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" A Program For Inland Fishing Development "

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NINTH ANNUAL CONVENTION IZAAK WALTON LEAGUE OF AMERICA

APRIL, 1931

Mr. Chairman and Waltonians: As I venture to outline a program for inland fishing development, which is that of Michigan, it would seem desirable at the start to make clear just what part of the state's extensive organization I represent.

I do not represent the sportsmen, because as an angler at least, I am a failure. But anyway, what one man could really represent the sportsmen of all kinds and degrees of any state? I do feel, however, from contacts of varying degrees of formality with the sportsmen of Michigan, that I understand, in an impersonal way, what they think and what they want, or at least roughly, how they vary in what they think and in what they want, and that is quite a bit. Inasmuch as it is our ideal in Michigan to maintain fishing for the people as a whole, it is vital that we consider the sportsmen's viewpoint in all that we undertake to do to improve the inland fishing within our state. But inasmuch as it is also our ideal to divorce politics and conservation, we cannot, if we are honest, which we are more or less, allow selfish, loud-speaking political minorities or individuals to dictate policy when this runs counter to the will of the great, and generally quieter, majority, or counter to the best judgment of technically competent advisers.

I do not represent officially our Conservation Commission and Department of Conservation, although from extended contacts with those organizations, I believe that I understand the opinions and, in so far as they have been formulated, the policies of the state's official conservation bodies.

To a scarcely greater degree, can I claim to represent the Michigan Division of your League. That I am a member of a local chapter, and its delegate at this meeting, does not qualify me to represent the State Division. But again my contacts with the leaders and officials of the organization have been so extended and so cordial as to make me feel that I understand their activities, plans and aspirations. I have learned so much from Mr. Harper, Mr. Doyle and others, and in reciprocation have helped them to crystallize their ideas on the state's inland fishing policy to a sufficient degree, to make me feel, wholly unofficially, that I am a comrade in the splendid forward-looking work of these men.

The one body which I can officially represent is the Institute for Fisheries Research of the University of Michigan. This department was founded in February, 1930, upon the request of our Conservation Commission and Department of Conservation, that the university take over the scientific investigations called for in the state's fish work. This was not an entirely new development,

inasmuch as the state's fisheries investigators had been for several years quartered at the university, where they received the advantages of library and laboratory facilities, and of cooperation with the university staff. In a way, the development of the Institute, and the resulting expansion of fisheries investigation in Michigan is the outcome of the tragic loss on October 4, 1929, of Dr. Jan Metzelaar, who was drowned while carrying on his work in one of Michigan's lakes.

Michigan's inland fishing program is ambitious, but makes no flaming promises. We do not expect to fill Lake Michigan so full to overflowing with fish as to compensate for the "Chicago steal" -- so called. It involves no simple panacea for the great ill of depletion. It is, we hope, sane, sound and conservative, and yet freed from fetish and forward-looking.

This program, while radical in a way, does not involve the casting aside now of any of the existing means of fish conservation and development. It recognizes the need for and involves protection from the lawless or ignorant elements which unfairly prey upon the fish supply. It acknowledges the need for protective, restrictive legislation, and aims to obtain and coordinate data which will make such laws more effective. Investigations now being carried on in Michigan, in part, at least, to form the basis for sound regulatory measures, are:

1. The rate of growth of game fish, their age and size at maturity, and the percentage maturing at each given age, weight and length. Such information is being obtained by reading the age of the fish from the winter marks on the scales or face bones. This basic information is valuable in determining size limits so as to allow for the natural spawning of desirable species, and for the removal of protection now often granted to runt species which may never attain suitable size.

2. The cause of dwarfing in such fish as perch. We hope to solve this problem by studying carefully the characteristics of the fish from different bodies of water; by following the history of fishing in the various waters, in conjunction with the planting records, and by marking experiments, which will help much in telling whether fingerlings of a large type of perch, say, will or will not grow large when planted in waters containing runt fish of the same species. If it be proved that in many waters a given species does not grow large because of natural or artificial over-stocking, then a reduction or removal of the size limit in these waters may be a means leading toward the actual increase in the number of legal sized fish present, or, more predacious fish may be introduced.

3. Population studies. We have begun and hope to expand the actual estimate of abundance of different age groups of our important fishes in different bodies of water. This work has been carried on chiefly with trout so far, and is especially adapted to the salmonoid fishes. Dr. Greeley of our staff has by actual count of the total fish supply in a limited part of a stream estimated the population per mile. In one stream into which the rainbow trout run from Lake Michigan to spawn, he obtained an estimated stocking of 22,000 trout per mile, but of these ninety per cent were rainbow, and only.8 percent of the

rainbows over the seven-inch legal size. Here we have clearly an overstocking of young fish, which according to preliminary growth studies, is causing an actual stunting of the growth rate. Our creel census is also yielding valuable data on the proportion of under-sized fish caught in different waters.

Intimately correlated with the population studies are the investigations of carrying capacity, an estimate of the number of fish a given body of water can provide.

4. Experiments to determine the effects of hooking. To obtain real information to be weighed against the unbased claims of high mortality or of low mortality, in undersized fish, which have been hooked and released, we are running a series of experiments to determine just how many do die after being so handled. This is a question of direct importance in deciding whether the size limit on trout and other fishes should be reduced or eliminated.

5. Observations to determine time of spawning. The accumulation of more accurate data on this point will, it is hoped, give a clearer idea of the proper closed season for different species, for different sections of the state.

6. Observations to determine the spawning areas. Data so obtained will be pertinent to the general laws closing or allowing the closing of certain streams and lakes, or parts thereof, and to special regulations closing certain waters permanently as nurseries, or temporarily during the breeding period as spawning refuges.

7. Tagging experiments to determine movements of fish. Investigation of the migrations of trout and other fishes has a bearing on restrictive legislation, as showing whether trout mature and remain in numbers in the feeders which are or might be closed, or whether they migrate into such protected waters. If or where adult fish habitually frequent the "nursery waters" in considerable numbers, then their catching off would very likely allow the smaller trout to persist and grow faster and more surely to adult size.

8. Investigations to determine the need of fish chutes. These studies involve tagging experiments to determine whether the fish do use the "ladders", and where they go to spawn if blocked by a dam, etc. Further and surer data were accumulated some years ago and will be further obtained by placing small fyke nets in the upper end of the fishways, to count what fishes can mount these passages, and in what number. These investigations of the fish fauna and stream conditions above and below the dams are also important, especially when the dams without fishways may be used as convenient barriers to hold competing species out of waters reservable for brook trout.

9. Creel census to determine yield of fishing effort. As related to the hot argument as to whether winter fishing should be allowed, especially with the spear, or whether any other season or method of fishing should be legalized, our actual tabulation of the amount of such fishing done in Michigan, especially in terms of the yield in fish per hour of such fishing, is distinctly to the point

Last year we received 15,000 records of individual fishermen's catches, and we hope to increase that eventually to 30,000 per year, which will give us a real picture of the fishing that is done in Michigan.

10. Food studies of fish predators. The need or lack of need for laws or activities to control the numbers of various fish-eating animals such as mink, herons, kingfishers, mergansers, turtles, water-snakes, etc., is not to be finally determined by heated argument based on preconceived notions and desires. This is a problem calling clearly for facts, and these are now being obtained by two members of our staff, Canuto G. Manuel and J. Clark Salyer.

I have spoken of the role that investigation is coming to play in that phase of the fisheries work of Michigan which is directed toward the elaboration of wise fishing regulations. I have done so primarily because that investigation is the job that has been assigned to the staff of the Institute for Fisheries Research. The obtaining of sufficient and sound evidence is one thing. The use of these data in the writing of the regulations is another matter. So also is the efficient, diplomatic, impartial and vigorous enforcement of these regulations, coupled with a campaign of education which will make the enforcement job easier and more effective as the years roll by. I believe I can venture to assert that it is an integral part of Michigan's inland fishing program not only to obtain scientific information on which sound regulations may be built, but further, that such regulations should be so constructed, and that these regulations should be adequately enforced.

Experience has taught us one vital lesson in fish conservation: needful as are the erection and enforcement of sound restrictive regulations, these alone are quite insufficient to hold back the flood of depletion. Higher and higher have we piled up the levees to hold back the rising waters, but the floods continue to break disastrously through. Other measures of control must go hand in hand with regulation and enforcement, if we would control the torrential problem of fish depletion.

Michigan's inland fishing program also attempts to embrace the historically second means for conserving and developing its game fish supply, namely fish culture. Although we realize that great losses in effort and money have often been involved in hatchery practice; that inefficiency has often and corruption occasionally entered; that fry or fingerlings have been dumped wholesale into waters wholly unsuited to the species planted, or containing already a sufficiency or even an excess of naturally produced fry or fingerlings, of like age to those being planted; that at times spawn-taking may have done more harm in preventing natural reproduction than good in furthering artificial propagation; that fry have been planted at tender ages unsuited to survival; that fish have often been planted in such a fashion as to invite their destruction; though we believe that hatchery diseases have been spread to natural waters, and that undesirable species have at times and in places been introduced by fish cultural activities, yet we firmly hold to the view that our hatchery and rearing system should be maintained and expanded, until or unless sound evidence accumulates to show some part or parts of fish-cultural practice to be needless or harmful. And then, only this part or these parts of the practice should be radically changed or abandoned, but they should be then altered.

In line with current tendencies, we are proceeding with the development of an immense fingerling rearing system in Michigan. General experience seems to warrant this change and expension. But fingerling rearing multiplies costs and dangers of production, in that it demands an immensely increased outlay in capital expenditure, a much greater cost of operation and increased hazards due to the epidemics which sweep like medieval plagues through some of our rearing stations, to bring destruction at times as high as ninety or even ninety-five percent to the carefully protected and nourished fingerlings. Those of you who are business men will, I hope, have now anticipated my point, that it is high time that we obtain some real evidence as to the degree of value derived from fingerling rearing; indeed, from artificial propagation in general.

Almost nothing has heretofore been done to estimate the survival percentages of planted fry and of planted fingerlings. And almost nothing has heretofore been done to estimate the relative effectiveness of artificial as contrasted with natural propagation. Common sense would seem to have demanded that such information should have been in process of accumulation for years; whereas our fishery officials have been content to give out their hatchery yields in terms of millions of fry and fingerlings, or, sometimes, have been malcontent with this meager information, but only far enough to fake their yield to a higher future. We propose by marking experiments to obtain an estimate for a number of waters of the actual production of legal-sized fish from the hatchery plantings; to compare the final yield for fry and fingerling plantings; then to determine from known costs which method of production is the more economical and how much so; also to learn for given waters what percentage of the fish caught were artificially hatched and reared. This will be a necessary beginning to the placing of fish-culture on a business basis, and will guide us to a greater efficiency in that it will save for waters needing them, those fry or fingerlings which would have been planted in waters where they would not yield returns commensurate with the expenditures involved.

The fingerling-rearing policy accentuates, as already intimated, the problem of coping with the fish diseases which so often decrease the yield and efficiency of our fish cultural plants, and increase the expense of operation. This situation is so acute as to threaten the development of fingerling-rearing, and to demand that technically competent men investigate the fish diseases, learn how they may be diagnosed and cured; and of more importance, learn how the epidemics may be avoided. In Michigan we have for this purpose added to our staff Wendell H. Krull, as fish pathologist. He also investigates the diseases of fish in nature, and the cause of their death.

Another problem accentuated by the fingerling-rearing program is that of transportation of fry from hatchery to rearing station, and of fingerlings thence to the public waters. This has necessitated a marked increase in number of trucks, tanks and personnel, with high initial and maintenance expense. To hold down this expense, and to decrease the danger in transporting the fish at tender ages, we are experimenting with new types of transportation cans to replace the traditional cream can. We are for the same reasons experimenting with the use of oxygen and other substances to determine whether a greater number of fish cannot be carried in a can, and whether these may not be kept in better condition during transportation.

Not only the transportation of fish, but every other detailed phase of fish cultural practice calls for searching scrutiny. Methods of rearing and holding brood stock, of taking and fertilizing the eggs, of developing and hatching the eggs, of rearing the fry and then the fingerlings, and finally of planting the fish, are all proper subjects for experimentation to uncover new and better practices, or of choosing between different practices in vogue. Whether the forcing of development by use of warmer water weakens, or strengthens, the resulting fish is one of the problems with which we hope to deal.

Of equal importance to the rearing of healthy fingerlings is the planting of them in waters in which the prospect for success is good. This end we are trying to reach in large part by our lake and stream survey. Last summer, as a result of our intensive examination, already mentioned by Mr. Doyle, of the seventy-odd fish lakes of Kalkaska County, Michigan, under the auspices of the State Division of the Izaak Walton League, we were able to make provisional estimates of the number of fish needed to restock these lakes. Summing the figures for the individual bodies of water, yields a fish budget for the lakes of the county. When this work explands to cover all the lakes and streams of the state, we can then have a fish budget for the whole state, one of the bases for a business-like organization of the fish-cultural work of the state.

In determining whether or not fish need to be planted in a given body of water, it is desirable to know (1) what species of fish are already present and in what abundance, which we learn in our lake and stream survey, from the experience of local conservation officers and others, from our creel census, and otherwise; (2) what the potential carrying capacity of the water is, whether the fish are over-crowded, and (3) whether they are of normal or stunted growth. In order to properly evaluate local conditions we need to investigate further the food of fishes and their competitive inter-relations.

Where fish should be planted is partly dependent on the nature of their movements or migrations. So we are studying the movements, chiefly by means of tagging experiments. More than ten thousand fish have been marked in Michigan with serially numbered tags, and their migrations are being studied as the returns from the marking experiments come to hand. This year we expect to tag thousands more. We shall be able to do this now to better advantage, since we have over the winter induced a manufacturer to produce a tag so light that even a fingerling may carry it without being overbalanced. One of the questions answerable by migration studies is how large a part of a lake or of a stream system will be stocked by a planting at one point.

We have had rainbow trout crossing the entire width of Lake Michigan in seven days, for instance, and on the other hand we have had brook trout remain in the same pool year after year.

When the initial wild orgy of destruction of our rich primeval fish supply forced upon the American consciousness a realization that the natural supply was not inexhaustible, was in fact being seriously depleted, there came the call for the enactment of restrictive legislation and for its enforcement. Since reckless abandon in destroying the resource was obvious, it was thought that the more control of this recklessness would serve to maintain the hitherto vanishing supply.

But depletion continued. A panacea was then sought in fish culture, coupled with more and better restrictive regulations and law enforcement. The call continues for more restrictions, more enforcement, more fish hatching and rearing.

But yet our fish supply dwindles. That this is true is not the fault of the restrictive legislature, nor of law enforcement, nor of fish cultural activities. Above all else it is the result of ever-increasing fishing intensity, coupled with natural limitations to fish production.

In a few waters of high natural productiveness, the supply of fish is holding up very well with very little help. In other waters of somewhat lower natural productivity, or more heavily fished, restrictive regulations and their enforcement are sufficient to maintain a fairly good fish crop. But the vast majority of our bodies of water do not present optimum conditions for fish life. These natural limitations are usually so pressing that the added limiting effect of overfishing suffices to cause a depletion of the fish population.

To prove how effective are the natural limitations on fish increase let me cite an imaginary lake of average fish conditions but without fish life. We add 10,000 adults, 5,000 of which are females producing 2,000 eggs each, or a total of 10,000,000 eggs. If only one egg in a thousand reached maturity, then after three years of immaturity, let us say, 10,000 adults would result. Now if we assume that each adult produced lives to spawn only twice, then after seven years our lake would have a population of 30,000 adults. Now we begin to reap the harvest, and catch off 10,000 in this lake after they have spawned once. With this very fair catch of 10,000 fish continued each year, and with a continued destruction by natural agencies of 1,000 fish to every one which reaches maturity, and with the natural destruction of all adults after they have spawned only twice, then after only twenty-eight years, we would have an adult population in our well-fished lake of 600,000. Even if ten years after the beginning of the fishing we had increased the catch to 20,000 per year, the population at the end of the twenty-eight year period would be 480,000; or if we had then increased the catch to 40,000 fish per year, the population would be 260,000, at the end of the twenty-eight year period, and after another nine years would have passed the wholly impossible total of 1,000,000. Clearly a fish having the limited reproductive capacity of our theoretic example suffers a destruction by natural causes far beyond the assumption of 1,000 destroyed per one surviving adult, and of each adult destroyed after spawning only twice. And of course, the destruction rate increases as the population increases.

I have bored you with a mass of detail. I have recited for you a pessimistic tale of continued depletion despite our efforts in restrictive legislation and law enforcement, and despite the expansion of our fish cultural program. I have presented our view that none of these conservational measures can be lightly cast aside, that on the contrary we need more and especially better fishing regulations, based as far as possible on sound scientific information, as fast as this can be accumulated; that these regulations to be effective obviously must be well enforced; that fish culture needs to be extended, improve and put on a sound business basis by a scientific study of all phases of fish cultural practice, and by the building up of fish budgets through lake and stream surveys. We have faith that these improvements will help, but we believe we would be deluding ourselves if

we thought that improvements in laws, enforcement and fish culture would alone suffice to maintain, at a respectable level, general public fishing in our waters, in the face of an increasing drain.

We are restricting the catch of game fish, especially during the spawning season, and we are carrying a certain number of fish over the early critical stages of development in our hatcheries. What more can we do?

The Michigan inland fishing program attempts to answer this question with environmental control. In this answer we are aiming to strike directly at the limiting factors which block the natural tendency of wildlife to increase in numbers by geometrical progression. What we mean by environmental control may be illustrated by the cover control work now under way in our trout streams. Many of our streams or parts of streams have the clear, cold water of weakly varying flow which trout prefer, yet are devoid of trout or nearly so. These streams have even shallow bottoms, without adequate shelter. Some are so far entirely natural reasons; others because the snags were removed by floating logs or pulp wood, or because the holes have filled with sand carried into the stream from burned over land. To make these stretches available for trout, we are introducing barriers of one sort or another, most of which are of the hole-digging type. Every angler knows that trout tend to have individual holdings in deep holes. We are testing out on a large scale the natural assumption that an increase in the number of holes along the stream will make it possible for more trout to live and to be caught there. We are attempting to make trout waters out of long stretches now unoccupied. In many streams it would seem logical to expect that at a relatively low cost the adult trout population may be doubled or even quadrupled by such environmental control. And we are experimenting to discover if bass streams may not also be so improved.

As an integral part of our program we are carefully checking and double-checking this relatively new idea of environmental control in public waters. To continue with our example of cover control work in trout streams, we are mapping and listing the snags, logs, dams, floating covers and other devices we put into the streams to make them more acceptable habitats for trout. And we are marking each unit with a numbered metal tag, so that we may return year after year to learn what types of installation are most permanent, most economical, and most conducive to trout increase. We have numbered many of the barriers put in by the late Dr. Jan Metzelaar, who pioneered in this work, and also many naturally located snags and deadheads, to follow what they do in making the stream more fit. This work is being done by Clarence Tarzwell, one of the members of our Institute staff.

Our ideal is to test and to check, and to regard whatever is done as an experiment to be closely watched and profited by, so that failures and ineffective operations may not be unduly repeated, and so that practical successes may be extended.

The possible improvement of trout streams by the planting of willows, alders or other shrubs along the banks, also calls for extensive experimentation. Open streams, especially in the southern part of our state, may have the temperature held down by shading, so as to double perhaps the headwater portion which is fit for trout.

The possibilities of improving lake fishing by environmental control measures is equally alluring. Pioneering work is being done now in Michigan in an effort to improve inland lake fishing by making the conditions in the lakes better suited to the increase of fish life. We are consciously passing beyond the stage of trusting to restrictive legislation and its enforcement to conserve our lake fish supply, and beyond the state of expecting fish culture to maintain the supply. We are accepting these forces as needed, but are stepping out to find a new and added means not merely of fish maintenance, but of fish increase. I repeat, not merely of fish maintenance but of fish increase. And we are bringing all of these fish conservation and fish development means together into a fish management project for each section of the state as it is covered.

Waltonians may well take notice and we hope be proud, for this application of environmental control and fish management to our inland lakes which are open to public fishing is an Izaak Walton League project, conceived, developed and carried into application by Harry F. Harper, President of the Michigan Division of the League, with the aid of Earl C. Doyle, Executive Secretary of the Division. The details of carrying on the investigation and of drafting the reports and recommendations has been the fortunate lot of our Institute for Fisheries Research. Three promising lads, financed by Mr. Harper, namely R. W. Eschmeyer Laurence M. Ashley and Samuel N. Jones, have borne the brunt of this work. And they are being trained as a nucleus, out of which we hope will grow an organization large enough to carry to completion the inventory survey of 5,000 Michigan lakes.

Our program in this lake development project is to make a careful study of all of the lakes of a county or other area, and to prepare for each a colored map. This shows:

1. By colors, the kind of bottom material in all parts of the lake -- a feature of great importance in fish production.

2. By soundings and contours, the depths of the lake, and the shape of the lake basin -- also matters of importance.

3. By appropriate symbols, the location, shape, size and composition of the weed beds -- which I need not remind you fishermen, is of vital import.

4. By stippling, the location of spawning beds.

5. By different types of outline, the nature of the shore, whether overgrown, plain or steep.

6. By accurate outline, the details of the shape of the lake, especially of the bays.

7. By usual means, the inlets and outlets of the lake, if any, and the adjacent swales, marshes and swamps.

8. By conventional signs, the roads, trails, houses, cottages, camps, etc., near the lake.

For each lake the map is supplemented by information on cards, giving:

1. The physical and chemical characters of the water, including color and transparency, and the temperatures, dissolved oxygen, free carbon dioxide, two kinds of alkalinity and the acidity, all of which are related to fish life.

2. The kinds of plants present and their abundance in each bed, with a cross reference to the map on which each bed is numbered. The weeds are of importance to ducks as well as to fishes.

3. The present fish life of the lake, the game species, the coarse fishes, the noxious fishes and the minnows present, and their abundance as closely as that can be learned.

4. The history of the lake as to general fishing conditions, and changes in abundance of each important species.

5. The abundance of natural food for the game fishes.

6. Specific stocking recommendations stating species and number of each needed.

7. Material for local regulations, as the designation of lake as pike lake, bass lake or trout lake; location of spawning refuges, etc.

8. Statement as to public fishing privileges.

9. Need for improving facilities for fishing, as providing boat livery, constructing or improving trails into lake, etc.

10. One of the results of the lake survey is the building up of environmental control recommendations, covering such points as making connections with adjacent swales; damming of inlet or outlet; increasing weed beds, adding shelter; fertilization; addition of gravel spawning beds.

In this environmental control it is our idea to select out those characteristics of the lake which appear to be limiting the fish production, and which are amenable to change, and to offer definite quantitative recommendations for the changes proposed. If a lake has nearby a disconnected swale which would become a rich feeding ground for the lake fishes, we recommend the opening of a channel from lake to swale. Here is an example, Big Twin Lake. Adjacent to it there is a swale. That swale is very rich in natural fish food. A nice rampart, a small rampart separating that from the lake, has been built up. It would be a small matter to build a channel there to allow the fish entrance and egress, so as to feed upon that supply that now is doing no good.

If there is danger of the lake fish getting out into trout streams, or of merely dropping to oblivion down the outlet, we recommend the construction of a loose gravel-and-brush dam in the outlet. A considerable number of these lakes have outlets directly into trout streams. The advantages are keeping the lake fish like pike, out of the trout streams where they do harm, and preventing the loss of fish like blue gills, which have a habit of dropping out of the lakes in the fall.

If shelter for young fish is poor, we recommend introducing a certain stated number of brush heaps. These lakes which are mapped with a clean yellow border are very often surrounded with a clean sand shoal where a small fish would have very little chance for survival. There is practically no shelter in which it may hide. We are recommending for such lakes, and of these there are a considerable number in Kalkaska County, that brush heaps (piles of brush tied together and weighted down at sufficient depths where they will be out of the way) be introduced to give the young fish a chance to escape their enemies. If the lake is apparently in serious lack of basic fertility and food production, we recommend the addition of a given amount of acid phosphate. We are going to try out that as a most promising lead in the way of fertilizing.

Here is a lake, Little Twin, which in spite of its depth, has a clean sand bottom throughout. There has not been enough organic life produced in that lake to produce a deposit of organic mud on the bottom of that lake. The actual water has not the qualities to produce this life, and we cannot expect a high fish production in a lake of that sort, no more than we could expect a high crop from a land of clean silica sand, so we are recommending for lakes of that sort the actual addition of fertilizer to cause an increase in the amount of the basic food on which the fish feed. This sounds, perhaps, too radical, a little extreme, to attempt a thing of this sort for natural lakes, but when we recall that the United States Bureau of Fisheries has at its Fairport Ponds in Iowa produced without artificial feeding, more than 10,000 fingerling game fish per acre of pond by fertilizing the water, we have fair reason to believe that fertilization of natural lakes may also lead to greater fish production.

If spawning conditions seem unfavorable, we recommend adding a given number of loads of gravel in heaps for spawning beds. And whatever is done we look on as an experiment to be watched from year to year.

All the recommendations for all the lakes are then brought together to comprise the fish management project for the county or other unit involved.

Last summer we covered seventy lakes of Kalkaska County, Michigan. The reasons for selecting this county were several. In the first place, the county had been covered by the Land Economic Survey, which provided accurate maps of the lake outlines, roads, the surrounding land, cover, etc. Secondly, very little previous work had been done on the lakes of this county. Thirdly, Kalkaska County is relatively undeveloped from a resort or recreational standpoint, especially as compared with many southern counties. Fourthly, the nature of the country makes the fish productivity of the lakes relatively low, so that every effort must be made to improve the conditions for fish lifeand to stock the lakes, in order that the supply can be maintained and if possible, increased in the face of the increased fishing which the future is bound to bring. Lastly, it is one of the counties for which we consider this development of the recreational or tourist resources to be of vital economic importance. Kalkaska County lies in a part of Michigan which, by general agreement, has as one of its greatest, if not its greatest asset and economic resource, its lakes, streams, woods, open spaces and pure air. The importance of guarding these against despoilment and of developing them to the greatest attractiveness and utility is fundamental to the welfare of the county. The purpose of the lake inventory of Kalkaska was to help in this development, by providing general information on the lakes and by suggesting methods of improving the fish conditions.

In presenting the Kalkaska fish management project to an enthusiastic meeting of local residents called at the instigation of the Michigan Division of the League, I said, in part:

"Kalkaska is surely on the threshold of a great resort development which has been, of course, retarded by the passing financial stringency. It is of vital importance that the development be guided along lines which will provide the maximum economic return in future years. It is especially important that the right of the local public and of the general tourist and camping public to fish in the lakes of the county shall be safeguarded and perpetuated and that fishing and camping and summer-home building be facilitated and encouraged.

"These ends can be reached in large part by the obtaining or retention of state, county or township holdings on each and every lake of any consequence in the county. Only in this way can the obtaining of exclusive rights on the lakes by individuals or small groups be prevented. The speed and thoroughness with which the lakes of other sections of the state are being taken over by private parties is amazing. Action must be taken or Kalkaska residents and tourists will, before many years, be confronted by 'No trespass' signs on every hand. The suggestion is presented that <u>now</u> is a time very opportune for the obtaining of these riparian holdings to insure continued access to the lakes by the public.

"Facilitating and encouraging of lake development can be accomplished by:

1. The spread of correct information and maps.
2. The better marking of roads and trails.
3. The marking or improvement of trails into the lakes.
4. The development of camp sites and facilities, and
5. The development of some boat livery service on as many lakes as possible.

"The importance of developing fishing, fishing conditions and fishing facilities in all of the fish lakes of the county may be stressed. To do this will increase the fishing, without unduly straining the fish supply in the few better known and most accessible of the lakes. This retarding of the fishing strain is especially important in a region like Kalkaska where the natural productivity of the lakes is relatively low."

"It is a general misconception that all fish need is water and stocking. This is, however, no more true than would be the idea that all one needs for crops is land and seed. Lakes differ in productivity just as much as do farms. In a clean sand region, farm production is much less than in regions of prime soil, and in such reasons lake production is generally correspondingly low, and for the same reason. Lake water must contain fertilizing elements to maintain fish life, and lakes in a region of light low-productivity soils receive little run-off and what water does enter the lakes has had little opportunity to leach the life-maintaining chemicals from the soil.

"It is therefore not to be expected that the fish supply of the lakes of Kalkaska County will stand up well under an increasing strain of fishing, unless special efforts are made to develop this fish supply. We believe that much can be done to maintain and even improve fishing in the county, if energy and vision, hard work and an eye to the future is put into the project. To carry on this work would put Kalkaska on the conservation map, for the Kalkaska project would be watched and discussed with interest in conservation circles from one end of the country to the other. This work would be of a pioneering nature and would bring great and wide credit to those who carry it on."

The residents of Kalkaska County, though it is one of the poorest in our state, enthusiastically received this project, and pledged themselves to carry it out.

What we have done is a relatively humble beginning, but it brings hope that we may be able in Michigan, by environmental control, coupled with older means, to build up our fish supply in the very face of the increasing drain. And if we do so succeed in Michigan, we may bring hope to all the country that the decrease in fish abundance may be checked.