

Original: Fish Division
cc: Education-Game
Institute for Fisheries Research
G. P. Cooper

INSTITUTE FOR FISHERIES RESEARCH
DIVISION OF FISHERIES
MICHIGAN DEPARTMENT OF CONSERVATION
COOPERATING WITH THE
UNIVERSITY OF MICHIGAN

ALBERT S. HAZZARD, PH.D.
DIRECTOR

April 23, 1946

ADDRESS
UNIVERSITY MUSEUMS ANNEX
ANN ARBOR, MICHIGAN

Correction to
REPORT NO. 1035

EXPERIMENTAL LIBERALIZED FISHING REGULATIONS

by

G. P. Cooper

The accompanying Institute Report No. 1035, dated March 19, 1946, deals with experimental fishing regulations mostly on lakes. Bear Lake in Hillsdale County and Saddle Lake in Van Buren County are in a separate category with no size limit on bluegills, sunfish, and other pan fishes. The original intent in setting up the experimental regulations on Bear and Saddle was to eliminate the size limit on pan fishes and also to eliminate the daily creel limit on pan fishes less than six inches long, but to still retain the statutory closed season on bluegills and sunfish and to have the lakes remain closed to all fishing from April 1 to June 24, inclusive.

Through either an over-sight or a misunderstanding the Conservation Commission's orders on Bear and Saddle were so worded that they allow more liberalized fishing than was intended. The Division of Field Administration interprets the orders to mean that these two lakes are open to hook and line fishing throughout the year for the taking of bluegills, sunfish,

perch, rock bass and calico bass at any time. In addition to the statutory creel limit for such species (25 singly or in any combination except not more than 15 bluegills) six inches in length or over, an unlimited number of the under-sized of such species may also be taken. (All other species may be taken only in the season and number provided by statute.)

The above applies only to Bear Lake in Cambria Township, Hillsdale County and Saddle Lake in Columbia Township, Van Buren County.

INSTITUTE FOR FISHERIES RESEARCH

by G. P. Cooper



MICHIGAN DEPARTMENT OF CONSERVATION

To FAW 4/22/46 Date

From Al-Kamund conest Hour

Because of changed status of
Bear and Jaddle Lakes re
discussion yesterday, these
reports are obsolete in that
respect. Hazard will need to
immediately assign census clerks.
Does he need further instruction?

Report # 1035

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March 19, 1946
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ANN ARBOR, MICHIGAN

EXPERIMENTAL LIBERALIZED FISHING REGULATIONS

by

Gerald P. Cooper

The legislature in 1925 passed the "Discretionary Power Act" (Act 230) giving the Conservation Commission authority to impose more restrictive regulations on the taking of fish and game if such restrictions were deemed necessary for the preservation of a species. In 1945 the act was amended to give the Conservation Commission authority to set up more liberalized fishing regulations on not more than twenty lakes and ten streams (limited to one per county and for a period not to exceed five years) for experimental purposes. This authority was requested by the Department to determine whether or not our existing regulations are more restrictive than they need be.

The results of studies by the Institute for Fisheries Research over the past fifteen years point to the conclusion that many of our present regulations are not needed, and could be either eliminated entirely or liberalized to a considerable extent to the benefit of fishermen and without seriously depleting the species involved.

The majority of our lakes now have an adequate variety of warm-water game and pan fishes well established. These warm-water game fishes, and especially the pan fishes, when in lakes to which they are well adapted,

tend to produce more young than the waters can support. This is a fundamental biological fact. In most of these species a single female lays from 5,000 to 20,000 or more eggs per year. Natural reproduction under normal conditions, and even partially-successful natural reproduction under adverse conditions in certain years, can be expected to produce an adequate supply of young, and, as a general condition, more than enough young in most lakes.

Where there are too many fish, their growth is slow and fewer fish annually reach a size attractive to anglers. This adverse effect of over-population now appears to be a more important problem in warm-water fish management than the question of under-stocking. Over-population and stunting of pan fishes occurs in some lakes to the extent that relatively few fish ever reach legal size, and a large part of the lake's fish-producing capacity is held up in a population of small fish which are of no interest to the angler. It is obvious that in such lakes natural reproduction is too successful. While extreme over-population by pan fishes may be confined to a relatively few lakes, we now believe that some degree of over-population occurs in many (probably the majority) of our lakes; in other words that most lakes have more young pan fishes than they need for best production, and more than enough breeder fish left after fishing takes its toll.

In lakes where pan fishes are badly stunted, the present size limit is of no benefit, but is actually detrimental in not allowing fishermen to remove the excess of small fish. If fishermen would remove enough of these small fish, it is certain that the lake would be benefited. Even in lakes where stunting is not extreme, the removal of a limited number

of undersized pan fish would do no harm, and it is obvious from a check on Bear Lake, Hillsdale County, during 1945 that fishermen are not interested in removing considerable numbers of them. Furthermore, the lakes where fishermen might be expected to remove a considerable number of undersized pan fishes are the lakes where these small fish are especially abundant and where their removal might do some good and would do no harm. On the basis of present evidence and reasoning it is concluded that size limits on pan fishes are not needed at all, and if anything are detrimental rather than beneficial.

In lakes which are overpopulated with certain species of pan fishes it is difficult to justify any restrictive regulations (closed seasons and creel limits, as well as size limits) on fishing for these species. And for the majority of the other lakes it now appears that fishermen could take a greater proportion of the crop of adult pan fishes, and there would still be enough left for adequate natural reproduction. In other words our present regulations on season and creel limits restrict the harvest too much. Whether or not any regulations on fishing for pan fishes are needed is open to question, but a gradual liberalization of present regulations, or liberalization on a few waters, would be the most logical procedure in testing the extent to which the present regulations should be changed.

As compared to the pan fishes, there is much less evidence of overpopulation, stunting, and under-cropping of the larger game fishes such as the northern pike, walleye, largemouth bass, and smallmouth bass. However, on at least some waters there may be a need for revision of size limits and possibly other regulations on these larger species.

For the several species of trouts the evidence indicates that fishermen are cropping these species close to the limit on most waters. There

are exceptions in some instances and here more liberalized regulations would probably be beneficial.

In some very cold trout streams where natural reproduction is very successful and growth is slow, there is a large natural mortality among fish less than seven inches long. A reduction in size limit on trout in such streams might afford a greater yield of trout to the angler than is obtained with the present size limit.

There are several streams where Great Lake rainbows are very abundant, and where the young spend about two years in the streams and then migrate to the Great Lakes mostly without attaining the legal length of seven inches. These young rainbows contribute very little to the angler's creel because of their small size, and few of the spawning-run adults are caught because most of them remain in the rivers for only a short time. The elimination of the seven-inch size limit on rainbows in these streams would allow a better utilization of the crop.

In certain lakes in the southern part of the state where hatchery trout are now being planted, the present closed season limits trout fishing to the summer and fall. By the opening date (June 25) the trout have moved into the deeper water because of temperature changes. Spring fishing would encounter these trout nearer the surface where presumably they would be easier to catch. The justification for planting these legal trout (expensive to raise) is dependent upon fishermen catching a large percentage of them, and the present rate of return is not entirely satisfactory. An earlier opening date on such lakes might allow better returns on these trout.

The preceding discussion outlines some of the problems which now face the Conservation Department in its efforts to provide better fishing.

Some of the questions could be solved by research independent of participation by the fishing public. But mostly they involve tests on the value of present fishing regulations and on the effect of possible changes in regulations, which would necessarily involve the fishing public.

The Conservation Commission has approved experimental liberalized regulations on (at present) a total of thirteen lakes and one stream in Michigan. These new regulations will be in effect during 1946, and in most instances have been approved for a five-year period. The purpose has been to test the effect of these new regulations, with the idea that, if the results are favorable, they might be applied more generally to other waters. This of course would require action by the legislature. The thirteen lakes are grouped in several categories each with a different change in regulations. The reason for this was to evaluate each regulation separately, before modifying several of the existing regulations on a particular water. It is anticipated that as the effects of these individual liberalizations become evident other restrictions might be lifted to determine how far it is safe to go in eliminating the present general fishing regulations.

The waters involved, the new regulations, and the reasons for setting up these regulations are given in detail in the following outline:

(A.) Bear Lake, Hillsdale County

Saddle Lake, Van Buren County

No size limit on pan fish (bluegills, sunfish, perch, crappies, calico bass, rock bass), and no creel limit on pan fish less than six inches in length.

Other regulations remain the same. Closed to all fishing April 1 to June 24, inclusive. Statutory closed seasons on bluegills, sunfish, largemouth bass, smallmouth bass, pike, etc. No change in size

limits or creel limits on fish other than pan fish. No change in creel limits on pan fish over six inches in length.

Purpose of the liberalization on these two lakes is to determine whether or not fishermen would keep enough undersized pan fish to warrant having the legal size limit, even if it is assumed that protecting these small fish is desirable; and to find out if fishermen will take enough to do some good (increased growth) in lakes where pan fishes are over-populated and stunted.

On Bear Lake, Hillsdale County, during 1945, under experimental regulations, there was no size limit on pan fish. During the season fishermen kept a total of only 962 undersized pan fish, mostly bluegills, or about 8 per acre on this 117-acre lake; and only 18.8 per cent of the successful fishermen saved any undersized fish at all. The obvious conclusion is that these fishermen were not especially interested in keeping these small fish. One factor which might have discouraged Bear Lake fishermen from keeping undersized pan fish was that these fish were counted in their total creel limit and would prevent their taking the limit of larger fish. For this reason the regulation for 1946 was set up with no creel limit on the undersized fish.

(B.) Big Portage Lake, Jackson County

Sugarloaf Lake, Washtenaw County

Minnewaukon Lake, St. Joseph County

Fife Lake, Grand Traverse County

Open throughout the year on fishing for perch, rock bass, crappies, and other species not protected by statutory closed seasons.

No closed season on bluegills and sunfish.

Statutory closed seasons remain in effect on largemouth and

smallmouth bass, northern pike, trouts, etc.

No changes in size limits or creel limits.

The purpose of these regulations is to find out if our lakes will afford this additional amount of fishing for pan fish and other non-game fish without jeopardizing future fishing.

(C.) Whitmore Lake, Livingston County

Pontiac Lake, Oakland County

Lobdell Lake, Genesee County

Craig Lake, Branch County

Duck Lake, Calhoun County

Fine Lake, Barry County

Open throughout the year to fishing for perch, rock bass, crappies, and other species not protected by statutory closed seasons.

Statutory closed seasons remain in effect on bluegills, largemouth and smallmouth bass, pike, etc.

No change in size limits or creel limits on any species.

Regulations are the same as enacted by the 1945 legislature for non-trout lakes north of highway M-46.

The purpose of liberalization on these lakes is to demonstrate in southern Michigan the value of year-round fishing for species not protected by closed seasons and to determine if the quality of summer fishing is affected by permitting a greater harvest of such fish as pike, perch, crappie, rock bass, bullheads, etc.

(D.) Birch Lake, Cass County

Open to fishing for all fish except largemouth bass, smallmouth bass, bluegills and sunfish, beginning May 15 each year instead of June 25.

No other changes in regulations.

The purpose of this change in regulation is to give fishermen an opportunity to take a greater percentage of the legal-sized rainbow trout which are being planted in the lake, and to take them in a more sporting way by fly fishing in the spring. Also to permit a greater harvest of perch, rock bass and other species not protected by closed seasons.

(E.) Part of Hunt Creek (Sections C, D, and E) and upper Fuller Creek at the Hunt Creek Experiment Station in Montmorency County.

The legal length on brook trout is reduced from 7 to 6 inches. All other regulations remain in effect.

The stream has a large population of small brook trout, entirely from natural reproduction, and a considerable natural mortality among sub-legal trout appears to be evident. It would be better conservation if fishermen harvested some of these smaller trout. The purpose of the legislation is to test the effect of a lower size limit on the trout returns to anglers.

On each of these preceding 13 lakes and one stream the Department will have men assigned to the job of checking all or a fair sized sample of the fishing results. Where possession of fish of certain sizes or certain species would otherwise be illegal, a duplicate of the creel census record will be issued as authority for fishermen to possess such fish for a period not to exceed three days.

Considerable prior information has been obtained on the game fish populations and results of fishing for most of these waters, and additional growth and population studies will be made, along with the creel census studies, to determine the effect of these liberalized fishing regulations.

INSTITUTE FOR FISHERIES RESEARCH

by Gerald P. Cooper
Associate Fisheries Biologist

Report approved by A. S. Hazzard

Report typed by E. F. Livingston

INSTITUTE FOR FISHERIES RESEARCH

DIVISION OF FISHERIES

MICHIGAN DEPARTMENT OF CONSERVATION

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ADDRESS
UNIVERSITY MUSEUMS ANNEX
ANN ARBOR, MICHIGAN

GENERAL INSTRUCTIONS TO PERSONNEL ASSIGNED TO LAKES
WITH EXPERIMENTAL FISHING REGULATIONS

by

Gerald P. Cooper

The experimental liberalized regulations have been put into effect by the Conservation Commission with the idea that we will determine on these test waters how fishing is affected by these changes and the extent to which more liberal regulations should be applied to our waters generally. Some of the important questions which we can anticipate will arise in evaluating the effect of the liberalized regulations are these: Will the additional spring fishing for certain species (bluegills, sunfish, perch, crappies, and to some extent pike and walleyes) result in a certain amount of cropping during the spring entirely at the expense of fishing during the summer, or will the spring catch be entirely or partially an increment of gain in the total harvest from the lakes? In either event it will be important to know the total fishing returns by seasons. Will the added fishing pressure the first year be followed by a decline in fishing returns in succeeding years, and what will be the extent of such a decline? Will spring fishing for fish on their spawning beds, especially bluegills, so disrupt natural reproduction as to cause a subsequent scarcity of young fish and a decline in the species; and if such a decline should take place

would the effect be adverse or beneficial? (It could be beneficial if the species was over-abundant and stunted.) In lakes which are over-populated with stunted pan fish, will the additional fishing thin the population sufficiently to cause better growth? These and other vital questions can be answered either entirely by creel census or by creel census in conjunction with studies on fish populations and age and growth. The creel census clerks who are assigned to these lakes have the "lion's share" of the responsibility in getting the basic data for the answers to these questions. On each lake the first responsibility of the creel census clerk is to do as good a job as possible in getting the creel census data.

Each creel census clerk is being supplied with a copy of:

- (1) The present "General Instructions."
- (2) A general prospectus on the details and purposes of the liberalized regulations on each lake.
- (3) Suggestions for creel census.
- (4) Directions for taking scale samples of fish.
- (5) Suggestions for observations on spawning habits of fish.
- (6) Several Institute reprints dealing with creel census and related subjects.
- (7) A few copies of "For Better Fishing."

The above outlines and reports will supplement the general directions and comments given in the present statement.

Operations on Sugarloaf, Big Portage, Minnewaukon, and Fife lakes

The dual function of the man assigned to each of these lakes is to obtain creel census data, and to issue to fishermen permits for possession of bluegills and sunfish "out-of-season."

An official checking station obviously is necessary, where fishermen are required to obtain these special permits. The present plan is that the clerk at each lake will make arrangements for the rental of a cottage or suitable building to be used as a checking station, rental to be paid by the Fish Division. The clerk may use the cottage as living quarters. In lieu of the state furnishing living quarters, the clerk can be expected to work at irregular hours and week ends which is necessary to do a good job on the census. When the fishing intensity on the lake becomes heavy, and it therefore becomes necessary to operate the checking station about 14 hours per day, 7 days per week, it may become necessary for the regular census clerk to have additional help; this would occur only during the period from March 15 to June 25, because after June 25 it will not be necessary to issue fish permits or to man the checking station full-time. When it becomes necessary to obtain extra help at the census station, the census clerk should locate a local man to be employed on a half-time, C grade basis to work at irregular hours as needed, the employment of this individual to be subject to approval by the Institute and the Lansing Office. (It is assumed that no one on the Civil Service C Register, except a local man, would be interested in such a part-time C job with irregular hours; although it may be necessary to go through the regular channels to obtain this part-time help.)

The records obtained from fishermen reporting at the checking station from March 15 to June 25 will be selected data representing only fishermen who catch bluegills and sunfish. We need from these lakes a record of total fishing for all species during all seasons, which should be census records on all fishermen when this is possible, or a random sample (of known extent) of the total fishing. When fishing intensity is great, the records obtained at the checking station, though selective, may serve as

one basis for estimating total fishing, in the following way: Presumably the records obtained at the checking station will be on all fishermen who catch bluegills and sunfish. If the clerk can get a strictly random sample of all fishermen on the lake, by working independently of the checking station, contacting these fishermen after they have completed their fishing and as they are leaving the lake, this random sample would give species composition, catch per hour, etc., and in addition the percentage of all fishermen who catch some bluegills and sunfish. From this percentage figure and the records obtained at the checking station for all bluegill and sunfish fishermen, the total fishing and its results could be computed. Calculating total fishing intensity by periodic boat counts (explained in the accompanying "Suggestions for Creel Census") could be employed as a check on the preceding method, or vice versa.

The census clerk should send in a weekly summary (on supplied forms) giving his creel census data on all fishermen interviewed, data on boat counts, etc. In addition the census clerk should compute or estimate what percentage of the total fishing for each day is represented by his creel census data for that day; this information should be given on the back of the weekly summary sheet, together with a statement as to how these percentage figures were obtained.

Operations on Craig, Duck, Fine, Whitmore, Pontiac and Lobdell lakes

The primary concern of the two men assigned to these lakes is taking the creel census. The liberalized regulations are such that fishermen do not need to obtain any permits from the census man. Where one man is assigned to three lakes, the problem here is to take a random creel census on each lake on such a schedule that the total fishing on each lake

can be computed from the census with a fair degree of accuracy. Theoretically this should be possible, but the experience of men who have taken such censuses has been that it is a difficult task because of numerous variables which affect fishing. Since the intensity and/or quality of fishing vary throughout the season, throughout the days of a week, during the day, and probably geographically on each lake, the census methods must be adapted to these variables.

A certain technique for a one-man census on three lakes, to allow for the variations in fishing intensity and quality, can be predetermined in a theoretical way; but such a schedule would need to be altered to allow for unanticipated variations in weather and other factors which are so important in affecting fishing intensity. Where each man is to spend two days a week on each of three lakes his weekly schedule should be so planned, week-by-week, that the three lakes are censused on equal numbers of heavily and on equal numbers of lightly fished days, and this adjustment of schedule for comparable sampling, as nearly as possible, should be continuous throughout the season. Periodic boat counts made in conjunction with a random sample census on individual fishermen is suggested as a technique of computing total fishing intensity and results. Detailed suggestions are given in the accompanying statement by Mr. Fukano.

Operations on Birch, Bear and Saddle lakes

On Birch Lake during prior seasons Mr. Scholma has been able to get a nearly complete census by directly contacting practically all of the fishermen. The earlier opening date on Birch this year does not involve any changes in statutory closed seasons on protected species. Therefore, it will not be necessary to issue creel census permits to fishermen, nor

to establish an official checking station. Presumably the same degree of completeness of the creel census can be obtained this year as in former years.

On Bear and Saddle lakes it will be necessary to establish a checking station, since fishermen will need permits for possession of undersized pan fishes, and it is our responsibility to service the fishermen at these checking stations at all reasonable hours during the day, seven days a week, when fishermen might come in with these undersized fish. At these lakes the job of the creel census clerk is to issue these permits, to obtain records on the number of undersized pan fish kept by fishermen, and to conduct an independent creel census on the total fishing on the lakes. It is expected that the man assigned to each of these lakes will, throughout the summer, need assistance in operating the checking station and to give him some free time for a random census of fishermen on the lake. The man assigned to each lake should make arrangements for establishing a suitable checking station, and should make arrangements for engaging the services of a local man for an assistant, when such assistance is necessary. The status of the checking station and of additional assistants should be the same as on Sugarloaf, Big Portage, etc. lakes, see above.

On Bear and Saddle lakes the complete returns on fishermen who keep undersized pan fish may serve as one basis for computing the total fishing returns, if there are a considerable number of fishermen who keep undersized pan fish and if a separate random sample, independent of the checking station, can be made on fishermen as they come off the lake with their complete catches (see above discussion under Sugarloaf, etc. lakes).

Boat counts in conjunction with a sampling census would be a second approach to evaluating total fishing, as discussed above under other lakes. On days when fishing intensity is light, it may be possible to interview practically all fishermen on the lake and obtain complete records on the fishing, rather than resort to a sampling procedure.

Other observations on lakes

As time from creel census studies permits, you are asked to make some additional observations on these lakes.

Obtain daily records of water temperature on the lake. These temperatures should be taken at points away from the shore shallows where unusual variations in temperature are likely to occur. For the sake of uniformity take these temperatures during the middle of the day, between 10:00 A.M. and 2:00 P.M. Record the temperatures in table form.

On each lake some scale samples from game fish should be collected by the creel census clerks. The bulk of the scale collecting, however, will be done by a special fish-collecting party on the lakes during June and July, according to present plans. See the accompanying directions for the extent to which each census clerk should contribute to this scale collecting.

Critical observations on the natural reproduction of game fishes in these lakes might be of considerable value. The type and quality of future fishing on these lakes may be largely dependent on the success of current natural reproduction, and more so than on the effect of the present liberalized regulations. Or the present changes in regulations might have some direct effect on natural reproduction, either detrimental or beneficial. The men assigned to these lakes may have an opportunity to make and

record important observations, and are encouraged to do so. See the accompanying suggestions on this subject by Mr. Carbine.

Other suggestions

Each of the creel census clerks should keep in close contact with the local Conservation Officer. The liberalized regulations on some of the lakes present special law-enforcement problems, and there should be a general understanding between the officer and the census clerk on the issuance of special permits. Also the officer can be of real service in explaining the purpose of these special regulations.

Posters giving the special regulations for each lake are being supplied each clerk, and more can be obtained from the Ann Arbor office on short notice. The Conservation Officer should be consulted as to appropriate places for posting these regulations.

Large signs for use at checking stations will be available soon. These may necessarily be made up at the Institute, since production of official signs at the Sign Shop at Gaylord has been temporarily suspended.

Each man assigned to one of these lakes should keep a daily record of the hours worked, and the methods used in taking creel census for himself and any assistant. This record should be kept up-to-date daily, on large-size paper (not in the official Diary books), and preferably in table form. This record will be of considerable value in evaluating the creel census data by either the clerk himself or by supervisors of the study. This record should be kept by the census clerk until called for.

Each full-time clerk on these lakes is to submit a monthly activities report to the Ann Arbor office at the end of each month. This report should indicate the days and hours spent on each lake and the type of work which was done. If all of the work was on creel census, that could be so

indicated in an initial statement; also the same for name of lake where all work was done on one lake. This should be followed by a record of the hours worked each day. As a matter of practice the monthly activities report may be merely written up as a summary of the daily work record sheet.

Receipts for boat rentals, records of official mileage on personal cars (daily speedometer readings must be given), and receipts covering other necessary expenditures should be sent in at the end of each month.

INSTITUTE FOR FISHERIES RESEARCH

by Gerald P. Cooper
Associate Fisheries Biologist

OBSERVATIONS ON SPAWNING HABITS OF FISHES

by

W. F. Carbine

Men assigned to the census studies on lakes with special regulations should make an effort to obtain certain information on the spawning habits and other phases of the life history of the various species of fish as follows:

1. Dates on which spawning of the various species is observed, and when possible, the duration of the spawning season for each species.
2. Actual count or estimate of the number of beds used for spawning by the various species.
3. Location (plot on map) and depth of the spawning beds or spawning grounds of the various species.
4. Temperature of the water (several times each day) during the spawning season.
5. Mortality (predation or disease) of the eggs or fry on the spawning beds.
6. Any mortality of adult fish. To what do you attribute the cause of death?
7. Do anglers anchor boats and/or fish over the spawning beds?
8. Record any observation of interest, such as any unusual concentration of fish over the spawning beds, etc. Many things that may be of interest to you might be of some value to us at some later date.

Several reprints dealing with the spawning habits of several important species will be supplied to each man. In addition to this, the following brief notes have been prepared for your benefit.

Northern pike. The spawning migration of pike from the lake into inlet and outlet streams leading to marshes, or from the lake into marshes adjoining the lake shore, will start as soon as the breakup of ice occurs, and may last for a period of 10 to 20 days. The majority of the northern pike run at night. Actual spawning starts as soon as the water warms up to about 45°F. Therefore, most of the spawning is done on warm, sunny days, usually in the afternoon. Northern pike do not construct nests, but broadcast their eggs over the bottom in water varying in depth from several inches to several feet. Grassy, weedy areas are preferred for spawning. The spawning act is accompanied by a great deal of splashing. The eggs hatch in from 10 to 20 days depending upon the water temperature.

If the lake has neither an inlet (including small ditches) nor an outlet, and if northern pike are present in the lake, it is possible that these fish spawn in some shallow, weedy portion of the lake. We do not have any data on this type of spawning, and it might be possible for you to obtain some information on this. If actual spawning is not observed, it might be worth while for you to look for pike fry or fingerlings. Young pike (up to about an inch in length) will be found near the surface of the water on bright, sunny days, attached to or beside a rush or grass stem. Any young pike captured should be preserved so that the species can be determined because mud pike occupy the same habitat.

Walleye (yellow pike perch). Walleyes migrate from the deep water into the shallow water during or shortly after the breakup of the ice in lakes. Spawning takes place in both lakes and streams soon after the water temperature reaches about 45°F. In lakes, a bottom composed of wave-washed rubble, gravel and sand is preferred for spawning, while in streams, either a sand or gravel bottom may be used. Walleyes do not construct nests but broadcast their eggs over the bottom. Spawning occurs at night according

to observations made at Lake Gogebic by Paul Eschmeyer, in water ranging from several inches to several feet in depth.

Common sucker. Suckers usually spawn in gravel bottomed streams, but they have been observed spawning on shallow water gravel bars in lakes. Nests are not constructed by suckers. Spawning takes place during the day and at night, soon after the water reaches 40°F.

Yellow perch. Perch start to spawn in lakes and streams soon after the water temperature reaches 45°F. They do not construct nests of any kind, but lay their eggs, embedded in long gelatinous strings, in shallow water. The eggs are attached to submerged parts of aquatic plants, brush piles, etc.

Crappie. Very little is known of the spawning habits of crappies and any observations that you make will certainly be welcome. Crappies construct nests similar to bluegills and bass, Spawning probably occurs in May and June.

Other fish. The spawning habits of the smallmouth bass, largemouth bass, pumpkinseed sunfish, green sunfish, longear sunfish, rock bass, warmouth bass and bluegill are similar. The smallmouth bass spawns in late April or early May and is the first of this group of fishes to spawn. The largemouth bass will usually be the second species to spawn and will be followed shortly thereafter by the other species.

INSTRUCTIONS TO CREEL CENSUS CLERKS

ON TAKING OF SCALE SAMPLES

by

W. C. Beckman

On Fife, Bear, Saddle and Sugarloaf lakes, the clerk will take 50-75 bluegill samples every two weeks, and 25-50 samples from the other game species.

It is realized that certain species will not be abundant enough to permit this size of sample each period. Therefore, the clerk will take samples from these species as he finds them throughout the period of census.

It is suggested that the clerk concentrate his sampling on a two or three day period for those species which are abundant. The purpose of these samples is to give data on the growth of the species through the year. For this reason it is desired that the samples be spaced at the two-week intervals and all taken in a brief period in that interval.

For the remaining lakes (Big Portage, Minnewaukon, Craig, Duck, Fine, Whitmore, Pontiac, Lobdell and Birch) the clerks need not take scale samples from the dominant game species in the lakes. A special collecting party will net each lake this summer, when presumably an adequate sample of the common species will be obtained. It may be difficult to get adequate samples of northern pike, bass, or game species such as crappies which may be rare in a particular lake. The creel census clerks should obtain scale samples on such species whenever possible and convenient.

Scale samples will be taken in the following manner:

1. Total Length only will be taken. Total Length being the greatest dimension between the most anteriorly projecting part of the head and the farthest tip of the caudal fin when the caudal rays are squeezed together. For the present the fish should be measured in millimeters; but when new measuring boards are available, measurements are to be made in inches and tenths. Indicate for each measurement whether millimeters or inches.
2. The scale sample will be taken from the left side of the fish, just below the lateral line at a point below the front of the spiny dorsal fin.
3. The species, lake, date, length, etc., data will be filled in on the scale sample envelope with the collector's name or initials in the appropriate space.
4. Sex data will be helpful if it is possible to determine it. Many fishermen do not like to have their fish cut into. But if possible, include sex data.
5. As wide a variety of sizes from small to large, as possible, should be included in the sample. This range in size is of considerable importance, and, in so far as possible, care should be taken to insure a good size range in each sample.

March 21, 1946

SUGGESTIONS FOR CREEL CENSUS ON BIG PORTAGE, FIFE,
MINNEWAUKON, AND SUGARLOAF LAKES

by

K. G. Fukano

The purpose of the creel census on these lakes is to determine the fish yield. As all fishermen catching and keeping bluegills or sunfish prior to June 25 are required by law to receive a permit for lawful possession of these fish, you will have the total number of bluegills and sunfish removed from the lake. The clerk will make spot checks on the lake which will give the composition of the catch, and make boat counts which will give the fishing intensity. By manipulating the above mentioned data an accurate estimate of the species yield can be obtained.

Procedure to be followed in taking creel census from March 15 to June 24 inclusive.

1. Under the heading Residence of the angler record the county instead of the city as specified if the angler is a resident of Michigan. If out-of-state angler record the state of residence.
2. Ignore the columns headed average length and undersize.
3. All creel census slips should be marked with either C or P in the upper right hand corner. C is recorded if the angler was interviewed at the end of his fishing trip and a P if the fisherman continued angling after you contacted him.

4. Be sure to enter complete information in spaces provided. Reports are of little value if incomplete. A creel census slip is to be filled out for each individual or party interviewed, whether or not fish are caught.

5. The "time fished chart" at the bottom of the slip is to be filled out according to the directions found there.

6. The following technique is suggested as a method of calculating total fishing effort per day, when the fishing intensity becomes too great to allow a complete census on all fishermen. Periodic counts of boats and fishermen angling from shore, docks, or wading should be taken say at 8:00 a.m., 10:00 a.m., 2:00 p.m., 6:00 p.m. and 8:00 p.m. Figure a fishing day in hours starting in the morning when about half of the boat intensity has been reached, and extending to that time in the evening when about half of your boat intensity has left the lake—say from 7 a.m. to 8 p.m. (in May)—and omit an hour or more for noon if most fishermen leave the lake at noon and if you make no boat count at noon. You would then have a fishing day of about 11 hours. If your five boat counts average 40 boats (sum of the five boat counts divided by five), you would have a total of 440 boat hours (number of hours in the fishing day multiplied by the average number of boats) for your total fishing intensity for the day. If by a separate random sampling of fishermen whose fishing has been completed, you found the average was 4 hours per boat per day, then you have had $\frac{440}{4} = 110$ boat hours that day. From random sampling you will have a figure for average number of fishermen per boat, and this figure times the 110 boat hours per day would give you a figure on fisherman-hours for that day.

On certain lakes a count of fishermen not using boats is necessary with the boat count. Of course these fishermen must be sampled to

determine the average length of fishing day and composition of catch. Keep these records separate because the fishing effort of shore and boat fishermen will be worked out separately.

7. A weekly summary sheet for the previous week's fishing should be mailed to the Institute for Fisheries Research, University Museums Annex, Ann Arbor, Michigan no later than Wednesday. The weekly summary is to be filled out by using the data obtained from contacting the fishermen. Under the heading "number of anglers" the number of fishermen interviewed is to be recorded. On the back side of the weekly summary sheet you are asked to record or give an estimate of the percentage of the total fishermen which you contacted each day. For example, if you contacted 25 fishermen and you feel that there were 100 fishermen, your estimate would be 25 per cent for the day. A copy of the weekly summary is to be kept on hand at the checking station for reference. The filled creel census books will be collected when one of the men from the office is in your vicinity.

8. Anglers not catching bluegills or sunfish are not required to be checked at the station. Therefore, the clerk will spend about fifteen hours a week on the lake checking fishermen and collecting creel census data. The problem is to get a random (and partial) census on the fishing which can be used in conjunction with your boat counts to compute the total fishing and its results. The bulk of the time on the lake obtaining creel census records should be spent on Friday, Saturday, and Sunday or the days with the heaviest fishing intensity. As large a proportion or random sample as possible of C fishermen should be taken. Following is a suggested tentative schedule (must be considered

flexible, depending on the weather and other factors) for a random (and partial) census of the total fishing:

Sat.	Mar. 16	5 hrs. (3 to 8 p.m.)	Wed.	Apr. 17	4 hrs.
Wed.	Mar. 20	4 hrs.	Sat.	Apr. 20	5 hrs. (3 to 8 p.m.)
Fri.	Mar. 22	5 hrs. (3 to 8 p.m.)	Sun.	Apr. 21	6 hrs. (8 to 2 p.m.)
Sun.	Mar. 24	6 hrs. (8 to 2 p.m.)	Tues.	Apr. 23	4 hrs.
Tues.	Mar. 26	4 hrs.	Fri.	Apr. 26	5 hrs. (3 to 8 p.m.)
Sat.	Mar. 30	5 hrs. (8 to 1 p.m.)	Sat.	Apr. 27	6 hrs. (8 to 2 p.m.)
Sun.	Mar. 31	6 hrs. (2 to 8 p.m.)	Mon.	Apr. 29	4 hrs.
Wed.	Apr. 3	4 hrs.	Fri.	May 3	5 hrs. (3 to 8 p.m.)
Fri.	Apr. 5	5 hrs. (8 to 12 m.)	Sun.	May 5	6 hrs. (8 to 2 p.m.)
Sat.	Apr. 6	6 hrs. (2 to 8 p.m.)	Wed.	May 8	4 hrs.
Thurs.	Apr. 11	4 hrs.	Sat.	May 11	5 hrs. (8 to 1 p.m.)
Fri.	Apr. 12	5 hrs. (8 to 1 p.m.)	Sun.	May 12	6 hrs. (2 to 8 p.m.)
Sun.	Apr. 14	6 hrs. (2 to 8 p.m.)	Tues.	May 14	4 hrs.

The time under items 6 and the schedule under item 8 are suggestions, perhaps a more workable method of obtaining a random sample may be worked out on your lake.

Procedure to be followed in taking creel census from March 15 to June 24 inclusive if the angler catches and keeps sunfish or bluegills.

1. The clerk shall make a duplicate copy of the creel census record. Separate slips shall be issued to each angler. In the case of husband and wife or father and child a single slip will suffice. The carbon copy is given to the angler.

2. On the second line marked Name of Lake or Stream draw a line through of Lake or Stream and use the dotted line to the right for the angler's name.

Procedure to be followed in taking creel census from March 15 to June 24 inclusive if the angler catches only fishes not subject to closed season laws (perch, suckers, rock bass, crappie, bullheads, warmouth bass, etc.)

1. The clerk does not have to make a duplicate copy of the creel census record to be given to the angler.

SUGGESTIONS FOR CREEL CENSUS ON
CRAIG, DUCK, FINE, LOBDELL, PONTIAC, AND WHITMORE LAKES

by

K. G. Fukano

The purpose of the creel census on these lakes is to determine the fish yield. The clerk will make spot checks on the lake which will give the composition of the catch; and the clerk will make periodic counts of boats and fishermen angling from shore, docks or wading to compute the total fishing. By manipulating the above-mentioned data, it is expected that the total fish yield can be calculated with a fair degree of accuracy. Procedure to be followed in taking creel census.

1. Under the heading Residence of the angler, record the county instead of the city as specified if the angler is a resident of Michigan. If the angler is from out-of-state record the state of residence.

2. Ignore the columns Average Length and Undersize.

3. All creel census slips should be marked with either C or P in the upper right hand corner. C is recorded if the angler was interviewed at the end of his fishing trip and a P if the fisherman continued angling after you contacted him.

4. Be sure to enter complete information in spaces provided. Reports are of little value if incomplete. A creel census slip is to be filled out for each party or individual interviewed, whether or not fish are caught.

5. The "time fished chart" at the bottom of the slip, is to be filled out according to the directions found there.

6. The following technique is suggested as a method of calculating total fishing effort per day. Periodic counts of boat and fishermen

angling from shore, docks, or wading should be taken (say at 8:00 a.m., 10:00 a.m., 2:00 p.m., 6:00 p.m., and 8:00 p.m.). Figure a fishing day in hours, starting in morning when about half of the intensity has been reached, and extending to the time in the evening when about half of the boat intensity has left the lake -- say from 7 a.m. to 8 p.m. (in May) -- and omit an hour or so for noon if most fishermen leave the lake at noon and if you make no boat count at noon. You would then have a fishing day of about 11 hours. If your five boat counts average 40 boats (sum of the five boat counts divided by five), you would have a total of 440 boat hours (number of hours in the fishing day multiplied by the average number of boats) for your total fishing intensity for the day.

If by a separate random sampling of fishermen whose fishing has been completed, you found the average was 4 hours per boat per day, then you have had $\frac{440}{4} = 110$ boat hours that day. From your data on average number of fishermen per boat, you can then compute the total fishermen per day.

On certain lakes a count of fishermen not using boats is necessary along with the boat counts. Of course these fishermen must be sampled to determine the average length of fishing day and composition of catch. Keep these records separate because the fishing effort of shore and boat fishermen will be worked out separately.

7. A weekly summary sheet should be mailed to the Institute for Fisheries Research, University Museums Annex, Ann Arbor, Michigan, when time permits. This summary should give the records for fishermen actually contacted; records, including date and time, of all boat counts made; and your calculation or actual counts of the number of boat-trips on the lake for those days when counts were made. A copy of the summary is to be kept on hand by the creel census clerk. The creel census slips will be collected when one of the men from the office is in your vicinity.