from the youngest to the oldest. When the totals of these individuals in each spawning class was plotted in Figure 1 over calculated reduction rates it fell between the curves representing 60 per cent and 70 per cent. It would then appear, after more careful analysis, that the mortality of the Connecticut River shad had been between 62 per cent and 73 per cent, but this might not be true. These calculations were based on comparison of each succeeding spawning class to the preceding class. Fewer individuals in the older class might mean either that that group had been reduced by a mortality rate or that it had remained constant in numbers and the succeeding spawning class had been larger. Thus, two unknown factors may combine to produce the percentage figure originally thought to be the mortality rate. If it could be assured that the run of virgins was equal in number from year to year, then one of the unknown factors would be eliminated and it could be assumed that a true mortality rate could be found by comparison of the number of virgins to the number of one mark spawners in the sample of any run.

In order to test this method of calculating mortality, Table 3 was constructed to show what would happen to hypothetical runs of virgin shad if virgin population changed from year to year and mortality rates also changed. Nothing in this table as given has actually happened. It merely shows what the composition of each year's run would be if virgin populations and mortality rates were as listed.

Reading from left to right at the top of the page, the runs are separated as listed by year dates. In line under this, an arbitrary virgin population for that year is listed, and a mortality rate, given as a percentage, is included in brackets. Each year's virgin population

TABLE 3. SHOWING EFFECT OF VARYING VIRGIN POPULATIONS ON APPARENT MORTALITY RATES

	1944	1943	1942	1941	1940	1939	1938
	100,000	50,000 (75%)	75,000 (80%)	80,000 (75%)	80,000 (75%)	80,000 (75%)	50,000 (50%)
	87.5%	70%	73.3%	75%	75%	68.8%	
(1st spawners)		125	300	267	250	250	312.5
		80.8%					
(2nd mark spawners)			37.5	80.1	66.7	62.5	78.1
		78.5%					
(3rd mark spawners)				10	20.0	15.6	19.5
(4th mark spawners)					2.5	4.7	5.2
(5th mark spawners)						.59	1.5

NOTE: Real mortality rates for each year included in parentheses ( ). Apparent mortality rates are underlined. Any year's sample, based on a thousand virgins from the year chosen, may be found by reading the real numbers diagonally down from the upper left hand margin toward the lower right. Example—a sample with 1,000 virgins taken in 1944 would also contain 125 one mark spawners, 37.5 second mark spawners, 10 third mark spawners, 2.5 fourth mark spawners, and .59 fifth mark spawners. (See text.)

will be reduced by this percentage. The column under 1944 was given a virgin population of 100,000 and 1943 was given one of 50,000. It will be remembered that the mortality rate was established by a comparison of the number of virgins with the number having one spawning mark. After the scales had been read, if 500 virgins were found, it would be necessary to multiply this number by two to raise it to 1,000. Then the number of first, second, third, and fourth spawners found in the catch would also be multiplied by two. If it were assumed that 1,000 virgins appeared in the sample for 1944, which had been arbitrarily assigned 100,000 virgins, then 1/100 of that year's run of virgins was taken. If this is a fair sample it is logical to assume that 1/100 of the fish remaining in each spawning class was taken. However, the 50,000 virgins of 1943 had been reduced to 12,500 by a 75 per cent mortality rate. If 1/100 of these had been taken, the sample would contain 125 shad. This would be only 12.5 per cent of a thousand and would show an apparent mortality rate of 87.5 per cent, although the virgins for that year had actually been reduced by only 75 per cent. Likewise, if 1,000 fish were taken from the 50,000 virgins in 1943, 1/50 would be taken and 1/50 of the remaining first spawners of 1942 would be taken. The virgins of 1942 had been reduced by an 80 per cent mortality rate which would have left 15,000 to appear in the run of 1943. If 1/50 of these were sampled as were the virgins of that year, 300 would appear in the sample. This would show an apparent 70 per cent mortality rather than the 80 per cent which had really reduced that year's virgins. Table 3 was calculated in this manner.

In order to find a method of determining true mortality rates, through study of spawning marks, it is necessary to have an adequate sample of scales from each year's run. This sample should be representative of the composition of the year's run. An index of abundance of virgins is also necessary. This can be found from the index of abundance of the whole run by using the simple formula given below. The spawning classes of the samples of the two consecutive years being treated must be placed on a comparable basis, the simplest means being that already decribed of dividing the virgins into one thousand and multiplying each remaining spawning class by the quotient.

When IV = Index of abundance of virgins $\quad IV = \dfrac{RA_1(TS_2)}{RA_2(TS_1)}$

RA_1 = Relative abundance of current year
TS_2 = Total sample for previous year
RA_2 = Relative abundance of previous year
TS_1 = Total sample of current year

(TS = 1,000 virgins and number of repeaters with one spawning mark $R_2+R_3+R_4+R_5$ etc.)

When the relative abundance of each year's virgins is known, the mortality rate may be found by the following formula:

When MR = Mortality rate $\qquad MR = 1.00 - \frac{IV_1(FS_1)}{(IV_2)\ V_1}$

FS_1 = Numbers of repeaters with one spawning mark in sample

IV_1 = Index of abundance of virgins for year when sample was taken

IV_2 = Index of abundance of virgins for the previous year

V_1 = Number of virgins found in year when sample was taken

This formula utilizes the theory of mortality rates, but eliminates the necessity of graphs or tables for finding them.

The system of finding mortality rates for each year's shad run seems to have little value in Connecticut's problem because of lack of a substantiated index of abundance and because mortality rates found by this method will always be a year behind. When samples are taken for any year, the reduction in numbers of the virgins of the previous year is known. It is the mortality rate of that year which is shown by the reduced number of first spawners that appear in the sample. Possibly, however, this method should not be lightly discarded because it may hold some of the answers to Connecticut's problem. If a true index of abundance can be found for a series of years, true mortality rates for each of those years may be found through scale study. If fishing intensity greatly influences the yearly mortality rate of successive years, the mortality rate should vary directly, though not proportionately, with the number of nets fishing for those years. If it is shown by comparison that the number of nets fishing does greatly and directly influence the mortality rate for each of these years, then it will be possible, knowing the index of abundance and the number of nets fishing for a current year, to predict within reasonable limits of accuracy, what the mortality rate has been for that year. If the mortality rate can be found in this way for any year, the escapement is also known for that year. The escapement of any year, minus the natural mortality rate for the balance of that year, makes up the run of repeaters for the following year. Those fish lost by natural mortality could be presumed to be the difference between the numbers expected to return as repeaters and the numbers of repeaters found to have returned. The numbers of virgins expected in

each year's run might be estimated as the average from a 10-year period. Thus it can be seen that, with the information available in the future, there is, at least, a possiblity of predicting the size of a successive year's shad run in the Connecticut River within satisfactory limits of error for management purposes.

SUMMARY

1. The history of the shad fishery in the Connecticut River shows great variation in the total yearly catches of shad.

2. Length-frequency curves made from data from angler's catch fail to indicate that age classes are characterized by difference in average size of individuals.

3. Catch per hour of angling shows little correlation with daily river volume and available fishing space during the 4 years studied. Catch per hour in 1943 and 1944 did not appear to be influenced by water temperature.

4. A method of finding yearly mortality rates as determined by identification of spawning classes through scale study is explained and criticized. It is shown that this method is of little value in estimating the size of a succeeding year's run of shad in the Connecticut River unless an index of relative abundance of yearly runs can be found. The value of the use of mortality rates in estimating the next year's run is limited because sampling and scale reading of any year gives only the mortality rate of the previous year.

ACKNOWLEDGMENT

The author wishes to express his appreciation for the direction and assistance of Dr. Daniel Merriman and Dr. Herbert Warfel of Bingham Oceanographic Laboratory, Yale University, New Haven, Connecticut, in preparation of data for this manuscript. He acknowledges grateful appreciation to Miss Louella Cable of the Fish and Wildlife Service, Department of the Interior, College Park, Maryland, for assistance in mounting and reading scales. He is also indebted to Dr. William Herrington, of the Fish and Wildlife Service, Department of the Interior, Cambridge, Massachusetts; to Dr. R. P. Hunter and Mr. Lyle Thorpe of the Connecticut State Board of Fisheries and Game, Hartford, Connecticut, for aid in the preparation of the manuscript.

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DISCUSSION

CHAIRMAN MERRIMAN: Is there any discussion on Mr. Moss' paper? I would like to know about the matter of interpretation annually of shad scales and the very recent book which came to my desk not so long ago from Russia—voluminous work on shad and the interpretation of shad scales. Have you anything to comment?

MR. MOSS: I saw the book and there happened to be an English summary at the end of each chapter. I perused that briefly.

They apparently, on the species of herring which they don't call shad, have found annually what they call "spawning marks." They have annually an interpretation of what they call "spawning marks"—the peculiar way they form. They think that the fish are fat before spawning but after spawning or during and after spawning, a great deal of that fat is lost and the skin stretches down and becomes slack over the reduced skeleton and frame. That crumbles the scales around the socket edges where they are soft and the spawning mark is produced in that way. Now, whether that is the way the spawning marks are produced in the Atlantic Coast shad, I don't know, but at least they do recognize a spawning mark.

THE DISTRIBUTION OF THE WINTER FLOUNDER (*PSEUDOPLEURONECTES AMERICANUS*) AND ITS BEARING ON MANAGEMENT POSSIBILITIES

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The winter flounder, *Pseudopleuronectes americanus,* is one of the select group of American North Atlantic fish that is equally popular with both the commercial fisherman and the salt-water angler. While the commercial fishery is widely scattered along the coast from Maine to New Jersey, its chief center of activity is southern New England and New York. In these areas, the bulk of the catch is taken by small otter trawlers under five net tons and generally manned by less than three men. The boats fish out of many scattered points such as Provincetown, Hyannis, Woods Hole, and New Bedford, Massachusetts; Point Judith and Galilee in Rhode Island; New London and Stonington in Connecticut; and Northport, Port Jefferson, Mattituck, Montauk, Babylon and Freeport in New York—to mention but a few of the more important ports of landing. Interspersed among these ports are many other minor ports out of which one or more boats may fish.

The small size of the winter flounder dragger confines its fishing activity to the shoal waters adjacent to the shore and also to within a relatively short distance of its home port. Thus, the economic well-being of the fishermen and their families is dependent on a continued good supply of fish in a relatively limited area.

The sport fishery for winter flounders is most important south of Cape Cod, particularly in the waters around Long Island, New York, where the proximity of the recreational facilities of Long Island to the large population of New York City has encouraged the development of an extensive sport fishery for many species of fish including the winter flounder. Similarly, an extensive sport fishery has developed in Rhode Island, Connecticut, and New Jersey, particularly near population centers. Many of the fish are caught off docks, piers and shore, or from row boats, and to a lesser extent from power boats. The gear used is relatively simple and inexpensive, ranging from hand lines to light rods and reels with one to three hooks attached close to the sinker or to a "spreader" rig made from a piece of wire. Sea worms and clams serve as bait. The ready availability of the winter flounder to the angler and the simple and inexpensive gear needed to catch it are to a great extent responsible for the large sport fishery for winter flounder.

Aside from the recreational value of the winter flounder to the sportsman, towns adjacent to important fishing grounds benefit monetarily from the angler's activities. Money obtained from the sale of bait, tackle, food, drinks, and gasoline and from rental of rooms and boats materially adds to the income of many primarily "resort" towns. A scarcity of winter flounders on accessible grounds discourages sportsmen from visiting these towns, and this results in a decreased revenue.

All in all, it may be concluded that the winter flounder is of such importance in the region of southern New England and New York that every effort should be made to insure a good supply of fish.

Available information on the life history and distribution of the winter flounder indicates the possibility of developing a management program which could accomplish this purpose. The fundamental biological data upon which the proposed management program is based may be divided into three categories: (1) The early life history and distribution of the young of the winter flounder; (2) the size and age composition of the winter flounders subject to the commercial and sport fisheries; (3) the distribution of winter flounders of sizes subject to the commercial and sport fisheries.

1. *The early life history and distribution of the young of the winter flounder.*—The early life history and distribution of the young of the

winter flounder is fairly well known. In southern New England and New York, spawning occurs in shoal waters of from 1 to 3 fathoms from about mid-December through May (Bigelow and Welsh, 1925, p. 505; Perlmutter, 1939, p. 21). The peak spawning period varies throughout the range of the species according to the temperature of the water which, on the shallows of the spawning grounds, fluctuates considerably in relation to changes in air temperature. Unlike most commercial species of fish, the eggs are not buoyant but sink to the bottom where they stick together in clusters (Breder, 1923, p. 311). Masses of such eggs often are found on the commercial fyke nets set for winter flounders in the shoal waters along the channels of Great South Bay, New York.

The predominant physical forces affecting the movement of eggs and larvae in the protected waters of the spawning habitat are wind and tide. Because the winter flounder eggs are adhesive and demersal, their distribution is relatively little affected by wind and tide. Consequently, it is reasonable to conclude that the young in any one area are primarily the product of spawning fish in that area.

Throughout the first year of life, the winter flounder is mainly limited to the shoal waters along the shores of the bays and estuaries where it is readily captured by beach seines. As they grow older, the fish tend to wander away from the shores into the deeper, adjacent waters.

2. *The size and age composition of the winter flounders subject to the commercial and sport fisheries.*—In obtaining information on the size composition of the winter flounder catch, particular attention was paid to the more important fishing areas in southern New England and New York, including Nantucket Shoals off southern Massachusetts; the region off Point Judith and Watch Hill, Rhode Island; and Long Island Sound, Gardiners Bay, the Peconic Bays, Shinnecock, Moriches, and Great South Bay on Long Island, New York.

Winter flounders in Long Island, New York, waters enter the commercial and sport fisheries at from 7 to 8 inches depending on locality and season (Lobell, 1939, pp. 78-81; Perlmutter, 1940, p. 16). Many of these smaller-sized fish are retained by the angler, but in commercial practice, fish under 10 inches in length are usually thrown back since they are undesirable as market fish. The same general conditions hold for southern New England waters. Length frequency samples of the commercial catch of winter flounders taken from May 1940 through February 1942 off Watch Hill, Rhode Island,—an area fished by both Connecticut and Rhode Island boats—show fish entering the catch at from 7 to 9 inches (35 to 45 half-centimeters). This was also true for the region of Point Judith, Rhode Island, during

approximately the same period (Figure 1). In the Nantucket region, winter flounders enter the commercial catch at 10 inches (50 half-centimeters) in length. Smaller fish are not taken, primarily because the flounder fishermen in that area use a large mesh net which permits unmarketable sizes of flounders and "trash" fish, particularly the sculpin, *Myoxocephalus octodecimspinosus,* to go through.

Preliminary age studies of winter flounders in New York waters show that fish between 8 and 10 inches long are 2 to 3 years old

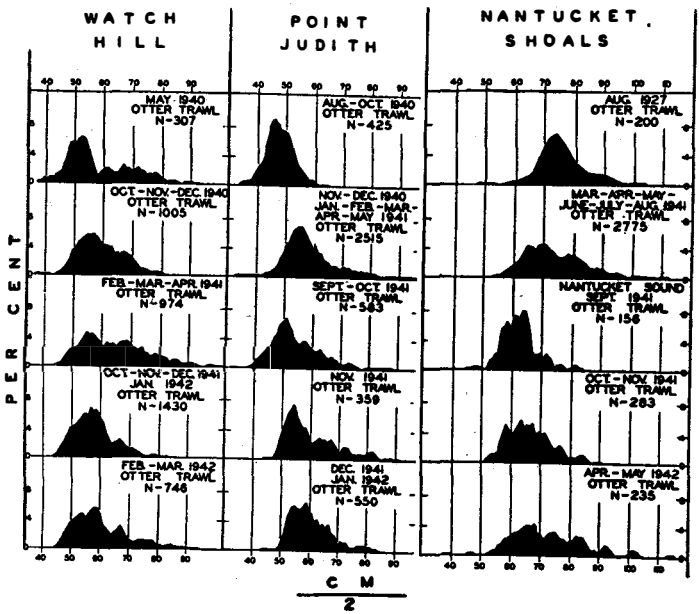

Figure 1. Length composition of blackback caught off Watch Hill and Point Judith, Rhode Island, and Nantucket Shoals, Massachusetts. Measurements to nearest half-centimeter. Data smoothed by a moving average of threes.

(Lobell, 1939, p. 86; Perlmutter, 1940, p. 16). Furthermore, field observations in the New York area indicate that fish in this size category are mostly mature [which is in agreement with observations made by Bigelow and Welsh (1925, p. 505)]. Information on the ages of winter flounders in southern New England waters is not available but may be expected to be similar to results obtained in New York waters.

Summing up, it has been established that: (1) The young of the winter flounder in an area are mostly the product of local spawning; (2) they remain in the shoal water near the shores of the bays and estuaries during the first year of life; (3) as they grow older, they

tend to move off into adjacent deeper water and in the second and third years, begin entering into the catch of the commercial and sport fisheries.

3. *The distribution of winter flounders of sizes subject to the commercial and sport fisheries.*—Information on the distribution of winter flounders subject to the commercial and sport fisheries was obtained primarily by means of tagging experiments. Samples of fish from the catch of commercial fishermen or taken by otter trawls and fykes operated by Fish and Wildlife Service personnel, were marked with celluloid disc tags. The technique used, numbers of fish tagged, and

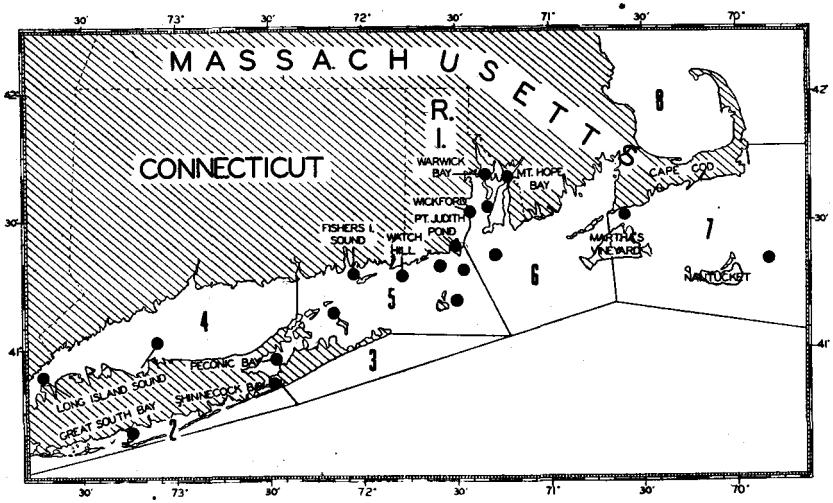

Figure 2. Areas used in analysis of blackback tagging experiments. Solid circles indicate tagging localities. Area 1, New Jersey Coast; Area 2, Great South Bay, Moriches Bay, and Shinnecock Bay; Area 3, ocean off the eastern part of the south shore of Long Island; Area 4, Long Island Sound; Area 5, Block Island Sound including the Peconic Bays and Gardiners Bay; Area 6, Narragansett Bay and the waters east of Point Judith to Martha's Vineyard; Area 7, east of Martha's Vineyard, waters about Nantucket and Nantucket Shoals; Area 8, Cape Cod Bay; Area 9, vicinity of Cape Ann, Massachusetts

localities in which fish were tagged will not be discussed in detail at the present time. Preliminary information on these subjects is contained in reports by Lobell, 1939, Perlmutter, 1940, and will be described in greater detail in a future report.

In planning the tagging experiments, a particular effort was made to distribute them as widely as possible throughout the more important winter flounder fishing areas, as shown in Figure 2. Experiments were conducted in the Great South Bay, Shinnecock, and Moriches Bay regions off southern Long Island; the western and eastern Long Island Sound region accessible to the northern Long Island

and Connecticut fishermen; the Peconic and Gardiners Bay area accessible to the eastern Long Island, Connecticut, and Rhode Island fishermen; Point Judith, Narragansett Bay, and Block Island Sound areas accessible to the Rhode Island fishermen; and the Nantucket Sound and Shoal areas accessible to the southern Massachusetts fishermen.

To facilitate analyis of the data, the coastal waters from Massachusetts to New Jersey were divided into nine areas (Figure 2). Area 1 is the Jersey Coast; Area 2, Great South Bay, Moriches Bay and

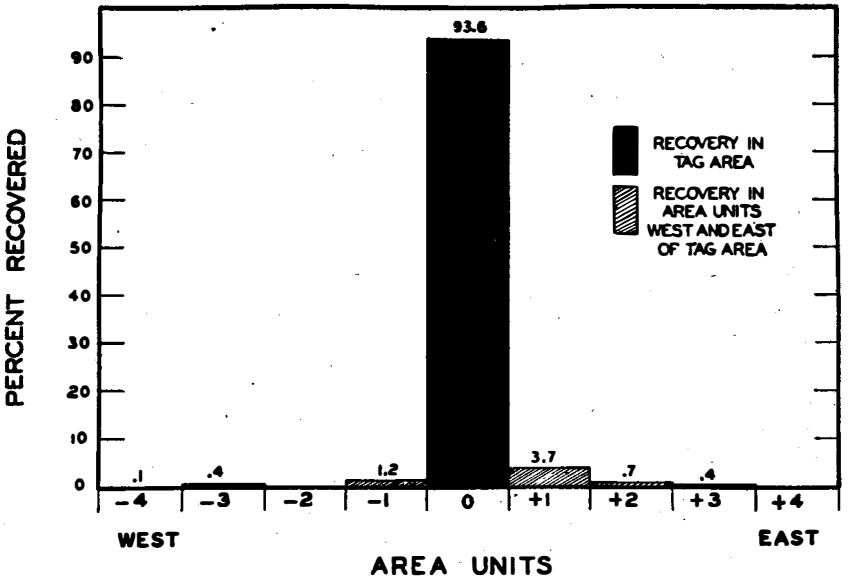

Figure 3. Percentage of winter flounders recovered from tagging experiments in southern New England and New York bays in the tag area and by area units west and east of the tag area; 10,172 fish tagged, 1,767 recaptured.

Shinnecock Bay on the south shore of Long Island, New York; Area 3, the ocean off the eastern part of the south shore of Long Island, New York; Area 4, Long Island Sound; Area 5, Block Island Sound including the Peconic Bays and Gardiners Bay; Area 6, Narragansett Bay and the waters east of Point Judith to Martha's Vineyard; Area 7, east of Martha's Vineyard, the waters about Nantucket and Nantucket Shoals; Area 8, Massachusetts Bay; Area 9, waters off Cape Ann, Massachusetts. Returns from these experiments are summarized in Figure 3.

The area in which the fish were tagged is numbered zero. Each of nine areas mentioned previously are considered as area units. Going

east from the tag area, the area units are consecutively numbered from +1 to +4 and west from —1 to —4. The percentage of returns in the tag area is indicated by the solid bar and returns in other areas by the hatched bars. Out of a total of 10,172 fish tagged in southern New England and New York bays, 1,767 were recaptured. Of these, 93.6 per cent were recovered in the tag area and 4.9 per cent in the adjacent eastern and western areas. Therefore, it may be concluded that the winter flounders in southern New England and New York bays are largely localized stocks. Any movement of fish away from these bays is not a directed migration but rather a gradual dispersion from population centers, a characteristic phenomenon with nonmigratory animals.

Management possibilities.—Since young winter flounders are the product of local spawning and the stocks of adult fish drawn upon by the sport and commercial fisheries remain highly localized, it follows that each of these resident stocks offers the same management possibilities to nearby communities as do their clams, oyster, and scallop resources. To get the most out of such a natural community resource, certain basic statistical and biological information is essential including: (1) The annual drain on the flounder population (total catch); (2) the effect of this drain upon the relative size of the population (catch per unit of effort); (3) the annual recruitment (obtained from the age composition of the stock and the catch per unit of effort).

Such information can be obtained through well-planned tagging experiments, collection of complete statistics on the total catch and effort expended, and supporting biological data such as age, composition of the stock, growth, and length—weight relationship. With these data as a foundation, it would be possible to determine the maximum amount of fish that could be removed each year from a local stock without injury to the stock and to regulate the catch accordingly.

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DISCUSSION

CHAIRMAN MERRIMAN: Is the matter of age analysis confined entirely to scale work or is there some otolith work?

DR. PERLMUTTER: There has been some otolith work from Rhode Island State College. You can check age from the otolith but you can't get any good information on the comparison of growth rates from one area to another and so on because you can't use the otolith the same way as you can the scale—you can't calculate age. You can calculate age from the scale. I don't think anybody has ever done it very well because the margins of the otolith do not show up as well as the scale margins do.

DR. EMMELINE MOORE (New York): Did I understand you to say that the 7-inch fish would be about 2 years old?

DR. PERLMUTTER: That is right, according to what was determined near Long Island, somewhere between 2 and 3 years old.

DR. MOORE: It seems a rather rapid growth.

DR. PERLMUTTER: They grow rapidly for the first 3 years, we know that, because, during our survey, the 1-year-old fish, in Long Island, we were able to get in the spring of the year; we were able to get the young of the year previous—those about 5 or 6 years old definitely showed about just one check. This has been verified in unpublished data in Rhode Island State College. Unfortunately, there has never been a really good job on age analysis. We don't consider our job an expert one. Most of the work had to be rushed under certain conditions which we couldn't avoid. We didn't always have the facilities to attend to detail that we would have liked.

DR. MOORE: I do think a great deal of help in that analysis is found in the correlations of scale and otolith.

DR. PERLMUTTER: Oh, yes, it would check. We have a disadvantage in winter flounder that you can't check all ages of the young and that is not true of most species of fish.

CHAIRMAN MERRIMAN: Dr. Warfel, did you have a question?

DR. HERBERT E. WARFEL (Connecticut): I didn't quite understand the graph in which you showed the distribution of returns from your taggings. That is an over-all general picture that could be referred to any geographical unit?

DR. PERLMUTTER: That represents a summary of all experiments of fish tagged in the bay. We have another summary which was taken outside the bay which doesn't concern the problem. That involves all experiments of Connecticut and Rhode Island. The place where they were tagged was zero. If the fish was in one unit area away from the tagged area, we put it in this column (indicating).

DR. WARFEL: Is that on an annual basis?

DR. PERLMUTTER: That comes from all 3 years and 4 years. We have done it for this purpose—I didn't want to go into great detail—we have it on an annual basis in our final summary. When you throw the 4 years together, you still get this percentage.

DR. WARFEL: With regard to your age analysis, what is the maximum means you have been able to reach on the scale?

DR. PERLMUTTER: We got a very rough age analysis. It isn't an age analysis that I would want to publish except to say this is what we get, this is the type of age, 3 years and 4 years is what we got by reading checks. We checked the first years by the otolith standard, but we didn't go through with it the way we wanted to. We went up to 5 years.

DR. WARFEL: Do you think the fish are 2 years or 3 years or both when they come into the fishery?

DR. PERLMUTTER: I think they are both and I think probably it varies greatly—each big area or locality to another, from one bay to another. I don't think you can take the results from one bay and apply them to another, that is, not from one little bay to a large bay, because they are localized and we have done mesh studies which I didn't mention here, which show variations up and down the coast but no general pattern of variation.

DR. WARFEL: Thank you.

SENATOR FREDERIC C. WALCOTT (Connecticut): Has the speaker ever read Dr. Borden's report? We hired him in Connecticut in 1926-27 and possibly '28, I am not sure, he went into it very carefully. The first thing he did was to stop letting them up the mouth of the river. We preferred to let the fish go up. Then the next thing we did was to close off the salmon river and they were down to such a low ebb—the shad fishery on the Connecticut River—that they let the gear rot and some of them threw their gear away. Most of them stopped their fishing.

We got it back so that it exceeded the catches of 1893 and '94, which are record catches, by stopping the netting at the river and then catching the fish, stripping them and hatching them out. Then we used rods and let them all out with the fish that hatched normally in the river.

CHAIRMAN MERRIMAN: I think you have reference to Mr. Moss' paper on the shad particularly.

SENATOR WALCOTT: Borden was the man who did all the scientific work.

CHAIRMAN MERRIMAN: You are wholly correct, and Mr. Moss, I know, has read that paper and knows it very thoroughly, indeed.

I would like to ask Dr. Perlmutter a question, if I may. It involves the matter of meristic counts in these things. Are the populations of winter flounder wholly separate and isolated and is that detectible by blood counts or scale counts or blood ray counts?

DR. PERLMUTTER: One of the difficulties of meristic character is that the variation is dependent to some extent on section and to some extent on age classification, that is, the year classification in which the fish happens to be. The environment seems to have some effect on the meristic character so that a meristic class born in 1943 and one born in 1945 might have some variation in the meristic counts which would be due to environment and nothing to do with the genetic composition of the stock.

So, it is a very dangerous character to use unless you have a tremendous amount of material over a long period of time to allow for that. One place I was certain it meant something was in differentiation between the *Pseudopleuronectes dignabilis*, the lemon sole, and the *Pseudopleuronectes americanus*. Some people say the lemon sole is another species and others say it is a big flounder, so I am still not sure.

I can differentiate between the lemon sole and winter flounder commercially. The winter flounder is anything weighing less than 3 pounds from a commercial standpoint and anything that looks like a winter flounder under 3 pounds, is a lemon sole. Unfortunately, most fish that come from Georgian Bay, which is where the lemon sole is supposed to have originated—but the ones from other areas, particularly Connecticut, Rhode Island and New York, are mostly under 3 pounds, so they are predominantly blackbacks, but if you take the dorsal ray counts of those animals, you will find there is a considerable difference in the average ray counts.

The ray counts, I think, are about 61 to 67 for the blackback and somewhere from 65 to 72 for the lemon sole. That is just a dorsal breakdown. It is higher for the lemon sole.

CHAIRMAN MERRIMAN: Higher in the open water?

DR. PERLMUTTER: That doesn't mean much either any more. I have a lot of species that don't work that way.

CHAIRMAN MERRIMAN: I am very interested in that because in working on another species of fish, the ocean trout, we have interesting variations in the vertebral count from different areas and it is possible to interpret that on the basis of the bay races as opposed to open water races.

DR. WARFEL: You are getting the same result that Smitty got in Europe.

DR. PERLMUTTER: So identically the same that it is startling.

DR. WARFEL: May I ask one more question on this age matter that just occurs to me? What was the dominant age phase that you had in Europe?

DR. PERLMUTTER: There was no one. There were three, four and five in the limited time age work, with four predominating in the catch. After five, we didn't get very many. This was primarily Long Island.

DR. WARFEL: That is where I am working, too.

DR. PERLMUTTER: Connecticut and Rhode Island would probably follow, but in southern Massachusetts, you have a different group there.

MR. DAVID H. WALLACE (Maryland): Do you find any differential growth rates in various age groups depending upon the size of the population?

DR. PERLMUTTER: You are going down a lot finer than I could possibly go. I had to cover the fisheries from Maine to New York and I couldn't go into that detail.

MR. WALLACE: You were saying you had various populations localized.

DR. PERLMUTTER: I based those on tagging primarily. I haven't gone into the biology of each one trying to find the difference in growth rate or anything of that sort. That is something that would require a lot more study than I can possibly give.

MR. WALLACE: But won't you need to have something like that to work out eventually, a management plan for these local populations?

DR. PERLMUTTER: I recommended, as a matter of fact, that each area would have to do that with the area unit and the area units are worked out—it is up to the individual areas that are most concerned about their fishery to do something about it. All we can do is point out these things to the people who are interested.

MR. WILLIAM NEVILLE (New York): In connection with your question, Dave—you probably recall this, Al—that at least the Long Island populations, that is, taking all the ocean and eastern bay and Long Island Sound, there are significant differences in population units as indicated by size, the rates of growth. We seem to have much larger populations, that is, a larger size, in the eastern bay region, as compared to perhaps lesser growth rates or smaller size fish comparatively in other areas and that, obviously, shows up in different growth rates for different ages.

But I would like to ask our friend, Al, a rather embarrassing question, perhaps. Would you say that the winter flounder population is subject to overfishing in view of fishing density or would you consider the population is more subject to unwise or inefficient fishing on the basis of prevailing size limit?

DR. PERLMUTTER: If I have to give you an answer, I would say it is inefficient fishing rather than overfishing. We can't say what has happened to the winter flounder population because nobody has kept a record of the population as a unit. Before 1895, they were catching them by hook and line and in 1895, they started using a trawl, that is, a beam trawl from Provincetown, and from there on, it developed from a power boat fishery, which was an otter trawl mostly, but in all that time, all the statistics we have been able to get have been a combined catch of flounders. I have tried to break it down into winter flounder and four other species, but I can't do it.

In 1937, they started to take statistics by individual flounder species, but even that, up to the present time, is not adequate because that is only based on an annual catch, which is a rough estimate of the catch. It still doesn't give us figures for many of the states where the flounder is most important, but it does give us figures by individual areas. All we have is the roughest of estimates. As a matter of fact, it might be because of the difference in popular names. We were getting yellow tail classified as winter flounder in Provincetown.

MR. NEVILLE: Isn't it true that the recommendations to date have been more along the general lines of increased size limits to take advantage of the rapid period of growth which fits into the economic picture?

DR. PERLMUTTER: It is still better utilization of what you have. Rather than saying, "This thing is on the skids and it must go down," it is a question of this is the way we have it now. We don't know what happened in the past, but all we know is this is what we have. How shall we use this resource? We can use

it much better than we are using it now provided we know what we have there and what we can do with it.

DR. WARFEL: Is there any indication, Dr. Perlmutter, that fisheries actually have declined?

DR. PERLMUTTER: Scientifically, I can't say. If you want my opinion, I think it has gone down some.

DR. WARFEL: You haven't any data along that line at all?

DR. PERLMUTTER: I have some information from fishermen's log records that would indicate some decline in the catch per day from the early 1930's to the present time. There are only a few log records. Most fishermen's log records for that size boat are very poor. Many of the papers are missing, but we also know that the fleet has dwindled to a large extent, which indicates that something has happened, but there is an economic condition that comes in there that can't be interpreted. The rise of the yellow tail fishery, for example, has put a lot of the fishermen into the yellow tail from the blackback because it pays more in the present economic conditions where the ceiling price is pegged. So, it is hard to say from our information that it has taken a drop.

DR. WARFEL: Have you any indication within the population itself?

DR. PERLMUTTER: Biologically? No, because you don't have enough material way back to compare it with.

DR. WARFEL: Do you know if the Borough has any size measurements back in 1912-14, along in there?

DR. PERLMUTTER: No.

DR. WARFEL: Nobody bothered to measure?

DR. PERLMUTTER: No.

MR. NEVILLE: You might get that from the hatcheries.

DR. PERLMUTTER: They only keep the females in the hatcheries. They never kept a record of the males. There is a possibility that some records are hidden in the hatchery. I will take that back, if you find them. I have never been able to.

MR. WILLIAM F. ROYCE (Massachusetts): I would like to ask for some information. I have been summarizing some of your tagging data after you turned the records over to me and I calculated the mortality rate for the Rhode Island blackback population from the several tagging experiments that you did there was in the neighborhood of 50 per cent per year, which does not seem too high for a species which comes into the fishery as young as the blackback flounder. The Nantucket Shoals population had a similar mortality rate as calculated from the tagging data.

DR. PERLMUTTER: For Nantucket Shoals I would say that 50 per cent wouldn't mean as much as in the Rhode Island tagging experiments, although even there, there might be some question. You see, that Nantucket Shoals and the Rhode Island tagging experiments both draw on a population of fish which is not only localized, but which is always moving to the east. I didn't bring it into the discussion because it has nothing to do with it, but there is some indication that this slight amount of drift away from the home area, the bay area, enters into the population, because if you tag fish south of Point Judith in the Blackwells Island area or the shoals off Nantucket, which are offshore, those fish will show movement away from that and be recorded caught in other places. There is a tendency for the fish to drift toward the east after they leave the home waters. That is a perfectly natural thing. If you have your center of production in the bays, it is expected that as the fish get older, they have more of a chance of dispersing from those centers. They keep going out of these bays and then they are off in this offshore water and the following year they move a little farther off, so they could either move toward New Jersey or toward Nantucket, but the blackback flounder drifts from New York to southern Massachusetts. In New Jersey, you are getting to a place where flounder exist and they exist in Delaware, but not in optimum condition. Many fish never go down that way. They never have.

DR. WARFEL: Come spring, I do a little fishing with a hand line. In the light of the fact that these things are so terribly localized as you indicate they are,

how do you explain the fact that along last April or the first of May they show up all of a sudden down on the Branford River in Connecticut where I fish, and by the first of July they are not around there at all.

DR. PERLMUTTER: That is another story, but there is a local migration—I say "localized," it is within that bay area. We found on Long Island, when the water temperature reached around 68 degrees, that the fish would move right out of the bay toward the inlet and stay at the inlet. They wouldn't be available to hook-and-line fishing off the docks, but they would be to the boats in the inlets. That is true mostly of the area south of Cape Cod where the bays warm up and you come up to Gloucester and they are right in the same spot. The water is cold.

DR. WARFEL: Which way do they move there?

DR. PERLMUTTER: They just spread out around there.

DR. WARFEL: They don't go out in deep water and come back into the bay?

DR. PERLMUTTER: They are mostly around there. They may move out a dock or two. Sometimes you can't catch them at the dock.

FISHERY MANAGEMENT IN MARYLAND

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Interest in conservation is usually stimulated by the threat of decline or damage in some source of natural wealth. This applies to soil, forest lands, fur and game animals, and, of course, to fishery resources.

Records of the U. S. Fish and Wildlife Service for the 50-year period between 1890 and 1940 show an alarming decline in Maryland's fin fisheries. Shad catches dropped from over 7 million pounds to less than one-half million. Herring fell from nearly 20 million to slightly over 4½ million pounds. Besides these fish of major importance, other less valuable species have shown similar decreases.

It would not be fair to suggest that Maryland was totally unaware of the downward trend in her fisheries, and that no restorative measures were attempted. A considerable number of ideas were tried and proved unsuccessful. Shad hatchery operations which have been conducted since 1876 are the most striking example. From 5 million to 150 million fry were released each year, and no recognizable restoration, or even stemming of depletion has taken place. Restrictions on length and type of gear, shortened seasons, size limits and the prohibition of industrial pollution have likewise been unsuccessful in achieving a restoration.

In 1940, recognizing the threat of irreparable damage to the State's fisheries, the commercial fishermen of Maryland held public meetings in all Tidewater counties to discuss the problem. Representatives from each county were chosen to serve with federal and state techni-

cians on a committee to devise a means for rebuilding the fisheries. After meeting for several months, the committee finally drafted the present Maryland Fishery Management Plan. This program, originating with the fishermen and written by their own committee, expressed the ideas of men who knew best what procedures would be most beneficial to the industry. The Maryland Management Plan is not, therefore, an attempt to tell the fishermen how to do a job they have learned through generations of experience. It does not decrease the efficiency of their efforts by imposing regulations on the operation of their gear, but is simply a method recognized by the fishermen themselves to be practical and necessary in the restoration of the State's fishery resources.

The operating principle of the Plan is a very fundamental one, applicable to all living things—*the protection and preservation of sufficient brood stock.* In the Maryland program this is accomplished by reducing the fishing effort. This reduction in fishing was achieved by stabilizing the amount of licensed gear participating in the fishery at the 1940 level, when the amount of gear was somewhat less than in the years preceding. The power to increase or decrease the amount of gear was vested in the Department of Tidewater Fisheries. Statistics, biological data, and recommendations relative to the condition of the industry were supplied by the combined efforts of the Department of Research and Education and the U. S. Fish and Wildlife Service.

Earlier in this discussion it was indicated that the Maryland Plan was designed to protect and benefit not only the fish, but also the fishermen. It would be well to enlarge briefly that idea, and explain how the operation of the Plan can assure the fishermen a constant and increased income, at the same time promoting the restoration of Maryland's fishing grounds.

The occasional appearance of an unusually large run of fish is an occurrence familiar to commercial fishermen and sportsmen alike. Equally familiar is the accompanying influx of "fair-weather fishermen," men who ordinarily follow other lines of work and who are simply drawn into fishing by the opportunity for an easy income. The results of such an influx are obvious—first, a glutted market, with reduced prices which prevent the regular, full-time fishermen from reaping their fair shares of the "bumper crop"; second, a serious reduction in the brood stock of fish which would assure a good run in succeeding years if only the *normal* number of men were operating; and third, the depletion in a single year of a crop of fish that would supply the full-time watermen for three or four years with fish of steadily increasing weight and value.

A major point used in selling the Management Plan was the prom-

ise of increased yields. There are two ways in which these yields can be accomplished, both of which are integral features of the program. First, the number of fishermen will be maintained at a level that will insure sufficient brood stock to reproduce successfully year after year. The second source of increased yields is in the increased weight and value of a fish from one year to the next.

The idea can not be too strongly emphasized that the fisherman suffers no loss by allowing some of the fish to escape his nets. Since a fish can be caught and marketed only once, it is obvious that a fisherman should get as much as he can in pounds and dollars when he does catch that fish. A fish which escapes the net for a season not only increases in size and value, but has the opportunity to spawn and add materially to the stock of the fishery. However, the fisherman can't stand by and wait for the fish to grow up before he sets his net, and the Management Plan doesn't expect him to do that. It will simply maintain the number of fishermen operating in Maryland waters at the present level until increased yields indicate that additional fishing will not be injurious to fish or fishermen. Observe that the number of fishermen was not reduced, but simply stabilized. Fishermen operating at the time the Plan went into effect were not put out of business, or restricted in their operations, but were protected from having additional fishermen or gear enter the already overworked industry.

The next question to arise regarding the Management Plan is whether or not it is practical, whether or not it will actually work. The answer is that it most certainly will work. It had already proved itself effective before it was adopted in Maryland. The shad fishery of the Hudson River rose from 40,173 pounds in 1916 to 4,243,000 in 1942 simply because fewer nets were used in the fishery. In this case, however, no conservation program was responsible for the decrease in gear. It was merely a case of the fishery being so depleted that many fishermen could not make a living, and were forced to stop fishing. The increase in shad resulting from the reduction of gear was maintained and further built up by the application of sound management, and the Hudson River fishermen are now enjoying better runs of shad than ever before in the history of the fishery.

Efficient administration of any conservation plan requires accurate biological and statistical information. Special programs have been set up in Maryland to meet these requirements.

In cooperation with the U. S. Fish and Wildlife Service, the Maryland Department of Tidewater Fisheries and Department of Research and Education initiated in 1944 a system of daily catch records for all licensed fishermen in the State. Accurate reports of the catch of all species, the amount and type of gear used, and the area fished, are

submitted at the end of each week on forms especially designed for each of the types of gear fished in Maryland. The effect of the number of units of each type of gear fished in each river or particular area of the Chesapeake Bay can thereby be determined, as well as the trends of the total fishery.

Statistical records are supported and supplemented by biological data. A very valuable source of this type of information is found in scale collections from commercial catches, sampled periodically by state and federal biologists. In the rock, or striped bass, the number and spacing of annual rings on the scales provide excellent indices to the age and size composition of the catches, the rate of capture of individual broods of fish, and the rate of growth. A different, but equally valuable characteristic is found in the scales of the shad. Each time a shad enters fresh water to spawn, a distinct scar-like mark is formed around the edge of the scale. As the fish grows, the scale increases in size, and more materials are laid down around the scar. The number of these "spawning marks" makes it possible to determine what percentage of the run are returning for the second or third time. A direct index is thus provided to the survival and escapement of brood stock.

Additional information is provided by periodic sampling at established points of major rivers with a small-mesh haul seine, to determine the survival of juveniles, and the comparative success of spawning from one year to the next. Plankton collections on and near spawning areas likewise provide comparative data on the amount and success of spawning in each season. Temperature, density, and salinity records are made in conjunction with all haul-seine and plankton sampling, and present supplementary data valuable in analyzing the information collected.

The actual results of the Management Plan from the day when it first became effective, up to the present time are of considerably more interest than the techniques employed in its administration.

Obviously, only the most accurate data possible was suitable for a critical analysis of the success and productivity of the Plan. It was previously stated that the collection of daily records from all licensed fishermen in the State was not begun until 1944, and long-term records for periods before and after the establishment of the Plan were needed for a satisfactory comparison. The source of this information was found in the files of a leading Maryland seafood dealer. Actual sales slips were obtained, representing the daily landings of two pound-net fishermen, who have operated the same type of gear in the same locality for a number of years. The striped bass and the

shad, two species of major importance in Maryland, were used as indices.

Striped bass are recognized as having occasional years when spawning is particularly successful, and an exceptionally good crop of fish is produced. Two such broods were produced in 1934 and in 1940, one brood prior to management, and one following the adoption of the Maryland Plan. A 4-year period, following the appearance of the 1934 and 1940 broods in the pound net catches, was used to trace the rate of capture of each of these groups of fish. In each of the 4 years a typical period of fall fishing was taken as an index to the composition of the commercial catch for that season. Records were taken for the first 26 days of fishing following September 16, the period usually ending on October 14 or 15. The number of pounds of large, small and medium rock (fixed standards of size set up by the dealer) was recorded, together with the price per pound for each size.

The capture of the broods was traced by starting with the number of pounds of small fish caught in the first year, and then as these fish grew in the succeeding year, the number of "mediums" in the second year. In a similar manner, the medium fish grew and became large fish, and the large fish in the third and fourth years indicated what portion of the brood had escaped capture to reach the larger size. The trend of the individual broods was recognized by taking into consideration the number of small fish entering the catch each fall.

Briefly surveying the results of this study, the following facts indicate the value of management in the efficient utilization of a brood of fish. Considering first the 1934 brood, the peak of production was reached in 1936 when 60,800 pounds of medium rock were caught. In 1937, only 3,869 pounds survived as large fish, and in 1938, the total landings were only 1,308 pounds of large rock, indicating nearly a complete capture of the brood. The 1940 brood grew somewhat more rapidly, and reached its peak of production while still in the "small" size classification. The peak, reached in 1941, was 30,401 pounds, indicating that the 1940 brood, although a "bumper crop," was considerably smaller than the 1934 group. This peak, under controlled fishing dropped only to 21,008 pounds of mediums in 1942, and in 1943 the brood was still represented by 14,347 pounds of large fish, and in 1944, 5,057 pounds of large fish were taken. This is even more striking when it is noted that all these large fish were of the 1940 brood, since there were no intervening broods which could have contributed fish of that size to the catch. Briefly summarized, controlled fishing produced more fish of larger size and higher price from a smaller original stock.

Consider the potential wealth in that 1934 brood if it had been

properly managed. Instead of 3,869 pounds in 1937, 42,000 pounds would have been produced, and instead of 1,308 pounds in 1938, the catch would have been 28,694 pounds. A total yield of 70,694 pounds instead of 5,177 pounds would have been obtained in the two years following the peak.

Fully as important as the efficient utilization of large broods is the value of management in the protection of brood stock. Shad offer a particularly good example of this effect. With rare exceptions, each year's brood is directly dependent on the number of fish which reach the spawning grounds. Under management, more shad escapes the nets to spawn, return to the sea, and come back the following year to spawn again.

Analysis of the effect of management on this species was based on the period from 1937 to 1944, inclusive. In this instance, the first 26 fishing days following April 15 were used as an index to the shad fishery for each year.

Temporary increases occurred in 1939 and in 1941, but in each case the following year was marked by a decrease which exceeded or nearly equaled the recovery. In 1943, another recovery occurred, but this time it was not followed by a decline, for in 1944 the catch continued upward, reaching a point about five times above the 1942 level. For the first time in the period of years in which these observations were carried on, the recovery of one year was not followed by a decline in the next year. It is here that the effect of management is seen. When young shad leave the spawning ground they do not return until 4 to 5 years later, so the effect of allowing spawning fish to escape would not be felt in the fishery for at least 4 years. The Management Plan was not put into effect officially until 1941, but the fishing level was at low ebb in 1939 and 1940 (The Management Law froze the number of licenses at the 1940 level) and the effect of reduced fishing is seen in the 1943 and 1944 catches.

The trends shown by the two species used in this analysis are reflected in the increased total catch. Fish and Wildlife Service records for the period from 1941 to 1943 show an increase of over two million pounds, despite the stabilization of gear and the wartime reduction in the number of men operating. Although final and complete data for 1944 and 1945, collected through the system initiated in 1944, is not yet available, there are indications of continued improvement.

The fin fisheries of Maryland are worth approximately half a million dollars annually to the watermen, and as restoration progresses, they will increase in value. Additional pounds and dollars will not only mean higher incomes and better living for the fishermen, but

will be reflected throughout the State. Packers, dealers, truckers, ice plants, boat yards, and net and gear manufacturers will all feel the effects of increased yields. Postwar developments in refrigeration and transportation promise to enlarge the market for Maryland seafood by providing new and profitable outlets to absorb the increased and continuing high levels of production which are expected. The Chesapeake Bay has long been famous for its production of sea trout, striped bass, white perch, and river herring, and continued operation of the present Management Plan gives great promise of bringing it to an even higher position among the Nation's seafood centers.

DISCUSSION

DR. JOHN VAN OOSTEN (Michigan): Under the Maryland plan, you say you have frozen the fisherman. Have you also frozen the amount of gear that each fisherman can use?

MR. TILLER: Yes, sir. It is not possible for any man holding a fishing license to operate any more gear or any greater number of units of gear than he was licensed for at the time the program was put into effect.

SENATOR FREDERIC C. WALCOTT (Connecticut): Why don't you limit the length of the striped bass so you can conserve them?

MR. TILLER: I was expecting that.

SENATOR WALCOTT: Cut out the Washington market—you would be up against it.

MR. TILLER: Well, I will tell you, I may be a little prejudiced and in favor of our Maryland fishermen. I started working with the Fish and Wildlife Service in the summer of 1941 and I worked pretty steadily that fall and the following spring and ever since then, with the commercial fishermen of Maryland. There have been times when I have been to their nets and fished their types of gear, their haul seines and pound nets right along with them.

If there had been a 14-inch limit, as has been suggested in some meetings by some conservation groups, those men wouldn't have taken 10 per cent of their catch. And still we got in 1944 the greatest catch of rock fish we have ever had in the history of the fishery and we got a greater number of large fish. We got more pounds of fish and further, numbers of fish. In other words, we are not catching up all the little ones. We are protecting our nursery areas by not having enough gear to hurt them.

SENATOR WALCOTT: They have been catching them up in New Jersey. They are catching tons of undersized fish. They ought to have a law in Maryland, I think, of 6½ inches from snout to fork of tail.

MR. TILLER: We have to consider the fact that in Maryland we are fishing on an entire nursery area. The gear there is supported on a nursery area and if those men have to fish on a nursery area, we can't wait for the fish which leave to come back to support them. The only thing we have to fish on is a 12-inch and 14-inch fish.

SENATOR WALCOTT: I think you will lose your business if you don't wake up.

MR. TILLER: We caught more this past year than we have ever caught even before and we got more larger fish. Our percentage of mediums, that is, the 2-pound fish, and the percentage of 5- and 6- and 8-pound fish is greater than we have ever had before in the history of our fishery.

SENATOR WALCOTT: How long will you have to go now without those large catches?

MR. TILLER: This is all 1-year class. We are doing right well on one. We are expecting another one in about 1 or 2 years.

MR. R. G. BRESSLER (Rhode Island): What is your plan to bring new blood into your fishing industry down there? How do new men get into it?

MR. TILLER: Mr. Wallace from the Department of Tidewater Fisheries is the Administrative Assistant of that Department. I hope he will call me if I misquote anything, but we are making provision for returning veterans. We are making provisions for the enlargement of the industry as men drop out, as licenses are transferred and as men die and leave the industry. There is a provision for enlarging it, but there is no suggestion for enlarging it at the present time until the industry shows it can stand it. Am I right, Dick?

MR. DAVID H. WALLACE (Maryland): If I might comment, the law does basically provide that additional licenses can be issued if, in the opinion of the Commission, on the basis of these biological records and the catch records, increased fishing is justified. Those licenses are then to be issued by lot from all the applicants who might wish to enter the fishing at that time.

However, at the present time, new people can come into the industry if they care to buy out, so to speak, people who are already engaged in the fishing business.

MR. BRESSLER: Do you supervise these purchases? What is there to keep a man from asking $100,000 for a business that is worth perhaps $10,000 because he has monopoly?

MR. WALLACE: It is large enough, I think the number of fishermen is great enough so that the people would never get together to fix prices on the gears. So far, that has never come up and has never even been approached. The sales to date have been pretty much on the basis of what the thing is really worth to the people.

CHAIRMAN MERRIMAN: I still don't understand and would like to ask further about this business of restricting the level of the fishing intensity by controlling the number of people fishing. You control it to a level and during this period, certainly a fair number of those fishermen have died and gone out of business. How do you pick the men who take their places? Is that done wholly by lot or what means of choice have you?

MR. WALLACE: If I may answer that, at the present time the only people who are getting licenses in Maryland are veterans who had previous fishing experience before they went into the service.

CHAIRMAN MERRIMAN: Putting it off a war basis for a moment and assuming we have passed a wartime period and there are no veterans or any other particularly chosen group, how would you go about it? Here one man dies and you want to have him replaced right off, how would you pick the man?

MR. WALLACE: That license is generally transferred to any number of persons who care to purchase the gear and the license from his family. It can be transferred within a family to the man's heirs if he wishes.

CHAIRMAN MERRIMAN: The choice of the successor really lies with the fisherman?

MR. WALLACE: That is right.

CHAIRMAN MERRIMAN: Thank you, very much.

DR. JAMES NELSON GOWANLOCH (Louisiana): I am interested in this because of a problem arising down in our State of Louisiana in our shrimp fishing, which figure I gave incorrectly, which is now leveling off. Our production is about 120 million pounds out of the Alaskan-Canadian states of 150 million. The situation now is an intensified fishing effort without increase, of course, and it is further intensified by the fact that people seeing the very high prices paid for shrimp, particularly, I regret to say, on the Black Market, are putting as much as $125,000 into a single piece of gear.

I should like to know how you manage the buying of gear—by your legislature? We haven't been able to down there.

MR. TILLER: Maybe our legislature is reflecting the effects of our educational program. I hope so. We feel that our fishermen and our legislators and our delegates, all the major figures in our conservation picture, our fishery picture in

Maryland, are lining up pretty well to see the light, so to speak, after 150 years of depleted fisheries.

DR. GOWANLOCH: We should like very much to have a copy of that opinion to read to our legislature.

MR. WALLACE: I think that the primary reason that the law, which we have in Maryland, has stayed on the books for 5 years is the fact that it was put into effect primarily by the fishermen themselves and the legislators do listen to what the fishermen say and not to conservationists, particularly, but I don't believe the law would have been maintained if the commercial fishermen themselves hadn't been very strongly for the law. If your shrimp people can get together and get a proposal to present themselves, it might work.

MR. DAVID R. GASCOYNE (Illinois): You referred to the inception of a daily landing report in 1944. Is that report mandatory or is it a matter of cooperation?

MR. TILLER: It is required by law. We received a great number of licenses of records from unlicensed fishermen on a purely voluntary basis, but every fisherman who is licensed to fish in Maryland waters is required to turn in a catch record according to our system. We have had very good results.

MR. GASCOYNE: That is followed up, is it, by enforcement individuals?

MR. TILLER: For the first 2 years, we put the thing on a good will basis and out of about 900 fishermen in the state we have only at this time 50 delinquent fishermen. I don't believe it will be necessary to put the thing on an enforcement basis. We did it on a personal contact basis by writing them letters and lots of letters. It seemed to be the touch that was needed rather than trying to browbeat them into it, but it is mandatory.

DR. JOHN VAN OOSTEN (Michigan): You might be interested to know about the problem Ontario has had—they have had a similar type of management program in effect about as long as I can remember, probably 50 or 60 years, on the Great Lakes. They not only control the number of fishermen, the quantity of gear, but they also tell the fishermen with fixed gear, where they have to set their nets. They keep the different types of gear apart.

If you run into difficulties, you might want to contact that department and you might profit by its experience. I think the Department of Conservation of Minnesota has a similar plan in effect on the boundary lakes of northern Minnesota.

MR. WILLIAM F. ROYCE (Massachusetts): Mr. Tiller, you mentioned that the Maryland fisheries prior to 1940 had been seriously depleted and I am wondering if you can explain why you think fixing it at the level at which it was depleted will eventually result in an increase?

MR. TILLER: At that time, the depletion together with the low prices, the prewar prices for fish, had effected pretty much the same change in the Maryland fishery as a change which took place in the Hudson River fishery, but not to such a large extent. The efficiency was produced by a reduction in yield. I can't give you the exact number of licenses in the previous years from 1930 to 1940, but I believe there was a downward trend. As the fisheries continued down, it couldn't support as many fishermen and it became less and less profitable for a man to fish. If he couldn't fish, he would go on as a member of a crew for another man. Only the strong survived and some of them didn't survive too well. They went into boat yards and different places as riggers and did things like that.

MR. ROYCE: I have another question. The striped bass, I believe, is a migratory fish and the Maryland catch accounts for a relatively small proportion of the local East Coast catch; is that correct?

MR. TILLER: Yes.

MR. ROYCE: Why do you feel that your management plan has been principally responsible for the increase in the catch of striped bass during recent years? Couldn't it have been the effect of a fluctuation in the fisheries or possibly the effect of the adoption of the size limit by other states which are fishing the same population?

MR. TILLER: On the basis of scale collections from 1941 through 1945 and an investigation of catch records, we feel that the spawning areas of Chesapeake Bay contribute more to the striped bass fishery than any other tributaries of the Atlantic Coast. There are more square miles of spawning area in there. We have above Maryland, the Delaware Bay, New York and then we have the North Atlantic coastal waters, none of which produce as great stocks of great quantities of young fish as do the Chesapeake Bay waters.

We have noticed from scale analyses that the appearance of an unusually large run of fish in the fall of one year will be accompanied by a corresponding migration up the coast from the Chesapeake Bay in the following spring. That was noticed in the 1934 and 1940 dominant year class. These fish that appeared from the 1940 brood in the fall of '41 in tremendous numbers as 11- and 12-inch fish, were picked up in the spring of '42—the early spring of '42, heading north. Scale measurements, calculated length measurements and all the other indices and analyses we could use typed them with our Chesapeake stock.

MR. NEVILLE: Quite a number in this room are exposed to this striped bass situation, as you know, and I don't think Dick meant to state that the management plan in the Chesapeake Bay had accounted for the recovery of the striped bass. I think there is a distinction there. I think what Dick said or meant to say was that as a result of the management plan, you have had better utilization of the groups of striped bass that have come along, particularly 1942.

But if the management plan has a tendency to protect fish until they reach a larger size and if we need a larger brood stock to even increase the conditions in striped bass, this management plan would do it. In other words, there was a distinction there that the management plan did not account, naturally, for the 1944 brood because there was no management plan in effect, nor did it account for the 1940 brood, but utilization or the use of those fish that came along from that brood more advantageously used by the fishery, brought out more pounds of fish of that 1940 brood because of the management plan and a lesser number of units of gear than would have been possible if that plan had not been in effect.

MR. NELSON MARSHALL (Florida): Has anyone ever seriously questioned whether or not it is constitutional and has it been brought to trial so that we have any precedent to follow regarding that issue?

MR. TILLER: I mentioned a few moments ago that the statistical program was based the first 2 years on a good will contact basis. During those 2 years, I did much of the contact work and I was exposed to a great deal of feeling on the part of fishermen in certain localities that it was not constitutional, that it was not democratic, that it was a God-given right of every Maryland water man to go in there and take those fish because the good Lord put them there.

I had a couple of answers for them. Sometimes they seemed pretty satisfied and sometimes after I had spent a couple of hours with them, I was able to sell them. I found actually, though, that there were very few men who had a legitimate complaint. It was easy enough to tell them that in the City of Baltimore the number of taxicabs is at a fixed number so that the number of taxicab drivers do not cut each other's throats by an over-supply of cab service, and the same thing on the basis of radio stations and utilities. That satisfied some of them.

Then you could also tell them that the good Lord had some right fertile country in the Midwest that was put there for us to use and we didn't use it right and there isn't much there left now, and that appealed to some of them. There were a few actually who had, I believe, legitimate complaints and who were caught short when the law was put into effect. They had perhaps been doing nothing but fishing their entire lives and they had a legitimate complaint when they were not allowed to get back into the fishing game as prosperity came along, but they will be taken care of as the fishery enlarges.

DR. VAN OOSTEN: On the Great Lakes, we feel that plan can't go into effect because of the fact that everyone believes there it is unconstitutional. I think

that if we were to try it in the Great Lakes, we are all pretty well convinced we would lose out.

You might have the same trouble if anyone wanted to take it to court. You can convince your fishermen, but somebody some time in the future is going to get the bright idea of dragging it into court and that is the only way you will ever find out.

MR. TILLER: I believe Mr. Wallace's answer to it will be the answer to your question, that the fishermen themselves put that law in and there is only a very small minority that complain bitterly and at long length.

DR. VAN OOSTEN: Yes, but you will have some people who want to get a license and you won't give it to them. It isn't the fisherman who is already there but the fisherman who wants a license.

MR. MARSHALL: If anybody should like to propose such an idea in any part of the country—for example, I come from south Florida, the Marine Fisheries there —we would like to know in advance what the legal questions are so we can answer the questions in advance.

MR. TILLER: We have never had it contested yet, have we, Dave?

MR. WALLACE: I think Mr. Fred Zimmerman who has been working very close-closely with the Atlantic Trade and Marine Fisheries, has moved into the question of constitutionality of this law and he knows more about it than anyone else. It has never actually been tested in court, but the Attorney General for the State of Maryland examined the statute before it was passed and Mr. Zimmerman did a lot of study on it in relation to the whole Atlantic Coast and I suggest you contact him probably through Mr. Wainwright.

CONSERVATION OF WHALES—A WORLD-WIDE PROJECT

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Everyone knows whales but few have seen one. No single group in the animal kingdom has been the subject matter for as many items of recreational reading. No other group of animals has been more relentlessly exploited, as shown by the history of whaling from its inception and extending beyond the era of international conservation which began in 1931. From that year until the present, those nations that would preserve in perpetuity the whale resources and a whaling industry have had to struggle against a selfish and vociferous minority of nations or of men who regularly come forward with new excuses or reasons as to why the whalers "should not be obliged to play the game according to the rules this year." This is the same sort of controversy that takes place annually between conservation authorities and those hunters who want a 12-month open season and no bag limit.

Public interest in the conservation and management of whaling resources cannot be stimulated unless the facts are known.

Historical review.—The economic value of whales and whale products was first realized by residents along the Mediterranean Coast. It is reported that the first use of oil derived from the carcass of a whale

that had washed ashore was to feed the vigil lights on the altars of churches and shrines. The Basques originated the whale fishery about the twelfth century and by the end of the sixteenth century their whaling operations had been extended to the waters of Iceland, Newfoundland, and Labrador. A common whale fishery in the vicinity of Spitzbergen was originated in the late sixteenth century and vessels from England, the Netherlands, Germany, Denmark, and Norway participated. Their operations gradually shifted westward to the coasts of Iceland, Greenland, Davis Strait, and Baffin Bay and the enterprise continued until about the close of the eighteenth century. Depletion of the right whales around Spitzbergen caused the westward shift of the industry; the bowhead or Greenland whale was soon depleted there, and the shift for new populations pushed westward.

The sperm whale, which occurred in the open Atlantic but not in the Arctic, was the objective of the New England whaling enterprise that began during colonial days. The English and German vessels soon entered the same grounds. The peak production occurred in 1837 when a take of 126,884 barrels of sperm oil was reported. Nantucket whalers began to take the southern right whale about 1763 and when the Revolutionary War began there were more than 300 American vessels engaged in the enterprise. About 1840, the United States was the leader in the whaling industry for it operated nearly 600 of the more than 800 vessels engaged in the fishery.

New Bedford, Massachusetts, was the center of the great industry and some vessels in the fleet made their headquarters at other ports such as Sag Harbor, Nantucket, and Gay Head. In 1846 the United States had 735 whalers and about 40,000 persons were employed in the industry. (In 1946 the United States has no licensed vessels in the whaling industry, as of the date this article is written.)

American whaling operations conducted by the New England fleet were not confined to local waters, except perhaps, at the beginning. In the 1850's Americans were taking whales in the Bering Sea and even farther north, for the sperm whale had declined in numbers and the bowhead whale was being sought. Humpback whales were then taken off the coast of Africa. The Indian Ocean and the Sulu Sea were abandoned as no longer profitable by American whalers about 1880.

In the nineteenth century the Norwegians founded a new era in whaling based on new methods of capture and new species of whales. The right whales, bowhead whales, and sperm whales which formed the basis of the industry up to the end of the eighteenth century were relatively slow-moving creatures and their thick layer of blubber kept the animal afloat after it had been killed so that it could be placed

alongside for flensing. These whales were taken largely by sailing vessels, and the whales were killed by means of hand-harpoons or bomb-lances heaved from rowboats. The hand-harpoon and the bomb-lance were unsuited for the capture of the large blue whale, fin whale, humpback whale and sei whale. These species move with great speed and strength, and a dead whale usually sinks.

To meet the changing conditions in the whale fishery—the transition from the capture of sluggish brutes to the capture of the strong and swift fin whales—new weapons were invented by the Norwegian whaler Sven Foyn. He developed the bomb-harpoon to replace the hand-harpoon and the bomb-lance. Instead of rowboats the swift, steam-powered killer boats came into use and permanent shore stations were established to process the whales. A modern Norwegian industry began in 1868 and ended in 1904 when a newly-enacted law outlawed whaling off the north coast of Norway. At the peak of this phase of the industry, about 1886, a total of 18 companies were operating 34 killer boats.

Long before whaling was prohibited off the northern coast of Norway, Norwegian whalers had begun to transfer their activities to other grounds. Whaling in Iceland began about 1883, and from that year until 1889 there was only one whaling station in Iceland and blue whales only were taken and processed. Whaling off Iceland remained very profitable at least up through 1909.

In 1894, Norwegian whalers began to work also off the Faro Islands, and in 1903 operations were begun off the Shetland Islands, then whaling stations were established on the northwest coast of Ireland. Beginning in 1909 whaling everywhere in the North Atlantic began to decrease.

Whaling was conducted in eastern Asia for the first time about 1889. A second attempt was made in 1897 when 220 whales were taken in the vicinity of the Sakkhalin Peninsula. In Japanese waters proper, whaling was far more extensive for it had gone on there from ancient times without interruption. About the turn of the century the Japanese operated 11 shore stations and utilized Norwegian methods.

A whaling operation off the coast of Chile has been conducted since 1910.

In 1904 and 1905, whaling operations were first initiated in the Antarctic, especially in the vicinities of South Georgia and South Shetland, and in a few years' time these waters became the focus of the whaling industry. Observations in the Second Report of the

International Whaling Committee on Whaling Statistics (1931)[1] are especially significant:

"Obviously, however, a whaling industry in such distant and unknown waters could not have developed so rapidly or attained such dimensions if it had not been for the introduction of the so-called floating factories, which revolutionized the industry. It was impossible to establish land stations until absolutely reliable knowledge had been obtained of the fishing grounds. Moreover there were not many places in these parts which were suitable sites for land stations. For such a purpose one must have good spacious sites in a place where there is no danger of interruption and damage through the pressure of ice and similar dangers of this polar region. In addition to a safe harbor there must be an ample and continuous supply of fresh water —and these are only a few of the more important requirements which must be satisfied in selecting such a place.

"The floating factory, on the other hand, affords far greater facilities. If the whaling ground is satisfactory it can remain there; if not, it can move elsewhere. If the conditions at a particular harbor cease to be suitable, it can go on to another. If the whales move away, the floating factory can follow, so that the catchers need not waste time by towing the carcasses for long distances.

"The available statistics also show how largely the development of the industry in the Antarctic has become dependent upon these floating factories.

"For many years, however, these vessels were only employed from a definite harbour which served as their basis. A well-sheltered harbour was chosen where the floating factory could anchor and the flensing proceed without any disturbance. The whales were flensed alongside and the blubber and flesh hoisted on board.

"This meant that the whaling companies had to get concessions from the governments of the countries within whose territories the whaling grounds were situated.

"About the year 1923, however, another new departure was made. An increasing number of floating factories began to operate along the edge of the antarctic ice, and the new factories were to a large extent built with a ramp in the stern, so that the whole whale could be hauled on board in the course of a few minutes.

"This was an enormous advance. The whalers were now independent of harbours and concessions and could operate on the open sea.

"Whaling became a pelagic undertaking. The development of the

[1]The Committee for Whaling Statistics was established by the Norwegian Government. It acts as an international depository for whaling statistics of all nations signatory to the International Agreements. Reports have been issued annually since 1930, under the title "International Whaling Statistics" (Det Norske Hvalrads Statistiske Publikasjoner).

industry received a fresh impetus, and whalers increasingly made for the edge of the antarctic ice. Thus whaling has proceeded along three-fourths of the whole south-polar cap during the whaling season 1930-31."

Statistics of whaling.—The foregoing discussion has pointed out that the modern era of whaling began about 1868. The total number of whales killed during the years 1868 to 1939 is shown in Table 1.

TABLE 1. WHALES KILLED IN THE YEARS 1868-1939

Years	Total number of whales killed	Years	Total number of whales killed
1868	30	1905	4,592
1869	17	1906	3,519
1870	36	1907	4,490
1871	20	1908	5,509
1872	40	1909	8,490
1873	36	1910	12,301
1874	51	1911	20,408
1875	39	1912	24,838
1876	45	1913	25,673
1877	36	1914	22,980
1878	116	1915	18,320
1879	130	1916	17,542
1880	163	1917	10,088
1881	283	1918	9,468
1882	351	1919	10,242
1883	569	1920	11,369
1884	485	1921	12,174
1885	1,423	1922	13,940
1886	986	1923	18,120
1887	925	1924	16,839
1888	709	1925	23,253
1889	585	1926	28,240
1890	799	1927	24,215
1891	910	1928	23,593
1892	1,330	1929	27,990
1893	1,607	1930	37,812
1894	1,528	1931	43,129
1895	1,526	1932	12,988
1896	1,925	1933	28,907
1897	1,791	1934	32,586
1898	1,993	1935	39,311
1899	1,541	1936	44,855
1900	1,635	1937	51,379
1901	2,204	1938	54,835
1902	8,065	1939	[1]40,662
1903	3,867		
1904	4,931	Total 1868-1939	822,384

[1]The figure is incomplete.

Throughout the period covered by this table there was a continuous increase in production, with a significant jump in 1910 which may be attributed, at least in part, to the beginnings of Antarctic operations. It also should be noted that there was a decline in the total take of whales in 1932 when 12,988 were taken as compared with 43,129 during 1931. As will be mentioned later the cause of that low catch was a collapse in the whale oil market. After 1931 through 1939 when the annual compilation of whaling statistics by the International Committee for Whaling Statistics at Sandefjord, Norway, was interrupted by the war.

TABLE 2. WHALES KILLED IN THE DIFFERENT MAIN AREAS 1868-1939

Years	All areas		Antarctic		North Atlantic and Arctic		Africa		Pacific North		Japan		Others	
	No. of whales killed	Per cent	No. of whales killed	Per cent	No. of whales killed	Per cent	No. of whales killed	Per cent	No. of whales killed	Per cent	No. of whales killed	Per cent	No. of whales killed	Per cent
1868-1899	22,025	100	.....	.....	22,025	100	.....	.....	.....	.....	.....	.....	.....	.....
1900	1,635	100	.....	.....	1,514	92.6	.....	.....	121	7.4	.....	.....	.....	.....
1901	2,204	100	.....	.....	2,099	95.2	.....	.....	105	4.8	.....	.....	.....	.....
1902	3,065	100	.....	.....	2,648	86.4	.....	.....	417	13.6	.....	.....	.....	.....
1903	3,867	100	.....	.....	3,010	77.8	.....	.....	857	22.2	.....	.....	.....	.....
1904	4,931	100	.....	.....	3,656	74.1	.....	.....	1,275	25.9	.....	.....	.....	.....
1905	4,592	100	195	4.2	3,505	76.4	.....	.....	892	19.4	.....	.....	.....	.....
1906	3,519	100	582	16.5	2,508	71.4	.....	.....	429	12.1	.....	.....	.....	.....
1907	4,490	100	1,112	24.8	2,897	64.5	.....	.....	481	10.7	.....	.....	.....	.....
1908	5,509	100	2,312	42.0	2,696	48.9	106	1.9	395	7.2	.....	.....	.....	.....
1909	8,490	100	3,883	45.7	3,182	37.5	724	8.5	518	6.1	.....	.....	183	2.2
1910	12,301	100	6,099	49.6	2,318	18.8	1,531	12.4	1,131	9.2	968	7.8	254	2.2
1911	20,408	100	10,230	50.1	1,932	9.5	4,377	21.4	1,451	7.1	1,938	9.5	480	2.4
1912	24,838	100	11,727	47.2	1,311	5.3	6,859	27.6	1,799	7.2	1,586	6.4	1,556	6.3
1913	25,673	100	10,760	41.9	1,174	4.6	9,270	36.1	941	3.7	1,605	6.2	1,923	7.5
1914	22,980	100	9,408	40.9	1,130	4.9	5,590	24.3	1,601	7.0	2,022	8.8	3,229	14.1
1915	18,320	100	9,864	53.8	579	3.2	2,765	15.1	1,327	7.2	2,100	11.5	1,685	9.2
1916	17,542	100	11,792	67.2	190	1.1	1,945	11.1	1,211	6.9	1,803	10.3	601	3.4
1917	10,088	100	6,474	64.2	.....	.....	922	9.1	802	8.0	1,697	16.8	193	1.9
1918	9,468	100	4,304	45.5	864	9.1	695	7.3	1,233	13.0	2,177	23.0	195	2.1
1919	10,242	100	4,787	46.7	785	7.7	1,282	12.5	1,556	15.2	1,671	16.3	161	1.6
1920	11,369	100	5,441	47.9	1,456	12.8	1,310	11.5	1,763	15.5	1,279	11.2	120	1.1
1921	12,174	100	8,448	69.4	310	2.5	1,263	10.4	129	1.1	1,487	12.2	537	4.4
1922	13,940	100	7,023	50.4	918	6.6	2,335	16.7	1,356	9.8	1,506	10.8	802	5.7
1923	18,120	100	9,910	54.7	1,204	6.6	3,105	17.1	1,363	7.5	1,422	7.9	1,116	6.2
1924	16,839	100	7,271	43.2	1,667	9.9	3,649	21.7	1,102	6.5	1,526	9.1	1,624	9.6
1925	23,253	100	10,488	45.1	1,523	6.6	4,384	18.8	1,892	8.1	1,875	8.1	3,091	13.3
1926	28,240	100	14,219	50.4	1,635	5.8	4,646	16.4	1,804	6.4	2,148	7.6	3,788	13.4
1927	24,215	100	12,665	52.3	1,443	6.0	4,144	17.1	2,064	8.5	1,546	6.4	2,353	9.7
1928	23,593	100	13,775	58.4	1,596	6.8	3,835	16.2	1,412	6.0	1,607	6.8	1,368	5.8
1929	27,990	100	20,341	72.7	1,197	4.3	3,362	12.0	1,241	4.4	1,463	5.2	386	1.4
1930	37,812	100	30,167	79.8	1,506	4.0	3,498	9.2	975	2.6	1,312	3.5	354	0.9
1931	43,129	100	40,201	93.2	703	1.6	823	1.9	.....	.....	1,147	2.7	255	0.6
1932	12,988	100	9,572	73.7	827	6.4	1,043	8.0	319	2.4	1,036	8.0	191	1.5
1933	28,907	100	24,327	84.2	1,004	3.5	1,168	4.0	591	2.0	1,122	3.9	695	2.4
1934	32,586	100	26,087	80.1	583	1.8	2,392	7.3	1,019	3.1	1,436	4.4	1,069	3.3
1935	39,311	100	31,808	80.9	568	1.4	3,004	7.7	855	2.2	1,787	4.5	1,289	3.3
1936	44,855	100	30,991	69.1	722	1.6	3,768	8.4	857	1.9	1,840	4.1	6,677	14.9
1937	51,379	100	34,579	67.4	1,910	3.7	3,966	7.7	730	1.4	2,066	4.0	8,128	15.8
1938	54,835	100	46,039	84.0	750	1.4	3,044	5.6	483	0.9	1,970	3.6	2,549	4.5
1939	[1]40,662	.....	38,356	.....	802	.....	[2].....	.....	232	.....	[2].....	.....	[3]1,272	.....
Total 1868-1938	781,722	100	476,881	61.0	81,545	10.4	90,805	11.6	38,497	5.0	4 7,142	6.0	46,852	6.0

[1]The figure is incomplete. See note 2 and 3. [2]Whaling has been carried on during 1939, but no information is available. [3]Not including the whaling off New Zealand during 1939, as no information has been available from this ground.

TABLE 3. NUMBER AND GROSS TONNAGE OF FLOATING FACTORIES AND CATCHERS ENGAGED IN PELAGIC WHALING IN ANTARCTIC 1925-26—1938-39

	Floating factories			Catchers				
							Average per catcher of:	
Seasons	Number	Gross tonnage	Average gross tonnage per fil. factory	Number	Gross tonnage	I.H.P.	Gross tonnage	I.H.P.
1925-26	[1]15	85,182	5,679	[1]50	10,250	34,600	205	692
1926-27	[1]17	107,944	6,350	[1]60	12,600	41,220	210	687
1927-28	[1]18	117,178	6,510	[1]64	13,568	45,184	212	706
1928-29	[1]26	195,273	7,511	[1]91	19,474	63,973	214	703
1929-30	38	315,840	8,312	163	35,697	118,827	219	729
1930-31	41	358,168	8,736	200	45,200	151,000	226	755
1931-32	5	50,130	10,026	33	8,283	29,766	251	902
1932-33	17	218,756	12,868	112	28,224	97,216	252	868
1933-34	19	238,616	12,559	112	28,672	98.896	256	883
1934-35	23	263,379	11,451	143	36,322	127,842	254	894
1935-36	24	289,303	12,054	165	42,405	149.655	257	907
1936-37	30	370,380	12,346	184	51,888	189,152	282	1,028
1937-38	31	408,332	13,172	244	71,980	270,108	295	1,107
1938-39	34	467,534	13,751	270	80,460	307,530	298	1,139

[1]Including the floating factory "Thor I" and 3 catchers, operating from South Georgia.

The distribution of the total catch of whales by areas is indicated in Table 2. The importance of whaling operations in North Atlantic and Arctic waters had dwindled gradually from 100 per cent in 1899 to only 1.4 per cent in 1938. North Pacific catches, which never comprised more than 25.9 of the total, and that only for one year, have dwindled likewise to insignificance. Whaling off the coast of Africa, which got off to a good start by 1910, had dwindled considerably by 1938. Thus the Antarctic remains as the only stronghold of whale populations.

Total catch statistics, as is well known, are apt to be misleading unless something is known of the amount of effort (vessels, gear, and man-power) that goes into making the catch. Table 3 shows the number of factory ships and killer boats operating in the Antarctic from the season 1925-26 through the season 1938-39. During that period there was a tendency for the numbers of vessels to increase up until the 1930-31 season when 41 floating factories with 200 killer boats operated. In 1931-32 only 5 floating factories and 33 killer boats were in operation. The reason for the operation of only 5 factory ships in 1931-32, with 33 killer boats, which resulted in a take of approximately 9,000 whales was due to the collapse of the world market for whale oil. During that season most of the major whaling nations agreed not to send their expeditions to the Antarctic. During the 1932-33 and subsequent seasons until 1938-39 the number of factory ships and killer boats again increased. It should be noted also that the average tonnage of the factories and the tonnage and power of the killer boats increased about one hundred per cent between 1925-26 and 1938-39.

Norway and Great Britain, as shown in Table 4, were the major participants in the Antarctic whaling. It should be noted that Japan and Germany, comparatively recent newcomers into whaling, were expanding operations rapidly and by 1938-39 had 6 and 5 expeditions, respectively, in the Antarctic. The United States had one ex-

TABLE 4. WHALING EXPEDITIONS IN THE ANTARCTIC IN THE SEASONS 1930-31—1938-39

Seasons	Number of expeditions owned in					Total
	Norway	Great Britain	Germany	Japan	Other countries	
1930-31	30	13	....	....	4	47
1932-33	9	8	....	....	1	18
1933-34	11	9	....	....	1	21
1934-35	13	10	....	1	1	25
1935-36	13	9	....	1	3	26
1936-37	14	11	1	2	4	32
1937-38	11	11	4	4	3	33
1938-39	13	10	5	6	3	37

pedition in the Antarctic in the seasons 1937-38 and 1938-39. Two United States operations were maintained in Australia during the summer seasons 1937 and 1938. With the closure of the last remaining land station in California at the end of the summer season of 1944, whaling activities on the part of the United States came to an absolute standstill.

During the war period very limited whaling operations were carried on in the Antarctic, although the statistics have not yet been published. Operations were resumed by three British and six Norwegian floating factories during the 1945-46 season. There was a shortage of killer boats and reports indicate that the take was not as great as expected.

Evidences of depletion.—Professor Birger Bergerson, of Norway, presented at the International Whaling Conference held in London during November 1945, an interesting resume which shows unmistak-

TABLE 5. CATCH OF BLUE WHALES IN THE ANTARCTIC DURING THE SEASONS 1932-33 TO 1938-39

Season	Total number	Average per killer boat
1932-33	18,891	160.0
1933-34	17,349	137.7
1934-35	16,500	107.8
1935-36	17,731	101.3
1936-37	14,304	73.0
1937-38	14,923	58.3
1938-39	14,081	50.1

able evidences of depletion of the whales in the Antarctic. In 1932-33, 17 factory ships and 112 killer boats were in operation, and produced about 2.4 million barrels of oil. Upon comparing these figures with those for the season of 1938-39 when 34 factory ships and 270 killer boats were operated (twice as many floating factories and 2½ times as many killer boats) it is extremely disturbing to note that the more than twice as great a fleet obtained only about 11 per cent greater production than was obtained in 1932-33.

The reason for the great decline in the catch is due to the excessive take of blue whales as shown in Table 5. In the 1932-33 season an average of 160 blue whales was taken per killer boat. In the 1938-39 season this average was only 50.1. It is to be hoped the controls now in effect under international agreement through the maximum catch quota will result in some recovery of the harassed blue whale stocks.

Early efforts at international cooperation.—During the first World War it was realized some action on an international scale was necessary in order to prevent the extinction of the whales. While research workers and commercial operators agreed that something should be done, the road to international action was long and tortuous.

In 1923, the French Academy of Science suggested the formation of an international committee to deal with exploitation of the riches of the high seas. In 1924 an Assembly Resolution of the League of Nations resulted in the appointment of a committee of experts on matters of International Law, who in 1925 suggested for examination the matter of "exploitation of the products of the sea." In 1929 after some investigation the economic committee of the League of Nations concluded that international measures for protection of whales were urgently needed.

Britain and Norway, the two outstanding whaling nations, saw the necessity for conservation and began to prepare legislation for unilateral application to protect the future of the industry. In 1929 Norway enacted laws that prohibited the catching of right whales, whale calves, and cows accompanied by suckling calves; a mandate was given to whalers to utilize whale carcasses as fully and efficiently as possible, and to prevent the killing of immature whales.

In 1934, Great Britain passed laws regulating her whaling industry to prevent waste, and in 1935 Australia passed a similar Act.

An International Bureau of Whaling Statistics was established at Oslo in 1930 as a result of efforts of the Conseil Permanent pour l'Exploration de la Mer.

The 1931 International Convention.[2]—A Committee of the League of Nations prepared a draft international whaling agreement during 1930. A Convention for the Regulation of Whaling was signed at Geneva in September 1931, by the representatives of 26 nations (Russia, Japan, Chile, and Argentina did not sign). Ratification by the United States was proclaimed by the President January 16, 1935.

The Convention which became effective in January 1936, was based on the same principles as the Norwegian law then in force but was of world-wide application. It exempted the shore whaling of aborigines, to protect the livelihood of certain tribes. The killing of right whales (which had already become rare), the killing of calves or suckling whales, of immature whales, and of female whales accompanied by calves were all forbidden acts. It provided for the fullest possible use of whale carcasses and required that the equipment of floating factories and land stations conform to certain standards. Crews were to be paid according to species, size, and value of whales caught. The collection of whaling statistics was provided for.

In 1932, all the Norwegian and all English firms but one formed a production cartel to protect themselves from overproduction of whale oil, such as occurred in 1931 and resulted in a collapse of the market.

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[2]Department of State, Treaty Series, No. 880, 1935.

They estimated the total quantity of whale oil which could be placed on the world market at a fair price, and distributed quotas among their members. Quotas were expressed not only in barrels of oil, but in "whale units," thus stimulating greater efficiency. The beginning of the catching season was set late so that whales would be taken when in prime condition; minimum lengths to be caught were fixed, and crews were to be paid as specified in the League Convention. These measures were temporarily successful up to about 1936. But Germany started whaling and Japan intensified her efforts to develop her whaling industry. Also increased efficiency due to better equipment offset the imposed restrictions. Moreover, the restrictions were applied only to Antarctic waters S. of 40 deg. S. and the unrestricted pursuit of whales in warmer seas was more destructive than in the southern grounds.

International Conference of 1937.[3]—Norwegian representations to the British and German Governments led to a Conference in London in May-June, 1937, which drafted an International Agreement for the Regulation of Whaling to be in force from July 1, 1937, to June 30, 1938. Japan refused an invitation on the grounds that her industry was so little developed that she could not limit it. Most of the countries appeared willing to limit catch or equipment, but because no laws conferring such powers existed, the various governments were urged, in the final protocol, to enact the necessary legislation to limit the number of killer boats that might be used in connection with a land station or a factory ship.

The principal provisions of the 1937 Agreement are as follows: Those regulations having to do with areas and seasons may be visualized by referring to the accompanying chart of the world on which have been noted various provisions of the Agreement.

1. At least one inspector is to be maintained on each whaling factory ship.

2. The Agreement applies to factory ships, whale catchers, or killer boats, and to land stations, as well as to all waters in which whaling is prosecuted.

3. Prosecution for violations is to be undertaken by the government of the violator.

4. The capture or killing of gray whales and right whales is forbidden.

5. Minimum size limits for certain species were established as follows: Blue whales—70 feet; fin whales—55 feet; humpback whales—35 feet; and sperm whales—35 feet.

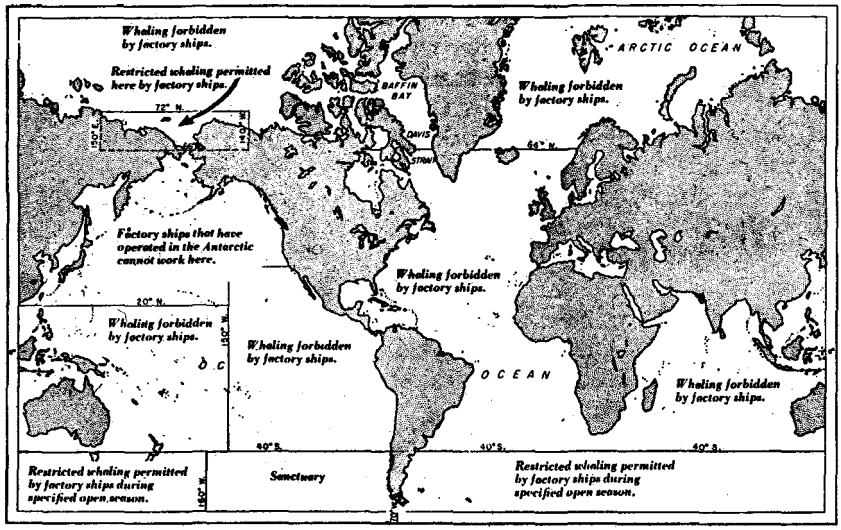
[3]Department of State, Treaty Series, No. 933, 1938.

6. The killing of calves, suckling whales, or female whales accompanied by calves is forbidden.

7. The use of a factory ship or killer boat for taking or treating baleen whales in waters south of 40° South Latitude is forbidden except during a prescribed season.

8. The use of a land station or a whale catcher for taking or treating whales in any area or in any waters for more than 6 months in any periods of 12 months is forbidden.

9. Four closed areas were set aside in which the use of factory ship or whale catcher for the purpose of taking or treating baleen whales is prohibited.



According to Article 3 of the International Agreement, land stations can be operated anywhere except in the Sanctuary, but only for 6 continuous months in each year

10. Notwithstanding the Agreement, any contracting government may authorize the killing and treating of whales for scientific research.

11. The fullest use shall be made of all whales taken.

12. No more whales shall be taken for delivery to a factory ship or to a land station than can be treated within a period of 36 hours from the time of killing each whale.

13. Each contracting government is required to obtain complete statistics on the take and processing of whales by each factory ship, land station, or killer boat under its jurisdiction.

The 1937 Agreement, according to present information, has been ratified by the following: Australia, Canada, Chile, Denmark, Eire, France, Germany, New Zealand, Norway, Mexico, South Africa, United Kingdom and United States of America. Noteworthy is the fact that Japan and the Union of Soviet Socialist Republics are not parties to and have not ratified the 1937 Agreement.

Amendatory protocols.—The 1937 Agreement was to be effective for only a single year; therefore, amendatory protocols were negotiated in 1938, 1944, 1945, and 1946 to provide for continuity of and necessary minor changes in regulations. Outstanding among such changes is a provision in the 1944 Protocol which prescribes a catch quota of 16,000 blue whale units as the maximum permissible take from waters south of 40° South Latitude.[4] It is the intent of the signatories and the sense of the various whaling conferences that the catch quota should be revised upward or downward in accordance with information on the status of the whale stocks as disclosed by continuing scientific investigations conducted by the signatory governments.

What of the future?—Statistics presented earlier in this paper demonstrated that up to the 1938-39 season the take of whales per killer boat seemed to be on a continuous decrease. Whaling activities in the Antarctic were resumed on the largest scale since before the war, during the 1945-46 season. However, only 3 British and 6 Norwegian factory ships were dispatched to the Antarctic and none of these was able to arrive on the grounds in time to take advantage of the full season of 4 months provided under the regulations. Therefore, the prescribed quota of 16,000 blue whale units was not reached during the 1945-46 season.

For the coming 1946-47 Antarctic season and for the immediate future those who would preserve the Antarctic whaling stocks as a basis for a continuing whaling industry will have to face the contentions of those interests who urge that the present postwar shortage of fats and oils is so serious that absolutely no handicaps to maximum production of whale oil should obtain. Some few selfish operators in the whaling industry are urging this viewpoint only because the present high price of whale oil will permit them to make handsome profits now, which profits will tend to lessen as normalcy in world conditions is restored. Others who urge the relaxation of whaling regulations prescribed by international agreement in the interest of world relief are not enlightened as to the true status of the whaling resources. The best answer for their arguments is that the United States found it possible to maintain maximum production from her

[4]A blue whale unit is calculated on the basis that 1 blue whale equals, (a) 2 fin whales, or (b) 2½ humpback whales or (c) 6 sei whales (1944 Protocol).

fisheries throughout the entire war period by promoting maximum utilization of the quantities taken and by no relaxation whatever of conservation measures that were needed to preserve the resources. It is better, by far, to be assured of a continuing production of whale products year after year, even though it may not meet requirements in any one year, than to meet requirements by excessive production during one, two or more years and thereby exhaust the resource and have nothing for the future.

The history of whaling from its inception has been a continuous process of the exploitation of one area until it was exhausted and the moving on to another area. No new areas are left for exploitation! The world must be satisfied with what resources it now has, and bend its efforts toward their restoration. The whales provide an excellent opportunity for demonstrating what all maritime nations can do by working together in the field of whale conservation. If the nations of the world concerned with whaling cannot collectively manage and preserve the resource, international cooperation in general would seem to face a dismal future.

TECHNICAL SESSION

Tuesday Morning—March 12

Chairman: F. P. CRONEMILLER
U. S. Forest Service, San Francisco, California

Vice-Chairman: VICTOR H. CAHALANE
U. S. National Park Service, Chicago, Illinois

RANGE AND FOREST LANDS AND WILDLIFE

CONTROLLED ANTELOPE HUNTS AND SOME PROBLEMS OF ADMINISTERING PUBLIC HUNTING

DANIEL W. LAY
Texas Game, Fish and Oyster Commission, Silsbee, Texas

Many states have had far more experience with controlled public hunts than we in Texas have had with only two antelope hunts. The original correspondence that lead to my place on this program suggested that public hunting be discussed because we need to benefit from the experience of other states. So these remarks admittedly represent a beginner's viewpoint.

Antelope are now sufficiently numerous in nine western states to justify hunting. Because of the vulnerability of the species and the limited numbers, some type of regulated hunting has been practiced in every state. Wyoming started hunting antelope in about 1928, New Mexico in 1932, Oregon in 1938, Arizona and Idaho in 1941, California, in 1942, and Texas in 1944. The number of permits issued have ranged from 150 to 3,000 per state per year. Hunter success has varied from 38 to 98 per cent and appears to have averaged about three kills for every four hunters afield. Although most states hunt only bucks, Nevada permits killing either sex and Oregon specifies animals of either sex having ear-length horns.

Operation of antelope hunts in each of these states follows the same

general pattern: aerial or aerial-and-ground census are made to determine numbers and the ratio of mature bucks to others; hunting pressure is distributed by assigning hunters to specific territory; permits are sold (usually for $5 each) on an impartial basis, and checking stations are operated to obtain data on the hunts.

Texas conducted hunts in the trans-Pecos region in 1944 and 1945. In this region the species occurs in the Upper Sonoran on the foothills and plains between the several mountain ranges and the desert shrub formation. Although this is essentially grassland, composed of such species as side-oats grama, black grama, curly mesquite and buffalo grass, there is an interspersion in many places of mesquite, juniper, sotol, yucca, and lechuguilla. Rainfall averages from 10 to 17 inches a year. Ownership is in blocks of from a few thousand acres to over 300,000 acres. There is practically no public domain in Texas. During the war years domestic sheep were introduced in large numbers with serious effects on the range and on antelope. In sheep pastures antelope were declining, and cattle and sheep ranchers generally wanted the antelope reduced. This economic pressure is one of the reasons hunting was planned for 1944.

In setting up the hunt, contracts were made with landowners for removing specific numbers of antelope, depending upon the aerial counts of their respective herds. Landowners were allowed to assign 20 per cent of the hunting permits, although some did not use them, and the public hunters were assigned the balance by the state department. Permits were issued for approximately half of the adult buck antelope, since the sex ratio was approximately 50-50. This ratio was followed on large and small herds alike. The smallest hunt unit was five hunters to a ranch; the largest was 50 to a ranch. Units of less than 15 or 20 hunters are undesirable because they require as much supervision as larger ones.

Hunting was closely supervised to protect the ranchers' interests and to regulate the kill. Ranches were hunted in three groups, three days each in 1944 and two days each in 1945. Two wardens were assigned to each ranch to check hunters in and out and to direct and check hunters in the field. Checking stations were operated in central towns to obtain measurements, weights, and age-group data. Aging by years is impracticable and grouping young, prime, and old is considered sufficient. The prime group is approximately 5 to 8 years old. The hunt required the services of approximately 20 department employees. Hunters paid $5 each for the special antelope license and ranchers were permitted to charge not more than $25 per hunter. The department costs were somewhat more than the returns from the special licenses.

Places were assigned to 402 hunters in 1944 and 529 hunters in 1945. Of the license holders who hunted, 90.5 per cent were successful in 1944 and 73.7 per cent were successful in 1945. There was a definite increase in wariness of the antelope the second year; but rain and bad roads also contributed to the lower success of the second hunt. Kills for the two hunts were 297 and 323. Failure of approximately one fourth of the license holders to hunt each year seems to be a problem for other states as well as for Texas. We were able to place 74 alternates the second year by promising drop-outs preference the next season if they returned their licenses in time to assign the places to alternates. This ratio seems to be constant enough to assign an excess of permits to the larger hunting units.

Many hunters came unprepared the first hunt so we gave each licensee specific suggestions in 1945 as to methods of caring for the meat and preserving the trophy, and what clothing and equipment would be needed. Photographs and descriptions were distributed to help hunters distinguish bucks from does.

Only seven does were killed in 2 years and these resulted from shooting into moving herds, which was illegal. Less than a dozen yearling bucks were killed, as hunters sought trophies. In view of this record there seems no need to further restrict the bag limit under our present system of close supervision.

Most of the hunting was done with the aid of automobiles for stalking. Foot or horseback hunting on the open flats is impracticable. However, in some of the rougher areas foot hunting was necessary and provided good sport due to the availability of some cover.

Public interest in the hunt was strong in spite of wartime restrictions on transportation and equipment. Approximately two applications for each place were received and a public drawing was necessary. Those who had not received a permit the first year were given preference and these new applicants received all the 1945 places. A list of 115 alternates was also drawn. Hunters have applauded the hunts with no audible exceptions. In spite of the necessary regimentation, which no one likes, they consider it a democratic program that gives the hunters a type of hunting few could obtain otherwise. Although antelope will never provide any large amount of hunting, interest in the hunts will doubtless continue as long as the species is maintained as a trophy species, worthy of a good hunter's skill.

Ranchers like the hunt because it reduces grazing pressure on their ranges. They like state supervision because it relieves them of the task of entertaining large numbers of personal guests or operating public shooting preserves, as is necessary with other species when a

general open season prevails. They also realize careful control and distribution of hunting are necessary to prevent overhunting of the antelope.

From the state's standpoint we have certain reservations about controlled hunts. There is no doubt the antelope herds are being managed conservatively. There is no doubt the antelope hunts have made friends for the department. But the 500 hunters served represent only one fourth of 1 per cent of the state's hunters and required at least 20 man-months of personnel time. Enthusiastic requests for controlled hunting of other species indicate this has been only a small beginning. Without going into the problem of purchasing or leasing enough acreage to provide a significant amount of hunting, it is apparent certain factors limit the amount of controlled hunting that can be conducted.

Drawings and the actual assignment of hunters to ranches would be simple if we did not attempt to permit parties to hunt together on ranches of their preference. But we feel that hunters who are going to make a 1,000-mile trip to hunt antelope should be given this extra service. Assignment of hunters to specific ranches involves more paper work than one might expect. Yet it must be done carefully and with the utmost fairness.

Through experience we have learned some shortcuts in administering the hunt but there will always be a minimum of office work that can't be reduced. Field supervision costs per hunter might be reduced some; but in private-ownership areas some supervision must be given each ownership hunted.

I dislike the prospect of making hunting more artificial. And I think you will agree that the hunter should be left to his own initiative as much as possible commensurate with the requirements of the species hunted.

Public hunting grounds open during certain periods with no restriction to hunters have been used in other states but we fear this would result, in Texas, in less hunting success and also higher hunter mortality. Since by neither route can any large portion of the hunters be served, we favor enough hunt supervision to assure excellent hunting for those fortunate enough to receive permits.

There are so many special local situations and problems, that few generalizations can be made. From our very limited experience it seems apparent that the public wants this service even at the cost of increased budgets, and that administration must be kept simple but strictly impartial. Since we can't provide hunting for everyone, we think hunt standards should be maintained so that permit holders will have a high degree of success.

DISCUSSION

MR. L. D. MCGREGOR (Michigan): Do you have any trouble with out-of-state hunters?

MR. LAY: No. All public relations must be assigned to resident hunters as long as they wish. We have had a few out-of-state hunters who came as guests of the landowners.

MR. LESTER BAGLEY (Wyoming): Do you have any restrictions as to the number of nonresidents that may come in, or deadline when they may submit applications?

MR. LAY: No. We always have a deadline before a drawing, and there is no reason why nonresidents couldn't file their application, but according to our rule, we have to honor all Texas applications first.

MR. BAGLEY: You have to fill your Texas applications before the nonresidents'?

MR. LAY: Yes. At present I would say the only opportunity for an out-of state hunter to hunt antelope in Texas is to come as the guest of some landowner who is participating in the hunt.

MR. BAGLEY: What is the difference in fee between the resident and nonresident?

MR. LAY: The regular state license is $2 for residents and $25 for nonresidents.

DR. WALTER P. TAYLOR (Texas): I would like to ask Mr. Bagley a question. if I may. In Texas we find this interesting relationship between domestic sheep and antelope, to the detriment of the animal. Do you find that in Wyoming? I have heard someone say from up your way that you didn't run into that conflict between domestic sheep and antelope in Wyoming?

MR. BAGLEY: I am sorry I arrived late and did not hear that part of the paper. Would you state it briefly?

MR. LAY: One of the reasons we started hunting during the war period was that sheep were being introduced into the antelope range, and the antelope were on the decline. Also, they wanted to get further reduction in antelope because of competition for grass.

MR. BAGLEY: There is a complication there. That is the only thing we have noticed, that in these vast areas, such as the Great Red Desert of Wyoming, there is competition between domestic sheep and antelope, but that is the only conflict that we have encountered.

I don't know whether that answers your question or not.

DR. TAYLOR: Not quite. In Texas there doesn't seem to exist a conflict between antelope and cattle, but there does seem to be a very definite conflict between antelope and sheep. It isn't a competition for food alone, but sheep and antelope don't like each other, whereas cows and antelope get along all right.

MR. BAGLEY: The type of forage is better for sheep and antelope than it is for cattle. Cattle will thrive and do well on the salt sage of the Red Desert, but the distances from water make it unavailable in most cases to domestic cattle, while it is available to sheep and antelope.

I might state that in the Great Red Desert area in southern Wyoming where we have approximately 30,000 antelope, in that same area during the winter season they run approximately 300,000 to 400,000 head of domestic sheep, and they frequent exactly the same areas, and as long as we don't get too many antelope on one individual territory, we have little complaint.

DR. J. V. K. WAGAR (Colorado): I might say in connection with sheep and antelope in Colorado, we have not noticed any interference between the two. I don't recall that you mentioned Colorado had its first season in 1945 since 1939. We issued 1,150 permits. It worked out very well.

MR. VICTOR H. CAHALANE (Illinois): I would like to ask Mr. Lay a question or two. Can you type the hunters that engage in these managed hunts? Were they largely city dudes, or the rugged rancher type? I ask that because I am interested in learning if there has been any appreciable resentment among the hunters to the regulated type of hunt as opposed to going out and being free from the supervision of the doggone state employees.

MR. LAY: No. We were interested in that point ourselves when we first undertook this, but we were giving these hunters entrée in the places they could only drive by and look over the fence at, some of the biggest ranches in Texas, where it was practically impossible for anybody to get a personal invitation and they were so glad to get inside that fence that they didn't mind having a game warden in the same car, or nearby. As a result, we didn't get any objection along that line.

MR. BEN GLADING (California): What time of year did you hold your hunt? What was the basis for it?

MR. LAY: The first 10 days in October. We selected that period because that was just prior to the cattle-working season in that country, and that was the time the ranchers wanted it. Apparently it fits all right as far as we are concerned.

MR. GLADING: Did you find considerable numbers of bucks with swollen necks?

MR. LAY: No, just a few.

MR. GLADING: In California we ran the season 1 year in the spring—in May—and 3 years in a similar time as yours, and there seemed to be advantages both ways, because we felt that we were killing off the bucks at a time just prior to the breeding season, and possibly were doing something to the reproduction. There seems to be, in our recent counts, a great lack of fawns over the earlier counts. We are wondering if that hasn't been the cause for it.

Next year we will probably drop the hunt, and if it is ever taken up again, we will probably go back to the spring season.

MR. LAY: That is very interesting. We found by thinning out our 50-50 sex ratio on the second year, we had a better fawn crop where we hunted than where we hadn't.

MR. GLADING: Possibly ours was just chance. The hunters said there was a higher proportion of what you might call eye meat in the fall season, but, on the other hand, in the spring the pelts weren't so good, and trophy value less.

MR. LAY: Of course, the traditional hunting season is in the fall; the hunter probably enjoys getting out more than he does in the spring.

SOME ECOLOGICAL ASPECTS OF THE MISSOURI WILD TURKEY STUDIES[1]

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and

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Until a few years ago the restoration of the wild turkey, *Meleagris gallopavo silvestris,* in Missouri appeared to be a complicated and almost hopeless task. Prospects were not bright in the fall of 1934 when Bennitt and Nagel (1937) estimated a maximum of 3,585 birds and concluded the population was still declining, despite the limited season, the establishment of refuges, and annual restocking. Yet in the past few years intensified efforts at management and closure of the hunting season have led to a moderate upswing in the turkey population.

Distribution and abundance.—Originally the turkey range covered the wooded areas and adjacent prairies of the entire state. Turkeys were apparently still abundant in parts of the northern counties until long after their settlement, as indicated by the report of Bogardus (1874) that in 1866 he and two others killed over 50 in 3 weeks on Shoal Creek in Clinton County, northwestern Missouri. By contrast, deer had disappeared from northeastern Missouri 25 years earlier. In 1934, turkeys were found in only 45 of the 114 counties of the state. Today only 31 counties are known to contain turkeys, and of these only 17 contain more than six flocks each, although the total number of birds has increased. Only one small area remains in the southeastern lowlands where settlement and agriculture may ultimately eliminate the species. Thus, it has taken a little less than a century to exterminate the turkey on 83 per cent of its original Missouri range.

The present occupied range embraces about 7,000 square miles in the Ozarks (Leopold and Dalke, 1943) with a spring or minimal breeding population of 4,340 or an average of 22.3 turkeys per township.

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[1]A contribution from the Missouri Cooperative Wildlife Research Unit, Missouri Conservation Commission, University of Missouri, American Wildlife Institute, and Fish and Wildlife Service cooperating. The material contained herein is embodied in the larger manuscript by Dalke, A. S. Leopold, and Spencer on The Ecology and Management of the Wild Turkey in Missouri. Notes and data of Dr. Leopold were used with his permission. He was unable to participate because of pressure of work in Mexico.

Three classes of density are recognized on the basis of numbers of birds per township:

Number of birds per township	*Area sq. miles*	*Per cent*	*Flocks number per township*
1-20	4,130	59	1.6
20-40	1,750	25	3.8
40-60	1,120	16	5.9

The 596 flocks recorded show the following distribution by size classes:

Number of birds	*Per cent*
1- 5	38
6-10	41
11-15	17
16-20	4

On refuges producing 15 to 20 turkeys per square mile the zones of influence surrounding these refuges are producing 3 to 5 birds per square mile.

Factors affecting distribution and abundance of turkeys, soils, topography, and vegetation.—Within the forested region of the state, a closer relationship seems to exist between the distribution of turkeys and that of certain soil types than between turkeys and woodland as such. The most productive areas of turkey range vary from approximately 70 per cent to 95 per cent of timberland. The Clarksville stony loam, a widespread residual-limestone soil associated with the roughest topography in the Ozark region, was found to support 79 per cent of the turkey population. All of the densest populations occur here, the greatest concentrations being in the glade or "bald" country of the southwestern Ozarks. Only 40 per cent of this land is farmed. A closely related soil, Clarksville gravelly loam, supports 15 per cent of the turkeys. While steep and hilly in many places, it covers more broad valleys and flat ridge-tops and hence, more tillable land.

Land-use practices.—Turkeys are adversely affected by the land-use practices which characterize the livestock and agricultural industries in the Ozarks today. The almost universal overgrazing of pastures and woodlands has been especially damaging to turkey habitat. Extensive burning of the woodlands supplements overgrazing in suppressing desirable perennial ground cover and in delaying sound forest management. Together these factors have appreciably lowered the carrying capacity of the region for all game species. Corrective efforts

have begun. The U. S. Forest Service, with eight purchase units in the Ozark region, is leading the way to sound management of timberlands, and the fire-control programs of the Forest Service and the Conservation Commission are helping break down the tradition of annual burning. At present, two thirds of the occupied turkey range is within the boundaries of the two national forests, but since 40 per cent of their gross area is still privately owned, it is not yet possible to appraise the effects of the Forest Service program on the total turkey population within the state.

Ecological relationships, composition and organization of winter flocks.—Hens that have been unsuccessful in raising their broods often attach themselves to other family groups. Two or three hens may be seen together with 20 to 30 poults. As family groups begin to mingle together with the approach of fall, there occurs a more general reassortment of the entire turkey population, from summer families to winter flocks.

As in quail, the timing and duration of the fall shuffle may be affected by the weather, but by the end of November the flocks of turkeys are usually settled on their winter range. These areas are occupied until late March when flocks begin to break up with the onset of the breeding season, unless some major disturbance like a forest fire forces the birds to seek new territory.

There is only partial segregation of the sexes during the winter. Occasionally, however, three or four old gobblers leave the larger flocks and remain together through the winter and into the spring. The tendency toward segregation is more pronounced in the gobblers. Of 26 flocks studied, 23 per cent were composed of gobblers, 8 per cent hens, and 60 per cent mixed.

As the population increases there is more and more of a tendency for individual flocks to group together in "droves." We have observed up to 40 turkeys in a "drove." This type of grouping is only temporary, but is often repeated.

In a population of 2,450 turkeys, representing 264 flocks, counted over a 6-year period, the average size flock was 9.28 birds.

Winter flock range.—In well-stocked territory a flock range is not a separate area used only by one flock. We have found considerable overlapping of ranges where populations average 3 to 5 birds per section.

In the rough Ozark ridges and hollows the pattern of daily flock movements may vary from a broadly elliptical area of 4 or 5 square miles to a long, narrow area embracing one or two ridges, the intervening creek valley, and small, dry tributaries. Where turkeys are not continually disturbed by human activities they keep more closely to

the sources of food. The duff on hillsides, or post oak knobs or flat-topped ridges of blackjack oak is literally turned upside down by turkeys seeking mast, seeds, and hibernating insects. Cultivated fields provide food for the winter, and since corn is often left out until spring, turkeys soon learn this source of food. Use of fields is more widespread in late winter when supplies of mast and berries become scarce.

Influence of woods operations on the wild turkey.—It has been our experience that turkeys invariably move out during the course of logging operations. The Wilderness Refuge in Oregon County was created in 1938, but lumbering operations continued on the area until 1941. During those 3 years the turkeys increased from 12 to 25 birds. The year after cutting ceased, the population jumped to 71 birds. On the Drury Area similar instances were observed. An area along Fox Creek has been logged for stave bolts, saw timber, and cedar posts between 1938 and 1941. Only a few scattered birds were reported in 1940, but by the winter of 1942 turkeys had again occupied the territory covered by the logging operation.

Gobbling and gobbling territories.—As the breeding season approaches, the winter flocks separate into smaller units. In late March and early April groups of two to five birds are commonly encountered in place of the larger winter flocks; at this season the sexes are usually separated. Complete disintegration of flocks does not occur until gobbling is well underway.

Casual gobbling and strutting may occur on warm days late in the winter (Leopold, 1944). However, the period of active gobbling which results in mating begins during the last days of March, reaches its greatest intensity between April 15 and 30, tapering off to the end of May.

A census of 77 gobbling males revealed a use of a wide variety of cover types. There seemed to be a slight preference for high "balds" and abandoned fields. Some birds had gobbling territories as far as 2 miles from the nearest winter flock territory. The distances between gobbling males varied from three quarters of a mile to one quarter of a mile. The average gobbling territory embraces an area of from 100 to 300 acres.

In a normal population of wild turkeys most of the breeding is done by adult gobblers. The yearling males usually keep to themselves and make little effort to participate in mating activities. The nonbreeding of young males may be due in part to the aggressiveness of older gobblers, but there is considerable evidence that they are not physiologically prepared to breed. Old gobblers probably are necessary in a pop-

ulation for successful reproduction, and this point must be considered in transplanting wild-trapped turkeys for restocking purposes.

Laying, incubating, and hatching.—Turkey hens begin to lay before the winter flocks have completely broken up; in other words, mating begins before the gobblers have selected their territory. A hen in company with other hens may slip off to her nest, lay one egg, and return to the group. Nests are located in a wide variety of cover and topography. There appears to be no preference for any type. They were found in timber of various age classes, except dense reproduction, abandoned fields, grazed pastures, and grassy glades or "balds." None of the 29 nests found was in the deep woods, and most of them were within 200 yards of water. The incubation period of the wild turkey is 28 days. Disturbances during the early part of incubation may, and often does, cause abandonment of the nest. The hatching period is short, and the hen and her young leave the nest within 24 hours. Poults are brooded each night and in inclement weather during the day also.

Approximately 54 per cent of the nests hatch in June and 38 per cent in May. The peak of the hatching season appears to be between May 20 and June 10.

Nesting failures are due largely to the activities of man around the farm or in the woods. Of the 29 nestings of which we have record only 38 per cent were successful. Of the 62 per cent unsuccessful nests, 38 per cent failed to hatch because of the activity of man either around the farm or woods or through direct observation of the nest. All the records reported resulted from the accidental discovery of nests.

There is a gradual decline in the average size of broods. In June the average was 9.6, July 8.8, August 8.1, and September 7.7, or a loss of about 20 per cent during the summer.

Forest fires are a real menace to incubating and laying turkey hens. Figures compiled by the Forest Service for a 9-year period and by the Missouri Conservation Commission for a 5-year period show that 62 per cent of all fires occur in March, April, and May. The most critical period extends from about April 10 to June 10, a span of 60 days when turkey nests and small broods are vulnerable to destruction.

The drying up of water sources in summer is a serious factor to turkey survival in the Ozark region. Severe droughts are infrequent in Missouri; Thornthwaite (1941) shows that during the crop season the Ozark region has been humid 30 out of 39 years, and semi-arid only once in the same period (1900-1939). Yet there are large blocks of woodland in which nearly all surface water disappears during the

hot months, forcing the turkeys to move or concentrate around a few water holes where they are very vulnerable to poaching.

Predators.—Although there is now no turkey season in Missouri, man still causes a larger drain on the wild turkey population than all its natural enemies combined. The presence of such predators as the gray and red fox, coyote, red wolf, and self-hunting dogs throughout the turkey range would seem to be a threat to turkey populations. The meagre record of turkey kills attributable to any of the above indicate two things: (1) That the number destroyed by them is relatively small, and (2) that the adult native wild turkey has a remarkable ability to survive. On Caney Mountain Refuge where only minimal control of predators has been practiced, but where other management methods have been stressed, turkeys have increased in 5 years from one bird to 550 acres to a bird per 40 acres. So rapid an increase could not possibly occur if the resident foxes, coyotes, and self-hunting dogs were any great deterrent. "Kills" by these predators have been aided in some cases by the presence of woven wire fences. Often a wild turkey will pace back and forth on the downhill side of a webbed fence, trying to get through rather than fly over (Leopold, 1942). At such times, turkeys can and do become prey to the fox, coyote, or dog.

The writers realize that in other areas depredations on mature turkeys have jeopardized management programs and must be considered a major mortality factor. In Missouri, however, we believe that the larger carnivores play a role decidedly subordinate to persistent poaching by man.

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DISCUSSION

MR. G. A. AMMANN (Michigan): Has burning been detrimental to turkey ranges in all cases?

DR. DALKE: I can't speak for the ranges other than in Missouri. It certainly is detrimental where it comes at a time when the turkeys are nesting. We do find that turkeys seem to avoid density for reproduction; they do like open areas. So that in many areas where there have been repeated fires, there are still some turkeys. The gobblers like to strut and gobble on those areas. However, we believe that in the long run continual burning not only reduces the carrying capacity

and fertility of the soil, but is affecting the ability of the turkey to increase and survive.

MR. T. H. HOLDER (Arkansas): Have you made an estimate of the number of turkeys killed by poaching this year? It must be substantial.

DR. DALKE: It is substantial. I don't have the exact figures. In some areas it is rather intense; in other areas it is not, but it is continual; it isn't sporadic.

MR. C. O. HANDLEY (Virginia): With reference to this question of the effect of burning on the wild turkey, H. L. Stoddard, in his work in the Southeast, has found that so-called spot burning has been quite advantageous to the wild turkey in keeping the brush out, and burning conducted in a certain way also brings in a type of vegetation which is quite favorable to the turkey, the legumes which deposit nitrogen in the soil. I don't know that it has been proved, but it appears to me that burning of that type that brings that type of vegetation improves the soil rather than depletes it, and it also certainly favors the development of wild turkey by cleaning up the range.

DR. S. C. DELLINGER (Arkansas): I just came back from a visit to Stoddard's farm, and I believe our conditions in the Ozarks are quite different. He has the long leaf pine. It is a rather open forest, and they burned it almost forever. You don't have the heavy underbrush and the hot fires that we have in the Ozarks, and when they burn at Stoddard's farm, they are going to get rid of the oaks and other hardwoods, which are the trees that we have.

I am convinced that burning is good in Georgia, but I rather doubt it in the Ozarks, from my own observation. The burning that they do there, too, is a controlled burning, as stated, done very gently, after a very heavy dew or a light rain. In our Ozarks, they wait until it gets dry and they turn it loose and then they kill most of the timber and everything underneath the trees, which makes a barren area.

It would be very interesting to make a study in our area to see whether legumes come back under those trees, but my observation leads me to believe that that is not the case. I haven't made a detailed study of it, but that is what I am inclined to believe. In our Ozark forests in Arkansas there are very few legumes. As a matter of fact, the area under consideration with us and in part of Missouri is composed of prairie-type plants of which there are very few legumes; they are mostly deposits; even on the high areas we find derelict prairie types of vegetation.

MR. HANDLEY: The type that he describes is just as detrimental to the development of wild turkey in Georgia as it is in Arkansas, and I agree with him entirely.

MR. LAY: I would like to ask the gentleman from Missouri if their propaganda and educational program toward controlling fires, not setting fires, has had much effect on those Ozark residents that habitually burn.

DR. DALKE: We have still got the problem. I think we are making headway. There are certain areas in which there is very definite improvement, but we still have a long way to go.

DR. DELLINGER: We are trying to get our season moved up a little to the last of April rather than the first of April, for two reasons: We feel that the first of the season you are more likely to get those vigorous old toms. We also feel that the hens are probably fertilized more than one time during the season. That is certainly true in domestic turkeys. Our hunters tell us that that is not true, that one fertilization is all that is necessary, one mating. I know that that isn't true, or is not held to be true in our domestic flocks.

I would like to know if Dr. Dalke could throw any light on that question. We have had to fight that out with the hunters, and they are not convinced that we are correct, but my information from a zoological standpoint is most fowls are fertilized along during the laying.

DR. DALKE: I agree with you. In the early spring, as we approach the breeding season, the flocks still are not completely disintegrated, but a gobbler setting up his territory is not as wholly dependent as some other birds. A hen is coming there several days. So I am sure there is more than one.

DR. DELLINGER: Some of our nests that we have located show the eggs weren't fertile, especially in the areas where we have had heavy hunting pressure. That would probably indicate that that was the cause.

MR. AMMANN: I might mention an interesting experiment that we carried on, on a game farm, with pheasants, that might help answer your question regarding the fertility of eggs, or, say, the number of times the cock would have to be in contact with the hen. We segregated some hens from the cock just to try to test that particular problem, and we found that one hen laid a fertile egg thirty-five days after she was separated from the cock. However, a number of the later eggs were infertile, a high percentage of the eggs were infertile after about eighteen to twenty days, as I remember it, but we do know that on the thirty-fifth day a fertile egg was laid.

RUFFED GROUSE CENSUSING IN WEST-CENTRAL CONNECTICUT

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In June of 1940 an investigation program of ruffed grouse (*Bonasa umbellus*) was initiated by the Connecticut State Board of Fisheries and Game, with the purpose of enabling that organization to administer and manage the grouse resource to better advantage. One of the problems early encountered was to know, with reasonable accuracy, the grouse population on a specific area. The feasibility of an accurate and economical method of grouse censusing for Connecticut was questionable so an attempt was made to census grouse on the Litchfield-Morris Wildlife Sanctuary in west-central Connecticut. Unfortunately it was necessary to terminate the work at a relative early date so less data are available than would be necessary to warrant definite conclusions.

Description of study area.—The Litchfield-Morris Sanctuary, of some 4,000 acres in extent, is situated in Litchfield County, Connecticut; part of the Sanctuary being in the township of Litchfield and part in the township of Morris. The lands are owned by the White Memorial Foundation and have been in the process of acquisition since 1913. Much of the area formerly was farmland which is now in all stages of reversion, and this condition, together with coniferous plantations plus areas of forest lands, that were never cleared but frequently cutover, has produced a conglomeration of forest cover types. Except for the prohibition of hunting and a possibly greater extent of forested lands, the Sanctuary is quite typical of the New England Upland that comprises most of western Connecticut.

Census method and computations.—The grouse census method used

was that developed by R. T. King (unpublished data) and it was believed that monthly censuses together with a spring drumming site count would provide reasonably accurate population data. For the monthly censusing a 760-acre Study Area was selected and divided into 40-acre blocks, one-quarter mile on each side. The lines bounding these blocks were compass surveyed, paint blazed, and very lightly cleared of brush. North-south lines were designated by letters and east-west lines by numbers. Due to the irregular boundaries of the Sanctuary it was necessary to limit the width of the Study Area to one-half mile, and the length to 2¼ miles, with an extra 40-acre block on the northeast end. The census lines provided a fair sample of the Study Area and have been checked with a forest cover type map. For censusing, the lines, totaling 12.4 miles in length, were walked twice each month on consecutive days. The grouse flushes were recorded and flushing distances (the distance from the observer to the point from which the bird flushed) were obtained wherever possible. In most instances the lines were covered in two days, but on occasion it required three and sometimes four days of censusing. On no one day was the same line covered twice. An attempt was made to conduct the censuses on days of comparable weather conditions for it was believed that a sudden radical change in the weather might produce a change in the distribution of the birds. On a few occasions when a pronounced weather change occurred while censusing, the data were discarded and censusing begun again when conditions were more favorable. Monthly censuses were conducted from October 1940 until June 1942 with the exception of the month of November 1940. The censusing was done about the twentieth of each month. In as much as King's grouse census method has been described elsewhere (Fisher, 1939) it seems unnecessary to present a more detailed description in this paper.

The census computations were based on a sampling technique with the sample being obtained by multiplying an average flushing distance by two, and this result by the length of line traversed. Thus a simple proportion was evolved of number of birds flushed to the area of the sample (average flushing distance times two times the length of line traveled) as the number of birds on the total area is to the total area. The number of birds flushed included both birds seen and heard; the average flushing distance was obtained by totaling the flushing distances for that particular census and dividing by the number of distances obtained; the length of line had previously been chained; the total number of birds on the Study Area, or 760 acres, was the unknown; and the 760 acres was the area on which the population was desired. Inasmuch as the census lines were covered twice the total

length of line was doubled as was the acreage of the area involved. Hence the answer of number of birds was halved to represent the actual number on the 760 acres. The Study Area contained 33.2 acres of "blank" areas, including bodies of water, open fields, houses with surrounding grounds, et cetera. No birds were flushed or seen in these areas hence they have been considered as voids as far as grouse are concerned. In computing the number of acres of usable range per grouse, the total of the "blank" areas is subtracted from the 760 acres and the result divided by the computed population.

TABLE 1. GROUSE CENSUS DATA, OCTOBER 1940 TO JUNE 1942

Census month	Number of grouse flushed	Number of flushing distances	Average flushing distance (yards)	Population on 760 acres	Number of acres usable range per grouse
Oct. 1940	20	12	12.2	70	10.3
Dec. 1940	24	12	23.3	44	16.5
Jan. 1941	18	10	18.3	42	17.3
Feb. 1941	27	21	21.2	54	13.5
Mar. 1941	16	9	21.4	32	22.7
Apr. 1941	12	6	13.8	39	18.6
May 1941	7	5	7.2	41	17.7
June 1941	6	4	11.7	22	33.0
July 1941	20	17	9.6	88	8.3
Aug. 1941	18	7	15.9	48	15.1
Sept. 1941	29	14	12.3	100	7.3
Oct. 1941	27	20	15.2	75	9.7
Nov. 1941	17	7	15.9	45	16.2
Dec. 1941	15	9	11.4	56	13.0
Jan. 1942	15	13	17.0	37	19.6
Feb. 1942	17	8	14.2	50	14.5
Mar. 1942	12	10	14.6	35	20.8
Apr. 1942	14	8	13.9	43	16.9
May 1942	6	6	9.7	26	26.2
June 1942	9	7	15.9	24	30.3

Census data.—Table 1 presents the statistical data obtained during the censuses as well as the total computed population on the Study Area and the number of acres of usable range per grouse. The number of grouse flushed per census varied but as is natural the largest number of birds were flushed in the fall and the least number in May and June. The lack of birds in May and June may be due to the nesting season for the daily mobility is undoubtedly less in the nesting season than at other seasons, and the chances of flushing birds would be less. The maximum number of birds flushed on any one census was 29 in September of 1941, and the minimum was 6 which occurred in June 1941 and again in May 1942. The total number of grouse observed was 329 on 492.8 miles of line, or about one grouse per 1½ miles of line walked.

The number of flushing distances was usually less than the number of birds flushed for frequently a bird went up but the observer was unable to ascertain the exact spot from which it flushed. In one half of the censuses less than ten flushing distances were obtained which is a small number from which to derive an average. The ratio of the

number of flushing distances obtained to the number of birds flushed was approximately two to three. The average flushing distance per census varied for as the birds shifted within their seasonal and yearly cruising radii they were found in different forest cover types, and data based on average flushing distances per forest cover types show that flushing distances will vary with cover types.

The population figures show a relatively high fall population with a rapid decline in the late fall, and a gradual fluctuating decline throughout the winter and spring. The census data throughout the summer varied considerably and cannot be considered reliable. This was probably because the area was not sufficiently large, or enough broods flushed, to present a fair sample of the number of broods, or number of young per brood. The winter population figures show a variation of 33 per cent between some monthly census which can be considered a 33 per cent error in as much as the population figure increased. This error would eliminate the possibility of taking an individual census and obtaining a reliable population figure. However, with a series of monthly censuses it was possible to construct a curve of the population which can be considered reasonably accurate (Figure 1).

Drumming site count.—To check the census method described and to obtain data on grouse drumming, a drumming site count was made in April and May of 1941. The Study Area was thoroughly checked for drumming birds and once a site was located careful periodic checking was used to be certain that it was an established drumming site and not a chance occurrence. Eighteen drumming sites were found on the area and two others within 100 yards of the boundary. Thus there were 18 drumming males on the Study Area and, assuming a 1 to 1 sex ratio (Bump, 1932; Bezdek, 1944), the spring population was 36 birds. This was slightly lower than the 39 birds recorded in the April, and the 41 in the May censuses. In connection with grouse drumming it was found that of the 20 drumming sites, 9 were on stonewalls, 7 on down logs, and 4 on rock outcrops or boulders. Often a bird would use two or more objects within a localized area, or two or more places along the same stonewall.

Breeding potential.—The drumming site count in the spring of 1941 showed 18 drumming males on the Study Area, or, using a 1 to 1 sex ratio, a population of 36 adults. The average number of eggs per clutch has been assumed to be 11, and this figure has been fairly well substantiated by the few nests observed as well as by other investigators (Bump, 1935). Assuming that all 18 females nested successfully the breeding potential for the spring of 1941 would have been 198 chicks. This figure added to the number of adults, 36, would give a

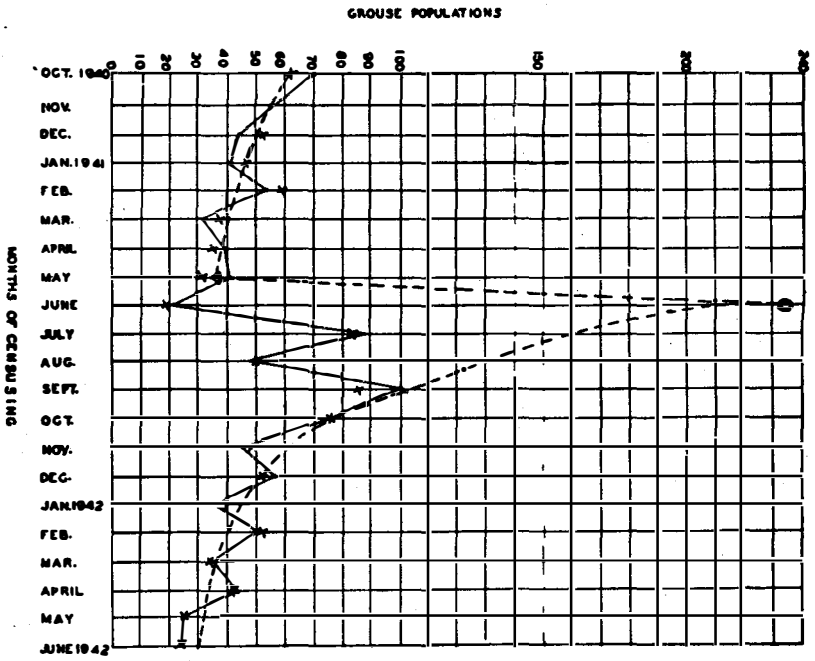

Figure 1. Graphs of monthly grouse populations

1. Population computed from monthly censuses, •; 2. Population computed from drumming site count, △; 3. Adult population plus breeding potential, O; 4. Populations computed using actual and average flushing distance per forest cover type, ×; 5. Graph constructed from monthly censuses, drumming site count, and breeding potential, — — — —; 6. Graph of monthly grouse censuses, ————————.

theoretical June population of 234 birds. Undoubtedly the figure of 198 chicks was never obtained for indications were that nest mortality was relatively high, as was found in New York State (Edminster, 1939). However, it does represent the potential and is a basis from which mortality can be ascertained.

Population curve.—A population curve for the census period has been drawn in Figure 1. The sector of the curve from October 1940 to May 1941 was constructed by inspection utilizing the census computed from the drumming site count as a reliable May population. The June population was the breeding potential plus adult birds. From September 1941 to June 1942 the curve was again constructed by inspection and connected to the June 1941 population. The curve shows the population trends during the fall, winter, and spring plus giving reasonably accurate population figures. The portion of the curve from May to September cannot be utilized for actual population data as the time of occurrence and degree of mortality factors are

TABLE 2. AVERAGE FLUSHING DISTANCES PER FOREST COVER TYPES

Forest Cover Types	Number of flushes	Average flushing distance (yards)
1. All aged hardwoods (red oak, white oak, black birch)	70	18.1
2. Old field reverting, poles and saplings (grey birch, fire cherry, thornapple, red maple, apple)	53	13.3
3. Red maple swamp (red maple, American elm, black ash)	44	17.2
4. White pine plantation, poles (white pine, red maple, grey birch)	27	13.3
5. White pine plus all aged hardwoods (white pine, oaks, red maple, black cherry)	20	13.6
6. Alder thicket (alder, shrubs)	19	12.3
7. Red maple swamp plus hemlock (hemlock, red maple, American elm, black ash)	17	14.4
8. Red pine plantation, poles (red pine)	13	10.8
9. Scotch pine plantation, poles (scotch pine)	5	18.8
10. Old field reverting, saplings (red maple, grey birch, fire cherry)	5	11.4
11. White spruce plantation, poles (white spruce)	5	12.8
12. Clearcut (red maple stump sprouts)	3	16.0
13. Hemlock plus all aged hardwoods (hemlock, red oak, white oak, black birch)	2	16.0
14. White pine and hemlock, all ages (white pine, hemlock)	2	12.5
15. Blue spruce plantation, poles (blue spruce)	2	11.0

not known. In the fall of 1941, and likewise in 1942, the curve shows a rapid decline in population which is rather surprising in as much as there is no hunting on the area. During the winter there is a rather steady "normal" decline.

Average flushing distance per forest cover type.—In computing a grouse population by the King census method it is imperative that an accurate average flushing distance be obtained. For the 20 monthly censuses there were 10 on which less than 10 flushing distances were available from which to compute the average flushing distance. In recording grouse observations on the Study Area the forest cover types in which the birds flushed were noted. From these data an average flushing distance for each forest cover type has been computed.

The forest cover types, number of flushes per type, and the average flushing distance for each type, are presented in Table 2. The forest cover types do not necessarily conform to any existing classification so the principal species present in each type are recorded. In seven of the types less than six flushing distances were available, but these types are of limited extent. The red maple swamp and all aged hardwoods had average flushing distances of 17.2 and 18.1 yards, respectively. Except for the pole Scotch pine plantation, where only five flushing distances were obtained, these were the longest average flushing distances. Conifers were absent from both of these types. The red maple swamps were practically pure red maple with a scattering of elm and ash, and the all aged hardwoods were principally oaks, black birch and red maple. Correspondingly the shorter average flushing distances tended to be in the coniferous plantations or denser cover types.

TABLE 3. MONTHLY CENSUS DATA USING ACTUAL, AND AVERAGE PER FOREST COVER TYPES, FLUSHING DISTANCES

Census month	Number of grouse flushed	Average flushing distance (yards)	Population on 760 acres	Number of acres of usable Range per grouse
Oct. 1940	20	13.6	62	11.7
Dec. 1940	24	19.2	53	13.7
Jan. 1941	18	16.6	46	15.8
Feb. 1941	27	19.3	59	12.3
Mar. 1941	16	18.2	37	19.6
Apr. 1941	12	14.9	36	20.2
May 1941	7	9.8	31	23.4
June 1941	6	13.1	19	38.3
July 1941	20	10.1	83	8.8
Aug. 1941	18	15.2	50	14.5
Sept. 1941	29	14.2	86	8.5
Oct. 1941	27	15.3	75	9.7
Nov. 1941	17	14.6	49	14.8
Dec. 1941	15	12.2	52	14.0
Jan. 1942	15	16.5	39	18.6
Feb. 1942	17	14.2	51	14.3
Mar. 1942	12	14.6	35	20.8
Apr. 1942	14	14.0	42	17.3
May 1942	6	9.7	26	28.0
June 1942	9	15.8	24	30.3

Of the grouse that flushed while censusing, flushing distances were obtained on approximately two thirds and, whereas the other one third was included in the computations, they were ignored in determining the average flushing distance for each monthly census. The monthly censuses have been recomputed using the flushing distances where available, and the average flushing distance for the cover type from which the bird flushed, where no flushing distance had been obtained. That is, if a bird flushed from an all aged hardwood stand and the flushing distance was not obtained, the average flushing distance for all aged hardwoods, 18.1 yards, was used for that bird.

The census data used in the recomputation of the monthly populations, the monthly population figures, and the number of acres of usable range per grouse are presented in Table 3. The computed population on the 760 acres does not vary radically from the population figures obtained using only actual flushing distances. This was surprising for 329 flushing distances were utilized in computing these censuses compared with 215 actual flushing distances. The monthly populations as computed are shown in Figure 1. In general the recomputed populations form a smoother curve with less fluctuation than the population curve based only on actual flushing distances.

SUMMARY

The King grouse census method was used to obtain monthly grouse populations on a 760-acre Study Area in west-central Connecticut. Twenty monthly censuses were completed from October 1940 to June 1942, and a drumming site count was made in the spring of 1941. From these data a population curve was constructed which it is be-

lieved is reasonably accurate for all seasons except the summer, that is the months of June to August, inclusive. Individual censuses, exclusive of the summer, showed as much as 33 per cent error. An average flushing distance per forest cover type was derived from the grouse flushes. The monthly censuses were recomputed using the actual flushing distances available; and, for the birds that flushed and no distances obtained, the average flushing distance, for the particular forest cover type from which the bird flushed, was used. Monthly populations based on this method tended to produce a smoother population curve.

From the work performed the following notes, or procedures, regarding the usage of the King grouse census method are advocated:

1. Census grouse monthly, exclusive of the summer months, so as to obtain a series of monthly population figures from which a population curve may be drawn. Do not use an individual census figure as a population figure.

2. Use as much census line as possible for, within limits, the more line covered the greater are the chances of flushing birds and likewise the more flushing distances will be obtained.

3. The censusing should be performed in a single day whenever possible. The longer the censusing period the greater the susceptibility of weather change.

4. Record the forest cover type for each bird flushed and compute an average flushing distance per forest cover type. Use these averages for birds that flushed but for which no distances were obtained.

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DISCUSSION

MR. JOHN DODGE (New Hampshire): Mr. Frank, have you any data on the population trends of grouse in the State at the moment?

MR. FRANK: No, I don't have any data on the population.

MR. DODGE: In our State, we have been very much interested in the tremendous drop in the grouse population.

MR. FRANK: We are trying to work it up from other reports.

MR. MAURICE BROOKS (West Virginia): I wanted to raise the same question. During the years 1940 and 1942, about the time of your census we had a relatively-stable grouse population in West Virginia. In 1944 and 1945, the decrease has

been spectacular. We have a very sharply-decreased grouse population in the State, which we can account for on hunting pressures, as the hunting pressures presumably during the war were not so great as they had been, but the grouse decrease has been really quite spectacular. I wondered whether anybody else has had similar experiences.

MR. FRANK: As for myself, I was in Europe most of that time. In this area, they did take censuses once in the fall and once in the spring. Again, as I pointed out in the paper, I can't hold much reliability on an individual census, because at the best it is a trend. They found from that censusing once in the fall and once in the spring that it has been fairly stable in this area. They did not report any decline in '44.

MR. F. H. BEZDEK (Ohio): In connection with the remark by the gentleman of West Virginia, since we are adjoining states, before I went into the service we worked on ruffed grouse in Ohio. Although some of the things are vague in my mind, I would like to make a few statements. Back in the 1890's and 1900's, during the period then, and before that when so much timber was being cut out for use in charcoal furnaces and the like, and when it was pretty well denuded along the Ohio River, we had a fair grouse population, but in the last 4 or 5 years or so it seems that our population in that section has been pretty stable. Apparently in some areas where the grouse population doesn't reach a certain peak, there is no noticeable cycle. At least that has been our experience in all the findings of Dr. Chapman, who worked there before I did, and my own. By population being pretty stable, none of the areas that I censused, which was the same method that Dr. Chapman developed or used, it never got around to more than one bird on an average per study area to 15 or 20 acres. That was the highest population we ever got during the peak of the run prior to the hunting season. So it is interesting to compare that with the drop in West Virginia in '44 and '45, although we have had no census since that time.

We found no change in the population of birds in that area in the last 20 years, or even more than that, since about 1900.

MR. G. A. AMMANN (Michigan): In Michigan we had exactly a parallel situation to what Mr. Brooks cited for West Virginia, a relatively-stable population of ruffed grouse from '40 to '42, with possibly '42 a little higher, and in '43, '44 and '45, a drop in '44, and in '45 particularly a very sizable drop in population from all indications.

MR. GARDINER BUMP (New York): I think that perhaps we can give our friend from West Virginia a little encouragement on that, in that these periodic decreases are nothing at all new. The years ending in 4 or 5 have seen a number of periodic declines followed by a slight recovery and then by a still further decline in the years ending in 7, 8, or 9. I am not making any predictions as to what may happen, except that 1896, 1906, 1907, 1917 and 1918, 1924, 1927, 1928 and 1929 were all years of extreme grouse scarcity over a good share of the grouse range, and we can be, I think, reasonably sure that those periods will come again, and also that there will be a pretty complete recovery quite unassociated with your hunting pressure on grouse.

MR. JOHN P. LEONARD (Connecicut): I used to hunt grouse as a kid. In those days, practically every farmer had to work up a woodpile from his forest area. We had numerous little clear-cuttings or plots along in the woods where grouse liked to live. Our method of heating our homes has changed to oil and coal, and our forest lands are not cleared, there are not as many of these openings, and I wonder if that isn't one of the reasons why our grouse don't do so well, because they don't have the number of environmental areas to have nesting and feeding sites, and the grubs that inhabited the old logs and stumps that were left.

I think all those things help to cut down our grouse population. I wonder if Mr. Bump could answer that.

MR. BUMP: You are absolutely right, the grouse follows, to a certain extent, the actions of the axe. On the other hand, in a state like New York and most of

the northern states, abandonment is increasing among farmlands, and there is today, therefore, as the area is abandoned and the land becomes overgrown, far more of the summer and fall feeding grounds which are represented by your cut-over lands than we ever had before. The one advantage of the situation that you mentioned is that you went into the woods and opened up a new area, and that still will bring more grouse in a heavily-wooded area.

THE PRESENT STATUS OF MOOSE ON ISLE ROYALE

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The tragic reduction of the Isle Royale moose herd from an overpopulation during the early '30's to a mere remnant by 1936 has focused national attention on this problem. Like the Kaibab deer herd, this is another example where an animal population exceeded its food supply. Today we are more cognizant of these maladjustments and are better prepared to prevent them than in the past.

With the responsibility of wildlife research on national parks now in the Fish and Wildlife Service, that organization initiated a study of the Isle Royale moose in the spring of 1944. It has been the responsibility of the authors to carry out that assignment.

During the period from about 1929 to 1935 the moose on Isle Royale underwent a drastic reduction due to the effects of a depleted food supply. The term starvation is purposely avoided because it is merely the chief contributing factor to the cause of ultimate death. According to Murie (1934), the moose population was somewhere between 1,000 and 3,000 in 1930 and he reported a seriously overbrowsed condition over most of the island. How many moose were left on the island by 1935 is not known but the number perhaps did not exceed 200. By 1936 the carrying capacity for moose on the island had probably reached its lowest point. In addition to overbrowsing, a great reduction of balsam fir browse was inflicted by the spruce bud worm. In 1936 fires burned over approximately one fourth of the island. These eliminated a large part of the browse supply for 2 or 3 years, but in the long run have been one of the greatest factors in permitting a comeback of the moose. Today the 1936 burned area supplies more browse than the remainder of the island combined.

The animals were at their lowest some time between 1935 and 1937 and since then have been steadily increasing. This fact leads to the realization that a close check must be kept on the population and the

browse supply in order to avoid a repetition of moose wastage through an overpopulation and subsequent browse shortage.

The problem has been approached by a study of the food situation in relation to the present population. A preliminary survey of the island was made in May of 1944 followed in September by an appraisal of the aquatic foods. In February 1945 an airplane census was made and in May a winter browse survey was completed. From these investigations a knowledge of the present moose situation has been obtained.

The aerial count was made by the senior author and Park Ranger Karl Gilbert on February 5, 1945 from a Waco 5-passenger biplane equipped with skiis. A monoplane would have been better for this purpose but none was available. Eight parallel strips were flown lengthwise of the island at approximately 1-mile intervals and 300 to 500 feet above the terrain (Figure 1). A 30 per cent coverage was accomplished and 122 moose were seen. The handicap of the lower wing in obstructing the visibility of one observer, coupled with seeing many fresh tracks but no moose, led us to attribute a 20 per cent error in the count. The outcome was an estimated 510 moose on the island and both observers feel that this was a conservative figure.

During most of the winter the majority of the moose were concentrated on the ridges and on the 1936 burn (Figures 1 and 2). This was clearly shown by the location of the animals from the plane and by the browsing pressure as indicated by our browse survey.

Now let us analyze the browse situation in the spring of 1945 and see what might be expected if the herd continues to increase. The aquatic foods of the moose have never fully recovered from their depletion at the time of the maximum population. A few waterlilies are present but they are being eaten about as fast as they grow. The sedge mats are still broken up by wallowing animals, and pond weeds are quite scarce except in the deeper waters.

The field data on browse utilization was obtained by appraising 689 one-one-hundredth-acre plots in representative cover types on the island (Figure 2). The plots were spaced at 10-chain intervals and run in straight lines or parallel to trails. Where trails were followed the plots were taken far enough from the beaten path to avoid the excessive browsing that is characteristic along all trails. This procedure gave an unbiased and random sampling of the island vegetation.

The browse survey method used was the one developed by Aldous (1944) for deer browse surveys. The only change made was increase in the height of the browse line to 12 feet.

The data were gathered from 17 areas on the island to give regional and habitat classification to the findings. This data has been summarized for the purpose of presenting an over-all picture of the

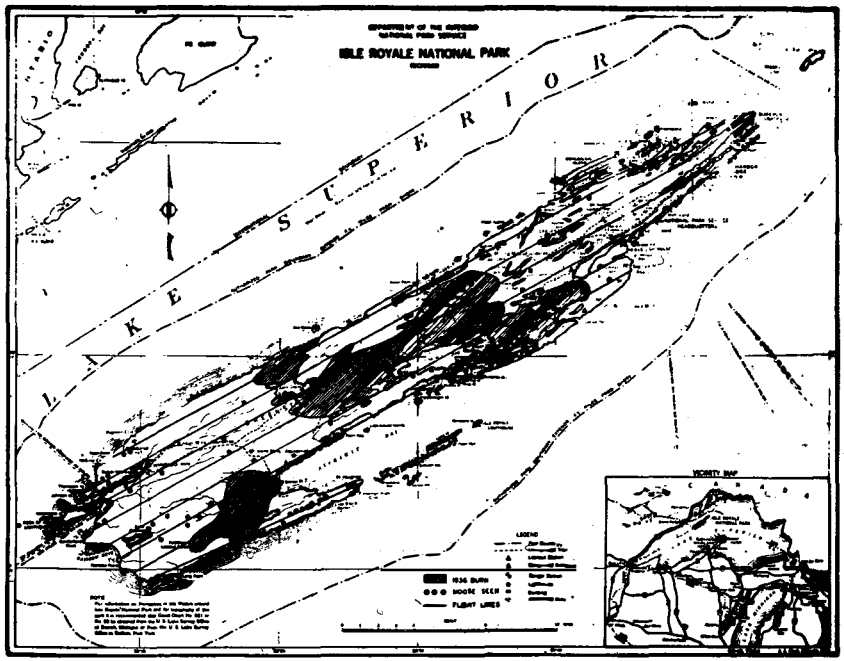

Figure 1. Survey flight lines, moose seen, and location of 1936 burn.

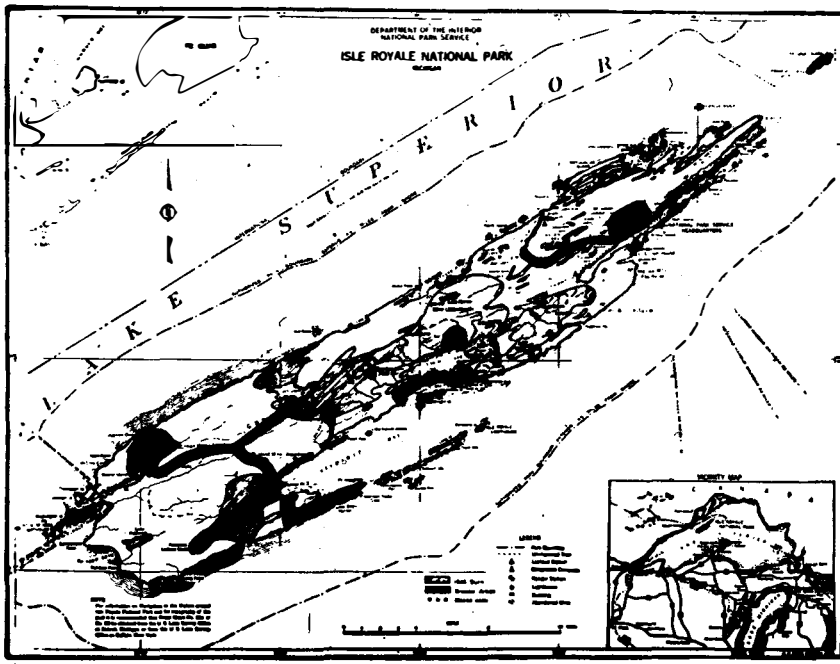

Figure 2. Location of 1936 burn and areas covered in browse survey.

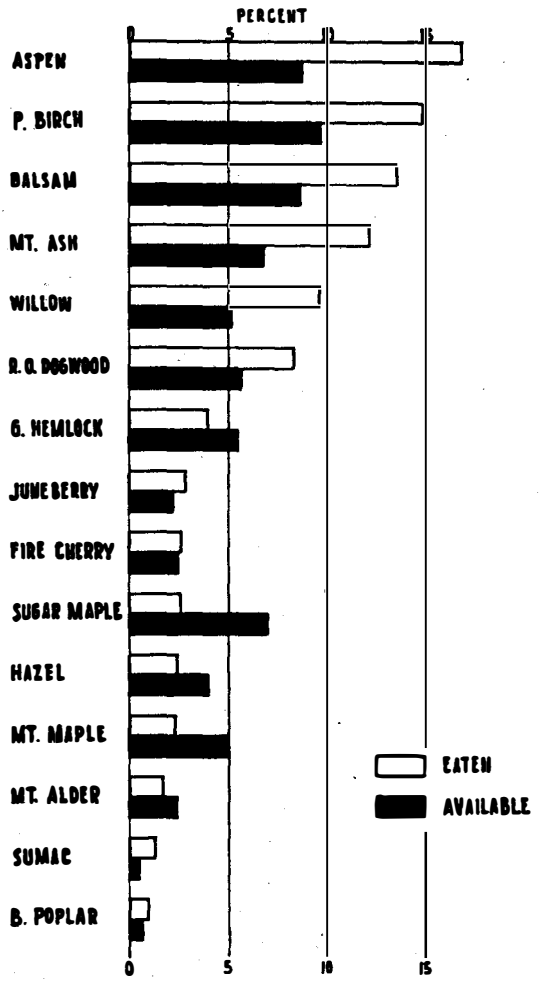

FIGURE 3. PERCENTAGES OF THE MORE IMPORTANT FOODS EATEN AND THEIR AVAILABILITY.

browse situation on the island (Figure 3, Table 1). In these analyses the results from Passage and Smithwick Islands have been omitted because there was no recent evidence of moose habitation. During the course of these surveys the writers covered approximately 150 miles

TABLE 1. THE WINTER FOOD OF MOOSE ON ISLE ROYALE

Area	Summary all plots		Beaver Island		Washington Island		Huginnin Cove		Island Mine Lake Desor & Windigo		Siskiwit Bay to Island Mine	
Basis	689 plots		10 plots		12 plots		54 plots		73 plots		25 plots	
	Available	In diet	Available	In diet	Available	In diet	Available	In diet	Available	In diet	Available	In diet
1. Aspen (*Populus tremuloides*)	8.7	16.9	.....	.....	.....	.....	8.6	17.7	0.1	0.4	6.4	19.0
2. Paper birch (*Betula papyrifera*)	9.8	14.9	12.5	6.2	7.4	9.5	4.1	4.4	0.8	2.2	2.4	5.1
3. Balsam fir (*Abies balsamea*)	8.6	13.6	15.0	15.1	16.1	29.0	10.5	16.2	1.3	4.9	2.1	3.8
4. Mountain ash (*Sorbus americana*)	6.8	12.1	8.8	15.4	9.7	17.6	7.8	13.6	2.8	8.8	4.3	8.3
5. Willow sp. (*Salix* spp.)	5.1	9.6	.....	.....	2.0	1.2	0.6	0.7	0.1	0.2	3.8	10.5
6. Red osier dogwood (*Cornus stolonifera*)	5.6	8.3	1.2	3.1	1.0	6.9	4.1	5.9	0.3	0.1	14.7	24.2
7. Ground hemlock (*Taxus canadensis*)	5.5	4.0	15.0	10.5	9.7	1.1	6.4	2.2	1.3	0.3	1.1	.....
8. Juneberry (*Amelanchier Bartramiana*)	2.2	2.9	3.8	9.2	.....	.....	1.0	1.0	0.1	0.3	8.3	11.6
9. Fire cherry (*Prunus pennsylvanica*)	2.5	2.7	1.2	3.1	12.7	27.0	3.7	5.9	0.6	1.3	2.4	2.7
10. Sugar maple (*Acer saccharum*)	7.0	2.7	.....	.....	.....	.....	.....	.....	54.2	58.1	6.2	8.6
11. Beaked hazelnut (*Corylus cornuta*)	4.0	2.5	.....	.....	.....	.....	3.7	4.2	3.1	2.9	6.2	3.4
12. Mountain maple (*Acer spicatum*)	5.0	2.3	21.3	37.4	30.9	7.7	10.5	4.8	7.2	6.0	1.9	0.9
13. Mountain alder (*Alnus crispa*)	2.4	1.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
14. Sumac (*Rhus glabra*)	0.5	1.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
15. Balsam poplar (*Populus balsamifera*)	0.6	1.0	.....	.....	.....	.....	5.1	11.6	.....	.....	3.8	1.3
16. Highbush cranberry (*Viburnum trilobum*)	1.4	0.8	.....	.....	.....	.....	.....	.....	.....	.....	0.3	.....
17. White cedar (*Thuja occidentalis*)	5.8	0.7	7.5	.....	.....	.....	10.1	1.3	19.1	4.0	13.9	.....
18. Yellow birch (*Betula lutea*)	0.8	0.6	.....	.....	.....	.....	6.7	5.9	2.8	5.0	.....	.....
19. Speckled alder (*Alnus incana*)	3.2	0.3	.....	.....	.....	.....	6.4	4.4	.....	.....	15.3	0.6
20. White pine (*Pinus strobus*)	0.4	0.3	1.2	.....	.....	.....	0.2	.....	0.1	.....	.....	.....
21. Honeysuckle (*Lonicera canadensis*)	7.8	0.2	13.8	.....	3.1	.....	6.2	0.2	1.1	0.1	1.6	.....
22. Red maple (*Acer rubrum*)	0.1	0.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
23. Round leaf dogwood (*Cornus rugosa*)	0.1	0.1	.....	.....	.....	.....	.....	.....	1.2	2.6	.....	.....
24. Black ash (*Fraxinus nigra*)	0.4	0.1	.....	.....	.....	.....	.....	.....	0.1	0.1	.....	.....
25. Black spruce (*Picea mariana*)	0.8	0.1	7.5	.....	.....	.....	.....	.....	0.5	.....	4.5	.....
26. Red berried elder (*Sambucus pubens*)	1.4	0.1	1.2	.....	6.4	.....	1.4	.....	2.8	2.7	.....	.....
27. Currant and gooseberry (*Ribes* spp.)	0.2	Tr.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
28. White spruce (*Picea glauca*)	2.2	Tr.	.....	.....	1.0	.....	2.9	.....	0.3	.....	0.3	.....
29. Green ash (*Fraxinus p. lanceolata*)	Tr.	.....	.....	.....	.....	.....	.....	.....	0.1	.....	.....	.....
30. Jack pine (*Pinus banksiana*)	0.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
31. Juniper (*Juniperus c. depressa*)	0.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
32. Rose (*Rosa* spp.)	Tr.	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.5	.....
33. Nine-bark (*Physocarpus opulifolius*)	0.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
34. Tamarack (*Larix laricina*)	Tr.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

TABLE 1—Continued). THE WINTER FOOD OF MOOSE ON ISLE ROYALE

Area	North Shore Siskiwit Bay, Old Dock		Hay Point		North of Hay Bay		Feldtman Tower Trail		Houghton Point Ridge		Wright Island	
Basis	25 plots		21 plots		27 plots		40 plots		103 plots		40 plots	
	Available	In diet	Available	In diet	Available	In diet	Available	In diet	Available	In diet	Available	In diet
1. Aspen (*Populus tremuloides*)	18.0	26.5	1.4	1.8	16.8	24.0	5.5	10.7	14.8	24.4	.....	.....
2. Paper birch (*Betula papyrifera*)	1.3	1.6	4.5	9.7	24.8	23.2	41.7	49.4	13.1	15.7	4.2	4.8
3. Balsam fir (*Abies balsamea*)	6.5	8.6	33.5	50.7	2.8	2.6	1.9	0.3	4.1	4.8	18.6	18.8
4. Mountain ash (*Sorbus americana*)	2.1	3.0	1.6	2.1	2.2	3.0	3.2	5.7	24.7	39.6	6.5	7.7
5. Willow sp. (*Salix* spp.)	6.4	9.7	0.7	0.9	13.8	20.6	11.8	17.1	2.4	3.9	.....	.....
6. Red osier dogwood (*Cornus stolonifera*)	24.8	30.5	15.7	28.4	2.5	1.2	3.2	3.4	3.7	4.0	1.2	1.4
7. Ground hemlock (*Taxus canadensis*)	.....	.....	15.7	1.2	.....	.....	0.6	0.9	2.0	0.2	53.2	61.7
8. Juneberry (*Amelanchier Bartramiana*)	.....	.....	0.3	0.7	.....	.....	3.9	9.8	0.8	0.5	.....	.....
9. Fire cherry (*Prunus pennsylvanica*)	7.3	7.5	.....	.....	7.3	5.5	2.5	.6	1.8	1.4	.....	.....
10. Sugar maple (*Acer saccharum*)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
11. Beaked hazelnut (*Corylus cornuta*)	.....	.....	.....	.....	12.1	12.6	.....	.....	Tr.	.....	.....	.....
12. Mountain maple (*Acer spicatum*)	2.2	1.4	2.6	0.2	1.5	.....	3.5	0.6	9.4	4.5	6.6	3.2
13. Mountain alder (*Alnus crispa*)	0.5	0.5	.....	.....	1.0	1.5	.....	.....	0.5	0.3	.....	.....
14. Sumac (*Rhus glabra*)	2.2	3.7	.....	.....	2.3	3.5	.....	.....	.....	.....	.....	.....
15. Balsam poplar (*Populus balsamifera*)	2.4	1.6	3.3	0.2	.....	.....	.....	.....	.....	.....	.....	.....
16. Highbush cranberry (*Viburnum trilobum*)	.....	.....	7.2	3.3	0.2	.....	.....	.....	0.8	0.2	4.0	2.3
17. White cedar (*Thuja occidentalis*)	7.6	0.1	0.7	0.4	0.8	0.2	2.2	0.9	7.0	0.1	3.8	0.1
18. Yellow birch (*Betula lutea*)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
19. Speckled alder (*Alnus incana*)	.....	.....	10.2	0.4	2.2	.....	6.3	0.3	2.3	0.1	0.2	.....
20. White pine (*Pinus strobus*)	2.9	3.2	.....	.....	0.2	.....	.....	.....	0.1	0.1	.....	.....
21. Honeysuckle (*Lonicera canadensis*)	2.6	Tr.	1.6	.....	2.7	0.3	2.7	0.3	6.3	0.2	0.6	Tr.
22. Red maple (*Acer rubrum*)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
23. Round leaf dogwood (*Cornus rugosa*)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
24. Black ash (*Fraxinus nigra*)	2.4	2.0	.....	.....	1.0	0.6	1.9	.....	Tr.	.....	.....	.....
25. Black spruce (*Picea mariana*)	1.1	.....	.....	.....	3.1	1.2	0.6	.....	Tr.	.....	.....	.....
26. Red berried elder (*Sambucus pubens*)	.....	.....	0.7	.....	0.8	.....	7.4	.....	2.5	.....	0.6	.....
27. Currant and gooseberry (*Ribes* spp.)	1.1	.....	.....	.....	0.2	.....	0.3	.....	0.2	.....	.....	.....
28. White spruce (*Picea glauca*)	6.4	0.1	.....	.....	1.7	.....	0.8	.....	3.4	.....	0.5	.....
29. Green ash (*Fraxinus p. lanceolata*)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
30. Jack pine (*Pinus banksiana*)	.....	.....	.....	.....	.....	.....	.....	.....	Tr.	.....	.....	.....
31. Juniper (*Juniperus c. depressa*)	2.2	.....	.....	.....	.....	.....	.....	.....	0.1	.....	.....	.....
32. Rose (*Rosa* spp.)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
33. Nine-bark (*Physocarpus opulifolius*)	.....	.....	0.3	.....	.....	.....	.....	.....	.....	.....	.....	.....
34. Tamarack (*Larix laricina*)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

TABLE 1—Continued). THE WINTER FOOD OF MOOSE ON ISLE ROYALE

Area	Between Siskiwit Bay and Lake		North of Siskiwit Lake		McCargo Cove Trail		Mt. Franklin Trail		Rock Harbor Trail		Mott Island	
Basis	74 plots		20 plots		47 plots		45 plots		58 plots		15 plots	
	Available	In diet	Available	In diet	Available	In diet	Available	In diet	Available	In diet	Available	In diet
1. Aspen (*Populus tremuloides*)	7.2	13.5	9.6	10.8	20.2	31.9	10.7	13.5	7.0	17.6	0.9	2.8
2. Paper birch (*Betula papyrifera*)	6.4	12.9	63.4	71.8	3.9	3.6	5.6	11.9	6.7	13.2	0.4	1.7
3. Balsam fir (*Abies balsamea*)	1.5	2.0	.....	.....	4.8	6.5	8.4	10.0	25.6	47.4	49.2	2.2
4. Mountain ash (*Sorbus americana*)	3.4	5.9	0.3	0.4	1.2	1.2	4.6	1.6	2.7	5.9	3.4	14.9
5. Willow sp. (*Salix* spp.)	13.9	22.2	11.2	10.5	7.5	17.2	5.9	13.4	0.8	2.1	5.4	16.4
7. Ground hemlock (*Taxus canadensis*)	12.0	17.6	.....	.....	3.9	5.6	2.8	3.5	1.0	1.5	10.1	36.7
8. Juneberry (*Amelanchier Bartramiana*)	0.3	Tr.	.....	.....	.....	.....	0.8	.....	0.6	.....	2.9	5.4
6. Red osier dogwood (*Cornus stolonifera*)	3.9	5.9	.....	.....	8.0	10.9	7.9	9.8	2.2	2.0	2.5	11.0
9. Fire cherry (*Prunus pennsylvanica*)	3.3	2.8	1.1	0.7	4.6	5.4	0.5	0.7	0.3	0.4	.....	.....
10. Sugar maple (*Acer saccharum*)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
11. Beaked hazelnut (*Corylus cornuta*)	5.9	11.3	.....	.....	13.6	3.3	27.8	29.2	.....	.....	.....	.....
12. Mountain maple (*Acer spicatum*)	4.8	1.5	0.7	Tr.	0.6	Tr.	2.8	.....	0.8	.....	.....	.....
13. Mountain alder (*Alnus crispa*)	2.7	1.7	.....	.....	4.3	6.9	2.6	4.0	13.6	4.3	8.8	.....
14. Sumac (*Rhus glabra*)	0.5	1.0	4.8	5.8	1.8	5.9	.....	.....	.....	.....	.....	.....
15. Balsam poplar (*Populus balsamifera*)	0.1	0.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
16. Highbush cranberry (*Viburnum trilobum*)	0.8	0.4	.....	.....	0.3	0.3	1.5	0.4	4.6	4.4	9.2	8.6
17. White cedar (*Thuja occidentalis*)	1.1	0.5	2.5	.....	0.2	.....	.....	.....	1.5	0.4	.....	.....
18. Yellow birch (*Betula lutea*)	0.1	0.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
19. Speckled alder (*Alnus incana*)	7.4	.....	0.3	.....	2.5	.....	2.3	0.3	1.4	.....	3.4	0.3
20. White pine (*Pinus strobus*)	0.1	0.2	0.7	.....	0.1	.....	.....	.....	0.6	0.7	.....	.....
21. Honeysuckle (*Lonicera canadensis*)	20.5	0.2	2.7	Tr.	17.9	0.2	2.6	.....	19.3	.....	.....	.....
22. Red maple (*Acer rubrum*)	.....	.....	.....	.....	0.5	1.1	0.8	1.7	.....	.....	.....	.....
23. Round leaf dogwood (*Cornus rugosa*)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
24. Black ash (***Fraxinus nigra***)	0.4	.....	.....	.....	0.1	.....	.....	.....	.....	.....	.....	.....
25. Black spruce (*Picea mariana*)	.....	.....	.....	.....	2.0	.....	.....	.....	1.9	.....	.....	.....
26. Red berried elder (*Sambucus pubens*)	0.1	.....	.....	.....	0.3	.....	0.2	.....	.....	.....	.....	.....
27. Currant and gooseberry (*Ribes* spp.)	0.1	.....	.....	.....	0.2	.....	.....	.....	0.3	0.1	.....	.....
28. White spruce (*Picea glauca*)	2.5	.....	2.7	.....	1.3	.....	6.1	.....	3.9	.....	1.3	.....
29. Green ash (*Fraxinus p. lanceolata*)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
30. Jack pine (*Pinus banksiana*)	.....	.....	.....	.....	.....	.....	0.2	.....	0.6	.....	.....	.....
31. Juniper (*Juniperus c. depressa*)	0.6	.....	.....	.....	0.2	.....	5.9	.....	4.5	.....	2.5	.....
32. Rose (*Rosa* spp.)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
33. Nine-bark (*Physocarpus opulifolius*)	0.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
34. Tamarack (*Larix laricina*)	.....	.....	.....	.....	.....	.....	.....	.....	0.1	.....	.....	.....

afoot over the island. A total of 40 moose were seen and all appeared to be in good physical condition.

The browse survey:—An examination of the degree of utilization in the various areas studied show that the heaviest usage was in the brushy areas, ridges, and semi-open places. Mature hardwood and swampy areas were used rather lightly as the undergrowth was either scanty or of low palatability.

A study of the browse data shows that the 12 top ranking winter foods in order of their importance to moose are: aspen, white birch, balsam fir, mountain ash, willow, red osier dogwood, ground hemlock, juneberry, fire cherry, sugar maple, beaked hazelnut, and mountain maple. A total of 28 browse species were eaten but 6 additional ones were listed that had not been eaten in order to have a record of their occurrence. These may serve as browse index species when an increase of the moose population forces the animals to eat them (Table 1).

The first 12 species referred to formed 92.5 per cent of the moose food during the winter period. These plants in general are both well distributed and palatable. Some of the less important food species are highly palatable but have poor distribution. Sumac is perhaps the best example of this latter group. It was browsed severely on every occasion but was found on only .7 per cent of the plots. On the other hand such species as honeysuckle, elderberry, and white cedar had good distribution but were eaten only occasionally.

One of the best examples of moose effect on the ecology of Isle Royale is shown by the past and present status of ground hemlock. Adams (1909) stated that this species had luxuriant growth and was well distributed over the island where conditions were proper for its growth. Brown (1935) said that outlying islands, such as Passage, Smithwick, Mott and Wright, have abundant ground hemlock which has not been browsed. Murie (1934) says "this form is very abundant in the spruce and balsam forests. Practically everywhere as a result of browsing the branches are dead except for a few leaves near the roots. It cannot be longer considered a source of food on the island." Today ground hemlock is still abundant on Passage and Smithwick Islands where no evidence of moose habitation has been found. On Mott and Wright Islands the hemlock is being rapidly depleted and will soon be as sparsely distributed as it now is on the main island. The dead twigs of this species referred to by Murie are mostly gone and now only small fronds are present that have grown up since the past high population. However, there is a general distribution of the hemlock which, if left unbrowsed, would eventually form another dense growth over suitable parts of the island.

Balsam fir is another species that has been greatly affected by moose browsing. Young growth is being kept down to the point that reproduction cannot replace the mature stock that is left. Along the Rock Harbor trail small balsams up to 2 feet high are quite common but they have been kept at a low height by repeated browsing. One small tree a foot high was cut at the ground line and its annual rings showed it to be 20 years old. It can safely be predicted that as long as a large moose population exists on the island it will never revert to a balsam forest as it was originally described. White spruce is fast replacing the balsam as it is rarely browsed. White cedar was heavily utilized during the past high population but apparently so only because they were forced to eat it. In the present study white cedar formed 5.8 per cent of the available food but constituted only 0.7 per cent of that actually eaten. Unless the moose population again reaches a high peak, white cedar can be expected to increase on the island. Jack pine is showing good growth on some of the burned areas as it has a low palatability. No browsing on this species was observed. White pine within reach of moose is quite scarce but is heavily browsed when available. While it formed only 0.4 per cent of the available food it composed 0.3 per cent of the food eaten on the island. The dwarf junipers and black spruce are not influenced by moose as the former were not found eaten and the latter was nipped only on rare occasions.

Aspen is the number one winter food of the moose. It formed 16.9 per cent of the diet but amounted to only 8.7 per cent of the available browse. This situation is not desirable as the consumption is in excess of the production. If this condition continues aspen will gradually form a much smaller part of the diet and reproduction will be kept in a brushy condition. This will not only affect the moose but will be a limiting factor on the beaver population of the island. The beaver are already hard pressed for aspen and are living largely on paper birch and this condition will exist as long as moose continue to retard aspen reproduction. Fallen aspen are being barked quite extensively by moose, but standing trees are not yet being barked to any extent. Cross sections of old scars on aspen showed that they had been eaten quite severely back about 1932.

Paper birch is the dominant species coming into the burns. Although the new growth is now 8 years old it is difficult to find birch higher than 5 feet. It made up 14.9 per cent of the winter food and 9.8 per cent of the available food. While the spread between utilization and availability is quite high the good regenerative power of birch will permit such usage. However, heavier utilization is not recommended.

Mountain ash ranks near the top on the palatability list of the moose. This species has good distribution over the island as it occurred in 42.4 per cent of the plots. It formed 6.8 per cent of the available food but made up 12.1 per cent of the food eaten. This is not a good ratio, as mountain ash does not have the ability to withstand such heavy usage. In addition to heavy browsing, the bark of this species is being severely eaten. The consumption of both twigs and bark at the present rate will soon deplete this food supply to a mere fraction of its present value.

Willows are an important item in the food of the moose but due to their spotty distribution they ranked fifth in the winter diet. They were found in 21.2 per cent of the plots, but formed only 5.1 per cent of the available food. Nine and six-tenths per cent of the food eaten was from this source. Here again the utilization is much higher than the availability and in time the willow will be killed back to a lesser production than at present.

Red osier dogwood has spotty distribution but is generally heavily utilized. It formed 5.6 per cent of the available food and 8.3 per cent of that consumed. This species is holding up satisfactorily as the utilization is not excessive although heavier use is not desirable. An increase in this species cannot be expected because of its habitat requirements but it should about hold its own under the present degree of usage.

Juneberry and fire cherry both have about the same distribution, usage, and availability. They formed 2.2 and 2.5 per cent, respectively, of the available food and made up 2.9 and 2.7 per cent of the food eaten. A little more browsing pressure was exerted on the juneberry. They are both taking about maximum utilization and will withstand very little additional pressure.

Sugar maple was abundant on the southwestern end of the island from about Lake Desor to Washington Harbor. In that area it formed 58.1 per cent of the food eaten and made up 54.2 per cent of the food available. In the over-all picture, however, it formed only 2.7 per cent of the food. Even though it played such an important part of the diet in the one area, it was nowhere heavily browsed.

Beaked hazelnut was quite plentiful in some areas, but absent from others. In the aggregate it formed only 2.5 per cent of the food although 4 per cent of the available food was from this source. Only light to moderate utilization was encountered.

Mountain maple had general distribution but was browsed on only moderately. This species is preferred to sugar maple but much less palatable than red maple. The latter had very poor distribution but in most cases was browsed heavily and the utilization was double the availability.

It was of particular interest to note other decided preferences between different species of the same genus. Mountain alder was utilized quite heavily in some places and moderately in others, whereas speckled alder was eaten infrequently and to a very light degree.

Balsam poplar was eaten heavily, yellow birch and roundleaved dogwood moderately, but their distribution was so poor that they are unimportant to moose except in very local areas.

Black ash, green ash, currants and gooseberries were all poorly distributed and eaten only on rare occasions. No winter browsing was noted on raspberries and thimble berries although these species are quite abundant.

CONCLUSIONS

1. The present moose herd is preventing a satisfactory recovery of the aquatic food plants which were so severely depleted by the recent high population.

2. Twenty-eight plants were found to be utilized during the winter, but 12 of these formed 95.5 per cent of the food eaten and of this number 6 formed 75.4 per cent. This clearly demonstrates that a few species are receiving most of the browsing pressure. In fact seven of these plants are being utilized in excess of their regenerative ability.

3. An airplane census in the spring of 1945 showed that the moose herd had increased to approximately 500 animals. While figures on the actual number of moose is desirable, the real criterion is in the condition of the available browse regardless of the accuracy of the population estimates made. Both writers believe that the carrying capacity of Isle Royale has now been reached.

4. If the moose herd continues to increase without some kind of a check, the plant sucession on the island will be influenced still more drastically by a moose made ecology. The resulting problem in wildlife management is being given consideration by the National Park Service.

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DISCUSSION

LIEUTENANT A. K. ADAMS (Michigan): Is there any further transplanting of moose contemplated by the National Park Service at present from Isle Royale?

MR. ALDOUS: I think Mr. Cahalane can answer that better than I can. I don't know of any.

VICE-CHAIRMAN CAHALANE: That question is a policy matter that can be answered with finality only by the Secretary of the Interior. I shall be glad, however, to discuss some aspects of the problem as it appears to me.

In several instances, the National Park Service has instituted measures to reduce the numbers of big game mammals in the national parks. Most of you are familiar with our program to control the numbers of elk in Yellowstone, the elk and deer in the Estes Park region of Rocky Mountain National Park and the deer in Zion National Park. In each instance, careful investigation had proved conclusively that the excessive populations of these animals had arisen as a result of inadequacies in the park boundaries and from man-caused alterations of original conditions. Among them were preemption of the ancestral winter range and removal of effective predatory enemies. In two instances, (Zion and Rocky Mountain National Parks) the animals were demonstrated to be causing profound and highly destructive changes in the vegetation of important scenic sections of the parks. Preservation of the plant life here was considered to be of such importance that it took precedence over other considerations. Zion Canyon particularly was classified as a "museum piece" or "sacred area," and action was taken to restore and then to preserve a predetermined aspect of landscape.

We do not find the same problems at Isle Royale. The fauna there seems to have evolved to its present stage without any major interference by man. Some attempts were made during the 1920's to control predators (coyotes), but it is doubtful that the trapping which was done exerted any important or lasting influence. Although man-caused fires and logging have wrought drastic changes in the forest cover during the past century, the shift from old-growth forest to shrubs has created conditions that are more, rather than less, favorable for the moose and many other species. Incidentally, it should be recognized that fires resulting from lightning strikes and other natural causes have occurred on the island ever since the Ice Age.

There are no man-made restrictions of boundaries. Isle Royale is a biotic unit. About 45 miles long, it averages 8 or 9 miles wide. It is sufficiently large, therefore, to support a considerable number of moose. The topography and cover is so diversified that year-long habitats are present. Essentially, there is little difference in moose biotics between a large island and a continental range. On both, the species is limited by certain factors. On the island, the surrounding water is an effective barrier. In the case of the continent, the territorial range is circumscribed by an ocean shore, by climatic factors, by impassable mountain ranges, by the distribution of suitable cover or food, or by a combination of these or other circumstances. The difference between insular and continental ranges is one merely of size.

The moose and other wildlife species reached Isle Royale by natural means. With the exception of caribou (and possibly lynx), all species of the original fauna are still present. Apparently the moose have taken the place formerly occupied by caribou. Considerable research has not revealed that the wolf ever existed on the island. The Indians made visits to mine copper but did not establish permanent homes. They feared the spirits that, they believed, dwelt there. The predation factor, therefore, seems to be unchanged.

Finally, at Isle Royale, we are not faced by a need for preserving special "sacred areas." The park contains no scenic shrines. It is a fine wilderness area which has intrigued the imaginations of many persons. Because it has not suffered the "vandalism of improvement," it has remained that way. No roads interfere or mar the natural setting. Waterways and trails are the only means of travel. If man sets out to regulate Isle Royale, the wilderness character which was the reason for park establishment will be lost.

It is important that the moose be retained as a prominent member of the Isle Royale fauna. We want to keep the snowshoe hare and other small animals whose abundance is affected by the upward and downward trends of the moose population. The species of plants which are eaten by these animals, which serve as cover for them, and which are enjoyable aesthetically to man, must also be

conserved. We are appreciative, therefore, of the investigations which have just been described by Messrs. Aldous and Krefting.

'Can this conservation of floral and faunal species be accomplished without the intervention of man? There may be some observers who will paint a black picture of the effects of allowing the moose to stabilize by natural means. Dire results were predicted nearly 20 years ago when the species had reached an extremely high peak. The collapse came, as predicted. But the valley bottom was neither as deep nor as wide as had been feared. Even at the lowest ebb, moose could be found readily almost anywhere in the old haunts. Except possibly by comparison with the period of extreme abundance, Isle Royale continued to offer a real wildlife spectacle.

These remarks may leave this audience with the impression that I for one have decided that the National Park Service should not undertake management of the Isle Royale moose herd. On the contrary, my mind is entirely open. I have tried merely to point out that a number of factors must be considered in following the legal precept that Isle Royale, its scenery, its natural and historic objects, and its wildlife must be retained in a natural condition for the enjoyment of present and future generations. It may be possible to accomplish this without human intervention.

MR. RICHARD POUGH (New York): Through the continental range of the moose, the timber wolf almost needs a sanctuary today.

MR. CAHALANE: The timber wolf certainly has very few sanctuaries; it could stand another. Isle Royale, it seems to me, might be a suitable place for the restocking of timber wolves. Perhaps the word "restocking" would be wrong, because our research has not revealed any evidence that the wolf ever was able to cross the North Channel and get onto the island.

Isle Royale has been known, of course, for 300 years. There are, however, very poor records, unless they exist in the files of the Hudson Bay Company, or possibly at McGill University. I haven't been able to pursue that line of suggestion. I think there are some people who would like to see the wolf established on the island. Very likely some control of the wolf will be necessary if that is done, but it would keep us in complete possession of the facts.

CRUDE PROTEIN DETERMINATION OF DEER FOOD AS AN APPLIED MANAGEMENT TECHNIQUE

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The initiation in 1940 of a comprehensive study of black-tailed deer, *Odocoileus hemionus columbianus* (Richardson), was prompted by the interest of the Oregon State Game Commission in the species because of their apparent decrease in numbers and persistent small size in much of the western Oregon habitat. It was well known that there were periodic losses of deer, which in some winters were nominal and in others great. This also varied, apparently, with habitat. The deaths all followed a definite pattern. Deer of all age classes grew progressively weaker even in mild winters. The losses of young deer were greater. It was found that most deer died with full stomachs.

Black-tailed deer by natural inclination find the margin of the rain forests ideal habitat, clinging stubbornly to this ecological range even when forage conditions deteriorate. The tangle of salal and vine maple provide concealment in the forest of towering giants. Here a closed canopy persists so that only filtered light reaches the forest floor. Douglas fir, hemlock, and spruce predominate. It is the adjacent logged, or burned over areas, well covered by weeds and browse plants that feed the deer. Ecologically, it is the ideal example of "forest-edge habitat.

By a comparison of field data at the beginning of the study, several vital facts were brought into focus. Losses seemed to be determined by habitat condition. Variations in size, too, seemed to be influenced by environmental differences. Study areas were then chosen so that one carried the best of the environmental factors which were reflected in more abundant, healthier, and larger deer. The other carried the extreme disadvantages. The logged and burned over ranges with interspersions of timber in northwestern Oregon seemed the most productive. For convenience we shall hereafter refer to this as Area 1. The wooded areas with much closed canopy and scattered glades, carrying more mature browse plants, in central coastal Oregon, low in production, shall be designated as Area 2.

Predation and disease were quickly eliminated as basic reasons for deer losses after a thorough investigation of their effect showed them to be of only minor importance as limiting factors in deer survival. An important lead to better understanding seemed to lie in the protein variation in preferred deer foods. Use of this concept is not a new technique but its value on black-tailed deer range has not been

TABLE 1. PREFERRED FOODS OF OREGON BLACK-TAILED DEER

Vine maple (*Acer circinatum*)
Red alder (*Alnus rubra*)
Fire weed (*Epilobium angustifolium*)
Cascara (*Rhamnus purshiana*)
Red elderberry (*Sambucus callicarpa*)
Red huckleberry (*Vaccinum parvifolium*)
Salmonberry (*Rubus spectabilis*)
Western blackberry (*Rubus vitifolius*)
Thimbleberry (*Rubus parviflorus*)
Mint (*Stachys pubens*)

generally demonstrated (Helmers, 1940). Interest in protein developed when 22 bucks taken on recently-burned Area 1 were found to have an average hog-dressed weight of 213 pounds. Bailey (1936) records 200 pounds as the weight of a large buck of this species, but cites a record of 219 pounds. Of the 22 bucks observed, many exceeded this last figure. Another clue to a probable solution lay in the deer records taken in Area 2, a closed canopy habitat. Here mature 3 to 5 point bucks average less than 125 pounds. Field observation and stomach and pellet samples determined that the species of preferred foods were almost identical on both types of habitat (Table 1). Soils likewise fell into the same classification, but rainfall in Area 1, that of the heavier deer, was almost twice as great as in the other area. Its leaching effect would logically be presumed to be a detriment to soil productivity, yet in this range deer were in heavier flesh, a contradiction to this presumption. Their large size apparently resulted from minerals added by the fire to a soil of low mineral content.

The burned area had more cloudy weather due to its coastal location, but in the open terrain was more directly affected by intermittent sunlight and browse plants flourished. There were more of the preferred species here than in the southern range, where they grew precariously in closed canopy habitat. This deduction turned research toward the analyzation of the protein content of the preferred browse plants in both areas, and it was immediately apparent that Area 2 fell lower in protein percentages (Table 2). In comparison, salal (*Gaultheria shallon*) growing in similar habitat in both ranges had a protein content in December of about 4 per cent in Area 2 and 5.85 per cent in Area 1. Alder (*Alnus rubra*) rarely exceeded 5 per cent in Area 2 in midwinter, but was found to be as high as 8 to 10 per

TABLE 2. PROTEIN VALUES OF BROWSE PLANTS BY PERCENTAGES

Steamboat District Area 2.

Browse species	Date	Percentage protein
Vine maple	January 4, 1945	3.72
Salmonberry	January 4, 1945	5.68
Thimbleberry	January 4, 1945	3.44
Red alder	January 4, 1945	6.78
Red huckleberry	January 4, 1945	5.04

cent at that time in Area 1. In successive years as the canopies closed on burned or cut-over land, the differences were less marked. Vine maple (*Acer circinatum*) taken on the Trask River drainage in the Tillamook burn in September 1942, showed an average of 12.83 protein. Samples taken at the same station in 1945, 6 years after the burn, had an average of 9.26 per cent protein in September. Data at hand shows this to be a common trend. As canopies and the chemical components of recently-burned soils change, they apparently produce less nutritious food.

Seasonal variation in protein content in preferred deer food is marked. The time of the year in which browse plants reach their highest nutritional level varies with the species. Thimbleberry is usually at its best in midsummer but is a poor winter food. Salmonberry is more nutritious in early fall and persistently holds a higher level in winter (Table 3). Black-tailed deer losses coincided with periods

TABLE 3. SEASONAL PROTEIN VALUES BY PERCENTAGES[1]

Trask River District Area 1

Browse species	Jan.	April	July	Sept.	Nov.	Dec.
Vine maple	3.75	6.55	8.19	9.26	9.38	4.77
Salmonberry	6.65	7.20	8.91	12.77	9.98	4.17
Thimbleberry	4.15	6.52	10.44	8.85	8.07	4.73
Red alder	9.16	7.85	12.85	12.85	10.60	9.11
Red huckleberry	6.87	7.05	11.42	9.41	8.44	7.00
Red elder	7.33	7.00	12.85	10.71	9.74	7.90

[1]Analysis by J. R. Haag, Nutritional Chemist, Oregon State College.

when low protein levels were reached in the browse plants. This occurred earlier in the year when a long period of dull weather persisted in the fall. Collections in Area 2 on January 4, 1945, and analyzed for protein showed such low percentages that deer whose normal feeding time was from 7 to 10 hours daily in midsummer to maintain good health, could not have maintained the same body weight in January had they fed twice as long each day. Subsequent work has indicated that when protein falls below 5 per cent, a deer crisis is at hand. Forecasts made on this basis have proved correct, and losses on closed canopy areas run particularly high. They did not occur in Area 1 where the average protein content remained much higher, and parasites were not a factor on burned overland. When proteins fell to a critical level in Area 2, deer losses were increased by parasitic infestations as they took nourishment greatly needed by deer whose digestion was overtaxed in handling an increased bulk of fibrous browse.

The analysis of browse plants which spring from the ashes of a burn as soon as plant growth is possible, shows an exceptionally high nutrient content. This continues in a diminishing degree for several

TABLE 4. PROTEIN VALUES OF PREFERRED DEER FOODS ON OLD AND NEWLY-BURNED AREAS

Species	Date	Percentage protein burn 6 years old	Percentage protein burn 3 months old
Fire weed	December 2, 1945	9.90	12.42
Vine maple	December 2, 1945	4.77	8.39
Thimbleberry	December 2, 1945	4.73	11.60
Blackberry	December 2, 1945	7.27	14.91
Salmonberry	December 2, 1945	7.17	13.07

years (Table 4). It is similarly good, though not as high, on newly-logged areas. The effect of strong sunlight on growing plants is obvious. This high level apparently accounts for the extremely large deer whose general health is further insured by the lack of parasites on their feeding grounds following a fire.

These investigations of deer habit and survival clearly define good black-tailed deer habitat as those areas upon which high protein browse grows and persists well into winter. Such range is not greatly limited in Oregon as logging and seasonal fires, both accidental and slash, release vast acreages yearly. That their use is definitely a management necessity if stability in production is to be maintained for blacktails, has been determined in this study. Protein analysis is a useful tool in this relationship.

In conclusion, protein analysis has been found to be a valuable aid as a wildlife technique on this western range since it determines specifically the food values or lack thereof on occupied habitat. The problem of management then is to redistribute deer to suitable ground. This cannot be done instantly. It can be accomplished by continued field attention and the planning of harvests to exert hunter pressure where needed and thus forcing deer from poor to good habitat where effective regulations can be used.

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COOPERATIVE WILDLIFE MANAGEMENT IN VIRGINIA

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This paper deals with the program resulting from the cooperative agreement between the Virginia Commission of Game and Inland Fisheries and the U. S. Forest Service, for cooperative wildlife management on the 1,400,000-acre area embraced in the George Washington and Thomas Jefferson National Forests. I have essayed to present to you some facts and figures about this program because I was an interested observer when it was born, watched it grow for 3 years, then was completely out of touch with it for about 4 years, and came back to find it a lusty, healthy-growing thing whose progress gave me a great deal of satisfaction, and restored my faith in both human nature and Mother Nature. These two forests, the George Washington considerably the larger, are located in the western highlands of Virginia, mainly in the Alleghanies. About one eighth of the George Washington, including the 30,000-acre Big Levels Refuge, lies in the Blue Ridge, as does a small part of the Jefferson. Most of the Virginia National Forest land is, however, typically Alleghany in character. The average elevation is from 2,000 to 3,300 feet, extending past 4,500 feet on some of the higher ridges and peaks. Much of this Alleghany country is covered with a thick shrubby growth, the characteristic succession resulting from destructive and widespread fires in the not-far-removed past. In some sections, however, are a few areas where good stands of timber, both hardwoods and white pine, still remain.

For a brief physical description of the Alleghany region in which the two Virginia National Forests are principally located, I borrow a few paragraphs from Addy (1940), whose study of the ruffed grouse was carried on in several sections of the Jefferson National Forest.

"The typical arrangement of the Alleghany Mountains (in Virginia) . . . is a series of linear ridges, separated by deep valleys, extending the length of the State from Tennessee in the southwest to Maryland in the northeast. . . . The Alleghanies are . . . composed of sandstone and shale, and in some cases limestone. The valleys . . . are underlaid with limestone with smaller amounts of shale. . . .

"The Alleghany Mountains are capped by the Silurian and Mississippian sandstones, while the slopes are largely of the Devonian and Ordovician shales. . . . Almost all of these sandstone and shale formations give rise to very poor soils with steep slopes where farming cannot be undertaken, and where timber production and grazing are the only profitable enterprises. So it is that these western mountains

are extensively forested, well down to the valley floors and broken only by scattered farms and settlements.

"The Great Valley of Virginia, situated between the Blue Ridge Mountains to the southeast and the Alleghany Mountains to the northwest, extends throughout the State. It is underlaid for the most part by the Valley limestone formations. In the southwestern part of the State the Mississippian limestone is found. Some sections are underlaid by the Devonian shale formations. Locally from the northwest of the Great Valley, there are minor valleys with the same geology. In southwest Virginia, there are other limestone valleys to the northwest of the Great Valley, which are underlaid by Mississippian limestone."

While these limestone soils are quite fertile and are generally cleared for farming, many of the valleys are so narrow, and their slopes so steep that they remain uncleared.

The Virginia National Forests, except for small fractions in the Blue Ridge below 1,800 feet elevation, are within the Transition Life Zone, with suggestions of the Canadian Zone on the higher ridges, where are found spruce and other Canadian life-forms.

Average rainfall in these forests varies from 35-40 inches annually in the northern part of the State, to 40-45 inches annually in the southwestern section. Average annual snowfall in the mountains is 20-30 inches.

Addy (1940) comments that "the characteristic proximity of one ridge to another in the Alleghany Mountains, and the great extent of the linear ridges with the many coves, ravines, and other hiding places, make it possible for (ruffed) grouse populations to be replenished readily from the surrounding territory when excessive shooting or other factors have reduced the birds. . . . Scrub pine, white pine, and pitch pine are common in the Alleghanies, with a dispersion of hemlocks. Rhododendron and laurel provide well-dispersed, and effective cover."

The climax vegetation of the Alleghany area in general is of the deciduous broad-leaf formation, more specifically of the oak-chestnut and oak-chestnut-hickory associations. White pine-hemlock communities are frequent in the more humid soils and on the cooler slopes. Bear oak communities are frequently on old burns or on sheet-eroded slopes, on areas wherein soil humus has been destroyed to the extent that a conspicuously infertile mineral soil remains. Bear oak also occurs on infertile shale areas. Extensive shale barrens of marked interest to the plant ecologist occur extensively along the Alleghany ridges, especially from Montgomery County northwestward. Throughout the area are small openings of grassland on the sites of abandoned clearings.

Addy (1940) describes a typical better game area of Bland County as carrying an abundance of wintergreen (*Gaultheria procumbens*), arbutus (*Epigaea repens*), partridge berry (*Mitchella repens*), smilax (*Smilax* sp.), and grape (*Vitis aestivalis*); with rhododendron (*Rhododendron maximum*), laurel (*Kalmia latifolia*), and small pines (*Pinus* spp.) providing effective cover. Huckleberries (*Gaylussacia* spp.) and blueberries (*Vaccinum* spp.) are abundant; and service berry (*Amelanchier* spp.), cherry birch (*Betula lenta*), maple leaved arrowwood (*Viburnum acerifolium*), and black haw (*V. prunifolium*) are common. Buffalo nut (*Pyrularia pubera*), observed by workers at the Virginia Cooperative Wildlife Research Unit[1] and by forest rangers to be browsed to a marked degree by both white-tail deer and elk, is frequent in many areas of the southwestern Virginia counties. Buffalo nut seems to be of such importance that the Virginia Unit is giving it special study.

While at the present there is adequate and satisfactory range in most sections for the successful management of white-tail deer and wild turkeys, a considerable acreage is still under private ownership within the boundaries of the two forests. It is highly desirable that federal ownership within the purchase unit boundaries be consolidated as soon as possible, since the management program in many sections can be seriously handicapped by utilization of these private holdings for certain agricultural uses, or by their over-exploitation as forest lands.

It is interesting to note that although the white-tail was shot out, perhaps *hounded out* would be a better term, in all but possibly two of the western counties, the black bear was never completely exterminatd in the rugged back country of the George Washington Forest in the north, and in Grayson and Washington Counties in the southwest. A herd of approximately 200 elk maintains itself on a 60,000-acre tract of private land within the Jefferson unit boundaries, but obviously the range is too limited for their extensive management.

To indicate the characteristics of the fauna of the region, the Ranger's Population Record for the 96,000 acres of National Forest in Smyth County is used as Table 1. The Hurricane Branch Closed Wildlife Area, to be described later in some detail, is in this county.

Predators other than those noted in Table 1 are principally the great-horned owl, *Bubo v. virginianus,* and the Cooper's hawk, *Accipiter cooperi.* I considered mentioning some of the snakes as nest predators, but finally decided to make only this reference to them. Two ex-

[1]The Virginia Commission of Game and Inland Fisheries, Virginia Polytechnic Institute, American Wildlife Institute, and U. S. Fish and Wildlife Service, cooperating.

TABLE 1. RANGER'S POPULATION RECORD FOR SMYTH COUNTY, HOLSTON DISTRICT, JEFFERSON NATIONAL FOREST. AREA IN NATIONAL FOREST—96,000 ACRES

Species	Estimated population May 1, 1944	Population objective 1948	Estimated carrying capacity	Remarks
Black bear	2	2	2	Range limited because of sheep
White-tail deer	825	1,100	1,900	
Elk	0	0	0	Range too small
House cat	100	50	0	None desired
Dog	140	70	0	None desired
Bobcat	20	10	10	
Fox	700	400	400	1944 population too high
Beaver	3	10	1	Stocked on private land 1944
Mink	50	75	100	
Cottontail	2,500	2,500	2,500	
Gray squirrel	2.000	4.000	8,000	
Fox squirrel	200	200	5,000	
Red squirrel	300	300	300	
Woodchuck	700	700	700	
Wild turkey	15	75	900	
Ruffed grouse	2,000	2,800	3.500	
Bobwhite quail	500	700	1,000	
Muskrat	0	0	0	
Opossum	700	700	700	
Raccoon	200	250	400	
Skunk	600	600	600	
Weasel	200	200	200	
Woodcock	25	50	200	

tinct predators, whose demise may have to be considered later, were the gray wolf, *Canis mexicanus,* and the panther, *Felis couguar.*

The purpose of the foregoing discussion is to indicate generally what type of area is administered under the cooperative agreement between the U. S. Forest Service and the Virginia Commission of Game and Inland Fisheries. I shall attempt now to explain generally the terms of the agreement and how they are carried out.

It was not quite 8 years ago that the Virginia National Forest cooperative agreement was put into effect. On June 13, 1938 the agreement was signed by representatives of the U. S. Forest Service and of the Virginia Commission of Game and Inland Fisheries, having been authorized by the Virginia General Assembly earlier in the year. As has been noted, the wildlife management area thus provided comprises about 1,400,000 acres, in 30 western Virginia counties. Definite plans for developing the area for wildlife were included in the agreement, these plans being based in large measure on the experimental work done in the Big Levels Refuge from 1935 to 1938. The management and other work on the Big Levels, which included the creating of numerous small clearings, predator control, especially of roving dogs, increased fire protection, and close patrolling, were accompanied by most satisfactory increases in the number of wild turkeys, deer, and bobwhite quail on the refuge.

What I consider was an extraordinarily effective piece of public relations work preceded the formulation and signing of the National

Forest cooperative agreement. The public was informed of the proposal, and the plan was discussed in dozens of fish and game clubs in western Virginia for more than a year before it was definitely formulated and the General Assembly requested to authorize the State Commission to enter into the agreement. At its annual meeting in 1937, the Virginia Wildlife Federation adopted the proposal as one of the objectives of its 4-point program.

It is probable that many of the fish and game clubs thought that they were putting pressure on the Forest Service and the Game Commission to do something about which these agencies were not overenthusiastic, but the success of the Big Levels Refuge would indicate that neither the Forest Service nor the Commission needed much urging. In fact, one Forest Service officer who is now executive director of the Virginia Game Commission, was probably more responsible than any other individual for the formulation of the agreement. At least he should share the credit with another, Justus Cline of Stuarts Draft, Virginia, of whom you have probably heard, and to whom as a citizen-conservationist the Big Levels Refuge was dedicated some years ago.

In addition to being preceded by effective "educational" work, the proposal for the agreement was carefully thought out. It provided for a $1 fee to be charged each sportsman using the cooperative area, a special Forest Service stamp being issued by the Commission, and the proceeds from stamp sales being used exclusively for the development, stocking, and protection of the Cooperative Management area. The objectives of the program, as printed in a pamphlet cooperatively prepared by the Forest Service and the Commission immediately after the plan was finally adopted, were as follows: (1) to maintain sufficient breeding stock of all species so that there will be provided the maximum surplus of game animals, fur bearers, birds, and fish for annual harvest by sportsmen and trappers, on a sustained-yield basis; (2) to increase and stabilize the carrying capacity by improving the environment by such means as may be found practicable; (3) to effect, in so far as possible, a natural balance of all wild birds and other animals; (4) to maintain animal populations not to exceed the maximum natural carrying capacity for any one species; (5) to effect and maintain wildlife populations in harmony with all other forest uses; (6) to protect and preserve the aesthetic values of wild animals and birds of both game and nongame species; (7) to control the number of undesirable species where and when it is necessary to effect good ecological and biological balance.

The first year of the agreement, 1938-39, saw 11,690 sportsmen, hunters and fishermen, buy the special National Forest stamp. In

1944-45 the number had grown to 19,049. The first 7 years of operation, to July 1, 1945, brought in $99,975 in stamp sales. Up until July 1, 1945 these sales had provided $70,677 for development and management work on the two forests. Approximately $34,000 of this was allocated to the Jefferson, and a little less than $37,000 to the George Washington.

There are minor differences in the allocation of stamp funds to various management activities on the two forests. On the Jefferson, expenditures for environmental improvements, mainly clearings, plantings, and refuge boundaries, made up 7.7 per cent. Patrol and law enforcement by deputy wildlife managers employed as a part of the program took 62 per cent. Fish stocking got 9.7 per cent; game stocking 3.8 per cent, and education one per cent. Clerk's fees for selling the stamps took 12.8 per cent; printing 0.9 per cent; and miscellaneous 0.7 per cent. The expenditures from the stamp fund on the Jefferson, and those for the George Washington are generally in about the same proportion, are not high for environmental improvement or game stocking, only $3,606 and $1,086, respectively. But to these accounts Pittman-Robertson funds have contributed about $6,600 to environmental improvement on the Jefferson, as well as something like $25,000 to the restocking program. For example, in 1941-42 there were 118 deer stocked in the Jefferson at a cost of $6,014.48. Of this amount $751.81 came from the National Forest stamp fund, $751.81 from the State Game Fund, and $4,510.86 from Pittman-Robertson funds. Approximately 1,430 deer were stocked on the two forests from 1938 to 1943 inclusive, of which 578 were planted on the Jefferson. Financed in the same manner, 448 wild turkeys were released on the Jefferson from 1939 to 1944 inclusive.

On the Jefferson, seven closed wildlife management areas averaging about 6,000 acres each, have been established, enclosed with a single strand of wire, and plentifully posted with the usual good taste of the Forest Service. These areas are, in effect, refuges on which most of the environmental improvement work and stocking has thus far been done. The term "refuge" was deliberately avoided when these areas were established, since it was anticipated that it might later be expedient to open them to hunting. Virginians, it was felt, probably regard tradition as solemnly as residents of any other state, and those who planned the program felt that there might be public opposition to opening a "refuge" to hunting, whereas a "closed management area" sounds a lot different.

On all but two of these seven closed areas, resident deputy wildlife managers are provided. These men are paid 50c an hour when working on stamp fund projects, and 48c an hour when working on Pitt-

man-Robertson environmental improvement projects. They have full-time work, so that their incomes average about $100 a month. In the final analysis, about 70 per cent of their pay comes from the stamp fund, about 30 per cent from Pittman-Robertson. I should not wonder but that these deputy wildlife managers are the most important factor in the success of the program. The Forest Service has done an extraordinarily good job in selecting men of outstanding qualifications, interest, enthusiasm, and good sense. The rangers are justifiably proud of them and of the work they do. Frankly, I used to think that people of the backgrounds of these deputy managers, traditionally individualistic mountaineers, would have to *own* something if they were to be particularly interested in it. Perhaps it is due to conscious or unconscious indoctrination by the Forest Service officers; at any rate these deputy managers are just as proud of their management areas as if they owned them as private preserves. I wish I had the time and the words, perhaps I should also have music, to wax really eloquent on this subject. As a substitute, let me quote a few figures from the Ranger's 1943 report on the Hurricane Branch Closed Wildlife Area, a 5,660-acre tract located in Smyth County, Holston District, Jefferson National Forest.

The Hurricane was designated as a closed area in 1938, when it was enclosed by a single strand of No. 9 wire, and marked with signs placed about 200 feet apart. A large entrance sign was placed at a point where Virginia Highway No. 16 meets a road running through the closed area. A deputy wildlife manager's cabin was constructed and placed on the area, about 400 yards from a gate on the road entering the refuge.

The following improvements have been made by the deputy manager since the area was established:

1. Approximately 300 clearings have been made, the largest 3 acres in extent, the smallest about 20 by 20 feet.
2. Approximately 400 spruce and white pines have been planted for screening cover.
3. Approximately 350 apple trees and 100 cherry trees were located, pruned, and given annual care.
4. Approximately 600 grapevines were planted.
5. Approximately 400 viburnum seedlings were planted.
6. Four acres of skid trails were established as cleared areas.
7. Two acres of small clearings, 3 acres of old clearings, 1 acre of new larger clearings, and one-half mile of skid trail were planted to orchard grass and weeds.

Hand labor was utilized in making these improvements, the deputy manager's efforts being supplemented by a few man-days of extra

labor each year. The area is constantly patrolled by the deputy manager, who also maintains the boundary wire and the signs.

That the cooperative plan has succeeded in increasing populations of desirable species is, I think, demonstrated by the data of Table 1, since Smyth County can be considered as fairly representative of the entire area. It is admitted that these estimates are only estimates, but they are based on careful observation by competent persons. In November 1945, a 2-day deer hunting season was opened in six counties of the Jefferson, the first time there had ever been a legal deer season in that section, since the deer had been exterminated long before there were any game laws on the books. The resulting bag was 170 bucks. As has been noted, 578 deer had been planted on the Jefferson since 1938. A few, a very few, had been stocked in earlier years, some in 1929, but in very small numbers and with doubtful results. In 1945, a very conservative estimate of the deer herd in those six counties would, in my opinion, be at least 2,500 head.

I have gone into some detail in discussing the wildlife management work on the Jefferson, principally because practically all of this work has been done under the terms of the cooperative agreement. Excellent work was done on the George Washington for several years prior to 1938, but even there the wildlife program was expanded and revitalized by the cooperative agreement. A planting of 13 deer was made by the State in 1926, and from 1933 to 1937 inclusive, 146 additional deer were stocked on the George Washington. From 1938 to 1944 inclusive, 794 deer were stocked on this forest, under the cooperative agreement, and five additional counties were opened to deer hunting. Table 2 indicates the estimated changes in populations of some species from 1939 to 1944.

One interesting variation exists in the management procedures on the Jefferson and the George Washington Forests. On the former, the deputy managers are employed full-time, and reside on or near the

TABLE 2. ESTIMATED WILDLIFE CENSUS (PARTIAL STATEMENT) GEORGE WASHINGTON NATIONAL FOREST (VIRGINIA ONLY)

Species	Total population May, 1944	Hunter-trapper take season 1943-44	Total population May, 1939	Hunter-trapper take season 1938-39
Black bear	600	35	500	30
White-tail deer	7,000	300	2,300	220
Cottontail	13,000	1,000	9,500	1,200
Squirrel (gray and fox)	18,000	5,000	10,000	4,000
Turkey	3,000	200	1,900	190
Ruffed grouse	7,000	700	6,000	1,000
Bobwhite	1,200	500	1,500	450
Raccoon	3,500	280	2,450	800
Beaver	10 colonies	.....	2 colonies	.....
Number hunter days 41,000 Number trapper days 1,000			Number hunter days 30,000 Number trapper days 2,000	

closed management areas, where practically all their environmental improvement work is done. On the George Washington, a larger number of deputy managers is employed part-time, and these operate all through the forest, except that a Forest Service employee is resident manager of the Big Levels Federal Refuge. As on the Jefferson, work plans for the deputy managers are prepared by the Forest Service, with the collaboration of the state game wardens and field biologists. The wardens and rangers cooperate in training the deputy managers on the job. Work done by deputy managers on the George Washington in the year 1943-44 totalled 13,327 man-hours, and included the following:

161 "Closed Management Area" signs constructed.
3 Entrance to Closed Area signs constructed.
462 Closed Area signs posted.
77 miles of boundary brushed out and wired.
57 miles of skid roads planted or reseeded.
191 small clearings, aggregating about 18 acres, seeded.
104 acres of old clearings planted or reseeded.
28 acres of new clearings seeded.
17 acres food-bearing shrubs and trees pruned and released.
158 miles of skid roads cleared and thinned.
13 acres of old clearings brushed out and restored.
39 acres of new clearings cleared.
140 acres of new clearings sprouted.
37 acres of slashings created.
744 small clearings, aggregating 84 acres, cleared.

As has been previously noted, a portion of the stamp funds was used for fish stocking, There are about 257 miles of trout stream on the Jefferson, and about 500 miles on the George Washington Forest. Approximately one fifth of this was stocked by the Forest Service, using stamp proceeds for the expense of stocking trout reared at federal hatcheries. Such stocking amounts to about 48,000 adult rainbow and brook trout annually. About 400 miles of the remaining streams on the forests are stocked by the State. Experimental stream improvement installations have been made on a few streams, and similar installations will be made on other streams when funds are available.

Future plans for the Virginia National Forests call for expansion of the present program of environmental improvement, better and more extensive law enforcement and stream improvements. It is hoped that ultimately it will be possible to place one full-time resident forest and wildlife manager on each 25,000 acres of National Forest land. More funds will be needed for this expansion, and I believe that they

will be available, because of the high regard which Virginians have for the achievements of the Game Commission and the Forest Service in their cooperative efforts thus far. The Virginia program has demonstrated that real cooperation between a federal agency administering federal lands, and a state agency administering wildlife is not only possible but also highly productive of results.

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DISCUSSION

CHAIRMAN CRONEMILLER: Has anyone a question? I guess Mr. DeLaBarre will have to ask the question and answer it.

MR. DELABARRE: I want to ask you a question, because in getting some data for this paper, Mr. Cross and I went to the Hurton Branch area and spent a little time with the rangers. There have been four deer plantings made in that section, and in the course of our conversation, the ranger said it seemed peculiar to him that all four of those plantings had moved to the west, to the north, and to the south, but were reluctant to move to the east, although in two or three instances that was better country; it was more similar to that in which they were put, and there were fewer dogs to the east.

I talked to Charlie Handley about it, and expected Charlie to pooh-pooh, but I wonder if anyone has heard of any observations of that type. Here were only four plantings, I will admit, that seemed to move. While they were reluctant to move eastward, they finally did move somewhat to the east, but only after they had moved to a considerable extent in the other directions first. I know in one area, at least, where they moved across the valley instead of following the ridge to the east, which would have seemed logical, I should have thought. If anyone had heard anything of that type, it might be worth advising. Also, I would like to know if anyone has had any experience with this buffalo nut. It looks like that is really a deer browse of very great importance, and I would say it was frequent all through that area.

CHAIRMAN CRONEMILLER: I can comment a little on that, although I haven't the details. In southern California we ran a deer study. We captured a doe in the Chaparral Forest in southern California, put a small bell around her neck, in a perfectly wild country, with no inhabitants, no dogs, nothing to bother her, and for 3 years you could hear that bell at any time, practically, from the point at which she was captured. She spent her life in not much more than 40 acres, mostly in a little cove. If snow got over 6 inches in depth, she moved about a quarter of a mile to the south slope.

The State wanted to move them out, and they moved 11 deer from a similar type of cover into this area. Two of them were belled; the remainder were branded by paint. An attempt was made thereafter to observe them. None of them settled in the area itself. One of them moved 11 miles. Another moved 6 miles and took up habitation along the edge of an orange grove. They were damaging young citrus trees and had to be killed. On being released, in 2 and 3 days they would be 6, 8, and 10 miles away, just moved right out of a tremendous rough country, and there was no rhyme or reason to the direction they moved, or the places that they were found to have settled in.

MR. DELABARRE: As far as you know, they moved eastward as well as in other directions?

CHAIRMAN CRONEMILLER: Yes. These generally moved downhill.

MR. CHARLES O. HANDLEY (Virginia): In discussing why these deer moved in the direction in which the predators were found—and, incidentally, the dog is our worst predator, I believe, in Virginia for most species—the experience of Mr.

DeLaBarre is quite similar to another that I might relate in a mountain and lake area of Virginia. Down there the mountains all run to the southwest and northeast, and the mountain ridges are wooded, very often the valleys being either populated or pasture land. The deer from the mountain and lake area, where they could readily move either north or south along the mountain ridges, moved to the east. There is a valley there about three miles across that the deer had to cross, and I believe that the predator, the dog, was responsible for this moving; where the deer would move up and down the mountains, the dog would follow very readily, and the deer seemed to think that was no protection, but they could come to the mountain top there and look across the valley over here three miles and there was a good range, and they would get over there and would look back and see where the dogs were, and apparently they just tried to cross for protection to throw the dogs off. I don't know of any other reason why they go into the regions where the predators are most abundant rather than up and down the mountains.

EFFECTS OF DDT ON WILDLIFE IN A MISSISSIPPI RIVER BOTTOM WOODLAND

LEO K. COUCH
U. S. Fish and Wildlife Service, Chicago, Illinois

It is disturbing to find DDT (dichloro-diphenyl-trichloroethane) released for public use long before adequate research has revealed its limitations. Its promise as this ultimate Utopia in insecticides seems to overlook dangers to other forms of animal life. The effectiveness of DDT for household use in curbing flies, bedbugs, and mosquitoes, military uses in controlling lice that spread typhus, and against insects of veterinary importance, has been demonstrated. In agriculture and forestry, potential dangers have not been fully appreciated. In fact, applications of DDT in the outdoors, whether on marshes, lakes, streams, on crop and pasture lands and in forested areas, present a serious threat to fish and wildlife species. Only now are we becoming aware of the possible misuse of this powerful chemical in the hands of the uninformed public.

This paper covers observations before and after extensive applications of DDT on forested lands along the Mississippi River from August 5 to October 6, 1945. The area administered by the War Department is known as the Savanna Ordnance Depot Proving Grounds, located in northeastern Illinois. Assistance of the Army Sixth Service Command, Chicago, and military personnel of the Ordnance Depot is gratefully acknowledged. Dr. E. M. Searls, entomologist for the Sixth Command, rendered personal aid in furnishing personnel, equipment, and transportation, making it possible to collect considerable data over a wide area. Flyway Biologist, Robert H. Smith, assisted with observations at the October spraying.

Objectives and plans.—While this region along the Mississippi has not been classed in a serious malarial zone, the presence of malaria carriers among Italian prisoners of war caused Army authorities some concern over the possible spread to military and civilian personnel working on the post. Experiments were designed to test the airplane method of applying DDT for mosquito control. An invitation was extended to the U. S. Public Health Service and the Fish and Wildlife Service to send observers. Tests were to range from 0.2 to 5 pounds of DDT per acre. But recent tests by the Bureau of Entomology and Plant Quarantine and military areas had shown lower rates were effective. Last minute plans were changed to 0.5 pound per acre, and these were held uniformly for the August and September sprayings. In October, due to weather conditions and changes in plane control, the application was far from uniform.

Objectives were to note by extensive observations the effect of DDT on fish and wildlife, including birds, mammals, reptiles, amphibians, fish, and crustacea. Populations were noted before and after each of three sprayings, and any dead or affected individuals recorded.

Description of the sprayed areas.—Now that the war is over, a more detailed description of the area can be given. The Savanna Ordnance Depot is about 12 miles long and 3 miles wide, including some upland consisting of rolling prairie on which the ammunition dump is located. These upland areas were not sprayed except in the immediate vicinity of headquarters. The sprayed portion can logically be divided into three areas, one containing the flood plain of the Mississippi River below the Bellevue Dam, a large island, and the headquarters area, which included the Apple River for a mile above its mouth, covering in all about 4,000 acres. The lowland area was composed of mixed old-age hardwoods: chiefly hard maple, ash, elm, birch, willow, pin oak, and swamp cottonwood. Since 1918, the entire area has been closed to hunting, and it might be said that all wildlife has had total protection for 27 years. There is little undergrowth and but a few shrubs due to the closed canopy and the seasonal fluctuations in the Mississippi pool of several feet. A common interior small pond is often in shade, although some are fringed with buttonbush. Most of the hardwoods are past their prime, and as a result, the decayed trees provide in excess of 10 den trees per acre. This, perhaps, partially accounts for the astonishingly high raccoon population. As the pool drawdown is rather sharp throughout the summer, bottomlands are covered with new layers of silt, permitting little vegetation. Occasionally where trees have died from excessive floods, young hardwoods prevail. Buttonbush and a ground covering of grasses, *juncus,* asters, hibiscus, cardinal flower, and other miscellaneous vegetation grow lux-

uriantly. Under the canopy of mature hardwoods, poison ivy persists in tangled low thickets. Bordering the large ponds and waterways are mixtures of ash, river elm, cottonwood, willows, and tangles of wild grape.

The open water area above the Bellevue Dam near the Illinois shore supports several hundred acres of the American lotus (*Nelumbo pentapetala*), a favorite feeding place for waterfowl in October. With the exception of a good pin oak mast crop, a few grapes and lotus seeds (Yonker nuts), the area did not yield a great deal in seeds, nuts, or fruits for late summer and fall use by wildlife. Most of the water areas were devoid of pondweeds and other vegetation due to the fluctuations in water levels, and without doubt, carp and other fish were factors in causing so much turbidity in interior lakes and ponds as to influence aquatic plant growth.

The ponds in the vicinity of headquarters were more open, and one near the entrance highway more nearly represented a prairie pond with a good population of amphibians. While most of the spray fell on woodlands, a few ponds typical of open marshes gave some indication of what might happen to marsh fauna.

Application of DDT by airplane.—On August 8, spraying began with a B-25 Mitchell bomber using No. 2 fuel oil as a spreader and solvent in a 5 per cent DDT solution and emulsion, at 10:55 a.m. down river from Bellevue Dam. The plane flew at elevations from 100 to 200 feet, traveling at 200 miles per hour, and through pipe in the bomb bay door, released the spray at the rate of 210 gallons per minute. Tanks in the plane holding 550 gallons were refilled at Truax Field, Madison, Wisconsin. In the August-September sprayings, strips were made from 300 to 400 feet wide, depending on the air currents, and were guided by an Army jeep spaced by Dr. Searls at intervals along the Bellevue Dam and on the highway leading to the Depot headquarters. This ground control was highly important, as it permitted little overlapping and a uniform coverage. Checks made with yellow paper spaced at 50-foot intervals and examination of the rubber expansion cracks on the concrete highway bore this out. The October spraying was done entirely by pilot control from the air, and as a result, several areas were treated 2 and 3 times, while others were missed. It is uniform coverage at the rate planned that minimizes the harm to fish and wildlife. Sprayings were approximately at 30-day intervals.

Method of study.—Populations of birds and mammals were determined as nearly as a hasty inventory would permit before and after each of the sprayings. It was assumed that the lists for August and

early September represented the resident bird populations, while the October lists were confined to those known to have not been affected as yet by migration through the area. Fourteen mosquito checking stations on the sprayed area were made points for estimating the fauna poulations and noting of changes following the sprayings. Two areas on the Iowa side of the Mississippi River, which were not treated with DDT, were used as check areas. Ten ponds were examined in August and October for fish life with the aid of a minnow sweep net and relative changes in populations were noted. While entomologists from the U. S. Public Health Service, Mr. J. Lyall Clarke and Dr. Searls, were present, no attempt was made to check closely on insect populations.

Effect on DDT on animal life—insects.—Within 30 minutes after the oil spray fell, insects began to shower down through the forest canopy. In general, coverage was effective and while entomologists were assigned to note effects on insects, data was correlated to explain the presence or absence of bird life. Immediate control of adult mosquitoes and larvae was noted in the August and September sprayings. The drift from adjacent unsprayed areas hastened to repopulate the area and numbers were so restored as to make retreatment necessary at 30-day intervals. The effect on other insect species was likwise very pronounced, and their absence reflected in the absence of insectivorous birds.

Birds.—No dead birds were found which could be traced to mortality by DDT. A fresh, partly-eaten pied-billed grebe was noted by Biologist Smith on a point bordering the slough near the highway, but the death pointed to predators. Two normal grebes and a wood duck were observed on a slough nearby.

A nest of catbirds with three young was kept under observation for 36 hours, but no noticeable effect was apparent. The young left the nest as normal birds do and were not again seen.

Goldfinches nested along the Bellevue Dam, and while not located, the adult birds were observed busily carrying insects to the young. As this was on the border of the sprayed area, insects were brought from the outside. The day following the first spraying, three flycatchers were observed chasing the same lacewing.

It was apparent that with the sharply reduced insect population, some shifting of bird populations would be made. After the first spraying, from the third day insect eaters began to desert the sprayed area. By September all the insectivorous birds had left the area, with the exception of the woodpeckers. Noticeably absent were swallows,

flycatchers, warblers, vireos, redstarts, and thrushes, although these birds were in normal numbers off the sprayed area. Particularly noticeable were the swallows feeding above the dam and along the Mississippi proper. Near Station No. 5, which apparently was missed by the October spraying, chickadees and flycatchers were seen. Little dependence was placed on October bird populations as migration was in progress. One flock of over 100 rough-winged swallows was seen on October 3 flying through the sprayed area, but it was noted that no feeding was done. The normal number of fish-eating birds was present throughout, including bald eagles, ospreys, egrets, blue and green herons. Biologist Smith and I observed about 2,000 wood ducks in small flocks fly from the sprayed areas into the lotus beds above the Bellevue Dam on October 3.

Mammals.—As previously noted, the raccoon population was exceptionally high in the wooded areas of the Depot, while the crayfish were nearly wiped out by DDT. Apparently it caused no raccoon mortality, as the sign was as abundant in October as in August. I observed one female and two half-grown young feeding on sick crayfish about 11:00 a.m., the next day after the first spraying. After 15 minutes of observation, when one young had eaten a dozen crayfish, I captured it and held it for 10 minutes to note any toxic effects. In October it was noted that the raccoons had changed their feeding habits. Acorns were noted in the scats as were bits of mussel shells. Along the shore of many ponds, small piles of freshly-cleaned mussel shells were common, and it is thought that these were feeding places for raccoons. Muskrats likewise eat mussels, but there was little sign of these in the Crooked Fork area.

Other mammals not affected on the area included beavers (three colonies), muskrats, gray squirrels, marmots (one seen), cottontails, and swamp rabbit. Thirteen-lined ground squirrels were numerous in the headquarters uplands, as were foxes and opossums. One black raccoon was seen on October 3.

Reptiles and amphibians.—No snakes were seen in the Mississippi bottoms, so little information could be obtained from all observers. Frogs were abundant in ponds near headquarters and along the highway. Only one dead frog was examined, while in the same pond 20 live ones, including one large leopard frog (*Rana pipiens*), were checked. It was exceedingly difficult to record mortality on frogs as each pond had its share of herons, egrets and raccoons that would leave nothing which might have died for evidence each day. Turtles were numerous in all ponds and channels and no change could be noted in populations or recently killed carcasses found.

Mollusks.—Fresh-water mussels (*Anodonta*) were abundant in main channels, and from the evidence of feeding by raccoons, no mortality was accused by DDT.

Crustaceans.—DDT proved to be highly toxic to crayfish (*Cambarus*) at these relatively low rates of application. In August in one pond 6 inches deep Mr. Clarke and I observed all the crayfish were on their backs 20 hours after the first spraying. The pool still had oil coverage on the surface. Three hours later all crayfish (30) were dead in this pool about 10 by 30 feet in size.

In October, in checking all sprayed areas, no live crayfish were seen in the various pools, and only a few active "chimneys" among thousands of inactive ones. Fresh mounds by the score and 14 live crayfish were observed at the Iowa checking stations.

Fish.—DDT sprayed at less than one-half pound per acre had little effect in the "woods" ponds on fish life. At the spillway into the pool below the Bellevue Dam several common shiners were observed with "D.T.'s," and it is believed the running water carried the oil bearing DDT to the fish in a temporary mixing with water. Samples of fish populations were taken by a sweep minnow net at various stations, and no reduction in populations could be noted.

We located one poacher on the area, who had a set hoop net on the order of those used commercially in Reelfoot Lake, Tennessee. About 500 pounds of healthy carp were in the net, although the DDT had only been out for about 48 hours.

Twenty-four hours after the October spraying, where the pilot had made three runs over the same channel west of the headquarters building, and, combined with a strong breeze which had drifted the heavy oil spray into one shore, some loss of fish life was noted. One 12-pound carp, evidently affected by DDT, ran ashore and was placed in a small pond for observation along with three toothed herrings (*Hisdon tergisus*). The carp recovered in 2 days while the herring succumbed. At the same place shiners came ashore, but in a bucket of water dipped from along the shore these likewise recovered after 24 hours. Several other "sick" fish were noted along the shore. One effect of the DDT might be said to make fish more readily available to fish eaters. DDT must have piled up along this shore at the rate of several pounds per acre.

SUMMARY

From these tests, with the careful preparation made by the Sixth Service Command, results show that mosquitoes can be readily controlled with 5 per cent DDT in No. 2 fuel oil sprayed by planes at the

rate of between 0.2 and 0.5 pounds per acre. At these levels, provided the spraying is accomplished by experienced pilots who are familiar with the area covered and with favorable climatic conditions, little harm will result to fish and wildlife. After August 1, few nests of birds are occupied. As the *Anopheles* breeding season in this Upper Mississippi area normally begins at this time, spraying from August to October—at 30-day intervals—is relatively safe. If there is agitation for controlling "nuisance" mosquitoes as early as May or June, then bird nesting populations would be affected through removing the food supply.

Certain species of fish, notably toothed herring and several species of shiners and dace, are killed at rates of 0.5 pounds of DDT per acre in agitated waters. In one case, while the quantity was not known, fish killed were at an accumulated rate several times that normally applied.

Crayfish are readily killed at 0.5 pounds per acre and this may also have an effect on raccoon populations. This knowledge, however, may be of practical benefit in controlling crayfish in the South where they cause heavy losses to certain agricultural crops.

CONCLUSIONS

Results of the extensive application of DDT by airplane, without question show this to be an effective method in controlling mosquitoes. The possibilities of uniform application under proper weather conditions on river bottom forested lands has much to commend it over other methods applied from the ground. Relative costs on a private operational basis may prove to be the factor limiting the treatment of large areas. The possibility of commercial treatment of summer resorts is now a possibility with planes available on government surplus property lists. Extensive coverages are in prospect for the future and may wipe out segments of our fauna and possibly flora, also.

While the results herein noted at the rates applied show no losses to birds and mammals, the breaking up of food chains through suppression of insects and cold-blooded vertebrates may have serious indirect consequences. Little is yet known of the accumulated effects traceable to DDT, particularly in bird nesting seasons, or the resulting shift of bird and mammal populations.

Intensive research is needed to answer these questions. The present whole-hearted cooperation of biologist, entomologists and public health officials, is a healthy sign that technicians are working together in the end that a useful chemical may perform benefits for the human race, and at the same time preserve those forms of life which we all enjoy and cherish.

TECHNICAL SESSION

Tuesday Morning—March 12

Chairman: CHARLES A. DAMBACH

Vice-Chairman: DANIEL L. LEEDY

Ohio Cooperative Wildlife Unit, Columbus, Ohio

ADVANCES IN WILDLIFE TECHNIQUE

COVER MAPPING FOR FOREST AND WILDLIFE MANAGEMENT IN CONNECTICUT

MILTON C. ARNOLD

Connecticut Board of Fisheries and Game, Hartford, Connecticut

The increasing demand for multiple use in land management stresses the need for a more detailed inventory of plant communities and land values which will consider not only the overstory species but also the shrub and herbaceous species associated with them. In developing an effective program of management, it should be kept in mind that forestry and wildlife are closely allied and that any operation designed to benefit one is certain to affect the other to a greater or lesser degree. Considering that the pattern of the vegetation is a basic influence on the abundance and distribution of woodland game, it is of definite value to plan forest operations with a view toward providing the most desirable wildlife environment. Any map designed to serve as the basis for such management should describe in considerable detail the location, character, and interrelationship of the different plant communities so that steps may be taken to secure the greatest good for both objectives.

The method of cover mapping described in this report involves the preparation of two maps of each area. One to locate, classify, and describe the overstory, and the other to describe the associated undergrowth and ground cover. Large areas are divided into compartments of 100 to 500 acres, each of which is mapped separately on sheets of a convenient size. These sheets are bound in book form, with the overstory map of each compartment appearing on the left page and the

corresponding map of the undergrowth and ground cover on the right, so that the two can be readily compared. Notes of interest to the forester, game technician, and general land manager are taken in each cover type and form the basis for the management plan.

The forest type map.—The forest types are determined by the species composing the actual dominant forest cover and not by the basic site factors which may give rise to these types. The overstory is divided into stands of uniform character requiring a definite form of management. The type classifications are based upon a system developed by the Connecticut Department of Forestry which correlates them with Society of American Foresters' cover types. These divisions are classed as subcompartments and are numbered consecutively, beginning with number one for each new compartment. All forested types are broken down into age classes of 20-year periods, with the first age class further subdivided to indicate growth from 0-10 or from 11-20 years of age, as an aid to management.

Information concerning the type, age, composition, and density of each stand is shown on the map by formula. The development and interpretation of this formula is illustrated by the following examples:

Subcompartment No.		
Type	Age class	SH — II — III
Per cent of 3 predominant species	density	5H — 30 I-M (6)

Subcompartment No. 1

Softwood—Hardwood—Mixed ages (21-60 years)

50 per cent Hemlock—30 per cent Oak—10 per cent Maple—60 per cent density

When it is desired to show the occurrence of tree species of special value to forest or wildlife, which occur only infrequently throughout the overstory or in varying degrees as an understory, the formula can be adjusted to indicate their presence and abundance.

3	Subcompartment No. 3
MHI+	Mixed Hardwood—11-20 years old
50 — 3M — 1P+H (8) H(1)	50 per cent Oak—30 per cent Maple—10 per cent Pine + occasional Hemlock—80 per cent density

Understory hemlock—1 0 per cent density

The undergrowth-ground-cover map.—Shrub and herbaceous species forming the undergrowth and ground cover are an important part of the wildlife habitat. Their occurrence as a part of the forest com-

munity, together with the wildlife which they shelter, exerts a decided influence upon forest culture. The mapping of shrub and herbaceous species combined with the overstory map will furnish a fairly complete picture of the vegetation on any area surveyed and will demonstrate further the distribution and interrelationship of the many cover variations.

The dominant vegetation in each subcompartment is indicated by a formula listing the percentages of the three most important species in undergrowth and ground cover and estimating the density of each layer. Where important variations in undergrowth or ground cover occur within a subcompartment, the area is further subdivided by a special type line and receives a subdivision letter. Thus, 1A indicates subdivision A of the subcompartment No. 1. This permits a more complete coverage of the plant associations and gives consideration to the many small areas which are of material importance to wildlife such as: hedgerows, old orchards, small openings, swales, sizable vine tangles, small coniferous groves of dense cover, and similar features. All subdivisions receive a descriptive formula as illustrated in the following examples. Those too small to permit the use of formula are referred to the descriptive write-ups accompanying each cover variation.

Subcompartment No. — Subdivision (if any)	1A
Per cent of 3 predominant undergrowth species—density	6V-2Hz-1L (3)
Per cent of 3 predominant ground-cover species—density	4f-3Sa-2W (5)

Subcompartment No. 1—Subdivision A

60 per cent Viburnum, 20 per cent Hazel—10 per cent Laurel—30 per cent density

40 per cent Fern—30 per cent Sarsaparilla—20 per cent Wintergreen—50 per cent density

To facilitate the location of detail when comparing the map of the undergrowth-ground-cover with that of the overstory, the subcompartment lines (overstory type lines) and subcompartment numbers will appear on both maps. This will provide a form of grid which will make possible the quick location of corresponding points on each map.

Field method.—1. The field work should be conducted during the growing season to permit the most accurate mapping of ground cover. A suitable base map of the area to be worked must be obtained, which will show the boundaries, roads, and important topographical features. It is preferred that large areas be divided into compartments for reasons of management and that each compartment be mapped on a

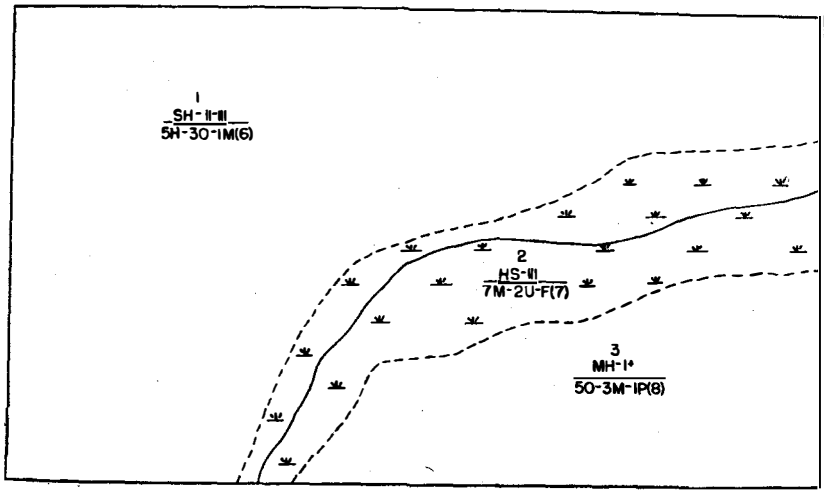

Plate A. The map of forest types showing the division into subcompartments and the use of symbols in describing the characteristics of each stand.

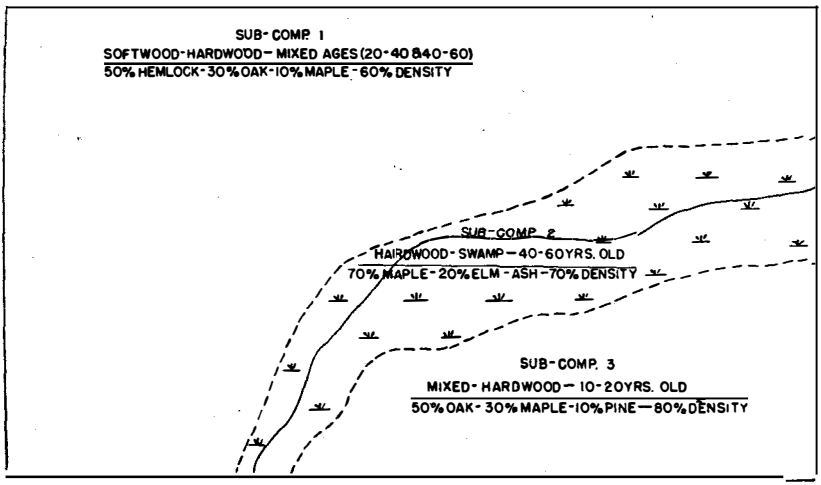

Plate B. A map corresponding to "A" above to show the interpretation of the symbols used.

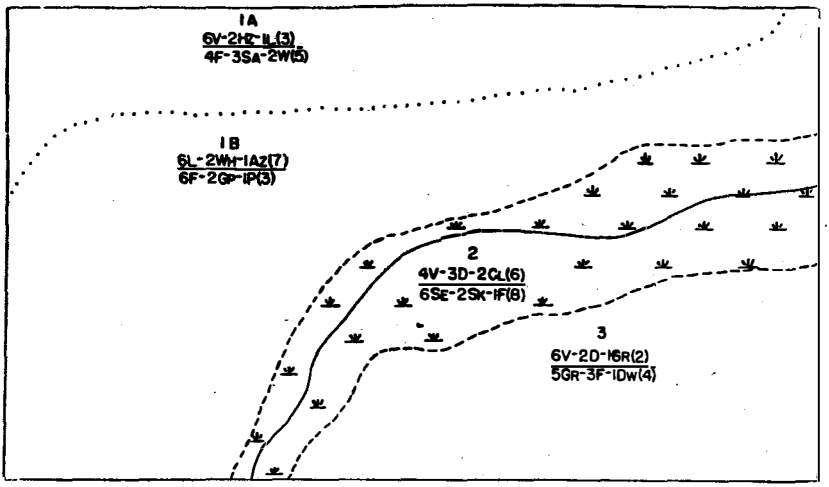

Plate C. A map of undergrowth-ground-cover used as a supplement to the forest type map and showing the distribution and abundance of shrub and herbaceous species.

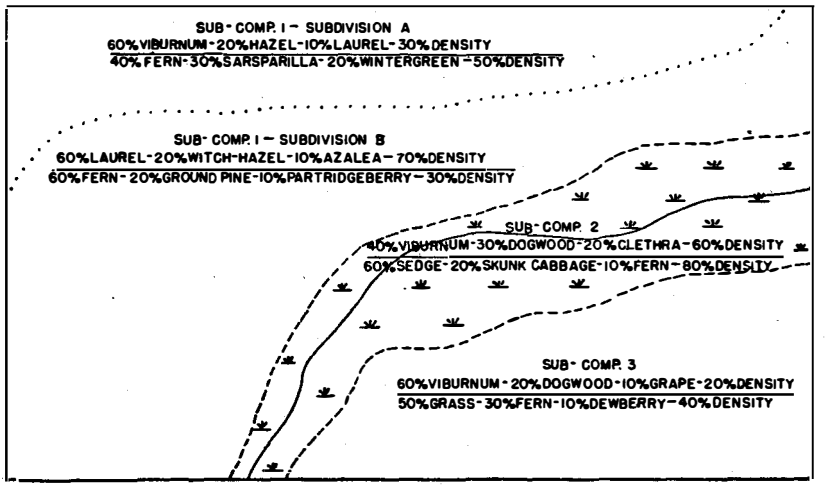

Plate D. A map corresponding to "C" above to show the interpretation of the symbols used.

FOREST TYPE DESCRIPTION

Forest type	*Map Symbol*	*Description*
1. Pine—SAF No. 9, No. 37	P	over 60 per cent white or pitch pine
2. Hemlock—SAF No. 11	H	over 60 per cent hemlock
3. White cedar—SAF No. 90	WC	over 40 per cent white cedar
4. Tamarack—SAF No. 25	T	over 60 per cent tamarack
5. Softwood-hardwood—SAF No. 8, No. 48	SH	any combination from 60 per cent softwoods and 40 per cent hardwoods to 60 per cent hardwoods and 40 per cent softwoods (except where the softwood is white cedar)
6. Mixed-hardwoods—SAF No. 49, No. 50, No. 51, No. 52	MH	over 60 per cent transition hardwoods (oak, ash, maple, birch) or Connecticut hardwoods (mixed oaks and hickory)
7. Northern hardwoods—SAF No. 12	NH	over 60 per cent birch, beech, and maple
8. Oak ridge—SAF No. 36, No. 33	OR	over 60 per cent stunted hardwoods occurring on rock ridges
9. Hardwood swamp—SAF No. 26	HS	over 60 per cent hardwoods occupying swampland
10. Old Field—SAF No. 7, No. 46	OF	abandoned field on which more than 50 per cent of the growth is temporary and of poor timber species
11. Plantation	PL	stands established by planting
12. Field	F	areas more than 80 per cent clear of trees or shrubs
13. Open swamp	OS	any swampy area more than 80 per cent clear of tree growth

AGE CLASSES

Timber age	*Symbol*	*Timber age*	*Symbol*
0- 10 yrs.	I—	61- 80 yrs.	IV
11- 20 yrs.	I+	81-100 yrs.	V
21- 40 yrs.	II	101 yrs.	VI
41- 60 yrs.	III	All-aged	A

SPECIES SYMBOLS

Overstory species	*Symbol*	*Overstory species*	*Symbol*
Aspen	A	Maple, sugar	Ms
Apple	Ap	Hop-hornbeam	N
Balsam	B	Oak, white	O
Cedar, white	C	Oak, chestnut	Oc
Cedar, red	Cr	Oak, red	Or
Chestnut	D	Oak, scarlet and black	Os
Birch, black	Eb	Pine, white	P
Birch, gray	Eg	Pine, Austrian	Pa
Birch, white	Ep	Pine, jack	Pj
Birch, yellow	Ey	Pine, Jap. red	Pjr
Ash	F	Pine, pitch	Pp
Hickory	G	Pine, red	Pr
Hemlock	H	Pine, scotch	Ps
Blue beech	I	Spruce, red	S
American beech	J	Spruce, black	Sb
Cherry, black	K	Spruce, Norway	Sn
Locust, black	L	Spruce, white	Sw
Maple, red	M	Tamarack	T
Elm	U	Gum, black	Y
Butternut	V	Tulip	Z
Basswood	W		

Undergrowth species	*Symbol*	*Undergrowth species*	*Symbol*
Alder, smooth and spotted	Al	Hawthorne	Hw
Alder, black	Ab	Laurel, mt.	L
Azalea	Az	Laurel, sheep	Ls
Buttonbush	Bb	Nightshade	N
Blueberry and huckleberry	Bl	Oak, scrub	O
Bayberry	By	Poison ivy	Pi
Barberry	Br	Poison sumac	Ps
Bittersweet	Bt	Rose	R
Clethra	Cl	Sumac	Su
Chokeberry	Ch	Spicebush	Sb
Dogwood	D	Shadbush	Sh
Elderberry	E	Spirea	Sp
Grape	Gr	Sweet fern	Sf
Greenbrier	Gb	Viburnum	V
Hazelnut	Hz	Witch hazel	Wh
Juniper	J	Willow	Wl
Honeysuckle	Hn	Woodbine	Wb

Ground-cover species	*Symbol*	*Group-cover species*	*Symbol*
Aster—goldenrod	as	Hellebore	h
Blackberry—raspberry	bl	Jack in the pulpit	j
Bedstraw	bd	Lily of the valley, false	l
Buckwheat, false climbing	bu	Marsh marigold	m
Clover	cl	Partridgeberry	P
Cinquefoil	cq	Rush	r
Cranberry	cr	Sedge	se
Cucumber, wild	cu	Sarsaparilla	sa
Dewberry	dw	Skunk cabbage	sk
Dwarf cornel	dc	Smartweed	sm
Fern	f	Sorrel	so
Flag-iris-cattail	fl	Strawberry	st
Grass	gr	Solomon seal	ss
Ground nut-hog peanut	gn	Wintergreen	w
Ground pine-lycopodium	gp		

separate sheet of a convenient size. Compartments up to 500 acres can be mapped on a sheet 12 inches by 16 inches using a scale of 1 inch to 600 feet.

2. Strip lines are run by compass and chain at 500-foot intervals and at right angles to the major drainage. These strips are numbered consecutively from north to south in such a way that there is no duplication in strip number on the entire area.

3. The undergrowth-ground-cover map is drawn in the field and will show subcompartments outlined by forest type line, undergrowth-ground-cover subdivisions with descriptive formulae, and topographical and cultural features. The forest type map can be prepared in the office from the field map and from data collected on form sheets. The form sheet used is as follows:

LITCHFIELD-MORRIS SANCTUARY CONNECTICUT STATE BOARD OF FISHERIES AND GAME

Cover Data

Forest	Type and Age
Block	Date
Comp.	Strip
Sub-Comp.	Distance
Plot	Course

Description of Species

	Percentage	Density
Overstory		
Understory		
Undergrowth		
Ground Cover		
Reproduction		
Slope and Aspect		Soil
Silvic Condition	T M D	Origin
Logging Factors		Site Quality

Wildlife Values

Available Foods	S—Scant	C—Common	A—Abundant
Fruiting Species			
Budding Species			
Seed Species			
Leafy Species			
Browse Species			

Cover Values	P—Poor	F—Fair	G—Good
Nesting		Drumming	
Brooding		Winter	
Molting		Den Trees	

Remarks and Recommendations

4. Each recognized unit of undergrowth and ground cover will be described on a form sheet recording cover features, wildlife values, and recommended treatment. A summary of each compartment will be prepared by the mapper using these form sheets as a source of information for discussing such items as topography, soils, growing stock, protective measures, logging facilities, recreational features, silvicultural condition, wildlife food and cover, and recommendations for forest culture, wildlife management, and recreation.

5. Completed sections of the map are assembled in book form and bound in a stiff cover. It is advisable to paste them to muslin or similar material so that they will withstand constant handling. The overstory map should appear on the left page and the undergrowth-ground-cover on the right so that the two can be readily compared. As a preface, a location map of all compartments surveyed will be useful in determining their correct orientation. The distribution of overstory types may be clearly shown by coloring the different types with an indicative color.

SUMMARY

The method of cover mapping described applies to forested areas where a detailed knowledge of plant distribution and abundance is a requisite to practical forest and wildlife management. Separate maps of forest types and the associated undergrowth and ground-cover are prepared by sections on sheets of small size so that they may be bound in book form. The segregation of the two types of cover data and the division into subcompartments based on forest types is intended to permit a clearer interpretation of map data and a ready comparison of corresponding areas without the use of an overlay or similar method.

The method may be applied to other localities by adjusting the forest type classification and species index to conform to local conditions.

THE SPORTSMAN'S QUESTIONNAIRE METHOD OF ESTIMATING THE GAME KILL IN INDIANA

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One of the prime objectives of the game administrator is to produce the maximum number of wild game species for the gun, and still have a sufficient carry over of brood stock for perpetuating the species. The best way to judge the relative success of the open season is to have an annual tabulation or estimate of the wildlife harvest. A knowledge of the yearly take of game birds and mammals means the same to wildlife management, as the volume of sales does to business. All game administrators use some method for determining these trends. The sportsman's questionnaire is simply the method used by Indiana for estimating the annual take of wildlife, as well as for the collection of other pertinent data.

Many methods have been devised for gathering this information. Gordon (1940) analyzed reports received from all but four states and one province of Canada regarding the collection of kill statistics. Twenty-two of the reporting states and provinces were making attempts to obtain reasonably complete records. Returns from license holders varied from 10 to 98 per cent.

With a few exceptions in the past, game kill figures have generally been collected by: (1) compulsory license tab report, enforced or otherwise, mailed directly to the central office of the administering agency, (2) collection of data by license issuing agents, and (3) various field checks and estimates made by conservation officers and other officials. It is evident that returns will vary greatly, especially when considering the last mentioned method. Accuracy and reliability are generally in proportion to the effort exerted by the individual state. Pennsylvania (Slaybaugh, 1944), with an enforced fine for violation, has been able to obtain a return of 93 per cent or over. The tabulation of this entire return represents the most comprehensive form of kill data. Regardless of the system of collection, criteria that should be considered are reliability, attitude of the sportsman regarding the report, time necessary for compilation, and cost.

In 1940, the sportsman's questionnaire (Figure 1) was initiated by the Indiana Division of Fish and Game through its Pittman-Robertson Wildlife Research Project 2-R. In principle, the method is based upon reports from a random sample of the holders of the resident hunting, fishing, and trapping license and the free permit issued to war veterans.

108—34M—10-46

Figure 1

State of Indiana
DEPARTMENT OF CONSERVATION
DIVISION OF FISH AND GAME

SPORTSMAN'S QUESTIONNAIRE

WE NEED YOUR HELP. You are one of a small group of license holders selected to help the Division of Fish and Game secure information on the annual kill and the present status of wildlife in Indiana.

If you will take a few minutes of your time now to fill out and mail this questionnaire we will greatly appreciate this cooperation. Please answer the few questions listed below regarding your hunting, fishing and trapping activities during the past open season.

The hunting and trapping information should include the game birds, game animals, and fur-bearers taken during the period from the opening of the squirrel season to the close of the trapping season on January 15, 1946. Report your kill only, and not the kill by your party. Your name has been selected for reporting, so do not pass this form to another person.

IN ORDER TO OBTAIN AN AVERAGE IT IS JUST AS IMPORTANT THAT WE HEAR FROM PERSONS WHO HAVE NOT KILLED OR CAUGHT ANYTHING AS FROM THE MORE SUCCESSFUL SPORTSMEN.

The questionnaire should be returned in the enclosed, self-addressed envelope. No postage stamp is necessary.

Did you fish during the past open season?_____**(yes or no)**
Did you hunt during the past open season?_____**(yes or no)**
Did you trap during the past open season?_____**(yes or no)**

IF YOU ARE A FISHERMAN AND DO NOT HUNT OR TRAP—JUST ANSWER THE ABOVE QUESTIONS AND MAIL THIS QUESTIONNAIRE

HUNTER'S KILL

Kind	Number times you hunted each kind	Total Season Kill
Fox Squirrel		
Grey Squirrel		
Rabbit		
Quail		
Pheasant		
Hun. partridge		
Ducks and coot		
Geese		
Woodcock		
Red Fox		
Grey Fox		

(If you hunted with other persons, report your kill only.

NIGHT HUNTER'S CATCH

Kind	Number times you night hunted	Total Season Catch
Raccoon		
Opossum		
Skunk		
Mink		
Others (give name)		

(If you night hunted in partnership, report only your share of furs pelted.)

How many times did you go Fox Chasing for sport only, with no intention of killing the fox?_____

What percentage of your furs, taken by hunting and trapping, did you sell or ship out of the State?
_____%

TRAPPER'S CATCH

Kind	Number days traps were set for each kind	Total Season Catch
Muskrat		
Mink		
Raccoon		
Opossum		
Skunk		
Weasel		
Red Fox		
Grey Fox		
Badger		
Rabbit		

(If you trapped in partnership, report only your share of furs pelted.)

Name of Sportsman_____ County_____
(where you now live)

THANKS FOR YOUR COOPERATION

This random sample involves a report form mailed to approximately one out of every 25 persons holding either a paid license or a free permit. The number of names necessary from each county is given to the local conservation officer at the end of the calendar year. He then contacts the county clerk, who issues these licenses, and selects the first name out of each stub book of 25 and the first and last names out of each stub book of 50 paid licenses sold in each county. Names of free permit holders are selected from the state file in the central office in Indianapolis.

The night hunting and trapping seasons close on January 15. Each year we endeavor to have the bulk of our questionnaires mailed within 2 weeks after this closing date. In 1944, a total of 15,121 were mailed, third class, to a cross-section of paid license holders and 1,630 to free permittees. A postage paid envelope was enclosed, and four cents postage was paid for each of the 6,116 returns. Of this number, 72 or 1.2 per cent were unrecordable.

No questionnaires are sent to farmers hunting on their own property or to nonresident license holders. The questionnaire is made as simple as possible, with special emphasis being given to the object of the survey and the method to be used in reporting. A psychological approach is used in the first introductory sentence "WE NEED YOUR HELP." The entire sample is based on voluntary returns which vary from 35 to 50 per cent. It is interesting to note that paid license holders generally give a voluntary return of about 35 per cent, while the returns from free permit holders range from 45 to 50 per cent.

There has always been an uncertainty regarding the proportionate kill by the license holders who do not return their questionnaires. In 1944, the group, plus the unrecordable returns, represented 10,717 or 64 per cent of the total random sample of 16,751. After this nonreporting group had been given from 6 to 8 weeks to answer, a second questionnaire was mailed, first class, to a random selection of 400 paid license holders and 50 free permittees who had not returned the questionnaire. The names of those not answering the "follow-up" questionnaire were given to the conservation officers for contact and investigation.

The significant result of the "follow-up" questionnaire was the larger number of license holders not using their licenses. As many of these persons were in the armed services or important defense work, it is natural to assume that they would not submit proportionate voluntary returns. The mailing of the second questionnaire, first class, and personal investigation by the conservation officers covered a higher

percentage of this transient group. It is interesting to note in the original returns that the nonuse group involved only 5.9 per cent of the paid license holders, as compared with 16.4 per cent of the free permit holders. This made a total of 434, or 7.2 per cent of the original 6,034 returns, that reported no use of their license while 54, or 14.4 per cent of the 374 complete "follow-up" questionnaire returns, were listed as not using their licenses. Using a weighted average, the deduction for nonuse of licenses is obtained by using the following formula:

$$\frac{Xa + Yb}{S} = c$$

X = Total recordable questionnaires received from original questionnaire
a = Percentage of original questionnaires showing no use of license
Y = Total questionnaires not returned
b = Percentage of "follow-up" questionnaires showing no use of license
S = Total random sample
c = Percentage of license holders not using license

Or

$$\frac{6{,}034 \times 0.072 + 10{,}717 \times .144}{6{,}034 + 10{,}717} = \frac{434 + 1{,}543}{16{,}751} = \frac{1{,}977}{16{,}751} = 11.8 \text{ not using license}$$

This "follow-up" questionnaire has been used for 2 years. For purposes of comparison the license use and hunting success for the more important species, as computed for the first mailing and second or "follow-up" questionnaire groups, are shown in Table 1. With nonuse deducted from both groups it will be noted that the averages are comparatively close.

Reporting license holders (which term shall be interpreted as including both the paid license holders and free permittees) are placed in seven different sporting classes: hunting only, fishing only, trapping only, hunting and fishing, hunting and trapping, fishing and trapping, and hunting, fishing and trapping. Deducting nonuse, nearly one half of these persons in 1944 participated in only one of the three major sports. The percentage of persons participating in one sport only has progressively increased since 1940, probably a reflection of less time for indulging in recreation. During the war period, fishing only has always surpassed hunting only, reaching a high in 1943. In considering the three major sports by using combinations of the different sportsmen classes, the present trend shows that about 7 per cent of the participating license holders trap, 72 per cent hunt, and 77 per cent fish.

Other than obtaining the different percentages of persons who participate in fishing the rest of the questionnaire involves hunting and

TABLE 1. COMPARISON OF LICENSE USE AND HUNTING SUCCESS BY PARTICIPATING LICENSE HOLDERS IN FIRST MAILING AND SECOND MAILING GROUPS, 1943-44

	1943		1944		2-year average	
	First mailing	Second mailing	First mailing	Second mailing	First mailing	Second mailing
Percentage hunting only	18.6	25.3	21.1	22.2	19.8	23.6
Percentage fishing only	29.7	23.5	27.7	28.7	28.7	26.3
Percentage trapping only	0.4	0.7	0.1	0.6	0.3	0.7
Hunting and fishing	43.3	43.8	43.8	41.3	43.6	42.5
Hunting and trapping	1.8	0.4	1.3	1.3	1.5	0.8
Fishing and trapping	0.3	0.0	0.3	0.3	0.3	0.2
Hunting, fishing, and trapping	5.9	6.3	5.7	5.6	5.8	5.9
Percentage of participating license holders who hunt squirrel	41.7	41.8	44.4	40.3	43.1	41.0
Average kill per hunter per season	11.2	10.9	10.4	8.4	10.8	9.6
Percentage of participating license holders who hunt rabbit	58.4	63.2	60.5	58.1	59.5	60.5
Average kill per hunter per season	11.4	14.9	11.2	11.8	11.3	13.4
Percentage of participating license holders who hunt quail	28.9	31.2	29.0	18.4	29.0	24.5
Average kill per hunter per season	12.3	12.6	10.4	9.0	11.3	11.2
Percentage of participating license holders who hunt pheasant	24.0	22.1	23.3	21.3	23.7	21.7
Average kill per hunter per season	1.1	1.1	1.1	1.1	1.1	1.1
Number of participating license holders	5,640	285	5,600	320	11,240	605

trapping. For all types of day hunting, information is requested regarding the number of times each species is hunted and the total kill. Night hunting covers the number of night hunting efforts and the total catch of the various species. Trapping data consist of the number of days traps set for each species and the total season's catch. This information is presented in five major divisions comprising upland game, fox hunting and chasing, migratory birds, night hunting, and trapping. The state is divided into six general districts in accordance with farming practices and zoogeographic features. A separate table is prepared for each species of animal and data are compiled on a district and state basis.

Small upland game provides hunting sport for the greatest number of Indiana hunters. Squirrel, rabbit, and quail have state-wide distribution, while ring-necked pheasant and Hungarian partridge are localized principally in the northern part of the state. The aggregate kill of these upland game species will annually average over five million pieces of game.

In order to present the method of calculating the various statistics in such a manner that this paper will not be construed as eligible for presentation at a meeting of mathematicians, the method will be explained without the use of formulae and in as simple a manner as possible. In short, the entire tabulation is built around the average hunting efforts per hunter per season and the average kill per hunter per season.

The bobwhite quail is our most important game bird and our calculations for the 1944 harvest are as follows:

Total license holders	394,470
Total not using license (394,470 × 11.8 per cent)	46,547
Total participating license holders	347,923
Fraction of participating license holders who hunt quail	0.284
Total quail hunters (347,923 × 0.284)	98,810
Average kill of quail per hunter per season	10.3
Calculated total kill of quail (98,810 × 10.3)	1,017,743

In the above tabulation the 28.4 per cent of participating license holders who hunt quail is determined by dividing the total quail hunters reporting by the total participating license holders reporting. The average kill of quail per season is determined by dividing the total reported kill of quail by the toal quail hunters reporting.

Other information of significant importance is the average kill per hunting effort. This is determined by dividing the total reported kill of quail by the total number of times quail were hunted. It is believed

that the number of times each species is hunted is the most convenient term for measuring the activities of hunters in the field. If the information were requested on an hourly basis many of the hunters, especially the more active ones, would not go to the trouble of even turning in a report. Reporting on a day basis is open to much confusion on what constitutes a day. The same objection can be given to the term "times" which may mean one-half hour or a full day. Gordon, Jr. (1941) found the number of trips taken in pursuit of big game in Michigan to almost always be identical with the number of days spent hunting such game. Recording was done on a basis of 8 hours per day. He found that the vast majority of small game hunters spent perhaps 6 hours maximum, but hunting efforts usually consisted of a number of short trips of 1 to 2 hours. Small game hunting statistics collected in Indiana are quite similar. No matter what the term, the interpretation by a large number of hunters over a period of 5 years should tend to level off when using the data for annual comparisons. Annual statistics collected on a state-wide basis during the past five open hunting seasons are presented for certain species in Figure 2. A glance at such a chart will show the game administrator upward or downward trends in the population of each important game species.

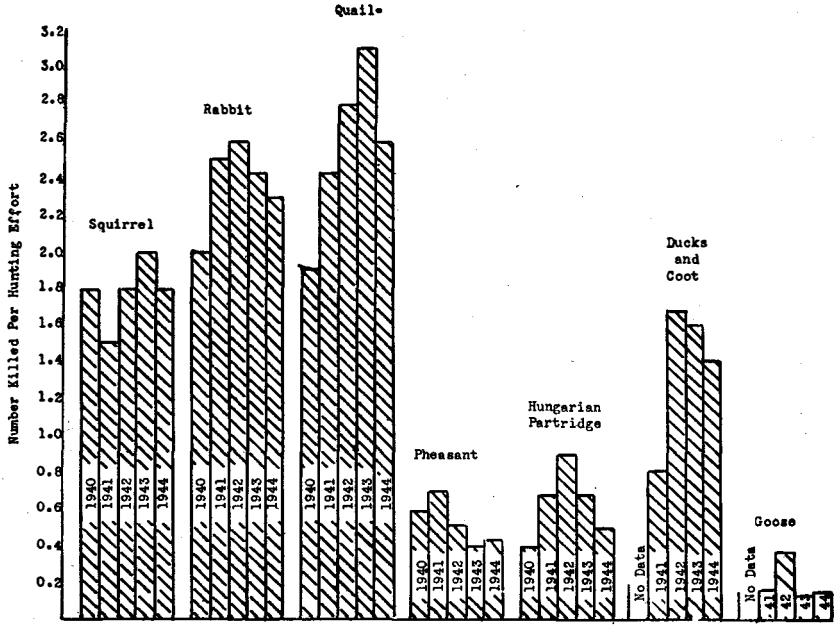

Figure 2

We place more importance on the average kill per hunting effort than on any other data. During the war period, the number of hunters in the field has fluctuated considerably, as well as the total number of hunting efforts. The average kill per hunting effort is more stable and gives a better picture of the wildlife situation.

Hunting preferences by species, have been determined by dividing the total hunting efforts made for each species by the total hunting efforts for all species. This method has its disadvantages as a hunter preferring to hunt quail might show in one hunting effort a kill of quail, pheasants, Hungarian partridges, and rabbits. It is necessary, however, to give each bird or mammal an equal tabulation rating. It appears that in considering the total hunting efforts exerted in the state that this sport hit the bottom in 1943. In 1944 there was an increase of 5 per cent in the total hunting efforts, as well as an increase of nearly 20,000 in the sale of paid licenses and distribution of free permits.

There are many other refinements and calculations too numerous to cover in this paper (Barnes, 1945). Each year some improvement has been added to our questionnaire form.

The cost of collecting kill statistics must always be considered. Expenditures per 1,000 questionnaires are as follows:

Printing questionnaires, envelopes, etc.	$ 6.90
Machine folding of questionnaires	1.00
Mailing (1,000 @ 1½ cents)	15.00
Return postage (365 @ 4 cents)	14.60
Addressing envelopes (12 hours @ 75 cents)	9.00
Stuffing and mailing (5 hours @ 60 cents)	3.00
Opening and filing returns by counties and districts (10 hours @ 75 cents)	7.50
Compiling questionnaires (24 hours @ 75 cents)	18.00
Total cost	$75.00

The itemization of costs does not include expenditures for "follow-up" questionnaires. The time and travel expenses of conservation officers in obtaining the original mailing lists and contact of persons not answering their "follow-up" questionnaires is also excluded. These field men are paid on a monthly basis with a standard expense allowance and this work can be considered as a routine activity. A clerk brings all statistical data up to the actual total recorded hunting efforts and kill for districts and state. The remaining calculations

and preparation of tables are carried out by the writer as a Pittman-Robertson activity and costs are not included.

In summary, the sportsman's questionnaire is a rather convenient method for collecting kill statistics, especially for states having limited funds. Like polls of popular opinion, it is based on a scientific selection of the sportsmen. Disadvantages are: the statistics are an estimate rather than the actual kill; reliability decreases with smaller samples, thus the average estimate of the woodcock kill is less reliable than the rabbit kill because of the small return from woodcock hunters. Advantages are: minimal costs, the gathering of information on a voluntary rather than a compulsory basis, less nuisance to the sportsmen, ease of compilation of small sample, and rapidity of method with final results available within 6 months or less after close of the hunting season.

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DISCUSSION

CHAIRMAN DAMBACH: I think the material Mr. Barnes has presented has given us food for thought, particularly in view of the fact that some states have discontinued their methods of game kill and have come up with another method of approach to this same problem and one certainly which is deserving of discussion. Do you have any questions about this paper?

MR. BILL T. CRAWFORD (Missouri): I would like to ask one question. It is a fundamental question but I realize the necessity for getting harvest figures. Are these figures basic in any management or protection work that you are carrying on in the state? Can you change your seasons and so forth on this type of information?

MR. BARNES: You can surely see with this pheasant kill going down and with the data for each year, there should be food for thought for doing something about the pheasants, and if you notice these trends with our different species, if it were really carried out to that extent, you could fairly well manage each species because this average kill per hunting effort to me is very important. It means whether the hunter has had success or not and, incidentally, these trends have also been more or less verified by reports from hunters in the field concerning the relative success of the hunting season each year.

CHAIRMAN DAMBACH: Any further questions?

VICE-CHAIRMAN LEEDY: Mr. Barnes, have you any figures which would represent the percentage of fur sent out of the State of Indiana by the trappers and hunters who take the pelts?

MR. BARNES: Yes, we do that as a question which is included in our sportsman's questionnaire. We have found on a 5-year average that 17 per cent of the pelts taken are sold out of the state.

VICE-CHAIRMAN LEEDY: Does that vary much from one year to the next?

MR. BARNES: It has varied some from 12 up to 22 per cent. I don't think it has actually varied that much. Possibly it may be this small sample and with a 5-year average, of course, it would tend to level out and I believe in 3 of the 5 years, it has been 17 per cent.

QUESTION: Continuing that thought, how complete is the coverage of your local fur buyer?

MR. BARNES: We do not cover our local fur buyers at all. We simply rely on the returns from trappers reporting on this form.

QUESTION: What I meant was this: How completely—how easy—is it for the average farm boy to sell his fur to a fur buyer in Indiana?

MR. BARNES: I would think that with the average farm boy in Indiana there would be some tendency to sell probably to Sears-Roebuck with whom they deal considerably. As to the exact percentage or the trend, I do not have those figures.

QUESTION: Do you license the fur buyers in Indiana?

MR. BARNES: Yes, our fur buyers are licensed.

QUESTION: Do they have to make a report?

MR. BARNES: Yes.

QUESTION: Is there any portion of your hunting population that is not required to have either a license or this permit that you speak of?

MR. BARNES: Yes, farmers hunting on their own land. We have no figures at all to substantiate what they kill.

QUESTION: You don't cover that?

MR. BARNES: It would be only the farmers who buy a license and who hunt on other property. Incidentally, in 1940, we took a cross section of the various occupations of our license holders. We found that about 16 per cent of our license holders were farmers. By comparing that with the census figures for 1930, we found that 17 per cent were farmers, so we were that close in our questionnaire—16 per cent as compared with 17, as published in the census figures.

MR. HAROLD PILLSBURY (New Hampshire): You have relatively large figures. Did you make any effort to see what the minimum figures that you had to have for the size of the sample—in other words, before you could have a reliable percentage showing the trends?

MR. BARNES: We started that in 1940 with a total of 8,000 questionnaires sent out. The next year we increased it to 16,000. This last year in 1945, which I have not included, we have increased it to approximately 26,000.

MR. PILLSBURY: You did not feel, then, that the smaller numbers the first years were giving you a true average, a true trend?

MR. BARNES: We did not.

MR. PILLSBURY: That would be a problem in the smaller states such as ours. We would have to know somewhere near what we could look forward to in taking samples. That would be an important question to us.

MR. BARNES: In other words, this sample covers about 1.5 per cent of the license holders.

CENSUSING A DEER HERD BY SAMPLING METHODS

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As far back as the time when aboriginal man learned to count by tallying things on the fingers of one hand, he has probably been counting big game animals. As a science, the determination of wild animal populations has gotten little beyond the point where we can count up to multiples of the fingers on both hands. This is said with apologies to some workers who have made an important start in the use of sampling methods.

Economic biology and game management require some accuracy in estimating wildlife populations and more in evaluating trends. Apparently the answer lies in the development of sampling methods which would consist of an accurate appraisal of population intensity on a small area which would be applied to a larger area of similar character.

For some years the writers have considered the possibility of using some such method for determining deer populations by periods on the winter range of the interstate deer herd which summers in Oregon to a large extent on the Fremont National Forest and winters on the Modoc National Forest in northern California. An irruption of this herd started some time prior to 1935 when it was first recognized. A heavy population of deer resulted and throughout the winter range the important browse plants have been severely damaged or are now dead.

In an attempt to secure an accurate appraisal of the problem which would portray the condition of the vegetation and the deer population and its trend, studies were started in 1937. Because the deer were more or less in continuous movement over their winter range a satisfactory census method was not developed until 1943. The method finally developed which parallels that of Erickson's (1940) is herein discussed.

The winter range comprises an area of approximately 400,000 acres. The topography, broadly speaking, is flat but in detail is gently undulating with a few hills and ridges giving accent to the landscape.

The cover types include: (1) open Ponderosa pine types with an understory of bitterbrush (*Purshia tridentata*) and pine reproduction of varying density; (2) browse types with bitterbrush predominating, and (3) open juniper-sage types with limited amounts of bitterbrush. All types contain a fair amount of bunch grasses, annual grasses, and

other herbs. The use of the types by deer is to a considerable extent in the above order as the winter weather becomes more severe.

The favored forage species throughout the winter included bitterbrush ,a few low shrubs, and various herbs. Juniper is normally lightly used but is an important emergency feed when deep snow makes herbs and low shrubs unavailable.

In the pine type nearly all deer could be sighted up to a distance of 100 yards and more, and to a distance of 300 to 500 yards in other types. The species concerned, Rocky Mountain mule deer (*Odocoileus hemionus hemonius*) probably lends itself better to census work than other species and races, at least in winter. From the onset of the rut in early November until it approaches its summer range the following spring it is generally in open cover types, is found mostly in groups, and being then more or less active during the daylight hours, is easily sighted, one or more of a group usually standing or in movement.

Since the area involved was extremely large an extensive census method was required. The deer were more or less in movement throughout the winter period, being forced from certain areas as snow accumulated, and voluntarily seeking others as certain foods became available and as dietary requirements seemed to change. Therefore, a single count of the whole herd had to be made within a short period, in order to avoid duplicating or missing a part of the herd. Repeated censusing by localities appeared to be required for determining migrations. Little of the movement of the herd from place to place was clearly evident at one time. Definite trails were seldom made. Instead the bulk of the movement was in the nature of an imperceptible drift, typically of 10 to 20 miles a month, with periods of 2 to 4 weeks of perhaps no movement, depending on weather conditions. Lightly-used roads and trails provided fairly good random coverage of the area. These were designated as sampling strips and termini were located where there was a change in vegetation type, at road junctions and so forth (Figure 1). Cars were used on the roads when passable. Elsewhere and otherwise saddle horses were used.

For each strip an estimate was made of the area visible in which deer would be counted. This was rechecked repeatedly on the basis of the sight distance at which deer were observed. Deer occasionally seen beyond the designated limit of a strip were not enumerated. The strip counts were converted into deer per square mile and this figure was applied to the area of the unit to which the strip applied. From this total the number of deer by types and localities was determined for the time of the count.

In order to keep track of deer movements and to determine total use

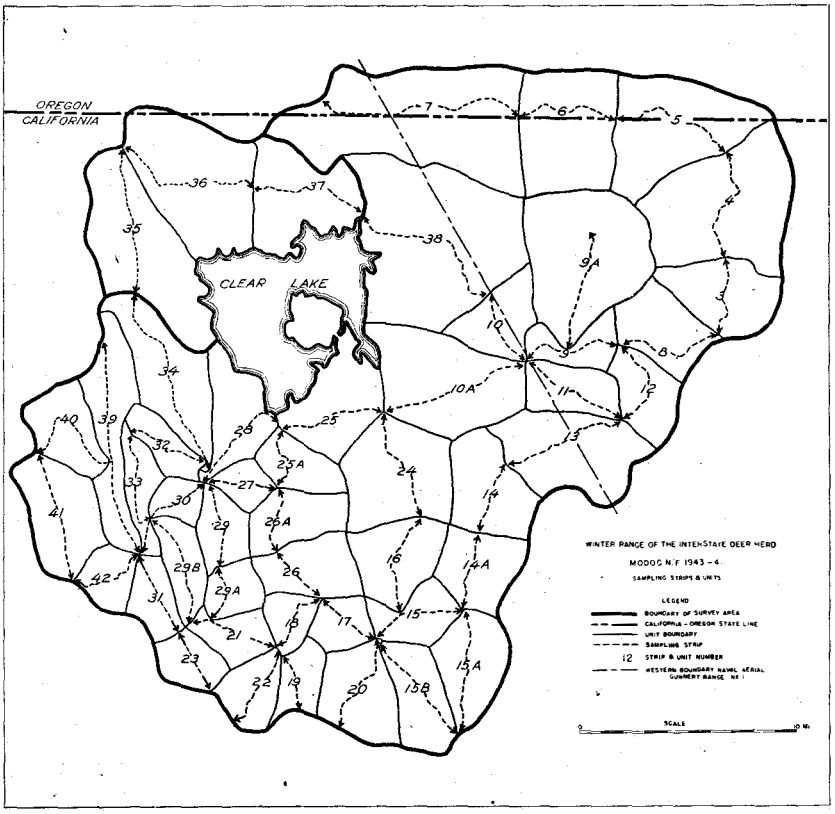

Figure 1

by deer of each area and type, the work was repeated at intervals of 10 days to 2 weeks. Figure 2 shows the area used and the concentration areas during the period. Only occasional counts were made in areas not yet occupied by deer. The total number of strip counts for the 49 sampling strips was 376. In addition, 44 side trips were made for exploration or to check with conditions found on strips or to study abrupt migrations. Due to inclement weather, unforeseen circumstances, or excessive travel required to make certain counts, figures were secured for only 80 per cent of the strip counts planned. These blanks were filled in, either by mathematical interpolation from a previous and a later count or by an estimate based upon information as to relative numbers of deer on adjoining units at the time.

Normally the men worked in pairs, one driving the car and the

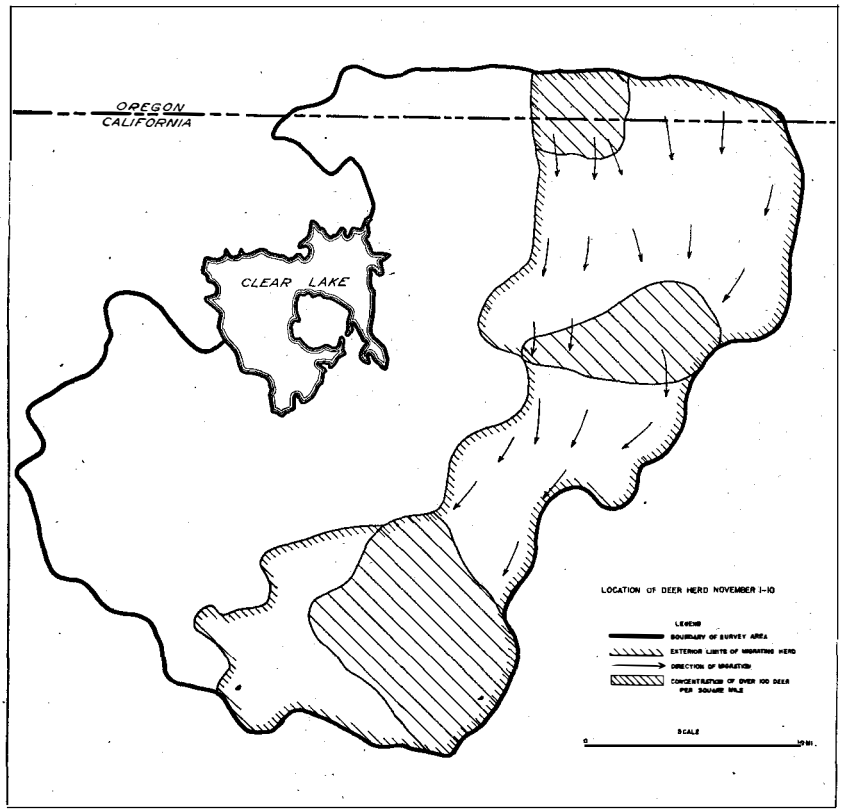

Figure 2

other "spotting" and recording. When deer were sighted, the car was stopped or driven to a vantage point and with the aid of binoculars both men working together counted and classified the deer as to does, fawns, and bucks. The latter by antler point classes when possible. Unclassified deer and unclassified bucks were recorded separately.

The work of two men for 10 days was required for each complete count. Thirteen such counts were made in the winter of 1943-44. The findings that season indicated that one count after all of the deer had reached the winter range (about mid-December) was adequate to indicate trends and appraise the results of the management applied. One count per month, November to April in later years, gave satisfactory information on numbers, movements, and total use by areas.

The test of such a sampling method may be expressed in relation-

ships of repeated samples. Ocular examination of the data shows what we thought was a remarkable consistency. The computed populations for nine counts between December 10 and March 20 when all of the deer were within the area sampled were 19,916, 22,719, 19,833, 21,935, 19,731, 20,575, 20,502, 19,802, and 20,637 deer. These figures vary from 95 per cent to 110 per cent of an arithmetical mean. The data indicates a loss of perhaps 2,000 animals during the period which, if applied to the average indicated size of the herd, would keep the derivation within a still narrower range.

This consistency seems to show that we have developed a sound base. Certainly it is at least an adequate base from which to determine trends. There is need now for determining the relationship between these estimates and the true size of the herd. The method to this point presupposes that all deer were seen and recorded within certain limits of observation on each strip. Observers of wildlife have frequently noted certain species being more in evidence in the mornings and evenings. However, much of feeding is done during daylight hours in winter; in addition, their activities shift to areas of more open cover and a part of their wildness disappears. A casual study of the relation of time of day to the size of counts showed an average of 61 animals between sunrise and 10:30 a.m. (standard time), 60 animals between 10:30 a.m. and noon, 45 animals between noon and 2:30 p.m., 32 animals between 2:30 p.m. and 4:30 p.m., 39 animals between 4:30 p.m. and 6:30 p.m., and 69 animals between 6:30 and dusk. In the open brush and pine types, counts were fairly consistent throughout the day.

The relationship of weather to the effectiveness of the counts in this area appeared to be of less importance than time of day.

A comparison of the effectiveness of counts by automobile versus those made on horseback and afoot definitely favored the automobile. This is due to the fact that a deer's senses of smell and hearing are quite keen and they have sufficient time to escape from the vision of an observer on horseback, which they seldom seemed to do from a car. Their sense of smell is particularly effective in warning of the approach of enemies from the windward. It was found particularly desirable to avoid down-wind counts when on foot or horseback.

It is believed the method has many possibilities as a winter census method on ranges that have areas of uniform topography of considerable size and with uniform cover types. Since the first essential in applying the method is to break the area into units of uniform cover, topography, and forage, its limitations can be rather simply determined.

Full notes were taken on life history, herd classification, forage condition and utilization, related species, and weather. The results of the study were reported on by Fischer, Davis, Iverson, and Cronemiller (1944).

While the relationship of the computed number to the true population is not now known, it is believed a correlation for some areas may be developed. Possibly this cannot be done to a point much closer than the current guess. Perhaps it is not important. The present method is believed to provide an adequate base from which to record trends, recommend desirable take, and determine quite accurately the effects of the management principles applied.

For this area and perhaps others similar in character, it is believed the method is adequate for existing extensive game management.

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DISCUSSION

MR. GEORGE H. KELKER (Utah): How many man-days were occupied in making that kind of a study and did you try any other way to see whether it would be shorter to get the same results?

MR. CRONEMILLER: The 210 miles of travel and counting on the 49 strips took two men 10 days and we found that we did the work much more intensively in the winter of '43-'44 when we made the 13 counts and for this area, that is so uniform one count seems to be adequate, forgetting the total number, because our maximum variation was a minus five to a plus ten per cent of arithmetical mean.

We did find in different years a very great difference in deer behavior and in '43-'44, the deer did not move into the area they used in heavy winters. In the lower part of the winter range, until the 10th of January, no deer were seen. The following year, we had a very cold snow on the 13th of November and the deer came in in large numbers. For that reason, we want to carry on one count a month for 5 months for a few years to tie into climatic conditions and get those records.

MR. BILL T. CRAWFORD (Missouri): How heavy was the human population within this area?

MR. CRONEMILLER: None.

MR. CRAWFORD: Were the roads traveled frequently by people passing through?

MR. CRONEMILLER: There was no travel. There were a few woodcutters. There was an aerial gun range at one time, but normally it was a wild area a considerable distance from human population.

MR. CRAWFORD: I was thinking of it in terms of the Missouri Ozarks where we do have a fairly heavy dense human population, yet we do have large areas of fairly wild country and I was just wondering whether that would do anything to your strip counting.

MR. CRONEMILLER: I doubt if it would unless an epidemic of poaching or running with dogs or something like that would disturb them.

MR. CRAWFORD: Is there lots of running with dogs?

MR. CRONEMILLER: That makes them wild and more difficult to count.

DR. RICHARD WEAVER (Connecticut): Would the use of an airplane help at all in checking the large concentration? Was the vegetation such that you could have used it?

MR. CRONEMILLER: We have tried the use of airplanes there, you might say repeatedly. Being an aerial gnnnery range, we had the use of planes any time we wished. We did locate the air strip boundaries by use of the airplane. We located concentration areas and we made one more conclusion that probably some of those you can count from the air are a little over-optimistic in the area they see and I think it was in South Dakota where they reported last year on their tests that they only figure a strip of 1,800 feet wide that they can count from the air in open country.

DR. WEAVER: You could limit the area at least where they weren't and cut out a lot of travel maybe.

MR. CRONEMILLER: That is true and then your back country is hard to get to and you can take a flight out there and if there are any deer there or not, it saves you a trip.

CHAIRMAN DAMBACH: I would like to ask Mr. Cronemiller how he determines the effective weight of observation?

MR. CRONEMILLER: We go down through a 2- or 3-mile strip and we are experienced in that type of thing in timber cruising. We estimate the width of a strip that we work in timber cruising or range surveying or mapping distances and we have that experience of estimating those distances and we would estimate the average width the distance that we can see on either side of the road. It might be 10 chains and develop to 12 and 16 and then back to 10 through a strip. We would make a record of that. Then, thereafter when deer were sighted, we would check that distance—estimated distance the deer were sighted to see how close we were to our original estimate.

CHAIRMAN DAMBACH: You assume you saw all the deer within the area you observed?

MR. CRONEMILLER: Well, we say something like that. We have arrived at a figure. We don't say that is all the deer. We have arrived at a figure which is a base.

MR. HARVEY E. HASTAIN (California): I think Mr. Cronemiller's figures showed that his census men are probably as exact as any that have been taken on deer in any place in the United States, that is, the set of figures that he has shows as little variation from month to month as anything that has ever been given. But, as he pointed out in his talk, we would have to avoid putting this down on a per acre or per square mile basis until we find out a few more factors and since that is the crux of the whole problem, I think that we have to rely on this index right now as all we have and hope that sooner or later we will get something better.

MR. C. W. SEVERINGHAUS (New York): Can you give me any idea on your maps there—you have certain checkered areas blocked in where your concentrations were.

MR. CRONEMILLER: Yes.

MR. SEVERINGHAUUS: Do you have any ideas as to the proportion of your deer on that toal range that is within those concentrations? I mean over the entire area that you have—30 miles north and south, east and west.

MR. CRONEMILLER: I will have to guess. It, of course, builds upon from zero and we get up to a point where we have 60 per cent of our deer within the bitterbrush type and that is practically a concentration and there will be times when it will run around 60 or 50 per cent, you might say, which are in concentration areas and they are quite clearcut, too, because when a unit starts to run over 30 deer per square mile, it jumps immediately to 80 and will average 100.

MR. SEVERINGHAUS: How far, then, outside of the boundary of your concentration, will the remaining 40 or 50 per cent of your deer be?

MR. CRONEMILLER: Some times of the year, there are deer in every part of this unit and while a concentration area may be 5 to 10 per cent of the total area, there will be deer over all of it. By mid-December, the deer are on half of the

area and by late January, they are on all of it and then snow raises the amount of the timber type and there is only 75 per cent of them.

MR. SEVERINGHAUS: Your deer concentration, then, is left in 25 per cent of your areas?

MR. CRONEMILLER: Yes, but that concentration area moves around.

MR. SEVERINGHAUS: I mean at any known period, you have somewhere between 50 and 60 per cent of your total deer population that you are evaluating there within the concentration that you have.

MR. CRONEMILLER: That is true.

MR. SEVERINGHAUS: The rest of it is fairly widely scattered over the entire area?

MR. CRONEMILLER: Yes.

MR. HASTAIN: Fred, you say those figures you have are probably less than the total population, would you not?

MR. CRONEMILLER: That is what we would assume since these figures are all the deer we saw, some of them must have escaped and it is pretty difficult to duplicate any counts.

DR. WALTER P. TAYLOR (Texas): We have been very much interested in the time of-day factor in the matter of counting deer. We made some tests that showed that you have to multiply counts made in the middle of the day by about two in order to get true figures, that is, for the white-tailed deer under Texas conditions, and I don't know whether it applies to the mule deer in northern California or not, but we have given up counts at any other time of the day than, say, half an hour before sunset and half an hour after sunset.

We find pretty consistent runs of twice as many deer per area if we count them that way. That means you have to shorten your census lines a good deal, but you certainly do get a better line on the number of deer in the country and I would suspect, although I don't know whether mule deer go the same way as the white tailed deer or not, but your totals of deer per area might be under what they really should be, counting all day long.

MR. CRONEMILLER: The type of behavior of deer varies a lot between races in California. Our southern mule deer is more sensitive to wind and you can't see a deer when the wind is blowing and the Rocky Mountain mule deer just walks around on the other side of the juniper bush and eats.

QUESTION: You mentioned taking data on range utilization. I assume that is food plant utilization. Is that just generalized or were they taken according to standardized procedure?

MR. CRONEMILLER: Standardized procedure and rather truly random samples, a method developed by Hormay of the California Forest Ranger Station, put out as Research Note 33, I believe, on estimated utilization of bitterbrush. Then, we developed our own method for our juniper.

WILDLIFE SAMPLING BY SOIL TYPES

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At the Ninth North American Conference, Denney (1944) made a preliminary report on wildlife relationships to soil types, emphasizing the factors of animal distribution and nutrition. Since that time certain practical applications of that relationship have been studied in Missouri and compiled in terms of a state-wide inventory of wildlife and habitat conditions. This paper is concerned with the methods employed and the information obtained in those studies.

Any state that has within its boundaries a large variety of habitat conditions for game and fur bearers is constantly faced with the problem of how best to conduct censuses and obtain population and harvest data that can be applied on a state-wide or local basis. Endless combinations of environmental factors often make a state-wide inventory of wildlife an expensive and drawn-out process even when using the more recent developments in techniques.

Missouri, containing a diversity of vegetative types, climate, topography, and land-use areas, fell naturally into the category of a problem region. None of the obvious environmental factors seemed to fit into a pattern of game-range classification which would permit the establishment of an accurate yet brief sampling procedure or which explained the irregular distribution and behavior of some species. Because of this situation, a new and more fundamental basis for game-range classification was sought which would bring most of the variable conditions down to a common denominator. Thoughts turned naturally to a consideration of the basic parent of living things—the soil.

A study of previous wildlife surveys in Missouri reveals an interesting picture of the growing concept of soil—wildlife relationships. Aldo Leopold (1931) classified the Game-Range Types of Missouri into three major divisions and five subdivisions, and associated them with the original vegetative types. Bennitt and Nagel (1937) introduced in Missouri the term "zoogeographic regions," a classification of land types corresponding to the physiographic and land-use regions defined by Miller and Krusekopf (1929). In these systems comparative correlations between wildlife populations and game regions were made with reference to effects of the predominating types of land use on such populations. Despite this progress, the game regions set up by these systems were broad and included a wide variety of cover, food, water, and land-use conditions. Attempts to sample these regions and expand the data to the area of each proved unsatisfactory.

Considering these former developments, investigation by the Federal Aid workers led to the conclusion that a system of classification based on major soil types most accurately delineated the individual homogeneous land and land-use areas, and therefore the homogeneous game ranges, because all the major factors influencing game range are in one way or another associated with or reflected through the soil. The individual soil type, then, became identified with the individual game range, no matter where it is found, and the variations in soil types were found to be the most satisfactory basis on which to explain the variations in wildlife population.

Mechanics of the study.—The concept of soil types as game ranges called for a new study of wildlife and land-use conditions based on this classification. If the soil type was the underlying factor, then a survey of any representative sample of each major soil type should be adequate to show wildlife conditions on the entire type. Data from all the samples together should show conditions of the respective wildlife species for the whole State.

In consultation with representatives of the Soils Department of the Missouri College of Agriculture and the Soil Surveys Division, U. S. Soil Conservation Service, 38 soil sample areas were located, covering all the major soil types of the State. These areas included 373,900 acres, or an average of 9,840 acres per area (15.4 square miles). Much consideration was given to the actual selection of the areas, since it was imperative that they be an almost perfect representation of the total conditions on the soil type. In fact, the choice of areas that was made has been considered so satisfactory that the Soil Conservation Service and the College of Agriculture are now using them as a basis for their state-wide planning work.

Using aerial photograph mosaics prepared for each area, detailed cover maps were completed during the summer months. The percentage of each cover type in an area was determined by planimetering. When the cover type was expanded to the acreage of each soil type and assembled for the entire State, the results were very gratifying. Considering just the cultivated crops and rotation and natural grasses, the figures were within 5 per cent of the state-wide totals obtained by the Federal-State Cooperative Crop Reporting Service. This fact strengthened the belief that any acreage of a vegetative type thus derived by expansion from the sample areas could be considered accurate. Here for the first time we had a complete picture of the actual acreages and accurate locations of cover types for both state-wide and local conditions.

The next step in the study was the preparation of ownership plats

of the areas to facilitate the interviewing of landowners and operators. Livestock records and land tax delinquency data were also obtained. The use of livestock records has proved of value in determining grazing pressure, which is closely tied in with wildlife populations and environmental conditions. The land tax delinquency data have been valuable because, generally speaking, the amount and duration of tax delinquency are closely associated with land use and quality of the land, which is definitely reflected in the wildlife population.

A winter census, with bird dogs, of a portion of each area was conducted during January and February. The census covered 51,595 acres, and required 528 hours of field work, or an average of 1.023 hours per 100 acres censused. Records on rabbits, squirrels, and other species were recorded on the basis of number of observations per hour in the field.

After the end of the fur season, the project leaders interviewed all the trappers and fur-hunters and a large percentage of the farmers on each area to determine their harvest of wildlife species and woodland products, and kind and extent of predator and rodent damage. A total of 947 trappers, fur-hunters, and farmers were interviewed for an average of 25 per sample area.

After all field work was completed, each project leader prepared a report for each area under his jurisdiction. The material was then expanded to represent the total acreage of each soil type, and a summary report representing the whole State was written.

Results of soil sample surveys.—A. Bobwhite quail. Being the No. 1 game bird in Missouri and found in every portion of the State, quail were given a slightly preferential and more thorough treatment than other game in this study. The data obtained by interviewing all the residents on the soil areas and by censusing, with dogs, are divided into three parts: (1) prehunting season fall population, (2) harvest, and (3) late winter population. The expansion of the data from the sample areas to the total area of each soil type for the 1942-43 data indicated a fall population in 1942 of 5,166,000 birds, a known kill by man of 811,000, and a late winter population of 2,007,000. The kill by man is restricted to the birds killed or seen killed by landowners, and thus is necessarily low. Independent studies indicate that the total kill is at least double this known kill or even in excess of that, since landowners play only a small part in the quail harvest.

The fall population in 1942 ranged from one bird per 3.2 acres (Ashe soil) to one bird per 33 acres (Knox soil), or averaging for the State one bird per 7.9 acres. Late winter populations in 1943 ranged from one bird per 8.7 acres (Clarksville gravelly soil) to no birds on

2,018 acres (Wabash soil), or averaging for the State one bird per 22.3 acres.

The known kill by man in the 1942 season ranged from one bird per 10.2 acres (Crawford soil) to one bird per 2,167 acres (Clarksville stony soil).

Although quail are found to some degree on all soil types, they were most abundant (one bird per six acres or less, in fall) on 14 upland areas. These areas were widely scattered throughout the State and were not directly related to climatic factors or vegetative types.

If the data obtained from the soil study areas in Missouri are reasonably accurate, it would indicate that only about 38 per cent of the fall population of quail survives to late winter and that at least 16 per cent of the fall population is killed by man. The remaining 46 per cent must be largely natural mortality (although it undoubtedly includes substantial additional kill by man not reported).

B. Fur bearers. In determining the fur harvest, project leaders attempted to contact every person concerned with it on each of the 38 areas. The form used in recording field information included space for the fur-taker's name, number of fur bearers taken, method of harvest, number of traps, number of dogs, number of pelts sold, disposition of pelts, trends, and general notes. While conducting the interviews, the exact area trapped or hunted was charted on an aerial photograph and later planimetered to obtain the acreage.

Two methods were used to measure the value of the harvest: (1) on the basis of the land actually used by traps and dogs, and (2) on the basis of the total acreage of the State. The portion of each of four types of persons taking fur on the basis of methods used was calculated. These groups were: hunters using dog and gun only, trappers using only traps, hunter-trappers using both methods, and unclassified persons. Percentage of take by each group for each species was worked out.

The average pelt production over the State as a whole was 98.0 acres per pelt; the average value, 1.15 cents per acre. This average represented the extremes of 14.1 acres per pelt (average value 11.94 cents per acre) to 1,157.1 acres per pelt (average value, 0.13 cent per acre). Total pelts produced was 448,897. In expanding the data on personnel engaged in the harvest, we find a total of 27,558 people thus engaged on 5,208,431 acres. Relative proportion of the personnel was: hunters, 43.1 per cent; trappers, 34.0 per cent, hunter-trappers, 19.0 per cent, and unclassified, 3.9 per cent.

To gain an idea of the effectiveness of sampling fur harvests by soil types, the data can be compared with the fur reports as recorded by

fur buyers. State totals calculated from the sample area data show a difference of approximately 15 per cent from the fur buyers' reports. Records for the individual species were close in most instances. At least two species—the raccoon and civet—were within 5 per cent of the totals obtained from the fur reports. The gray fox was within 1 per cent. These data take on an added significance when it is realized that the 38 sample areas contained only eight-tenths of one per cent of the total area of the State.

C. Rabbits and squirrels. The soil sample data on rabbits and squirrels were based primarily on interviews with landowners and sight records made during the quail censusing. The interview data when expanded gave the best information we have to date on actual harvests of these species and the distribution of the harvest. The sight records failed, however, to serve as an accurate index to the population.

D. Predation. A portion of the study on the sample areas was given to determining the extent of predation by foxes (red and gray), coyotes, and other species. The data were assembled on the basis of total state damage, average damage per farm on the various soils, damage per acre of farmland, and complete breakdown of damage done by individul species. The total financial loss calculated for the State on the basis of the soil samples was approximately 10 per cent more than figures developed on a county basis by other agencies. The soil sample predation material has proved more satisfactory than the other available information by allowing the State to be zoned by density and by species.

E. Other uses for soil sample data. In addition to the soil sample areas being used as a basis for determining wildlife populations, harvests, and habitat conditions, the data have been used in preparing management plans. As the study is based on a soils concept, specific wildlife-management practices applicable to a single soil type are easily coordinated with those of other agricultural agencies. After each area was soil mapped, it was divided into capability classes, and a list of approved agricultural methods helpful to the production of wildlife was prepared for each class.

Another extensive use of the soil sample data has been in the preparation of watershed-development plans and river- and flood-control plans favorable to wildlife. Nutritional studies of game are also being conducted on the sample areas, making use of the wide range of fertility levels and deficiencies found in the various soils.

F. Limitations. The limitations of an inventory of wildlife based on soil types are confined largely to those concerning censusing and in-

terviewing. The soil areas serve merely as a tool in setting up the censuses and in conducting the interviewing; thus the data are only as good as the quality of the two procedures. Further studies of census methods and interviewing are being conducted on the sample areas at this time, and it is hoped that eventually all types of game can be accurately inventoried yearly, using this sampling method or one closely allied with it.

Another source of error in these studies was in the expansion of the data. This always involved a chance for a discrepancy in the data to be greatly enlarged. However, to date there has been little evidence of such a gross error being committed.

SUMMARY

1. Using 38 soil sample areas, located on all of the major soil types of Missouri, an accurate yet brief method of sampling wildlife populations, harvests, and habitat conditions was derived.

2. These areas included 373,900 acres, or an average of 9,840 acres per area (15.45 square miles), and represented eight-tenths of one per cent of the total area of the State.

3. By cover mapping the soil sample areas and expanding the data to the acreage of each soil type, the first complete picture of actual acreages, locations, and conditions of vegetative types for the State were acquired.

4. The wildlife population, harvest, and habitat data, when expanded to the area of the soil type, appeared to give satisfactory information.

5. Its success depends primarily on the quality of censusing and interviewing conducted.

6. The soil sample data have also been used in preparing management plans. As the information is based on a soils concept, the plans are easily coordinated with those of other agricultural agencies.

7. Additional work and refinements are necessary but this method of sampling appears the most feasible of those attempted in Missouri.

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DISCUSSION

CHAIRMAN DAMBACH: It seems to me that this paper opens up a rather new approach to sampling of wildlife populations in one sense and, yet, it is not a new approach because agricultural agencies have been for a great many years predicting crop production on the basis of land capability and sampling systems somewhat comparable to this as far as crops are concerned. Wildlife is a crop and it looks as though Missouri is starting out in the direction of sampling the wildlife crop by soil types. Do we have any discussion of this paper?

DR. RICHARD WEAVER (Connecticut): What was the percentage of kill on your quail data?

MR. CRAWFORD: The percentage of kill was around 16 per cent, but we are confident that probably that figure runs more, from 25 to 30 per cent. You see, the kill was based on what the landowners killed and what they saw killed so that is something you are going to have to cover more intensively in later work.

MR. MORRIS: I would like to ask Mr. Crawford if there is any comparison between areas of improved farmland and areas where there have been more farm ponds?

MR. CRAWFORDS Of course, in Missouri, we have a tremendous farm-pond program. We have 25 to 30 thousand farm ponds and they are being built at the rate of 10,000 a year. Very definitely the population of our game species is up in areas where we have good farm ponds. There is a lot of difference between a farm pond and a farm pond acceptable to wildlife.

I won't go into what a good farm pond is. One that is fenced and has an adequate acreage, a watershed and undervents would certainly cause a better population of wildlife in Missouri and according to standards where the areas have been under intensive management by agricultural agencies, very definitely our quail population is always up and the rabbit and squirrel population is always up.

MR. JOEL R. BENJAMIN (Ohio): What percentage of this large number of ponds you have in Missouri is acceptable from a wildlife standpoint?

MR. CRAWFORD: Well, the Conservation Commission in Missouri started on the farm-pond program approximately in 1940. The 30,000 ponds or 20,000 ponds that I am speaking of have been the ponds that have been built since that time. They are the ponds that have been made according to the strictest recommendations. If we wanted to count the little pigpen ponds, we could get probably a couple hundred thousand.

DR. WEAVER :How many people were involved? I don't think you quoted the staff required.

MR. CRAWFORD: No. We have a Pittman-Robertson project which before the war included about 15 men. However, I can safely say that five men occupied for about three months of the year could handle it. After your areas are set up in operation, it is just a matter of going back and repeating them. The number of men required to operate this type of thing would be cut down a great deal.

MR. CLEON E. WEBB (Ohio): I believe you said that after having made this study, it was rather easy to fit your game-management practices into the picture. Would you tell me what are some of the game-management practices that you used in the areas where general farming is practiced?

MR. CRAWFORD: Well, I don't really think we have time to go into that very intensively here. You see, these recommendations in this study were arrived at through working with our soil conservation farm districts. We have worked up a very nice agreement there and when the farmer wants his place soil mapped and wants it set up on a balanced farm basis, we try to send one of our men who is capable of seeing that certain practices that we have set up are applied to those farms.

As far as the actual recommendations, they include a whole list of things, especially in quail where we recommend fencing some areas out that are getting heavy livestock pressure. We are still working on farm ponds although we have a lot of them—the nutritional aspects of that, liming, and so forth. We have found that wildlife production on areas that have been treated with various types of

fertilizer, and so forth, are up and it is just a practice of what we call good farming that really makes our game come around. If you care to go into some of those practices at a later time, I could give them to you.

CHAIRMAN DAMBACH: What is the comparative cost of sampling your kill by this method as vs. the conventional methods. Have you any ideas on that?

MR. CRAWFORD: Well, I think that is an important point. However, our conventional methods always make our records come in by county blocks. You know a county is an arbitrary thing that is set up. We were very interested in seeing that our game was sampled on a basis that was strictly based on the land.

Now we have gotten away from that county idea and maybe if it costs us even more, it has certainly proved its worth. I can't give you the exact cost of that project. It ran into a lot of money because we had to get all the aerial photographs and we had all this cover mapping and it was quite expensive but the main expense is over now and it is just a matter of repeating on our areas.

THE TRAPPING AND TRANSPLANTING OF ROCKY MOUNTAIN BIGHORN SHEEP IN COLORADO

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The Rocky Mountain bighorn sheep (Ovis canadensis canadensis) found in the Tarryall Mountains of Colorado comprise probably the best known and largest individual mountain sheep herd in the United States. At the present time, this herd numbers approximately 750 animals. According to Spencer (1943), this herd went through two known periods in its history when its numbers were severely depleted. Once, in 1885, when losses were supposedly caused by the psoroptic mite; the second time in 1923-24, when the losses were attributed to hemorrhagic septicemia. Since the latter outbreak, the herd has increased steadily in number until it has reached its present population.

This increase was due to the following factors: the lack of competition with other big game species and livestock, sufficient winter range relatively free of snow, and the prevention of poaching. As a result of the comeback of this herd, an ideal situation was created for the trapping of bighorn sheep and the transplanting of them to suitable areas in the State.

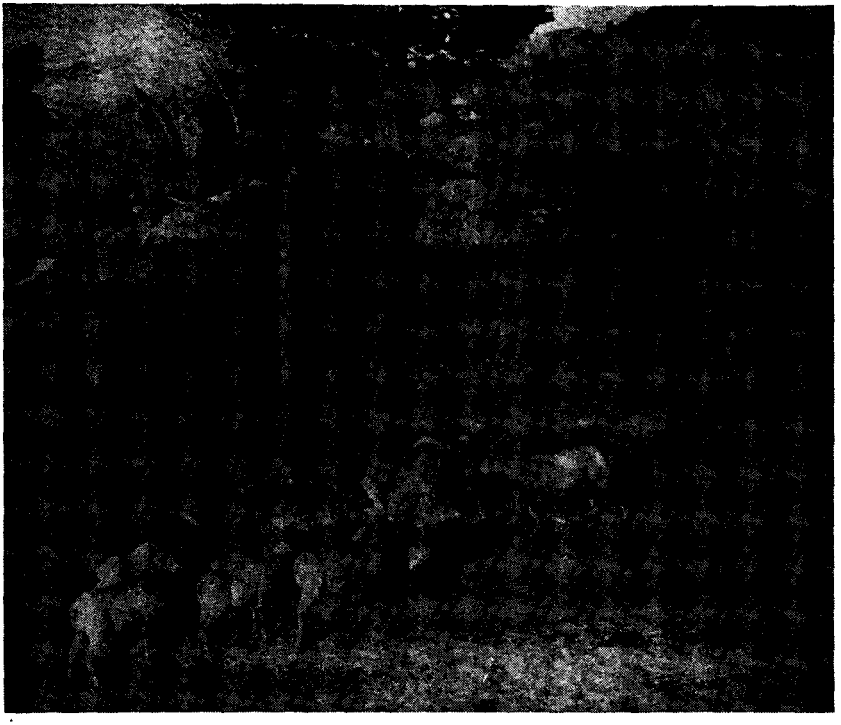
In September of 1944, a project was set up under Federal Aid to Wildlife Restoration for Colorado to cover the trapping and transplanting of these animals with the U. S. Forest Service cooperating.

A privately-owned area in the vicinity of Sugar Loaf Mountain was chosen for the trapping site because of the large number of sheep that congregate and feed in that vicinity during the winter. One trap of approximately 1½ acres was constructed. It was large, with the belief that a trap of this size would be much more satisfactory in trap-

ping and retaining large numbers of sheep. A small corral and chute were built at one end of the trap into which small numbers of animals would be driven for loading.

Posts were set 10 feet apart. Two 47-inch strips of woven wire fencing, making a total height of 7 feet, 10 inches, were attached to the posts. This fencing had 10-gauge wire for the top and bottom strands. Interior strands were 12½ gauge with 6-inch openings. Since the height to which sheep could jump was not known, two additoinal strands of No. 9 wire were strung around the tops of the fence posts, approximately 8 inches apart, making the total height 9 feet, 2 inches. The wire strands and fencing were placed on the inside of the posts. The two strips of woven wire fencing were fastened together by hog ties. Two No. 9 wire strands were placed around the bottom of the trap in order to further strengthen the fencing. One of these strands was placed 2½ feet above the ground; the other, 9 inches above the first.

Originally, four gates, 10 feet wide and 7 feet high, were placed



Sheep in Sugar Loaf trap, Tarryall Mountains (Photograph by Floyd H. McCall)

around the trap. These were drop gates with hinges along the top. The same type of wire fencing was used in their construction, but they were additionally reinforced with No. 9 wire and with wood cross bars. The gates, when dropped, locked automatically. They were sprung by wires running over to a haystack blind in an adjacent field.

Leading from the trap on the down-hill side was a corral whose diameter was 50 feet. The corral joined the trap by a hinged drop gate, 10 feet high and 6 feet wide, comparable in construction to those on the trap. Rope netting, 6 feet high, was placed around the inside of the corral on posts 10 feet apart. This netting was made from size 108 cord; the mesh was 3 inches. The netting was squared, copper

Men driving sheep from trap into corral. Man in foreground is waiting to spring drop gate when sheep enter corral. Chute and truck shown. Haystack in background served as blind for springing gate to trap when sheep entered. (Photograph by Floyd H. McCall)

cleated, and was hung on one-half-inch Manila rope. Above this was placed a 47-inch strip of woven wire fencing comparable to that used in the construction of the trap. The rope netting was loosely stretched to prevent the sheep from injuring themselves by jumping against it. Off one side of the corral the chute was built the entrance of which could be blocked by a hinged gate swinging from the side. This entrance was covered with the same type of fencing used on the trap. The chute was made of rough lumber and one end raised 4 feet above the ground so that its bottom coincided with the height of the bed of a 1½ ton stake body Chevrolet truck. The chute was wider at the top than at the bottom in order to handle large rams.

Since the trap was located on private land, cattle were using this area as winter range and they frequently moved into the enclosure with the sheep for feed. Because of the cattle some changes were made

in order to keep them out of the trap. All of the outside gates of the trap were closed with the exception of one, through which the sheep frequently entered the trap, approaching by way of a rocky cliff nearby. Barbed wire was strung from the sides of the trap to the rocky cliff, thus preventing the cattle from entering the trap.

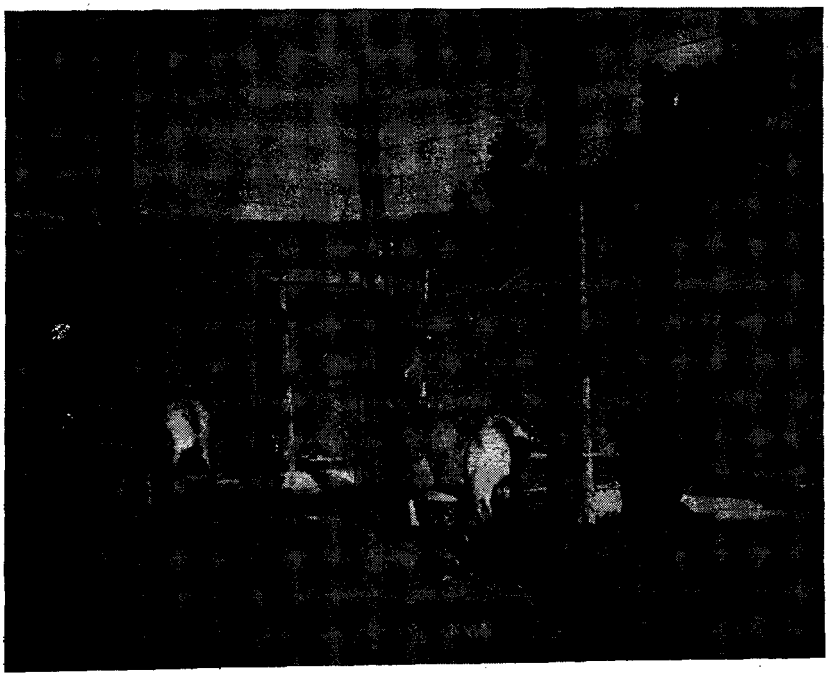
It was decided that none of the sheep would be taken until after the period of rut (Nov. 15-Dec. 20); and that trapping would have to be finished by the middle of March, as by then most of the ewes would be too far advanced in their period of gestation.

Iodized block salt and hay were used in the trap for bait. A few sheep would wander into the enclosure from time to time for feed and salt and would then leave for several days. Originally plans had been made not to spring the trap for a small number of animals, but rather to wait until a large number of animals were in the trap. As time went on and only small bands went into the enclosure, it was decided to spring the trap on a group of 10 or more sheep, provided the animals were young and that the age and sex groups were not too much out of proportion.

The trap was sprung two times during the winter, once on February 28, when 16 sheep were in the enclosure; the second time on March 14 when 17 sheep had entered the trap. Both times the trap was sprung during the middle of the afternoon and the sheep were left in the trap overnight. The hay which had been used for bait now served as feed. These animals were not watered while in the trap as we thought it advisable to handle these animals the same way livestock are handled previous to being shipped.

The first sheep trapped were driven into the corral by men who entered the trap and walked slowly towards the corral end. Some of the sheep charged the wire fence while being driven toward the corral, but they did not seem to injure themselves. After a few minutes of moving back and forth the sheep entered the corral and the drop gate was sprung making considerable noise. This noise frightened them and they all started jumping at the rope netting. A few caught their horns in the netting and hung there. One ewe hit the netting with such force that she made a hole, but it was repaired before she or other sheep had a chance to hit the same place again.

Most of them were then herded into the entrance leading to the chute. This entrance was covered with wire and some of the sheep injured themselves slightly by hitting it. Once started, the sheep ran through the chute into the truck where they immediately became quiet. This truck had rope netting on the top and canvas on the top and sides.



Driving sheep into chute (Photograph by Floyd H. McCall)

Two of the ewes would not enter the chute so they had to be caught, and dragged through the chute into the truck. One of the lambs escaped back into the trap. This lamb was caught after hitting the wire fence several times without apparent injury and then carried to the truck.

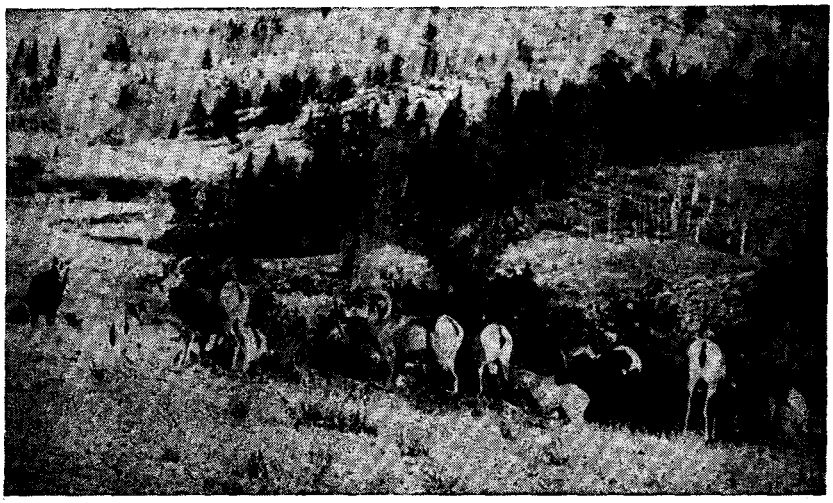
The sheep were trucked 32 miles to an area on the Pike National Forest, taking 1¼ hours to cover this distance. During this trip the truck was stopped a few times to observe the condition of the sheep. In almost every case, the sheep were bedded down and taking the ride easily.

Two men tagged seven sheep in the truck at the planting site. The sheep became so excited it was thought best to release them without tagging the others. The sheep left the truck on a run and appeared to be in good condition as they went up a nearby hill.

Two days after the first group of sheep had been trapped and moved, other sheep were feeding in the open trap. On the 14th of March the trap was sprung on 17 more sheep. We had decided, because of the first trapping experience, that the side of the corral and

the entrance to the chute should be covered with canvas after the next sheep were trapped. We felt that once the sheep entered this enclosure they could not see out and would then quiet down, thus preventing their jumping against the rope netting and being injured. This time when the men entered the trap and started working the sheep towards the corral entrance, the sheep shied clear of the corral and would not enter its open gate. A high wind caused the canvas to flap. However, it was thought that the sheep would have been wary of the canvas even had the day been calm. The sheep became highly nervous, some charging the wire fence with great force. Because of this, two of the sheep were seriously injured, one dying immediately and the other some hours later. It was interesting to observe that none of the sheep jumped over 4 feet in height when hitting the fence.

Following the injury of those sheep, the canvas was removed and some of the sheep were then easily driven into the corral. The corral gate was then dropped slowly and quietly. As the sheep were very nervous some of the men were stationed outside the corral and by waving their arms slowly and talking softly it was possible for them to prevent the sheep from running against the net. Several times the sheep charged the netting, but stopped when someone shouted. The men inside the corral then worked the sheep into the chute and truck. The remaining sheep in the trap were driven into the corral. This took considerable time as the sheep were wary. Some of them hit the wire netting but none were injured.



Bighorn sheep in the Tarryall Mountains (Photograph by C. E. Hagie)

Once these sheep were in the corral it was easy to work them into the chute and truck. One ewe tested the wire fencing on the chute entrance and the first time she hit it, went partially through. She then backed up and hit it again with such force that this time she went completely through the fence, hitting the ground approximately 10 feet beyond the fence. Without pausing she ran off up the hill. This was a surprising fact as we did not believe that an animal of that weight (approximately 110 pounds) would be able to go through the woven wire fencing. Because of the nervous state of the sheep, it was decided not to tag the sheep except for two that had been caught in the corral and then placed in the chute.

Some of the sheep's wariness about entering the corral was evidently due to their being able to see the man waiting to spring the corral gate. A long wire had been fastened to the gate and this was held by one of the men stationed at a distance of approximately 20 yards outside the trap. It was impossible for him to hide completely as he had to stay far enough in the open so that the wire would not bind on the guide. Time after time sheep walking up to the corral saw this man lying down and moved away from the corral gate. This did not seem to bother the sheep when the trap was sprung the first time, but it probably added to their nervous state the second time.

These sheep were moved 140 miles to the Luis Maria Baca Grant in Saguache County. During the trip, which took 5 hours, the sheep were observed twice and in each case the sheep were either bedded down or were standing quietly. At the planting site, the truck gate was opened, the sheep jumped out, ran up a hill and then slowed down, looking back often. This last trip proved that once sheep are in the truck, they are relatively safe and can be carried for long-distances before being liberated.

During the winter's activities covered by this report, 33 bighorn sheep were trapped. Of these, 30 were transplanted, 2 were killed, and one escaped. The sex-age ratio of these plantings was as follows: (7 tagged) March 1 planting, 5 lambs, 3 rams and 8 ewes 1¾ years old or over; (2 tagged) March 15 planting, 6 lambs, 1 ram and 7 ewes 1¾ years old or over.

The total cost of this project for the fiscal year was $2,525.05. On this basis the 30 animals trapped and transplanted cost $84.17 per head, the State's share being $21.04. The rope netting and truck which were used on this project, had been purchased through other funds some years before. No charge for the use of these items was absorbed by the bighorn sheep project. The $2,525.05 represents the maximum cost per sheep as all construction work done the first year and non-

expendable supplies purchased during that time are represented rather than being depreciated over the life of the project.

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DISCUSSION

MR. C. N. FEAST (Colorado): I might add that in most sections of the West, mountain sheep are on the decline. In Colorado, they can proudly say they are on the increase, and it is my experience that mountain sheep require an extensive winter range and most of the mountain states with all these mountain valleys are being utilized by the cattle and sheep and, unfortunately, our mountain sheep don't have many places to winter. For that reason, their growth is practically limited to where they have adequate range and in a particular area where the mountain sheep are not in competition with livestock.

It is an area where the National Forest has taken all livestock off the forest areas and the local range ranchers are of such financial condition that they are not using the lower ranges for excessive livestock use and everybody is very cooperative in this program. For that reason, the sheep have taken over the lower valleys in the winter and have it unmolested. This herd has developed from some 50 to 75 animals to around 5 or 6 hundred, to my estimate.

The mountain sheep is quite a rare animal. It is quite a sight. We proudly hope by our trapping and transplanting program we can scatter them around over Colorado and some other parts of the West and some day maybe we will have the mountain sheep as part of our hunting program.

They are comparatively wild when they have plenty of room to run in, but once you get them in the covered truck, they lay down and we are able to handle them, ear tag them and work with them without any difficulty whatsoever. They didn't seem to be too afraid and they were not too excitable after they were put in the enclosure where they couldn't see.

Since this report was written, we successfully trapped quite a number more and they were taken and planted in Mesa Verde National Park in the southwestern part of Colorado. The total mileage of that trip was about 400 miles. We have negotiated an exchange agreement with Idaho and we are going to try to transport our next mountain sheep from central eastern Colorado clear up to the northern part of Idaho. If we make it, it will be about the longest distance that sheep have been transplanted. In conclusion, I would like to say that the trapping we do is based upon what we estimate as the increase and our aerial counts show that we are just about keeping up with things. This herd should produce about one hundred sheep a year.

We are trapping in other areas. We believe in 10 years' time we can distribute a thousand sheep around the State of Colorado at likely points with habitat satisfactory and in 8 or 10 years, we can have some mountain sheep on it.

MR. CRAWFORD: Why does it seem that the sheep are on the increase in Colorado and they are down in every other place?

MR. FEAST: It is the winter range. We have some places where the winter range is satisfactory, where they can range on that winter range unmolested—I say "unmolested," I mean by that completely unmolested, no encroaching or feeding, no public traffic or no livestock use or anything else. They don't seem to be too wild an animal after they get used to a habitat, but if there are any domestic uses on their winter range, they won't come down to us.

MR. CRAWFORD: In other words, the other states don't have that winter range?

MR. FEAST: Well, I don't know, but we have very concrete evidence of the fact that our herd is on the increase because when we first made the count some years ago, our estimate was that there was less than a thousand a day. We are pretty

sure that we have 3,000 or more because on this one herd, we have 700 and we can handle them and raise them just like domestic sheep and we believe that we can sufficiently develop their habitat. That is something we are considering now—if the winter range is not available, we ship them to one where it is available.

DR. WEAVER: Does it seem that the competition of the cattle in the other areas is the major factor?

MR. FEAST: I don't know whether it is competition of cattle or sheep. It is just the fact that there is domestic use there. If it is intense, the sheep won't come down because (see photographs) that is just a typical grass valley, a mountain valley where the hillsides have become pretty well covered with snow, especially the north slopes. The south slopes of the valley and quite a way up the south slope, it is covered with various grasses and the sheep come down to those open places and graze on the dead grass the same as would your domestic livestock.

Here is another point which perhaps might be a factor in the development of the sheep. A female in the lambing time requires seclusion. They go back to the high points and have their lambs and hide out and it is very difficult to find them. So, perhaps, that might be another factor. You have an adequate mountain area for lambing and the proper slope and it seems as though they all lamb in places where there are warm, sunny slopes and, yet, there is adequate cover and shelter.

A combination of all that may be the cause of success in developing our sheep program. That is what we are trying to find out right now.

DR. WEAVER: How long had your cattle been off that range?

MR. FEAST: I couldn't answer right away. I don't have that information. We just know that on that particular range there is no livestock use at the present time.

DR. WEAVER: It is just that it is not permitted, no fencing connected with it?

MR. FEAST: That is right. The Forest Service has closed off livestock. The reason they did it was partially because of known sheep and partially because livestock use in the past has been very heavy and as a matter of utilization, it was necessary that the use be limited. That is one reason why we are engaging in this sheep transporting project because the sheep poulation has developed to a point where it has become very apparent that the utilization of the forest by the sheep had become excessive and it was essential to carry on a traffic program or there was every possibility that the sheep would suffer from some epidemic as a result of too heavy population, too much concentration.

DR. WEAVER: Has Idaho removed some from grazing or did they just have some land that seemed suitable?

MR. FEAST: We don't know the particular place that they intend to transplant them. Before we plant the sheep, we hope we will have an opportunity of looking over the environment to determine whether or not it is feasible, but according to this exchange of correspondence and exchange of conversation on the subject, Idaho claims that they have a good many places where, as far as we can advise them, it is good sheep range.

MR. CRAWFORD: Did the Pittman-Robertson project show that there was a mineral deficiency in certain areas that the sheep were actually feeding on?

MR. FEAST: That is possible. As far as the dietary requirements are concerned where we have our sheep, that doesn't seem to be too important. The important factor of our experiment has been concentration on winter feeding grounds and disease and poaching losses or inadequately arranged places where they could eat and feed. We notice progressively year after year on this sheep herd as they were building up in population, their tests on parasites run one plus, two plus and three plus, and the first year that we trapped, they gave us some tests on parasite concentration of four plus and advised us that that was the danger line. They said something should be done to relieve that congestion, so we took that as a good opportunity of trapping and transplanting and we have developed a pretty good technique.

They are a fine animal and we may not succeed. But, at least, we have learned

something about them. That may be the answer as to why they are on the decrease generally and here they are on the increase, but there is no reason, considering the results of the development we have had at the Tarryall Range, why we can't increase that herd from at least one hundred up to five or six hundred—I don't know the exact figure—but we know if things are right, they can be increased and that is what we want to find out and just what are the right conditions of environment.

QUESTION: What is the predator situation?

MR. FEAST: The predator situation there is normal. We have made no attempts to rid the predators from that particular area, nor have we made any attempts to rid the areas of predators where we transplant them.

QUESTION: Isn't it unusually light?

MR. FEAST: Well, it is just normal. The principal predator of Colorado is the coyote—assumed predator. There is quite a bit of conflict on the opinions of the people there as to whether it is a predator of any importance or not, but I will say that there has never been any activity in that area which would take out what we call a so-called predator. There are no mountain lions in the territory. As far as coyotes are concerned, that area has as many coyotes per square mile as any other area.

AN INTENSIVE METHOD OF DETERMINING HUNTER NUMBERS AND ACTIVITIES

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The collection of accurate hunting data is an important phase of many research investigations of game species. Hunting success is an important yardstick by which to measure results of game management activities. The system of hunter census here described was developed to determine hunter numbers and activities on a 6,000-acre tract at Amherst, Massachusetts, in the years 1940-43 during the course of intensive investigations of ring-necked pheasant populations.[1] The method of using checking stations, as described by Burroughs and Dayton (1941), could not be used on this area, and such extensive methods as those developed by Gordon (1941) and Davison (1943) were not feasible. Because of the large number of roads leading from the area, road blocks were impractical.

The Massachusetts study area was largely agricultural; about 55 per cent of the land was cleared, 35 per cent was woodland, and 10 per cent was brushland that was reverting to woods. The area had 23.6 miles of improved roads. The perimeter, with the exception of one small segment, was bordered by roads, and all other parts were accessible by a maze of improved roads. Small game species, in order of importance, included ring-necked pheasants, cottontail rabbits, ruffed grouse, and gray squirrels. Woodcock and several species of ducks

[1]Massachusetts Federal Aid in Wildlife Restoration Project 3-R.

were also hunted. Gun pressure was heavy (4,500 gun-hours expended in 1941) but no control was maintained over the number of hunters using this area.

The census method used on this Massachusetts area, was, with modification, used by Bishop (1945) on a 6,000-acre area in Connecticut in 1941-45 and in Oregon by Hazeltin (1943) in 1942. Game species present on the Connecticut area were almost identical to those found on the Massachusetts area. The principal species on the Oregon area was ring-necked pheasants.

Objective.—The intensive census method described here was developed to determine the total number of hunters using the area, total gun-hours expended, the kill of ring-necked pheasants and some other game species, and other important facts about hunters and hunting.

Method of census.—For convenience of census, hunters were divided into two groups: resident hunters and transient hunters. Resident hunters were defined as hunting individuals who resided on the study area, or lived nearby and reached it on foot. Transient hunters included all others who gunned the tract, arriving by automobiles or other vehicles.

Resident hunters.—Resident hunters were contacted before the opening of the gunning season and each given a card like that shown in Figure 1. The purpose of the survey and the card was explained at the time of contact, and each hunter was requested to keep a record of his hunting activities. Cards were returned by mail after the close of the hunting season or called for by project employees.

Transient hunters.—Transient hunters were contacted, or their cars were tagged with "car" cards (Figure 2) by observers who patrolled the roads of the area by automobile. Instructions on the card asked one member of the hunting party to indicate the total number of hunters in the party, number of hours hunted, and the number of pheasants, rabbits, and ruffed grouse killed; and also to post the card in a conspicuous place along the road. A thumb tack and pencil were supplied with each card. Hunters' cars were identified by the locations in which the cars were parked and the presence of hunters' paraphernalia inside. Hunter cars parked in farmers' yards were tagged when possible.

As each car was tagged (Figure 3) the time, location, license number and number of the "car" card were recorded on "contact" cards (Figure 4) which remained in the possession of the observer. Maintenance of this record was necessary to record "car" cards distributed and to facilitate elimination of duplication. Duplications occurred

PLEASE ENTER EACH DAY OF HUNTING SEPARATELY. ACTIVITIES OF EACH HUNTING TRIP. EVEN WHEN NO GAME HAS BEEN SECURED, SHOULD BE RECORDED.

Date	Hours Hunted	No. in Party	Township Hunted in	Game Hunted For	Game Secured by Party	No. and Breed of Dogs Used
				...Pheasants ...Partridge ...Rabbits ...Squirrels		
				...Pheasants ...Partridge ...Rabbits ...Squirrels		
				...Pheasants ...Partridge ...Rabbits ...Squirrels		
				...Pheasants ...Partridge ...Rabbits ...Squirrels		
				...Pheasants ...Partridge ...Rabbits ...Squirrels		
				...Pheasants ...Partridge ...Rabbits ...Squirrels		
				...Pheasants ...Partridge ...Rabbits ...Squirrels		
				...Pheasants ...Partridge ...Rabbits ...Squirrels		
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				...Pheasants ...Partridge ...Rabbits ...Squirrels		
				...Pheasants ...Partridge ...Rabbits ...Squirrels		
				...Pheasants ...Partridge ...Rabbits ...Squirrels		
				...Pheasants ...Partridge ...Rabbits ...Squirrels		

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

First Class Permit No. 31, Section 384½, P. L. & R. Amherst, Mass.

Postage Will Be Paid by Addressee

Department of Wildlife Management
Massachusetts State College
Amherst, Massachusetts

The purpose of this card is to obtain some detailed information about hunting in Massachusetts. Your cooperation is appreciated. YOUR SIGNATURE IS NOT NECESSARY.

Sporting Club Member? Yes No (Check one) Hunting Experience .... Years

Age ....Years. Gauge of Gun Used .... Model ....

Do you hunt with a dog? Yes No (Check one) Breed? ....

Can you give an estimate of the number of pheasants or partridge crippled but not taken?

.... Partridge

.... Pheasants

Figure 1. Sample of card distributed among resident hunters.

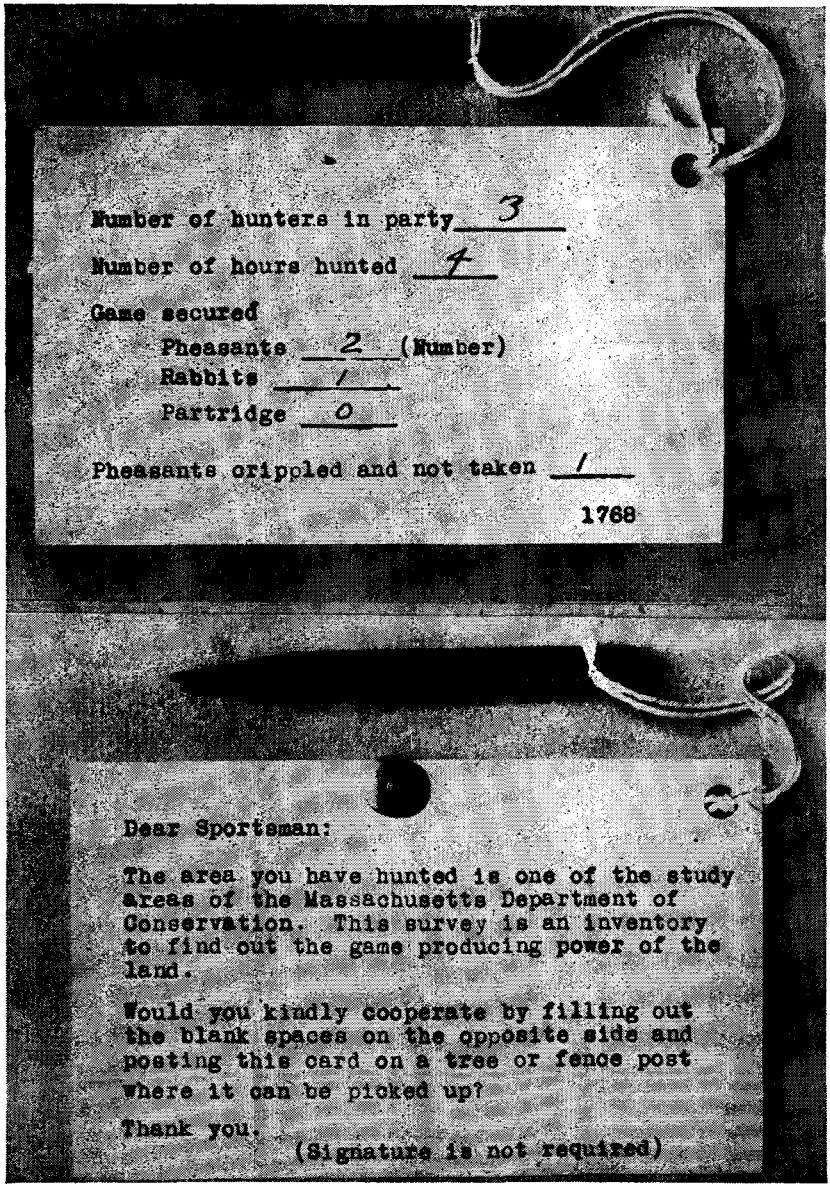

Figure 2. Sample of 3 by 5 inch mimeographed cards which were attached to transient hunters' automobiles.

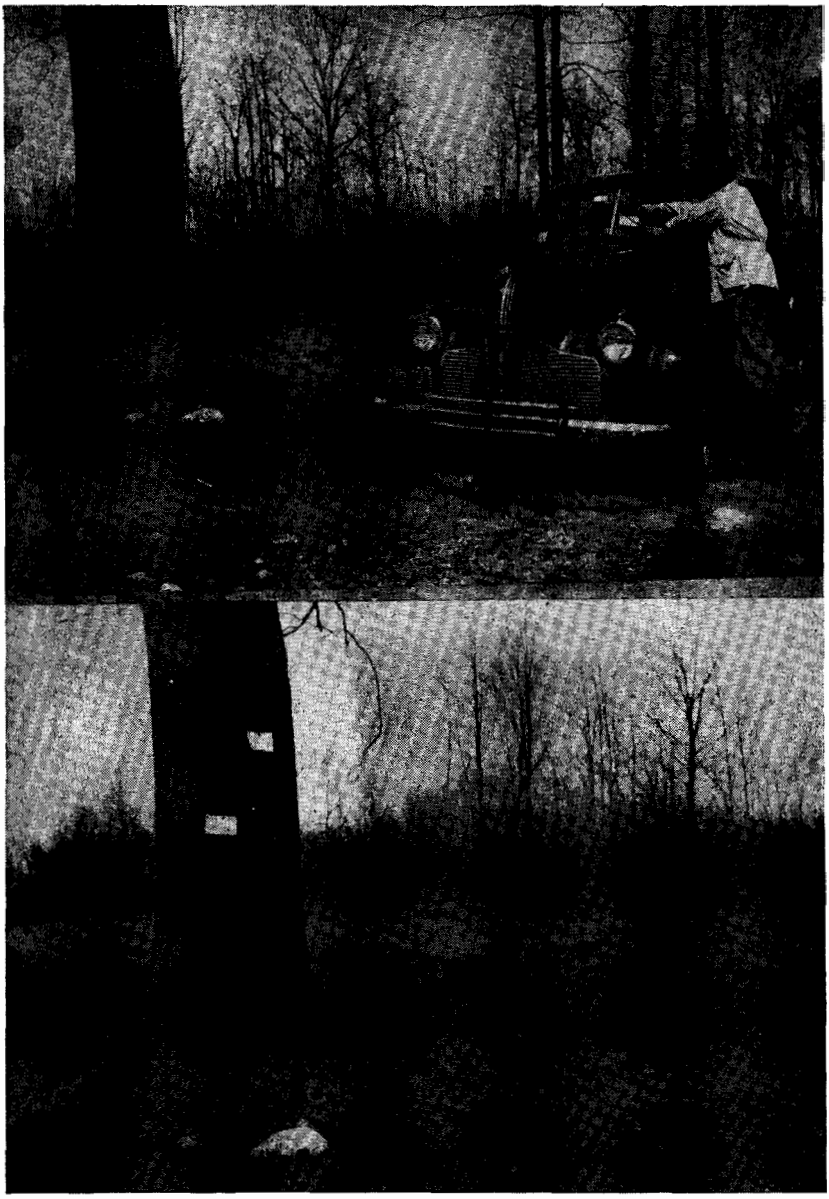

Figure 3. (Upper) Attaching a "car" card to a hunter's automobile. (Lower) "Car" cards were filled out by hunters with the pencil provided and posted along the road from where they were collected.

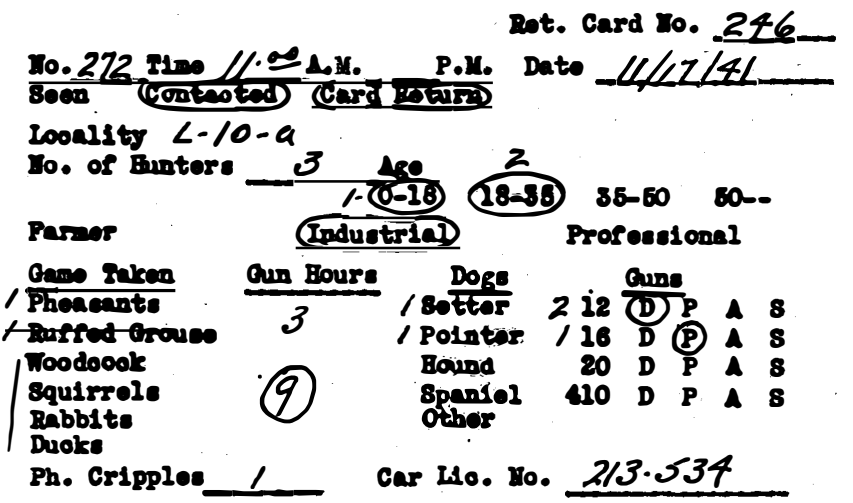

Figure 4. Records of the distribution of "car" cards or data collected from hunters contacted were maintained on this type of card.

when the same party of hunters parked their cars in more than one place on the area and reported the total accumulated expenditure of time and game killed on each card. The data from the "tag" cards were transferred to the corresponding "contact" card for tabulation and permanent record.

The remaining blanks in each "contact" card were filled in if the hunting party in question was seen or contacted. Hunter ages and the employment status was estimated in many cases. The use of dogs and the gauge and model of guns were recorded from observation.

Four complete patrols each day were necessary to cover the area effectively, and special trips were made to some areas where it was known hunters concentrated. Patrols were started at about 8:00 a.m., 10:30 a.m., 1:00 p.m., and 4:00 p.m. Two men were needed for patrol work each day throughout the first weekend of the open season, and on Saturdays and holidays. (Sunday gunning was illegal in Massachusetts.) On other days, one person could effectively patrol the entire 6,000-acre area. Each patrol trip did not involve driving all the 24 miles of roads on the area. Because of favorable topography, the presence or absence of hunter's cars on some lightly-hunted areas could be detected from a distance. An average of about 100 miles travel per day was spent in patrolling the area.

Results.—The number of "car" cards distributed and the percentage of usable returns in various years for Massachusetts, Connecticut, and Oregon are given in Table 1. A combined total of 5,000 cards

TABLE 1. NUMBER OF HUNTERS' CARS TAGGED AND THE PERCENTAGE OF CARDS RETURNED IN MASSACHUSETTS, CONNECTICUT, AND OREGON

State	1940		1941		1942		1943		1944		1945		Totals	
	Number distributed	Per cent returned	Number distributed	Per cent returned	Number distributed	Per cent returned	Number distributed	Per cent returned	Number distributed	Per cent returned	Number distributed	Per cent returned	Number distributed	Per cent returned
Massachusetts	440	75.8	507	78.7	371	81.4	351	79.2					1,669	78.7
Connecticut			720	69	878	82	493	85	475	82	655	80	3,221	78.8
Oregon					110	76.4							110	76.4
													5,000	78.7

were distributed in all states, and of these approximately four cards were returned for every five distributed. The lowest card return for any year was 69 per cent, experienced in Connecticut in 1941. The highest return was 85 per cent, in the same state in 1943.

The actual number of cards returned in Massachusetts and Connecticut was greater than indicated in the figures in Table 1 which included only cards returned with usable data. Each season a number of cards were returned with no data on them or were found where hunters had discarded them. For example, 91 per cent of all cards distributed in Connecticut in 1945 were eventually collected, but only 80 per cent of the total contained usable data. Eleven per cent were blank or contained illegible or obviously inaccurate figures.

This method of collecting hunting data from transient hunters is novel and for that reason it would be logical to anticipate a decrease in returns if the method was used on the same area for a number of years. However, returns from Connecticut and Massachusetts, where the method was used 5 and 4 years, respectively, on the same areas remained approximately the same.

The high percentage of return of car cards made it possible to figure reliable averages and compute accurately the total game kill and gun-hours expended by transient hunters. Many checks made on the Massachusetts area over a 4-year period through contacts with hunters showed that very few had falsified their card reports. Perhaps the accuracy of card reports was due to the simplicity of the questionnaire and to the fact that no request was made on the cards for the name of the person making the report or other party members. Reports were also made on the spot when the hours hunted and total kill were fresh in hunters' minds.

The method of obtaining hunting data from resident hunters did not operate as effectively as that used for transient hunters. Most resident hunters neglected to keep their records up to date. This was partly overcome by frequently contacting resident hunters throughout the hunting season to encourage filling out the cards.

Costs.—The cost data given in Table 2 is based on records obtained from operations on the Massachusetts area. Salaries of patrolmen and travel expense are the two largest items. Under Massachusetts conditions, 6,000 acres was approximately the upward limit of area that could be covered by one patrolman with additional help during abnormally busy periods. A larger area could be covered if there were fewer roads and hunters.

TABLE 2. COST OF CENSUSING 10 SQUARE MILES FOR A 30-DAY HUNTING SEASON IN MASSACHUSETTS

Salaries		
1 Patrolman for 26 days @ $5.00		$130.00
1 Patrolman for 9 days @ $5.00		45.00
Travel		
2,600 miles @ $0.05 per mile		130.00
Materials		
Cards, pencils, tacks, etc.		10.00
Total cost		$315.00
Cost per acre per season	$0.053	
Cost per square mile per day	$1.29	

SUMMARY

1. An intensive method of hunter census based on card reports was devised and used, 1940-43, on a 6,000-acre Massachusetts area during the course of an intensive investigation of ring-necked pheasant populations. It was used with modifications on a similar area in Connecticut and in Oregon.

2. Hunters were divided into two groups: resident hunters, or those who resided on the study area or reached it on foot, and transient hunters, who arrived on the area by automobile or by other vehicles.

3. Resident hunters were contacted before the hunting season and asked to keep detailed records of hunting activities on cards furnished them.

4. Transient hunters were contacted or their cars were tagged with questionnaire cards to which a thumb tack and pencil were attached. These cards were filled out by the hunters and posted along roads from which they were collected by later patrols.

5. Approximately four of every five cards distributed to transient hunters were returned with usable data. The accuracy of the information supplied, as indicated by field checks, was apparently high.

6. Most resident hunters did not keep up-to-date hunting records on the cards supplied them without frequent reminders during the hunting season.

7. The cost of using this method in Massachusetts for a 30-day season (Sunday hunting excluded) was $0.053 per acre. The cost per square mile per day was, for the season, $1.29.

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DISCUSSION

MR. MILFORD (New Hampshire): Did you make a comparison of those cards with other methods in that work?

MR. WANDELL: I didn't because I didn't know of any other method that would produce the results that we were after.

MR. MILFORD: That is what I meant, whether there was a comparable method that would be favorable in cost.

MR. WANDELL: You mean road cards where they could be used? No, I didn't. I didn't compare those cards. I didn't consider that because I knew we couldn't use road cards. We had too many roads leaving the area.

MR. J. S. BISHOP (Connecticut): What did you do about cards on cars of nonhunters?

MR. WANDELL: Usually they marked them. We did get a number of returns from men who were working in the woods on the gypsy moth control, but we recorded license numbers when a man wrote down that he wasn't a hunter, as some of them did, or if we didn't get a return for two or three times running on the same card, we usually looked around to see whether or not he was hunting. He might have been trapping also, so we kept a running list of license numbers of cars that should be tagged and engaged in other activities.

MR. BISHOP: Did you keep the use of those cards?

MR. WANDELL: No. We threw them out entirely.

MR. BISHOP: Our nonhunter cards were used as usable cards. We used that as a factor. That may be one of the reasons that our results may have been a little higher.

SEED STOCK REFUGE INVESTIGATION

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This work, Connecticut's Pittman-Robertson Project 4-R, began in the fall of 1941 and was completed at the close of the 1945 hunting season. The project was intended to test the value of food patches of field corn, surrounded by small refuge areas, as a pheasant-management measure. It was carried on in what is about average pheasant territory for the State. Hunter take was selected as the index of the productivity in pheasants of the area. In order to judge the value of the food patches and refuge areas, information on hunting pressure and success was obtained for one season before the refuges were established (1941), and for one season after they were abandoned (1945). The same data were obtained during the 3 years between, while the food patches and refuge areas were in operation.

Plans were to have a full-time technician on the area throughout the life of the study with as much additional help as was necessary during the hunting season. Mr. Norman Wilder started the work, left for the army and was followed by Philip Barske, James Van Weelden, Daniel D'Agostino and for the 1945 hunting season check, Gordon Woods and O. E. Beckley. During each hunting season one full-time man was employed in addition to the technician. In 1941,

two or three additional men were used on opening day, Saturdays, and holidays. During the seasons of 1942 through 1945 one additional man was employed on these days. My contribution as project leader has been to furnish continuity to the work and the methods of study as personnel has changed.

The study area comprises most of the eastern half of the Town of Wallingford and contains about 6,500 acres. There is a complete network of secondary roads, some improved and some dirt. About half of the area is in quite evenly distributed farm woodlots, some of which are pastured. Orchards are frequent on the area and rank with hayfields and silage corn in area occupied. During the study, land use has become increasingly intensive and one valley was dammed and about 60 acres flooded as a public water supply.

The Wallingford Rod and Gun Club sponsors a Regulated Hunting Area in the town. Nearly three quarters of the study area, including much of the better pheasant territory, comes under this plan. Most of the balance of the area is closed to hunting by the landowner. Regulated Hunting Areas, open by permit, are hunted more heavily than most other land open to the hunter. The study area may be divided into 28 coverts, 22 of which might support pheasants. Of these 22 coverts, 2 were privately posted throughout the study, 1 was posted during the first hunting season and open thereafter and another 1 was posted during the last two hunting seasons.

The hunting season study.—Banding, car cards and interviews. Beginning in the fall of 1941 most of the cock pheasants liberated by the department have been banded. On the study area all cocks liberated by the department, except for one release of 45 birds in 1943, were leg-banded with sealed aluminum bands. The bands used are stamped "Return Conn. F & G" and are numbered serially.

The Wallingford Club also liberated cock pheasants on the area and in the vicinity during the study. All but 29 of such cocks liberated on the area were also banded, 27 of this 29 were released in August 1941. Unbanded cock birds were released by the club on land adjoining the study area during the hunting seasons of 1944 and 1945. Information was available as to the date of liberation and the number of such birds released. On the basis of this information reports of a number of unbanded cocks, killed on the study area during those years, were tabulated as released rather than wild-raised birds.

The method of obtaining information about hunting pressure and success on the area was substantially that developed by Wandell for

use on a similar project in Massachusetts. A card was left under the windshield wiper of every car found parked on the study area during the hunting season. This card requested cooperation and asked the number of persons hunting from the car, the time to the nearest quarter hour that they had hunted, the bag of pheasants, divided into banded and unbanded birds, and the band numbers of any banded birds. A pencil and a thumb tack were left with the card, which carried a line requesting that it be thumb-tacked to the nearest fence post or tree. In 1944, the low year, 475 cards were issued, 878 issued in 1942 was high. Gross return of the cards varied from 81 per cent to 91 per cent of the number issued. From 69 per cent to 85 per cent of the cards issued were returned with such information as to be usable. Cards were classed as usable when all of the information requested was given, or could be supplied or interpreted by the checker; and when "not hunting" or some nonhunting activity was entered on them. Corrections by the field men were infrequent and consisted of such changes as deleting a car or hunting license number from the space provided for pheasant band numbers, when the other information was completely and apparently conscientiously given. From these returns it appears that from 94 per cent to 96 per cent of the cards issued were placed on cars from which the occupants were hunting. Table 1 gives this information for the 5 years.

During the 1941 hunting season a number of hunters were interviewed in the field in addition to complete coverage of the area with carcards. Information from carcards filled out by parties that had been interviewed was used in arriving at the estimated hunting pressure and success but was not combined with that from other carcards. Hence, it is possible to compare information obtained by interview and observation of hunting parties with similar information furnished on carcards by hunters that had not been interviewed. The average number of persons per party interviewed, compared to the average number hunting from a parked car, as reported on the carcards, should indicate the reliability of these reports. The number of persons in a party is apparent and does not depend on an estimate as does time hunted. It is not subject to the variation that is possible in the reported kill when interviews are made during the course of the day's hunt while carcards are not filled out until the hunter is leaving. During the 1941 season 170 hunting parties consisting of 308 people were interviewed, an average party size of 1.805. There were 455 usable cards returned by hunters that had not been interviewed, stating that 826 persons had hunted from those cars, an average party size of 1.815. If available personnel had permitted, the interviews would

TABLE 1. NUMBER OF CAR CARDS ISSUED AND RETURNED

	Days of open season	Cards issued	Total cards returned		Cards returned usable				
					By hunters	By nonhunters		By both	
			Number	Per cent of issue	Number of cards	Number of cards	Per cent of issue	Number of cards	Per cent of issue
1941	43	720	583	81.	455	41	6.	496	69.
1942	43	878	764	87.	679	39	4.	718	82.
1943	43	493	439	89.	392	26	5.	418	85.
1944	31	475	398	84.	362	22	5.	384	81.
1945	31	655	594	91.	493	28	4.	521	80.

have been continued throughout the study as a continued check, and for the added information that is obtainable. However, it is felt that the 1941 figures indicate a remarkable agreement between the results of interviews and carcard information. The 308 hunters interviewed had spent an average of 2.36 hours afield and taken a pheasant for each 11.8 men. The 826 hunters reporting on carcards had spent an average of 2.49 hours afield and taken a pheasant for each 12.3 men.

Hunting pressures and success. The study area is not served by public transportation hence it was assumed that all hunters used motor vehicles, except for those hunters resident on or quite near the area. The latter cases were sought out and most such hunting attempts on foot recorded on carcards. A small amount of hunting on the area originated from cars parked outside the area but this was assumed to have been balanced by time spent and game taken off area by hunters whose carcards were left. The information obtained on the carcards seems to be an excellent sample of nonresident hunting pressure and success. Total cards issued to hunter cars seem a suitable base for a conservative estimate of the total nonresident hunter activity.

It was assumed that, if 95 per cent of the cards returned usable were from hunters, then 95 per cent of the cards issued had been placed on cars from which the occupants were hunting. Dividing the number of cards placed on hunter cars by the number of such cards returned usable, provides a correction factor, which, applied to the data from the usable cards, increases it to an estimate of the nonresident hunter activity. A simpler way of arriving at the same factor is to divide the number of cards issued by the total number returned usable. These correction factors vary during the 5 years from 1.18 to 1.33. More important than the changes in magnitude involved, are those that alter the relationship of the figures. Tabulation of 1941 reports showed 1,134 persons hunting and a take of 42 unbanded pheasants; in 1942 both figures were slightly larger, 1,144 hunters and 45 unbanded pheasants. The calculated figures, obtained by applying the corrections, are 1,520 hunters and 56 birds in 1941 against 1,400 hunters and 55 birds in 1942. Both 1942 figures now being smaller than those for 1941. The calculated number of hunters is rounded to the nearest ten, kills are to the nearest bird for each group. Tables 2 and 2A compare the reported and calculated figures for the five hunting seasons.

With the long hunting season in Connecticut, hunting pressure appears deceptively light. The average is 30 hunting attempts per day for the 5 years, which is about 216 acres per hunter. However, more than half of the total pressure is applied on about seven peak days.

TABLE 2. SUMMARY OF CAR CARD INFORMATION

	Number of hunters	Total hours of hunting time	Average time per trip hours	Pheasants bagged Released	Wild	Total	Hours hunted per bird tagged
1941	1,134	2,781.25	2.45	51	42	93	29.9
1942	1,144	2,743.5	2.40	96	45	141	19.5
1943	694	1,904.5	2.74	69	14	83	22.9
1944	647	1,599.0	2.47	25	15	40	40.0
1945	968	2,704.75	2.79	78	18	96	28.2

TABLE 2A. CALCULATED HUNTING PRESSURE AND SUCCESS

	Correction factor	Number[1] of hunters	Total hours[1] of hunting time	Pheasants bagged Released	Wild	Total
1941	1.33	1,510	3,730	68	56	124
1042	1.22	1,400	3,350	117	55	172
1943	1.18	820	2,250	81	17	98
1944	1.24	800	1,990	31	19	50
1945	1.26	1,220	3,400	98	23	121

[1]To the nearest 10.

These days are opening day, the first Saturday, Armistice Day, Thanksgiving Day, the opening of the rabbit hunting season, and other Saturdays. On such days an average of 85 hunting attempts are made, allowing about 80 acres per hunter. Pheasant cover on the area is about a quarter of the total acreage and most of the hunters are primarily interested in pheasants. The area hunted is, therefore, probably about 20 acres per hunter. The man-hours hunted on these peak days average about 270, which is a man-hour of hunting on each peak day for each 6 acres of pheasant cover. Since there are seven of these days more than a man-hour of hunting time is spent for each acre of pheasant territory, at times when the average distribution of hunters is one per 20 acres of such cover. Table 3 gives some information about these peak days for the 5 years.

The hunter bag on the area has been small during the entire study. Man-hours hunted per bird bagged have gone down, and up and down during this time. The best year was 1942 with 19.5 hours per bird bagged, the poorest 1944 with 40 hours. In terms of estimated kill per acre the take has varied from a bird for each 130 acres to a bird for each 37.8 acres.

Wild-raised and stocked birds. The source of the pheasants that were bagged on the area is of interest in showing how birds raised in the wild and those stocked at various times contribute to the hunter take. Birds raised in the wild varied from 17 per cent to 45 per cent of the birds reported killed during the study. Stocked birds are divided into two groups by season of the year stocked. Birds stocked in August and September made up 8 per cent to 10 per cent of the bag during the 2 years 1941 and 1942 in which liberations were made at that time.

TABLE 3. ESTIMATED ACTIVITY FOR DAYS OF GREATEST HUNTING PRESSURE

	Days		Hunters[1]		Hours[1]		Pheasants bagged[1] Released		Wild		Both	
	Number	Per cent of season	Number	Per cent of total	Number	Per cent of total	Number	Per cent of bag	Number	Per cent of bag	Number	Per cent of bag
1941	6	14	763	50	2,028	54	29	43	34	61	63	51
1942	9	21	712	50	1,716	51	57	49	21	38	78	45
1943	8	19	424	51	1,238	55	34	42	6	35	40	41
1944	8	26	432	54	1,078	54	25	81	14	74	39	78
1945	5	16	650	53	2,003	59	62	63	15	65	77	64

[1]The correction factors given in Table 2A were used in arriving at these estimates.

TABLE 4. COMPOSITION OF THE BAG FROM KILLS REPORTED ON CAR CARDS

	1941		1942		1943		1944		1945	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Native	42	45	45	32	14	17	15	37.5	18	19
During season stocked	24[1]	26	65	46	30	36	11	27.5	25	26
Pre-season stocked	9	10	11	8	0	0	0	0	0	0
Stocked off area covers	3	3	5	3.5	3	4	10	25.	40	42
Preceding years stocking	0	0	1	1	0	0	0	0	0	0
Stocked, place and date unknown	15	16	14	9.5	36	43	4	10	13	13
Total stocked birds	51	55	96	68	69	83	25	62.5	78	81
Total native and stocked	93	100	141	100	83	100	40	100	96	100

[1]Includes 2 "308" incompleted bands. In determining the correction factor for 1943, these birds are further classified as "stocked, place and date unknown" 17, and "sub-standard cock stockings" of which 19 were recovered.

TABLE 5. RELEASE AND ESTIMATED RECOVERY OF BANDED COCK PHEASANTS BY SEASON OF LIBERATION

Season of liberation	1941		1942		1943		1944		1945		Total		Per cent of recovery
	Released	Recovery	Released	Recovery	Released	Recovery	Released	Recovery	Released	Recovery	Released	Recovery	
Spring	21	0	20	0	25	0	6	0	3	0	75	0	0
Pre-season	58	19[1]	47	16	0	0	0	0	0	0	105	35	33
In-season	79	45	159	93	111	47	58	16	116	38	523	239	46
Total	158	64	226	109	136	47	64	16	119	38	703	274	39

[1]Includes bird released in 1941 but killed in 1942.

This tabulation does not include birds released off area but taken on area. The correction factors used in obtaining the figures of estimated recovery are as follows: 1941, 1.86; 1942, 1.43; 1943, 1.56; 1944, 1.48; 1945, 1.51.

Birds stocked during the season constituted 26 per cent to 46 per cent of the bag. In addition three other classes of stocked birds are necessitated by the figures reported: birds "stocked place and date unknown," birds "stocked in off area coverts," and for the case of a single bird, "from preceding year's stocking." Birds that were reported as a banded cock killed but for which the band number was not given, varied from 9.5 per cent to 25 per cent of the total bag. These figures for the 5 years are given in Table 4. Obviously all such kills of stocked birds should be combined with the kills of known origin in estimating the value of the liberations at different periods. This has been done, assigning the "stocked, placed and date unknown" entries to the other three categories "pre-season stocked," "during season stocked" and "stocked in off area coverts" in proportion to their reported relationship. Further, the known kills of birds liberated at a given season must be increased for hunters not reporting. For ease in handling, these two operations are combined into a correction factor for each year which can be applied to the reported kill of any group of stocked birds. This method facilitates the conversion from reported to estimated take, of various tabulations showing the success from stockings in various coverts and at various times. Applying this method, of computing the estimated take of a given group of stocked birds, to the reported take, we find that 33 per cent of the cocks stocked on the area in August and September were probably taken by hunters. There were 105 banded cocks stocked during these months in 1941 and 1942, and the take is estimated at 35. Birds were stocked during the season in all 5 years. A total of 523 of these were banded and it is estimated that 239 or 46 per cent were recovered. Recovery from some individual liberations during the season was considerably higher and recoveries for 2 of the 5 years were above 50 per cent. Table 5 gives this information.

One other comparsion between wild-raised and the cocks stocked before and during the hunting season is of interest. This is the elapsed hunting time, between the opening of the season, or the date stocked, and the date that the last of such birds was reported killed. This might be termed the period during which the birds furnished sport. For the 5 years, this period varied from 29 to 43 days for wild-raised birds, an average of 34 hunting-days. The various liberations of pre-season stocked birds furnished from 0 to 68 days of hunting, averaging 19 days. The various liberations during the season furnished from 1 to 29 days of hunting, averaging 10 days of hunting from a liberation. Table 6 gives this information for each liberation.

TABLE 6. SPREAD OF KILL AND REPORTED RECOVERY OF BANDED COCKS

Year 1941	Liberation date Native	Number liberated	Date of last kill	Number killed	Number days hunting
	9- 1-41	40	11-20	42	29
	10- 5-41	18	10-25	5	7
	10-26-41	8	10-30	4	11
	11- 4-41	20	11- 8	4	12
	11- 9-41	23	11-12	4	8
	11-16-41	14	11-20	10	10
	11-18-41	14	11-20	2	4
1942	Native		11-22	4	5
	9- 1-41		11-26	45	35
	8-23-42	11	11-14	1	68
	8-25-42	10	10-22	1	5
	9- 6-42	26		0	0
	10-13-42	15	11- 4	10	16
	10-18-42	20	10-31	7	13
	10-26-42	46	10-20	6	2
	11- 4-42	48	11-27	17	29
	11-10-42	30	12- 1	23	24
1943	Native		11-25	12	14
	10-20-43	25	12 4	14	43
	10-22-43	23	11- 6	10	16
	10-31-43	18	11-13	12	20
	11- 1-43	28	11-15	1	13
	11- 8-43	17	11-10	2	9
1944	Native		11-12	5	5
	10-16-44	24	11-25	15	31
	10-22-44	9	10-31	4	9
	11- 6-44	25	10-24	4	2
1945	Native		11-13	3	7
	10-16-45	28	11-24	18	31
	10-22-45	27	10-20	5	1
	10-29-45	36	10-31	10	9
	11-13-45	25	11- 3	8	6
Average	Native		11-17	2	5
	Pre-season	20			29-43 34
	During season	24			0-68 19
					1-29 10

Note: This tabulation does not include birds liberated off area but taken on the area.

CONCLUSIONS

The methods used in obtaining data on hunting pressure and success and on the effectiveness of the stocking of the area seem to have been sound and the figures obtained were satisfactory for calculating the hunting pressure and success of hunters not resident on the area.

The hunting pressure on the area was heaviest in 1941, decreased to a low in 1944, and increased again in 1945. More than half of the hunting on the area was done on from 5 to 9 peak days. On such days the pressure is considered severe.

Hunting success on the area varied widely during the study. It was poorest in 1944 when 40 hours were hunted per bird bagged and best in 1942, with 19.5 hours per bird bagged. To further darken the picture for the average hunter it is likely that some hunters took the season limit of 15 cocks from the area each year.

Cock birds raised in the wild on the area were a considerable part of the take at the beginning of the study, furnishing 37 per cent of the bag during the first 2 years. They dropped to 17 per cent of the bag in 1943. Numerically, the take has increased each year since, but

the per cent of the bag has gone up and down due to differences in the number of birds stocked. In addition to their numbers in the bag the wild-raised cocks furnished more days of hunting than stocked birds and provided sportier shooting.

With low potential production of birds in the wild on the area and even lower actual production the need of stocking to meet hunting pressure is evident. Birds stocked at intervals during the hunting season were most successfully brought to bag. Estimated take indicates that 46 per cent of these liberations were bagged on the area. From the number of birds bagged on the area that were stocked in off area coverts it can be assumed that an additional 5 per cent of these birds released on the area were bagged elsewhere. Liberations on the area during August and September of the first 2 years are estimated to have been 33 per cent recovered. No cocks released on the area in the spring appeared in the bag.

In the spring of 1942 food patches of field corn were established in 18 coverts on the area. They were maintained for the two following years. Prior to the 1942 hunting season, small refuges of from 10 to 40 acres were posted around each food patch. Adjacent to five of the food patches, areas of swale land as winter cover were fenced against grazing to provide adequate cover. Where necessary the food supplies on the refuges were supplemented by maintaining feeding stations. Management of this kind and intensity did not maintain the population of pheasants in the wild during the widespread reduction in the numbers of pheasants which occurred in 1943.

DISCUSSION

CHAIRMAN DAMBACH: Is there any discussion of the paper? It seemed to me he opened up a couple of questions which pertain to men who are interested in pheasant yield, particularly on the success of wild vs. released birds. Are there any questions?

MR. H. G. TAPPLY (Massachusetts): I wonder if Mr. Bishop would care to express an opinion on the length of season. That has been brought up at former meetings. It was brought up last night by Professor Leopold as to the spreading of the seasons. In general in the East, the season is long where we have the short crop—that is, the natural crop of pheasants—in the West where they have a better natural crop.

I notice that his paper indicates that while the season is long—31 days—yet, the peak of hunting is pretty high at certain spots. I would like to have his opinion as to whether that intensive hunting period proves to be the same or is there any difference with the short or long season?

MR. BISHOP: We figured the cumulative percentage of kill for the birds that we had to do with—if we could take the first week or at the most, the first 10 days of the season, we could reduce our kill by 50 per cent, but no amount of time taken off the back end of the season would probably reduce the kill more than 10 per cent. In other words, they would kill as many in a season of a week or 10 days as they would in the present season. If the pressure is high enough, the first week or 10 days they take 80 or 90 per cent of the available birds.

MR. TAPPLY: Of course, it is obvious that if you took 10 days off the first of the season, you would still have 10 days which would be the first of the season.

MR. BISHOP: Precisely.

MR. TAPPLY: Your point is that you gained a psychological victory by adding 20 days to the end of the season which, perhaps, satisfied a lot of hunters. Is that your conclusion?

MR. BISHOP: That is it exactly. With the number of hunters who are ready to go into the field and take birds, they would take just as many birds in the short season—the shortest possible season that we could put across—a week or 10 days or even a 5-day season—they would take so close to the same amount of birds that they would otherwise take out that there is no point in shortening it, the idea being to get a man out in the field with a dog or gun, whether there is anything there for him to hunt or not and give him some outdoor recreation.

MR. TAPPLY: It would be interesting to know and to get the comments of Chairman Dambach from Ohio as to why they don't give their hunters the satisfaction of that tail-end 20 days.

CHAIRMAN DAMBACH: I think it would be far better if I called upon someone from the conservation group in Ohio on that. Mr. Robey, would you care to comment on that point?

MR. GEORGE D. ROBEY (Ohio): The attitude generally in Ohio has been that enough birds would be taken in the 2-week season to justify closing. The rabbit season does continue on through and there has been some agitation on the part of the sportsmen and some of our law enforcement men to close off the rabbit season too or to make the two seasons contiguous. The reason for that is that the claim is made at least that these hunters hunting rabbits are also out shooting pheasants and that may be so. Further than that, I don't know how to quite answer that. Maybe Dr. Reis can answer that. I couldn't go any further with it.

CHAIRMAN DAMBACH: Would you care to comment further on that, Mr. Sun?

MR. JACK SUN (Ohio): I think there is one factor and that is to try to avoid, to a certain degree, getting into the snow that we usually get some time in December because when there is snow on the ground, it increases immeasurably the possibility of a hunter, especially a hunter without a dog, taking a pheasant and I think that may have been a factor in the minds of the council when they set up the closing of our season around the first week in December.

CHAIRMAN DAMBACH: There is still another factor, I think, that should be given consideration and that is the farmer. Farmers aren't too anxious to have gunners over their fields for any longer period of time during the hunting season than is necessary as the pheasants are in the soybean and corn belt. It is an inconvenience to farmers when the pheasants are in the field.

They operate their combines clear up to Christmas and even later and that is still another factor of some importance.

MR. GEORGE H. KELKER (Utah): Another thing that regulates the length of the season is with regard to the disposition of the warden service. In Utah, we have a 3-day or 4-day season on pheasants allowing three cock birds per day. Our pheasant season comes at the weekend following the deer season. The game wardens have had 10 days or rather 12 days on the deer checking stations and patrolling. The following weekend, they patrol and have some checking stations on pheasants.

A week later, at the conclusion of the pheasant season, they are out patrolling and supervising the checking stations for elk. It happens that in Utah the cities are along the foothills and the hunting area is usually in the mountains—on one side and the agricultural end is on the other. Because of that arrangement of heavy hunting on deer, on pheasant and on elk, the season has to be short and the number of birds taken is either a 1-, 2-, 3- or 4-day season as well as the number of birds per season. That way they get the removal of the pheasants according to the number and at the same time, supervise the warden service to the best of its ability.

CHAIRMAN DAMBACH: In other words, then, your short season is not due to undue kill of birds, but as a matter of convenience, in using personnel. Any other discussion on this?

MR. KENNETH MAYALL (Ontario, Canada): I think there is just one other point that wasn't taken up. I believe there is an added question with reference to the length of season, an added question in addition to the one of how many birds have already been taken and that is how smart the birds become. In Ontario, and certainly other places, it is very notable that after 2 or 3 days the pheasant becomes a great deal smarter. He either lies lower or else he flies sooner and that has a considerable effect on whether the length in season is going to result in more birds or not.

MR. EMIL J. N. OTT, JR. (California): We shortened our bag limit in California for two reasons. One of them was primarily to cut down the kill and the other one was that we set our bag and possession limit. By setting our bag and possession limit and shortening our season, we can almost approach what we have as the number of birds we can have during a season or rather, we permit the taking of 10 birds there, and before we had the bag and possession limit, we had a 10-day season. Unless we had a warden behind every man in the field, he would illegally bring home 30 birds in a season.

Now, if he is lucky, he can get by with the number of birds he can ordinarily take. We are very much interested in the longer season. Of course, in California, we have nice roads and sunshine and everybody hunts every day for pheasant. We have dogs working in the field with the men with a gun during the off season. That is a sort of touchy subject, but it has worked out.

We use our dogs 7 to 8 months a year in California and keep them in pretty good shape. We have built up a great interest in the use of dogs in the field and from a conservation standpoint, I think with the combination of the two of them, we are approaching somewhere near where we can more or less control the shooting and the take of pheasants in California.

CHAIRMAN DAMBACH: Your program has been developed and planned to the favorable use of dogs in hunting open game.

MR. OTT: Very much so. In fact, we go so far as to encourage it by holding our birds over and releasing them after the open season so that these men can use them in their bird dog trails. We do everything we can to encourage the use of dogs. In fact, it is getting so that in pheasant hunting very seldom do you see a group of people out without a dog. We encourage it to its utmost because of the checking we have had in our sportsmen's clubs, we have found that we have reduced the loss a great deal.

Some of these people actually tell the truth and they say it takes five birds to get one in the bag and anybody who has shot pheasants who isn't a good shot, sometimes that is more the truth than we all know.

TECHNICAL SESSION

Wednesday Morning—March 13

Chairman: WILLIAM ROWAN
Alberta University, Edmonton, Alberta, Canada

Vice-Chairman: LLOYD L. SMITH
Minnesota Department of Conservation, St. Paul, Minnesota

FRESH WATERS, MARSHES AND WILDLIFE

A WATERFOWL RECONNAISSANCE IN THE GRAND PRAIRIE REGION OF ARKANSAS

ARTHUR S. HAWKINS, FRANK C. BELLROSE, JR.
Illinois Natural History Survey, Urbana, Illinois

and

ROBERT H. SMITH
U. S. Fish and Wildlife Service, Winona, Minnesota

During the past decade waterfowl have cost the American public more money than any other class of game. These costs have been shared by the hunter in pursuing his sport; the government in enforcing regulations and acquiring, developing, and maintaining refuges; and by the farmer in suffering losses to his crops. In comparison to other costs, the amount used for research has been small, presumably because immediate action was needed to save the ducks and because most research requires time. We now have time to work on the fundamentals that were by-passed. This paper deals with wintering-ground fundamentals, particularly those concerning the mallard on its wintering ground in Arkansas.

The wintering grounds offer probably the best opportunity to obtain reliable population figures on mallards. Thoroughly-trained census takers using modern devices, including airplanes and aerial cameras, could obtain figures considerably more accurate than those furnished by untrained and often incompetent census takers that supply some of the figures now being used.

The wintering grounds also are the proper places to get mallard sex and age ratios. A large series of age ratios is the best yardstick devised to measure the crop produced. No one has availed himself of the excellent opportunities offered in Arkansas and Louisiana to obtain age and sex data.

Are the present wintering grounds adequately supplied with feed and with resting areas to take care of the needs of present and future mallard populations? Opinions concerning this question are plentiful, but facts are scarce.

How many mallards die on the wintering grounds? So far we lack reasonably accurate hunters' kill figures. Losses to trappers and natural losses likewise are unknown.

When do mallards pair and what effect does hunting have on the pairs? These and other questions remain to be answered.

Grand Prairie.—We are able to shed light on some of these questions from information obtained concerning mallards on the Grand Prairie Area surrounding Stuttgart, Arkansas. Grand Prairie as herein defined occupies nearly a thousand square miles bounded on the east by the White River Bottoms, on the south by the Arkansas River, on the west by Bayou Meto, and on the north by the Rock Island Railroad. Within these boundaries are several tributary bayous and ditches draining a prairie devoted to rice culture. Dotting the prairie are numerous timbered depressions known as "islands" or "pin oak flats," at least two dozen of which are used as rice reservoirs or as "green tree" reservoirs.

A few definitions may be in order. "Pin oak" flats are misnamed. There are no pin oaks (*Quercus palustris*) in the area. The tree for which the flats are named is the willow oak (*Q. phellos*). Rice reservoirs are leveed flats or dammed creek bottoms choked with dead or dying timber. They have two uses in the Grand Prairie Area: (1) for irrigating rice fields, (2) for duck hunting. Green tree reservoirs are built like rice reservoirs, but are used specifically for duck hunting. After the hunting season the water is released so that the timber does not drown.

The bottomlands bounding or transecting the area total more than a quarter-million acres, and include White River National Wildlife Refuge, which contains over a 100,000 acres. The ecology of the White River bottoms has been discussed by one of the present authors in an earlier report (Smith, 1939).

The reservoirs are estimated to occupy about 10,000 acres.

The rice acreage of Grand Prairie is about 175,000 acres, according to information received at the state rice experiment station. There is

an unknown additional acreage of soybeans and lespedeza used in rotation with rice and probably approximating the rice acreage.

Grand Prairie has produced rice for more than 40 years. It now yields about two thirds of the rice produced in Arkansas, which ranks only behind Louisiana as a rice-producing state. Rice culture requires the use of an enormous quantity of water, most of which on Grand Prairie is pumped from shallow wells. Recently ground-water supplies have become overtaxed and, as a result ground-water levels have dropped, making pumping more expensive than formerly. At first, reservoirs were built to develop a cheaper water supply. Later, when it was discovered that the reservoirs attracted ducks, many farmers found that hunters were willing to pay enough for their sport to offset initial and maintenance costs for reservoirs as well as pumping costs for filling them. The farmer could then hold the water until needed for rice. Many farmers prefer reservoirs to wells not only because duck hunters pay for the irrigating water, but also because fields can be flooded more quickly and evenly from reservoirs than from wells. The first rice reservoir in the area was built in 1928, the next in 1933. Twenty or more have been built since 1933, mostly during the height of the duck depression, when Grand Prairie enjoyed some of the best shooting to be had at that time.

The reservoirs have been successful in attracting the ducks away from the bottomlands. At first the duck hunting center was Gillett near the lower end of Grand Prairie, and only a few miles from White River Refuge. As more reservoirs were constructed, the ducks were drawn away from their former haunts so that now the mallard capital is Stuttgart, 30 miles north of Gillett and 25 miles from White River Refuge. Formerly, the ducks fed and rested in the bottomlands during the day and fed in the rice fields at night. Now most of the mallards rest on the rice reservoirs and feed in the nearby fields, returning to the bottoms only during periods when high water covers fresh feeding grounds. When we visited the Stuttgart area in January 1946, most of the ducks were using the reservoirs. While we were there a flood covered many acres of the bottomlands, and most of the ducks moved into the newly flooded areas. Many mallards left Arkansas at that time. Concurrent with the decrease in Arkansas, a marked increase was reported in the bottomlands of Mississippi and Louisiana, evidence that a wintering population of mallards is very mobile.

Food conditions.—We can speculate that a shortage of food in the Grand Prairie area caused the mass southward exodus at a date when spring migration was close at hand. There is some basis for this belief. Mallards are supposed to frequent the Grand Prairie area chiefly

on account of the plentiful food supplies furnished by rice, acorns, soybeans, lespedeza seed (according to local hunters), and the weed seeds that go with rice culture, including wild millet (*Echinocloa* spp.), smartweed (*Polygonum* spp.), nut grass (*Cyperus* spp.), teal grass (*Eragrostis* spp.), and others.

Available food supplies in the Grand Prairie area fluctuate greatly from year to year, depending usually on water conditions when the ducks are present. In some years, mast is plentiful and available; in other years, it is plentiful but unavailable except in artificially-flooded green-tree reservoirs; still other years there is no mast. Likewise, the amount of waste rice and soybeans available, varies with cropping conditions.

We examined 100 mallard stomachs taken during the middle of January from various hunting places within the Grand Prairie area. Apparently little rice remained in the fields, for this grain comprised less than a tenth of the food in the stomachs. No acorns, soybeans or lespedeza seeds were represented in the stomachs examined. Field weed seeds of the species already mentioned were almost exclusively the kinds of food found in stomachs by mid-January. There is the possibility that the mallards were taking weed seeds in preference to crops or mast. Perhaps weed seeds alone were plentiful enough to supply the feed needs of the wintering ducks. The remaining possibility is that Grand Prairie had so little duck feed by early 1946 that many mallards left for other areas. If so, northward-migrating ducks, some of which already were arriving when the local mallards departed, must have gone hungry.

Age and sex ratios.—The primary purpose in visiting the Grand Prairie area in January 1946 was to obtain age ratios of mallards on their wintering grounds. Similar studies in Illinois during the 1945 fall migration had indicated a shortage of young birds, evidence of a poor hatch. There is always the chance that age or sex ratios taken along the flyway are distorted by differential age or sex migrations. Even where mallards are wintering, there is some question whether sex or age ratios are the same on more northerly grounds as on those in the far south. Grand Prairie was selected for our wintering-ground bag inspection studies because of its central location. Three days were needed to inspect 711 mallards and 55 other ducks. Then the kill fell off because of the mallard exodus to flooded flowages to the east in Mississippi and to the south in Louisiana, making it unprofitable for us to remain longer.

We encountered technical difficulties in classifying drakes as to age because by January the sex organs of many juveniles closely resem-

bled those of adults. Hens were easily aged by the presence or absence of openings to the bursa and oviduct. The age ratio of birds in the Arkansas sample was 0.7 juvenile per adult, which was identical with the ratio obtained in Illinois, in the fall of 1945. That mallards fared badly on the breeding grounds in 1945 is indicated by comparing the above ratio with the average ratio obtained in Illinois for the preceding six years: 1.4 juveniles per adult.

Hunting is so good in the Grand Prairie area that the better hunters can, and a few do, deliberately select drakes. Hence, the preponderance of drakes in the bag may not be significant. The sex ratio of the sample inspected showed 55.8 per cent drakes.

Kill estimate.—How does the kill in Arkansas compare with that in other parts of the wintering grounds? Arkansas returns from mallards banded in Illinois are almost double those of its nearest competitor, Louisiana, but this comparison may not be valid for several reasons. Perhaps Louisiana receives more mallards from flights that are not sampled in Illinois traps than does Arkansas. Perhaps much of the Illinois flight winters north of Louisiana and never runs the gauntlet of Louisiana hunters. Information on these details remains to be worked out. We believe, however, that the mallard kill in Arkansas is larger than that for any other state in the Mississippi flyway's principal wintering area.

The 1945-46 kill on Grand Prairie was the largest in several years due in part to an unusually early flight. Opening day during the past 3 years has been November 2, but usually few ducks are present in the area during the first week of the season. Thus, in 1943 and 1944 the opening week's kill comprised less than 1 per cent of the total season's kill; but in 1945 it made up nearly 7 per cent of the season's kill.

Few places in the country offer a better opportunity to measure the kill accurately than does the Grand Prairie area. Grand Prairie hunting is so highly commercialized that even local residents who are not rice farmers or guides must pay to hunt ducks. Most out-of-town hunters stay at the same hotel and have their kill processed at the same cold-storage plant. Up to January 10, 1946, the Riceland Hotel at Stuttgart had sold 882 nonresident and 750 resident hunting licenses for the 1945-46 season. The Meyer's Ice Cream Company of Stuttgart handled the kill resulting from 2,626 hunts. A card-filing system used by Mr. Gus Meyer during the past three hunting seasons made possible an analysis of the kill per hunter per day for the three seasons (Table 1). It was the opinion of local guides, club owners,

TABLE 1. KILL RECORD BY 10-DAY PERIODS ON GRAND PRAIRIE, ARKANSAS, DURING THREE HUNTING SEASONS, 1943-44 THROUGH 1945-46.[1]

Period	Man-days of hunting			Total kill			Average kill per hunter per day		
	1943	1944	1945	1943	1944[1]	1945	1943	1944[2]	1945
November 2-11	46	24	257	409	278	2,066	8.9	11.6	8.0
November 12-21	280	109	310	2,409	1,070	2,452	8.6	9.8	7.9
November 22-December 1	313	215	396	2,717	2,290	3,100	8.7	10.6	7.8
December 2-11	343	338	459	2,905	3,708	3,779	8.4	10.9	8.2
December 12-21	216	432	289	1,873	4,853	2,243	8.6	11.2	7.7
December 22-31	150	170	294	1,286	1,955	2,285	8.6	11.5	7.7
January 1-10	258	199	460	2,311	1,959	4,010	8.9	9.8	8.7
January 11-20	.....	354	161	.....	3,780	1,234	....	10.7	7.6
Total or Average	1,606	1,841	2,626	13,910	19,893	21,169	8.7	10.8	8.0

[1]Records furnished through the courtesy of the Meyer's Ice Cream Company, of Stuttgart, Arkansas, where at least a third of all the ducks bagged on Grand Prairie are processed for the hunters.

[2]Bag limit in 1944-45 was 15.

and conservation officers that the Meyer's Company handled from a third to two thirds of all the ducks shot in the area.

If the number of ducks brought into the Meyer's Ice Cream Company represented a third of those bagged on Grand Prairie, the kill in that area in 1945-46 was about 63,500 plus crippling losses. Grand Prairie furnishes about half the duck shooting in the State of Arkansas according to returns received over a 5-year period from nearly seven hundred banded ducks bagged in Arkansas (Table 2). The Arkansas kill in 1945-46 would thus total about 127,000 plus crippling losses, a figure equivalent to about half the kill in Illinois in recent years. The average kill per hunter per day at Grand Prairie clubs, however, was about two ducks more than at Illinois River clubs.

TABLE 2. TERMINUS FOR 1,714 MALLARDS BANDED IN ILLINOIS AND KILLED SOUTH OF ILLINOIS DURING THE PERIOD 1939-44.

Place recovered	Number recovered		Per cent recovered	
Arkansas	698		40.7	
Grand Prairie		352		20.4
Rest of State		346		20.3
Louisiana	371		21.7	
Missouri[1]	206		12.0	
Mississippi	128		7.5	
Tennessee[1]	127		7.4	
Texas	87		5.1	
Oklahoma	45		2.6	
Kentucky[1]	29		1.7	
Alabama	23		1.3	
Total	1,714		100.00	

[1]Missouri, Kentucky, and Tennessee at the present time are not important wintering areas for the Illinois River flight of mallards. Most of the ducks bagged in those states were taken during migration.

If the number of ducks handled by the Meyer's Company was two thirds of the number of ducks killed on Grand Prairie in 1945-46, the local kill would total 28,225; the state kill 56,450. According to the formula we have used the take-home kill in Arkansas during the hunting season of 1945-46 fell between the two extremes 56,450 and 127,000. The higher figure is far short of the kill commonly assigned to Arkansas, which is considered to be a first-class duck hunting state. If kill estimates for other states are comparably high, and in Illinois at least, they have been in the past, it follows that our entire national system of kill-accounting is out of kilter. Likewise, it follows that if hunters kill approximately 10 per cent of the duck population annually and if the 10 per cent represents a much smaller figure than formerly thought, then our population estimates also are too high.

Pairing.—Some mallards are paired when they reach Illinois early in November. The majority are paired by the first of the year. Hunters report that paired mallards are more easily decoyed than groups of unpaired birds. The effect on the population of breaking

up pairs 3 or 4 months before the breeding season is unknown. Presumably, new mates are chosen and no lasting harm is done. Detailed studies on the wintering grounds of prebreeding behavior are needed badly.

CONCLUSION

Wintering grounds offer a fertile field for waterfowl research, a field scarcely touched up to the present time. Studies similar to the one herein reported should be repeated in Arkansas and inaugurated elsewhere. Only through such studies can we hope to remove the guesswork from waterfowl accounting.

SUMMARY

1. To date, research has received little of the funds used to maintain our waterfowl population; as a result, fundamentals of management have been neglected.

2. More accurate information is needed concerning the composition and size of wintering populations, food conditions, mortality rates from various causes, and the wintering-ground behavior of waterfowl.

3. A brief study of wintering mallards in the Grand Prairie rice area of Arkansas has provided us with some of the information that is needed from all parts of the wintering grounds.

4. One hundred mallard stomachs from Grand Prairie contained 90 per cent weed seeds, 10 per cent rice, no soybeans.

5. Age and sex ratios based on an inspection of 711 mallards were 0.7 juveniles per adult and nearly 56 per cent drakes.

6. Kill figures covering three hunting seasons indicated that the kill in 1945-46 was the greatest. The estimated take-home kill by Arkansas hunters during the 1945-46 season was not over 127,000, about half the Illinois kill.

7. Many mallards are paired by the first of the year while the hunting season still is in progress. The significance of breaking up pairs at that season is unknown.

8. Present bookkeeping methods on waterfowl leave much to be desired. Wintering grounds offer excellent opportunities for obtaining greater accuracy in measuring waterfowl populations.

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DISCUSSION

MR. VERNE DAVISON (South Carolina): I have heard a good deal about the regulations we are going to have to have reduced from the Southern Atlantic Coast. Many of our biggest hunters there have some proposals to make. I wonder if we are too young to hear what we might expect. Can't we get down to some figures here? Someone who has something to do with regulations or with research —is the bag limit reduction to be brought down to five a day? Is that a fair figure, or are we going to do it by little driblets of 10 or 20 per cent, and in a season shortened what is indicated as a 50 per cent shortage? Mr. Hawkins' paper does indicate that the hunting being what it was before and the actual reproduction being only half, it really takes some serious figuring. I wonder if someone might give us something to take back home to think about and to brace ourselves against.

MR. JOHN M. ANDERSON (Ohio): If no one is going to answer that question, I want to give you an example of what the hunter is wondering about, the waterfowl population in connection with what Mr. Davison has just said. I was sent over here by a duck club, made up of the usual composition, you know, of 24 or 25 wealthy duck hunters. Just before I left, I had a conference with the president and on his desk were the status reports of the Fish and Wildlife Service of the past few years, and a couple of articles from Ducks Unlimited. He said to me, "Mr. Anderson, frankly, I am confused. I want you to go over to the Conference and see if you can find out what is coming off. I read some of this material and I get the impression that we could bring back live decoys and baiting. If that is going to happen, I want to know it so I can start buying grain.

"On the other hand, from the status report it looks as though the regulations are going to be tightened up, and as a club member said, I, for one, don't believe that we should bring back baiting or live decoys or raise the bag limit. I don't want to see it reduced too far."

The point I am making is that duck hunters themselves—and the club members killed the large majority of the ducks—are actually confused and are asking for information and they sent me over to get just such information. I think we should take Mr. Davison's question very seriously and somebody had better get some good information available for these men.

MR. TOM MAIN (Manitoba, Canada): There is an impression abroad that Ducks Unlimited is trying to influence the regulations in connection with kill. We are just as anxious to see these birds continued, as our friends who are doing a great deal of talking. We have never tried to influence the bag limit or the regulations in any way. I think the gentleman who has just spoken may be confusing some of the reports that he has in his office that have been written by somebody else, rather than reports written by Ducks Unlimited.

I have a little book here we have just gotten up. It is just off the press. It is called "Cooperation Unlimited." It gives the policy of Ducks Unlimited and that is the only thing that we have put out for a long while to tell just what we are trying to do, how others are helping us do it, what is happening to the ducks, and so on. I would just like to have that thoroughly understood, that Ducks Unlimited are not merely representing the sportsman, endeavoring to have the high bag limits maintained, long seasons maintained and all that sort of thing, we are just trying to increase the number of ducks. I may say that we are getting a lot of help in Canada in doing this work. We have parties out now making surveys, where the Government is bearing part of the cost, and Ducks Unlimited are paying part of the cost. We are really getting along fine with the people up there and we are doing a powerful work helping the ducks.

MR. H. ALBERT HOCHBAUM (Manitoba, Canada): Mr. Main, you said that you were not trying to influence the waterfowl regulations—not in the service, no—but with the propaganda that you are putting out, which you don't take credit for when anybody calls it to your attention, and then use that mistaken fact to back statements as proof that such things as baiting and the other restrictions should be relieved. No, you are not doing it directly; you are doing it in a very indirect

manner. There is this book that was mentioned yesterday. I don't want to talk about it. The part of that book that can be opened to severe criticism comes from your office. It is used as arguments for relief of present restrictions.

I would like to ask you a question. On the current booklet you have in your hand, would you state the acreage of Ducks Unlimited land under management, please?

MR. MAIN: What?

MR. HOCHBAUM: The acreage of Ducks Unlimited land—one million and a quarter?

MR. MAIN: 1,300,000.

MR. HOCHBAUM: That is an engineer's estimate?

MR. MAIN: That is right.

MR. HOCHBAUM: Mr. Cartwright, what is the naturalist's estimate?

MR. MAIN: We have naturalists and biologists.

MR. HOCHBAUM: May I ask Mr. Cartwright his estimate?

MR. MAIN: Mr. Cartwright, your thirty seconds are up.

CHAIRMAN ROWAN: I think it would be a matter of interest, while we are all here together and this question of duck limit has been raised, just as a matter of interest, it is quite unofficial, how many people in this room would be agreeable to seeing a five-duck limit imposed next year? How many would like to see things exactly as they are remain? (None).

RECOVERY POTENTIALS IN NORTH AMERICAN WATERFOWL

H. ALBERT HOCHBAUM

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The great wildlife tragedy of the past decade is the false optimism that has attended the rise in waterfowl populations. On every hand we are offered superlatives describing the situation: *"the miracle of conservation," "production boosted 500 per cent," "overpopulations,"* increases reaching *"almost to the full carrying capacity of the environment."* If any disturbing news attended the flights of recent years it was blamed on the weather: *"record crop heads southward"* but *"haywire weather produces freaky duck season."* And then comes the "grand slam." In a recent press release (Gabrielson, 1946) we are told by the Fish and Wildlife Service that it sees "in the situation a threat to the future of migratory waterfowl hunting." One bad season and "pop" goes the waterfowl balloon.

How could this happen? Management has taken much credit for the rise in waterfowl populations. But management has failed. We have gone from reported overpopulations to poor flights in 2 years. Even before the shotgun shells are off the ration lists, even before all the hunters in the armed services have returned to the marshes, the situation marks the future of waterfowl hunting as jeopardized. This is not management! The "miracle" is not the restoration of water-

fowl; the miracle is that in 10 years we did not have the "know-how" to avoid the present situation which could have been avoided had management functioned. The miracle is that we could so steep ourselves in manufactured optimism that the current situation (which management should have foreseen) comes as a deep shock and surprise to most of us.

Management has failed in one of its most important functions. It has failed to foresee the current plight of waterfowl; it has failed to predict (as successful management of any domestic crop must predict), to manage and regulate the harvest in accordance with prevailing conditions that were measurable and predictable. Let us hope that we may learn. The future of waterfowl as game birds still depends upon management.

Waterfowl management admittedly is far more complex than in other game birds. The vast, mobile population is spread over our entire continent, the joint property of three nations. When we maage waterfowl we do not work with one species in one environment, as in quail or pheasants, managing and hunting one kind. Ducks in their many species are not alike. Each is unlike the others in behavior, in physical makeup and in its relationship to man, the hunter and would-be manager. As one small step, then, in setting the stage for future management, let us study some of the factors governing the potential recovery rates in the several species of American ducks. "Recovery," incidentally, is the proper word. Ducks are still in the recovery stage in their climb from the deep low of 10 years ago. Now and for some time to come management must concern itself with recovering lost populations rather than maintaining stable numbers.

When we manage the environment for "waterfowl" we must know that each species or group of species reacts differently according to its innate makeup. We must know that waterfowl management is not necessarily redhead management. We must know that factors responsible for an increase in mallards may not induce similar gains in canvasbacks. If we are to manage the harvest we must learn to predict why and when some species have produced substantial gains while others have not.

The following discussion attempts to describe some of the reasons for the differential recovery rate in our important game ducks. An understanding of the variation in productivity is essential, not only in the management of the environment, but in the establishment of sound waterfowl policy governing the harvest.

Numbers.—Great numbers by no means insure large populations. Indeed, in cyclic species, such as grouse and rabbits, population peaks

are followed by drastic "crash" declines. In our migratory waterfowl, however, we know of no such spectacular drops in population. The recent deep low developed over a long period of years and its cause, in contrast to other game cycles, was known. In waterfowl we see security rather than disaster in numbers.

Numbers in waterfowl probably have an important bearing on recovery rates. The larger the population, the better its chance to increase its numbers. This is due to the nature of the breeding environment. At no time are breeding conditions favorable throughout the range, as we know all too well from our studies in recent years. When abundant water renders marshes in dry regions safe, floods are apt to strike elsewhere in the range. At no time is the entire breeding area safe from drought and flood, fire and agriculture.

When numbers are large, the spread of the breeding population is such that it can absorb local adversities. It can suffer regional setbacks and still show an over-all gain. When numbers are low, local adversities may serious impair the entire population, as in 1945 when the redhead breeding grounds in Canada suffered drought and flood during the same season. We can draw a comparison with the rich and the poor investor. The rich man may scatter his investments widely, never chancing to lose all and always building his total securities. The poor man with his few investments chances meager gains and heavy loss.

While we cannot quote figures of relative waterfowl abundance, it is clear that those species which had the largest populations 10 years ago, the mallard and pintail, have shown the greatest recovery. This undoubtedly is due in part to their original advantage of greater numbers.

Management must direct its efforts towards improvement of conditions for small populations with their limited breeding area and their hazardous "investments." If management favors the small investor, so to speak, the species rich in numbers will take care of themselves.

Breeding range.—Breeding range varies widely according to species. There is a vast center of waterfowl breeding activity in the northern tier of the United States and in the prairie provinces of Canada where there is great specific overlap and where most of the important game species (with the exception of the black duck and wood duck) nest. Some, but not all species, have ranges extending far beyond this central region. Clearly the most successful species, such as the mallard and pintail, have the widest ranges. The much less successful ducks, as the redhead and canvasback which suffered so severely during the "duck depression," are much more restricted in

range (Gabrielson and Lincoln, 1941). The present breeding concentrations of these two diving ducks is at the northern edge of the original pattern of their continental breeding range.

One of the most serious pressures of this northern region is clear when we examine growth rates. Young canvasbacks and redheads require several more weeks to reach the flying stage than young mallards and pintails. They are favored by the longer spring and summer of the lower latitudes where, however, their breeding habitat is now greatly reduced through conflict with agriculture. Even in the latitude of northern Utah the main hatch of redheads is not awing until mid-September (Williams, 1944: 254). In the northern tier of states and in southern Canada many young redheads are not awing until October while some do not fly until ice comes (Hochbaum, 1944: 109). It is possible that there is some compensation in the longer days of northern regions, but evidence now at hand suggests that the northern portion of the breeding range cannot produce optimum crops in these species. Management must be directed towards the improvement of southern ranges for species with long growth periods.

A glance at any range map (Kalmbach, 1937; Kortright, 1942) shows the main breeding area of redheads and canvasbacks overlapping the agricultural regions and hazardous drought areas. Management has attempted to create drought-proof waters within this region; but the 1945 drought struck with such force in Saskatchewan and Alberta that even some of the newly-created areas were left dry or nearly so. The much-publicized Many Island Lake in southern Alberta is but one example of the failure of management to conquer drought. As yet we have been unable to provide drought-proof areas on more than a fraction of the dry regions. We are unable to control drought much beyond the established irrigation districts. But with the knowledge of the breeding ranges and with current information on water conditions we can predict seasonal production according to variations in water. This is an important function of management. Yet this year, despite drought in the west, and floods in important areas on the eastern prairies, and despite reports of poor production in the redhead, there were no steps to make compensating regulations. This is not management.

To one who knows the prairies of the northwest, it is clear that the cross-hatched range maps are most deceiving. Vast regions within these designated areas are untenable. The area acceptable to breeding ducks is but a fraction of the area indicated on the maps. This is particularly true in the diving ducks, notably the redhead, canvasback, and ruddy duck. These are primarily water-nesters; they nest

over water in emergent vegetation. Their range in large measure is restricted to areas where there are acceptable stands of emergent growths. Hence their range is greatly restricted within its over-all pattern; their numbers are concentrated. And because of their intolerance they do not respond rapidly to changing conditions. Emergent growths require a year or more to produce their stands. When management or natural forces increase the water supply, there is a lag in between the appearance of water and response by breeding birds of these species.

River ducks, on the other hand, being primarily land-nesters, do not demand the close relationship between the aquatic territorial site and the nest; they are much more tolerant in their choice of breeding situations. Thus their breeding range is much less restricted within the over-all pattern; their numbers are seldom as concentrated as in the diving ducks. When new water is available their reaction is immediate. An outstanding example of this great difference between river ducks and diving ducks was seen on the agricultural prairie of southern Manitoba in 1945. There was the most bountiful runoff in at least 8 years. Throughout the southern portion of the province were scattered thousands of small waters, many of them persisting through the season. To all of these areas came river ducks (mostly mallards and pintails but all the prairie species in this group were present), and there was the heaviest farmland nesting population in a decade. Territorial pairs were numerous where they had not been seen for years. But the new breeding population consisted only of river ducks. An extensive survey of this region revealed but one pair of diving ducks (lesser scaup) breeding on new water.

Thus we see that river ducks are spread, diving ducks concentrated. Concentrations are dangerous. When disaster strikes it may impair production in a considerable portion of a population. We must look with grave concern at the recent floods on the great Netley Marsh in Manitoba where breeds one of the largest redhead concentrations in the land.

Pioneering.—We know very little about the role of tradition in waterfowl behavior. We do not accept the stand that the breeding ground of a given species is an inherent range; yet we do not have full understanding of the land use shown by the different ducks.

We do know this, when new water areas are created there is a response on the part of certain ducks which come to nest at these new places. We see this in the new refuge marshes. It was shown by the 1945 behavior of river ducks on Manitoba farmland. These birds, in their many thousands, bred on new waters which had not existed with-

in their individual life spans. In other words, these ducks moved to areas with which they could have had no previous experience and which had not been used by ducks for at least one waterfowl generation. This is pioneering. Through its ability to pioneer a species responds rapidly to management. If it pioneers slowly, it responds slowly to management.

Clearly the most successful river ducks are the most rapid pioneers. The diving ducks pioneer slowly. River ducks being more tolerant in their choice of breeding environment than diving ducks find a wider variety of ecological patterns acceptable. Hence new waters, as we have seen, are accepted more rapidly by river ducks than by the deep waters.

I suspect, however, that variation in the pioneering trait reflects more than variations in breeding tolerances. The ability to pioneer is a part of the specific makeup and there is much variation species by species. The ability to pioneer is highly developed in the mallard and pintail, poorly developed in the redhead and canvasback.

To place the matter in different light, some species probably are more closely bound to traditions than others. Tradition-bound species pioneer slowly. We know, for instance, that the Canada goose is tradition-bound. When, as we know to have occurred, an entire local population is killed, the breeding traditions are killed with the birds and the area is barren of breeders no matter how attractive it may be. There are hundreds of "burned-out" marshes which are ecologically suitable for nesting geese, but which do not hold breeding populations because of broken traditions. When new traditions are established, as Pirnie (1938) has established goose traditions at the Kellogg Bird Sanctuary, in Michigan, a new local breeding population is created.

I suspect that similar traditions obtain in ducks and that river ducks are less tightly bound to them than diving ducks.

The importance of traditional behavior to management is great. It means that in species with strong traditional ties, we must build up "seed" populations on new or uninhabited areas, thus establishing new local breeding populations through the creation (or reestablishment) of traditions. We refer to burned-out marshes. Here traditions have been burned-out with the vanished birds. While we may not overrate the importance of the great Canadian breeding grounds, certainly we underrate the importance of breeding areas within the United States. The rebuilding of traditions here, I believe, is just as important as the rebuilding of marshes.

Sex properties.—In examining sex properties, as outlined by Leopold (1933: 95), we find the ledger partly balanced.

All American game ducks are monogamous in the wild.

Except for the long period in the wood duck (30 days), incubation requires between 3 and 4 weeks, with most species bringing off their young in 21 to 25 days.

All species produce but one brood a year.

The meager information at hand suggests only a slight unbalance of the sex ratio at hatching (Hochbaum, 1944: 51).

In adult populations we know that an unbalanced ratio obtains in many species of ducks. Here the ledger favors the river ducks, where the preponderance of drakes is not so great as in the diving ducks (Lincoln, 1932, 1933; Leopold, 1933; Mayr, 1939; McIlhenny, 1940; Erickson, 1943; Hochbaum, 1944; Petrides, 1944; Smith, 1946). This difference between the two groups becomes all the more apparent when we examine sex ratios of birds arriving on the breeding grounds (Table 1).

TABLE 1. SEX RATIOS OF RIVER DUCKS AND DIVING DUCKS, DELTA, MANITOBA[1]

Species	Male	Female	Percentage Male	Percentage Female	Ratio Male	Ratio Female
Mallard	1,226	1,197	50.6	49.4	1.02	to 1
Pintail	1,687	1,563	51.9	48.1	1.09	to 1
Redhead	538	388	58.2	42.8	1.38	to 1
Canvasback	1,908	1,008	65.4	34.6	1.89	to 1
Lesser scaup	6,940	3,447	66.8	33.2	2.01	to 1

[1]Sample counts of migrant flocks during the last 2 weeks of April and the first week of May, 1939 to 1945, inclusive.

We know very little about sex ratios beyond the fact that they exist. From studies in other game birds (Leopold, 1933: 110, 339) and in ducks we infer that an unbalanced ratio is a symptom of a low population. Logically, this same unbalance is an important factor in keeping population levels low.

We cannot manage sex ratios since we do not know what distorts them. But where there is serious unbalance, this knowledge should have an important bearing on regulations when populations are low and the reproductive season poor. Sex ratio is one of the fundamentals governing management policy for all domestic stock. It must be a fundamental in regulating the management of wild populations.

In the age of maturity we again find the ledger slightly unbalanced in favor of the river ducks. All river ducks breed their first year. Redheads, canvasbacks, and lesser scaups likewise breed their first year; but studies of the lesser scaup by Munro (1941) indicate that some individuals do not attain breeding maturity their first spring.

The American golden-eye, Barrow's golden-eye and the buffle-head all require more than one year to attain sexual maturity (Munro, 1939 and 1942). This, of course, greatly reduces the breeding potential in these species which, however, do not hold first rank as game ducks.

Nesting.—A. Time. The time of nesting has an important bearing on productivity. In southern Manitoba the mallards and the pintails are the earliest nesters; the lesser scaup, the ruddy duck and the white-winged scoter are the latest nesters, while the remainder of the species are the "middle" nesters (Hochbaum, 1944: 94).

The late nesters suffer a severe disadvantage in the tardy appearance of offspring; young lesser scaups are just hatching when early-hatched pintails are taking their first flights. The redhead, too suffers the disadvantage of late nestings for, while its season begins with the canvasback, the span of nesting is spread over a much longer period.

The products of late nestings suffer the hazards of late summer, as we shall discuss more thoroughly in our consideration of broods.

In general we might say that early nesting is the most hazardous; and it is in the time of nesting that the mallard and pintail suffer their greatest disadvantage over other species. Clutches during the early egg-laying stage are subject to frost damage. All nesting cover during the early season is dead growth of the previous year, hence more hazardous; it is more vulnerable to fire and to predator. During periods of heavy runoff, early nests are subject to disastrous flooding. Early nests are more vulnerable to agricultural hazards (with the exception of mowing) than late nests; through much of the range the period of early nesting coincides with the beginning of farm work.

Nests of the middle period are the safest. New growth makes better nesting cover. Farm work is already established. Fire is less ravaging in green growth. Predators find more buffer prey available.

Late season nests suffer from mowing and, in important parts of the range, from floods. The breeding waters of the lower Saskatchewan River and the Winnipeg River, for instance, reach their peak levels during summer rather than in spring.

The early-season disadvantage of mallards and pintails does not hold in the reign of management. These species receive the greatest benefits from nesting-ground management and the recovery rate under management is greater, because of this, than in middle- and late-season nesters. Fire can be and is widely controlled through education. The same applies to a lesser degree in agricultural offenses and predator control favors the early nesters.

B. Place. The important game species nest either on dry land or

over water in emergent vegetation. The wood duck, the buffle-head and the two golden-eyes nest in tree cavities.

All of the river ducks are land-nesters; the redhead, canvasback and ruddy duck nest predominantly in emergent vegetation. The lesser scaup regularly nests on land or over water.

The land-nesters apparently are vulnerable to the most severe hazards. Fire is more destructive; the pressure of agriculture more severe. The threat of predators is greater in land-nesters. Of the important nest predators, the ground squirrel, skunk, fox, coyote, and snake prey more heavily on land nests than on the insular nests in emergent vegetation. Water-nesters suffer the consequences of their concentrations, and are more seriously affected by fluctuations in water level.

The disadvantages of the land-nesters, however, are reversed under management. Management of fire and of farming improves conditions for river ducks tremendously. Control of predators, restriction of grazing and mowing and most other management practices favor river ducks. Thus the land-nesters may respond rapidly to management while the situation for the water-nesters remains fundamentally unchanged. Under management, the productivity rate of the river ducks is increased while there is little change in the diving ducks.

C. Waste. Nature "anticipates" some waste in reproduction. The potential wild duck crop is not 100 per cent of the eggs, as some highly popularized "duck mathematics" would have us believe. But in a few species there is added wastage over and above all other accountable losses. Two or more females deposit eggs in the same nest; when a number of 20 or more eggs is reached, the nest generally is abandoned and the potential output of two or more hens wasted.

This behavior, which we are unable to explain, is particularly frequent in the redhead and ruddy duck; wasted "dump" nests in these two species are found wherever they breed. Such behavior no doubt limits productivity considerably. It cannot be controlled, but it has a bearing on policy.

Rearing.—The age and date of the first flights of young ducks is an important factor in the productivity rate. Birds with short growth periods and early hatching dates obviously have greater chances for success than those with long growth periods and late hatching dates. The successful mallards and pintails have early hatching dates and short growth periods; the less successful diving ducks have late hatching dates and long growth periods (Hochbaum, 1944: 109).

Young which reach the flying stage by midsummer have almost 2

months in which to condition themselves for the autumn migration. The basic pattern of a duck's behavior is inborn, but it learns to direct its innate behavior to objects and places in its environment through experience. Thus young ducks flying by midsummer have much more time to condition themselves to their environment than those species which do not take flight until they are on the threshold of the autumn movements and the shooting season.

It may be that the early flying date in the mallard and the pintail is related to tradition. These young birds, we know, make extensive movements during late summer prior to their southward journey. They are familiar through experience with a much larger portion of the breeding range than the diving ducks which have much less time for "exploratory" movements.

Late flying dates overlap with the periods of severe late-summer drought and its attendant hazards. Diving ducks are far more vulnerable to drought than river ducklings.

The longer growing period and later hatching date in diving ducks apparently conflicts with the moulting period of the mother. In river ducks most hens remain with the brood until the youngsters are awing. There is still sufficient time to molt the wing feathers before the autumn flights. In diving ducks, however, the hen usually abandons her children before they take flight, this being necessary that she may molt her flight feathers in time for the fall passage. Young attended by the mother are much more wary in the presence of enemies than unattended young. A heavier brood mortality in diving ducks may result because they become orphans before they can fly.

Flight is an efficient means of escape from many enemies. River ducks being able to escape in flight at an earlier age than diving ducks probably suffer to a lesser degree from predator losses during the preflight period.

Clearly the river ducklings are favored during the growth period; undoubtedly the slower recovery in the diving ducks is due in large measure to their disadvantages as ducklings. Management cannot control growth rates, but it must recognize the importance of providing stable water levels for diving ducks through the critical period of late summer.

Hunting.—The pressure of hunting is not the same on all species. Even under similar conditions at the same time on the same marsh, the kill in one species may be much greater than the kill in another; a species with a low population may suffer heavier losses in proportion to its continental numbers than an abundant species (Hawkins and Bellrose, 1939). There is strong evidence, for instance, that the red-

head, newly replaced in the full bag, is being shot in greater proportion than some of the more common species. The Fish and Wildlife Service reports rather casually (1945) that "more returns were received for the redhead than for the lesser scaup although a smaller number of redheads had been banded." Hunting, then contributes heavily to the differentials in recovery rates.

Current regulations do little to favor species by the manipulation of time and place. Game laws have not kept pace with other advances in conservation; there is much to be done, much to be learned, and waterfowl policy must undergo some serious and drastic changes. The ultimate regulations will aim at controlling the *time* and the *place* of the kill *in favor of certain ducks* without placing a heavier weight on hunter and warden. For instance, in the important breeding regions of the West the duck season opens the last day of summer, September 20, in the northern tier of states. Opening day finds established aggregations of adults and well-matured juvenile mallards and pintails feeding on the upland fields. But in the breeding marshes, now shooting grounds, the young of many species of diving ducks are just taking their first flights, while many adult females are just recovering from the wing-molt. To hunt on these marshes in late September places this important seed stock in jeopardy. Wetmore, who made an exhaustive survey of western waterfowl marshes, said (1921: 10): "To make the opening date earlier than October 1 would be a great mistake, as it would inevitably lead to killing a large number of young ducks before they are in condition, while at the same time many of the adult birds would be molting." Dr. Wetmore was speaking of the Utah region; but his statement applies to the entire northern tier of states. If the officials who open the season on breeding marshes the 20th of September cannot follow the advice of their own technical reports, I implore them to spend a hot September afternoon examining marshland duck bags. They will find many young of redheads and of other species, birds in such poor condition that some are hardly worth plucking. How can Wisconsin and Minnesota ever hope to rebuild the breeding stock and the breeding traditions on their marshlands if they begin their shooting before the young and the molting adults are conditioned? Officials complain that they are slaves of public opinion. But if it is imperative to open the shooting September 20, the marsh species could be saved and the hunters given well-conditioned game by limiting early-season shooting to the uplands where mallards and pintails feed on agricultural land. Stubble shooting is to be had in most of the states now hunting ducks before the end of September. I am not trying to suggest this example as a regulation. I

am merely trying to show how pressure on a species or group can be reduced by manipulating time and place in favor of ducks. This also gives hunting without undue complications in regulations. Indeed, it is much easier to protect a species such as the redhead by regulating place than regulating number. If there is no marsh shooting until October 1, a substantial redhead population has been spared. Limiting the bag on redheads but permitting marsh shooting, places the species under much greater hazard. This is the type of regulation we must adopt ultimately if we are going to enjoy duck shooting in the future.

Besides our failure to heed such warnings as given by Dr. Wetmore, the lack of information is a great handicap to advances in waterfowl policy. We don't have the information we need. There must be larger staffs of trained men to study waterfowl on the breeding grounds so that information is available *before* the annual regulations are made. The present waterfowl situation, which is in large measure a direct result of hand-made overoptimism, could have been avoided had we been able to obtain annual reports from the vast breeding grounds that gave a true picture of existing conditions and numbers. *We have not even developed the techniques for appraising waterfowl populations on the breeding grounds.* Many states have more man-power and far better techniques for the preseason appraisal of the pheasant populations than the United States government has for the appraisal of breeding waterfowl populations.

Waterfowl policy is further complicated by the frequent over-optimistic and often unsubstantiated reports on waterfowl conditions in Canada issued by Ducks Unlimited. The good which has been done (which is considerable) is overweighed by a propaganda policy which rocks the very foundations of game management. Fake duckling rescues for publicity, thousands of acres credited to management where little or no improvement has been enforced—these do not contribute to sound waterfowl policy.

We have got to pull in our belts, forget about miracles, stop taking credit for the good of weather and blaming bad weather for poor flights. We must put an end to the stream of unsubstantial optimism that floods the land and build a program that operates on science and speaks with plain common sense. After 10 years we still are at the threshold of management.

Discussion.—I have attempted to show how different species react differently to the same situations. Waterfowl management must recognize and study these differences more carefully so that policy serves special species as well as "waterfowl" generally.

The discussion is general, the species many, so that we cannot draw up a precise table here showing the differences in potential recovery rates species by species. But let us apply the various conditions in two species to point up our discussion. We will compare the successful mallard with the unsuccessful redhead (Table 2).

TABLE 2. CONDITIONS INFLUENCING RECOVERY RATES IN MALLARD AND REDHEAD

Condition	Mallard	Advances recovery	Retards recovery	Redhead	Advances recovery	Retards recovery
Numbers.	Relatively high.	x		Relatively low.		x
Breeding range						
A. Regional	Extensive.	x		Limited.		x
B. Local	Spread.	x		Concentrated.		x
Pioneering	Rapid.	x		Slow.		x
Sex properties	More evenly balanced sex ratio gives mallard advantage.	x				x
Nesting						
A. Time	Early nesting hazardous.		x	Middle nesting less hazardous.	x	
B. Place	Land nests vulnerable to more hazards.		x	Water nests vulnerable to fewer hazards.	x	
C. Waste	Little.	x		Great.		x
D. Response to management	Rapid.	x		Slow.		x
Rearing						
A. Hatching date	Early.	x		Late.		x
B. Growth rate	Rapid.	x		Slow.		x
C. Period with hen	Full brood period.	x		Abandoned before full grown.		x
Hunting						
A. Condition	Young in good condition when season opens.	x		Young poorly conditioned when season opens.		x
B. Hunting pressure	Relatively light in proportion to numbers.	x		Relatively heavy in proportion to numbers.		x
C. Wariness	One of the most wary game birds.	x		One of the least wary game birds.		x

We see in Table 2 the overwhelming advantages enjoyed by the mallard—advantages that are further enhanced by management to a far greater degree than in the redhead. We see why the mallard is the more abundant species. The reasons for its more rapid recovery from the last depression are abvious. We know why future management must be directed towards the redhead and other species with low productivity rates. We see why merely placing the redhead on a protected list, as it was until a short time ago, is not enough to speed recovery. Waterfowl management must learn to measure productivity rates species by species, and it must know enough about habits to adjust policy according to these.

After 10 years we cannot blame the current plight of ducks on predators or on weather or on water conditions or on the combination of natural forces we know to be working. Certainly we cannot blame

sportsmen to whom we have given ever-optimistic reports and whose hunting we regulate. Management is at fault. Never has management been permitted to do so much; never has it failed so completely. If we are going to have ducks in sufficient numbers to hunt we must find out what is wrong with our management plan—right now! We must make the necessary changes as soon as possible. There is much to learn. There is much to do. Let us forget miracles and seek facts.

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DISCUSSION

CHAIRMAN ROWAN: This paper has raised so many topics of interest, that I am sorry we haven't a half hour for discussion, especially in view of the session we listened to yesterday, in which some of the dangers that are facing ducks in the Canadian North were mentioned. I might say that I myself am an ardent hunter, that last year the shooting in Alberta was extremely poor.

During the summer of last year, that is, the last breeding season, there were enormous tracts in Alberta over which practically no ducks bred at all. That is all the ducks were there and attempting to breed and extremely few ducklings were reared. It is a point of that description that has been mentioned many times

in Mr. Hochbaum's paper, the sort of thing to which we have no answer at all and which reflects, of course, on our future supply of ducks. We could not trace it to the weather. We could not trace it to water conditions. There was nothing obvious one could trace it to at all. Yet over large areas, practically no ducklings were reared at all.

I also should like to make one more remark. I know I should be seen and not heard, being the Chairman; but when we talked of the last duck depression, most people are not aware of the fact that in the late nineties, ducks were just as scarce in Alberta as they have been during the present duck depression. Oldtimers who knew the country well then, one or two, told me, for instance, they traveled 100 miles in the middle of the summer by ox team (that is even slower than walking, you have lots of chance to see the country) without seeing a single duck in parts of Alberta. During the sixties, that is another thirty years earlier than that, the Indian hunters hunting bison from northern Alberta to the south of the Province actually had to abandon their normal hunting trails for lack of water for themselves and their teams. The Province was so dry, again there were very few ducks. It was in the nineties that the first interstate duck legislation ever materialized on this continent between the Eastern States. Of course, nobody knew then what the answer was, but the answer was in western Canada; we know that today.

MR. RICHARD J. DORER (Minnesota): I heard what you said regarding the poor shooting during the last season. I heartily agree with what Mr. Hochbaum set forth, but I will say the actual figures in Minnesota, which is the breeding, duck harvesting state, do not bear out this contention that duck shooting has been poor during the last 2 years. We heard the same reports from our local sportsmen, but it seems strange that in Minnesota in spite of this supposed shortage of ammunition and the shortage of gasoline, in 1941 the hunters who had duck stamps bagged 18 plus ducks per hunter. The same figure obtained in 1942. In 1943, when ammunition did become a little scarce and there were strict restrictions there governing the purchase of gasoline and rubber, it went down to 16; but get this figure, in 1944 the figure popped up to 27 ducks per hunter.

If you will permit it, I will read this list. This represents only the first 2,000 cards selected at random and checked for 1945 and it indicates also that only 50 per cent of these people purchased duck stamps and that 20 per cent of the 2,000 indicated they were unable to go hunting. This is on the basis of 800 hunters. This is what they took: Mallards, 10,115; bluebills, 4,864; and teal, 7,732; and it goes down to the various species. So that we find that 800 hunters took 27,464 ducks.

In addition to that, they took 123 geese, 926 coots, 2 rails, 2 gallinules, 22 woodcocks, 78 doves, 1,500 gray squirrels, 277 fox squirrels, 703 cottontails, 238 snowshoe hares, and 103 raccoons, 6,165 ring-necked pheasants, 64 Hungarian partridge and 21 bobwhite quail.

We have heard a lot about the poor breeding conditions. I want to tell you in all sincerity I believe that gun pressure during the war years did as much to reduce the waterfowl population as all the other hazards combined. Remember that the figures I have read you come from the lone gallinule hunter. They are not required to report in Minnesota. This law is not strict enough in regard to that matter. One gallinule hunter, the conscientious hunter who cooperates with us and wants this great outdoor recreational privilege perpetuated, reports and he writes down the 3 mallards and the 5 or 6 pintails or whatever it is. But there are a great many beside the two gallinule hunters who are able to secure rubber and gasoline and ammunition who didn't report. Had they reported, that last figure there of 27 ducks would have been up in the neighborhood of 35 or 40, and we can't stand more than one season of that type.

A few years ago they had an agitation for shooting redheads. We were told through the medium of certain writers the redheads now rank next to the mallard, the bluebill. The figures here don't bear it out because where they killed 11,000 mallards, they took 704 redheads and they indicate also the redhead rootstock and

canvasback rootstock are practically shot to pieces. The redheads go through Minnesota when they go south and they have had a field day killing redheads there, until there are not enough to kill.

Just one more statement. These restrictions on the length of the season, on the size of the bag, and on the shooting hours, must be put into effect immediately. Furthermore, considering the slaughter of the Canada goose, I predict right now the Canada goose will be placed temporarily on the protected list possibly for 5 years.

Unless these things are done and unless we survey every water area to see whether or not it is carrying its peak load, peak production load, and get to work on those water areas, then hunting waterfowl will not be perpetuated. It will not even be continued for a period of 15 years.

CHAIRMAN ROWAN: I don't think anybody doubts the urgency of hunting pressure. I was simply saying hunting problems.

MR. WILLIAM VOGT (District of Columbia): If I may, I would like to add a brief comment on some of the international phases of management. At the present time, you can no longer go to Mexico and buy a pair of pintails and canvasbacks for 50 cents. Everyone of the better class restaurants in Mexico, although it is illegal, has ducks openly on the menu, all the hotels, the bankers' clubs, that are frequented by the leading citizens of Mexico City. Most of these birds come from the armadas, which is a stationary battery where the birds are baited in and killed once or twice a week. It is said they are killed as many as 3,000 at a time. The total numerical take at the present time is probably not very serious, but the armadas are being spread over new lakes in Mexico. Markets are expanding, as the tourist trade comes back, there will be more demand for wild ducks in the restaurants and within 10 or 15 years this problem may be a very serious one and the total take of ducks may influence hunting both in the United States and Canada.

I am wondering if this conference is going to draw up resolutions. If it is, I should like to suggest that the Fish and Wildlife Service be asked to make representations through the State Department to the Mexican Government to control the commercialization of the waterfowl. If you are not going to draw up resolutions, I still think an expression of opinion that this should be done would be helpful. There is a very good chance that if under the Migratory Bird Treaty we appeal to the Mexican Government, something would be done. It ought to be done now because the practice is becoming more entrenched. The people who control the armadas and sales are making more and more money out of it and the longer we wait, the harder it is going to be to do something.

I think it is very unlikely that the Mexicans will spontaneously do anything in the immediate future and appeal from the United States might have some influence.

MR. HOCHBAUM: I think it is quite proper we should keep our eyes on Mexico. I think it is quite proper, too, that we should start setting an example ourselves. Batteries may do a lot of damage, but our own lax waterfowl regulations can do just as much. We are far less conservative, for instance, than our neighbors to the north in our waterfowl shooting regulations. When I say lax, I believe that the opening of duck marshes in the northern tier of states from September 20th is an extreme laxity and I think before we start telling Mexico what we think about what they are doing, we should mind our own business first and try to form some international agreement of waterfowl regulations. Our regulations in the United States certainly are far less tight than in Canada and the Canadians I think could say much more about us than we could say about Mexico.

THE CHAUTAUQUA LAKE MUSKELLUNGE: RESEARCH AND MANAGEMENT APPLIED TO A SPORT FISHERY

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The Chautauqua or barred muskellunge (*Esox masquinongy ohiensis*) is a subspecies native to the upper Allegheny River drainage. This fish is most abundant in Chautauqua Lake where it supports one of New York State's important sport fisheries.

Chautauqua Lake is approximately 15 miles long with a maximum width of about 1½ miles. Its total area is 21 square miles. Normal elevation is 1,308 feet above sea level. Although there are several kettle holes reaching a maximum depth of 77 feet, Chautauqua Lake, in general, is a relatively shallow-water lake with a mean depth of 23.5 feet. Dense beds of aquatic vegetation thrive in all areas protected from strong winds.

Following a gradual decline over a period of 40 years, the Chautauqua muskellunge, under special management, has shown an encouraging population increase.

It is the purpose of this paper to present: (1) statistics showing the decline of the muskellunge in Chautauqua Lake, (2) the reasons for the decline, (3) the program of restoration and, (4) the results of the restoration program as reflected in the annual inventory of the spawning population and anglers' catches.

Decline of the Chautauqua muskellunge.—The muskellunge population in Chautauqua Lake has shown a gradual but noticeable decline for a period covering four decades.

In 1904, a hatchery was established on Chautauqua Lake for the propagation of muskellunge. Each spring during the muskellunge spawning season about the same number of pound nets are set in about the same locations and are fished for about the same number of days. The nets capture brood stock. The fish are stripped at the nets, released and the spawn taken to the hatchery for incubation. The number of muskellunge taken in the nets each year furnishes an annual inventory and provides an index of the muskellunge population from year to year. Records go back to 1910 and are presented in Table 1.

For the 10-year period, 1910-1919, the average yearly take was 2,034 muskellunge breeders. From 1920-1929 the average take dropped to 1,615. From 1930-1939, the average dropped to 1,246. In 1940, only 583 muskellunge breeders were taken.

Reasons for the decline.—What caused the decline? A study of the

TABLE 1. TOTAL ANNUAL CATCHES OF MUSKELLUNGE BREEDERS IN CHAUTAUQUA LAKE, 1910-1939, AND AVERAGE YEARLY CATCH FOR EACH 10-YEAR PERIOD

Year	Total catch	Year	Total catch	Year	Total catch
1910	3,101	1920	1,884	1930	1,970
1911	2,395	1921	1,696	1931	1,430
1912	2,100	1922	1,787	1932	1,531
1913	2,126	1923	2,066	1933	1,292
1914	1,045	1924	2,604	1934	1,184
1915	1,871	1925	1,171	1935	1,636
1916	1,623	1926	1,397	1936	1,094
1917	2,060	1927	1,079	1937	656
1918	1,698	1928	1,058	1938	794
1919	2,329	1929	1,409	1939	878
Average	2,034	Average	1,615	Average	1,246

problem indicated that the decline was caused by a combination of a number of factors.

First, the great increase in fishing pressure. The auto brought additional anglers to Chautauqua Lake each season. Power boats and outboards made it easier to fish. More people fished more hours.

At the same time, fishing methods became more efficient. Copperline fishing became popular in the 1930's and succeeded in taking muskellunge from the deep-water areas in midsummer. Formerly, these deep-water areas were virtual sanctuaries during the hot weather of July and August.

Fishing in the late fall with live bait seemed to be especially successful in taking very large fish, the backbone of the brood stock.

Such excellent fishing advertised itself and attracted even more anglers to Chautauqua Lake.

There are also some important biological aspects in the problem. Two unfortunate introductions of fishes were made in Chautauqua Lake years ago, the carp and the calico bass.

The carp is an indirect competitor of the muskellunge. Its habit of uprooting vegetation and rolling the water destroys much of the habitat and forage resources of the muskellunge.

The calico bass, being principally a minnow feeder, is a direct competitor. In recent years, the calico bass population has increased to a high level. This species, therefore, absorbs a large part of the total poundage of fish life which Chautauqua Lake is able to support, a poundage which would be more desirable in muskellunge.

Another important biological factor in the situation is the difference between male and female muskellunge in growth rate and age of sexual maturity.

In Chautauqua Lake, male muskellunge become mature in the third or fourth year at approximately 24 inches in length; females, however, do not become mature until a year or two later, between 25 and 32 inches in length. As the Chautauqua Lake muskellunge population

declined, fewer and fewer mature female fish under 32 inches in length were found in the spawning population.

Under a 24-inch size limit, then in effect, it was apparent that many female muskellunge were being taken by anglers before they had an opportunity to spawn.

Program of restoration.—The drastic depletion of the Chautauqua Lake muskellunge population called for drastic measures. A program of restoration was set up which emphasized: (1) new regulations governing the take, (2) renewed efforts in artificial propagation, and, (3) an over-all research program to correlate all phases of the problem.

It was apparent that "restriction" would have to be the keynote of the restoration program. In order to have *more,* the take would have to be *less,* temporarily, at least.

Provisions of the new regulations.—To limit anglers' catches in order to build up a larger spawning population of muskellunge, the following regulations were put into effect:

1. Muskellunge fishing season was reduced from November 1 to October 15. (Season opens July 1.)

This curtailment eliminated the most successful part of the angling season.

2. The individual angler's catch was reduced to five-a-season with a one-a-day limit.

3. The use of a metal line was prohibited. A 6-foot metal leader was permitted since the conventional cotton or linen is ineffective because of the sharp teeth of muskellunge.

4. The maximum number of hook points per line was limited to six.

5. The legal size limit was increased from 24 to 32 inches, total length.

6. The use of a gaff hook was eliminated. This restriction was included to save many sub-legal fish which have to be returned to the water under a 32-inch size limit.

7. A special muskellunge license was required of all persons, regardless of sex or age, to fish for muskellunge in the waters of Chautauqua (except Lake Erie) and Cattaraugus Counties, the two counties in New York State whose waters contain Chautauqua muskellunge.

The cost of the license is 25 cents. The license was designed, not to produce revenue, but to furnish a method for checking the status of the muskellunge fishing from year to year.

Five numbered seals are given with each license. When a legal-sized fish is caught, a seal must be attached by inserting through the mouth

and gill and locked. A season's fishing is completed when the five seals have been used.

At the close of the fishing season, a report of the season's catch is required. For convenience in reporting, appropriate space is provided on the reverse side of the special muskellunge license.

Propagation.—A hatchery, exclusively for the propagation of muskellunge, has been in operation at Chautauqua Lake since 1904. Until recently, the operations of the hatchery consisted of netting and stripping breeders, hatching eggs and releasing large numbers of fry. For the past few years, there have been some experiments in raising muskellunge to fingerling size.

Since 1940, over 30,000 fingerling muskellunge, ranging from 5 to 10 inches in length, have been liberated. Definite evaluation of this kind of stocking is not yet possible.

Research.—In 1941, when the new muskellunge regulations were put into effect, a research program was also inaugurated.

The two most important features of this phase of the work are: (1) tabulation of the angling statistics furnished by the special muskellunge license, and (2) an analysis of the composition of the muskellunge brood stock in Chautauqua Lake each year.

At spawning time every muskellunge taken in the nets is sexed and measured. The location of the net is recorded. The condition of the sex organs of female fish is noted, i.e., whether the fish is hard, ripe or spent. Just before the fish is returned to the water, a number-bearing metal strap tag is attached to the dorsal fin. During the past 5 years, nearly 6,000 muskellunge have been tagged. Considerable information on growth and migration has accumulated which is not presented in this paper.

Results of the restoration program.—The results of the restoration measures are reflected in: (1) the muskellunge spawning population as indicated by the annual netting inventory, and (2) anglers' catches as furnished by the returns of the special muskellunge license.

Spawning population.—In 1941, only 582 muskellunge breeders were taken in nets during the spawning season (May). In July, with the opening of the fishing season, the new regulations went into effect for the first time. In 1942, the annual inventory recorded 955 breeders. The brood stock increased to 1,418 fish in 1943. In 1944, it increased to 1,790 and in 1945, the number of breeders taken was 1,950. This figure approximates the annual 2,000-fish average take which prevailed during the period (1910-1919) when the Chautauqua muskellunge was most abundant. A summary of the data taken during the annual spawn-taking operations is given in Table 2.

TABLE 2. SUMMARY OF DATA COLLECTED DURING MUSKELLUNGE SPAWN-TAKING OPERATIONS, CHAUTAUQUA LAKE, 1941-1945

	1941	1942	1943	1944	1945
Number of days of netting	20	19	27	23	22
Average number nets fished per day	.....	11.9	11.6	10.8	10.8
Number muskellunge netted during spawning season	582	955	1,418	1,790	1,950
Number male muskellunge	352	672	1,036	1,188	1,428
Percentage of males	65.4	70.4	73.0	66.4	73.2
Number female muskellunge	160	203	330	575	516
Percentage of females	29.8	21.3	23.3	32.1	26.5
Percentage of hard females	.....	27.6	21.2	21.9	5.2
Percentage of ripe females	.....	46.8	44.8	38.8	40.3
Percentage of spent females	.....	25.6	34.0	39.3	54.5
Number immature muskellunge	26	80	52	27	6
Percentage of immature	4.8	8.3	3.7	1.5	0.3
Average total length (inches)—all muskellunge	33.0	29.7	28.5	29.1	29.2
Average total length (inches)—males	31.5	28.3	27.7	27.7	28.0
Average total length (inches)—females	38.8	36.3	32.0	32.4	32.3

Anglers catches. The ultimate objective of this project is to provide better muskellunge fishing. Actual fishing improvement, then, is the final criterion of the success of the project.

In 1941, 817 muskellunge, 32 inches and over, were reported by fishermen. In 1942, the catch increased to 1,512 fish; in 1943, 1,938 fish were taken. In 1944, the total recorded catch was 3,488 fish.

Each year, the average length of the muskellunge taken has been slightly over 35 inches and the average weight approximately 12 pounds.

About 90 per cent of the muskellunge taken by anglers were caught in Chautauqua Lake. The remaining 10 per cent is divided among the other waters in the region where the Chautauqua muskellunge is found.

While it still requires many hours of fishing effort to catch a legal-sized muskellunge (68 hours in 1944), the percentage of successful anglers has increased from 11.6 per cent in 1941 to 26.9 per cent in 1944.

Table 3 presents a summary of the angling statistics furnished by the special muskellunge license.

TABLE 3. SUMMARY OF ANGLING STATISTICS OF CHAUTAUQUA MUSKELLUNGE, 1941-1944

	1941	1942	1943	1944
Number licenses issued	5,057	5,004	4,384	7,269
Number muskellunge caught	817	1,512	1,938	3,488
Average length muskellunge caught (inches)	35.3	35.5	35.3	35.2
Average weight muskellunge caught (pounds)	12	11.8	11.8	11.8
Percentage of muskellunge caught in various waters:				
Chautauqua Lake	89.2	90.4	87.9	90.0
Cassadaga Lakes	4.7	2.8	2.0	1.6
Findley Lake	1.8	2.6	3.4	4.0
Conewango Creek	3.1	1.7	2.9	2.8
All other waters	1.2	2.5	3.8	1.6
Average number hours required to catch a legal muskellunge	168	108	76	68
Percentage of successful anglers	11.6	19.4	23.9	26.9

These figures, however, do not show the full measure of the sport provided. The thrill of catching 28 to 32 inch muskellunge cannot be discounted even though it's illegal to keep them.

In 1944, with a total catch of 3,488 muskellunge averaging 11.8 pounds per fish, the total poundage taken by anglers was 41,158 pounds or over 20 tons. Twenty tons of muskellunge! This is, indeed, tangible evidence that the Chautauqua muskellunge has made a most encouraging recovery from its previous low population level.

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DISCUSSION

MR. VERNE DAVISON (South Carolina): What size is Chautauqua Lake that produced your 41,000 fish?

MR. HEACOX: It is about 13 miles long. Its maximum width is about a mile and a half. In many places it is much narrower. Chautauqua is an old Indian name for bag tied in the middle.

MR. DAVISON: Less than 8,000 acres?

MR. HEACOX: Yes. I am not sure of that. Its maximum depth is about 77 feet, but about 60 per cent of the water is much less than that. The average mean depth is 23.5 feet. It is a very shallow-water lake. It has weed beds, lots of vegetation wherever the prevailing winds are such it doesn't knock it out. It is very rich in food, one of the richest lakes in New York on plankton and on up through the forage fish.

MR. LLOYD SMITH (Minnesota): What role has the hatchery had in this comeback? That is sort of putting one on the spot in the present argument about hatcheries.

MR. HEACOX: Well, I think it is a little obvious on the fry plan. We had a hatchery in 1904; in 1940, the population had decreased under heavy fishing pressure. Fry stocking couldn't meet heavy fishing pressure because of the length of time it takes to produce a legal-sized muskellunge or larger. We are not sure just how this fingerling stocking is going to work out, but there is some hope on that. They have natural food, of course, and are not subjected to artificial food, as are trout, and there is every reason to believe their life span is much more normal than the trout's. Right now we can't evaluate it because we don't have the information. We have only been raising them 5 years on a production basis.

MR. SMITH: Are you marking any of these fingerlings by fin clipping or tagging or any other scheme?

MR. HEACOX: Yes.

MR. SMITH: Have you had any returns on your spawning?

Mr. HEACOX: Last year we tagged for the first time and there have been some sporadic attempts to fin-clip, but no definite information is available on that. This project will continue. It is one of these things you get into and you find you need just so much more information all the time. It has been going 5 years. I suspect it will be going another 5, maybe 10.

MR. BRUCE F. BRADLEY (Ontario, Canada): If planting of fingerlings was discontinued for 5 consecutive years in that lake, would you care to hazard an estimate as to how the population would show up in that lake? What I am trying to get at is this: Are the regulations more important than the propagation? How important is the artificial planting of game fish in waters?

MR. HEACOX: That covers the whole field. Personally, I feel that the regulations, based on previous study and research, are a story in themselves, how those regulations are put into effect. There was a tremendous background of research and study in order to come up with the right answer; so I think their management and regulation has been the important thing. However, there is a great deal of natural spawning there, judging just from the number of spent female fish we pick up in the nets. There are many more eggs produced on that sort of a check (I mean you figure the spent fish has already spawned) than we take in the hatchery—not many more, but it is almost equal there. When you get in this other field of stocking in general, I think probably in the next few years with all the boys back, you are going to see some information on a lot of projects. I am familiar with one that has been going on even during the war, based on that, to find out just what happens to hatchery fish, trout in this particular case, of different sizes, different plantings for home spawning, and so forth. I know a lot of the other workers in the field are also engaged in all sorts of projects. I would hate to hazard a guess on the trout situation right now.

MR. DAVISON: May I make one more suggestion? If you would add to your figures the poundage of fish harvested per acre, we might compare it with all the other types of spawn management we are working with. For instance, it appears that you have gotten down to about as low as 1 pound of fish per acre, maybe you are back up to 10 pounds of fish annually and that seems to be a better comparative figure than we have used in the past. Would that be a sensible addition to your figures—when one is working with special areas and special forms of fish?

MR. HEACOX: Yes, I think so; you will have to take into account the tremendous poundage of fish in Chautauqua Lake. We have no record. It is through special licenses we are able to get that and the spawning count. To take the tremendous poundage of calico bass that lake produces, it is also very good for smallmouth bass and bullheads. It is a tremendous fishery in that lake. You have all those miscellaneous species; besides that the poundage may be even more in some cases. But in general, I think the trend from year to year would be a good index, except I think you will find as the muskellunge population increases in poundage, some of the fish, especially competitive species, may drop down in both pounds and numbers.

FISH POPULATIONS IN UNMANAGED IMPOUNDMENTS

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Notwithstanding the fact that the Missouri Conservation Commission has completely adequate facilities for stocking new impoundments with suitable fish, even under the much accelerated pond-building program, a large number of new ponds are being indiscriminately and improperly stocked, resulting in failure to produce, on a sustained basis, fish suitable for sport or food. The fish for such stocking purposes often are obtained with hook and line or with seine from a neighbor's pond or a nearby creek. Usually persons who stock in this way give no thought to suitability of fish species, and usually feel that the more fish taken for planting, the better. Some few owners do not stock at all, but let fish be introduced in whatever manner comes to pass.

Quite often these ponds furnish good hook-and-line fishing for a year or two, but the owners report the quality of fishing rapidly declining as the pond ages, until fishing activity is discontinued except for casual visits by fishermen or small boys during the season when fishing fever runs high. As interest declines, the pond receives little attention from the owner. Dams become impaired, water weeds may flourish, or cattle, given access, wade the water or trample the banks.

In the vicinity of Columbia, Missouri, are a great number of ponds of various ages. Some were constructed in the past century, while others date from more recent times. For most of these there are no records of fish plantings, except verbal reports given by the owner or some local resident. To learn of the condition of fish populations in such indiscriminately stocked and unmanaged ponds, the Missouri Conservation Commission selected a group of 30 such ponds for investigation.

These ponds are located on private lands, on stock farms, and on the University of Missouri agricultural farm. They range in minimum age from 5 years to 73 years, in area from 0.06 acre to 1.45 acres, and in depth from 3.5 feet to 15 feet. They have never been managed except that a few are fenced to exclude livestock.

The study began by surveying, sounding, and mapping each pond. After the shoreline was mapped, the depth contours were established from depth soundings. The acreage of each pond was computed by planimeter, and the volume obtained by finding the area within each depth contour. Fish populations were removed during 1944

and 1945 by draining or by poisoning with rotenone (Cube Root warranted 5.6 per cent rotenone). This was used at the rate of from one to five parts per million of water by weight, the amount varying according to the length of time the rotenone had been in storage (Leonard, 1938) and the temperature of the water. In deeper ponds, or where weed growth or underwater muskrat dens and excavations were present, the amount of rotenone was increased to assure complete kill. Of the 30 ponds, 28 were poisoned and 2 were drained.

The poison was applied in a thin paste consistency by casting it over the open water and stirring it into weedy areas or underwater muskrat dens. The lapse of time for the reaction of the fish to the poison varied with the temperature of the water and the kinds and sizes of fish. When green sunfish and black bullheads were present, first the small and then the larger green sunfish surfaced, followed by the small and then the larger bullheads. Within a few hours the majority of green sunfish were dead but bullheads floundered or gasped at the surface for hours longer. Several large bullheads, in 65° F. to 68° F. water, still struggled at the end of 25 hours.

The fish were retrieved with dip-nets and by hand as soon as sufficient numbers were concentrated along the pond banks. If a wind prevailed, often the fish concentrated in a zone several feet wide along the leeward shore. Retrieving continued at intervals of two or three trips daily until about the end of the third day when no more fish were taken. In each pond the species were identified and observations were made on the sizes of fish, as well as the condition of the population. In nine of the ponds where weed-growth, character of shore line, or weather permitted, the entire fish population was retrieved. The fish of each species were counted and the individuals of edible size or condition sorted out.

It was found, when the poisoning or draining of the ponds was completed, that 24 ponds contained fish, and 6 did not. Of the 10 species of fish represented, 6 were hook-and-line species and 4 were forage species, occurring either singly or in various combinations. Only one pond had as many as four species, in which case one of these was a forage minnow.

Ten ponds were inhabited by only one species, eight ponds contained two species, and six ponds had three species. In six instances a species was represented in a pond by one or two large adult fish. These are shown in Table 1. Also shown in this table are seven instances of a few adults of blunt-nosed minnow (*Hyborhynchus notatus* Rafinesque), goldfish (*Carissius auratus* [Linnaeus]), blackheaded minnow (*Pimephales promelas* Rafinesque), red-fin shiner (*Notropis*

TABLE 1. PHYSICAL CHARACTERISTICS AND FISH SPECIES OF 30 PONDS

Pond	Minimum age (years)	Area (acres)	Maximum depth (feet)	Fish present					Number hook-and-line species present
				Green sunfish	Black bullhead	Black crappie	White crappie	Other species	
University No. 1	16	0.25	5.5		x			Blunt-nose minnow Goldfish	1
University No. 2	16	0.16	4.5	x					1
University No. 3	12	0.69	8.5	x	x	x		Blackheaded minnow	3
University No. 4	10	0.59	9.0	x	x			Blackheaded minnow	2
University No. 5	6	0.85	11.0	x	x			Red-fin shiner Blackheaded minnow	2
University No. 6	10	0.27	8.0						0
University No. 7	8	0.41	8.0						0
University No. 8	8	0.32	8.5				x		1
University No. 9	7	1.06	14.5	x	x			1 yellow bullhead	3
University No. 10	7	1.45	14.0	x	x				2
University No. 11	5	0.13	4.5						0
University No. 14	20	0.06	4.5	x					1
University No. 15	18	0.08	4.5	x					1
Bass No. 1	40	0.49	4.0	x					1
Bass No. 2	40	0.12	3.5	x	x				2
Bass No. 3	8	0.17	7.0						0
Bass No. 4	6	0.51	10.5	x	x		2 specimens		3
Nitong No. 0	45	0.14	4.0						0
Nitong No. 1	45	0.43	6.0	x	x	x			3
Nitong No. 2	59	0.27	4.0	x	2 specimens		x		3
Nifong No. 3	50	0.19	3.5						0
Nitong No. 5	48	0.16	4.0		x				1
Nifong No. 6	50	0.15	4.5	x			x		2
Shepard No. 2	13	0.76	15.0	1 specimen			x	Red-fin shiner	2
Shepard No. 4	46	0.29	4.0	x	x				2
Trimble No. 1	19	0.30	4.0	2 specimens	1 specimen			Orange-spotted sunfish	3
Woolfolk No. 1	73	0.37	4.5	x	x				2
Middlebush No. 1	56	0.41	6.5	x					1
Middlebush No. 2	56	0.26	3.5		x				1
Hall No. 1	17	0.11	4.0	x					1

lutrensis [Baird and Girard]), occurring along with the hook-and-line fish.

The green sunfish (*Lepomis cyanellus* Rafinesque), occurring most frequently of any fish, either alone or in combination, was found in 20 of the 24 ponds. It occurred alone in six ponds. The species next in frequency of occurrence was the black bullhead (*Ameiurus melas* Rafinesque) found in 15 ponds, in 3 of which it was alone. Black crappie (*Pomoxis nigro-maculatus* Le Sueur) were found alone in one of the five ponds in which they occurred. White crappie (*Pomoxis annularis* Rafinesque) were found in two ponds, and orange-spotted sunfish (*Lepomis humilis* Girard) were represented in one pond. A single specimen of yellow bullhead (*Ameiurus natalis* Le Sueur) was found in one pond which was reportedly stocked by fishermen from creek seining shortly before the poisoning.

The presence of but one or two large specimens probably can be accounted for as chance introductions of specimens of the same sex or as survivors of the species. Bennett in his studies of Illinois lakes has noted that nearly always the few survivors of a species in a lake habitat are large, healthy individuals. The single green sunfish found with the crappie in Shepard Pond No. 2 was a survivor of the species, as indicated by the good catches of green sunfish from this pond only a few years previous. The catch of numerous bullheads in former years from Nifong Pond No. 2 indicates the two adult specimens of black bullheads were survivors of the population. The small numbers of adult minnows of the species most commonly found in local creeks suggest their introduction by live-bait fishermen.

No pond studied contained black bass or other suitable predators although reliable reports were received of formerly good catches of largemouthed bass (*Huro salmoides* [Lacepede]) from Shepard Pond No. 2. Evidently the bass had been overwhelmed and crowded out by the crappie, as sometimes is true of bluegill with bass (Swingle and Smith, 1942). The largest fish in any of the 24 ponds was a lone black bullhead weighing 3 pounds, 1 ounce, from Trimble Pond No. 1. Other than the two adult green sunfish, also occurring in this pond, the populations consisted of a myriad of orange-spotted sunfish.

In a group of nine ponds the fish were completely harvested and count and weight made by species. The study also included a count and an examination of edible-sized fish. The term "edible-sized" can be controversial when definition is attempted without considering the condition factor. Fortunately, in the case of these ponds most of the fish were so stunted and poor, or so large and healthy, that there was no question of which were or were not of harvestable size or suitable

condition for sport or food. In nearly all instances the fish of edible size were conspicuously apparent. For instance, in University Pond No. 3 (Table 2) the three bullheads weighing 3.94 pounds in aggregate, as compared to the total weight of 1.5 pounds for a random sample of 25 bullheads, show the great difference between the edible and the nonedible size.

Likewise, the one harvestable white crappie weighed 2.75 pounds as compared to the other crappies, an example of which is a specimen 6.2 inches in length, weighing 0.75 ounce.

In the case of University Pond No. 1 (Table 2) there are listed 50 black bullheads suitable for sport or food. These, with a minimum length of 8 inches and an average weight of 3.1 ounces, were the largest of the population. Fish of similar size and condition are commonly used as food by local hook-and-line fishermen; hence these bullheads were considered to be of edible size and condition in this instance.

In University Pond No. 8 (Table 2) there was a greater percentage of large fish than in any of the other ponds. This condition existed as a result of a planting of black crappies seined from a nearby pond by a local resident. Other than the 30 large crappie weighing 21.75 pounds, there were two size groups of smaller fish coinciding with two age groups of one and two years, as ascertained by reading of scales. This bears out the report by a local resident that the fish were introduced previous to the spawning season of 1943. One can only conjecture what the ultimate fate of this population would have been had it remained in the pond.

University Pond No. 3 and Bass Pond No. 2 (Table 2) carried the largest rate-per-acre load of fish, both in number and in weight, yet the numbers of harvestable fish in these ponds were only 4 in the former, and 13 in the latter. The total poundage rate per acre, 545.9 pounds for the former, and 536.0 pounds for the latter, agrees quite satisfactorily with crops from Illinois ponds (Bennett, 1943), but the number of harvestable fish was very small. Bass Pond No. 2, with a population of 2,929, was carrying a load at the rate of 24,408 fish per acre. Regardless of whether a pond had one, two, or three species, there was evident the same small number of harvestable fish.

A summary of the harvest of nine ponds, the number and weight of fish by species, the rate of pounds and numbers of fish per acre, the average weight of fish, and the number of edible-sized or harvestable fish is shown in Table 2. In this total water area of 3.31 acres, having a population of 26,685 fish, weighing 1,051.12 pounds, the average weight per fish was 0.039 pound. Of the 26,685 fish, only 119 were considered to be of edible size or condition.

TABLE 2. SPECIES COMPOSITION AND PRODUCTION OF FISH IN NINE PONDS

Pond	Green sunfish		Black bullhead		White crappie		Black crappie		Total		Rate per acre		Average weight	Edible-sized fish	
	Number	Weight pounds	Number	Weight pounds	Number	Weight pounds	Number	Weight pounds	Number	Weight pounds	Number	Weight pounds	Pounds	Number	Weight pounds
University No. 1			628	69.63					628	69.63	2,512.0	278.5	0.110	51[1]	10.0
University No. 3	2,061	75.13	6,218	246.88	699	54.69			8,978	376.70	13,011.0	545.9	0.041	3[1]	3.94
														1[2]	2.75
University No. 4	5,175	113.00	2	2.94					5,177	115.94	8,774.5	196.5	0.022	2[1]	2.94
University No. 8							371	35.88	371	35.88	1,159.3	112.1	0.096	30[3]	21.75
Bass No. 1	3,619	168.38							3,619	168.38	7,385.7	343.6	0.046	14[4]	8.75
Bass No. 2	1,215	28.38	1,714	35.94					2,929	64.32	24,408.3	536.0	0.021	5[1]	3.75
														8[4]	1.63
Nifong No. 1	722	24.00	2,167	82.06	53	4.63			2,942	110.69	6,841.9	257.4	0.037	3[1]	3.00
Nifong No. 2	908	45.13	2	2.19			116	17.38	1,026	64.70	3,800.0	239.6	0.063	2[1]	2.19
Nifong No. 6	730	23.25					285	21.63	1,015	44.88	6,766.7	299.2	0.044	.....	.....
Totals	14,430	477.27	10,731	439.64	752	59.32	772	74.89	26,685	1,051.12	8,061.9	317.5	0.039	119	60.70

[1]Black bullhead. [2]White crappie. [3]Black crappie. [4]Green sunfish.

The absence of predator species in these ponds and the evident overpopulation, with resultant stunting, parallel findings from other pond studies in states where sunfishes and bullheads are dominant (Ricker, 1942). When the pounds of fish per acre are used as a criterion of success of production rather than the pounds of usable fish, these ponds show an impressive figure. But only 5.77 per cent of the total crop by weight was usable, as compared to as high as 81 per cent usable fish found in managed ponds in Alabama (Swingle and Smith, 1940).

These 30 Missouri ponds indiscriminately stocked and unmanaged sustain a fish population high in numbers, normal in total pounds per acre, but the small number of edible-sized fish found indicates that Missouri ponds under such conditions, including the absence of suitable predator species, cannot be expected to produce, on a sustained basis, fish suitable for food or sport.

SUMMARY

Fish were present in 24 of the 30 ponds studied. Of these, six were hook-and-line species, and four were forage species. No predator species occurred in any of the ponds.

The green sunfish, occurring either singly or in combination with other species, was found in 20 ponds. The black bullhead was found in 15 ponds, the black crappie in 5, and the white crappie in 2.

One pond contained a pure population of orange-spotted sunfish, except for two green sunfish and one specimen of black bullhead, which weighed 3 pounds, 1 ounce.

Other species occurring infrequently were: yellow bullhead, goldfish, blunt-nosed minnow, blackhead minnow, and red-fin shiner.

Only 0.44 of 1 per cent by number and 5.77 per cent by weight of the total crop of 26,685 fishes, weighing 1,051.12 pounds, in a representative group of nine ponds, with a total area of 3.31 acres, were suitable for hook-and-line fishing or table use.

All species occurring either singly or in various combinations failed to produce satisfactorily for sport or food.

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DISCUSSION

CAPTAIN EARL S. HEALD (Florida): You mention that you are using a poison, that you had quite an accumulation of dead fish on the downwind side of the lake. We have been conducting a series of tests on the effects of DDT distributed by means of aircraft on pond-fish population, and we found that same thing. We have attributed it to the fact that the DDT drifted on the downward shore by the action of both waves and wind. Do you attribute your results here to the same thing, or has the rotenone been pushed over to that side of the lake, or is it evenly distributed throughout the lake?

MR. BAUMAN: No, the fish, when first affected, come to the surface and struggle and gasp with their mouths nearly out of the water and their tails hanging at about a 45° angle. That subjects them to the action of the waves, and the waves boost them along until it piles them up.

MR. DOUGLAS E. WADE (New Hampshire): Up at Hanover, New Hampshire, we have a new proposed dam going on the Connecticut River. It is a hydro-electric proposition and sponsored through private agencies.

I was present last year at the hearings held in conjunction with this new proposed dam which would raise the water level of the Connecticut River from the present stage to an additional 20 feet or so. During the hearings, it came out that the hydro-electric company sponsoring said dam was willing to make financial or physical adjustments on damages done to such items as roads, telegraph and telephone lines, sewage outlets. So, using that as an opening, I got in and testified and asked a rhetorical question, why, if the hydro-electric companies could make these adjustments, both physical and financial, couldn't they make physical and financial adjustments on the damage to natural streams.

It works out that way in New Hampshire which, as you probably know, is a small state and has a small Fish and Game Department very poorly financed. If they were to undertake a long-term program of research on this water that would be backed up by the proposed dam, they just couldn't do it. They don't have the funds and they don't have the personnel. It was my contention that the hydro-electric company should underwrite some of the cost for a 10-year study on the impounded waters, particularly in this one instance. It was a new innovation, I think, in the thinking of the hydro-electric people to be subjected to this rhetorical question and it had three results. Of course, it was rejected, but it made the hydro-electric people a little bit worried because the $90,000 or so estimated for a 10-year study meant that they would have to dig down into their profits and support the project.

I bring this up because I think there are a good many similar instances throughout the country where all of us can do a similar bit of propaganda work, if you wish to call it that. It may click in some instances, and once the precedent has been set, the hydro-electric companies, the private ones, now can help foot the bill and help us do a much better job in the management of impounded waters.

ADVANCEMENTS IN WILDLIFE MANAGEMENT ON INDIAN LANDS

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In 1941, the U. S. Fish and Wildlife Service was given the responsibility of carrying out wildlife research on Indian lands. Since that time, biologists of this Service have been making surveys of the major reservations and working toward a better appreciation and understanding of wildlife management problems on these lands. This work has been done under the Interior Department interbureau agreement of August 7, 1941, between the Office of Indian Affairs, the Indian tribes and the Fish and Wildlife Service. Their problems have been approached by studying the animals as well as by acquiring a knowledge of the Indians' concept of wildlife as a utility rather than as recreation. This paper summarizes the accomplishments that have been made in assisting the various tribes in the Lake States and the Dakotas in managing their wildlife resources. In this area there are approximately 8 million acres of Indian land with a population of some 75,000 Indians.

Until recently the animal population has been on a downward trend on many reservations in this area. This has been due to an unwillingness on the part of the Indians to restrict themselves in harvesting their wildlife crops and to their lack of concern in planning for the future. Since the passage of the Indian Reorganization Act of 1934, the tribes which accepted its provisions are becoming more self-governed than previously. Hence, they have been able to formulate constitutions and by-laws which give them the power to set up restrictive regulations for managing their wildlife. Due to the fear of losing their ancient trapping, hunting, and fishing rights, progress in inaugurating game ordinances has been slow. However, progress has been made during the past 4 years in changing this concept. While only eight tribal councils have adopted game ordinances to date, these are in effect on approximately 6 million acres or 75 per cent of the Indian land in this region. These ordinances are concerned chiefly with the actions of non-Indians on Indian lands, but they also contain limited provisions respecting the conservation of wildlife by Indians. On many reservations, ordinances would be ineffective due to their small size or to the scattered nature of the land ownership. State game laws are in effect on the large proportion of such areas that is under non-Indian ownership.

Education in wildlife conservation.—When the work on Indian lands was initiated, education in wildlife conservation was recognized to be of basic importance in establishing plans for future wildlife management. In carrying out this program, much attention has been given to visual education through the use of movie films. This visual aid was made possible through cooperative agreements between the conservation departments of Minnesota and Wisconsin, the South Dakota A. and M. College and the U. S. Fish and Wildlife Service. Approximately 300 showings have been made in 19 school systems to approximately 51,000 students and adults. Special movies of wildlife-conservation projects on Indian lands have also been taken during the past 4 years. Films will be prepared from this photographic material for demonstrating the progress made by Indians in wildlife management. Prepared film strips on conservation subjects have also been furnished to schools.

Advantage was also taken of every opportunity to present talks to students and adults and to assist school superintendents in organizing courses of study. Lists of books were prepared for classroom use and for libraries and copies of some of the better books were circulated in the schools. Special teaching aid outlines were also supplied to the schools. Since published material from the Indian conservation viewpoint was very limited, a wildlife reader was prepared by one of the Indian school teachers. This reader is now being used in a number of the reservation schools.

To stimulate more interest in wildlife conservation, one of the schools carried on a pheasant-rearing project while another operated a fish rearing pond. Among the adults, a sportsmen's club has been organized and there are prospects that other groups will do likewise.

Big game.—Although it is generally assumed that Indian reservations have been depleted of their big game, this is not true in all cases. Recent surveys on the more important reservations in this region indicate a total big game population of approximately 12,130. This total includes the following species: white-tailed deer, 10,500; mule deer, 370; moose, 80; elk, 80; antelope, 300; and the black bear, 800.

On the Rosebud Reservation in South Dakota, protection against hunting has made it possible for the deer to increase at a rapid rate. A regulated open season was possible for the first time in the fall of 1944. During that season 32 Indians purchased tribal licenses and in spite of unfavorable weather, they bagged 23 buck deer. The younger men were very enthusiastic about the hunt but the older

ones felt that the license fee entitled them to a deer regardless of how or when they got it. This is another example to show that the younger Indians are beginning to think of wildlife in terms of sport while the older individuals still cling to the concept of game as a utility.

White-tailed deer on the Cheyenne River Reservation in South Dakota have been protected since 1937. In 1942, the herd was estimated at 90 and at 200 in 1945. Within a few years it will be possible to have an open season there under a permit system.

The deer herd on the Grand Portage Reservation in Minnesota has been estimated at about 400 during the past few years and it has only been necessary to provide protection for them during the summer months. Non-Indians are also permitted to hunt on this reservation during the regular state seasons provided they obtain a permit from the tribal council and reside at the Indian lodge.

Antelope on the Cheyenne River Reservation have been protected since 1937 and this herd has been on the increase since that time. In 1942, the population was estimated at 200, while in 1945 it was believed to have increased to about 250. Seventy-five per cent of this reservation is suitable for antelope, and the range will support between 1,500 and 2,000 animals, provided the carrying capacity of the reservation is not exceeded by the combined stocking with domestic animals and wildlife. When that population of antelope is reached, it will be possible to have a limited annual harvest. Several small bands of antelope occur on the Standing Rock and Fort Berthold Reservations in North Dakota, but they are unprotected at the present time.

Black bear occur in fair numbers on most of the reservations in the Lake States and the present population is estimated at 800. Since most Indians do not utilize bear to any great extent, there appears to be little need of giving them much additional protection.

Eighty elk have been estimated for the Dakota reservations but most of these are under fence. Future management of this species on Indian reservations does not hold much promise, because of the comparative scarcity of suitable environment, and the likelihood of interference with farming.

An estimated moose population of 80 animals occurs on the Grand Portage, Nett Lake, and Red Lake Reservations in Minnesota although they are given practically no protection at the present time. There appears to be little chance of increasing this population as moose in similar areas in northern Minnesota which have been given complete protection have not shown an increase.

Fish.—By nature, Indians do very little sport fishing themselves, but they do derive considerable income from the sale of special licenses and by serving as guides. On the Menominee Reservation in Wisconsin, where stream trout fishing is considered the finest in the state, a sizable income is derived from selling special licenses.

On a number of reservations in Minnesota and Wisconsin, which are located in the heart of the tourist country, Indians also receive considerable income from serving as guides during the summer months. Since many of them realize that this work is dependent on good fishing, the services of biologists of the Fish and Wildlife Service have been requested to advise them on their fishery problems. Biological surveys of the important waters in the Lac du Flambeau Reservation in Wisconsin are now underway. Fish parasite investigations on some of the Menominee Reservation lakes have also been started.

At the Red Lake Reservation in Minnesota, a large commercial fishery is operated and managed by Indians. Prior to the war they were removing approximately 650,000 pounds of game fish annually. This take was well below the limits of productivity of the lake, hence the annual catch was increased to one million pounds of game fish during the war. Whether the lake can continue to produce under this pressure remains to be seen but as yet no evidence of depletion has been noted. In addition to the game fish, approximately 250,000 pounds of rough fish have been removed annually. In harvesting the fish, restrictions are set up as to size of mesh and footage of nets that can be used. At the present time the entire income on this reservation is derived from fishing, trapping, and timber. Within a few years the mature timber supply will be so depleted that the Indians will have to depend largely on wildlife and subsistence farms for their support until a second timber crop is ready for harvesting. Some commercial fishing is also carried on by Indians living on reservations on the shores of Lake Superior. This fishing is done entirely under state regulations.

Small game.—Upland game birds, waterfowl, and small game mammals are hunted very little by Indians. Interest in hunting them is lacking because the amount of food received does not compensate them for the effort and expense involved. As a result of this lack of hunting pressure, small game is plentiful in many reservations in this region. This abundance has attracted non-Indian hunters and the increased hunting pressure brought on by them is forcing the Indians to realize that they must manage these species even though they do not utilize them themselves. Here again the Indians'

concept of wildlife as a utility and not as a source of recreation is clearly demonstrated.

Fur bearers.—The most successful approach for getting action programs started in wildlife conservation has been through the medium of the fur-bearing animals. Interest in them is paramount because the pelts produce an economic return and the carcasses of many can be utilized for food. All species of fur bearers are trapped, but from the standpoint of greatest monetary returns, the muskrat and beaver are the most important.

In general, Indians are poor trappers and are very careless with pelt preparation. This is contrary to the general impression that they are "naturals" in this field. Three factors have been responsible for this situation: a lack of suitable equipment for trapping and pelt preparation; an insufficient knowledge of trapping and pelt preparation techniques; and a natural tendency to do things the easiest possible way.

The trapping seasons on many reservations starts in August and closes as late as June. The late season catches resulted in the taking of a high percentage of pregnant females and most of the early caught animals had unprime pelts of small size and of low quality.

Most animals were obtained by those methods requiring the least amount of effort. In some instances this meant they were taken either by spearing, shooting, or trapping. When traps were used, the common practice was to run long lines and to make infrequent visits to them. Oftentimes, dogs were used as aids in catching fur bearers, especially mink.

Before instructions were given, the care of the pelts was inferior to those prepared by non-Indians. Very little fleshing was done, and as a result much fat and flesh were left on the skins. Poorly-constructed stretchers of varied sizes and shapes were also used and improper drying methods were practiced. Small, unprime, and poorly-prepared pelts have been responsible for the low prices. This fact, coupled with the Indian's desire to get cash immediately for his pelts, has made him the victim of unscrupulous fur buyers.

Beaver. On the Cheyenne, Rosebud, and Pine Ridge Reservations in South Dakota, a system of regulating the beaver take has been in effect during the past 4 years. Under the permit systems adopted, the beavers have increased to the level where they can be harvested in comparatively large numbers on a sustained yield basis. The Cheyenne River method will be discussed here as it represents the best of the three systems followed.

The tribal council on the Cheyenne Reservation issued 49 paid permits during the 1940-41 trapping season and 137 beavers were harvested. The number allowed each permittee was unlimited. In the 1941-42 season 49 permits were issued and 128 animals were trapped although only 5 were allowed per person. Under the same regulations 117 were taken by 63 permit holders in the 1942-43 season. However, more drastic regulations were put into effect the following season when only one permit was allowed per household. During that season, 53 permits were issued and 163 beavers were trapped. Under the same restrictions in the 1944-45 season 69 permits were issued and 193 beavers were taken. Accurate records of the annual beaver harvest for the past four seasons have been possible because all skins must have state metal tags affixed by Indian Service or tribal council officers before they can be legalized. When they are tagged an exact record of where they were trappd is obtained. These records have made it possible to mark the annual catches on a map and determine where the greatest beaver production is taking place. Areas that are not holding up can be detected and closed to trapping if necessary. This regulated beaver cropping system is undoubtedly one of the best yet devised and has the following advantages: (1) reduces the sale of illegal furs to a minimum; (2) brings a better financial return to the Indians; and (3) provides an excellent system for recording the distribution of the catch.

Grand Portage in Minnesota has inaugurated a closed season on beavers for a 5-year period. Beavers have been restocked in the depleted parts of the reservation from outside sources or have been transplanted from areas of abundance within the reservation. Within a few years a managed beaver trapping program will become effective on this area.

Muskrat. On the Bad River Reservation in northern Wisconsin, a muskrat management project, known as the Bad River Muskrat Enterprise, has been in operation since the fall of 1942. This enterprise is patterned after the well-known muskrat projects near The Pas in Manitoba, Canada. The entire 10,000-acre marsh of this project was closed to trapping in December 1942, when it had a population of approximately 5,000 animals and was opened to trapping for the first time in November 1944, with an estimated 20,000 population. Under a 50-50 share-cropping system only 1,500 muskrats were taken during the 1944-45 season because of the shortage of trappers caused by the war. Approximately 2,400 have been trapped to date during the present open season.

Under the plan of operation, the marsh is divided into areas and the trappers either choose an area or draw lots if others want the same place. Catch and grade records are also kept for each one of these units. Most of the traps used are of the "stop-loss" type which makes it possible to reduce losses by "wringing-off" to a minimum.

All of the trapped animals are brought to a centrally-located fur house where they are skinned, fleshed, and dried. This makes it possible to give close supervision to all of the operations performed and high quality pelts result. Excess fat and flesh are removed from the pelts by placing them on fleshing boards and scraping them with a dull knife. For shaping and drying, the pelts are placed on uniformly-shaped wire stretchers which are provided by the enterprise. A receipt is issued for the daily catch when the pelts are turned in for drying. They are then brought to the adjoining drying room and hung up on separate drying lines, the number of which corresponds with the trapping area. After the pelts have dried slowly for about one week, they are removed from the stretchers, perforated with a fur marker, and graded. The furs are graded weekly and the trappers are then paid according to current market prices.

They are then baled and shipped to a fur auction company to be sold. Muskrat furs that are now reaching the market from this enterprise are considered to be among the finest in the country.

On the Turtle Mountain Reservation in North Dakota, the tribal council, through its sales association, has been buying fur from Indian trappers since the fall of 1944. The plan followed is to pay the local market price for furs and to sell them for more money in large lots through auction companies. All profits made are returned to the trapper on the basis of the number of pelts sold.

"Stop-loss" traps and wire stretchers are now being used by most of the muskrat trappers. Numerous demonstrations on proper trapping and pelt preparation have resulted in good quality skins now coming from the Turtle Mountain area.

CONCLUSION

Substantial progress has been made in the management of the wildlife resources on 8 million acres of Indian lands in the Dakotas and Lake States during the past 4 years, but much work still remains to be done. Due to the Indians' concept of wildlife as a utility rather than as a source of recreation, the greatest interest has been shown in the management of their fur-bearing animals. Regulated seasons, fur enterprises, marketing cooperatives, and re-

stocking programs are all examples of the advancements made in fur management on these lands. Conservation through visual education has been well received by both school children and adults. A sequence to this program should be adoption of a standardized course in conservation education for the children and an extension program for the adults. Game regulations are now in effect on a number of reservations, but there are still many where no conservation practices are being followed.

IMPLICATIONS OF A GOOSE CONCENTRATION

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Since the Fish and Wildlife Service has made so much progress in developing a far-reaching and effective system of refuges for migratory waterfowl, many of us have been lulled into a feeling of false security. We seem to forget that a species, or at least a large population of a species, can still be endangered. Yet this seems to be happening to the Canada goose at Horse Shoe Lake in Illinois.

From time immemorial nearly all the Canada geese moving southward in the Mississippi Valley have been funneled between the converging Ohio and Mississippi Rivers. Here lies the southern tip of Illinois, Alexander County, with cotton fields, cypress swamps, and sycamores bristling with mistletoe. Here too is the northern extremity of the traditional wintering ground of the Canada geese of the Mississippi Flyway. Old men still living in this region recall how the "honkers" shifted north or south along the river with each change in the weather. From the safety of the bars and islands the geese "worked out" widely in search of food and remained mobile, adaptable, and wild. During some winters they subsisted on bark browsed from willow shoots. But they always held their own, even though they were hunted through the fall, winter, and spring.

In 1927, the Illinois Conservation Department purchased a small area, 1,400 acres of land surrounded by an equal area of cypress swamp, formerly an oxbow of the Mississippi. A dam was built and the swamp transformed into Horse Shoe Lake. On the land, now actually an island in the lake, corn and winter wheat were planted to attract the geese. At first they came only to feed, returning to the river for gravel and to spend the night. But gradually they came to spend more and more time on the refuge; gravel was provided for them, and the concentration of the geese on this small

area increased each year. Most of the birds no longer flew the 3 miles to the river at night, but merely walked to the surrounding lake.

By 1941, one could see high-flying wedges of Canada geese coming from the northeast in early October, could see them circle just once above the green wheat fields of the refuge and could hear the tone and tempo of their honking rise before they pitched and "maple-leafed" to earth. Here they stayed, a little shy for the first few days, but soon confident enough to permit trucks, tractors, and people on foot to approach within 40 yards. Visitors found it hard to believe that these were wild, migratory geese. The extreme tameness exhibited by Horse Shoe Lake geese, I believe, is due not only to the constant presence of many human beings in their midst, giving them a false confidence in man, but also to the "safety-in-numbers" feeling resulting from the tremendous size of the concentration. When thousands of geese congregate, there seems to be a mob psychology making them oblivious to danger on the refuge or in its vicinity.

Horse Shoe Lake Refuge is not unique. By means of corn and live decoys man has been able to manipulate the movements of Canada geese in many places. Jack Miner enticed them from Lake Erie to his little artificial pond in Ontario; concentrations of several thousand were built up at Mayowood near Rochester, Minnesota, at the Logan farm south of Bath, Illinois, on the Rock Prairie in southern Wisconsin, and at the Bass farm in central Missouri.

The effects of these refuges have been diverse. Private enterprises such as those undertaken in Ontario and Minnsota have brought problems of subsidy for feed, and the fear of what might happen if feeding were discontinued. On public areas the kill has increased tremendously. The land surrounding Horse Shoe Lake was rapidly developed for goose shooting and dozens of commercial clubs were established. Concealed pits were dug as close to one another as state laws permitted, row on row of them, staggered so as to prevent geese from leaving the refuge without meeting a barrage of cross fire. Eleven thousand acres in the vicinity of the 3,000-acre refuge were developed in this manner and the total number of pits dug reached 487. Hunting pressure rose rapidly. In 1934, only a few hundred men came to Horse Shoe Lake to shoot; 10 years later there were nearly 5,000. The kill at one "club" increased from 400 birds in 1933 to 2,500 birds in 1939; at another it rose from 300 in 1936 to 3,000 four years later. The news spread rapidly. It was easy to get a limit at Horse Shoe Lake and you

didn't have to undergo any discomfort in getting it. The club owners met their patrons in Cairo and for $10.00 drove them to the club houses, then to the pits, brought them hot lunches, and came after them when they had got their limits. As soon as a man in the front line of pits had shot his geese another moved up from the second row. It was all quite legal, yet it looked as though our geese were being sold for $10.00 a pair.

By 1939, the wintering population at Horse Shoe Lake had increased to about 50,000 birds. This was a poor year for corn and wheat. The birds poured out of the refuge twice daily in search of food and over 17,000 were killed or crippled. The next year the shooting season was extended from 45 to 60 days! Better crops helped to hold the birds on the refuge but more than 13,000 were killed. By 1943, the shortage of gasoline and shells was a universal complaint, but the kill again exceeded 14,000.

In the fall of 1944 the Fish and Wildlife Service was at last able to establish the principle of limiting the kill by closing the season when a fixed number of geese (6,000) had been taken. But while the official machinery was creaking into action the kill mounted at the rate of 600 birds per day. By the time shooting was stopped 9,000 geese had been killed.

The open season last fall continued for just 5 half-days or a total of 22½ hours, during which the rate of kill was 225 geese per hour. This was probably the most fantastic slaughter on record, 1,400 birds being killed in the 4 hours of shooting on opening day. Thus, the record of Alexander County shows an average of well over 10,000 geese taken from this flock during each of the past 7 years.

It is obvious that when a bird with the hunter-appeal of the Canada goose becomes as easy to shoot as at Horse Shoe Lake, no ordinary hunting restrictions are effective. Many limitations have been imposed by both state and federal authorities. The bag limit was reduced from five birds in 1938 to two birds in 1942; the shooting was stopped at noon in 1942 and thereafter; a safety zone of 150 yards was established around the lake; since 1941 the pits have been spaced at a minimum of 150 yards with not more than two shooters permitted in each pit; and finally the season was reduced from 60 days to 5 half-days—but all these regulations failed to keep the kill within reason.

The problem is twofold: What can be done when such a concentration has become established, outstripped its food supply, and provided an unprecedented kill? And, what will happen when other states try to establish "Horse Shoe Lakes" of their own?

To meet the local problem the State of Illinois has tried to purchase more land to serve as a safety zone and to provide additional food. But prices have long since risen far beyond the value of the land for agriculture and it can no longer be had for any reasonable sum. In some years tons of shelled corn were shipped in, but the Fish and Wildlife Service found it necessary to prohibit the practice lest it provide a precedent that would aid other states in building up similar concentrations.

The problem at Horse Shoe Lake is apparently a conservation riddle for which there is no easy solution. If the Fish and Wildlife Service were to completely close the season in Alexander County, dozens of farmers who had nothing to do with establishing the refuge and who never made a dime from the goose shooting might be ruined, for in that county there are no silos and few corn cribs and corn is left standing all winter. In many years this low country is too wet to permit wagons in the field to gather corn even if there were a place to store it; and the same is true for soybeans. The other crops—rye, winter wheat, red clover, and spinach—are all in the sprout stage and especially attractive to geese. But if the season in Alexander County is not closed the last goose in this great flock —once numbering over 50,000 and now reduced to less than half of that number—may be killed by the type of "sportsman" who chooses to shoot at Horse Shoe Lake.

With the return of easy transportation and abundant ammunition the problem in Alexander County has become more acute and, what is more alarming, it is likely to arise in other states. There are dire forebodings in the quick success of Wisconsin's refuge on the Rock Prairie and in the plans for Ohio's "Resthaven" to be established on the route between the Jack Miner Refuge and Horse Shoe Lake. A refuge begun in all good faith may attract such a concentration as to invite prostitution of its initial purpose.

Before any other concentrations of Canada geese are developed there must be serious consultation between state and federal officials entrusted with their welfare and with field men, both biologists and enforcement officers.

We are a long way from knowing enough about the biology of geese to feel that we can manipulate their movements with impunity or to claim ability to manage them on a sound basis. Does anyone know what age geese must attain before breeding in the wild or how many young are produced per family? Despite the oft-repeated belief that geese mate for life no one is sure that this is true in the wild or that a lone goose will not take another mate

after its first has been killed. Until we know these and many other things we cannot estimate what percentage can be taken each year without endangering the breeding stock. There is much evidence that Canada geese are declining in numbers throughout the Mississippi Flyway. Since we do not know how long it may be before this reduced population can again produce a harvestable surplus, or whether it will do so at all, there seems to be little choice short of a completely closed season in the whole flyway.

The bigger problem is this: Can we learn from the example of Horse Shoe Lake? and prevent the establishment of small areas designed to concentrate geese, or are we to be faced again by the paradox of a refuge established for the protection of a species actually causing its decimation?

DISCUSSION

CHAIRMAN ROWAN: This paper raises a question that crops up in many forms all over the continent.

MR. LEONARD HALL (Missouri): I would like to ask Dr. Elder whether the Illinois Fish and Game Department has made any serious effort to help the Fish and Wildlife Service regulate that problem. I was down at Horseshoe Lake a couple of weeks ago. There is one small area outside the refuge that I saw which is owned by the state. We know that feeding geese can eat corn up to, say, 41½ or 42 inches on the stalk. There are 200 acres of corn there owned by the State of Illinois, planted by the Fish and Game Department still standing inside its refuge. It hasn't even been knocked down so that the geese can get the rest of the corn that is left on it, which I would estimate is about half a crop. That didn't seem to me a very good comment on the goodwill of the Illinois Fish and Game Department in handling that problem. They are not even willing to use the rest of the corn, which they planted there originally to hold the geese there, to help feed them through the rest of the winter.

Is Illinois interested in this problem or is it interested in killing out the rest of its geese?

CHAIRMAN ROWAN: I believe Mr. Hall can answer his own question. I am certainly not in a position to make any statement of policy concerning the Illinois Conservation Department.

MR. HALL: Comment, then.

DR. ELDER: The mere fact this consultation has been going on year after year and accruing seems to me to speak for itself.

MR. ALDO LEOPOLD (Wisconsin): I would like to ask if anybody of the Wildlife Institute is here to be sure this situation isn't going to be temporized any further.

DR. ELDER: I would like to make one additional remark, the opportunity to get acquainted with this situation was afforded me while on the staff of the State of Illinois Natural History Survey. The remarks are blamed solely on me.

MR. HALL: Mr. Leopold, I happen to know the Fish and Wildlife Service is apparently very anxious for this situation to be aired in any way it possibly can, and they are perfectly willing for any private individual to recommend that anything he feels should be done, be done, including closing the Canada goose situation all over the United States for 5 years, if he wants to recommend that. I don't know whether they would recommend it themselves.

MR. LEOPOLD: Obviously, what I am afraid of is a half-way measure will be tried and——(inaudible).

MR. HALL: I am afraid that that is in the wind.

MR. ARTHUR S. HAWKINS (Illinois): I would like to answer one of Mr. Hall's worries. About 3 weeks ago at Chicago, a meeting was held involving the Illinois Natural History Survey, the Illinois Department of Conservation and the Fish and Wildlife Service. At that time, this problem was aired very frankly from all sides and we all came to complete agreement that something would have to be done other than half measures, and all of these agencies pledged themselves to go through with their program.

This program, incidentally, is much as Dr. Elder presented it. We don't know the answers, but we are going to do the best we can with all the available information at our disposal to remedy this situation once and for all.

DR. ELDERS I would like to add the Illinois Natural History Survey now has in preparation a much fuller report on the entire situation and we hope it will appear within the year.

MR. DOUGLAS E. WADE (New Hampshire): Does that mean there will be an open season on geese at Horseshoe Lake this year, or will the action that Mr. Hawkins speaks of take place between now and the coming open season?

DR. ELDER: I believe some action is contemplated before that time.

MR. HALL: Dr. Elder, I would like to make one more comment, because I am tremendously interested in that situation down there. It is pretty close to home. I spent a good deal of time talking to people around that refuge and it is an amazing thing; no sportsman in America could believe what is happening down there, unless he goes there and sees it for himself. If a farmer down there this afternoon wants goose for tomorrow's dinner, he goes out in his hog lot, where there will be perhaps 200 geese feeding with his hogs, and he runs one up into a corner, against the wire fence and wrings its neck. That is how tame those geese are.

You talk to the man who is out past the perimeter of the shooting area, which is at most, I guess, three-quarters of a mile. Wouldn't that, roughly, take in the shooting area today, Dr. Elder?

DR. ELDER: There is some shooting up to a mile and a mile and a quarter.

MR. HALL: You ask a farmer out a mile and a half, he will say the solution of this problem is to zone the lake, that is, zone the area and move the shooting out, and you say to him, "How far do you live from the edge of the lake?"

He says, "A mile and a half."

You ask him how far out does he think this zone should be, and he says, "A mile and a half." If he lives 5 miles out, he thinks the zone should be moved 5 miles out. Obviously, no measure of zoning can save those geese because the men who own the land around the lake will plant it solid to corn and the depredation will be very great. I do not think the Fish and Wildlife Service can keep sufficient permits to club owners there to kill the geese. Those club owners all farm their land with share-croppers and they would be glad to furnish them ammunition. The geese would be killed before they ever got out to any zone which the Wildlife Service might set by share-croppers for eating the crops of the club owners that they might be justified in doing that, I don't know.

Is there a possibility of taking those geese out of Horseshoe, Dr. Elder?

DR. ELDER: I think every effort should be made to break up the concentration by any means possible, whether by a matter of flares, airplanes, or whatever means of disturbance that can be specified.

MR. HALL: To do that, you have to close Alexander County.

DR. ELDER: It would have to be closed for a large area. We do not know where the geese would go, whether they would remain as a flock or disperse, what their habits would be for the first few years after that concentration was broken up, but should add to the effectiveness of this corn situation, which is enhanced by the fact for many years, for obvious reasons, a short variety of corn has been cultivated there, which has all its ears, or a large share of them, within reach of the geese.

PITTMAN-ROBERTSON PROGRAM ACCOMPLISHMENTS AND PROSPECTS

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The last report to the North American Wildlife Conference on the Pittman-Robertson wildlife-restoration program was made in 1940 (Day, 1940). Funds to start work become available on July 1, 1938; consequently, this cooperative wildlife-restoration program was really in the formative stage early in 1940. Now that the work has been in progress for nearly 8 years, and all the states except Nevada are participating, a brief recital of accomplishments and a prediction of things to come can be made from a richer experience.

Since money lubricates the wheels of action, a glance at the bank balance is in order. On December 31, 1945, the special Federal Aid in Wildlife Restoration Fund in the Treasury contained $12,830,714. Between July 1, 1938 and June 30, 1945 the average annual deposits in this special fund from the federal excise tax on sporting arms and ammunition amounted to $3,233,572. We confidently expect that the average will be materially exceeded during the next few years. That expectation is based on the 30 per cent increase in hunting license sales following World War I, and the corresponding expanded sale of sporting arms and ammunition that will accompany a similar increase in the sale of hunting licenses.

Last June, the International Association of Game, Fish and Conservation Commissioners met in Chicago and discussed, among other things, the future appropriation of Pittman-Robertson funds. The conclusion reached was that the money accumulated in the fund should be appropriated out in progressively increased amounts over about a 5-year period along with current annual collections until the present backlog of funds is exhausted and the program can be restored to current financing. On that basis, appropriations in excess of $5,000,000 annually could be made during the peak appropriation period.

Notwithstanding the intervention of the war and the many limiting factors imposed by it, this cooperative wildlife-restoration program has made fine progress during the almost 8 years it has been functioning. The degree of success that has rewarded the efforts of the states has been due mainly to the type of workers they have employed. When this cooperative program began, quite a number of the states had no technically-trained game men in their employ. The employ-

ment of such men and the fine work done by them has been most gratifying. In numerous cases, workers who were first employed on Pittman-Robertson projects have been transferred to other game department activities where their talents and experience could better serve the needs of the states. In addition, former Pittman-Robertson workers are now the heads of fish and game departments in four states.

Continuity of effort on a high plane of effectiveness requires employment stability. In operating their programs, the states, with rare exceptions, have made every effort to obtain the best help available, and the men employed have reasonable assurance of permanent employment so long as they perform their duties in a satisfactory manner. Skilled help is a most valuable capital asset. The training of such help to the point where it is fully productive is costly; consequently, it is good business to maintain staffs of trained and experienced workers who can be depended upon to produce first-class results.

Since the commencement of work on this cooperative program, the states have stressed wildlife management research. In fact, 30 per cent of the money obligated on approved projects during the first 7 years of program operations went to finance such work. The making of annual population inventories and trend studies on upland game bird species as an aid to the game departments in setting appropriate seasons and bag limits are common activities. Numerous studies have been conducted to ascertain limiting factors on individual species and what can best be done to cope with them. Many studies have been made to learn whether big game ranges are under-, over-, or properly stocked. While appropriate actions to reduce excess big game populations have not always followed the recommendations of research workers, it is a fact that many have. To illustrate, studies of deer range forage conditions in the Black Hills of South Dakota have indicated the need for herd reductions in overpopulated areas. To accomplish this, the State Game Commission authorized the issuance of special licenses to take female deer during the 1945 hunting season. Many other similar actions could be cited.

Large sums of money have been spent in some of the states in the past for the artificial feeding of deer, where winter ranges were inadequate to carry existing populations. Pittman-Robertson studies conducted in Colorado (Carhart, 1943) and in Utah (Doman and Rasmussen, 1944) have shown the fallacy of trying to perpetuate excess deer populations by artificial feeding. This is an expensive practice and money saved through its discontinuance can be spent to much

better advantage on other types of beneficial work. Surveys of winter deer yards in Wisconsin (Feeney, 1943) have shown conclusively that many of them are overpopulated and herd reductions are badly needed. Investigations elsewhere have led to the restocking of big game animals on suitable lands from which they had disappeared. Studies of the results of stocking pen-reared quail in Oklahoma (Duck and Fletcher, 1944) have disclosed the lack of need for most of it and the futility of releasing birds where suitable habitat conditions are lacking.

Developmental measures have been extremely varied. In the Southeastern States emphasis has been placed on the planting of field borders adjacent to woodlands with perennial legumes such as *Lespedeza sericea* and *L. bicolor* to benefit bobwhite quail. Some of the states have stressed the leasing and development of small refuges on agricultural lands where heavy hunting pressure has shown the need for maintaining breeding nuclei of farmland game birds and mammals. During the first 7 years that the Pittman-Robertson Act was functioning, a total of 9,657 deer in 14 states were released in suitable areas where seed stock was needed. Starting early in 1939, Virginia, through a series of projects, released 1,417 deer. With protection and normal reproduction these plantings increased by 1945 in some localities to an extent that warranted the Virginia Commission of Game and Inland Fisheries in declaring a short open season on male deer.

Prior to the war a good start had been made on construction work to create impoundments for waterfowl. With the exception of New Jersey, which was able to keep its dragline operating in the Tuckahoe unit near Atlantic City through the war, all heavy construction of this nature ceased. Work was suspended on the Ogden Bay, Utah, project, the first Pittman-Robertson project to be approved after the Act became effective. While this project, located on the mud flats bordering Great Salt Lake, was not completed, the two major impoundments created are functioning satisfactorily as a combination refuge and public shooting ground. On the first day of the 1945 open season on waterfowl, checking station counts and estimates disclosed that 1,100 hunters visited this establishment and bagged 6,000 birds. Other activities along the development line that have been undertaken by the states include fencing and posting, varied habitat improvement work, the construction of headquarters buildings to facilitate administration, the trapping and transplanting of upland game birds, predator control to save remnant populations or to prepare sites for stocking, the trapping and transplanting of beavers, and the creation and

improvement of water facilities for wildlife in arid places where dependable supplies of water were lacking.

As to the acquisition of lands, the states purchased a total of 643,527 acres of land through June 30, 1945. These acquisitions were designed to provide refuges and management areas for upland game species, to establish refuges and combination refuges and public shooting grounds for migratory waterfowl and to provide for deer and elk winter ranges in the West. To the extent of available funds and suitable purchase opportunities, this type of program work continued without interruption throughout the war. In consequence some of the states have accumulated a large amount of construction work, particularly along water impoundment and stabilization lines, which work can be attended to as soon as equipment and materials are again available in needed quantities.

The end of the war found the state Pittman-Robertson programs operating on a very restricted scale due to personnel, equipment, and material shortages. In addition, annual appropriations to carry forward the work had been reduced to harmonize with expenditure opportunities. In recent months, large numbers of honorably-discharged veterans have returned to their former employment in wildlife management. Very few of the returned former employes have evidenced the desire to seek other lines of work. Consequently, the wildlife restoration organizations in the states should soon be adequately staffed with experienced help so they can resume suspended work and undertake new work.

The budget of the United States Government for the year beginning July 1, 1946 provides for the appropriation of $3,000,000 to finance the federal share of the Pittman-Robertson activities during the next fiscal year. If the Congress acts favorably on this, the states will be able to enlarge their work plans and get their organizations back in shape to meet increased future responsibilities.

Thus far in the short space of time available to me I have touched briefly on the status and accomplishments of the Pittman-Robertson program. But what will probably be the direction of state activities in an expanded future program?

As to research, we expect an expansion of effort and more productive results out of funds expended. Most of the project workers will be men who have returned to their old jobs after war service. Those men have gained much in maturity, poise, and judgment and will do better work than in the past. The states have already resumed work on some of the projects which were suspended due to the war. With

additional funds, the remaining unfinished research work can be completed. Based upon information coming to us from the states about their future plans, we expect greater emphasis on the making of inventories and population trend studies, also carrying capacity and range utilization investigations. States, that never had such information before this cooperative program came into being, have found it exceedingly valuable in determining what should constitute appropriate seasons and bag limits. There will also be much additional fact-finding work to learn more about limiting factors on the production of the various game and fur-bearing species and how best to correct those limiting factors. Along with this will be added attention to appraising the real worth of such measures as large-scale stockings of pen-reared game birds and the effectiveness of various plantings of trees, shrubs, and herbaceous vegetation on increasing farmland wildlife in particular.

As to the leasing and purchase of lands, more attention to providing small refuges for farmland wildlife in heavily-hunted localities can be anticipated. Prior studies (Miller and Powell, 1942) have disclosed that more than 80 per cent of the wildlife harvested is produced, pursued, and taken on agricultural lands; hence, the importance of emphasizing action in this field.

It is expected that the Western States, which need additional winter range for big game animals, will expand their land purchase programs. In Utah alone, more than 300,000 acres of desirable lands for deer and elk winter ranges have been jointly appraised by the State and the Fish and Wildlife Service. As funds become available and purchase opportunities present themselves, those lands can be acquired. We will undoubtedly see the increased purchase of lands for waterfowl refuges and public shooting grounds. To date, 22 states have acquired such areas. This will help spread waterfowl populations and provide additional hunting opportunities.

In the development field, habitat improvement measures, particularly for farmland wildlife, will be favored. The work already done in arousing soil conservation consciousness provides an excellent springboard from which to launch practices designed to increase farmland game populations at the minimum of cost. This can be done by injecting beneficial wildlife practices into farm planning in established soil conservation districts, thus insuring that wildlife production on such agricultural lands becomes incidental rather than accidental. Enlarged programs for fencing, posting, and the impoundment and stabilization of water will be forthcoming. The success that has rewarded earlier efforts to extend ranges and restore vanished

wildlife species through trapping and transplanting will provide another field for increased endeavor.

Some of the states have been hesitant about undertaking construction work due to concern about their future ability to finance necessary maintenance. They have urged that the law be amended to permit them to use federal allotments to absorb 75 per cent of such costs. Representative Robertson of Virginia, who sponsored the Pittman-Robertson Act in the House of Representatives, has introduced H.R. 3821 designed to amend the Act to permit the use of appropriated funds for maintaining completed projects. This bill, if enacted, will allow the states to use as much as 25 per cent of their share of annual appropriations to finance the maintenance of completed projects.

Taking the program as a whole, the money spent by the states to date on project activities has produced outstanding results. The states now have an excellent foundation of experienced help on which to build larger, future programs. Accumulated excise tax collections in the Treasury, and anticipated annual deposits, insure ample funds for financing the federal share of future work. With the generous appropriation of such funds, there is every reason to expect that future achievements by the states, through the Pittman-Robertson program, will dwarf the accomplishments made to date.

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DISCUSSION

MR. SETH GORDON (Pennsylvania): I would like to ask Mr. Rutherford a question as to the trend these Federal Aid activities seem to be taking, whether more of it apparently will in the future go into development projects, more of it into research, or more of it into acquisition. I have been watching it and so far approximately a third has gone into each of those three categories. I was just wondering what your observation is as to the future trend in this work.

MR. RUTHERFORD: During the first 7 years that the program was in operation, that is, from July 1, 1938 through June 30, 1945, 30 per cent of the money was spent on wildlife management research. The balance was spent on land acquisition and development and they were about equally divided. However, the largest appropriation we have received to date was $2,750,000 for the fiscal year 1942. That is the year when the war started and during that year the obligations on research were 24 per cent of the money.

Here is what I think: I believe that as larger appropriations are made, the research will go down proportionately because you can only handle so much of it. I believe that most of the states, when they get a corps of workers, well-trained, well-qualified workers, and plan their work ahead, will want to move a man from one job to the next as it goes along. So my prediction is that when we get into large appropriations on Pittman-Robertson, the research will probably be whittled down to not more than 25 per cent.

MR. GORDON: One other question, if I may, just to help others in the room—and I am not asking these questions for my own purposes. The International Association which met with you folks in Chicago last June recommended that the accumulated fund which now exceeds 12 million dollars be appropriated progressively over about 5 to 7 years, in addition to the normal income which means that in the next 5 to 7 years the appropriations under the Pittman-Robertson program should run anywhere from four to six million dollars. Is that approximately correct?

MR. RUTHERFORD: Yes, that would be. You see, on December 31st last, the fund contained almost 13 million dollars and we figure appropriation this year, if it is 3 million dollars as recommended, will cut that back to about 10 million dollars, and if that were kicked in, the 10 milion dollars, over a 5-year period, there would be 3 million a year out of that. The annual collections during the first 7 years amounted to a little better than 3¼ million dollars, so the two plus three and a quarter would make five and a quarter.

MR. GORDON: The high year was over five million.

MR. RUTHERFORD: Yes, but I was talking about the average.

MR. GORDON: The high prewar year was over five million dollars income.

MR. RUTHERFORD: Yes, that is true.

MR. GORDON: That probably was due to the fact that a good many folks were stocking up and buying up ammunition in anticipation of future needs, but with increase in the number of hunters, just as soon as ammunition and firearms become available, it is reasonably safe to predict that the average income should run from four to five million dollars a year on the basis of our experience in the high prewar year. Is that true?

MR. RUTHERFORD: I believe you are right on that. As a matter of fact, that high year was $5,535,000. With the pent-up purchasing power for guns in particular and the 7 per cent tax, it runs up pretty fast. I mean the collections run up pretty fast when you buy expensive guns.

MR. GORDON: My only reason for bringing out these questions is to clear up in the minds of all of those present here what an enormous expansion can be expected in this Federal Aid program. I was acquainted with some of that information, but I wanted you to give it to us.

MR. ALDO LEOPOLD (Wisconsin): Mr. Rutherford, I didn't hear you say anything about any modifications in the workings of the Pittman-Robertson Act. It seems to me that some modifications have become very difficult in the last year. Let me cite an example.

My state—and I am sure that there are a dozen of others at least—is wrestling with the problem of pheasant damage and it is going to get worse. In other words, the reliable and effective pheasant repellent to protect corn is a general need that is felt by a great many states. That is not a project that can fairly be saddled onto any one state. I would like to see Wildlife set up a plan whereby states that are interested can pool their funds and get a really adequate attack under your leadership into such a problem. Are such things under consideration?

MR. RUTHERFORD: It has been done before, Mr. Leopold; for example, several of the Rocky Mountain States conducted a joint investigation on bighorn sheep.

MR. LEOPOLD: That was a pooled effort?

MR. RUTHERFORD: No, it wasn't a pooled effort. Each conducted its individual operation, but the men working on it met at least twice a year to discuss their problems and their findings and the official Wildlife Act is sort of a coordinator.

MR. LEOPOLD: That is pooling knowledge. After all, the sheep problem in Colo-

rado and Montana might be different, but this pheasant thing has a peculiar nature. If you solve it in one place, it is solved all over.

MR. RUTHERFORD: The rub with that is trying to have one state put up money to hire a man in another state, and there are state laws that prevent that in a good many states. That is the unfortuntae element there with which you must contend.

MUSKRATS, DUCK PRODUCTION AND MARSH MANAGEMENT

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The Big Grass Marsh is located in Twp. 17, Rge. 10, 11, W1 in Manitoba and comprises approximately 26,000 acres of land and water, leased to Ducks Unlimited in 1938, tax free, and for nominal rental payments. The ownership of the land is as follows:

Rural Municipality of Lakeview	72 quarter sections
Rural Municipality of Westbourne	66 quarter sections
Privately owned	6 quarter sections
Provincial Government (Crown Lands)	16 quarter sections
Total	160 quarter sections

The marsh was drained for agricultural purposes in 1916, part of a 100,000-acre reclamation project. The area above proved unsuitable for agriculture and became wasteland ravaged by peat fires and dust storms. It was a death trap for waterfowl as sufficient water accumulated in the spring to start thousands nesting but the drainage ditches carried away the water and left the area dry by midsummer.

In 1938, the landowners involved agreed to permit Ducks Unlimited to restore the area for wildlife purposes. The municipalities leased their holdings to us for 20 years and the private owners and Provincial Government agreed to include their lands in the scheme.

A temporary dam held the runoff in May 1938 and in the fall of 1938 two permanent timberpile, stop-log structures were built on the main drainage canal, 7 miles apart, at a cost of about $10,000. A resident wildlife manager was placed in charge and year around patrols and studies were made. The area was cover mapped.

The runoff in 1939 and 1941 was negligible and it was not until the fall of 1941 that sufficient water was received to bring the north area to permitted level. During this period about 21 miles of double fire guards were constructed and some 300 peat fires were isolated by

trenches and later flooded. Since then runoff has been adequate to keep the north area to permitted level and to restore the south area. There are approximately 7,600 acres of water, averaging 2 to 3 feet deep (extreme depth 7 feet) behind the north dam and about 3,000 acres, averaging 1 to 2 feet behind the south dam—a total of about 10,600 acres of controlled water. In addition there are 500 to 600 sloughs and potholes surrounding the main water bodies which are nonpermanent. In wet years they retain water long enough to produce thousands of waterfowl and muskrats which find sanctuary in the nearby water behind our dams.

The private owners had a muskrat ranch on six quarter sections in the lowest part of the marsh when Ducks Unlimited appeared on the scene. There was an estimated muskrat population of 50 in 1938.

By 1942, the muskrat population was estimated at 2,745. The private owners applied to the government for permission to take off 700 pelts which was granted. In the meantime, the municipalities were requested by Ducks Unlimited to apply for muskrat ranching permits on their holdings. These were granted and the Provincial Government put through special legislation to allow municipalities to go into the business. The Provincial Government entered their 16 quarter sections into the scheme without participation in the revenues other than royalties. The private owners also entered the scheme on a basis of 20 per cent participation in the net proceeds for the duration of DU's lease.

A management committee was formed with three representatives from each of the municipalities, and one each from the private owners, the Provincial Government, and Ducks Unlimited. The latter act chiefly as technical advisers.

Table I shows results to date. It will be noted that the marsh has not yet reached peak capacity but it is believed that 10 to 15 thousand pelts will be average production. The Committee has recommended that 20,000 pelts be taken this year. High average prices for muskrat have been a prime factor in the outstanding success achieved to date.

Forty per cent of the gross revenue is paid out to trappers. Capital expenditures and general expenses take about 20 per cent of the remainder and from the net balance, 20 per cent is paid to the private owners, the residue going into the municipal treasuries.

A year around ranch manager is employed at $150 per month and expenses. No. 1 Stop-Loss traps are supplied and charged to the trappers who are credited with all traps returned at the end of the trapping season. This means that trappers are responsible for all losses.

TABLE 1. BIG GRASS MARSH MUSKRAT RANCH

Year	House count	Population estimate[1]	Maximum quota[2]	Authorized quota[3]	Actual catch	Average price	Total gross revenue
1938	.....	50	.....	.....	.....	.....	.....
1939	.....	.....	.....	.....	.....	.....	.....
1940	.....	.....	.....	.....	.....	.....	.....
1941	37	180	.....	.....	.....	.....	.....
1942	549	2,745	700	700	700	2.06	$1,442.00[4]
1943	1,649	9,894	5,000	5,000	3,340	3.01	10,071.00
1944	4,064	24,384	12,000	10,0000	9,309	2.16	20,149.26
			1,500)	1,500)	1,384)	1.41)	1,953.22)
1945	4,479	26,894	15,000)	10,000)	10,052)	2.61)	26,300.64)[5]
							$59,916.12

[1]Population is estimated on a conversion figure of five muskrats per house, to which is added 20 per cent for bank rats. The latter is an arbitrary estimate based on environment and experience.

[2]Maximum quota is set by the Man. Dept. of Mines and Resources on the basis of the house count.

[3]The authorized quota is determined on the basis of last minute information on marsh conditions supplied by the ranch manager.

[4]In 1942, the present cooperative plan of management was organized but did not come into operation until the following year. In the meantime the private owners were authorized by the government to take a crop of 700 pelts from their own lands.

[5]1,384 pelts were taken off under government permit in the fall of 1944 from areas which were considered too shallow to permit winter survival. Revenues from this salvage are included in the 1945 returns.

Drying sheds and stretchers are supplied by the ranch. The trappers skin the muskrats and the pelts are collected and delivered to headquarters where they are stretched and dried by a man employed especially for that purpose. The ranch manager rough grades and packs the pelt in cotton sacks which are sewn up and sealed with a tag detailing the contents, and delivered to the Secretary of the ranch (in this case the Secretary-Treasurer of the R.M. of Lakeview) who records the receipts and ships them by express to the Fur Auction in Winnipeg.

A census of muskrat houses is made in December after the ice is strong enough to carry light trucks or cars. From this a population estimate is made. Steady patrols are maintained by the ranch manager and an assistant to prevent poaching and to control predators. (Predator fur, such as mink, weasels, coyotes, and skunks, are taken when the fur is prime and the proceeds are supposed to be an addition or bonus to the ranch manager's salary. In practice, however, the manager finds it necessary to have the assistance of expert trappers to handle the predator fur and they get the full return from whatever revenues are produced.)

In early March, a survey is made by the ranch manager to determine how the rats have wintered. His reports determine the maximum quota set by the government and the authorized quota set by the management committee. The ranch manager is then instructed to hire the necessary number of trappers to take off the crop on a basis of a quota of 240 pelts to each trapper and 290 pelts to each head trapper. Approximately 60 per cent of the population is trapped.

Duck production in 1942 was about 5,000. Since then, the muskrats have opened up the dense stands of hundreds of acres of cane reeds (*Phragmites occidentalis*), hardstem bulrush (*Scirpus acutus*), and cattail (*Typha latifolia*). The resident duck population has steadily increased, especially canvasbacks, redheads and ruddy ducks, which nest around the clearings made by the muskrats, especially in bulrush and cattail. Mallards, pintails, and blue-winged teal—upland nesters—have increased remarkably, chiefly due, I believe, to the protection from fire, afforded by our patrolled fire guards. Mallards, pintails, and blue-winged teal particularly use the clearings of the muskrats as their "territory" and their houses for loafing spots. The present annual production of ducks ranges from 30,000 to 50,000 approximately, depending on whether the nonpermanent sloughs and potholes surrounding the controlled waters function or not. Hence, marsh management for muskrats automatically conditions the marsh for the best possible duck production; creates a substantial revenue for the people of the community, which enlists their enthusiastic cooperation; relieves Ducks Unlimited of maintainance and management costs, and has established a precedent of provincial, municipal, private, and corporate cooperation in wildlife management which is attracting widespread attention in western Canada.

In January of this year, the Saskatchewan Government requested the services of the author to set up a similar management plan on all suitable lands in Saskatchewan, south of Prince Albert. Preliminary organization has been accomplished on the Moose Mountain Provincial Park in southeast Saskatchewan, and in the Yorkton area which has Ducks Unlimited's Roussay-Leech Lakes (Illinois Lakes) as its nucleus. This project was sponsored and financed by the sportsmen of the State of Illinois, and has a muskrat crop of 7,000 pelts to be taken off this year. The acreages involved in these two initial projects are 65,000 and 46,000, respectively.

I have reason to believe that Alberta will adopt a similar plan in the near future.

These developments will bring thousands of men into the wildlife management picture under government supervision. They will have a basic economic interest in preserving the surface waters, food, and cover for fur. It will greatly enlarge the field in Canada for the employment of technically-trained wildlife managers.

I cannot conceive of a development more likely to further the aims of Ducks Unlimited which are, to restore, maintain, and increase the waterfowl population of North America.

TECHNICAL SESSION

Wednesday Morning—March 13

Chairman: CHARLES E. JACKSON
National Fisheries Institute, Inc., Washington, D. C.

Vice-Chairman: FRANK G. ASHBROOK[1]
Fur Resources Division, U. S. Fish and Wildlife Service, Chicago, Illinois

WILDLIFE IN BUSINESS

TRADING IN RAW FURS

ALEXANDER T. MACLEOD
The American Fur Merchants' Association, Inc., New York, New York

Fur animals have been in existence throughout the world since the beginning of time, and the fur trade is one of our most ancient enterprises. Fortunes were made and nations were financed through this valuable wildlife resource. Some three hundred years ago, during the period of early settlement of this country, fur animals provided one of the great sources of income for the Nation. Pursuit of the fur wealth was the incentive for the exploration of much of the country.

In almost every civilization, furs have been about the most valued article of commerce. Of course, it was not until after the discovery of North America that the world fur trade really got into its stride. Even today, furs are taken in every state of the Union, and, of course, Alaska. I attended a meeting of the fur trade in Montreal, Canada, recently, and it was interesting to note how many of the speakers referred to "trading in raw furs" as the basis of the pioneer spirit that settled and developed Canada.

Raw furs come from every continent of the world. In fact, it is

[1]Due to illness, Mr. Ashbrook was unable to serve as Vice-Chairman. Mr. Charles Kellogg took his place.

safe to say that every country produces some furs that enter the world markets. For years, American importers have been travelling all over the world, and on occasions at great risks, to get furs to our market. The incentive, of course, was profits, because in the early days, substantial profits were made. Only a few years ago, the son of one of our older merchants told me that he did not give his father any credit for making money in the fur market, but that he did give him credit for holding on to it during the past 10 years. He stated that 25 to 30 years ago, when he was working in his father's store, he would see imported skins sold very often at 100 per cent profit. Today, due to the speed of travel and improvements in communications, the world markets are brought closer together. Many more firms are in business, competition is greater and the margin of profit is narrower. Also, risks from the standpoint of merchandising and credit are greater. Today, one is lucky if he gets a 10 to 12 per cent gross profit. However, with this decided reduction in the margin of gross profit, the fur trade operates profitably due to the increased volume that we have been enjoying. The United States is the largest fur-consuming country in the world. Any losses suffered by the trade during a so-called "bad" year are not due to this reduction in gross profit, but rather to improper merchandising and a weak credit structure. More about the merchandising problem later.

The primary market for the distribution of the world's furs has changed. After World War I, it went from Leipzig to London, and during World War II, it came to New York. Russia sold her furs through the Amtorg Trading Co. in New York. Many of the London firms came to New York, and the London auction houses brought their sales here. Also, the Afghan Government representative came to New York to market their supply of furs, so that today, we are the world center for furs. We believe we can continue to hold this position provided we can get the cooperation of our Government. O.P.A. should be realistic and lift ceilings on all furs so that we can regain our export markets. Many of our domestic furs not in demand here are selling in Europe at prices well above ceiling, but we cannot take advantage of it. Also, the Department of State must see to it that in loans made to foreign countries, provision is made to set aside United States dollars for the purchase of furs from America.

The Chinese and Japanese markets have reopened, and some of our importers and exporters are now in China. London has already reopened her auction sales, and Russia is planning to do likewise. There is no sound reason why the world's furs should come to America via London when the greatest market is right here, on this continent.

The following figures will give you a pretty good idea of the fur business that is carried on in the United States today.

The annual catch last year of American raw furs, both wild and ranch, was estimated by the U. S. Fish and Wildlife Service of the Department of the Interior at approximately 100 million dollars. Imports for the year 1945 were $142,203,560. Annual sales of furs at retail have been running around 500 million dollars. You can readily see that the fur trade in all its branches is one of our important commercial industries. Many thousands are employed, and our Government receives millions of dollars in revenue through the retail excise tax and import duties. The Government realized over $85,000,000 last year on the excise tax alone. Furs are one of the richest and most constant (with proper conservation and propagation) natural resources in this country.

You might be interested in the following statistics: Approximately 40 per cent of the world's furs come from the United States and Canada. New York handles the biggest part of this crop of furs and also handles over 85 per cent of all imports of furs into the United States and Canada. New York manufacturers produce 90 per cent of all fur garments made in the United States. Here, we have approximately 1,000 dealers, importers, and exporters; 100 brokers; three large auction companies, with aggregate yearly sales of 60 million dollars to 70 million dollars; 2,000 manufacturers and hundreds of retailers.

In 1945, the imports of furs exceeded the estimated domestic catch by 50 per cent. Canadian furs, of course, are included in our import figures. Now, with the reopening of the Chinese and European markets, our imports will increase. Also, our exports of domestic furs, which were nil during the war, will increase. Prior to the war, our exports of domestic furs fluctuated between 15 million and 20 million dollars. Consequently, the ratio of foreign furs over domestic furs used in production will increase further.

You may feel that I place too much emphasis upon foreign furs and that this competition is harmful to our American raw furs. Such is not the case, however. Many of the furs do not compete with our supply, and if we did not receive them in volume, our domestic crop would be depleted in short order. Our export markets are most important to American furs. During the war, when our export markets were closed to us, many of our long-haired furs, such as wolf, red fox, opossum, raccoon, etc., were selling well below ceiling prices as there was very little demand for these articles. I do not think that any other industry had a product that was selling below ceiling continuously.

Fashion creates the demand for furs, and if there is no demand in this country, our only hope is our export markets.

There is one fact that we do not know, and it is a serious problem to the fur industry of America. It is one of the reasons for our inability to merchandise properly. Our furriers are too busy, and consequently, have not given much consideration to this problem. The average man in our industry forgets the past and refuses to look to the future. Just as this applies to merchandising and credit, it also applies to the source of our product. Unfortunately, we, in the trade associations, do not know how many furs of a particular species are trapped in a year and whether we are trapping them faster than they are bred.

It is interesting to note that in our industry, while the dollar volume may fluctuate considerably from year to year, the unit volume fluctuates much less. In a year when substantial losses are taken by the trade, from trapper and farmer to the retailer, you will find that the unit volume was there, but due to excessively high prices, the business was done in a falling market, at great loss. Unfortunately, the American raw fur season opens at a time (November) when there usually is a demand for the finished product, and it does not take much to get the buyers into the primary markets, competing with each other. The usual slogan is that due to a severe winter, or floods or shortage of labor, etc., there will be a short catch. We have never had a real shortage yet, and don't expect one. If we knew the actual number of furs of each species trapped every year, we would know during the open season whether or not there will be a shortage, and more important, whether or not we were depleting our supply. We have a pretty good idea of the demand for furs, but we have no idea as to the supply.

We know that the U. S. Fish and Wildlife Service of the Department of the Interior, which has cooperated splendidly with the fur trade, is cooperating with those states that compile this statistical information and will cooperate with all states if given the opportunity. Trapping of furs is a source of income for many of their residents, particularly the farmer, who is able to get additional income during his off season. If the farmers and trappers are made to see the importance of such statistics in the proper merchandising of these pelts, I am sure that they would go along.

The trappers, mainly farmers and farm boys, should be taught proper methods of trapping and handling furs for the raw fur market. This can be done through a cooperative effort in which the Fish and Wildlife Service, Extension Service, and the fur trade would

cooperate. This together with the statistical data previously referred to would emphasize to the people in the various states the value and importance of their fur resources. I frankly admit that the fur trade and more particularly our association has been unable to make any headway in this field alone. Therefore, I am presenting some of the problems to this Conference because I feel that it represents the largest and most influential group of persons interested in the production and conservation of wildlife. I hope that the information given in this paper will stimulate thinking along these lines both in the American Wildlife Institute and in the fur trade. Our fur resources in this country is a basis of one of the important industries, and, therefore, the source of supply should be preserved for our future generation.

DISCUSSION

MR. WILLIAM C. ADAMS (New York): Our Conservation Department in the State of New York, in common with a large number of states this year, has been on a very hot spot due to the fact that in these states there has been a very great decline in the pheasant population and in some states like New York in, at least, a large portion of the State, there has been a scarcity of cottontail rabbits.

While we take the position that predation is not a basic reason for the abundance or scarcity of any species in a given year, public sentiment demands and has demanded that we do everything we can to curtail the abundance of the red fox and the gray fox. We have learned recently, through OPA, that they have removed the ceiling price on red fox, but they are still retaining a ceiling price on gray fox for the reason that they use the gray mostly to trim coats and there seems to be a big demand for the gray for skin, surprisingly enough to us, and a very little demand for the red fox skin.

Do I understand that the low prices that have been paid for the red fox which has discouraged our trappers from going out and trapping, is due to the fact that there is no demand in the industry at present because of styles?

MR. MACLEOD: Yes, sir, that is correct. Where training people handle the red fox, you will find most of the casualties right there because the coat and suit fashion—not only the fashion for long haired fur has gone out, but also in your trimming end of it, MAP has some regulations I think, in which apparently they can't get the proper cloth for which to trim a coat. In fact, I was just down to Washington on a hearing for the silver fox on the question of the quota. The silver fox is just not in demand. It is selling now well below cost—the actual cost of raising these silver fox.

Of course, they have the imitation and platina which cost good money, but as soon as they get plenty full, they may get down, but at the present time, the demand for long haired fur, there just isn't any.

MR. ADAMS: Is there a kind of cycle in this demand? For instance, after 2, 3, 4 or 5 years, whatever it is, the styles will change again in favor of the long-haired fur. Is it that they keep shifting these styles in order to be able to utilize all these different furs from time to time?

MR. MACLEOD: I will tell you, I think, of course, from the standpoint of advertising, that has created the consumer demand. I think there is a good chance of long haired furs coming back. You see, the thing is, you will take other furs, you will run it up too high, and then when it gets too high, the public will rebel and then they will switch to something else.

MR. ADAMS: It is just our hard luck at the present time in connection with this great abundance, this extraordinary abundance of both gray and red foxes in over a large section of the United States, that the demand for fur should be for the short-haired and not a great demand for the long-haired furs. In other

words, if the trappers were getting a high price for red fox skin at the present time, they have done a great deal more to reduce the number.

Is it possible to put these furs in cold storage or, let's say, these long-haired furs like the foxes, for 4, 5, or 8 years, and if necessary, let them lie there until the demand returns for them? Is that at all practicable?

MR. MACLEOD: It is, but I don't know about that many years. I am not a practical fur man, but I do know about the proper scraping, and in putting them away in the ice house. I think it is quite possible that some of the dealers are doing just that, buying them because they are so cheap and are putting them in the ice house. It looks like a pretty good investment.

In due time, they will come back. It is just a question of time and domestic regulations, too.

MR. JOHN P. LEONARD (Connecticut): I was wondering if the European market has any relationship to the price of furs. Do we ship to the European market fairly large amounts when normal conditions exist?

MR. MACLEOD: Yes, we do.

MR. LEONARD: We don't have that now.

MR. MACLEOD: No. Take the opossum which was selling below ceiling right along, and as soon as the export markets were open—the London markets were open—immediately they began selling above ceiling. That stopped the export of opossum. Over in Europe you would get a whole lot more than 79 cents—I forget the ceiling over there—but still the OPA says you can't charge more than the ceiling price even though you are selling it to Europe. Consequently, this market can't take advantage of that, where in Europe they will pay $1.00 and $1.50 for it. You have to sell it at ceiling price and, therefore, you can't buy it under the ceiling.

You have to buy it over the ceiling if you are going to buy it, and consequently, we can't take advantage of the export market if some of our furs aren't in demand here and are over there.

MR. MERRILL GILFALLAN (Ohio): It seems to me that in our state one of our greatest needs is in helping the trappers organize. They are a group of individuals who can't organize very well and usually they are so individualistic or, perhaps, uninformed that it is hard to bring about unity among the ranks. There are many regulations which are unfavorable to trapping at the present, for example, muskrats. Most workers of various states agree that a lot of muskrat habitat is undertrapped and in Ohio, the Lake Erie marshes, where they do not have to abide by state regulations, they are much more productive than in the inland marshes. The juvenile-adult ratio is higher in the lake area marshes where they can trap much more extensively than other places.

It seems some means should be found to help the trapper speak for himself. Undoubtedly, they cannot do that. They won't work together. They are not a pressure group, for one thing. It has been discovered in a good many states that coons may become predators in marshes, yet the coon hunter, if he is organized, could defeat—nobody would want to destroy coons—yet the coon hunter could bring about continued coon conservation, whereas a trapper who represents an industry that is quite large cannot do anything to better his own interests. What would you suggest on that?

MR. MACLEOD: I will tell you, I think that is general. We can't get the proper cooperation here in New York, even our Association which is a trade association. We don't have the number of members that we should have and we are centered right here between 30th and 27th Streets and Sixth and Eighth Avenues. There is a Trappers' Association.

MR. GILFILLAN: There are two or three of them.

MR. MACLEOD: I don't know much about them. I haven't gone into that. The only possible chance is to get them to a meeting. Would they come to a meeting if you were to call one and discuss it?

MR. GILFILLAN: I don't know. The point is, I am suggesting that that is a

good angle to work from. Perhaps you and anyone else who is interested in helping the fur trade and the trapper—

MR. MACLEOD: I would be glad to supply anything you need.

MR. GILFILLAN: There is a lot of work needed in that connection.

MR. MACLEOD: From the standpoint of by-laws and drawing up certain codes and so forth, I would be glad to assist anyone, but, of course, we are a local trade association and are not national.

MR. ADAMS: We in the State of New York, for instance, have been working with Mr. Macleod here off and on over a period of several years in relation to a possible licensing of fur buyers. Now, it is no thought on our part of trying to sting the industry in that operation and neither is it our desire to pile on to the industry some more of this paper work that they must be sick and tired of at the present time.

But what we are trying to accomplish is some scheme to get an adequate inventory of the fur that is taken each year in each state. There is no group of people that is so secretive in their operations as the average trapper for perfectly obvious reasons and we have been puzzled with the way to try to get the story. We require every angler, hunter, and trapper at the time he buys, we will say, his trapping license for the year 1946, to state to us on a printed form we supply, the amount of fur taken by that trapper in the previous year and since 1918 we have a continuing record.

We don't believe that this is 100 per cent accurate, but it is very valuable in showing the trends, a sort of annual barometer, if you please, but I think that the industry itself could, perhaps, benefit itself and help the conservation departments in the several states by thinking over some practical method of getting this annual inventory of what is taken.

It is rather difficult to determine where to start because your farmer boy traps so many muskrats in a year. He may take them to his corner crossroad store and swap them for something. The crossroad store man turns them over to a traveling fur buyer and the fur buyer finally turns them over to some one central receiving plant. If you aren't careful, you are going to get a duplication there of the report of the take and I simply throw this out to the representatives here from the industry, that if they will look at it from their angle and what they have to go through, maybe some day we can evolve a plan that won't bear down unreasonably on the industry because we in our Conservation Department are trying to keep away from a lot of this laborious bookkeeping and forms of reports and control if we can achieve this practical result.

MR. MACLEOD: We will be glad to try it.

BEING FRIENDS

J. L. ALPHEN
President, General Seafoods Corporation, New York, New York

Fishing is a great sport, a swell sport. The other day a friend of mine went fishing. He fished all day without luck, and on the way home he went into a neighborhood fish market and said to the proprietor, "George, pick out five of your biggest sea trout and toss them to me."

"Throw them?"

"Sure. Just toss them over here, one at a time, so I can tell the family I caught them. I may be a poor fisherman, but I'm no liar."

Yes, fishing is swell. What would the publishers of joke books do without it?

Fortunately—or perhaps unfortunately—joke books are not the subject of my talk today. I have a much more important idea on my mind. If this were a solemn scientific gathering, I might becloud the idea in some such lofty title as "The Exigency of a Cooperative Relationship Between the Fishing Industry and the Sport Fisherman." But since we're just gathered here as friends, I'd much rather summarize the idea in a two-word phrase—"Being Friends." I like that expression "Being Friends."

I have heard it said from time to time—and I suppose you have, too—that commercial fishermen and sport fishermen are not the very best of friends. That may have been true some years ago, but not today. Both groups have come to see that they have many interests in common and that the problems which face one are the concern of the other

I suppose much of the past misunderstanding can be attributed partly to a lack of statistics. Considering their vastness and importance, it is surprising that so little is known of our aquatic resources. Unlike mining, lumbering, and other industries, fishing presents many mysteries to its own practitioners. But here are a few of the things that we do know.

There must be at least 15 million recreational fishermen in the United States; quite a figure, and against that just 130,000 who fish for their own livelihood and for the well-being of the millions who consume fish regularly (Jackson, 1944a).

The annual catch of the commercial fishermen averages better than four billion pounds and has a market value of about 250 million dollars (Steele, 1946). While there are few official figures on the annual catch of sportsmen, the figure is believed to be surprisingly

high, and indeed a number of isolated reports reveal the amazing fact that in certain important areas the yearly take of sportsmen exceeds that of the commercial fishermen.

The total value of our commercial fisheries, including equipment and installation, is about one billion dollars (Jackson, 1944b). Comparing very favorably with that, sport fishing supports a yearly business—travel, hotels, and equipment included—from the best estimates I can find, may be figured at better than one billion dollars today, and this figure may be quadrupled in the postwar era (Jackson, 1944a).

Clearly, both the sportsman and the commercial fisherman are involved in large-scale businesses. But there are other aspects of each pursuit which are not revealed in business figures.

Without a doubt, the greatest value of sport fishing is the enjoyment derived from it. Play is essential to the maintenance of health, particularly today when so much of our energy is demanded and consumed by the pressure of business activities. Fishing is a relief, a release. It is truly great fun.

The product of the commercial fisherman plays an equally important role in the lives of our people. A considerable portion of the 15 million sport fishermen supply their own needs. But that leaves the rest of our vast population, 125 million individuals, to be accounted for. We of the fishing industry have become the "agents," so to speak, of millions of consumers. It is our responsibility to catch their share of fish. If we haven't supplied the needs of everyone in the past, we hope to, and will, in the future. That is one of our obligations to our society.

The fishing industry has other obligations. There are hundreds of industries dependent on the by-products of fish. Fish meals and fish oils, for example, are of the greatest importance in animal feeding. Seaweeds have essential uses in bacteriological laboratories, in the preparation of certain foods and medicines, the manufacture of radar equipment, photographic supplies, and storage batteries. Fish oils find an important use as core oils in the casting of metals. They are also used in the hardening of bearings, in airplane parts and war munitions, in leather processing, and in the manufacture of printing inks, linoleum and oilcloth, paints, varnishes, and soap. And then vitamin A, the famous nutrition and eyesight vitamin, is produced largely from fish (Jackson, 1944b).

The uses to which fish can be put are numerous; they are so great, as a matter of fact, that if not one pound was consumed as food, there still would not be enough fish for industrial and other uses (Jackson, 1944a).

Both of us, then, are very large as businesses, and have extremely important functions where the health of society is concerned. We have common interests, and our needs, particularly those dealing with conservation, are mutually felt. Under those circumstances, cooperation seems inevitable.

However, I have heard people say, as I mentioned a moment ago, that commercial and sport fishermen do not always get along very well. I would like to bring up that point again, because I feel that what little ill-feeling still exists between the groups is due to information not substantiated by fact. I have heard a few sportsmen say that commercial fishermen are depleting the available supply of fish. I would like to cite a few illustrations which tend to refute that contention.

In 1928, the commercial salmon catch off Newfoundland was 1,500,000 fish. Just 2 years later, in 1930, the take suddenly tripled, leaped to almost five million. The following year, however, the catch dropped to a little less than 2,500,000 (Clouston, 1945). Certainly, these figures indicate that a number of factors, other than fishing itself, were responsible for the yearly variations.

In Long Island in 1938 the sport catch of flounders was one million fish, and the commercial catch was also one million. Tagging experiments, however, which were conducted in Great South Bay, Long Island, over a later 2-year period disclosed that 14 per cent of the tagged fish were taken by commercial fisheries and 24 per cent by sport fishermen. In Puget Sound commercial fishermen caught 42 per cent of the Chinook salmon in 1939, and sport fishermen caught the remaining 58 per cent. And according to the best estimates available, the annual take by sportsmen may equal or exceed that of commercial fishermen in the Chesapeake Bay and in the area of the Great Lakes (Jackson, 1944c).

The two latter figures are estimates, but they do give an indication of the United States as a whole, and the answer to that will have to wait until a method is developed by which a comprehensive evaluation of the sportsmen's catch can be made.

While comparative figures are highly useful, we must be careful not to read more into them than actually exists. These figures do not imply that either one of the two groups is responsible for the annual variation in the supply of fish. But they do point out very clearly that the annual catches by sport and commercial fishermen are not disproportionate, and from that fact the influence can be drawn that each group has an equal share in the responsibility of caring for our natural fish resources.

A fine example of the acceptance of this mutual responsibility was illustrated not long ago when flood-control power and irrigation interests sought to erect numerous dam barriers along the Columbia River (Columbia Fisheries, 1945). While these dams might serve the useful purpose of preventing floods and increasing the available supply of electricity, they would also prevent the breeding salmon from going upstream to spawn, and more important, prevent the downstream migration of young salmon. Industry and sportsmen have at last got together to exert their influence. Though they couldn't prevent the construction of some dams, they did succeed in having ladders built. Some success has been attained in getting the adult salmon upstream, but at best it's merely an experiment. If no additional dams are built the biologists may to some extent overcome these barriers and succeed in partly restoring the valuable Columbia River salmon runs.

However, a great danger lies in the proposed programs of the U. S. War Department of Engineers and the Bureau of Reclamation to construct upwards to 100 dams for various purposes on the Columbia and Snake Rivers and their tributaries. No one can foresee what the effect will be, but I am informed the biologists fear that continued flood control, irrigation, and power projects can only spell extinction for salmon and other various species of fish; but, at last, the sport fishermen and the commercial fishermen have tied their efforts together. Today, they have organized what is known as the Columbia River Fisheries Development Association, composed of commercial fish industry representatives, sportsmen, farmers, and state conservation organizations. They have raised funds to finance the fight and are preparing to propose to competent engineers a dam construction in the headwaters of tributaries which will serve these other interests but, at the same time, preserve the fish. Sport and commercial fishermen should have organized along these lines in the Columbia River areas years ago, but it is not entirely too late if they can now arouse sufficient public interest to protect these "God-given" natural resources. Those, who would dam all our rivers, are an active and aggressive group and the only chance that we sport and commercial fishermen have to save the fishery resources is to form similar strong and aggressive groups to protect the fishing interest. What is being done to bring the two groups together in the Columbia River is a late, but perfect, example of what we can do if we unite out strength.

I have heard a number of definitions of conservation. The best, I believe, is a fairly simple one; that conservation is the greatest possi-

ble use of our fish resources without impairment to their future productivity. I feel certain that that just about summarizes all of our concepts and is in complete agreement with the morals of society as well as the ethics of industry.

A number of things can be done, and are being done, by industry to achieve this perfect balance. But there are a few things that industry cannot do. It is possible to restock a stream, but no one can restock an ocean. Not much can be done either, to control the forces of the sea, the drift of currents, the temperatures and the salinity—all of which have a direct bearing on the survival and well-being of the fish population.

It may interest you to know that less than one half of one per cent of fish landed in Massachusetts are condemned as unfit for food. That is an extremely small proportion of waste when you consider the high perishability of fish. But we in the industry deplore even that waste, and the fishing industry today is working to reduce that loss, and it is doing so by a number of methods. Newer and better means of refrigeration are being installed on fishing trawlers. Speedier vessels are shortening the running time between banks and shore. Faster processing techniques are being developed. Filleting and quick-freezing, for example, which make it possible for people living inland to enjoy ocean fish as fine as the day when landed in Boston, are now accomplished in a matter of 2 or 3 hours. The advent of factory ships and new inventions have inspired new techniques, transportation and communication facilities, and technological developments. Faster and longer-ranged vessels, as well as the use of airplanes, blimps, helicopters, radar, and sonic depth-finders in locating schools of fish, are resulting in the discovery and utilization of more distant fisheries.

Industry is applying the principle of conservation in another direction. It is constantly developing and introducing new species, as a means of giving the older and more stable varieties a chance to multiply. At one time millions of fish caught were never brought back to shore (Jackson, 1944c). Rosefish, or ocean perch, was such a fish. Today rosefish has forged ahead of both cod and haddock in popularity (Jackson, 1944d). As a result, the public has benefited from the highly nutritious value of a once discarded fish, and the supply of cod and haddock has been given the chance to multiply.

We, in industry, believe we are doing our part to conserve the supply of fish; we know that you, the sportsmen, are doing your share too; but we also believe that a lot more could be achieved by both of us working together, by being friends, really good friends.

Pollution, for example, is a common danger. Poisoning of lakes, rivers, and bays has been regarded too often as an inevitable accompaniment of our industrial growth. Other countries have coped with the problem and successfully. We, instead, have temporized, while fish have continued to be killed.

Pollution is not a necessary evil. Studies by the Fish and Wildlife Service have revealed that proper treatment will render pollutants relatively harmless before they are discharged into our waters. Individually, we can fight against pollution, but only collectively can the full force of our energies be applied effectively.

I have made a list of the things which we can do, and should do, together. Here they are:

1. Support adequate Congressional appropriations for the federal agencies charged by law to carry out beneficial fish and shellfish functions. President Truman's recommendation for appropriation to the Fish and Wildlife Service for fishery work is the very minimum necessary to carry on the work; as a matter of fact, the estimates for commercial fisheries are the lowest in several years. There is an urgent need for additional funds for sanitation work at fish plants, for development of our water resources, for river-basin studies, for propagation of food fishes. Here is a splendid opportunity for sportsmen and commercial fishermen to combine their energies and influences and work towards a common goal.

2. Draw up a comprehensive national program in which the efforts of all fishermen will be properly coordinated to bring about a fuller use of the resources of our oceans, lakes, and rivers. We suffer now because of pollution, because of obstacles and barriers to our rivers, because of lack of information on the meteorological and oceanic effects upon breeding. We suffer needlessly.

3. Sponsor a thorough program of public education to inform people of the available supplies of fish, their high food value, and methods of preparation. We ought to work together to promote the consumption of new species of fish, as sources of good food, and as means of alleviating the pressure upon the better known varieties.

Being friends is good business. Both of us will certainly profit by supporting effective programs for the building-up and the utilization of our supplies of fish. Intelligently-planned programs can provide enough fish for both of us. But without such plans, neither of us can be assured of everlasting use of the country's great fish resources.

Let's be good friends and get these jobs done together.

DISCUSSION

MR. THOMAS H. CRONE (New York): What percentage of the inland commercial fishermen like those who operate in the district of Lake Ontario and Five Finger Lakes belong to the Commercial Fisherman's Association?

MR. ALPHEN: I believe most of them do.

MR. CRONE: The real conservationists in this State are always willing to cooperate with any group that believes in conservation and you spoke the truth when you stated that the commercial fishermen and sport fishermen have a common interest. However, as to the statement that most of the difficulty of cooperation is the lack on the one hand of knowledge of the sports fisherman as to the interest and operation of the commercial fisherman. That might be so in the marine district but not upstate.

The sports fisherman upstate or any of the associations that he belongs to is well aware of all the activities of the commercial fisherman. There actually is no cooperation. The sportsmen have always wanted to cooperate with them. The commercial fishermen, to my knowledge, most of them don't belong to any association. They may belong to a clique that politically can get their netting licenses and so forth and then from there on, they operate individually and they are our biggest poachers.

Now, I think that it behooves the organized commercial fishermen, regardless of whether he is of the marine district or not, for the interest of conservation—and I believe the marine commercial fishermen's associations are the best organized to move a little of their interest upstate, I mean that applies to other states and provinces of Ontario, Quebec and so forth—to do something with the inland commercial fishermen especially those that operate as lone poachers.

That is the only way we are going to get real cooperation and maintain our fish life on the upgrade instead of down. We find—and I think anybody that is acquainted with upland fishing will verify my statement—that our main trouble with the commercial fishermen is that they are in poaching wherever they can get away with it. If you give them a license to operate in this area, they are sneaking over into the other area. As a result we have had a lot of areas that have been destroyed for years.

The same as in World War I, they got busy and pulled the old war argument, "We need the fish to feed the people," and they all got extra licenses. As an example, they ruined Sodus Bay. That hasn't recovered yet. That is what you and I would like to prevent.

MR. ALPHEN: I think, sir, that you have given a specific example of what I have discussed generally, that the answer is being friends and getting together on this thing.

MR. G. M. SPARGO (Alberta, Canada): We have a problem, I think, that for which possibly the State of New York is to blame. We find that we have limitations on certain lakes. I am speaking from both the commercial and sport side. I happen to have had the unfortunate position of Director of Fisheries for a number of years. The situation there is intriguing in the respect that we have a limitation on the various lakes that have both white fish—which is not a catchable fish with a fly—and we also have trout and various other correlated fish in the same lake.

We found that a limit of 250,000 pounds in one lake meant nothing at all because the trade in Chicago and New York, if they happen to have a shortage of fish, immediately—if you will excuse the word "seduce"—they seduce our fishermen there by offering greater prices. The consequnce, of course, is that they put the pressure on the government officials so that the limit was raised from 250,000 to 500,000.

I think possibly you could help us out in Ontario very much, sir, if you would tell your industry here not to try to persuade them to fish more than they are entitled to.

MR. ALPHEN: I think your suggestion is a very good one and the industry does have a great many problems in education and cooperation that it must do if it is going to obtain its rightful place in the food industry. You know how difficult it is if you just refer to our Government Agency OPA. A friend of mine the other day said, "Do you ever realize the initials 'OPA' are the three middle initials of psychopathic?"

MR. RUDOLPH DIEFFENBACH (Illinois): Mr. Alphen, in discussing the fishery problem, made mention of the problems on the Columbia River with relationship to commercial fisheries there. Perhaps it will be of interest to this gathering to know that the Corps of Engineers and the Reclamation Service have developed plans of very far-reaching importance with regard to the so-called developments of practically every major river basin of the United States.

Perhaps it could best be typified by the Missouri River Basin on which hundreds of projects are planned, many of which are dams which will be used for irrigation power development and so forth—flood control. The Fish and Wildlife Service has recently inaugurated a study program of these areas in order to determine what effect these encroachments will have upon the existing fish and wildlife resources and to undertake to determine what benefits, if any, may be salvaged or derived from these developments. I am in charge of that work. One of the great difficulties that stands before us in connection with this work that we are doing is that while we may make recommendations for modifications of these development plans, there is no existing legislative authority that requires the application of the remedial measures that we suggest.

In the projects sponsored by the Corps of Engineers, their law does contain a provision that if any of these projects can show promise of having recreational possibilities, they can make plans, that is, the Corps of Engineers can make plans, to study such proposals, but before money can be made available to modify their initial plans, they must get the required funds by act of Congress. The same general principle applies with regard to the projects of the Reclamation Service.

In the latter instance, we being part of the same department, that is, the Reclamation Service, now have legislation in the making, which will protect the integration of our recommendations with those of the major objectives of the Reclamation Service so there is some promise there, but there are tremendous values involved in connection with the proposed developments as they pertain to fish and wildlife. The Fish and Wildlife Service states that our people are deeply concerned with what is going to happen to the fish and wildlife resources as a result of these proposed developments.

MEETING THE DEMANDS OF THE FUTURE ANGLER

JOHN M. HOLMES
The Associated Fishing Tackle Manufacturers, Washington, D. C.

In order to meet the demands of the present and future anglers of the United States, the fishing tackle manufacturers are confronted with two major projects. First of all, they must produce the largest quantity of equipment in the history of the industry to meet the tremendous pent-up demand; and secondly, they must work unceasingly to see that new and improved facilities for sport fishing are developed in every section of the country. Within the limits of the time allotted to me on this program, I shall try to point out some of the problems which the industry has had to face and how it is planning to solve them.

At this point it might be well to identify the organization I represent. The Associated Fishing Tackle Manufacturers is a nonprofit association, composed of 67 bona fide manufacturers of fishing tackle, who make approximately 85 per cent of the tackle manufactured in the United States. During the war we were considered by most government agencies as the mouthpiece of the industry in Washington.

Since July 1, 1942 the fishermen of this country have had to get along with old or makeshift tackle. On that date the War Production Board issued a limitation order, which immediately stopped further production of fishing tackle, except for military orders and commercial use. Military orders in the early days of the War were confined largely to emergency fishing kits, consisting of hooks, lines, small landing nets, baits, and a few accessories. The commercial fishermen only required hooks, lines, nets, and baits to carry on their trade. This meant that the largest segment of the industry had been virtually put out of business by the War Production Board edict.

With patriotic zeal and good old American ingenuity, most of the fishing tackle manufacturers immediately converted their plants to the manufacture of essential war goods. Radar parts, radio antenna, field telephones, gun mounts, sub assemblies, parachute cords, and dozens of other items used on the fighting fronts came out of factories, which since they were built had produced nothing but rods, reels, lines, and other types of fishing tackle. We are justly proud of the war record of the industry. Several new plants were built, many others enlarged, schedules were met and over a dozen Army-Navy "E" Production Awards were presented to association members.

Reconversion of the fishing tackle industry to peacetime civilian production did not start on a large scale until the middle of last fall.

Restrictions on the use of steel and copper base alloys were lifted in June, but other essential materials used in the manufacture of fishing tackle, such as phosphor bronze, nickel silver, plating materials, and lead continued in short supply for many months thereafter. Some of these materials are still difficult to procure, and of course the steel and brass strikes temporarily paralyzed many plants at a time when production lines were beginning to roll. Since Japan invaded the central part of China the only satisfactory source of bamboo for fishing rods has been entirely cut off. Domestic sources have been tried and found unsatisfactory. A limited supply of good quality bamboo was finally located in Puerto Rico, which is now being used, but this source cannot possibly meet the demand for rods. Up to this time no shipments have been received from China, but there are hopes that this condition will be changed in the next 6 months. Plant changeover, which of necessity was drastic in this industry, coupled with an uncertain labor market and the retraining of skilled workers have all combined to make the job of reconversion agonizingly slow.

Since last December there has been some agitation among fishermen, sporting goods dealers and in the press because well-known brands of prewar rods, reels, baits, and other tackle equipment have appeared on dealers' shelves in such insignificant quantities. It has been openly intimated that tackle manufacturers have been guilty of deliberately withholding shipments from the trade and building up excessive inventories of finished goods for more propitious delivery dates. The foregoing facts have been presented to prove that this is not so. It has not been clear sailing for manufacturers since the cessation of hostilities. The true facts reveal that the path of reconversion has been beset with more obstacles than actually existed during the war period.

Now let's look at the present delivery situation. When will you be able to buy normal quantities of the tackle you have been denied since 1942? Right now assembly lines all over the country are humming and shipments are leaving the factories in ever-mounting volume. By September or October most factories will be turning out equipment in 50 per cent greater quantities than in any prewar period. It is estimated that the full season of 1946, however, will only see the delivery of approximately 60 per cent of a normal year's supply of tackle. The reason for this relatively low figure is the fact that in a normal year substantial shipments start in January and February and this year they cannot possibly start before April and May.

The all-important questions in the minds of most anglers are: Will the new tackle be as good as it was before the war, or better? Will

there be a lot of new models or styles? Will some of the new materials developed in war production be used in fishing tackle? How much will the new tackle cost? I will try to give you reliable answers to these questions on the basis of information received from members of our association. Complete answers will not be available for many months because of as yet unsolved problems of production and unfinished tests of new materials and designs.

In general the quality of the fishing tackle produced in 1946 will be improved over that of the prewar period. New production methods and techniques have been learned in the manufacture of war supplies and these have been applied to civilian production. Most of the basic materials are improved and new ones have been substituted to give greater durability and utility than their prewar counterparts. Many factories have been enlarged and much of their obsolete machinery replaced with modern machines which insure better workmanship and more accuracy.

There will be few startling changes in the fishing tackle produced during the current year. During 1946 most of the rods and reels which you will find in your favorite sporting goods store will in most cases follow the patterns of the old familiar prewar models. What changes there are will not be easily discernible to most buyers. By the time the 1947 season rolls around it seems quite likely that some of the new ideas which have been experimented with since the end of the war will be on the market in a broad way. It is the opinion of most manufacturers that before drastic changes are made the new designs and materials should be thoroughly tested and experimented with before they replace the tried and proven models which have stood the test of time. There are of course some notable exceptions, a few of which I will attempt to touch on briefly.

Here are some of the innovations which will be found both interesting and of utility value in the new fishing tackle. A new magnetic anti-backlash reel with no mechanical backlash features. Through the use of magnets the plug can be thrown out freely. There are no mechanical contrivances on this reel to get out of order. This reel will not be ready for the market until late in the summer.

A new fly rod reel with the descriptive trade name "Re-Trew-It" has what is called by the maker finger tip control. This reel has no spring to wind—a simple flick of the finger activates the reel and winds up the surplus line.

A new design in casting rod handles makes its appearance on the top numbers of one manufacture's line. On this handle, which is called "E-Z Reach," the reel is placed at an angle permitting easy

thumbing without raising it above the level it would normally occupy on the ordinary offset handle.

Plastics will of course play a larger part in fishing tackle production in the future than they have previously. Plastic reel seats will be substituted for metal in many makers' lines, and plastic finishes and fillers on fly and casting rods will be noted here and there. We have a report that research and tests have been conducted by one manufacturer on a plastic fly rod that has unusual possibilities. The material used has strength and is of course light in weight. We prophesy that plastics will play an important part in tackle manufacture in the years just ahead.

Domestic fish hook manufacturers have made tremendous strides in the last 2 years. Before the war 75 per cent of our hooks were imported from Norway and England. To meet the demands of the United Nations for essential food fishing and emergency fishing kits, American manufacturers have tripled their prewar production facilities and are now producing hooks of all sizes and types at a rate of approximately 600 million a year.

The answer to the question of how much will the new tackle cost is quite simple. It will cost slightly more than it did in 1941 and 1942. But the increases will probably not exceed 15 to 20 per cent. Over-all costs in the industry have increased on the average about 35 to 40 per cent, but part of this increase will be absorbed at the manufacturing level. Most manufacturers have granted wage increases of from 50 to 65 per cent since 1941, but with the prospect of greatly accelerated production and more efficient methods they hope to reduce their present over-all costs to a point where a price rise of 15 to 20 per cent will be adequate.

The prewar fishing clan, which numbered almost 15 million men, women and children—over 8 million of whom were licensed each year —have been supplemented by countless thousands of returning war veterans. In far flung corners of the world, many of these veterans have learned the joy and solace of fishing for the first time. Uncle Sam has furnished his service personnel with complete fishing kits as part of the recreational program in many areas, while fly-tying, and casting are widely used in veterans rehabilitation centers in this country and abroad. This has of course increased the demand for equipment and placed an added burden on already inadequate fishing facilities.

This tremendous army of enthusiasts depends on clean waters for its source of health and recreation. Knowing this situation so intimately from close association, the fishing tackle manufacturers view with

alarm the increase in the number of polluted streams, rivers, and lakes in this country. For years we have strongly advocated the passage of a federal anti-pollution control measure by Congress with teeth in it. Through the medium of the Izaak Walton League of America, to which we make a substantial annual contribution, we have waged our fight and it is encouraging to note that it appears quite likely some such measure will be favorably reported out of committee to the present session of Congress.

The fishing tackle industry is keenly alive to its responsibilities to produce more and better tackle at fair prices, and to do its part in furthering a national program of conservation and propagation. Our association activities for the present year and on a long range basis call for full support of all agencies of government and private institutions charged with the responsibility for preserving our wildlife resources. Our individual manufacturers are committed to a policy of improving their equipment to fully meet the demands of the fishing fraternity. It is our firm conviction that the future of fishing in this country is unlimited.

DISCUSSION

MR. WALTER F. CRISSEY (New York): I am here on my own. I do not represent or express an opinion from the Fish and Wildlife Service officially. In traveling about the states, I hear a question that is asked me directly, "What is happening to the Buck-Clark Bill?" There is a feeling in the states that your Association is bucking the Buck Bill. I wish you would enlighten me.

MR. HOLMES: Frankly, I don't know it by that name. We, as an Association, are on record as advocating the passage of a bill similar to the Pittman-Robertson Act, which I presume is what you are referring to.

MR. CRISSEY: The Buck-Clark Bill.

MR. HOLMES: We, as an Association, are on record as advocating the passage of that type of legislation and, in fact, I have been working very closely with Carl Shoemaker for the past couple of months with the idea of having that Bill introduced into the present session of Congress. We do have a difference of opinion in our Association, frankly, as to the merits of that. We have some definite opposition, but we have a majority in favor of it and I believe that something like that will go through. It would be very beneficial because it is the only way that we estimate that about a million and a half dollars could be raised annually as a result of that type of legislation which we think is very essential.

MR. MERRILL GILFILLAN (New York): Does that increase the cost of tackle?

MR. HOLMES: At the present time on rods, reels and baits, you are paying a 10 per cent excise tax. What we advocate is a 10 per cent tax on all fishing tackle which would include lines, tackle, and everything else.

THE GOOSE AND THE GOLDEN EGG

CHARLES EDWARD GILLHAM

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The Greeks had the words for it: "Kill not the goose that lays the golden egg."

Shall we be like the countryman of ancient times, who possessing a goose that laid eggs of pure gold, reasoned that the bird was entirely composed of this precious metal and butchered the profitable fowl, only to find he had an ordinary goose? A very dead goose at that?

We are only a few jumps ahead of such a short-sighted policy. Unless this bird is given the protection it warrants, the future business in sports equipment dependent upon wildlife may end up on a platter, and its possible offspring forever be lost.

Let us look at the size of the eggs of this recreation goose. B. E. Strader, director of sales for Remington Arms Company, in a recent address said: "Americans may be expected to spend three billion, six hundred and forty-four million dollars a year for recreation about five years after the end of the war."

"In seeking to plan for post war years," he continued, "we have taken into *consideration the forecast trends towards a higher national income compounded with an objective trend towards the elimination of low-income groups.* Based on these trends, and 135 billions of dollars of gross output for goods and services in the postwar period, we find recreation's share would stand at $3,644,000,000—an increase of 121.8 per cent over 1935 and 1936."

According to a recent issue of National Wildlife Federation Conservation News, the business of supplying guns and ammunition amounts to about 39 per cent in value of all sports equipment. The figure of $121,855,304 is given as the manufacturers' selling price for the total sports equipment bill. Of this amount sporting ammunition leads the field with $29,091,475. Next in line is sporting firearms, a total of $17,268,915. In addition $1,272,170 is spent for hunting and shooting equipment.

Golf equipment comes next to arms and ammunition—$15,644,612 goes for this. Fishing tackle amounts to $12,574,758, and this figure, combined with guns and ammunition, goes to make up almost 50 per cent of the whole sporting goods bill that is spent on hunting and fishing equipment.

The golden eggs are large, but bear in mind the $46,360,380 spent for guns and ammunition are figures of the U. S. Department of Commerce as of 1939. The amount will rise.

What has been done, or is being done by the manufacturers of arms and ammunition, to give the golden goose adequate protection that her clutch of eggs shall not be disturbed?

The members of the sporting arms and ammunition industry were among the first to recognize the importance of conservation and restoration practices. Individually, and through the Sporting Arms and Ammunition Manufacturers' Institute, they support seemingly an endless list of activities beneficial to their sportsmen customers. The members of this Institute are: E. I. du Pont de Nemours & Co., Inc., Federal Cartridge Corporation, Hercules Powder Company, Inc., Ithaca Gun Company, Inc., The Marlin Firearms Company, O. F. Mossberg & Sons, Inc., Peters Cartridge Division, Remington Arms Company, Inc., Savage Arms Corporation, Western Cartridge Company (Division of Olin Industries, Inc.), Winchester Repeating Arms Company Division of Olin Industries, Inc.).

Following are a few examples of the activities of members of the industry in the conservation and related fields:

They gave wholehearted acceptance to the 10 per cent tax (later 11 per cent) on arms and ammunition. It is a continuous expense to the industry to maintain accountability for that tax. They accepted in good spirit criticism of shortsighted individuals who protested against continuing the tax when excise taxes were removed from many other sporting goods. This tax represents monies collected under the Pittman-Robertson Act.

Purchases of the industry's products have paid $25,406,167 in taxes since 1938, which have been earmarked for wildlife restoration. Of this only $11,900,000 has actually been appropriated. leaving a balance of $13,506,167 still available. Three million dollars have been requested by the Fish and Wildlife Service for the 1947 fiscal year. Remembering that the Federal Government may pay only 75 per cent of the cost of any project, the total potentially made available for wildlife restoration stands at $33,197,291.41.

They were among the first to adopt a policy of unselfish selfishness in perpetuation of their business by:

Sponsoring a national campaign to make shooting—already a safe sport—still safer.

Contributing to conservation organizations.

Supporting public and semi-public organizations for conservation and restoration of game.

Establishing technical schools for training in game management.

By educational campaigns reaching both adult and youth organizations.

Actively promoting game restoration in advertising.

Contributing research in game restoration technique.

C. S. Bedell, Director of the Sportsmen's Service Bureau of the Sporting Arms and Ammunition Manufacturers' Institute, in an address before the National Safety Congress, Chicago, called attention to the industry's Ten Commandments of Safety, a leaflet which has been distributed to the extent of 13,500,000 copies. In addition, 280,000 safety posters have been distributed, and more than one million persons have seen the Institute's motion picture, "The Making of a Shooter," a safety-education film. Approximately one half of this vast audience was composed of youth groups.

In his address Bedell called attention to the fact that of all accidents man may incur, only 17.05 per cent happen under the heading of sports and recreation. Breaking down recreational accidents we find that hunting is No. 11 on the list (compiled by Travelers Insurance Company):

Activity	*Claims*
1. In country or woods	361
2. Horseback riding	270
3. Baseball	256
4. Football	248
5. Bicycle	246
6. Winter sports	219
7. Bathing and swimming	202
8. Golf	178
9. Basketball	157
10. Athletic games	156
11. Hunting	140
Other classifications[1]	1,103
Total	3,536

Carrying this analysis a step further, we find that hunting was responsible in 1943 for fewer than 0.68 per cent of the Travelers' 1943 accident claims, as against 16.37 per cent for other forms of sports and recreation.

As examples of the efforts of members of the arms and ammunition industry to forestall the complete destruction of American game shooting, let me point out a very few activities of our industry mem-

[1]Boating and canoeing, bowling, tennis and squash, skating, scuffling and wrestling, gymnasium, fishing, at theatres, churches, and concerts, at parks, picnics and outings, dancing, billiards and pool, boxing, miscellaneous.

bers calculated to prolong the life of the goose that lays the golden egg.

When it became apparent that American colleges and universities were willing and able to take over the job of training young Americans in the arts of game breeding and game management, the sporting arms and ammunition industry closed its American Game Institute at Clinton, N. J., founded and maintained with industry funds, and the various members re-allocated their support to various phases of game restoration in its more specific applications.

Remington, du Pont, Hercules, and other manufacturers generously supported the American Wildlife Institute, helping make possible this annual conference, which serves as a clearing house for all game restoration techniques developed by the various federal, state, and private agencies concerned with this vital national problem. Education of game technicians through a cooperative program with land-grant colleges has been an outstanding achievement of this organization.

Western-Winchester, while wholeheartedly indorsing the program and policies of the American Wildlife Institute, have rendered their principal service to game restoration in a cooperative research program with the Soil Conservation Service that has continued without interruption for 10 years, and is recognized as the oldest continuous research project in game restoration through land-use practices still existing in its original form. As an outgrowth of this cooperative program, more than one half million textbooks on game restoration through land-use practices have been distributed free of charge, according to Charles H. Hopkins, director of public relations of Olin Industries, Inc. Similarly, textbooks on modern upland game propagation have been made available without cost to organizations and individuals requesting them.

Federal, meanwhile, has sponsored an educational program among 4-H club boys and girls—the future farm operators of our country—which has reached a cumulative audience of hundreds of thousands of young Americans since the program's inception.

These activities have been conducted by various members of our industry without the slightest jealousy, without any commercialization whatever. They are, of course, coordinated to the general program of the Manufacturers' Institute in game conservation and safety practices, in which all members of the industry participate.

It follows, therefore, that when a gun or ammunition is sold to a customer, the industry regards that customer as a friend, and has a mutual interest with him in the perpetuation of the sport of shooting.

We recognize that unless this policy is faithfully observed by all parties, shooting under the free American system is doomed.

Probably some of you have visited factories where guns and ammunition are produced. I am going to pass out a few samples of shotgun ammunition. These shells are cut away to show you their construction. Through the windows you have a view of the amount of work and material that goes into making up a commodity that sells for less than 6 cents. Because ammunition is so quickly expendable, requiring but a split second to fire it, few shooters give much thought to how it is made. I invite you to compare it as to workmanship and number of components with a metal lead pencil that retails for probably a dollar.

You are getting in American ammunition the very finest product that can be produced. Shells are subjected to rigid dimensional tests. They meet exacting demands as to quality, weight, and strength. Aside from meeting mechanical accuracy in their making, they are subjected to continuous investigation as to velocities, patterns, resistance to moisture and temperatures, and the like.

Our research laboratories are continually striving to improve ammunition and the guns to shoot it. Many of you can remember the muzzle-loading days. We have gone far in improving shooting equipment since then and in increasing the safety of our product.

While the amount of money spent for ammunition sounds like a terrific sum, the actual cost of ammunition is usually a small fraction of the total cost of hunting. An extreme example is that of Ray Trullinger, outdoor writer right here in New York. He purchased a box of 30-'06 ammunition and went moose hunting in Quebec. He used two cartridges and bagged his game. The next year he went back and repeated on another buster with just one cartridge. Two subsequent deer hunts resulted in two bucks and the expenditure of four more cartridges. The remaining 13 in the box he gave to a friend. He has not confessed as to the cost of guides. transportation. clothing. and all that went with those four hunts, but his ammunition bill was less than one dollar for four big game hunts.

American guns are among the world's finest so far as accuracy, safety, and durability are concerned. If a man will take care of his shotgun or rifle it will last him a lifetime. If he lives to a fair age, he can get out for a yearly arms cost of one or two dollars over a span of time. Compare the life of a gun with that of an automobile and the upkeep on it. Compare the cost of ammunition with the gasoline, oil, and tires needed to operate the car on a hunting trip.

Duck shooting expends considerable ammunition. If you require

even 50 shells to kill a limit of birds, how does this cost stack up with your transportation, guides, club fees, and other equipment? Probably the cough syrup and liniment required for complete recovery from exposure will be as much. Throw in the cost of the wool sox your boots wore out at the heels, and ammunition prices are secondary. If you needed to buy a new hat for the wife as a peace offering for your absence — well, anyway, ammunition is a small part of shooting costs.

How many people hunt? Approximately 14 million. They contribute some 20 million dollars annually in hunting license fees alone. Dr. Gabrielson estimates that 1¾ million Americans bought duck stamps this past season.

Who hunts? Pennsylvania Game Commission listed them as follows for their state in 1941-1942:

Unskilled labor	46.8 per cent	Industrial labor 67.3 per cent
Skilled labor	20.5 per cent	
Professional men	2.5 per cent	White collar workers 11.8 per cent
Clerical workers	3.4 per cent	
Businessmen	5.9 per cent	
Farmers	9.4 per cent	20.9 per cent
Students	6.7 per cent	
Women	1.1 per cent	
Unclassified	3.7 per cent	

Other states give different percentages, but this gives an idea of who does the shooting. Also it might lead to some thought when one considers where these people are to shoot. Note that only 9.4 per cent are landowners, or live on the soil.

Ages of shooters range from 12 to 70 and over. In the group 20 to 25 years appears 18.22 per cent of all hunters. Note this fits in well with the age of returning soldiers.

What do they shoot? Not all of them are after Dr. Gabrielson's ducks, as one might suppose from stamp sales and all the controversy regarding seasons. Waterfowl, in fact, are way down the line. They rank fourth. I quote from figures in the Remington Arms Company dealer letter, July 6, 1944. Shotshells are used as follows:

Rabbits	29.6 per cent	of all shells go for this sport
Squirrels	14.0 per cent	of all shells go for this sport
Quail	13.9 per cent	of all shells go for this sport
Ducks & geese	10.5 per cent	of all shells go for this sport
Pheasants	9.5 per cent	of all shells go for this sport

Doves	7.0	per cent of all shells go for this sport
Other game	3.5	per cent of all shells go for this sport
Traps & skeet	12.0	per cent of all shells go for this sport

The lowly rabbit leads the parade. Squirrels and quail almost tie for second. Ammunition for this type of shooting need not be high-velocity loads. In fact the trade calls the lower-velocity shells "rabbit loads." Part of the buiness end, then, of supplying guns and ammunition to hunters has a lot to do with this group. Certain sections such as the Southeast are heavy buyers of "rabbit" loads. Also cheap guns, as the single barrels, are popular for this kind of shooting.

In metallics .22 cartridges are the most common. Sixty per cent of them goes for hunting field game. Informal target shooting uses 27.2 per cent. Galleries take 7.7 per cent and formal targets 5.1 per cent.

Centerfire rifle and pistol ammunition is used to the extent of 37.7 per cent for big game and predators. Law enforcement takes 45.5 per cent. Formal target shooting 11.1 per cent. All other rifle 1.8 per cent, all other pistol 3.9 per cent.

How much game do we kill yearly? The figures of the U. S. Fish and Wildlife Service, 1942, will give you an idea, and remember that shooting pressure is increasing:

Big game—deer, elk, antelope, moose, sheep, goats, bear	646,973
Upland game — rabbits, squirrels, raccoon, opossum, woodchuck	71,090,217
Upland game birds—quail, pheasants, grouse, partridges, turkeys	41,409,869
Migratory game birds—(other than waterfowl)—doves, fantail pigeons, woodcock, rails, sora	16,716,336
Waterfowl — ducks and geese	16,716,336
Total	141,381,162

This figure also corresponds closely with our human population, or about one game bird or mammal per person is taken yearly in the United States.

As a matter of interest the U. S. Fish and Wildlife Service estimates the dressed weight of this bag of 1942 at 255,404,055 pounds of meat. This weight would be equivalent to 392,929 big live steers of 1,000 pounds each, if they dressed 65 per cent.

Head to tail, they would make an unbroken column 446 miles long.

It should now be evident that arms and ammunition manufacturers are the last people to wish to see the goose that lays the golden egg threatened in any way — even if that egg is not as solid and sub-

stantial as some eggs in other industries. Many manufacturers have an unlimited field that may be widened by advertising, or by better standards of living and prosperity among our people. Our business is definitely of a restricted nature, dependent upon the game supply of the Nation. We would be foolish not to recognize this, and for this reason if for no other, we were among the first to sound a warning against the possible disappearance of game and the vanishing of shooting as a sport.

Naturally arms and ammunition manufacturers will attempt to supply the demand for their products. But we hope that all administrative game agencies will give due recognition to the shooting pressure that is to be put upon all species of game, and administer their regulations in such a way that all types of shooting will be forever perpetuated.

We are, of course, interested in seeing that people have a place to hunt regardless of the amount of game they are permitted to take. Such things as public shooting grounds, we feel, should be provided wherever possible. Proper use of land and water will go far toward furnishing additional game habitat sufficient that some shooting may be enjoyed by everybody.

Trap and skeet shooting and rifle range competition take some pressure off the game supply, and should be encouraged. Americans like to shoot at something, even an inanimate object. Much of the desire to shoot is satisfied by these gun games.

We feel a distinct need for more outdoor news in the daily press of the country. Through intelligent columns, the public can be informed of the proper way to shoot. Attention could be called to the need for rigid conservation and restoration practices. An informed public can do much toward securing legislation that will aid in building up our game supply that we may always have some shooting. Also, as game is a by-product of proper land use, a distinct service might be rendered the peoples of our Nation in rallying them to this just cause.

We wish to stay in business, and continue to sell guns and ammunition. Therefore, we are fully as interested as you are in having a continued supply of game in America. We urge that all shooting be done in keeping with good management practices, and emphasize that it is not nearly as important to kill a lot of game as it is to play fair and take only what the wildlife populations will stand.

The Greeks had the words for it — the moral of "The Goose and the Golden Egg" is simply stated. I quote: "Those who have plenty but who want more soon lose all that they have."

DISCUSSION

MR. WILLIAM L. LAHAYN (Ohio): Did I understand you to say that public hunting on public ground was doomed?

MR. GILLHAM: No, sir, I did not. I said unless many of these things were doue, the free American way of shooting was doomed. Incidentally, I had a plug in here advocating public shooting, shooting for people who now don't have a chance. I had to skip this and cut it short. When I got on this subject, it was too long, but I wanted to incorporate it in this paper.

I said the free American way was doomed unless we snap out of it. That is what I mean, sir.

BIG BUSINESS KNOCKS AT THE GAME BREEDER'S DOOR

C. L. SIBLEY

Secretary, American Pheasant Society, Wallingford, Connecticut

We are so accustomed these days to the idea of billions of dollars being tossed carelessly around that possibly the title of this talk is misleading. Big Business thinks little these days of a few millions one way or the other. However, to a lot of us, a business that will return an individual a net profit, after taxes, of 15, 20, 25 thousand dollars a year or more, looks like "big business" to us. For the next 4 or 5 years such profits are possible for the game breeder with vision, initiative, business, and game-breeding experience and adequate capital and facilities. Please note these qualifications carefully.

There is a pent-up demand for game birds for shooting purposes at prices that will show an excellent profit. The war took most of the game breeder's experienced help via the armed forces or high wages for war production. Rearing of sporting pheasants and wild ducks was very much curtailed. We were busy winning the war. However, those game breeders who stuck with it in spite of all sorts of discouragements, such as labor troubles, high feed costs, poor quality feeds, scarcity of new equipment, wire, etc., reaped a very neat profit for their pains. The demand for game birds was far greater than the supply and prices paid were the highest in the history of the game-breeding business. This in spite of the fact that a great percentage of the sportsmen were so busy with war work they had little time for shooting. With the end of the war and more leisure, the demand for birds for shooting has skyrocketed to an unprecedented peak, and during the last year it has not been a question of "how much will the birds cost?" but "can I get the birds at any price?" It will take 3 or 4 years at least for game breeders to catch up with the demand. True, there are hundreds of ex-service men going into the game-breeding business attracted by recent high profits and the

chance to be their own boss with a healthy out-of-doors occupation; but scarcity of feed stuffs, equipment, wire, etc., combined with lack of experience will prevent inexperienced newcomers from flooding the game bird market for several years, if ever.

At present it appears that with a settlement of internal industrial and national difficulties, we can look forward to at least 3 or 4 years of high income for nearly everyone. Of course, we live in times such as no one has ever experienced before and almost anything can and may happen, but we can only prognosticate on the basis of past history and experience.

Several new sources of income from game birds have been developed during the past 3 or 4 years. The war prevented the usual importation of plumes and feathers for millinery and decorative purposes and the millinery trade had to fall back on feathers of domestic fowls and captive-reared pheasants and wild ducks. Pheasant and wild duck feathers with their unusual colorings and shapes, great sheen and remarkable beauty have been very much in demand for adorning milady's hat. By judicious advertising, this new market can not only be retained but enlarged, even though importation of foreign feathers is resumed. It's up to the ingenuity of game breeders as to how much of this market they wish to keep.

With unspendable money jingling in hundreds of thousands of pockets, the demand for game for eating has quintupled during the past few years. As a change from domestic chicken and duck, sometimes the only meats available at certain periods during the war, pheasant, wild duck, quail, wild rabbit, etc., have become increasingly popular, and can now be found not only in the higher class eating places which served these delicacies before the war, but in many less exclusive places where such items were formerly unknown on the menu. People have learned to enjoy eating game and, with the unprecedented amount of money in the pockets of John Q. Public, can afford to pay for it. For some years, at least, it seems reasonable to expect that the consumption of captive-reared game as food will increase. England, which formerly exported to this country thousands of pheasants shot in the pheasant drives on its large estates, will probably be in no position to resume such shipments for quite a long time, so that prices of American reared game will not have the price competition these imported pheasants formerly provided.

One businessman we know has made a tidy sum at Christmas by buying several thousand pheasants, killing them and packaging the full-plumaged birds in pairs, in attractive cartons with their colorful feathers intact. He incloses an appropriate card for the season with

the donor's name, dresses up the package with a sprig of holly or mistletoe, and sells these gift packages at $12.50 for a pair of cock and hen or $15.00 for two full-plumaged cocks. He ships anywhere in this country. Dry ice and air shipment insure safe arrival in good shape at distant points. Many a game breeder can take a tip from this gentleman and work up a lucrative business for himself by judicious advertising and progressive business methods. We have enough people in this country of ours who are able to afford such gifts to their friends so that the extent of the mail-order business of this sort is only limited by the supply of birds available and the business acumen of the seller.

Another man, a game breeder, in addition to raising all the pheasants, quail, and partridges he has been able to on his own place, with limited and inexperienced wartime labor, has bought several thousand birds a year to dress off for some of the swank clubs in nearby cities. He apparently does very well, judging by the large surtax he has to give Uncle Sam each year.

There is also the unsatisfied demand for high-class stock for breeding. From 1940 onward, no game birds were imported into this country and the demand for rare and expensive exotic game and ornamental birds of all kinds is far in excess of the supply. Zoos and private collectors have been bidding against each other for the small available supply of rare and beautiful birds and animals. We can be reasonably sure that the next few years at least, will see a demand that will not be satisfied for these high-priced, rare game and ornamental birds. Most of the people who collected and exported such birds to America in peacetime are now occupied with the basic necessities of shelter, food, and clothing, and the ravages of world-wide war have depleted, sometimes to the point of extincting, the supplies of these rare birds in the wild. A majority of these birds are edible game in their native habitats, and starving natives have not neglected this important source of food. For several years the sale and importation of high-priced breeding stock will be still another string to the game-breeder's bow.

In this connection, the rapid enlargement of air facilities will greatly increase the market for high-class game birds for breeding purposes. Our Latin American neighbors to the south especially, representing as they do the largest segment of the world unaffected by war, and still possessed of enormous natural resources, are increasingly bird-conscious and air transport should help the game-breeder greatly in developing a rich and prosperous market for his breeding stock.

The opportunity for profit, certainly for the next few years, is limited only by the skill, originality, initiative, experience, and resourcefulness of the game breeder. For some years to come the demand for the products of game breeding will be far in excess of the supply. We have learned, during the last decade, a great deal about mass production of game birds and animals, so that the numbers of certain species which can be profitably produced is almost unlimited. Bobwhite quail, for instance, may be produced in almost limitless quantities, and it is not too far-fetched an idea to envision the average family with roast quail on its table now and then, much as it has roast chicken now. Ring-necked pheasants and mallard ducks lend themselves to the same wholesale propagation, by methods developed during the last few years. Sooner or later progressive game breeders will take a leaf from the book of Mr. Woolworth of five-and-dime-store fame, and make larger profits from sales of greater numbers of game birds, at modest advances over cost of production rather than trying to sell smaller numbers at a greater profit per bird as has so long been the custom. With greatly increased gross sales, some game breeders will be in the "Big Business" classification. The business is there for the man with the ability to handle it.

A man with the necessary qualifications for success in game breeding could employ his talents to make more money in some other business, you say. Quite possibly. But in addition to the profit he makes there are the compensations inherent in the game breeder's way of life. To a lot of mighty keen men that incentive balances the scales in favor of game breeding.

Obviously, it is impossible in a paper of this length to do more than scratch the surface of this subject. Many questions will arise in your minds about some of the matters touched upon. If there is time, I shall be glad to answer any of them to the best of my ability.

DISCUSSION

MR. JAMES W. JOHNSTON, JR. (New York): On Monday morning during a discussion of production of game birds by state organization, the question was asked of the Superintendent of Game Birds from New York State, "What is the cost of an 8-week-old bird?" He gave a figure of one dollar. Could you give your opinion about that estimate?

MR. SIBLEY: If I gave you my frank opinion, there would be a great deal of sulphur in the air.

MR. JOHNSTON: I would like to have it.

MR. SIBLEY: I feel very strongly that state game farms, in order to justify their existence, are inclined to leave out what we might possibly call "intangibles," but what the businessman would call "overhead." The state game farm is supported by the taxes of the people of the state and in any figures that I have ever seen, as a businessman, those figures could be absolutely ripped to pieces, in my opinion. What age was that?

MR. JOHNSTON: Eight weeks.

MR. SIBLEY: In my opinion, taking feed, labor, and depreciation, all the overheads that the man in private enterprise must take into account, a ring-necked pheasant at 8 weeks would not cost anything less, at present prices, than from $1.50 to $2 to raise to 8 weeks. I think that is fairly conservative and I think also that price is the price it would cost a man who is on the job and who is right on his toes.

The man who has his own capital invested in the game-breeding business is on his toes every minute of the day to take advantage of every possible thing in order to keep down his costs and increase his profits. It is my experience that men working for the state on a salary, 8 hours a day and sure that if the birds all die from one cause or another it isn't coming out of their pocket, won't put in the same amount of concentrated thought and effort that the private breeder will, who has his own living and his own capital at stake.

MR. HIRAM B. D. BLAUVELT (New Jersey): What about a 14-week-old bird?

MR. SIBLEY: I should say that, of course, there is a variation in the cost because some people are very much more efficient than others, but I should say a 14-week-old bird would cost from $2 to $2.50. I think that is a very conservative figure.

MR. BLAUVELT: In the State of New Jersey, last fall, we paid $3. Would you say that was giving the commercial breeder a fair break?

MR. SIBLEY: No, I don't think it was. I think the comercial breeder who sold you birds for $3 didn't have his cost sheets up to date.

MR. BLAUVELT: What would be a fair price?

MR. SIBLEY: I certainly think nothing less than $3.50 in large lots.

MR. BLAUVELT: Some of those birds weren't too good, you know.

MR. SIBLEY: There we have something else again. Tailless birds that have been picked and crippled by cannibalism and that sort of thing naturally are not good shooting birds and they won't be. In a case like that, the breeder should be fortunate in getting what he can for them.

MR. BLAUVELT: You mentioned the fact that the breeding stock had gone down, which I think everyone concedes. What are we going to do to get the vitality and strength and everything of ring-necked pheasant breeding stock back? For example, what would you say a really top breeder today would be worth this spring?

MR. SIBLEY: Cocks or hens?

MR. BLAUVELT: Both.

MR. SIBLEY: Well, the going price has been in the fall about from $4 to $5 for good cocks and from $3 to $3.50 and possibly $4 for hens. That is in the State of Connecticut and that was last fall. The breeder who has carried those birds over and is taking a licking on his wire, feed, labor and all his other costs should get more for those if they are sold in the spring.

MR. WILLIAM L. LAHAYN (Ohio): Do you think that the supply through state game farms and also commercial breeders will ever supply the demand again? Do you think that the pressure on the hunting areas is too great to keep up with the supply?

MR. SIBLEY: Well, I think that the former speaker mentioned that: He touched upon that subject. I think that it is perfectly possible to produce limitless numbers of game birds. There is no reason why it can't be done, but the trouble has been that when the state game commission, for instance, bought birds, they would want to buy the birds at the cheapest possible price. There was no incentive for the game breeder to increase his output as this paper just said. There is no limit to the number of certain kinds of game that can be produced, game birds, especially, and I think that if the proper prices can be gotten and they certainly can be gotten today because the supply of birds is far less than the demand, that an experienced man is justified in adding capital and increasing his output of birds and he can do it very well because now labor is coming back and materials will soon be available for increasing. Does that answer your question, Mr. LaHayn?

MR. LAHAYN: Not quite, Mr. Sibley. The point of view I wanted you to point out was, do you think through natural—maybe I didn't explain myself in the first place fully—that the natural production in the wilds of restocking program will ever be sufficient to meet the demand?

MR. SIBLEY: In certain parts of the country it will. In some of the Western States, natural reproduction should, and I think, does take care of the sporting demands. For instance, North Dakota and some of the northern territory of grain-producing states find that the ring-necked pheasant is very successful and I know of eastern sportsmen who go there each year to get really good hunting, but in our thickly-populated Eastern States, I doubt very much whether naturally-propagated game will take care of more than 10 per cent of the demand for shooting.

I think the only solution to the shooting problem in our thickly-populated Eastern States is the private shooting preserve. The public shooting will depend almost entirely on liberation of birds immediately before the shooting season opens.

MR. EARL R. HOLM (New York): I am the individual who made the statement the other day in reply to an inquiry on cost. My statement as far as the pheasant production cost to the New York Game Department applied to the period before the war. I mentioned that we had no cost figures during the war years because we, like everyone else, had to curtail our activities. There was a demand to produce birds and the cost analyses which was something not too important in the eyes of some, went by the board.

I did not make a statement that the birds cost $1 apiece from 8 to 10 weeks of age, but, rather, that the cost there was slightly over a dollar. The birds produced by the brooder method cost around $1.20 apiece. We are still raising range birds. Those ran from $1.35 to $1.42, depending on the farm on which they were produced. As far as I am concerned, we have no quarrel with commercial game breeders and no intention of filling the air with sulphur.

I am reminded, however, of a session that we had in the Waldorf-Astoria. Probably some of the men who are here now participated. The game breeders meeting, our present Deputy Commissioner and I were invited to attend that particular session and talk on game farm production cost.

At that point, we were producing pheasants with a release of 6 weeks of age and slightly over for 90 cents. When that statement was made, it was around 1936 and '37. We were really taken over the jumps. The same questions were put out then that the state, because of its obligations and whatnot, had mistaken figures. We had our cost records examined by commercial game breeders, by various other agencies that have been interested, and I still defy anyone to find anyone who has pointed out any objection as to the way those were set up and the day in which the analyses were made.

I believe that New York State is the only one that we have found so far that has been keeping accurate cost production on birds. Questionnaires of other states have been absolutely fruitless. We include all of our costs except that of land. The state assumes that the land at the time it is purchased is going to maintain the same value. As far as building equipment, feeds, and personnel, even the office and administrative overhead, are all prorated and broken down to meet all those production costs. We also include our credits for sale of setting hens and whatnot maintained on an accurate accounting basis.

We feel that we have something of an edge over commercial breeders because it is not necessary for the state to advertise their products and through the sportsmen there isn't the large overhead involved in the sales. We are frank to admit that in some instances it may be necessary for us to pay higher prices for our labor than can be secured on commercial farms, but our labor scales are something that are imposed by the legislature.

At the present time, by that same position, it is impossible for us to even compete with farm labor because our legislature feels that our game farmers are getting enough money for the work they do. As far as the hours are concerned,

I almost defy anyone to expect as much as we expect of our Game Department personnel in the course of a working day. We have had to trim to some extent because the state ordinarily doesn't abide by the regular labor laws that are imposed by the Labor Department, but before the war, all of the personnel were putting in a full 12-hour day and a good many a great deal more than that.

MR. SIBLEY: Mr. Holm, your men only work 12 hours a day?

MR. HOLM: Twelve hours is what we require of them. A good many put in more hours. The foremen work around the clock. All the permanent personnel work around the clock.

MR. SIBLEY: When do they sleep?

MR. HOLM: Whenever they get a chance.

MR. SIBLEY: Well, I think that one fallacy is that the land that you ran your pheasants on was worth as much afterwards as it was before. For farming purposes, it wasn't. After land has been pastured to a concentration of pheasants, it has to be highly fertilized and fallowed in order to have it in anywhere near the good shape that it was before. That is just one little point that goes to substantiate what I said, that the intangibles do not show on your costs.

I have gone over some of these state costs and until you break them down, they are very plausible, but to the man who actually knows what he is doing and what he is talking about, there are so many discrepancies in there that it is just too bad.

MR. BLAUVELT: Mr. Sibley, on that 8-week-old proposition, does that mean anything as breeding birds—you know your danger comes about that time from grounding and all that sort of stuff.

MR. SIBLEY: It all depends on the conditions at 8 weeks. If you put out 8-week birds and they are not carefully watched, you may have a cold fall rainstorm and a bunch of dead birds.

MR. BLAUVELT: I mean completely in the wild liberation.

MR. SIBLEY: That is what I mean.

MR. GERRELL: I can say from my experience of the game breeders there that a good game bird can take anything after 6 weeks that the weather can offer. If he has all his feathers and has been raised right for the first 6 weeks, you can put him out in any weather. If the bird is raised in a brooder and his feathers are not developed correctly, never having had any sunshine on them, to develop that sheen that will shed the rain, then you are in a bad way.

We are talking about birds here, but we have to talk about the range-reared bird and also the brooder-reared bird, which is apt to be quite a different thing.

MR. SIBLEY: I should have qualified what I said by saying that 8-week-old birds are often released in cover where there isn't sufficient food for them and in that case, especially with brooder-raised birds, they may become a cropper.

WHAT RAT CONTROL MEANS TO BUSINESS

JAMES W. JOHNSTON, JR.[1]
Supervisor of Rat Control, Department of Health, Buffalo, New York

Man's worst mammalian pest is the brown rat (*Rattus norvegicus*) because it is cosmopolitan and very inimical to our economy and health. The impetus of World War II upon conservation of stored products, real property, and man power, has caused an ever-increasing number of cities to adopt modern rat control services which are aimed at prevention. It is the object of this report to focus interest upon a major phase of such work, the deratization of municipal dumps because they often are centers of infestation.

The work of your public servants would be made easier if many more of the citizens would take to heart the implications of the immense economic loss and spread of human diseases resulting from the activities of this alien pest. The U. S. Fish and Wildlife Service (Green, 1943) has estimated that a rat eats an average of $4.00 worth of food per annum in the United States, and the total food bill is 300 million dollars. It is known that a rat eats approximately 50 pounds of food a year, and certainly more than this of a grain diet.

Recently there was the case of a large meat-packing firm in a Great Lakes city (Johnston, 1944) which had a large cooler that contained dozens of open barrels of corned beef. The rats had burrowed and nested within the cork insulation of this cooler and entered the barrels for food. Their urine, excreta and *Salmonella* bacilli were deposited on the exposed meat. This shocking condition caused the condemnation of 35,000 pounds of the corned beef and the owners were forced to ratproof their establishment.

On Grand Island, near Buffalo, a leading farmer estimated $50,000 loss per annum due to rats affecting his poultry and stored feed (Lay, 1944). When one brooder was moved, 97 rats were killed by mechanical means and later many hundreds more with zinc phosphide bait throughout the premises.

Rat damage to urban property results (Silver, 1942) from the continual burrowing and gnawing of these pests, and large financial losses accrue in the aggregate when concrete floors and sidewalks are undermined and broken or buildings settle too much. Rats cause many fires (Johnston, 1944) by making flammable nests inside buildings where spontaneous ignition can occur. For instance, 3 years ago such

[1]Grateful acknowledgment is made to the Buffalo Junior Chamber of Commerce for paying the author's expenses to the conference.

a fire at Buffalo resulted in a $25,000 loss, and rats are quite fond of gnawing synthetic rubber tires. Notwithstanding all of this, a comprehensive appraisal of rat damage to real property has not been made in terms of monetary value.

Such discussions of rat depredations do not usually consider the cost of controlling the rodents, yet the pest control industry is vitally important to private business. In the long run, the costs of such services are amply justified by the protection of property and peace of mind, and this industry has made big improvements during the last 10 years.

The City of Buffalo (population 600,000) does direct control of rats only on city properties, such as buildings, dumps, zoo, dilapidated structures, and open lots. Our seven ash-and-refuse dumps are a major responsibility and the Commissioner of Health is in the position of having *to keep* the dump-rat population at a low level.

During the fall of 1943 two of our dumps were heavily and three others moderately infested. No intensive poisoning had ever been done. The biggest dump had more than 2,000 active nests on 3½ acres. The rats fed at the active front where some waste food materials were dumped because indifferent citizens hid this unlawful matter in ash cans. Large colonies were located in the steep, harbor-side bank and level ground along the other edges. Rats regularly traveled up to 200 yards for food and to compete with the abundant gulls.

While there were at least 10,000 year-around rats, undoubtedly considerable increase took place during the warm months. With the occurrence of hard frost in November, undoubtedly there was a semi-annual migration of rats into buildings within at least a mile, and this was promptly reflected by appeals for help from businessmen.

Observations on the preference which rats exhibit for dump materials for nesting sites showed that large piles of ashes often contain 6 to 10 large, active burrows. This is probably due to the easy digging and good drainage. These are eventually graded by bulldozers, but delays enable the rats to raise one or more litters.

Other materials, in order of apparent preference as nesting sites, are heaps of dead leaves, steep banks consisting of mixed materials, piles of building rubble or stones, pure subsoil from excavations, and odds-and-ends. The first two materials were used much more frequently than the rest of the list.

Human activity by day and night does not frighten the dump rats, who are well adjusted, but nevertheless, remain at a safe distance. The best kind of discouragement for rats is immediate grading of fresh piles by bulldozers, compacting by heavy vehicles, and then

covering by soil at least 2 feet thick. Rats do not burrow in this kind of material in economic numbers.

Although Buffalo has a large average annual precipitation and an exceedingly windy, cool climate, the brown rats thrive under these influences. Soaking of the ground does not destroy many litters of young, and each pair breeds five to six times (Silver, 1942) annually on the dumps.

On the other hand, our periodic, heavy treatments with zinc phosphide bait have rapidly decimated the rat colonies. After 2 years and five or six treatments, five of our dumps are clearly reduced to minor jobs because the populations are being maintained at low or subeconomic densities. The two largest dumps have shown evident fluctuations in rat abundance in spite of good kills during early spring and late fall. Therefore, additional midsummer treatments have been applied in order to keep the pests in check when breeding is frequent. It is quite probable that increases within a few months on these dumps are due to reinfestation from adjacent food processors and grain elevators situated within a mile. Such migrations take place during winter, also, because these mammals resume normal activity within a few days after a sudden drop or rise in air temperature.

On the two large dumps the rat colonies have shifted during 2 years from formerly very active sites to new or little-used ones. The new colonies are less than 100 yards from food sources. The theory is that two factors account for the shifts — dumping of attractive nesting materials nearer the active fronts and periodic, mass slaughters by the city's rat control staff. For instance, the biggest dump originally had dense colonies at the northwest end, but after three successive baitings, these became defunct. New colonies appeared at the southeast end close to the active front, which was gradually covering this waste land. And small colonies developed where a black, fine soil had been dumped and loosely graded by bulldozers.

Seven dumps, treated as one operation, have cost approximately $600 and have reduced the rats below economic importance for at least several months (Johnston 1946a). This is cheap, direct control when the great benefits to community and business are compared to cost. We use a mixed, fresh bait containing ground fish, dog food and vegetables (Johnston, 1946b). During the forthcoming spring baiting, we will change our standard poison to sodium fluoroacetate, as this wonderful new rat and mouse killer is now available in quantity to qualified officials.

Sodium fluoroacetate is the most effective and dangerous raticide, and must be exposed with the utmost precaution. It is a white powder

and is very water-soluble. The poison is mixed at a ratio of only 1 ounce to 25 pounds to yield a rapid "knock-down" or kill in 1 to 3 hours (Spencer, 1946). Since it is a respiratory depressant, the rats tend to leave the burrows and die on the surface.

The problem of guarding pet animals from poisoned rats or carcasses is of extreme importance (Ward, 1946) because the minimum lethal dose of sodium fluoroacetate for the brown rat is two to three times greater than it is for dogs and cats. The poison is equally as lethal in the carcass and hence secondary poisoning of carnivores will occur.

Two practical considerations are indicated by this toxicological relationship. Poisoned carcasses must be picked up within 24 hours after treatment of the dumps. This is facilitated by confining the rats' travel to a few feet by mixing a concentration greater than the minimum lethal dose in order to obtain very rapid "knock-down." The optimum lethal dose, which is the logical choice, has not been determined by the Wildlife Research Laboratory at Denver, Colorado, but soon will be. There is no effective antidote for sodium fluoroacetate poisoning in man or domestic animals, although 4 years of research have been devoted to this problem.

The action of sodium fluoroacetate (Ward, 1946) is not interfered with by any of the food baits tested, and it is very effective as a liquid bait in plain water. The compound is not volatile in solution. Its toxicity will remain for a very long time, but it is not cumulative within the body of the rats, and therefore a slight resistance can be developed by ingestion of sublethal doses.

CONCLUSION

Due to the great economic losses and health menace incurred by man from brown rats in cities and rural communities, it behooves all businessmen to demand municipal rat control services throughout the United States of America. These services are essentially biological in plan and emphasize preventive techniques as killing measures have only temporary benefits.

The use of fresh, ground bait and sodium fluoroacetate on municipal dumps is advocated, when handled by competent technicians who will guard against secondary poisoning of domestic animals. Dump-rat control is discussed as an important phase of public health service, and periodic baitings have reduced rat colonies to low densities. Such results are of incalculable value to business. The low densities can be maintained by inspections and treatments during the early spring and late fall.

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DISCUSSION

MR. JOHNSTON: This is the Eleventh North American Wildlife Conference. I am very grateful not only in a personal way but for the sake of the practical men in the field of control to have had this opportunity to be on this program and I wish to say publicly and I shall in a letter to our President, the former Senator, that hereafter more interest and more space should be provided at these Conferences for practical control in relation to wildlife management because the control of predators is very important for saving, as was mentioned this morning in the other session—I forget the expression—but a remnant of a native stock from extinction or in preparing sites for introduction or the planting of newly reared wildlife species.

MR. G. M. SPARGO (Alberta, Canada): I am glad to say that my Province is the only province and/or state in the United States or in Canada that has no brown rats—the only province.

MR. JOHNSTON: That is a unique thing.

MR. GEORGE O. HENDRICKSON (Iowa): We who are primarily interested in the more desirable forms of wildlife know from our field experiences that there are too many wild rats far in the fields. Our desirable forms of wildlife are all too often blamed for damage done in the grainfields, corn and so forth. The damage done is by the brown rat. I am happy to see a rat control man here and I hope that all of us interested in desirable wildlife will work more closely with the rat control people to eliminate the rat not only from farm buildings and city buildings, but from the entire landscape.

DR. ALBERT R. SHADLE (New York): I should like to make a statement on one point with regard to Mr. Johnston's paper, a point which is so common it has been talked about and is in the textbooks and so on, and I know this is going to be heresy to you to hear this. It is a common notion that the gnawing of wood and various other things of that kind is a major factor in the reduction of those teeth to the normal physiological shape and size.

My students and I have been working for a number of years on the rate of growth of various rodents and the information which we have on this—I have in mind a problem which will be a clincher on it, but at the present time, let me just say that the rate of growth of the incisor teeth is such that the gnawing of food and other material such as they do must be a relatively low factor in this rate of attrition.

Just to give you a word on the rate of growth in this brown rat. We worked on the rate of growth in the brown rat and the albino and we found this: And again if you consider this a tall story, I shall not be surprised, but I am happy to say that this has been checked on the Formosan wild rat by Hurahota and Huhota and they came to the same findings approximately that we did in Buffalo.

We found that the rate of attrition of the lower incisors was practically 6

inches per year and the upper incisors were something over 4. I don't happen to remember the exact figures, but I know that that seems like a fantastic tale and, yet, we have it checked with other things.

I did first the rabbits and you might be interested to know that the ordinary domestic rabbit wears away approximately 4¼ inches of his upper incisors per year and approximately 5 inches of the lower incisors. The lowers, of course, always do the major part of the cutting, but the main factor in that is the cutting of the lowers by the uppers in normal fashion, and then they can bring those uppers in behind and cut the lowers with the uppers and that is the way your shaping goes.

It is not due to the wearing away and the hard surface in front and the soft surface in back. One of the nicest demonstrations that I ever saw of this was on a beaver that I had under an anesthetic. You could just see those teeth act like a gouge going through a piece of steel. They just plowed right through there and plowed that stuff up. He demonstrated it as beautifully as anything you can imagine and in slow motion form so that there was no question whatever with regard to the way in which it was done.

CHAIRMAN JACKSON: Any other questions? Doc Shadle, I just wonder if beavers have toothache?

DR. SHADLE: Yes, there are cases, but I suspect—now, I haven't tested the thing, but I can tell you that these things grow so rapidly that even though they may develop a little trouble, we have had some cases of these animals losing their teeth and I am quite sure that when the teeth do begin to decay, they couldn't probably help having toothache. There are so many interesting things about those teeth that you ought to know, but I will just tell you that one of the most interesting things that I got into from this study of teeth is the occasional case of malocclusion which you come across.

Here is another tall tale, but I can show you an X-ray. You come to Buffalo and I will show you the X ray. Unfortunately, some student got hold of it in the icebox and fired it out when I was sick at one time, so I haven't a specimen, but I can show you an upper incisor which made two and a half complete revolutions before that animal died.

I can show you rabbit teeth, the lower teeth clear out of proportion and that [indicating] long. That is 2 to 2¼ inches. I am sure they are that long. I hesitate to say longer but you come up and I will show you the skulls and you won't need to take my word for it.

THE CAMERA AND CONSERVATION

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A recent survey reveals that approximately 80 per cent of the sportsmen in this country use photography in one way or another in connection with their interest in sports. Therefore, since about one third of the people in this country participate in sports, it is only natural that the manufacturers of photographic cameras and film should be interested in helping these people use photography in the most effective manner possible.

Sportsmen and those interested in sports use photography in a number of interesting ways. These can be classified, however, into four general groups:

1. The amateur photographer who makes pictures of his vacations—of the fish he catches (as well as the one that got away), of hunting, and other sports activities.
2. The magazine publisher who uses pictures to illustrate articles on hunting and fishing.
3. The manufacturer of sporting equipment who uses photography to advertise and help sell his products and also to provide visual instructions on its use.
4. State and national fish and game conservation groups who use photography as a visual aid in advising and instructing the sportsman on the many problems associated with conservation.

We know from experience and from information already collected the extent to which each of these groups has used photography in the past. The question now might be asked, "How can photography be used to greatest advantage in the future?" Before attempting to answer this question, I would like to discuss briefly the market trends in the field of sports.

Personally I do not like to use the rather dry figures usually associated with statistical data. Occasionally, however, it is necessary to draw upon the data provided by Market Research in order to obtain some kind of picture of the business trends of the future.

From such sources as the Census Bureau, the National Resources Planning Board, the Research Division of McFadden Publications, and the Department of Commerce, we find a series of percentage breakdowns of American families and the income classes which show very clearly the tremendous increase in the number of families in the income brackets above $3,000 per year since 1935. This change

will have a very distinct effect upon informal recreational activities and should indicate many more people able to spend the time and money required in hunting, fishing, and similar outdoor sports. With a reasonably strong national income condition in 1947, we can expect to find 32 per cent of the families in the country in the over $3,000 income class as against 10 per cent in the late 30's. (Figure 1) This

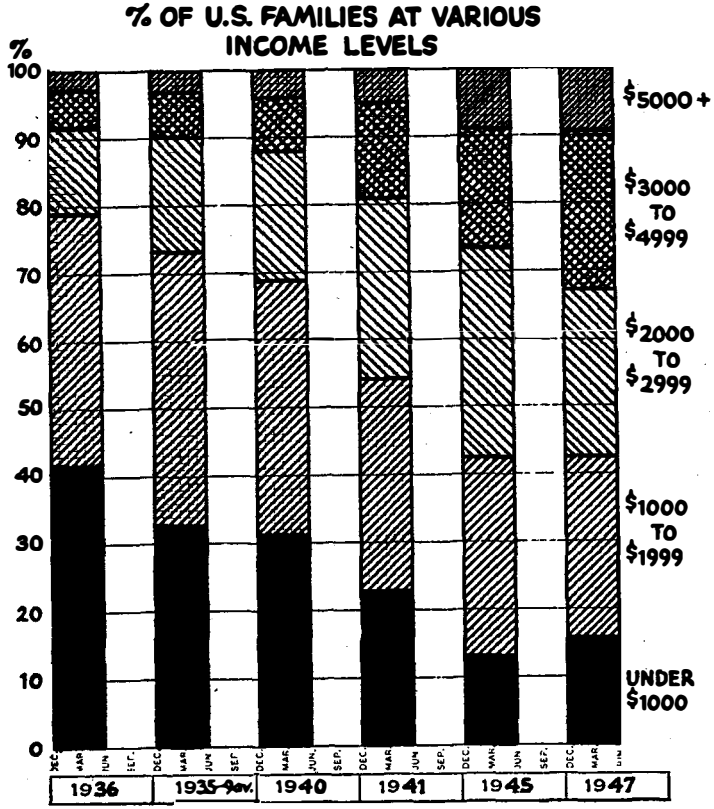

Figure 1.

is the primary group which can be looked for as spenders and doers in outdoor sports.

The Survey of Current Business of the Department of Commerce recently issued a study of consumer expenditures which estimated the amount of money spent in the United States for all consumption items. From this we have extracted those which appear to relate to the outdoor formal sports' market. (Figure 2) These show that the total

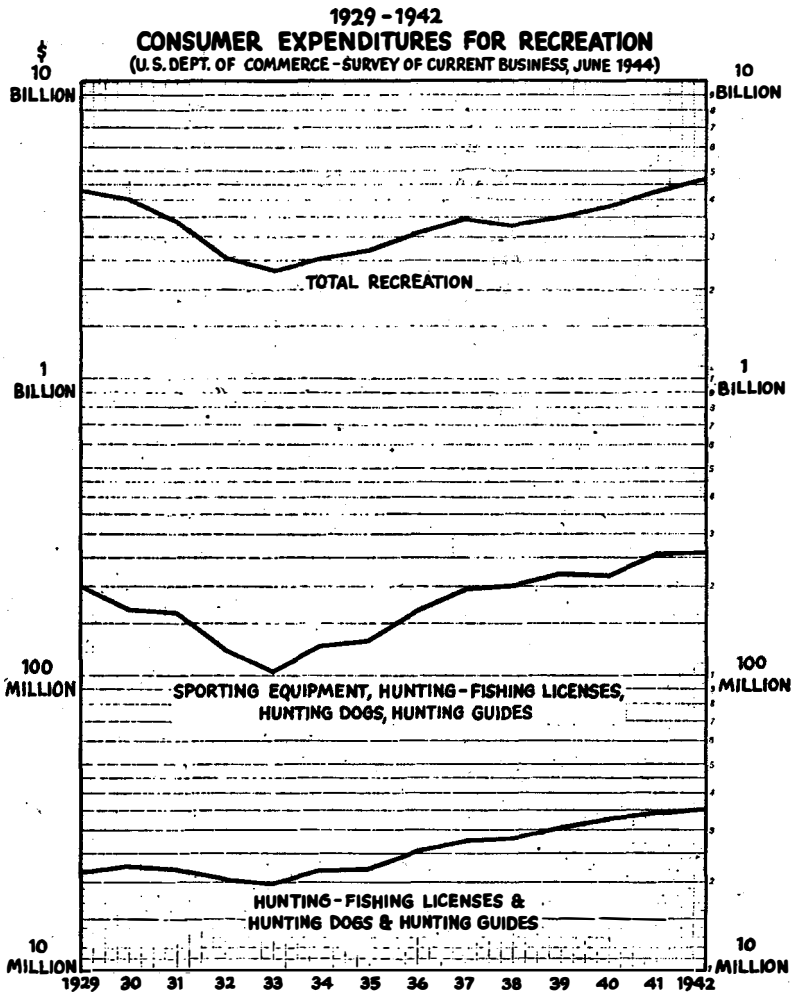

Figure 2.

expenditures for recreation of all kinds vary quite directly with the total national income. However, the money spent for hunting and fishing licenses and for the purchase and training of hunting dogs, as well as the services of hunting and fishing guides, seems to be little affected by changes in the national income. As shown on the chart, this classification has a steady if not rapid upward trend continuously from 1929. This appears to indicate a steady increase in the number of people actively engaged in hunting and fishing as a recreation. It

also indicates that in depression periods these people do not spend much money for equipment, but that they do spend rather in line with changes in personal and national income. We can, therefore, expect an increase over the prewar condition of, let us say, 1940, which might be sizable. It is interesting to note that in 1935 equipment, licenses, dogs, and guides combined represented approximately 4.8 per cent of the total expenditures for recreation, while by 1942 this had risen to approximately 5.6 per cent. This last year is possibly misleading, since equipment was not readily available due to the war situation.

In 1935 according to studies of the National Resources Planning Board, there was a wide range in the percentage of income spent for recreation which varied directly with increases in family income.

1947 MARKET

FAMILY INCOME CLASS	TOTAL ESTIMATED EXPENDITURES (MILLIONS OF DOLLARS)	% EXPENDED FOR RECREATION	ESTIMATED RECREATION EXPENDITURE (MILLIONS OF DOLLARS)
UNDER $1000	$6,140	1.6	$98
$1000-1999	20,120	2.6	523
2000-2999	27,260	3.4	927
3000-4999	36,860	4.0	1,472
5000 AND OVER	26,620	5.4	1,435
TOTAL	117,000	3.8	4,455
5.55% FOR SPORTING EQUIPMENT, HUNTING-FISHING LICENSES, HUNTING DOGS & HUNTING GUIDES			247

Figure 3.

(Figure 3) For instance, families with incomes under $1,000 spent 1.6 per cent for recreation, while those over $5,000 spent 5.4 per cent for recreation. Using this data, which under present conditions is extremely conservative, and applying it to the Department of Commerce estimate of consumer expenditures in 1947, which appeared in *Domestic Commerce* magazine in May 1944, we can estimate a minimum level of recreation expenditures in 1947. This would amount to at least $4,455,000,000. Assuming, on the basis of the previous chart, that 5.5 per cent of recreation expenditures are for equipment, licenses, guides, and dogs, we have a minimum postwar market of 247 million dollars as compared with approximately 220 million dollars in 1940. Probably this estimate should be increased in terms of the more favorable economic conditions which should prevail in 1947 as compared

with 1935. Certainly this is the minimum that we can expect to have American families spend next year.

With this information on the probable trends for the future, it is evident that conservation groups have got to work even harder than in the past, or by some future date, (1976 perhaps) there might be 100 sportsmen for every fish and deer in the United States.

Therefore, to the question "How can the camera be used to greatest advantage in the future?", we believe the answer is in the field of conservation. Motion pictures and still pictures especially prepared as visual aids to train and inform not only the present sportsmen but also the thousands of new ones who will seek licenses to hunt and fish each year.

During the past several years the Department of the Interior, a number of magazines devoted to wildlife, as well as state conservation groups throughout the country, have devoted a considerable part of their space and money toward informing the public on the conservation of wildlife and other related subjects of interest to the sportsman.

The wildlife group in this country is not unlike other groups, in that a certain amount of teaching has to be done in order to help men conserve and preserve the things which they enjoy. Imparting such information to people has always been a problem. It was well recognized 15 or 20 years ago that the best method of telling a story or teaching a specific lesson is through the aid of the motion picture. Some leaders in this belief made and used motion pictures effectively in disseminating information on wildlife for a number of years prior to the war. It is our belief that we were just starting to get under way in this direction when the war came along. Of course, practically all effort in the use of photography ceased with the start of hostilities. In a way, conservation groups are ready to start today where they left off in 1940; namely, to go ahead with the program of training through motion pictures and stills, not only the present sportsmen, but also the several million new sportsmen who will come into existence within the next 5 years.

In 1940 it was estimated that there were 12 million men who enjoyed hunting and fishing as a hobby. It is estimated now that by 1948 there will be 20 million men, or an increase of 8 million over the 1940 figure.

We believe that it has been very well demonstrated during the war years that photography as a teaching adjunct, or a visual aid, offers the quickest and most positive method of telling a story. In training the men in the Armed Forces, it has been estimated conservatively

that 40 per cent of the training time was saved by use of motion pictures. Likewise, a similar time was saved in the training of factory personnel in the operation of machines and the assembly of materials of war. Therefore, more people are convinced now than ever that the way to tell a story is through photography, and likewise more people are receptive to being taught by motion pictures. This naturally increases the responsibility of the various groups who will prepare such films to make sure that their films fulfill the purpose for which they were intended.

In order to demonstrate to you today the value of pictures as a teaching aid, I have selected a number of color slides which are not intended to tell a specific story. They are just miscellaneous pictures which as pictures would normally be of interest to any sportsmen, such as members of this group. I would like to run through these slides quickly, merely to point out that even though there is no connected story being told, each of you in the audience will be interested in viewing them. First, because they are of subjects in which you are interested; second, because they are in color. Try to imagine, if you will, how much more interesting these pictures would be if the entire series was so arranged that they told a definite story on conservation or some other similar subject in which this group is interested.

Just before the war I made a picture on "The Artificial Propagation of Trout." This picture was made at the New York State Fish Hatcheries at Mumford, New York, and was made with the cooperation of New York State Department of Conservation.

FUR FARMING — A PROFITABLE WILDLIFE BUSINESS

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The purpose of this paper is to stress the extent and importance of the production of fur animals in captivity (fur farming), and to briefly outline its history and development, and to discuss its success in recent years and the possibilities of still greater developments in the future and the opportunity for success and profit in fur farming.

A brief review of the history of furs in the United States will show why fur animal production on farms has become such a lucrative and promising undertaking. In almost every civilization furs have been among the most valued articles of commerce. This was true among the Chinese 3,500 years ago, and later among the Greeks and Romans. In medieval Europe fur was a luxury much sought after, and incidentally, men made greater use of it for clothing than did women. It was not until after the discovery of North America, of course, that the world fur trade really got into its stride. That it early became an enormously profitable business on this continent is attested by the fact that an Indian trapper could often be induced to part with his winter's catch, worth hundreds of dollars, for a blanket or two and a bottle of rum — and perhaps not very good rum. Among the great fortunes amassed in this game, that of John Jacob Astor is the outstanding example.

In these circumstances, with pelts readily obtained and profits large, no attention whatever was paid to the question of the possible exhaustion of this source of wealth that nature distributed with a prodigal hand. The more furs there were on the market, the more popular furs became. The luxury of the rich became the necessity of the moderately well-to-do. The trap lines were run not less but more intensively, to the profit of everyone — the professional trapper, the landowner, the farmer who could turn a few extra dollars without much trouble, and a large army of wholesalers, factory owners and workers, and retailers and their employees.

Naturally a depletion of fur resources resulted. This cannot be attributed, however, entirely to overeagerness in trapping. The disappearance of the wilderness — the natural habitat of fur animals — was a major factor. Nevertheless, even today trappers and fur farmers of the United States receive $75,000,000 a year for the raw furs they bring to the market. The astounding new development is that the fur farmers of the country who are producing silver foxes and minks

and their color phases account for about $20,000,000 of the total sum annually paid for raw furs.

The advent of civilization has checked, to some extent, the fur industry in all parts of the world. Its permanence is being bolstered by the rapid growth of fur farming, which is an important adjunct to the fur business. During the past decade fur farming has grown to the point of representing an investment of many millions of dollars. Already a husky juvenile giant, the industry promises to continue its expansion.

The wonder is that back in the old days when wild-caught silver fox pelts brought $1,000 each, trappers did not turn farmers and produce these animals, at least to supplement their annual fur catch. It is unfortunate that fur farming was not started earlier, especially since it is a natural outgrowth of the Indian and pioneer trapper practice of capturing fur animals alive during the summer and penning them until the pelts became prime with the approach of cold weather.

In the beginning of fur farming all these operations of trappers, fur tradesmen and fur farmers were cloaked with secrecy; but a few years later stories concerning the wealth to be obtained from this business leaked out. In 1910, one silver fox pelt brought the all-time high price of $2,627. This started a fox farming boom and sent the prices of breeding stock skyrocketing. The boom collapsed at the beginning of World War I in 1914, but in 1923 people were again investing anywhere from $500 to $5,000 per pair in foxes, which in some cases they had never seen. By 1927 the unhealthy speculation in breeding stock had died out and farmers went to work producing the animals for the fur.

Silver fox and mink farming is the greatest development so far in raising fur animals under strictly-controlled conditions. It still can be considered a relatively new enterprise for practically all its development has taken place since World War I.

In the early days Canada and the United States were the only countries that could boast of a fur-farming industry and that their governments were interested in fostering such an enterprise. Since then other countries have developed fur farming and when World War II broke forth, the world's production of silver fox pelts was well over a million, and mink pelts were not far behind. Prior to this war, during 1937, 1938, and part of 1939, there was a heavy decline in the prices paid for raw furs, and fur farmers came in for their share of the grief.

During this same period Norway was speedily becoming the world's

largest producer of silver fox furs and in 1939, more than 350,000 pelts were exported to England, France, Germany, South America, and the United States.

By 1937 the Norwegian platinum fox, a silver fox mutation, was arousing considerable interest in the fur markets of the world. A feverish demand developed for this beautiful fur and in 1940 a collection of 399 Norwegian platinum fox furs were sold in New York for an average price of $550. The sale was sensational with a single pelt selling for $11,000 to set an all-time high in fur sales history.

This important new development which produced such spectacular results was the incentive that compelled the fur farmers of Canada and the United States to concentrate greater attention on the possibilities of inheritence of fur color to develop silver fox and mink mutations.

World War II has dealt harshly with fur farmers, especially those in the Scandinavian countries and other parts of Europe. The production of fur animals, along with some other agricultural pursuits in the United States, was not considered an essential war industry. Contributing factors to a decline in fur farming during the war were that no exemptions from military service were possible, no priorities were granted for feed and materials, meat and animal protein were in short supply, likewise gasoline, labor was scarce, and there was the 20 per cent luxury tax on furs.

The production of foxes declined more than minks and perhaps 40 per cent of the fur farmers were forced to quit the business. Conditions were even worse in Europe especially in the Scandinavian countries. According to the best reports obtainable fur farming was reduced to such an extent that it seems certain the Norwegian fur farmers will not be producing large quantities of silver and platinum foxes for some time. The Norwegian blue fox, however, has fared better during the German occupation. Generally speaking, it is superior to all others offered on the raw fur markets. Its distinctive gray-blue color, fine texture and luxurious covering of fur makes it a superior commodity. This fox is the result of successful cross breeding where the most desirable characteristics have been retained in the offspring.

That live fox and mink shows in the fur-farming industry are becoming big business is evidenced by the fact that since hostilities ceased, fur farmers in the United States and Canada have lost no time in assuming their prewar pace in this phase of the business. As a matter of fact, the desire to conduct live fox shows has perceptibly increased. Upwards of 3,000 animals were placed on show tables this

year in various cities throughout the United States. Tremendous benefits from an educational standpoint are derived from holding such shows. Fur farmers connected with organizing and managing live fur animal shows are wondering how far this interest will go.

Prior to and during World War II, American and Canadian fox farmers have made great progress in breeding mutation foxes. By concentrating their efforts largely on the production of mutation foxes, they have, however, to a considerable degree, sacrificed the development of the silver fox. As a result there seems to be a dearth of full silver foxes of excellent quality.

It is true that the luxurious platinum fox and mutations such as the white face, white marked, and others are holding the attention of the fur trade and bringing the highest prices. These furs are evidence of the skill developed in recent years by the breeders.

Furriers and breeders should realize, however, that good specimens of full silver foxes are exceptionally valuable in producing full silver as well as mutation foxes. They should consider also that there are many women in the United States as well as abroad who will prefer to purchase a silver fox garment or neckpiece.

The greatest and most important event to date in fur farming and fur-trade history was the recent offerings of mutation mink furs. Some 47,000 skins valued at $3,000,000 were sold in New York recently. This splendid collection of beautiful furs attracted buyers from all parts of the United States, Canada, London, Australia, and South America. Even though the fur trade had been proceeding cautiously in purchasing all other kinds of furs, they did not hesitate in buying these exquisite peltries and paying very substantial prices for them.

The Silverblu mink was tremendously popular and the favorite with a limited number of furriers who could afford to handle this commodity. The top price paid for a single skin was $190, and the average for the whole collection (18,656 skins) was $91.83 per skin. It is encouraging to breeders of Silverblu mink that the market value of the finest pelts was maintained even though the quantity offered was double that of last season (1944-45).

The Royal Koh-I-Nur collection did not do so well. Only part of the offering (12,675 skins) was sold and the top price per pelt was $56, with the average at $36.66.

The Royal Pastel mink sold in Seattle recently is a relatively new mutation, and it is the first time a quantity of these furs (2,500) were offered for sale. The top price paid for the best skins was $172 and the average for the entire collection was $115.67. The fur farmers pro-

ducing this type of mutation claim that they will have from four to five thousand furs to sell next season.

The mutation mink furs offered at these various sales were the result of many years' work of a small group of breeders whose sole ambition was to produce a new and glamorous fur acceptable to the fur world. Over these years they invested a great deal of time and money. Undoubtedly they experienced numerous disappointments and setbacks, and although they sold some breeding stock at high prices, this was the second time they were able to produce a sufficient number of pelts to demonstrate to the fur trade their confidence in this beautiful new fur.

That fur farming is a profitable business when conscientiously and intelligently managed has been proved beyond doubt by a large number of fox farmers who have been breeding these animals for twenty years or more. Numerous young men from both farm and city who have worked on fur farms for experience later purchased pairs of silver foxes and minks and started in business. They knew how to pick good breeding animals and carefully searched until they found them. They were successful in producing and raising the offspring to maturity. Within a few years they were able to sell a sufficient number of breeding animals and pelts at a price that returned the original investment, paid their keep and that of the foxes, and left them with a good bank balance. When the time was right, they traded with a neighbor fur farmer for new breeding stock, and in that way increased the quality of the fur produced without the expenditure of any funds. Such persons who have started in a modest way and have been successful continue to raise fur animals and like it. Reputable companies that have dealt fairly with the stockholders have made money in the fur-farming business. Some of them have paid out thousands of dollars to the shareholders and at the same time have increased the breeding stock and ranch equipment. In many instances such expansion was effected without any enlargement of share capital.

Compared with these outstanding successes, the individual fox farmer might be considered more or less exceptional so far as breeding results are concerned. As a general rule, however, a greater number of foxes are produced and raised on the small ranches.

It can hardly be doubted that fur farming has become a permanent part of our agriculture. It has met with relatively more success in recent years than most other branches of agriculture, and it promises still greater developments in the future.

Fur farming fits in well as a sideline to general farming. It also provides a winter occupation that brings in additional revenue during

the season when both are needed to balance farm operation. The industry is all the more significant because it does not compete with any other kind of farming, and it utilizes land that is of little or no value for any other crop.

This is the time for fox farmers to study intelligently the economic conditions of this country. Under the present situation, it seems illogical to expect the fur trade to absorb such large quantities of furs as they did during the past few years when everything was booming. This is not only true of silver foxes and mink but many North American furs as well. The manner in which the promotion of sales was handled and the attitude of the buyers during the last two months is evidence of forced selling.

A comparison of business trends over a long period of years definitely illustrates that when the steel and automobile business are on the up and up — so is the fur business. Naturally when strikes occur, millions become unemployed and the country is experiencing an economic crisis, this turn of events will seriously affect the fur business.

Many fur tradesmen foresaw these conditions and curtailed their operations and like many others in business are now awaiting the outcome of the most highly-organized mass strike that American industry has ever experienced.

During this critical period, the fur trade has been buying very cautiously and seeking lower prices. Fur buyers and fur farmers on the other hand, have been pouring their furs into the markets. Good prices were obtained in December when very few fresh skins were on the market, but in January and February because of the industrial situation, prices began to decline.

It is unwise to force on the fur market enormous quantities of farm-raised furs and wild furs also, at a time when business conditions do not warrant increased purchasing on the part of fur tradesmen. Under such a situation, it is not surprising that ranch-raised mink and fox furs have declined during January and February. Unless the strike situation is settled promptly and satisfactorily, these prices may go lower. No one knows what the outcome of the present industrial and economic situation will be, so it behooves the fur farmer to follow the situation carefully and move cautiously.

SUMMARIZATION OF THE ELEVENTH NORTH AMERICAN WILDLIFE CONFERENCE

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In view of Seth Gordon's prophecy that you were to hear a "Lowell Thomas" summary of this Conference, I must confess at once that in a limited time I cannot review even the outstanding facts presented in thirty hours of papers and discussion. You will have to read them in the Transactions. I shall try only to give you one man's idea of some important trends in these Conferences, every one of which I have attended, the manner in which the present Conference relates itself to these trends, and some questions that are likely to arise in the light of what has transpired. In this I have followed Dr. Graham's initial suggestion.

I have attended as many sessions as one man could attend. In addition, I should like to express my appreciation of the assistance rendered by Miss Quee, Mr. Guthermuth, Dr. Graham, and most of the section chairmen. They sent me advance abstracts or typescripts of 41 papers — two thirds of those scheduled — and they and others have given me their views of important developments here. This has helped greatly, though of course I assume full responsibility for what I may say. If occasionally I name speakers, this is not to say that others could not equally well have been named.

Let me now proceed to a brief discussion of six trends which seem worthy of special note:

1. Values — At the First North American Wildlife Conference, in 1936, we told one another at some length that we ought to interest ourselves in wildlife conservation, and why. Since then, naturally enough, we have said little about this except to point out concrete values relating to business (the subject of an entire session this year) and other special phases of the subject.

If our reticence about wildlife values means that we take them for granted, well and good. However, if it means that we think the public takes them for granted, we should guess again; and if any of us thinks of wildlife only (or even primarily) in terms of dollars and cents, then a warning is in order. It is high time for somebody to stand before Congress, the Army Engineers, the Bureau of Reclamation, and any other agency which seems prone to emphasize cash

values, reminding them that in wildlife conservation these are almost always the lesser values. However "big business" wildlife may furnish, however many dollars per acre it may be worth, its greatest values are intangible. As well try to set a dollar value on a symphony orchestra, a school, or one's health. I am not yet convinced that our representatives in Washington or elsewhere are capable of thinking only in monetary terms; I am convinced that our argument will be weak indeed as long as it is couched only in these terms.

2. Education — The aim of education is to establish values in the human mind. If the public comes to accept them, then sooner or later — slow-moving and long-suffering though it is — it will get them, and in the process it will cast out those public servants who have not provided them.

We have been going at the matter of conservation education, earnestly but in many fashions, for something approaching a generation. Only now are we really beginning to square away. Ten years ago, I think, we were a good deal more confident that we knew the techniques and the answers than we are today. One impression which I received from the panel on education at this Conference was that we are becoming more realistic and less visionary.

Sociologists often point out that ordinarily it takes about 40 years (two generations) for the American people to change a basic habit or idea. If our educators — schoolmen and others — are to need 40 years more to establish the conservation viewpoint in American thinking, I fear that it will be too late. Yet I have seen in the past 10 years many signs that the educative process, like the upswing of a deer herd, follows a sigmoid curve; we are still in the stage of slow rise, but if we now realize the basic issues, as I believe we are coming to, progress will be more rapid. I am not referring, of course, to those violent surges of public opinion which a year later may go just as violently in the opposite direction. I am talking about a new view of the world, soberly arrived at and permanently established. Under modern conditions, this can be brought about more rapidly than was once possible. The Conference is clearly aware that this new viewpoint will not be established merely by setting up isolated courses in the schools by legislative fiat. There is much more to the problem.

It must be remembered that our subject involves relationships, always difficult for the average human mind to understand. We are dealing with a commodity about which many citizens already think they know a great deal; hence the public does not pay wildlife men the respect which it pays to the technicians in dam-building, internal medicine, or nuclear physics. Our greatest audience is made up of

unschooled persons. Finally, education deals with what has been called the most supremely inflexible thing in the world: the human mind, fettered by localism, tradition, impatience, attraction to big spectacles, reluctance to speak or accept plain truth, and the stubborn worship of "face."

Thus it is well that education has received increasing attention on these programs. It is our most urgent activity; it cannot be emphasized enough; and it has not been said often enough that the problem facing the non-school educators is far greater than that facing the schoolmen. We are a long way from having presented adequately even what we already know. Conservation in the schools presents a challenge, but there is an even greater challenge to the outdoor writers, radio speakers, extension specialists, and writers of bulletins which laymen are supposed to read.

3. Performance — Wildlife management on this continent is conducted by the public and its agencies. Neither can do the job alone. Apart from financial support, how are these agencies implemented?

One of the most important developments in the Conferences relates to this matter: Wildlife workers are getting their roots into the soil. In 1936, only one paper had much to say about the basic relationship of land and wildlife; in 1944, the Gabrielson-Wickard-Albrecht trio and seven other speakers gave it the spotlight and it has remained prominent during the present Conference. It has received more attention, while artificial propagation has received less. Significantly, at this Conference no fewer than three speakers, while admitting the legitimate place of artificial restocking in the wildlife scheme, warned against "indiscriminate" restocking; there was no such warning 10 years ago.

It is noteworthy, too, that we are thinking more about habitat-improvement, not in terms of the tin-cup approach, where wildlife interests beg for whatever scraps of land the other agencies do not want, but in terms of legitimate multiple use of land. I haven't heard Aldo Leopold's phrase "biotic view of land" used at this Conference, but its essential features have certainly been talked about, and this is what matters.

In the technical papers of this Conference, as of earlier ones, there have been examples of unclear objectives, wishful thinking, hit-or-miss conclusions, and unwarranted extrapolations. Nevertheless, even though the war has delayed completion of some of our best technical work, I think one can see a trend toward better-controlled, more objective, and more competent studies, many of them of a pretty basic

and analytical sort, like those reported by Einarsen, Hawkins and Bellrose, Hochbaum, and Nestler at this Conference.

We are better equipped as a result of this calibre of work. Our technical men are obligated to make their work reputable in the world of science as well as in the world of sport. Moreover, basic research, even when its results are not immediately usable, builds for a future in which it will surely be needed. Industry realizes this; along with its research of immediate practical utility, it is today conducting basic, often "impractical," research on an unprecedented scale. The federal government is coming to realize it, as bills now before Congress testify. The universities have always realized it. In the wildlife field, as a matter of ordinary foresight, we cannot afford to overlook the need for endeavors that aim at some goal more distant than trouble-shooting.

Another point which relates to performance: We have talked freely about technically-trained men; yet I wonder if even now this phrase means the same to everyone. It probably needs clarifying; not even the colleges and universities seem sure of their place in the program of training and research.

One of the most important trends among wildlife agencies, well exemplified by what has transpired at this Conference, is toward teamwork. Mr. Stephens has pointed out that in our multiplicity of organizations concerted action often fails to appear. Also agencies, being humanly inspired, sometimes work at cross purposes. For all that, I think that the current exchange of brickbats by the Fish and Wildlife Service and Ducks Unlimited, is a symptom of good health. Disregarding the merits of the opposing views, when such disagreements exist they should be discussed in public. When all seems to be sweetness and light in a field as full of controversial issues as ours is, the reason is either dictatorship or apathy — and I don't know which is worse. I hope that each future Conference will be enlivened by at least one good dispute, with candor and objectivity on both sides. There is plenty of raw material.

Yet in spite of such episodes — perhaps in part because of them — teamwork seems to be increasing. When the Atlantic States form a Marine Fisheries Commission; when the states up and down the Mississippi River operate together on the Father of Waters; when Lyle Watts talks about clearings, Dr. Gabrielson and Seth Gordon about soils, Dr. Hugh Bennett about wildlife, Leonard Hall about multiple use and the primacy of research — who can fail to see clear evidence of increasing teamwork? The only question is: Are we getting

the habit rapidly enough? The great obstacle to teamwork is that it submerges the ego — and the ego can be very buoyant.

Here is another aspect of the question: I was somewhat disturbed on learning of Congressman Robertson's remark to the effect that some members of Congress found difficulty in justifying the assignment of Pittman-Robertson funds to the states. I am reminded of H. G. Wells's remark in his *Outline of History* "—it is the universal weakness of mankind that what we are given to administer we presently imagine we own." This sort of attitude, to which not only Mr. Robertson but several other speakers at this Conference have alluded, smacks too much of "we, the administrators" or "we, the government" and "you, the people," as though some public servants thought they were doing favors to the people by helping to maintain the people's natural resources with the people's money. I have never seen this attitude in the dealings of any official wildlife agency, but it does appear here and there in other quarters. The success of wildlife conservation is particularly and intimately dependent upon administrative attitudes — both as between us and the public and as between us and other administrators.

Teamwork can also be international, a fact which has become increasingly apparent at these Conferences. For the time being, about all we can do is appraise wildlife situations on other continents. At this Conference we have heard about Micronesia from Lt. Baker, about France and North Africa from M. Blanc, about South Africa from Dr. Hugh Bennett, and about Central and South America from Mr. Vogt. In former years the only glances beyond our continent that I can recall have been Dr. T. Gilbert Pearson's occasional accounts of the activities of the International Committee for Bird Protection. This greater attention to other areas is both desirable and inevitable. If the civilized world survives at all it will be under a new internationalism, and wildlife interests cannot afford to lag behind. I hope that the next decade will see not only more international exchange of personnel and ideas, but also, following the example of many groups before the war, the convening of the First World Conservation Congress.

Meanwhile, one has only to attend the Wildlife Conferences to know that wildlife men still regard themselves as custodians, not proprietors; that their technology is growing in quantity and quality (even though the public doesn't know it yet); that teamwork, still too uncommon, is less the exception than it used to be; and that, to paraphrase Dr. Gabrielson's remark, we are only now beginning to realize the power from a head of pressure built up during the past 10

years. As Mr. Heydecker pointed out, progress is made by a series of small advances; gradually the cumulative effect becomes tremendous.

4. Self-Appraisal—In both the general and technical sessions we have become increasingly critical of our own procedures, as well as more realistic in appraising their success. As I have already remarked, it appears to me that we are much less confident of knowing all the answers than we were 10 years ago. Then, it was common to hear the remark that at these Conferences we spend our time telling one another how important we are; in the words of the Bandar Log, "We all say so, so it must be true." Of course, we have never been particularly backward in finding fault with others—sportsmen, farmers, legislators, schoolmen, the ultraconservative public, or whatever group happened to be the *bête noire* of the moment — but now we are properly looking to the beams in our own eyes as well.

In 1943, for example, we actually held a session entitled, "Mistakes Made in Wildlife Management." In it we threw bricks at ourselves; some of them were of the stage variety, but some were not. The net effect of open criticism, just as in the controversy referred to above, is almost always good; and especially does self-criticism deprive unfriendly critics of their ammunition.

No one can say that this Conference has not had its share of self-appraisal — from Mr. Stephens, Dr. Gabrielson, Mr. Hall, Mr. Gordon, and several others. I take it to be a sign that we are coming of age — less fearful of exposing weaknesses than we used to be. We can now hear Mr. Hochbaum say that after 10 years we are still only on the threshold of waterfowl management, knowing that it is so, yet not fearing to have someone say it publicly. Such candor is the mark of mature thinking and can only strengthen our position in the public esteem.

5. Raising the Sights — There is doubt that we are raising our sights geographically, biologically, and socially. We are talking about the rest of the world. We are discussing species, ecological situations, and techniques that we neither knew nor cared about 10 years ago. Most significant of all, I think we are coming to grips with the problems presented by the human mind and the society which it has developed. If there are broad subjects that we have neglected somewhat, I should say that they are the fur bearers, the marine and other food fishes, the nongame species, education (particularly nonschool education), and wildlife management as a private enterprise.

A comment on the last is in order. It is time for someone to present the idea of financial profit from the sale of private lands that have been improved by wildlife technicians. If this idea is accepted by

large landholders and mortgagors, like the insurance companies and metropolitan banks, the smaller landholders will fall in line. The results will be incalculably far-reaching.

Returning to the scope of this Conference, I still look forward to the day when we shall hear men discuss the management of songbirds, wildflowers, and the biota of a city, a tropical rainforest, or the eroded wastelands of China. We are headed in that direction. The day will come when some wildlife matters are administered even more internationally than by treaty. We shall not play our part if we concern ourselves only with sport, and only with North America.

Wildlife management is broader and richer than it was when these Conferences began to be called Wildlife Conferences instead of Game Conferences. Ten years hence, even without great industrial backing, it will be broader still. Unless we lose our sense of honest humility, unless we keep our research static and our education fragmentary, there is no doubt in my mind that the advances of the next two decades will far outstrip those of the past half-century.

6. Questions — I am proud to be able to express such opinions to you concerning a record of accomplishment. Yet the announced theme of this Conference was "Wildlife in a Changing World." Excepting about six, the sixty papers presented at this Conference have noted changes only by inference if at all, though I am sure much more was in the minds of the speakers. Perhaps it is appropriate in closing to record a few questions that have been stated or suggested and that are certain to arise.

Hunting and fishing pressures will increase at once; in the next few decades this country alone will have a population of 160,000,000 or 170,000,000 — more industrialized, more urbanized, and provided with better transportation, better weapons, more leisure, greater interest in the outdoors, and perhaps more money. Our land continues to deteriorate; yet we shall need always more products of land.

Question 1: In the face of all this, can our lands and waters continue to support free, extensive hunting and fishing? Mr. Gordon has said that the principle of public ownership of wildlife must be perpetuated; so we all feel, but is this possible?

Question 2: Shall the sportsmen continue to pay the bill? If they do, will they one day reach the point of diminishing returns, with the resulting effect on our operating budget? Or shall all those who benefit from the wildlife program share in its support (incidentally, taking some of the wildlife news off the sports pages)?

Question 3: Is this country moving toward a federally- dominated economy, responsive primarily to single-purpose pressure groups?

If so, what will this type of "public" representation do to the development of multiple values for all people, all lands, and all waters?

Question 4: What will be the effects of regional authorities upon wildlife, public ownership, and state administration?

Question 5: Will the next century see any wildernesses or virgin streams in North America?

Question 6: Among wildlife agencies, are we to expect a Babel of tongues and cross purposes, or one voice and teamwork concerned only with the problems of the moment, or foresight as well?

Question 7: Will administration and management keep pace with research and can all three together keep ahead, but not too far ahead, of public participation?

Question 8: Is the present trend away from the spoils system in state wildlife administrations merely a temporary result of public dissatisfaction, or is it the setting in of a strong tide? If it is the latter, how shall state populations that have been wrongly taught for 40 years learn to cast their lessons aside and readjust their thinking?

Question 9: Shall we be able to establish wildlife values, as part of the larger philosophy of conservation, in the public mind before it is too late?

Question 10: Shall we be able to extend our own personnel, money, thinking, and action to meet those in other countries and on other continents, in the new internationalism without which the world may one day revert to wildlife?

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