[ca 1950s]

# A TEST OF THE SOLUNAR TABLES

Harold J. Elser
Maryland Department of Research and Education
Solomons, Maryland

## Abstract

A study was made to determine whether the anglers fishing during solunar periods were more successful than those fishing between solunar periods. The raw data consisted of boat-rental ticket stubs on which the anglers of Loch Raven, Baltimore County, Maryland, were requested to enter their catches and on which were stamped the hours during which they used the boat. Stubs showing 2 and 1/2 through 4 and 1/2 hours fishing time were used for the study, but these only when the times stamped totally encompassed a solunar period or were entirely between two periods. The data, representing 1538 fishing trips were divided into classes according to anglers fishing during:

(1) a "major" solunar period, lasting about two hours;
(2) a "minor" solunar period, lasting about one and a half hours; and
(3) the interval between solunar periods.

The anglers of the first group spent 51 percent of their time during a "major" period, the second group spent 40 percent during a "minor" period, and the third group 0 percent during a solunar period. It was reasoned that, if fishing were significantly better during solunar periods than during the intervals between periods, the average solunar period angler would catch an appreciably greater number of fish per unit of effort than the average inter-solunar period angler.

The test showed that fishing in general was not demonstrably better during solunar periods. Crappies and bass seemed to be taken less readily and sunfish, yellow perch, and carp more readily during solunar periods. Apparently the catchability of catfish was not affected one way or the other.

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## Introduction

The Solunar Theory, which says that the activity of fish and game is affected by the position of the sun and moon, was first propounded in 1935 by John Alden Knight, an outdoor writer (see Knight, 1935a). Disclaiming credit for the original observations which gave rise to the theory, he stated only that he had improved upon and formulated a theory that had long been held by market hunters and some tribes of American Indians (Knight, 1950). He told of being introduced to the crude hypothesis by a fishing guide at Lake Helenblazes, Florida, about 1926, but found that, in its original form it would not hold outside Florida, and he was forced to make modifications to fit his new observations. Once having arrived at the "correct" explanation, he spent four years testing before publishing his theory. Unfortunately, Knight (1935a) did not present the data upon which he based his conclusions.

The theory evoked widespread interest, according to its author, and 1000 booklets giving the best fishing times (the Solunar Tables) were printed to satisfy the demand of

curious sportsmen (Knight, 1952). The demand increased until, to quote Knight (1950), "Today, instead of there being only a few thousand readers of the SOLUNAR TABLES, the schedules of Solunar Periods are read literally by the millions. Foreign editions are published in Canada, France, Germany, England, Denmark and South Africa. The novelty of 1935 is now a fixture." The Solunar Tables also, as of October 1, 1952, appeared as a syndicated feature in 91 American and Canadian newspapers.

There have been other attempts to commercialise the prognostication of fishing conditions. Most notable of these is the "Coble's Fisherman's Calendar" (Coble, 1952), which shows, by means of fish symbols, whether fishing will be good, bad, or indifferent on any day of the year. In addition, it indicates the time of day, to the nearest minute, when that day's fishing will be the best. Its prophesies are based on the phases of the moon (Lincoln, 1951) and would seem to be similar, fundamentally, to Knight's theory. A careful comparison, however, shows that they do not agree exactly on the best periods for fishing, Coble's best times occurring from 1:15 to 2 hours after the beginning of one of Knight's major periods. Coble's calendar is widely used for advertising purposes (Galleghar & Burton 1952), but there are at least two other systems used on advertising calendars (Distributors Advertising Promotions, 1953) (Cortland Line Co., 1953) which do not agree with each other or with Coble. Unfortunately, no information is available on the theories behind these latter systems, but probably they do not differ radically from that of the former. One other indicator of fishing conditions is worth mentioning. A fishing tackle company, as an advertisement, and it is hoped, with tongue in cheek, presents a small blotter on which is printed a fish with an eye that changes color with changes in humidity (Enterprise Mfg. Co., 1952). When the eye is blue, fishing is supposed to be good; when it is red, fishing is poor.

Apparently there has been no critical examination of any of these prediction systems, but in recent years there has been some testing of certain widely held beliefs about fishing and the movements and feeding of fish. One of these studies was carried on in Illinois by Dr. David H. Thompson, about 1946 (correspondence from Dr. George W. Bennett, Urbana, Ill.). Thompson, using the records of a private fishing club and the records of nearby weather stations for a twelve-year period, could find no correlation between the quality of fishing and the behavior of the barometer. Apparently, he did not publish the results of his study.

Parsons and Sieh (1950) working with gill nets in Cedar Lake, Iowa, found that "No correlation could be detected between the periods of activity of the fish and barometric changes, wind, sky cover, or solunar periods.", although they did find that walleyes, Stizostedion v. vitreum, and yellow bass, Morone interrupta, were more active at dawn and dusk than at other times of the day.

E. L. Cooper (1953) reports that a study of fishing on the Pigeon River in Michigan showed that trout were as easy to catch when the barometer was falling as when it was rising. Phases of the moon had no effect on fishing but there was a correlation between water temperature and the rate at which anglers caught trout.

Courtemanche (1953), using hoop nets, gill nets and wire traps in Lake Lauzon, Quebec, found that "White Suckers entered nets and traps much more freely when the moon was full, but showed no effect one way or the other as the barometer changed."

The test reported here was engendered by an excellent opportunity to examine virtually complete anglers-catch records from a Maryland reservoir. These records

were gathered for the purpose of ascertaining total harvest of fish and the use of them for testing the Solunar Tables was of a secondary nature.

## The Solunar Theory

The Solunar Theory, as explained by Knight (1935b) is, "Other conditions not being unfavorable, fresh-water fish tend to feed more readily during 'solunar periods' than at other times. The solunar period for any spot is the period, usually lasting about two hours, when the pull of the sun and the moon, as exerted at that point, would create either high or low tide, if that point were, in fact, on a seacoast." In other words, fish bite best on the turn of the tide, even where no tide is discernible.

Fish are allegedly able to determine solunar periods by perceiving slight variations in buoyancy. Again quoting Knight (1935b), "A short time ago a mining engineer told me that the bulk of the cave-ins of mine shafts and tunnels have been coincidental with solunar periods. It is not unreasonable therefore to assume that a fish, suspended as he is in the water in perfect balance between the pull of gravity and the push of buoyancy or water displacement, should be able to feel this pull without any difficulty. It is his constant job, if he wishes to maintain this state of balance, to inflate or deflate the air sac which lies along his backbone in order to compensate for the continual variations in atmospheric pressure. It must require a certain amount of correction also to meet the altering intensity of tidal or solunar conditions four times each day. Thus he is able to determine the solunar periods which are also his feeding periods."

Solunar periods are of two kinds, labeled "major" and "minor", corresponding to low tide and high tide, respectively. The major periods last about two hours while minor periods "last from an hour and a half to forty-five minutes" (Knight, 1953). Because of rotation, these periods sweep around the earth in an east-west direction at the rate of one circuit in twenty four hours and fifty minutes. Thus at any one place the solunar periods appear about fifty minutes later each day. Figure 1 shows the progression of solunar periods for the area under test for the first ten days of June 1952, together with the interval of time between any two periods.

## Method of testing

Insofar as can be determined, no test of this theory directly on angling has been reported in fishery biology literature. This is perhaps because of the difficulty of setting up a bias-free experiment. The most obvious method of testing is to keep records of one's own fishing success, listing the exact time at which each fish was taken, but such a test would be subject to the criticism that one's fishing ability might vary according to his convictions concerning the Solunar Theory. Such objections would be valid in any case where the data taker was aware of the reason for keeping records. A further difficulty of such method would be the gathering of sufficient data to cancel fluctuations due to randomness and to such factors as weather and diurnal fish activity.

A valid test then, would have to obey the following rules: (1) The angler must be unaware of the reason for reporting his catch; (2) there must be enough fishing hours recorded to give statistically significant results; and (3) the test must run over a period long enough to cancel out effects of weather, diurnal activity, temperature changes and all the other factors which conceivably might have some influence on the rate at which fish take the hook.

The raw data for the present test consisted of the catch records of 1538 fishing trips on Loch Raven, Baltimore County, Maryland (see Table 1), during the 184-day fishing season of 1952. This amount of data is felt to be adequate and the period covered long enough for a fair test. Bias was forestalled by the simple expedient of not informing anyone of the experiment until all the data had been collected. In fact, it did not occur to the author to conduct the test until about half way through the fishing season and much of the data had already been turned in. After that time no one connected with the gathering of the records was informed of the decision to test the theory. If there is any weakness in the data it is the fact that errors in the original records were not completely controlled, but as any error had an equal chance of falling in favor of or against the theory, it would not mar the statistical significance of the results.

Table I
Descriptive data of Loch Raven, Baltimore County, Maryland

| | |
|---|---|
| Location | about 10 miles north of downtown Baltimore |
| Area | 2500 acres |
| Maximum depth | 69 feet |
| Average depth | approx. 40 feet |
| Total alkalinity | 12 ppm |
| pH | 7.0 |
| Thermocline | poorly developed, at about 30 feet |
| Oxygen below thermocline | 4 ppm to 0 ppm at bottom |
| Water level | fluctuates irregularly according to rainfall |
| Average draw-down | less than 2 feet |
| Maximum draw-down recorded | in 1930 6½ feet |
| Type of lake | water-supply reservoir |
| Age | dam built in 1923 |
| Fish reported taken on 10,136 fishing trips in 1952 | |
| 765 Smallmouth Bass* | |
| 189 Largemouth Bass | |
| 36,421 Crappies (both White and Black) | |
| 3,009 Sunfish (Bluegill, Pumkinseed, Yellowbelly and Green) | |
| 413 Yellow Perch | |
| 1 Walleye | |
| 1,129 Catfish (Brown Bullhead and White Catfish) | |
| 6 White Suckers | |
| 564 Carp | |
| 33 Eels | |
| Number of fish harvested per acre | 17.0 |
| Pounds of fish harvested per acre | 4.6 |
| Total hours fished | 55,859 |
| Average hours fished per angler | 5.8 |
| Number of fish harvested per man-hour of angling | 0.76 |
| Number of fish harvested per fishing trip | 4.0 |
| Portion of unsuccessful fishing trips | 48% |
| Pertinent angling regulations: | |
| Fishing season in 1952 | May 3 to Nov. 2 |
| Bass season | opened June 1 |
| Legal lengths, black bass | 10 inches |
| Creel limits, black bass | 10 per day |

* Nomenclature follows American Fisheries Society recommendations

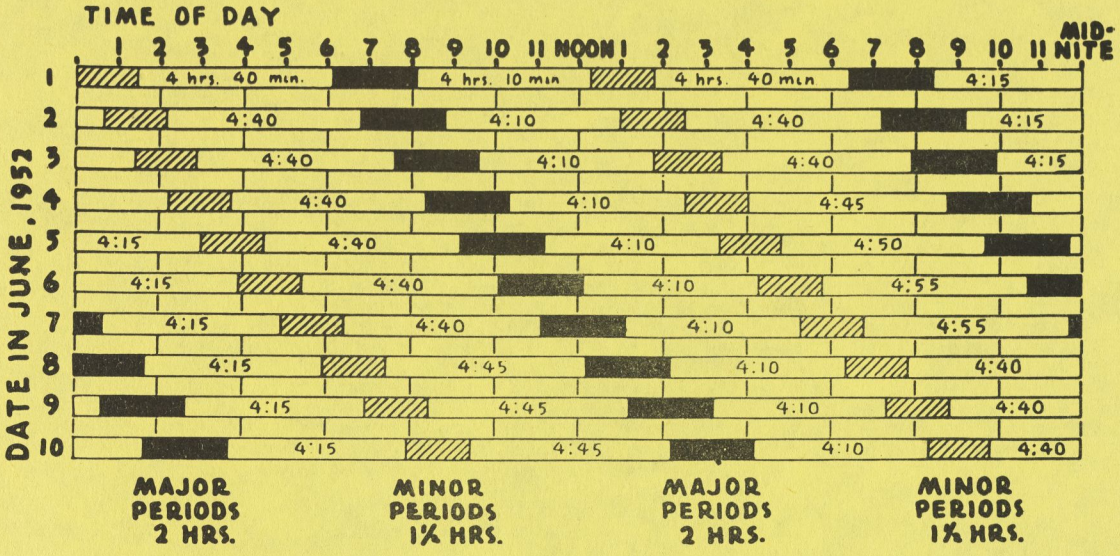
Since fishing was first allowed on Loch Raven it has been under the control of the League of Maryland Sportsmen, a federation of rod-and-gun clubs. The League maintains one boat livery with a supply of 75 boats; in addition, provision is made for the

beaching of privately-owned boats. As fishing is not permitted from banks or bridges and there are no cottages on the lake, all fishermen must pass through the boat livery area. It is estimated that 95 percent of the total fishing is done by people who rent boats, and it is from this group that the data for this study has been drawn.

All boat renters were given a ticket stub, as a receipt for their boat deposit, to which was attached a form for recording their catch. The front of the form contained blanks on which to enter the number and kind of fish taken and the number and kind of fish taken but returned to the water. The boat renters were also expected to record the number of anglers in the boat, their place of residence and the lengths of all bass caught. Stamped on the back of the form was the time at which they checked out the boat and the time at which they returned it; the stamping being done by the boat livery operators, using a hand-set circular time stamp. The form, with a typical entry, is reproduced in Figure 2. Very few of the anglers (about 0.15%) failed to return their forms. The portion of anglers failing to fill them out, or doing it incorrectly was much larger, but the livery attendants checked each form as it was turned in and were able to rectify most errors and omissions.

The ticket stubs were divided into three groups, designated "major period", "minor period" and "blank period": the first of these was composed of those forms on which the stamping indicated that their boats had been checked out for a time which entirely encompassed a major solunar period; the second group which covered a minor period; and a third which was entirely within the interval between two periods. The name "blank period" was adopted because it is less cumbersome than the more appropriate term "interval between solunar periods". Because the greatest length of time that a boat containing blank period fishermen could be rented (under the conditions imposed) was 4 hours and 55 minutes (figure 1), and allowing ten minutes for checking out and getting to its fishing site and another ten minutes for returning, the maximum angling time for a blank period fisherman was considered to be 4 hours and 35 minutes. Therefore, in order to make valid comparisons, all records from boats regarded as fishing more than this time were discarded. At the lower end of the scale, all records from boats rented less than 2 and 1/2 hours were discarded because that was the minimum time for which an angler could check out a boat and fish entirely over a major period (again allowing ten minutes for coming and going). All assumed fishing times were then rounded-off to the nearest half hour. This selection reduced the data to records from 2 and 1/2 through 4 and 1/2 hour anglers, about 15 percent of its original volume.

To illustrate the method of data selection, figures 2, 3 and 4 are presented. The form shown in figure 2, which is a photograph of an actual ticket-stub form, was interpreted in this manner; the boat was checked out about 8:20 a.m. and fishing was considered to have begun about 8:30 a.m. It was checked in again at 11:45 a.m. so fishing stopped at about 11:35 a.m. The first solunar period that day began at 6:35 a.m. and lasted until 8:05 a.m. (a minor period) while the next period did not start until 12:55 p.m. Therefore the boat contained blank period fishermen. Figure 3 is a reproduction (slightly modified) of the forms used in the primary study for the determination of fishing pressure patterns, and on which the fishing period of each party of anglers is represented by a horizontal line. The solunar periods for the daylight hours have been shaded in for illustrative purposes. The records represented by lines number 10, 13, 15, 20, 21 and 22, while of the appropriate length, had to be discarded because they start or stop within a solunar period. Figure 4 shows the relation of the solunar-test sample to the Loch Raven data as a whole.

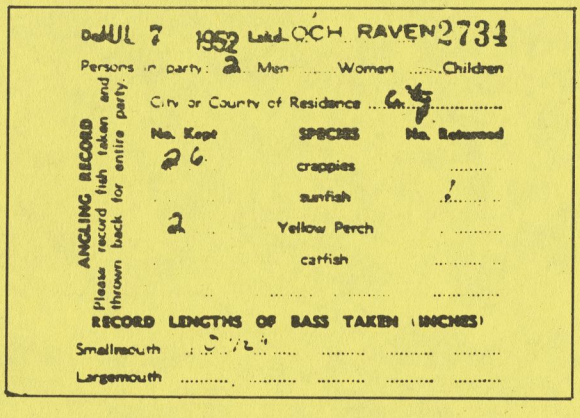



POSITION AND DURATION OF SOLUNAR PERIODS WITH TIMES BETWEEN, FIRST TEN DAYS OF JUNE, 1952

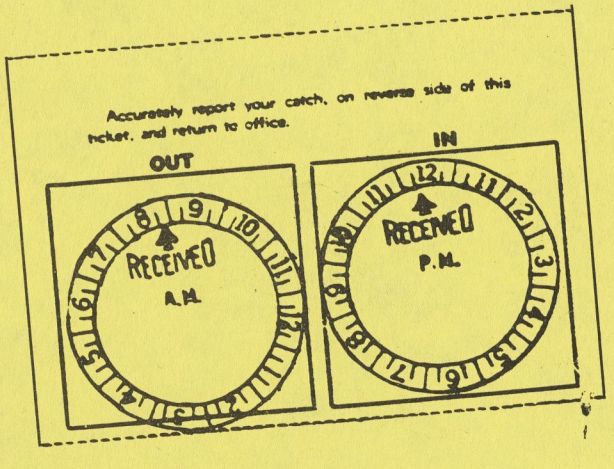
DATA FROM JOHN ALDEN KNIGHT "THE SOLUNAR TABLES" 18th ED.

FIGURE 1

Front

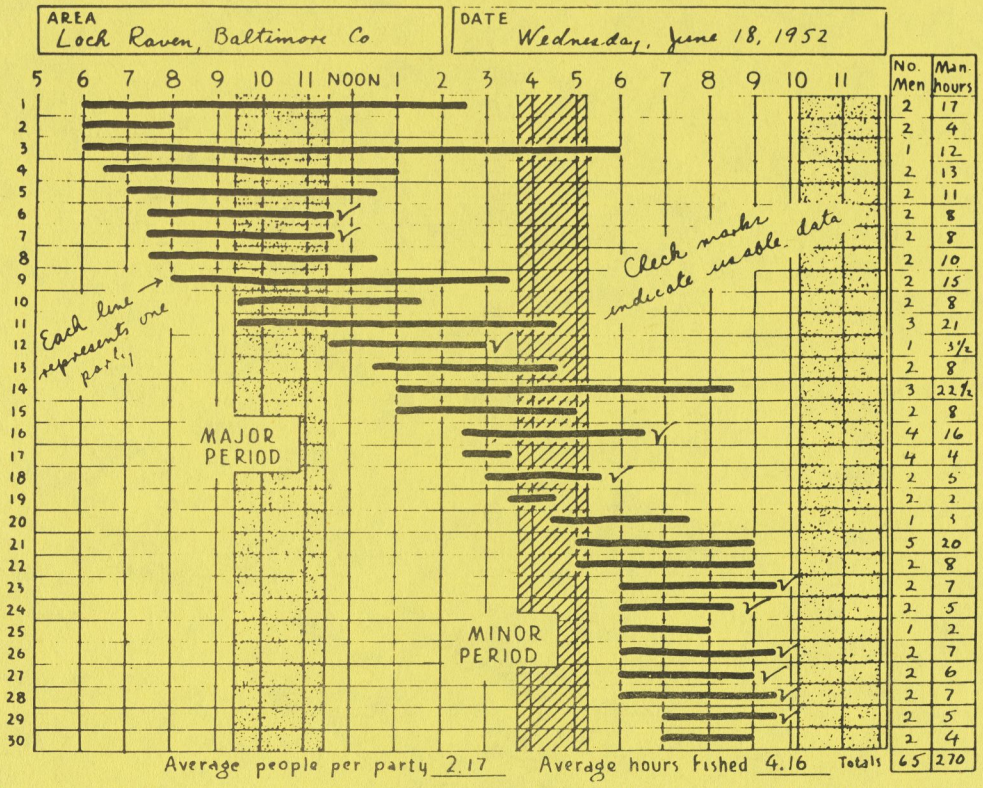



Back



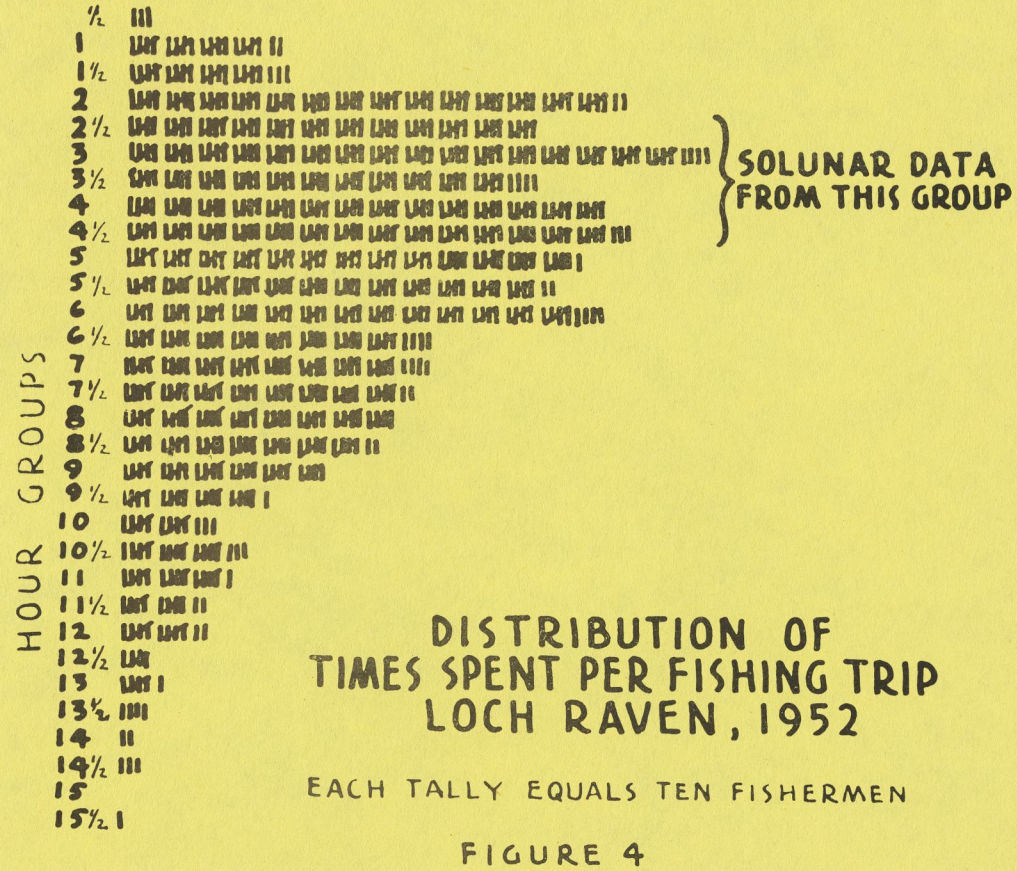

Example of the ticket stubs used as raw data for test of Solunar Tables

FIGURE 2




**ANALYSIS FORM, MODIFIED, SHOWING METHOD OF SAMPLE SELECTION**

FIGURE 3




## DISTRIBUTION OF TIMES SPENT PER FISHING TRIP LOCH RAVEN, 1952

EACH TALLY EQUALS TEN FISHERMEN

FIGURE 4

The selected data was analysed by period-groups, by length-of-time groups and by months in the same manner as was the data from the primary study. It was tested in every way available to locate possible bias for or against the Solunar Theory. The opportunity for such testing was very limited, but there was little to indicate relevant bias in the solunar sample. For instance, the portion of total fishing effort expended in each month of the season for the solunar-test sample was quite similar to that of all the Loch Raven data, thus:

| | Solunar sample | All Loch Raven anglers |
|---|---|---|
| 4 weeks in May | 20.4% | 18.8% |
| 4 weeks in June | 28.0 | 26.9 |
| 5 weeks in July | 25.9 | 23.5 |
| 4 weeks in August | 12.3 | 12.6 |
| 5 weeks in September | 10.3 | 13.4 |
| 4 weeks in October | 3.1 | 4.9 |

The solunar sample percentages were a little larger early in the season and a little smaller after August, because of the greater proportion of short time fishermen early in the season.

To ascertain whether there was a reasonable distribution of anglers over the various subdivisions of the solunar sample, the expected number of anglers in each category was calculated. This was accomplished with the following procedure:

(a) The number of possible intervals (by half-hour steps) in a 24-hour day in which a fisherman of each hour-period category could fish was counted, and their ratios within each hour-grouping were established. Example - On June 1, there were two possible times at which a 2½-hour major-period angler could start his fishing trip; 6:00 a.m. and 6:00 p.m. (see Figure 1). Minor-period anglers fishing for 2½ hours had 4 possible starting times, 11:00 and 11:30 the night before, 11:30 a.m. and 12 noon. Blank-period 2½-hour anglers had 16 possible positions, starting at 1:30, 2:00, 2:30, 3:00, 3:30, 8:30, 9:00, and 9:30 a.m. and 2:00, 2:30, 3:00, 3:30, 8:30, 9:00, 9:30 and 10:00 p.m. The ratios of possible positions in the 2½-hour-group, then, was 2:4:16 (major 2: minor 4: blank 16).

(b) On the basis of 1538 fishermen (the solunar sample) the expected number of anglers in each hour-group was calculated, using the ratios of hour-groups within the Loch Raven angling population (as indicated by figure 4). Example - For Loch Raven, the 2½-hour group contained 19.4 percent of the fishermen in the 2½ through 4½-hour groups. This percent (19.4) of 1538 anglers is 266, the expected size of the 2½-hour group.

(c) The expected number of anglers in each hour-group was divided according to the ratios found by step (a). Example - The 266 expected anglers of the 2½-hour group, when portioned by the ratio 2:4:16 becomes 24:48:194, after rounding off.

The expected number of fishermen in each hour-period category together with the observed number is as follows:

| Hour Group | Major period Expected | Observed | Minor period Expected | Observed | Blank period Expected | Observed | Totals Expected | Observed |
|---|---|---|---|---|---|---|---|---|
| 2½ | 24 | 26 | 48 | 41 | 194 | 180 | 266 | 247 |
| 3 | 68 | 50 | 102 | 101 | 204 | 202 | 374 | 353 |
| 3½ | 72 | 53 | 96 | 121 | 96 | 110 | 264 | 284 |
| 4 | 113 | 111 | 141 | 116 | 56 | 71 | 310 | 298 |
| 4½ | 135 | 176 | 162 | 146 | 27 | 34 | 324 | 356 |
| Totals | 412 | 416 | 549 | 525 | 577 | 597 | 1538 | 1538 |

With the exception of the 4 and 1/2 hour major period category, the differences between expected and observed are not statistically significant (99% level), which indicates there was no marked preference on the part of the Loch Raven fishermen to fish according to the Solunar Tables. The significant discrepancy in the one category is perhaps due to sampling variations and probably is not important.

The type of fishermen, as far as the data allows comparison, shows, again with an exception, no essential difference between solunar groups and the Loch Raven fishermen as a whole, thus:

| | Major Period | Minor Period | Blank Period | Loch Raven |
|---|---|---|---|---|
| Men | 76.7% | 78.3% | 73.4% | 78.0% |
| Women | 10.3 | 9.7 | 9.9 | 11.0 |
| Children (under 15) | 13.0 | 12.0 | 16.7 | 11.0 |

The difference between the percent of children fishing during the blank periods and the percent that would be expected if the blank period sample were chosen at random from the Loch Raven fishermen is explained in this manner: parties with children tend to fish a shorter average time than those without, and as the solunar sample was chosen from the shorter-time fishermen, a high proportion of children is to be expected. Among the three solunar-period groups, the blank period contains the most anglers in the lower hour-groups (see preceding table).

The solunar-sample fishermen came from the same places as did the Loch Raven fishermen, and in roughly the same proportions:

| | Major Period | Minor Period | Blank Period | Loch Raven |
|---|---|---|---|---|
| Baltimore City | 67.7% | 67.9% | 58.2% | 62.2% |
| Baltimore County | 29.4 | 29.9 | 38.6 | 32.8 |
| Other Maryland | 1.3 | 1.7 | 1.9 | 2.3 |
| Pennsylvania | 1.1 | 0.4 | 0.6 | 1.3 |
| Other out-of-state | 0.5 | - | 0.7 | 0.4 |

The residence proportions of the blank period fishermen are significantly different from the others, but this fact does not seem relevant to the test.

## Results

The 1538 fishermen of the solunar-test sample fished for a total of 5464 hours; an average of 3.56 hours. Broken down by period groups:

416 major period anglers fished 1636 hours, 50.9% (832 hours) during a solunar period.
525 minor period anglers fished 1950 hours, 40.4% (788 hours) during a solunar period.
597 blank period anglers fished 1878 hours, 0.0% ( 0 hours) during a solunar period.

The number of fish taken (all species), as reported by the anglers of each hour-period category was:

| Hour group | Major Period | Minor Period | Blank Period | Hour-group totals |
|---|---|---|---|---|
| 2½ | 1 | 14 | 442 | 457 |
| 3 | 190 | 168 | 278 | 636 |
| 3½ | 153 | 193 | 185 | 531 |
| 4 | 308 | 494 | 131 | 933 |
| 4½ | 287 | 264 | 71 | 622 |
| Period totals | 939 | 1133 | 1107 | 3179 |

There was a widely variable number of fishermen from one hour-group to another and from one period-group to another, and in order to make the catch figures validly comparable, they must be reduced to a common denominator. The obvious denominator is, of course, fish taken per man-hour of angling. This is the key of the test -- the key which determines whether the Solunar Tables were able to indicate the best fishing times on Loch Raven in 1952.

The following table lists the number of fish harvested per man-hour of angling, by hour-groups and by solunar-period groups, from Loch Raven during the fishing season of 1952:

| Hour-group | Major Period | Minor Period | Blank Period | Hour-group averages |
|---|---|---|---|---|
| 2½ | 0.02 | 0.14 | 0.98 | 0.74 |
| 3 | 1.27 | 0.55 | 0.46 | 0.60 |
| 3½ | 0.82 | 0.28 | 0.48 | 0.53 |
| 4 | 0.69 | 1.07 | 0.46 | 0.78 |
| 4½ | 0.36 | 0.40 | 0.46 | 0.39 |
| Period averages | 0.57 | 0.58 | 0.59 | 0.58 |

Confidence limits for the various entries in the preceding table were not calculated because of the peculiar nature of the curve formed by the frequency distribution of anglers in fish-per-man-hour classes. The curve resembles a hyperbola in which a few extreme values may materially affect the mean. Means of small samples from such a curve would normally show a much wider variation than comparable samples from normal or Poisson distributions.

Another measure of the "goodness" of fishing is the ratio of successful fishermen to the whole, defining a successful fisherman as one who catches at least one fish. In general, this is not as good a reflection of fishing conditions as is fish-per-man-hour, because a catch of one fish carries the same weight as a catch of a hundred. Never-

theless, it is a measure of the recreational value of a body of water so it has considerable value in some situations. In this case it indicates that major-period fishermen were, on the average more successful than the blank period fishermen. In the table that follows, the percent of successful fishermen for each hour-period category is listed:

| Hour group | Major Period | Minor Period | Blank Period | Hour-group averages |
|---|---|---|---|---|
| 2½ | 3.8% | 21.9% | 30.6% | 26.3% |
| 3 | 48.0 | 36.6 | 30.9 | 34.9 |
| 3½ | 34.0 | 34.7 | 38.2 | 35.9 |
| 4 | 45.1 | 40.5 | 40.8 | 42.3 |
| 4½ | 46.0 | 41.1 | 44.2 | 43.8 |
| Period averages | 41.8% | 37.2% | 34.1% | 37.2% |

There are only about 1.3 chances out of a hundred that the difference between the major-period and the minor-period averages is a chance difference due to sampling (the formula for calculating such probabilities is given in Arkin and Colton, 1939). The probability that the difference between the major and the minor period averages is a chance variation is about 0.147, or, 14.7 chances out of a hundred, and between the minor and blank periods it is 25.0 chances.

Although it is not necessary to the test, the breakdown of fish-caught by species is of some interest. There was no way of determining the number of fishermen who were fishing for bass, or for crappies, etc., but assuming that the various types of fishing were proportionately very much alike in the three periods, some significant differences are shown in the catch between periods. The following table shows the breakdown of the catch of each period, by species:

| | Major Period | Minor Period | Blank Period | Loch Raven |
|---|---|---|---|---|
| Smallmouth Bass | 0.7% | 1.5% | 1.6% | 1.3% |
| Largemouth Bass | 0.1 | 0.5 | 0.6 | 0.3 |
| Crappies | 86.9 | 84.4 | 91.3 | 90.8 |
| Sunfish | 8.7 | 9.1 | 4.0 | 5.9 |
| Yellow Perch | 1.9 | 1.4 | 0.3 | 0.4 |
| Catfish | 1.5 | 0.9 | 1.6 | 0.8 |
| Carp | 0.2 | 1.8 | 0.5 | 0.5 |

Highly significant differences (99% level) are shown between the percentages for crappies, sunfish and yellow perch for either solunar period and the blank period, and between the carp for the minor period and the other two periods. No such significance is shown for bass or catfish.

The assumption that the types of fishing effort were proportionately alike in the three period-groups may legitimately be questioned, for the analysis shows that the blank-period group had the largest proportion of children. It may be argued that children are predominately panfish anglers, so that it is to be expected that the blank period show a higher ratio of crappies. Acting on this new assumption, and combining yellow perch, sunfish, and catfish with the crappies in a panfish grouping, and the two species of bass opposed to them in a game-fish group, the figures of the preceding table take the following form:

| | Major Period | Minor Period | Blank Period |
|---|---|---|---|
| Game-fish | 0.8% | 2.0% | 2.2% |
| Panfish | 99.0 | 96.2 | 97.3 |
| Carp | 0.2 | 1.8 | 0.5 |

The new combination of figures shows that the blank-period and the minor-period groups caught significantly more game-fish but less panfish than the major-period group. If the figures are combined into two classes, solunar-periods and blank period, we have:

| | Solunar Periods | Blank Period |
|---|---|---|
| Game-fish | 1.5% | 2.2% |
| Panfish | 97.4 | 97.3 |
| Carp | 1.1 | 0.5 |

which shows a significant difference in the catch of game-fish and carp between the two divisions but not in the panfish catch.

In the light of the above facts, it is difficult to accept the proposition that a higher proportion of children means a higher proportion of panfish in the catch. The facts would argue, rather, that either children are better fishermen than adults (which seems unlikely) or bass are easier to catch during blank periods.

Another line of reasoning which may explain why game-fish appear in greater proportions in the blank-period catch has been offered by Knight (1950), "It is not uncommon for bait fishermen, to complain that The Solunar Tables are useless and that more fish are caught between solunar periods than during the scheduled feeding times. While these criticisms are no doubt well founded, the explanation is not difficult. Fish, particularly game fish, find most of their food in the shallows. When a feeding period arrives, game fish leave the deeper water and move into the feeding grounds. Bait fishermen, who almost always make it a point to anchor their boats in fairly deep water, actually are fishing in practically barren water during the solunar periods. Only after these periods draw to a close and the fish leave the shallows to return again to their resting stations, do the bait fishermen find a market for their wares in deep water."

There was no data available to indicate the ratio of bait to bass fishermen on Loch Raven in 1952, but observations at the lake indicated that a substantial part of the fishing population was made up of bass fishermen, perhaps as much as 30 or 40 percent. Some evidence pertinent to Knight's explanation may be gleaned from an analysis of the ticket-stub forms turned in by fishermen who reported catching only bass. Assuming that these people were bass fishermen and dividing the group by periods we find that:

11 major-period anglers, fishing 45½ hours, reported 7 bass -- 0.15 per man-hour
13 minor-period anglers, fishing 50 hours, reported 9 bass -- 0.18 per man-hour
12 blank-period anglers, fishing 47 hours, reported 9 bass -- 0.19 per man-hour

This is not enough data to show significance, nor does it take into account the hours spent fishing by bass fishermen who went home empty handed. As bass fishermen at Loch Raven habitually fish "the shallows" this analysis tends to show that Knight's explanation is not valid for bass. It may be valid for crappies, but it did not hold for sunfish, perch or carp as shown by the breakdown of species caught.

To test the effect of the solunar periods on the size of bass taken, the records were analysed for average length of bass taken during solunar periods and the blank periods, with the following result (the figures in parenthesis refer to the number of bass whose lengths were reported):

| | Major period | Minor period | Blank period |
|---|---|---|---|
| Average length, all bass hooked | 8.9 in. (24) | 9.6 in. (61) | 11.0 in. (40) |
| Smallmouth | 8.9 " (23) | 9.4 " (51) | 10.9 " (31) |
| Largemouth | 10.8 " ( 1) | 10.6 " (10) | 13.4 " ( 9) |
| Average length, legal size only | 11.6 in. ( 7) | 11.9 in. (22) | 13.5 in. (24) |
| Smallmouth | 11.8 " ( 6) | 12.0 " (16) | 13.5 " (19) |
| Largemouth | 10.8 " ( 1) | 11.8 " ( 6) | 13.4 " ( 5) |

## Conclusions

The hypothesis tested in this study may be stated formally: Fish are easier to catch during solunar periods than at other times. In view of the fact that the best measure of fishing success, fish caught per man-hour, shows no essential difference between solunar periods and blank periods, we can not conclude that our hypothesis is tenable. On the other hand, we have not proved the solunar periods to have no effect at all, as it would be entirely possible for a very small but real effect to exist but be masked by statistical error in the data.

The results of the analysis for ratios of successful fishermen shows that the catch of fish was spread over more anglers during major periods than during blank periods. This does not mean that fishing was better during the major periods, because it does not take into account either the number of fish taken by the successful fishermen or the time it took to catch them.

The test seems to indicate a difference in response to the solunar periods by various species of fish. Crappies and bass seem to respond negatively, while sunfish, yellow perch and carp respond positively. Catfish are apparently not affected one way or the other.

No indication was found to support an hypothesis by Knight that fish, particularly game fish, are found in shallow water during solunar periods and are more easily caught there at those times.

## Acknowledgments

A study of this kind requires aiding and abetting. Among those who aided were Miss Sarah T. Grinnell, who did much of the preliminary analysis work, and Edwin Harvey, manager of the boat livery at Loch Raven who kept a watchful eye on the data as it was turned in. Among those who abetted were several of my colleagues, chiefly Romeo Mansueti, Rudolph Scheltema, Earl Walker and R. D. Van Deusen.

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MARYLAND DEPARTMENT OF RESEARCH AND EDUCATION Ref. No. 56-3
Chesapeake Biological Laboratory
Solomons, Maryland December 12, 1955

MEMORANDUM

To: Maryland Game and Inland Fish Commission
From: Special Technical Advisory Committee for Deep Creek Lake
Subject: Management Recommendations for Deep Creek Lake

To formulate the most desirable management program for Deep Creek Lake, a special advisory committee was assembled at the Chesapeake Biological Laboratory on the above date. This committee, composed of biologists and fish management specialists, brought together knowledge and experience gathered in Maryland, Michigan, New York, Ohio, Pennsylvania, Virginia, West Virginia and Wisconsin.

It was agreed unanimously that Deep Creek Lake's mediocre fishing was a result of an overabundance of yellow perch. It was also agreed that the lake could be managed for either cool or cold-water fishing.

RECOMMENDATIONS

Management for cool-water species (smallmouth bass, yellow perch, black crappies, walleyes, rock bass, northern pike, etc.) seems to be the most practical course of action, although cold water fishing (trout) may be possible from a biological standpoint. Warm water management (largemouth bass, bluegills, white crappies, white bass, etc.) is infeasible because the limnological characteristics of the lake are unsuitable.

A. To develop cool-water fishing, the following procedures (to be applied concurrently) are recommended. The object is to reduce substantially the population of yellow perch and white suckers. If one or more of these techniques produces a desirable effect, the remainder need not be pursued.

We recommend:

1. The planting of all of the following large predatory fish:
   (a) Northern pike (Esox lucius)
   (b) Chain pickerel (Esox niger)
   (c) Walleyes (Stizostedion vitreum)
   (d) Splake (Lake trout - brook trout hybrid)
   (e) Striped bass (Roccus saxatilis)

2. Look for spawning concentrations of yellow perch and white suckers so that they might readily be controlled by mechanical or chemical means.

3. Investigation of the possibility of temporarily drawing down the reservoir to a low level (to increase predation) and implement same if found desirable.

4. Investigation of the desirability of establishing commercial fishing operations for yellow perch and suckers and implement same if found desirable.

B. In the event that none of the preceding management techniques produces the desired results, after a satisfactory period, it is recommended that Deep Creek Lake be managed for cold water fishing. This would require:

   (a) The extermination of all fish.
   (b) Heavy stocking with trout.
   (c) Establishment of regulations designed to eliminate the introduction of undesirable fish.

C. It is recommended that further investigation be carried on in this lake in order to assess the results of the management program and to gain further insight into its ecology.

Members of Special Technical Advisory Committee on Deep Creek Lake

Chairman
Harold J. Elser, Fisheries Biologist, Solomons, Maryland

From Pennsylvania Fish Commission
Dr. Albert S. Hazzard, Assistant Executive Director
Dr. Gordon Trembley, Chief Aquatic Biologist
Arthur Bradford, Fish Pathologist

From Maryland Game and Inland Fish Commission
Edwin M. Barry, Chief, Inland Fish Management
Albert M. Powell, Supt. of Fish Hatcheries
Albert Sanderson, Fisheries Biologist
Sigurd Brantingson, Regional Fish Culturist

From Maryland Department of Research and Education
Dr. L. [illegible]. Cronin, Director
Dr. Vagn Flyger, Chief, Natural Resources Inventory
Romeo Mansueti, Fisheries Biologist
David G. Cargo, Fisheries Biologist
John R. Longwell, Game Biologist

Not in attendance, but contributing by mail
Robert G. Martin, Asst. Chief, Fish Division, Commission of Game and Inland Fisheries, Virginia
Harry Van Meter, Chief of Fish Management Division, West Virginia Game Commission

## APPENDIX

During the all-day session of the committee, a number of ideas and opinions were expressed. They form part of the background material of the above recommendations. Sorted, combined and edited, they were:

1. Deep Creek Lake is a 3,900-acre hydroelectric impoundment of cool, very soft water at an altitude of 2,462 feet in the Allegheny Mountains. At full pool, it has a maximum depth of 70 feet, an average depth of 30 feet and a shore line of 62 miles. An average annual-maximum draw-down of 14 feet occurs in November or December. A poorly defined thermocline is found at about 30 feet, below which the oxygen falls to less than four parts per million. The pH is about seven. The water is moderately clear, Secchi-disc readings of eight feet being the rule. Vegetation is sparse. The rotenoning project of September 1955 indicated a standing crop of 85 pounds of fish per acre, 70 percent of which was yellow perch.

2. Fresh water fish can be grouped according to preferred habitat-temperature, although the categories do not have mutually exclusive limits. The most widely accepted groupings are known as cold-water species and warm-water species. However, there are enough species which are transitional in character to justify the establishment of a third grouping which might be called cool-water species. The species entering the discussion, classified according to preferred habitats are:

| Cold Water | Cool Water | Warm Water |
|---|---|---|
| Trout, all species | Smallmouth bass | Largemouth bass |
| Salmon, all species | Yellow perch | Bluegills |
| Grayling | Black crappies | Pumpkinseeds |
| Burbot | Walleyes | White bass |
| | Rock bass | Chain pickerel |
| | Northern pike | Brown bullheads |
| | Muskallonge | Yellow bullheads |
| | Longnose gar | Bowfin |
| | Shortnose gar | White crappies |
| | Black bullheads | |

3. Deep Creek Lake could be managed for cold, cool or warm-water fishing. It is undesirable to attempt to manage it for more than one kind. The limnological characteristics are such that warm-water management would be difficult and probably unfruitful.

4. There is need for further information which could best be obtained by a resident fisheries biologist.

5. Managing the lake for cool-water fishing seems to offer the following advantages:
   a. It is probably the least expensive of the possibilities.
   b. It offers a wider variety of fishing than does cold-water management.
   c. It utilizes the already established popular fish -- smallmouth bass, black crappies, rock bass, yellow perch.
   d. It offers year-round fishing.
   e. It is easier to maintain a cool-water population than either cold or warm-water.
   f. It offers fishing to the widest variety of anglers: children, novices and experts.
   g. It probably provides more fish per man-hour than does trout fishing.
   h. The mixed species tend to provide more steady fishing; if one species fails to bite, there are others the angler can catch.
   i. Boating and other water sports conflict less with cool-water fishing than with trout fishing.

6. Points in favor of cold-water management:
   a. Trout utilize more fully the available food in the lake.
   b. Trout are a highly desirable anglers fish.

c. Good trout fishing is a great tourist attraction.

7. Points not in favor of cold-water management:
   a. The present fish populations would have to be completely removed.
   b. The initial cost would be about $100,000. This would include the rotenone for fish removal and its application, fish pick-up and the first planting of trout.
   c. Trout would have to be planted annually -- probable cost about $40,000.
   d. Because contamination by undesirable species could not be entirely prevented, the Lake would have to be rehabilitated probably every ten years.
   e. It is unlikely that trout would provide good fishing during the summer months.
   f. While experts may easily take trout, children and novices find difficulty catching them.
   g. Trout management, in effect, puts all eggs in one basket; if fishing for the one species deteriorates, there is no other to compensate.
   h. Experience from other places indicates that trout provide, generally, only about 0.3 fish per man-hour -- no better than Deep Creek's present average for all fish.
   i. There appears to have been inadequate reproduction of trout in Deep Creek Lake in the past.

8. The history of fishing in Deep Creek Lake indicates that warm-water fishes have been only moderately successful.

9. Under a program of cool-water management, there is a possibility that trout planting may be continued.

10. Limnological conditions in DCL are similar to those of good trout-fishing lakes in the northern states.

11. Control of yellow perch populations can result in larger and healthier perch, thus increasing their desirability.

12. The utilization of brown bullheads and white suckers should be encouraged.

13. It would be desirable to establish a winter fishery for the purpose of utilizing yellow perch.

14. Pertinent characteristics of northern pike are:
   a. They are a very voracious fish, thus a good predator.
   b. They seem to prefer yellow perch when they have a choice.
   c. Pike seem to offer the best hope of yellow perch control.
   d. There is some doubt that pike could spawn in Deep Creek Lake because of the lack of large weed beds, so planting may be necessary on an annual basis.
   e. Pike spawn late in the winter, about the time the ice leaves the lake.
   f. They can best be planted as adults, but this is very expensive.
   g. Planting of 8-day old eggs is probably practical and inexpensive.
   h. Deep Creek Lake seems good habitat for pike growth.

15. Pertinent characteristics of chain pickerel:
   a. This species is normally a warm-water species but has been known to thrive in cool-water lakes.
   b. Pickerel are excellent predators but do not grow as large as northern pike.
   c. Pickerel were planted in Deep Creek Lake in 1930 and '31 but apparently did not reproduce.
   d. Adult pickerel are immediately available for stocking at low expense.
   e. Pickerel are native to Maryland, being especially common on the coastal plain.

16. Pertinent characteristics of walleyes:
    a. Walleyes, as predators, are about the equal of bass.
    b. Best walleye habitat seems to be cool, hardwater lakes, but they have been known to live in warm and soft-water lakes and rivers.
    c. They are an excellent game fish and very good to eat.
    d. Walleye occur in Maryland in greatest abundance in the Susquehanna River. They also occur in the Potomac. Repeated attempts to establish populations in Loch Raven have apparently resulted only in a small population. They live in Triadelphia Reservoir but, again, at a low population level.

17. Pertinant characteristics of splake:
    a. A predator about as good as bass.
    b. There is not much known about its ecology, but probably it would do well in any good trout habitat.
    c. Splake are excellent game fish and very good to eat.
    d. There may be some difficulty in acquiring planting stock.

18. Pertinent characteristics of striped bass:
    a. Striped bass are excellent predators.
    b. This species grows to a very large size.
    c. Fish for planting can be obtained easily and at reasonable expense.
    d. Striped bass are native to Maryland; abundant in Chesapeake Bay.
    e. Several populations are known which thrive in fresh water.
    f. Chances of success with this species would be materially strengthened if stock from a fresh-water population were planted.
    g. Striped bass are semi-anadromous, i.e., they must migrate to spawn. There is some doubt that Deep Creek Lake tributaries would furnish suitable spawning sites.

MARYLAND DEPARTMENT OF RESEARCH AND EDUCATION
Inland Resources Division
Solomons, Maryland

May 14-16, 1956
Ref. No. 56-17

# THE ROTENONING OF HOOP POLE COVE, AN EXPERIENCE WITH PUBLIC RELATIONS

Harold J. Elser
Fisheries Biologist

## INTRODUCTION

Despite a very unfavorable public-relations situation in Garrett County, Maryland, the Department of Game and Inland Fish and the Department of Research and Education carried out a successful rotenoning project in Hoop Pole Cove, an arm of Deep Creek Lake, in September of 1955. The project was designed to study the population structure of the lake as revealed by that in the sample area. One of the side-effects was a dramatic reversal of public feeling, from condemnation to approbation, for the state's biologists and fish management men.

Because public esteem can be documented in so few ways, much of the account which follows represents the author's interpretation of events and his evaluation of the statements made by many people. Behind these opinions, however, lie about seven years of experience with Deep Creek Lake and its residents and sportsmen.*

The lake is a 3900-acre hydro-electric impoundment lying at an altitude of 2462 feet in the mountains of western Maryland. It has become an important recreational lake, drawing its visitors especially from the Pittsburgh area. Its chief attractions are its cool summers, its beautiful scenery and its favorable environment for boating. Fishing could be the lake's major enticement but it has a history of booms and depressions and its reputation has suffered accordingly. Since 1951 an annual creel census has been measuring the quantity and quality of the catch and its results reveal a continued low rate of harvest** and a decline in fishing pressures, thus:

| Year | Dates covered by survey | Fish per man-hour | Estimated number of fishing trips |
|---|---|---|---|
| 1951 | July 1 - Sept. 23 (13 weeks) | 0.2 | 18,400 |
| 1952 | June 15 - Sept. 1 (11 weeks) | 0.3 | 16,800 |
| 1953 | June 1 - Sept. 7 (14 weeks) | 0.3 | 13,300 |
| 1954 | May 30 - Sept. 6 (14 weeks) | 0.3 | 10,100 |
| 1955 | June 1 - Sept. 6 (14 weeks) | 0.4 | 13,900 |

The people most concerned with fishing in Deep Creek Lake fall rather neatly into three groups: (a) the sportsmen of western Maryland - whose interest needs no explanation; (b) the proprietors of business places on the lake - this group caters to the short-time visitor and assumes that good fishing means good business; and (c) the owners of cottages who live at the lake during the summer - about half of this group are fishermen. The chief interest of the sportsmen and

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*Various reports of studies on this lake may be obtained from the author.

**It is assumed that a rate of catch of one fish per man-hour is the minimum for satisfactory general fishing.

cottage owners is smallmouth bass and crappies; trout enthusiasts in these groups seem to be in a minority. The proprietors, on the other hand, are interested in any kind of fish that can be caught easily by the novice; they claim that people who fail to catch fish also fail to return to the lake.

## THE CLOUD

The sportsmen and proprietors became very concerned over the continued depression in fishing and demands that the State "do something" gradually became more frequent and insistent. This "something", of course, meant heavy stocking of fish---only a few of these people seemed troubled by the fact that heavy stocking in the past had not produced good fishing. By 1954 there were demands that the creel census be discontinued and its appropriation used instead for the purchase of black bass. There developed a school of thought which held that the management of the lake should be taken over by the county commissioners---it was said that they couldn't do any worse than the State had. Some officials, harassed by frequent and bitter complaints, were half ready to agree.

As a result of studies started in 1948, considerable progress was made in the understanding of the lake's ecology, but it must be admitted that there was only indirect evidence pointing to the causes of the poor fishing. It was felt, by the author and others, that a rotenoning project on a sample area was called for, but in view of the touchy public-relations situation, the matter was not suggested publicly.

Perhaps the status of public opinion can best be illustrated by relating an incident which occurred in 1954. In September of that year, the Department of Game and Inland Fish drained a 20-acre pond only five miles from Deep Creek Lake because its fishing had deteriorated to almost nothing. It was found that the pond was overpopulated with stunted white suckers so rotenone was applied to the puddle left after draining. About a dozen bass were killed by the rotenone along with hundreds of suckers. This fact was discovered by a group of local sportsmen who, apparently overemphasizing the loss of bass and ignoring the kill of suckers, took high umbrage at what they seemed to consider was wanton destruction of our natural resources. So great was their indignation that they attempted to have the man responsible removed from his job. They did not succeed in this endeavor, of course, which is to the great credit of his superiors, but the attempt highlights the poor esteem in which fish management and biology were held.

## THE SILVER LINING

Shortly after this incident came an almost invisible turning point. This seems to have been the realization by a few property owners and proprietors that they did not, after all, know what was wrong with the lake. Heretofore, everyone had been his own expert, but this handful of more enlightened men were willing to call in outside opinion. They contacted the late Dr. R. W. Eschmeyer of the Sports Fishing Institute who, in turn, sent his associate Richard H. Stroud, to the lake to examine it and give his opinion about what ought to be done. Stroud suggested that more information was needed on fish population structure and that the best way to obtain this was to rotenone a sample area of the lake. His suggestion met with immediate approval by this small key group.

The next problem was (a) to enlarge the group who would be willing to sacrifice thousands of fish for the purpose of gathering information and (b) to get the approval of certain officials who were considered to be opposed to such a project. This phase was accomplished by the key group who, with skillful effort, was able to arrange a meeting of top administrators, the leaders of various civic and sportsmen's organizations, biologists and fish management men. At this meeting it was decided, after some persuasive argumentation, to go ahead with a rotenoning project.

A rough outline of responsibilities was laid out at this meeting. The leaders of the various local organizations were to do what they could to convince their respective groups of the desirability of the project. Publicity aimed at public acceptance was to be directed, in general, by the Maryland Department of Information; the details were left up to the key group and the author. The physical part of the project was to be divided among three agencies: (a) Game and Inland Fish - which was to furnish and apply the rotenone and pick up the dead fish; (b) Research and Education - which was to be responsible for the collection, analysis and interpretation of data and the reporting of results; and (c) the local group - which was to play host and take care of details best done locally. They were also to furnish boats and motors and supply help for picking up fish, applying rotenone, etc.

The date set for the rotenoning was September 7, 1955, yet as early as December, 1954, eight months before the big day, the publicity campaign was started. It was felt that there should be plenty of time allowed for public discussion as it was anticipated that tempers would boil and should be given a chance to cool off gradually. This is virtually whathappened, except that public ire did not rise nearly as high as had been expected.

Publicity was entirely in the newspapers except for two radiocasts shortly before "R" day (rotenoning day). During the winter and spring, stories were carried at about one month intervals, but in the summer were stepped up to weekly. Emphasis was placed on the size and uniqueness of the project (exaggerated, of course) and the fact that eight different agencies would take part. This latter statement was intended to impress the public with the importance of the project. Furnishing monthly and, later, weekly stories to the newspapers did not prove to be as much of a chore as expected. There was always some new development to report; another agency had agreed to lend a hand; a continuous temperature recorder was installed; the contours of Hoop Pole Cove were studied; volunteer help should report to so-and-so; we regarded almost any activity as news.

In March of 1955 a second meeting was held* -- this time the general public was invited, but the most vocal people in attendance were those who represented the sportsmen's groups from communities not in the immediate vicinity of the lake. This turned out to be a rather tumultuous indignation meeting but it was very expertly chairmanned by the Director of the Maryland Department of Information and was adjourned with most people apparently quite satisfied with the aims of the project. Looking back at the events which preceeded the rotenoning of Hoop Pole Cove, this meeting seems to have been the crucial point.

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*This meeting, as well as the previous one, was called at the request of the Governor, indicating the importance with which the project was regarded.

If doubts had not been allayed or tempers soothed, so much clamor might have followed that abandonment of the project could have been forced. This is guesswork, of course, but with the situation as delicate as it was at the time, it is felt that a mis-step might have had unfortunate consequences.

A third meeting, in July, this time with the property owners was, by comparison with the previous meeting, a rather staid affair. The project was explained in detail; questions were asked and answered; and a number of individuals offered their services and/or use of their boats and motors.

By late July, it was evident that all organized opposition to the project had disintegrated. There still remained a few rugged individuals here and there who thought the whole thing was a lot of "damned nonsense" but the mass of opinion seemed to be one of genuine interest coupled with frank skepticism as to its successful outcome. A curious effect of this interest was first noticed by our creel-census man -- he found that, beginning about three weeks before "R" day, fishing pressure in Hoop Pole Cove increased tremendously. One of the reasons this cove had been selected as the sample area was that its fishing pressure was about average for the lake, but now it became one of the most heavily fished areas.

A final meeting, which was well publicized in the newspapers and on the radio, was held in the evening before "R" day (September 6). Everyone who would take part in the project was asked to attend. The work was explained in detail, duties were assigned to volunteers and official badges and boat-markers issued. About 150 persons attended this meeting.

The interest the project had engendered by this time is indicated by the following: (a) at the final meeting, not one voice was raised in objection to any phase of the work, and (b) three or four people stated that they had taken a one or two-day holiday from their work in order to participate. Later it was learned that at least a dozen people had done this.

## THE PROJECT

Local people were used in ways other than applying rotenone or picking up fish. A group of a half-dozen lake residents was asked to aid in determining how soon after the rotenoning Hoop Pole Cove again became fishable. These people were furnished with suitable forms and asked to fish in the Cove starting on the third day of the project. As it turned out, the Cove became fishable so quickly that only one or two anglers had time to work at it before we had the information we needed.* Another use of local people, and one which was probably good public relations, was that the Ladies Aid of the Deep Creek Baptist Church was given the concession for furnishing food for the project's workers. They served coffee and donuts at nine and four o'clock and box lunches at noon. They made about $150 for their building fund.

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*Fish were caught in the Cove even before all pockets of potent water had disappeared. The first fish, a pumpkinseed, was taken 4 days and 2 hours after the first application of rotenone.

The rotenoning project was carried out with as much showmanship as possible proscribed, of course, by the need for accurate data taking. Volunteer help had been actively solicited, but if none had been forthcoming, the work would have been but slightly hampered for volunteers were used only as supplemental help. A headquarters area on the lake shore, in a pasture where there was plenty of room, was surrounded by a wire purportedly to keep onlookers from getting underfoot. The wire was not intended to be 100 per cent effective; it was to serve only as a mild restraint. However, whenever too many people slipped into the enclosure they were politely shooed out. Fish brought in by the pick-up crews were processed in full view of everyone. Data takers worked on picnic tables arranged as close as possible to, and parallel with, the restraining wire; these workers were warned that there would be a lot of talking and disturbance but that they would have to shut it from their attention. They answered questions asked of them but did not invite further conversation.

Processing of fish followed this pattern: as fish came in from the pick-up crews they were taken to the sorting table where they were separated according to sizes (small, medium and large) and then by species. Then they were weighed in bulk at the next table. From there they were sent to the appropriate small medium or large tables.* At the end of the line was the stomach analysis table where three biologists cut open fish of all sizes and kinds and recorded their findings. This activity proved to be by far the most popular with the onlookers for the table was surrounded constantly by the curious, standing two or three deep.

A public address system was used for keeping visitors abreast of events. At intervals of 20 to 30 minutes they were told of the background of the project, of its progress, the amount of fish brought in at the latest tally, and what was going on where at the moment. A "score board" was erected and on it was recorded the latest tally of pounds of fish by species and sizes. The largest fish of each species was also posted. It was planned that this would be kept up to the minute but the best we were able to do was to change it at about hourly intervals.

Game wardens and state police, intentionally conspicuous, were on hand in case of law violation or trouble. One law enforcement boat patrolled the boundaries of the survey area to keep out unauthorized boats, while two more patrolled within the area ready to lend assistance if needed.

The weather on "R" day was ideal and hundreds of photographs were taken. The subjects commanding the most film, however, were the aqualung divers -- dressed in their green "frog suits" they were the delight of the amateur photographers. These divers were sent down to study the sunken kill. Among other things, they found that the fish lying on the bottom were no different in species or size composition from those on the surface.

Fish which had passed through the processing area were given to anyone who would carry them away. Early in the day the demand was light, probably

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*Division by size rather than by species was used because the sampling system was different for each category. Species occurring in few numbers were handled at the large table regardless of their size.

because of suspicion of their edibility, and two barrels of perch were hauled away because of flies, but when it became apparent that there was considerable competition among the volunteer workers for fish, the demand increased and after that the only unused fish were the little ones and those that had been dead too long. In this connection, it should be mentioned that, from the very beginning of the project, the words "poison" and "toxic" were very carefully avoided. We used the noun "rotenone" as a verb or an adjective, or called it a "suffocant". One newspaper referred to the project as a "smotheration program". It is believed that this careful choice of words was an important factor in the success of the project.

Two independent estimators placed the crowd who came to watch at 1200. It was not all there at one time, fortunately, but people were coming and going all day long, even after operations had ceased for the day. Cars were often parked for half a mile or more on each side of the pasture gate.

The next day, Thursday, there were not more than a hundred visitors to the area. Volunteer help for that day was not expected, but a half-dozen people appeared offering their services. On the following three days we had no visitors and no volunteer help -- work consisted only of the odiferous job of picking up fish and weighing them, which was done by State employees.

## AFTERMATH

By the end of the first day of the project it was unmistakably clear that public esteem for scientific fish management had risen far beyond our expectation. The project officials were invited out to dinner; frowns changed to smiles; greetings were cheerier; there were hundreds of little things all of which added up to vastly improved public relations. Perhaps the most striking indication of the changed situation was the fact that people contacted casually in restaurants, etc., now asked what we were going to do about the lake instead of telling us what ought to be done.

The good-will remained undiminished through the following January at which time there was a popular movement among Garrett County sportsmen to ask the legislature to give the Game and Inland Fish Commission more power to set regulations than it now enjoys. The scheme has not yet reached fruition but the significant thing is that this attitude is diametric to that of a year before when it was thought by many that the county should take over the management of the lake.

As of April, 1956, the sportsmen's feelings had cooled somewhat, due to a misunderstanding regarding the planting of some trout, but the set-back was minor and perhaps to be expected. As of this writing (May 1) scientific fish management still appears to be enjoying considerable favor in Garrett County.

Now, in retrospect, what brought about this change of heart? It is difficult to point out specific causes with assurance since they include many diverse activities of varying importance each of which necessarily requires subjective evaluation. It is certain, however, that whatever was done right in the Hoop Pole Cove project outweighed whatever might have been done wrong.

It is the opinion of the author that the following factors contributed most to the improvement of the public-relations situation:

(1) Publicity was built up gradually over a long period.

(2) The reasons for the project were very carefully explained at the various meetings and in the publicity statements.

(3) Volunteer help was earnestly requested and used. Incidentally, no monetary remuneration was offered -- nor was it asked for by anyone.

(4) The public was cordially invited to watch the proceedings.

(5) The project was conducted with as much showmanship as possible. This includes the rather dramatic demonstration that the lake was overrun with yellow perch.

(6) The word "poison" was shunned in connection with rotenone.

(7) The project was carried out with smoothness and efficiency. There was not a hitch in the entire program, there were no accidents except for an overloaded pumping boat which swamped in shallow water, and no trouble of any kind. Perhaps the most frequent compliment I heard concerned the devotion to duty exhibited by the data-takers. Many people told me they were amazed at the way these workers labored so steadily and cheerfully from dawn to dusk. The data-takers were largely my colleagues at the Chesapeake Biological Laboratory but they were aided by volunteers and by the Laboratory's summer helpers.

A question which has often been asked of the author in the months since the project is this: "If you had it to do over, what would be done differently?" The answer (thinking now only of the public relations aspect): "I would plan the project for a Saturday or Sunday instead of a mid-week day so more people could come to watch". Because much of fish management is either dull and laborious and often buried beneath masses of data, it seems prudent to take full advantage of the spectacular nature of a rotenoning project and improve the public's appreciation of the biologists' efforts.

MARYLAND DEPARTMENT OF RESEARCH AND EDUCATION
Inland Resources Division
Solomons, Maryland

Ref. No. 57-12

February 12, 1957

# CONOWINGO-SUSQUEHANNA CREEL CENSUS REPORT, ~~1957~~ 1955

Harold J. Elser
Fisheries Biologist

A creel census was conducted during the summer of 1955 in the Conowingo-Susquehanna area by the Maryland Department of Game and Inland Fish and Department of Research and Education. This is the first time that this important sports-fishery has been studied in such detail, but it is hoped that the work will continue so that the annual variations in fishing pressure and harvest may be ascertained. The accompanying tables present, without interpretation, the statistics gleaned from that project.

The census work started on June 1 and ended September 12, 1955, covering the area from the Pennsylvania line to the arbitrary tidewater line which runs from the mouth of Deer Creek to Port Deposit. For greater usefulness, the data were divided according to three zones: (1) The Conowingo Reservoir from the Pennsylvania line to the dam, (2) the catwalk below the dam plus about 0.4 miles of the river below and (3) the Susquehanna River from that point to the tidewater line. The tables give the results for each zone (Tables II, III and IV), for the entire area studied (Table V) and the estimates of fishing pressure by weeks for the three zones (Table IV).

The pertinent statistics which do not appear in the other tables are given in Table I.

## TABLE I

Pertinent Statistics From The Conowingo-Susquehanna Area Creel Census Project
June 1 to September 12, 1955

| | |
|---|---|
| Area studied (Penn. line to tidewater) ..... | 6,600 acres |
| Length ..... | 10.5 miles |
| Number of anglers interviewed ..... | 2,757 |
| Fish caught and kept per acre (all species) ..... | 30 |
| Fish caught and kept per mile (all species) ..... | 18,800 |
| Pounds of fish kept per mile ..... | 19,000 |
| Fishing trips per acre ..... | 11 |
| Fishing trips per mile ..... | 7,800 |
| Percent of fish kept of total hooked ..... | 47 % |
| Percent of fish returned to water ..... | 53 % |
| Number of census days ..... | 104 |

F—NO. 12 5-51

TABLE II

# MARYLAND
# CREEL CENSUS REPORT—Dept. of Research and Education

Dept. of Game and Inland Fish,
cooperating with

SUSQUEHANNA RIVER

Date ALL SEASON, June 1 - Sept. 12, 1950

Investigators

| Number of fish taken per man-hour | Total number of man hours fished |
|---|---|
| 0.20 | 105,000 |

On the basis of 116 anglers

65 % of anglers caught NO fish

25 % of anglers caught 37 % of total

10 % of anglers caught 63 % of total

Average number of fish kept per fisherman 0.5

Average length of time spent fishing 1.9 hours

Composition of angling population

| | | | |
|---|---|---|---|
| MEN | 17,600 | 64 % | TOTAL |
| WOMEN | 4,300 | 16 % | 27,500 |
| CHILDREN | 5,600 | 20 % | |

Relative completeness of survey:

Estimated totals based on
1 % complete survey

## RESIDENCE OF FISHERMEN

| | |
|---|---|
| Garrett Co. | % |
| Allegany Co. | % |
| Washington Co. | % |
| Frederick Co. | % |
| Carroll Co. | % |
| Baltimore Co. | % |
| Baltimore City | 33 % |
| Harford Co. | 24 % |
| Cecil Co. | 21 % |
| Howard Co. | % |
| Montgomery Co. | % |
| Ann Arundel Co. | % |
| Prince Georges Co. | % |
| Washington, D. C. | % |
| Calvert Co. | % |
| Charles Co. | % |
| St. Mary's Co. | % |
| Kent Co. | % |
| Queen Annes Co. | % |
| Talbot Co. | % |
| Caroline Co. | % |
| Dorchester Co. | % |
| Wicomico Co. | % |
| Somerset Co. | % |
| Worchester Co. | % |
| Pennsylvania | 22 % |
| Virginia | % |
| West Virginia | % |
| Delaware | % |
| | % |
| | % |

## FISH CAUGHT

| | kept | | returned |
|---|---|---|---|
| Smallmouth Black Bass | 2,700 | 12.5 % | 5,200 |
| Largemouth Black Bass | 420 | 2.0 % | 210 |
| Black Crappie | 420 | 2.0 % | 2,100 |
| White Crappie | | % | |
| Bluegill | 210 | 1.0 % | 410 |
| Pumpkinseed | | % | |
| Yellowbelly Sunfish | | % | |
| Green Sunfish | | % | |
| Sunfish, unidentified | 1,450 | 6.7 % | 1,700 |
| Rock Bass | 420 | 2.0 % | |
| Yellow Perch | 210 | 1.0 % | 1,000 |
| White Perch | 830 | 3.9 % | 2,500 |
| Walleye | 620 | 2.9 % | |
| Pickerel | | % | |
| Brook Trout | | % | |
| Brown Trout | | % | |
| Rainbow Trout | | % | |
| Brown Bullhead | | % | |
| Yellow Bullhead | | % | |
| Channel Catfish | | % | |
| White Catfish | | % | |
| Catfish, unidentified | 11,800 | 54.8 % | 29,200 |
| White Sucker | | % | |
| Carp | 510 | 1.9 % | |
| Golden Shiner Hick Shad | | % | 210 |
| Eel | 1,000 | 4.6 % | 1,800 |
| White Shad | | % | 220 |
| Striped Bass | 620 | 2.9 % | |
| Total number of fish caught | 21,530 | % | 54,000 |

F—NO. 12 6-56

TABLE III

# MARYLAND
# CREEL CENSUS REPORT—Dept. of Research and Education

Dept. of Game and Inland Fish,
cooperating with

Date [illegible] 1955 (June 1 - Sept. 11)

Investigators [illegible]

| | |
|---|---|
| Number of fish taken per man-hour | 0.93 |
| Total number of man hours fished | 165,000 |

On the basis of 1,977 anglers

36 % of anglers caught NO fish

54 % of anglers caught 53 % of total

10 % of anglers caught 47 % of total

Average number of fish kept per fisherman 4.9

Average length of time spent fishing 5.2 hours

Composition of angling population

| | | | |
|---|---|---|---|
| MEN | 27,600 | 86 % | TOTAL |
| WOMEN | 2,500 | 8 % | 32,100 |
| CHILDREN | 2,000 | 6 % | |

Relative completeness of survey:

Estimated totals based on about 7 % complete survey

## RESIDENCE OF FISHERMEN

| | |
|---|---|
| Garrett Co. | * % |
| Allegany Co. | % |
| Washington Co. | % |
| Frederick Co. | * % |
| Carroll Co. | 1 % |
| Baltimore Co. | 5 % |
| Baltimore City | 43 % |
| Harford Co. | 12 % |
| Cecil Co. | 4 % |
| Howard Co. | * % |
| Montgomery Co. | * % |
| Ann Arundel Co. | 2 % |
| Prince Georges Co. | % |
| Washington, D. C. | % |
| Calvert Co. | % |
| Charles Co. | % |
| St. Mary's Co. | % |
| Kent Co. | % |
| Queen Annes Co. | % |
| Talbot Co. | % |
| Caroline Co. | % |
| Dorchester Co. | % |
| Wicomico Co. | % |
| Somerset Co. | % |
| Worchester Co. | % |
| Pennsylvania | 4 % |
| Virginia | % |
| West Virginia | % |
| Delaware | * % |
| [illegible] | % |
| Those then 1/2 of 1 % | % |

## FISH CAUGHT

| | kept | | released |
|---|---|---|---|
| Smallmouth Black Bass | 1,400 | 0.9 % | 1,500 |
| Largemouth Black Bass | 370 | 0.2 % | 820 |
| Black Crappie | 2,700 | 1.7 % | 8,500 |
| White Crappie | | % | |
| Bluegill | 560 | 0.4 % | 800 |
| Pumpkinseed | | % | |
| Yellowbelly Sunfish | | % | |
| Green Sunfish | | % | |
| Sunfish, unidentified | 1,530 | 1.0 % | 1,400 |
| Rock Bass | 440 | 0.3 % | 1,100 |
| Yellow Perch | 570 | 0.4 % | 340 |
| White Perch | 2,500 | 1.6 % | 4,900 |
| Walleye | 1,900 | 1.2 % | 220 |
| Pickerel | | % | |
| Brook Trout | | % | |
| Brown Trout | | % | |
| Rainbow Trout Herring | 310 | 0.2 % | 490 |
| Brown Bullhead | | % | |
| Yellow Bullhead | | % | |
| Channel Catfish | | % | |
| White Catfish | | % | |
| Catfish, unidentified | 140,000 | 89.6 % | 131,000 |
| White Sucker | 110 | 0.1 % | 220 |
| Carp | 720 | 0.5 % | 970 |
| Golden Shiner Hick Head | 310 | 0.2 % | 400 |
| Eel | 240 | 0.2 % | 190 |
| White Mud | 2,500 | 1.6 % | 500 |
| Striped Bass | 240 | 0.2 % | 1,000 |
| Total number of fish caught | 156,000 | 100.1 % | 167,000 |

FORM NO. 12 9-51

TABLE IV

# MARYLAND
# CREEL CENSUS REPORT — Dept. of Research and Education

Dept. of Game and Inland Fish,
cooperating with

CORONICO LAKE

Date ALL SEASON, 1955 (June 1 – Sept. 15)

Investigators

| Number of fish taken per man-hour | Total number of man hours fished |
|---|---|
| 0.38 | 53,000 |

Composition of angling population

| | | | |
|---|---|---|---|
| MEN | 10,600 | 72 % | TOTAL |
| WOMEN | 2,000 | 13 % | 14,900 |
| CHILDREN | 3,100 | 14 % | |

Relative completeness of survey:

Estimated totals based on about 12.5% complete survey

On the basis of 201 anglers

58 % of anglers caught NO fish

32 % of anglers caught 31 % of total

10 % of anglers caught 69 % of total

Average number of fish kept per fisherman 1.3

Average length of time spent fishing 3.5 hours

## RESIDENCE OF FISHERMEN

| | |
|---|---|
| Garrett Co. | % |
| Allegany Co. | % |
| Washington Co. | % |
| Frederick Co. | 1 % |
| Carroll Co. | % |
| Baltimore Co. | 3 % |
| Baltimore City | 28 % |
| Harford Co. | 22 % |
| Cecil Co. | 17 % |
| Howard Co. | % |
| Montgomery Co. | % |
| Ann Arundel Co. | % |
| Prince Georges Co. | % |
| Washington, D. C. | % |
| Calvert Co. | % |
| Charles Co. | % |
| St. Mary's Co. | % |
| Kent Co. | % |
| Queen Annes Co. | % |
| Talbot Co. | % |
| Caroline Co. | % |
| Dorchester Co. | % |
| Wicomico Co. | % |
| Somerset Co. | % |
| Worchester Co. | % |
| Pennsylvania | 9 % |
| Virginia | % |
| West Virginia | % |
| Delaware | % |
| | % |
| | % |

## FISH CAUGHT

| | kept | | returned |
|---|---|---|---|
| Smallmouth Black Bass | 1,000 | 5.1 % | 3,100 |
| Largemouth Black Bass | 400 | 2.0 % | 1,300 |
| Black Crappie | 3,500 | 17.9 % | 1,700 |
| White Crappie | | % | |
| Bluegill | 3,200 | 16.4 % | 3,200 |
| Pumpkinseed | | % | |
| Yellowbelly Sunfish | | % | |
| Green Sunfish | | % | |
| Sunfish, unidentified | 970 | 5.0 % | 680 |
| Rock Bass | 220 | 1.1 % | |
| Yellow Perch | 350 | 1.8 % | 550 |
| White Perch | 50 | 0.3 % | 50 |
| Walleye | | % | |
| Pickerel | | % | |
| Brook Trout | | % | |
| Brown Trout | | % | |
| Rainbow Trout | | % | |
| Brown Bullhead | | % | |
| Yellow Bullhead | | % | |
| Channel Catfish | | % | |
| White Catfish | | % | |
| Catfish, unidentified | 9,800 | 50.2 % | 10,400 |
| White Sucker | | % | |
| Carp | 50 | 0.3 % | |
| Golden Shiner | | % | |
| Eel | | % | |
| | | % | |
| | | % | |
| Total number of fish caught | 19,500 | 100.2 % | 21,000 |

F—NO. 12 A-57

TABLE V

# MARYLAND
# CREEL CENSUS REPORT — Dept. of Research and Education

Dept. of Game and Inland Fish,
cooperating with

Date ALL SEASON, 1955 (June 1 - Sept. 12)

POTOMAC-SUSQUEHANNA AREA

Investigators

| Number of fish taken per man-hour | Total number of man hours fished |
|---|---|
| 0.61 | 328,000 |

Composition of angling population

| | | | |
|---|---|---|---|
| MEN | 38,200 | 75 % | TOTAL |
| WOMEN | 5,800 | 12 % | |
| CHILDREN | 6,700 | 13 % | |

Relative completeness of survey:

Estimates totals based on about 39% complete survey

On the basis of 1,394 anglers

41 % of anglers caught NO fish

49 % of anglers caught 49 % of total

10 % of anglers caught 51 % of total

Average number of fish kept per fisherman 2.6

Average length of time spent fishing 4.4 hours

## RESIDENCE OF FISHERMEN

| | |
|---|---|
| Garrett Co. | * % |
| Allegany Co. | % |
| Washington Co. | % |
| Frederick Co. | * % |
| Carroll Co. | 1 % |
| Baltimore Co. | 2 % |
| Baltimore City | 36 % |
| Harford Co. | 15 % |
| Cecil Co. | 17 % |
| Howard Co. | * % |
| Montgomery Co. | * % |
| Ann Arundel Co. | * % |
| Prince Georges Co. | % |
| Washington, D. C. | % |
| Calvert Co. | % |
| Charles Co. | % |
| St. Mary's Co. | % |
| Kent Co. | % |
| Queen Annes Co. | % |
| Talbot Co. | % |
| Caroline Co. | % |
| Dorchester Co. | % |
| Wicomico Co. | % |
| Somerset Co. | % |
| Worchester Co. | % |
| Pennsylvania | 10 % |
| Virginia | % |
| West Virginia | % |
| Delaware | * % |
| | % |
| * - less than 1/2 of 1% | % |

## FISH CAUGHT

| | kept | | returned |
|---|---|---|---|
| Smallmouth Black Bass | 5,100 | 2.6 % | 9,800 |
| Largemouth Black Bass | 1,200 | 0.6 % | 2,300 |
| Black Crappie | 6,600 | 3.4 % | 12,300 |
| White Crappie | | % | |
| Bluegill | 4,000 | 2.0 % | 4,400 |
| Pumpkinseed | | % | |
| Yellowbelly Sunfish | | % | |
| Green Sunfish | | % | |
| Sunfish, unidentified | 4,000 | 2.0 % | 3,500 |
| Rock Bass | 1,100 | 0.5 % | 1,100 |
| Yellow Perch | 1,100 | 0.6 % | 1,900 |
| White Perch | 3,400 | 1.7 % | 7,400 |
| Walleye | 2,500 | 1.3 % | 200 |
| Pickerel | | % | |
| Brook Trout Herring | 310 | 0.2 % | 490 |
| Brown Trout | | % | |
| Rainbow Trout | | % | |
| Brown Bullhead | | % | |
| Yellow Bullhead | | % | |
| Channel Catfish | | % | |
| White Catfish | | % | |
| Catfish, unidentified | 162,000 | 81.9 % | 173,000 |
| White Sucker | 110 | 0.1 % | 220 |
| Carp | 1,600 | 0.8 % | 970 |
| Golden Shiner | 310 | 0.2 % | 670 |
| Eel | 1,240 | 0.6 % | 1,400 |
| White shad | 2,500 | 1.3 % | 770 |
| Striped bass | 660 | 0.4 % | 1,700 |
| Total number of fish caught | 198,000 | 100.2 % | 222,000 |

TABLE VI

ESTIMATED NUMBER OF ANGLERS, BY WEEKS, CONOWINGO-SUSQUEHANNA AREA
(Pennsylvania line to Deer Creek)
June 1 to September 12, 1955

| Week of | Reservoir | Dam | River | Totals |
|---|---|---|---|---|
| May 29 | 1,300 | 3,300 | 1,100 | 5,700 |
| June 5 | 1,200 | 4,200 | 1,800 | 7,300 |
| June 12 | 1,100 | 4,600 | 2,400 | 8,100 |
| June 19 | 1,300 | 3,100 | 4,000 | 8,400 |
| June 26 | 1,500 | 3,400 | 2,500 | 7,400 |
| July 3 | 1,500 | 3,000 | 2,900 | 7,400 |
| July 10 | 1,100 | 1,500 | 2,900 | 5,500 |
| July 17 | 840 | 900 | 1,000 | 2,700 |
| July 24 | 550 | 1,500 | 1,400 | 3,400 |
| July 31 | 690 | 720 | 890 | 2,300 |
| August 7 | 420 | 850 | 440 | 1,700 |
| August 14 | 740 | 1,100 | 320 | 2,200 |
| August 21 | 920 | 930 | 1,100 | 2,900 |
| August 28 | 930 | 1,700 | 1,700 | 4,300 |
| September 4 | 600 | 1,100 | 2,800 | 4,500 |
| September 11 | 200 | 380 | 220 | 800 |
| TOTALS | 15,000 | 32,000 | 27,000 | 75,000 |
| Percent of Total | 20.0% | 43.3% | 36.8% | |
| Miles | 4.6 | 0.4 | 4.5 | 10.5 |
| Acres | 5,100 | 30 (includes tail race) | 1,500 | 6,600 |

MARYLAND DEPARTMENT OF RESEARCH AND EDUCATION
Inland Resources Division
Solomons, Maryland

Ref. No. 57-28

May 30, 1957

# OPEN LETTER TO THE DEEP CREEK LAKE FISHERMEN

Dear Fisherman:

Large yellow perch can be taken in Deep Creek Lake. This letter suggests two different methods of doing it.

As you probably know, the yellow perch in Deep Creek Lake present a special problem to the biologists and fish management men. We know, from our sampling, that the lake contains a good supply of perch over eight inches, yet the average fisherman seems to take very few of them. The angler finds it easy enough to catch small perch so is inclined to think that the lake contains only little ones. Furthermore, application of biological principals to the Deep Creek situation indicates that fishing for all other species could be greatly improved if the perch population was reduced to about half its present size.

With this in mind, we began a study of yellow perch habits in Deep Creek Lake, hoping that some facts would come to light that would help the fishermen to catch more and bigger perch. The study was started in 1956 and, at this date, is far from complete. However, some of the habits of perch are so strongly indicated and are so important to the fisherman that, at the risk of being proven wrong later, we are making public our preliminary findings. It is intended that this will encourage many fishermen to experiment with the methods suggested and improve on them. Perhaps the total catch of yellow perch can be materially increased.

## INDICATED HABIT # 1

Larger perch are found in deeper water.

Observations of fishermen's catches and repeated experiments show that perch taken in water more than 20 feet deep are larger on the average than those closer to shore. Fish over eight inches seem to be in the majority in deep water while in shallow water relatively few perch reach that size. This suggests that better luck will be had by the angler who fishes out in the middle of the lake. One can go too deep, however, as it is believed that in July and August few perch will be found below 35 feet -- because of oxygen depletion at this depth.

## INDICATED HABIT # 2

A large number of perch feed on the surface on calm mornings in the summer.

Some perch may feed at or just below the surface in wavy water too, but this has not been observed. Any early riser who travels in a fast boat shortly after sun-up on a quiet morning can observe feeding perch anywhere in the lake. They are not distributed evenly; rather, they seem to be gathered in large, loose groups.

Inasmuch as "flat calm" mornings are common at Deep Creek Lake it is suggested that fly fishing for perch be tried. Some people have tried this method and report success, but it is not known whether dry flies or wet flies are best. Small pieces of worm on a trout hook should also be tried.

## INDICATED HABIT # 3

A substantial part of the perch population feeds on the bottom.

These fish move about very little. We caught a number of perch from deep water and tied small buoys to them so that their movements could be observed. None of these tagged fish moved more than 20 or 30 feet -- in up to eight hours of watching. This suggests that the angler who fishes from shore or from an anchored boat will be able to offer his bait to only the relatively few fish which happen to be in his area.

Experimental drift-fishing was tried and the results were very encouraging. Perch were boated about twice as often as when fishing from shore but the number of nibbles increased tremendously. It seems that further improvement should be along the line of hooking a larger percentage of the nibblers.

The tackle used is similar to the trolling rigs used in Chesapeake Bay. A three-way swivel is fastened to the end of the fishing line, and from one arm of the swivel a rather large sinker is tied, leaving about eight inches of line between the swivel and sinker. From the other arm of the swivel, tie a two-foot piece of light leader with a very small hook (we use a Carlisle number 12). Bait this hook with a tiny piece of worm -- about an eighth of an inch. Figure 1 shows the set-up.

Fishing is from a free-drifting boat. Line is payed out until the sinker just touches bottom. Line length must be adjusted frequently; of course, because the depth changes as the boat drifts and if the wind picks up more line must be let out. The sinker can be allowed to drag lightly over the bottom or it can be lifted a few inches and set down again immediately. If the sinker is lifted it progresses along the bottom in a series of little hops. It is believed that this action stirs up the mud slightly -- just enough to attract nearby fish -- and the bait rides near the top of a small cloud of silt, making it appear to the fish as if the bait were stirred up from the bottom. This, of course, is only theory at the present time, but we plan to send down a diver to check on this point.

In a strong wind, most boats, especially those with flat bottoms, will drift faster than is desirable. Drifting can be slowed up with a sea anchor; this is simply a board weighted so it will float with one edge up. A bridle is fastened so that the board is dragged with its broad side against the direction of drift. See Figure 2. Fishermen in Chesapeake Bay use a bushel basket instead of the board.

Stumps and rocks are the greatest annoyances in drift fishing. It is advisable to fasten the sinker with line of lower test than the fishing line: if the sinker hangs up, only the sinker will be lost.

In our experiments with drift fishing, it was found that the upper part of the lake, that is, the area south of Glendale bridge, has comparatively few stumps. Several times we have been able to drift more than a mile without getting hung up.

If you try either fly fishing or drift fishing we would appreciate hearing of your results. Tell the game warden or the creel census field man about it or drop a postcard to us.

Thank you,

Harold J. Elser

Harold J. Elser
Fisheries Biologist

P.S. Biological and fish management studies on Deep Creek Lake are a joint project of the Maryland Game and Inland Fish Commission and the Maryland Department of Research and Education.

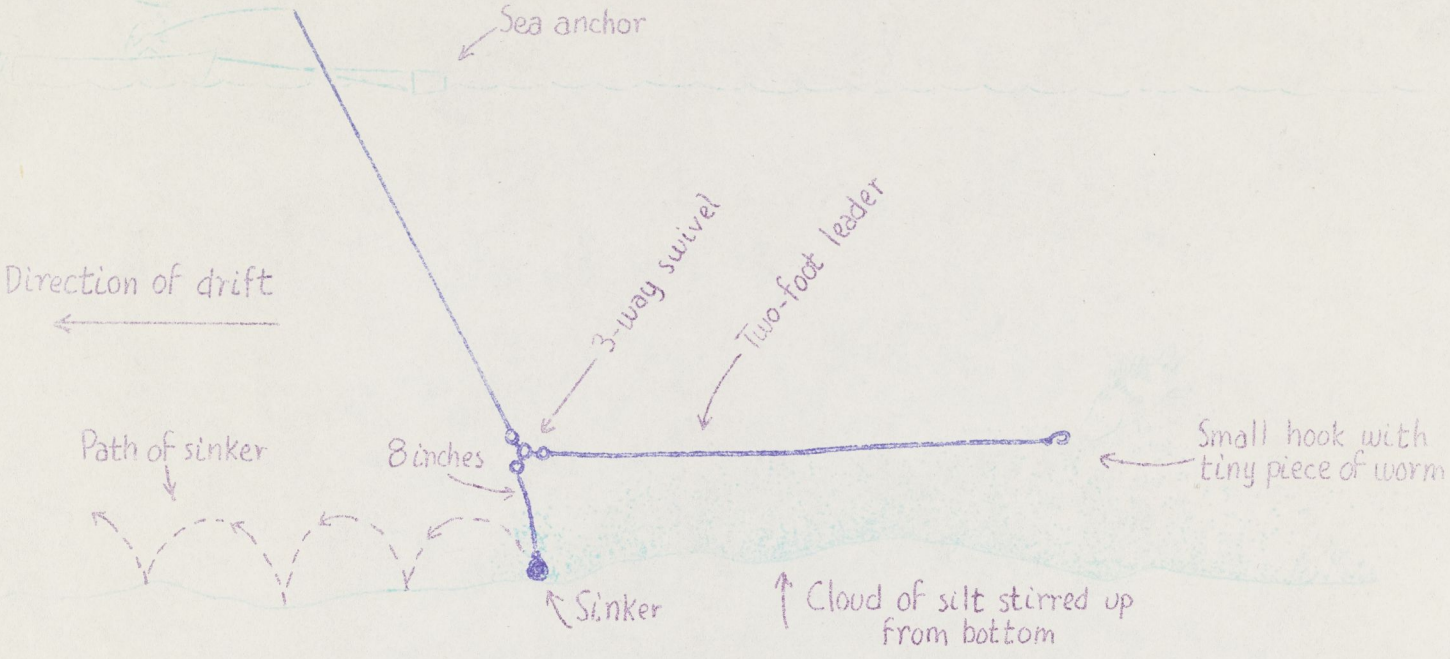


FIGURE 1 - RIG FOR DRIFT FISHING

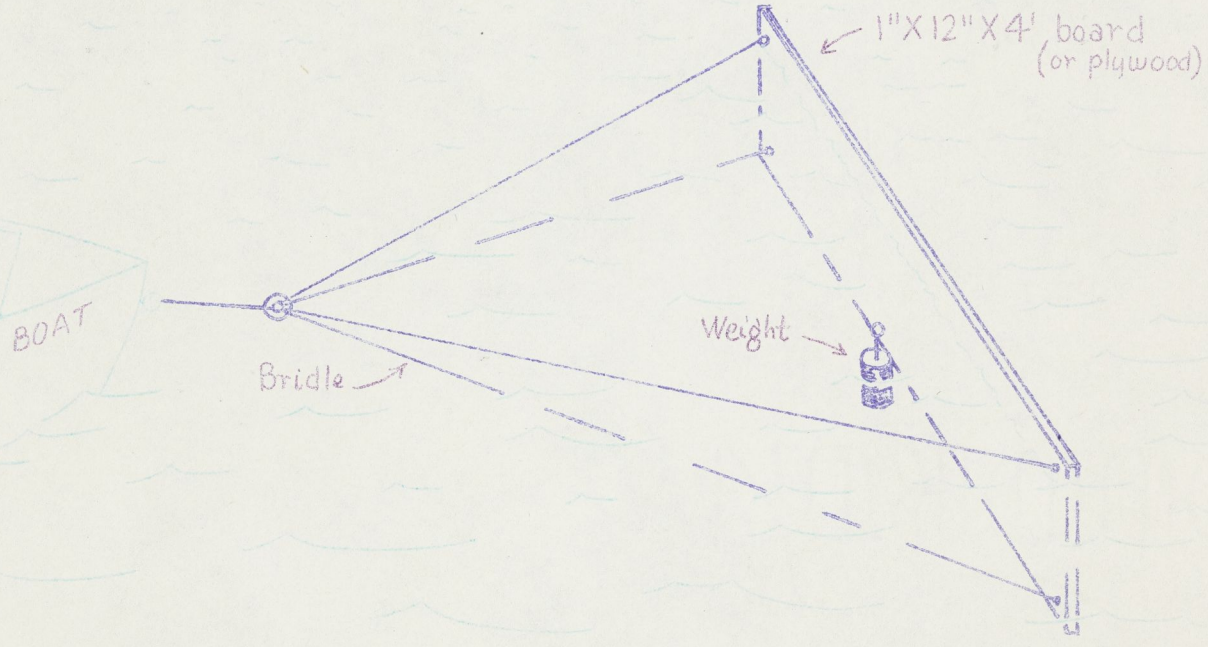


FIGURE 2 - SEA ANCHOR FOR DRIFT FISHING
(used only in strong wind)

Form No. 12 [illegible]

Dept. of Game and Inland Fish,
cooperating with

# MARYLAND
# CREEL CENSUS REPORT — Dept. of Research and Education

CONOWINGO-SUSQUEHANNA AREA
(from Penn. line to Tidewater)

Date ALL SEASON, 1957 (Apr. 1 - Oct. 12) (29 weeks)

Investigators Monroe Perry

| Number of fish taken per man-hour | Total number of man hours fished |
|---|---|
| 0.57 | 701,000 |

Composition of angling population

| | | | |
|---|---|---|---|
| MEN | 124,000 | 84 % | TOTAL |
| WOMEN | 12,000 | 8 % | 147,000 |
| CHILDREN | 12,000 | 8 % | |

On the basis of 3,498 anglers

30 % of anglers caught NO fish

60 % of anglers caught 56 % of total

10 % of anglers caught 44 % of total

Average number of fish kept per fisherman 3.0

Average length of time spent fishing 4.8 hours

Relative completeness of survey:
3.8 % complete survey
(5,553 interviewers out of estimated 147,000 anglers)

## RESIDENCE OF FISHERMEN

| | |
|---|---|
| Garrett Co. | * % |
| Allegany Co. | * % |
| Washington Co. | * % |
| Frederick Co. | 1 % |
| Carroll Co. | 2 % |
| Baltimore Co. | 40 % |
| Baltimore City | % |
| Harford Co. | 14 % |
| Cecil Co. | 11 % |
| Howard Co. | % |
| Montgomery Co. | * % |
| Anne Arundel Co. | * % |
| Prince Georges Co. | * % |
| Washington, D. C. | * % |
| ~~Calvert Co.~~ New Jersey | * % |
| ~~Charles Co.~~ Michigan | * % |
| ~~St. Mary's Co.~~ Missouri | * % |
| Kent Co. Connecticut | * % |
| ~~Queen Annes Co.~~ Tennessee | * % |
| ~~Talbot Co.~~ Ohio | * % |
| Caroline Co. | * % |
| ~~Dorchester Co.~~ Texas | * % |
| Wicomico Co. | % |
| Somerset Co. | % |
| Worchester Co. | % |
| Pennsylvania | 30 % |
| Virginia | * % |
| West Virginia | % |
| Delaware | * % |
| | % |
| | % |

* Less than ½ of 1%

## FISH CAUGHT

| | kept | | returned |
|---|---|---|---|
| Smallmouth Black Bass | 11,000 | 2 % | 7,800 |
| Largemouth Black Bass | 5,500 | 1 % | 17,000 |
| Black Crappie | 37,000 | 8 % | 13,000 |
| White Crappie | | % | |
| Bluegill | 3,200 | 1 % | 3,500 |
| Pumpkinseed | 30 | * % | |
| Yellowbelly Sunfish | | % | |
| Green Sunfish | 50 | * % | 30 |
| Sunfish, unidentified | 7,100 | 2 % | 9,000 |
| Rock Bass | 670 | * % | 1,900 |
| Yellow Perch | 9,100 | 2 % | 7,000 |
| White Perch | 33,000 | 7 % | 61,000 |
| Walleye | 1,700 | * % | 2,300 |
| Pickerel | | % | 80 |
| ~~Brook Trout~~ Hickory Shad | 4,300 | 1 % | 1,600 |
| ~~Brown Trout~~ White Shad | 15,000 | 3 % | 6,000 |
| ~~Rainbow Trout~~ Herring | 11,000 | 2 % | 9,200 |
| Brown Bullhead | | % | |
| Yellow Bullhead | | % | |
| Channel Catfish | 286,000 | 65 % | 232,000 |
| White Catfish | | % | |
| Catfish, unidentified | | % | |
| White Sucker | 300 | * % | 450 |
| Carp | 7,000 | 2 % | 1,500 |
| Golden Shiner | 110 | * % | |
| Eel | 2,000 | * % | 3,000 |
| Striped Bass | 5,800 | 1 % | 23,000 |
| Gar Fish, Mullett, Perch | 60 | * % | 60 |
| Total number of fish caught | 441,000 | 97 % | 299,000 |

F-NO. 12 8-57

Dept. of Game and Inland Fish,

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# MARYLAND
# CREEL CENSUS REPORT — Dept. of Research and Education

SUSQUEHANNA RIVER — Date ALL SEASON, 1957 (Apr. 7 - Oct. 12) (27 weeks)

(Tidewater to Dam but not including tailwater) — Investigators

| Number of fish taken per man-hour | Total number of man hours fished |
|---|---|
| 0.39 | 313,000 |

**Composition of angling population**

| | | | |
|---|---|---|---|
| MEN | 54,600 | 82 % | TOTAL |
| WOMEN | 5,300 | 8 % | 66,200 |
| CHILDREN | 6,300 | 10 % | |

Relative completeness of survey:
Estimated from interviews with 679 anglers, 338 of whom were thru for the day.
1 % complete survey

On the basis of 338 anglers

56 % of anglers caught NO fish

34 % of anglers caught 42 % of total

10 % of anglers caught 58 % of total

Average number of fish kept per fisherman 1.9

Average length of time spent fishing 4.7 hours

## RESIDENCE OF FISHERMEN

| | |
|---|---|
| Garrett Co. | % |
| Allegany Co. | % |
| Washington Co. | % |
| Frederick Co. | 2 % |
| Carroll Co. | 2 % |
| Baltimore Co. | 35 % |
| Baltimore City | % |
| Harford Co. | 11 % |
| Cecil Co. | 13 % |
| Howard Co. | % |
| Montgomery Co. | * % |
| Ann Arundel Co. | % |
| Prince Georges Co. | % |
| Washington, D. C. | % |
| Calvert Co. | % |
| Charles Co. | % |
| St. Mary's Co. | % |
| Kent Co. | % |
| Queen Annes Co. | % |
| Talbot Co. | % |
| Caroline Co. | % |
| Dorchester Co. | % |
| Wicomico Co. | % |
| Somerset Co. | % |
| Worchester Co. | % |
| Pennsylvania | 36 % |
| Virginia | % |
| West Virginia | % |
| Delaware | % |
| New Jersey | 1 % |
| | % |

* Less than ½ of 1%

## FISH CAUGHT

| | kept | | returned |
|---|---|---|---|
| Smallmouth Black Bass | 9,800 | 8 % | 3,400 |
| Largemouth Black Bass | 4,500 | 4 % | 12,000 |
| Black Crappie | 5,600 | 5 % | 2,700 |
| White Crappie | | % | |
| Bluegill | 510 | * % | |
| Pumpkinseed | | % | |
| Yellowbelly Sunfish | | % | |
| Green Sunfish | | % | |
| Sunfish, unidentified | 5,200 | 4 % | 4,100 |
| Rock Bass | | % | 510 |
| Yellow Perch | 5,200 | 4 % | 2,500 |
| White Perch | 22,000 | 16 % | 33,000 |
| Walleye | 870 | 1 % | 680 |
| Pickerel | | % | |
| ~~Brook Trout~~ Hickory Shad | 3,100 | 2 % | 1,000 |
| ~~Brown Trout~~ White Shad | 6,900 | 6 % | 4,900 |
| ~~Rainbow Trout~~ Herring | 9,000 | 7 % | 4,600 |
| Brown Bullhead | | % | |
| Yellow Bullhead | | % | |
| Channel Catfish | 45,000 | 36 % | 25,000 |
| White Catfish | | % | |
| Catfish, unidentified | | % | |
| White Sucker | 120 | * % | 120 |
| Carp | 2,700 | 2 % | 680 |
| Golden Shiner | | % | |
| Eel | 1,400 | 1 % | 2,200 |
| St. Bass | 2,200 | 2 % | 2,400 |
| Fall Fish | | % | 240 |
| Total number of fish caught | 124,000 | % | 100,000 |

FORM NO. 12 8-57

Dept. of Game and Inland Fish
cooperating with

# MARYLAND
# CREEL CENSUS REPORT — Dept. of Research and Education

CONOWINGO DAM

Date ALL SEASON, 1957 (Apr. 1 - Oct. 19) (29 weeks)

Investigators Monroe Terry

| | |
|---|---|
| Number of fish taken per man-hour | 1.01 |
| Total number of man hours fished | 252,000 |

Composition of angling population

| | | | |
|---|---|---|---|
| MEN | 46,400 | ____ % | TOTAL |
| WOMEN | 4,300 | ____ % | 53,000 |
| CHILDREN | 2,300 | ____ % | |

Relative completeness of survey:
5 % complete survey
(4,333 interviewers out of estimated 53,000 anglers)

On the basis of 2,984 anglers

26 % of anglers caught NO fish

64 % of anglers caught 59 % of total

10 % of anglers caught 41 % of total

Average number of fish kept per fisherman 4.9

Average length of time spent fishing 4.7 hours

## RESIDENCE OF FISHERMEN

| | |
|---|---|
| Garrett Co. | * % |
| Allegany Co. | * % |
| Washington Co. | * % |
| Frederick Co. | * % |
| Carroll Co. | 2 % |
| Baltimore Co. | 46 % |
| Baltimore City | % |
| Harford Co. | 13 % |
| Cecil Co. | 2 % |
| Howard Co. | % |
| Montgomery Co. | * % |
| Ann Arundel Co. | 1 % |
| Prince Georges Co. | * % |
| Washington, D. C. | * % |
| Calvert Co. | % |
| Charles Co. | % |
| St. Mary's Co. | % |
| Kent Co. | % |
| Queen Annes Co. | % |
| Talbot Co. | % |
| Caroline Co. | * % |
| Dorchester Co. | % |
| Wicomico Co. | % |
| ~~Somerset Co.~~ Texas | * % |
| ~~Worchester Co.~~ Ohio | * % |
| Pennsylvania | 34 % |
| Virginia | * % |
| ~~West Virginia~~ Tenn. | * % |
| ~~Delaware~~ Conn. | * % |
| Michigan | * % |
| Missouri | * % |

* Less than ½ of 1 %

## FISH CAUGHT

| | kept | | returned |
|---|---|---|---|
| Smallmouth Black Bass | 690 | 0.3 % | 340 |
| Largemouth Black Bass | 540 | 0.2 % | 1,900 |
| Black Crappie | 7,000 | 2.7 % | 3,800 |
| White Crappie | | % | |
| Bluegill | | % | |
| Pumpkinseed | | % | |
| Yellowbelly Sunfish | 510 | 0.2 % | 630 |
| Green Sunfish | | % | |
| Sunfish, unidentified | | % | |
| Rock Bass | 440 | 0.2 % | 840 |
| Yellow Perch | 2,000 | 0.8 % | 2,300 |
| White Perch | 9,100 | 3.6 % | 22,000 |
| Walleye | 740 | 0.3 % | 1,500 |
| Pickerel | | % | 80 |
| ~~Brook Trout~~ Hickory Shad | 1,200 | 0.5 % | 640 |
| ~~Brown Trout~~ Am. Shad | 8,200 | 3.2 % | 1,100 |
| ~~Rainbow Trout~~ Herring | 1,700 | 0.7 % | 4,600 |
| Brown Bullhead | | % | |
| Yellow Bullhead | | % | |
| Channel Catfish | 215,000 | 84.3 % | 166,000 |
| White Catfish | | % | |
| Catfish, unidentified | | % | |
| White Sucker | 70 | * % | 330 |
| Carp | 4,100 | 1.6 % | 200 |
| ~~Golden Shiner~~ Mullett (?) | 60 | * % | 20 |
| Eel | 400 | 0.2 % | 630 |
| ~~Striped Bass~~ | 3,100 | 1.2 % | 19,000 |
| ~~Brown Trout~~ | 20 | * % | 40 |
| Total number of fish caught | 250,000 | 100.0 % | 230,000 |

F—NO. 12 8-57

Dept. of Game and Inland Fish,
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# MARYLAND
# CREEL CENSUS REPORT — Dept. of Research and Education

CONOWINGO RESERVOIR
(Penn. line to Dam)

Date ALL SEASON, 1957 (Apr 1 - Oct 28, 1957)

Investigators Monroe Terry

| | |
|---|---|
| Number of fish taken per man-hour | 0.45 |
| Total number of man hours fished | 136,000 |

Composition of angling population

| | | | |
|---|---|---|---|
| MEN | 22,600 | ____% | TOTAL |
| WOMEN | 2,600 | ____% | 28,000 |
| CHILDREN | 3,000 | ____% | |

On the basis of 196 anglers

49 % of anglers caught NO fish

41 % of anglers caught 46 % of total

10 % of anglers caught 54 % of total

Average number of fish kept per fisherman 2.2

Average length of time spent fishing 4.8 hours

Relative completeness of survey:
541 anglers interviewed out of 28,000;
1.9 % complete survey

## RESIDENCE OF FISHERMEN

| | |
|---|---|
| Garrett Co. | ____% |
| Allegany Co. | * % |
| Washington Co. | ____% |
| Frederick Co. | ____% |
| Carroll Co. | 1 % |
| Baltimore Co. | 43 % |
| Baltimore City | ____% |
| Harford Co. | 22 % |
| Cecil Co. | 24 % |
| Howard Co. | ____% |
| Montgomery Co. | ____% |
| Ann Arundel Co. | 1 % |
| Prince Georges Co. | ____% |
| Washington, D. C. | ____% |
| Calvert Co. | ____% |
| Charles Co. | ____% |
| St. Mary's Co. | ____% |
| Kent Co. | ____% |
| Queen Annes Co. | ____% |
| Talbot Co. | ____% |
| Caroline Co. | ____% |
| Dorchester Co. | ____% |
| Wicomico Co. | ____% |
| Somerset Co. | ____% |
| Worchester Co. | ____% |
| Pennsylvania | 9 % |
| Virginia | ____% |
| West Virginia | ____% |
| Delaware | * % |
| | ____% |
| | ____% |

* Less than ½ of 1 %

## FISH CAUGHT

| | kept | | returned |
|---|---|---|---|
| Smallmouth Black Bass | 1,000 | 2 % | 4,000 |
| Largemouth Black Bass | 460 | 1 % | 3,000 |
| Black Crappie | 24,500 | 40 % | 6,800 |
| White Crappie | | % | |
| Bluegill | 2,600 | 4 % | 3,400 |
| Pumpkinseed | | % | |
| Yellowbelly Sunfish | | % | |
| Green Sunfish | | % | |
| Sunfish, unidentified | 1,600 | 3 % | 4,400 |
| Rock Bass | 230 | * % | 570 |
| Yellow Perch | 1,900 | 3 % | 2,200 |
| White Perch | 2,300 | 4 % | 6,100 |
| Walleye | 110 | * % | 110 |
| Pickerel | | % | |
| Brook Trout | | % | |
| Brown Trout | | % | |
| Rainbow Trout | | % | |
| Brown Bullhead | | % | |
| Yellow Bullhead | | % | |
| Channel Catfish | 26,000 | 42 % | 41,000 |
| White Catfish | | % | |
| Catfish, unidentified | | % | |
| White Sucker | 110 | * % | |
| Carp | 110 | * % | 570 |
| Golden Shiner | 110 | * % | |
| Eel | 230 | * % | 110 |
| Striped Bass | 460 | 1 % | 1,000 |
| | | % | |
| Total number of fish caught | 62,000 | 99 % | 74,000 |

MARYLAND DEPARTMENT OF RESEARCH AND EDUCATION
Chesapeake Biological Laboratory and
Inland Resources Division
Solomons, Maryland

Ref. No. 58-6

February 1958

# NOTES ON THE CHAIN PICKEREL IN MARYLAND

Harold J. Elser and Romeo Mansueti

This potpourri of information on the chain pickerel was assembled to answer a request for source material for an article on this species for the National Research Council's forthcoming Handbook of Biological Data. Because much of the information might be useful to various Marylanders, it was decided to duplicate the material for limited distribution.

## DISTRIBUTION

Chain pickerel are distributed widely over Maryland, but the greatest concentration is in the freshwater tributaries of Chesapeake Bay. They are found frequently in salinities up to 6 or 8 p.p.t. /parts per thousand/ and occasionally in water as salty as 12 p.p.t. The freshwater ponds of the Delmarva Peninsula, where they have become landlocked, are also favorite habitat.

Item 1. Of 11 Maryland impoundments that were drained and/or rotenoned, two contained populations of chain pickerel.

Chambers Lake, Caroline Co. Coastal Plain, 5 acres, elevation less than 20 feet. Drained and rotenoned Oct. 1950. Vegetation common, with weedy stream above. 203 pounds of fish per acre, 10.4 percent of which was chain pickerel.

Smithville Pond, Caroline Co. Coastal Plain, 43 acres, elevation less than 20 feet. Drained and rotenoned Nov. 1955. Vegetation sparse but weedy stream above. 63 pounds of fish per acre, 4.5 percent of which was chain pickerel.

The following projects did not turn up chain pickerel, although there is an extremely high probability that, had they been present, they would have been discovered.

Back Creek Pond, Kent Co. Coastal Plain, 10.5 acres, elevation less than 20 feet. Floating algae abundant, rooted aquatics sparse, marsh bordering upper end of pond. Drained Oct. 1956. 391 pounds of fish per acre, no chain pickerel.

Greenbelt Lake, Prince Georges Co. Near fall line, 22 acres, elevation 109 feet. Vegetation common around edges. Drained and rotenoned Nov. 1956. 83 pounds of fish per acre, no chain pickerel.

Kelly Pool, Prince Georges Co. Near fall line, 10.3 acres, elevation 115 feet. Vegetation sparse. Drained Jan. 1956. 117 pounds of fish per acre, no chain pickerel.

Cascade Lake, Washington Co. Catoctin Mountains, 19 acres, elevation 1313 feet. Vegetation rare. Drained Nov. 1956. 171 pounds of fish per acre, no chain pickerel.

Deep Creek Lake, Garrett Co. Allegany Plateau, 3900 acres, elevation 2642 feet. Vegetation rare. 70-acre cove rotenoned Sept. 1955. 86 pounds of fish per acre, no chain pickerel.

New Germany Pond, Garrett Co. Allegany Plateau, 10 acres, elevation 2468 feet. Vegetation rare, but weedy stream above. Drained March 1955. 129 pounds of fish per acre, no chain pickerel.

Cunningham Lake, Garrett Co. Allegany Plateau, 17.5 acres, elevation 2592 feet. Vegetation sparse. Drained and rotenoned Sept. 1954. 114 pounds of fish per acre, no chain pickerel.

Avalon Pond, Baltimore Co. Coastal Plain, near fall line, 2.5 acres, elevation about 100 feet. No vegetation. Drained and rotenoned Nov. 1950. No estimate of pounds per acre, no chain pickerel.

Item 2. This is an extract from a forthcoming book by Dr. Mansueti on the freshwater fishes of Maryland. This gives, in general, the distribution of chain pickerel in Maryland. If more detailed information is desired, there are hundreds of collection records in this office.

"Chain Pickerel. Esox niger LeSueur.

"Geographic Distribution: From New Brunswick and the St. Lawrence River and Lake Ontario drainages southward, east of the mountains, to Florida and in the Mississippi Valley (perhaps as a distinct subspecies) to Texas, southern Missouri and the Tennessee River system in Alabama; introduced into the Lake Erie drainage of New York.

"Range in Maryland: Uhler and Lugger (1876) remarked as follows: 'Widely distributed in the quiet and grassy tributaries of the tidewater region of both shores. Much esteemed, particularly by the farmers of the more central counties. Sold in the towns of Worcester County by hucksters, who transport them in light wagons from place to place. The placid creeks of the marshes bordering and connecting with Sinepuxent and Newport Bay, ... are the favorite haunts of these fish, and there they may be seen basking at the surface in the full sunblaze of a summer's day.' Hildebrand and Schroeder (1928) recorded them from the following localities: Havre de Grace, Annapolis, Solomons, Love Point. Truitt, Bean and Fowler (1929) recorded them from the following counties: Anne Arundel, Baltimore, Caroline, Cecil, Calvert, Charles, Harford, Kent, Montgomery, Talbot, Wicomico, and Worcester Counties. This species has been found to be widely distributed in the Coastal Plain province of the State. There are a few records of its occurrence above the Fall Line. This species has been introduced in the Appalachian Province, where it now is found in certain weedy mountain streams in Allegany and Washington Counties. This is the result of stockings made in 1930 and 1931 by the Maryland Conservation Commission. Of these, 5000 fingerlings, and 1,000,000 fry, were stocked in Deep Creek Lake in Garrett County, but the species has not been successful in acclimatizing itself in the reservoir.

"Habitat and Habits: This species spawns in fresh water in early spring at low temperatures in weedy areas close to shore. It occurs in almost all ponds, swamps, streams, estuaries, and rivers of the lowlands, frequently entering brackish water in salinities up to 12 p.p.t. It feeds on fish and certain invertebrates."

OCCURRENCE OF SPECIES IN POPULATIONS OF 11 MARYLAND IMPOUNDMENTS FROM WHICH REASONABLY COMPLETE DATA IS AVAILABLE. DRAINING AND/OR ROTENONING PROJECTS FROM 1950 THROUGH 1957

| Species | Chambers | Cunningham | New Germany | Deep Creek | Smithville | Kelly Pool | Back Creek | Greenbelt | Cascade | Frazier | St. Paul |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Largemouth Bass | x | x | x | x | x | x | x | x | x | x | x |
| Smallmouth Bass | | x | | x | | | | | | | |
| Chain Pickerel | x | | | | x | | | | | | |
| Redfin Pickerel | | | | x | | | x | | | | |
| Black Crappies | x | x | | x | x | x | x | x | x | x | x |
| White Crappies | | | x | | | | x | | | | x |
| Bluegills | | x | x | x | x | x | x | x | x | x | x |
| Pumpkinseeds | x | x | x | x | x | x | x | x | x | x | x |
| Yellowbelly Sunfish | x | | | | | | x | | | | |
| Green Sunfish | | | | | | x | | x | x | | |
| Rock Bass | | | | x | | | | | | | |
| Warmouth | | | | | | | x | | | | |
| Mud Sunfish | x | | | | x | | | | | | |
| Yellow Perch | | | | x | x | | x | x | | x | |
| White Perch | x | | | | | | x | | | x | x |
| Rainbow Trout | | | | x | | | | | x | | |
| Brook Trout | | | x | | | | | | | | |
| Brown Bullhead | | | x | x | x | x | x | x | x | x | x |
| Yellow Bullhead | x | | | x | x | | | | | x | |
| White Catfish | | | | | | | | | x | | |
| White Suckers | | x | x | x | | | x | x | x | x | |
| Chub Suckers | x | | | | x | | x | x | | | |
| Carp | | | | x | | | x | x | | x | |
| Goldfish | | | x | | | | | x | | x | |
| Eels | x | | | | x | x | x | x | | x | x |
| Channel Cat | | | | | | | | | | x | |
| Gizzard Shad | | | | | | | | | | x | x |
| Golden Shiners | x | | | x | x | x | x | x | | x | x |
| Mudminnows | | | | | x | | x | | | | |
| Blue Spotted Sunfish | x | | | | x | | | | | | |
| Black Banded Sunfish | | | | | x | | | | | | |
| Darters - Hololepis fusiformis | x | | | | x | | x | | | | |
| Mad Toms-Schilbeodes marginatus & S. mollis | | | | x | x | | x | | | | |
| Pirate Perch | x | | | | x | | | | | | |
| Mummichog-Fundulus heteroclitus | | | | | x | | x | | | x | |
| Creek chubs | | | | | | | | x | | | |
| Cutlips Minnow | | | | | | | | x | | | |
| Blacknose Dace | | | | | | | | x | | | |
| River Chubs | | | | x | | | | | | | |
| Fall Fish | | | | x | | | | | | | |
| Number Species Collected | 14 | 6 | 8 | 17 | 19 | 8 | 20 | 16 | 9 | 16 | 10 |

## COMMERCIAL CATCH

Chain pickerel are a minor part of the commercial catch in Chesapeake Bay and tidal tributaries. The bulk of the marketed fish is caught in the tidal streams at the head of the Bay and the Eastern Shore, although, until restrictive legislation was passed in the 1940's, the Severn and Magothy Rivers were good producers.

The following table has been abstracted from a table that will appear in the book on the freshwater fishes of Maryland.

### PRODUCTION OF FRESH WATER FISHES IN THE COMMERCIAL FISHERIES OF MARYLAND WATERS FOR VARIOUS YEARS (1887-1955)

| | Pikes and Pickerels | |
|---|---|---|
| Year | Pounds | Value |
| 1887 | 521,146 | $ 42,303 |
| 1888 | 577,745 | 37,286 |
| 1890 | 576,557 | 35,836 |
| 1891 | 563,264 | 35,264 |
| 1897 | 114,710 | 8,919 |
| 1901 | 67,530 | 5,390 |
| 1908 | 35,000 | 3,800 |
| 1925 | 71,691 | 16,456 |
| 1930 | 10,918 | 2,019 |
| 1931 | 14,474 | 2,205 |
| 1932 | 18,073 | 2,978 |
| 1933 | 28,688 | 3,918 |
| 1934 | 18,600 | 2,967 |
| 1935 | 21,100 | 3,076 |
| 1936 | 39,100 | 6,211 |
| 1937 | 39,900 | 6,377 |
| 1938 | 43,900 | 6,540 |
| 1939 | 36,300 | 5,260 |
| 1940 | 29,000 | 3,994 |
| 1941 | 55,900 | 7,441 |
| 1942 | 34,600 | 5,038 |
| 1944 | 41,200 | 8,287 |
| 1945 | 33,000 | 7,013 |
| 1946 | 22,500 | 5,122 |
| 1947 | 23,600 | 4,595 |
| 1948 | 23,200 | 4,578 |
| 1949 | 22,400 | 4,534 |
| 1950 | 11,800 | 2,103 |
| 1951 | 13,208 | 2,528 |
| 1952 | 12,200 | 2,433 |
| 1953 | 18,511 | 4,598 |
| 1954 | 9,948 | 2,197 |
| 1955 | 2,528 | 506 |

(Undoubtedly, there were several estimation systems used in these figures. However, since 1944, all figures are based on the same collection system).

Source of early records: U. S. Bureau of Fisheries. Since 1944: Maryland Department of Research and Education, Solomons, Maryland.

The term "pikes and pickerels" is used because the commercial fisherman does not differentiate between E. niger and E. americanus. Almost all these fish, however, would be E. niger.

Average wholesale price in 1956 was 18¢ per pound, second in value to striped bass. Thus:

| | | | |
|---|---|---|---|
| Striped bass | 25¢ | Eel | 8¢ |
| Pickerel | 18 | Bluefish | 7 |
| Yellow perch | 17 | Hickory shad | 6 |
| Roe shad | 17 | Catfish | 5 |
| Butterfish | 15 | Buck shad | 5 |
| Grey trout | 15 | Carp | 3 |
| Croaker | 14 | Alewives | 2 |
| Flounder | 10 | Menhaden | 2 |
| White perch | 10 | | |
| Spot | 10 | | |

Pertinent regulations:

No commercial fishing in non-tidal waters.

Season closed Mar 15 to Apr 30 in tidal waters.

Size limit, 14 inches (all waters and both sport and commercial).

Hook and line creel limit, 10 per day.

## SIZE-DISTRIBUTION IN A POPULATION

We have the size-distribution of a chain pickerel population for only one lake, Smithville Lake, which we drained and rotenoned in November 1955. The number of pickerel measured for the Chambers Lake project (Oct. 1950) was too small to yield a reliable size distribution.

SIZE-FREQUENCY DISTRIBUTION, BY HALF-INCH SIZE CLASSES, OF CHAIN PICKEREL TAKEN FROM SMITHVILLE LAKE, CAROLINE COUNTY, MARYLAND, NOVEMBER 1955.

| Size-class | Estimated * number | Total weight * (ounces) |
|---|---|---|
| 3.0 - 3.4 | 5 | 0.5 |
| 3.5 - 3.9 | 3 | 0.4 |
| 4.0 | 1 | 0.2 |
| 4.5 | 3 | 1.0 |
| 5.0 | 8 | 3.6 |
| 5.5 | 40 | 23.3 |
| 6.0 | 66 | 47.7 |
| 6.5 | 118 | 108.5 |
| 7.0 | 124 | 141.8 |
| 7.5 | 112 | 155.9 |
| 8.0 | 92 | 155.6 |
| 8.5 | 49 | 98.0 |
| 9.0 | 41 | 98.5 |
| 9.5 | 21 | 59.9 |
| 10.0 | 15 | 48.8 |
| 10.5 | 11 | 42.0 |
| 11.0 | 2 | 9.0 |
| 11.5 | 3 | 15.0 |
| 12.0 | 2 | 11.2 |
| 12.5 | 2 | 13.5 |
| 13.0 | 5 | 36.0 |
| 13.5 | 6 | 48.0 |
| 14.0 | 6 | 56.8 |
| 14.5 | 14 | 144.9 |
| 15.0 | 15 | 168.9 |
| 15.5 | 12 | 151.2 |
| 16.0 | 13 | 177.6 |
| 16.5 | 8 | 117.2 |
| 17.0 | 1 | 16.4 |
| 17.5 | 1 | 15.7 |
| | 799 | 1967 ounces |
| | | 123 pounds |

* Based on the measurement of 227 pickerel selected at random.

(Figures are from raw data and have not been rounded off).

Some idea of the spawning condition and season of the chain pickerel in Maryland may be found in the following table. Additional information is given in the extract from Sanderson.

REPRODUCTIVE CONDITION OF CHAIN PICKEREL, Esox niger, FROM NORTHEAST RIVER AT CARPENTERS POINT, CECIL COUNTY, MARYLAND

Degree of Ripeness, Sex, and Number of Fish Examined

| | Hard Gonads | | | Green Ripe Gonads | | | Running Ripe Gonads | | | Spent Gonads | | | Immature Fish | | | Total Number Examined | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F | M | ? | F | M | ? | F | M | ? | F | M | ? | F | M | ? | F | M | ? |
| Mar 17,'55 | 16 | 8 | - | - | - | - | 2 | 17 | - | - | - | - | - | - | - | 18 | 25 | - |
| Apr 6,'55 | - | - | - | 7 | - | - | 1 | 2 | 3 | - | - | - | 3 | 18 | - | 22 | 21 | - |
| Apr 15,'55 | - | - | - | - | - | - | 4 | 8 | - | 30 | 18 | - | - | - | - | 34 | 26 | - |

AGE AND GROWTH

We have very little information on age and growth of Maryland pickerel. What little is available is given below and in the quotation from Sanderson. The Smithville data is the result of back-calculating while the Chambers Lake data is simply the age of each specimen examined.

AVERAGED CALCULATED TOTAL LENGTHS AT EACH ANNULUS, CHAIN PICKEREL COLLECTED FROM SMITHVILLE POND, CAROLINE COUNTY, MARYLAND, NOV. 1955

| Annulus number | 1 | 2 | 3 |
|---|---|---|---|
| Average length in inches | 7.4 | 12.4 | 14.1 |
| Number specimens examined | 19 | 12 | 6 |

AVERAGE LENGTHS OF VARIOUS AGE GROUPS OF CHAIN PICKEREL COLLECTED FROM CHAMBERS LAKE, CAROLINE COUNTY, MARYLAND, OCT. 1950

| Age group | 0 | I | II | III | IV |
|---|---|---|---|---|---|
| Average length in inches | 8.1 | 11.0 | 13.6 | 17.2 | 22.3 |
| Number specimens | 7 | 6 | 19 | 2 | 2 |

EXTRACT from Sanderson, A. E., Jr., 1950. An ecological survey of the fishes of the Severn River with reference to the eastern chain pickerel, Esox niger LeSueur, and the yellow perch, Perca flavescens (Mitchill). Unpublished M. S. Thesis, Univ. Md. Dept. Zool. 1-47.

. . . . . .

The eastern chain pickerel, Esox niger LeSueur, is the second largest game fish of the Severn River. A member of the family Esocidae, the eastern chain pickerel is characterized by an elongated, round body, a long head with a depressed, flat snout and chain-like reticulations on the sides of the body of adult fishes. The eastern chain pickerel is distinguished from the grass pickerel, Esox americanus (Gmelin), by the number of branchiostegale. There are 14 to 16 branchiostegale present in Esox niger LeSueur, while Esox americanus (Gmelin) ordinarily has 11 to 13 branchiostegale. In the Severn River the eastern pickerel is widely distributed. This species is found from Severn Run to the Chesapeake Bay on the open river along shore and in the tidal creeks. In the Severn River they are found more often in and around river bottom covered with aquatic vegetation. They normally inhabit water varying from two feet to seven feet deep. Eastern chain pickerel of the Severn River were observed to rest close to the bottom in woody areas facing the shoreline. When feeding actively, the

pickerel was often caught in water less than one foot deep. The tidal stage appeared to have little effect upon the feeding time. Most pickerel were observed to feed in the early morning when the surface water temperature was warm in early autumn and late spring. In the winter pickerel fed in the late afternoon when the surface water temperature ordinarily reached a maximum for the day. Food of the predaceous eastern chain pickerel consisted of a number of different species of fish. Hildebrand and Schroeder (1927) reported the presence of silversides, sticklebacks and killifishes in the stomachs of six specimens examined on the Chesapeake Bay. Observations on stomach contents of adult eastern pickerel collected during this survey indicate that the pickerel is most selective when there is a variety of abundant smaller inshore fishes. During the autumn months the main food of the pickerel was observed to be the menhaden, Brevoortia tyrannus (Latrobe). With the advent of cold weather and disappearance of menhaden from the shallow water, the food of the pickerel changed to fishes of the genus Fundulus. During the winter and early spring months the food of the pickerel varied. Stomachs examined contained the three species of Fundulus listed in Table II, sunfish, Lepomis gibbosus (Linnaeus), yellow perch, Perca flavescens (Mitchill) and silversides of the genus Menidia. On one occasion a partially digested pickerel nine inches long was removed from a 23-inch roe pickerel.

Seventy-nine adult eastern chain pickerel were examined during this survey (see Table III). The sex ratio was 35 buck fish to 44 roe fish. Buck fish comprised 44 per cent of the population, roes 56 per cent. The average length of the male pickerel was 19.3 inches. The average length of the female fish was 21.5 inches. Male pickerel averaged 1.6 pounds in weight, considerably less than the female pickerel which weighed an average of 2.4 pounds. Male pickerel with one annulus had an average length of 17.1 inches. The average weight for roe fish with one annulus was 1.2 pounds. Buck fish with two annuli had an average length of 18.1 inches. They weighed 1.3 pounds. Roe fish with two annuli had an average length of 20 inches and a weight of 1.8 pounds. Buck with three annuli attained an average length of 20 inches and an average weight of 1.6 pounds. Roe pickerel with three annuli attained an average length of 22.8 inches and a weight of 3.0 pounds. The bucks with four annuli reached a length of 22.1 inches and averaged 2.3 pounds. Roe fish with annuli reached a length of 24.7 inches and attained a weight of 3.8 pounds. Only one roe fish with five annuli was recorded. This pickerel was exactly 26 inches long and weighed three pounds and eight ounces. This fish was caught near station IV on March 11, 1950. The greatest increase in weight of the buck fish occurred between the fourth and fifth year (third and fourth annuli). The greatest increase in weight for the roe pickerel occurred between the third and fourth year (second and third annuli).

Spawning of pickerel in the Severn River during the spring of 1950 was first observed to occur on March 5, 1950. The surface water temperature that day was 5.8 degrees centigrade. Ripe and spawning fish were also recorded on March 9, 1950, and March 11, 1950. On May 1, 1950, seven pickerel examined showed only residual roe and milt remaining in the body cavity.

. . . . . .

## RECORD FISH

Longest fish on record from Maryland waters: 25.7 inches, 68 ounces. Taken by angling from upper part of Magothy River, February 25, 1951. Angler unknown.

Heaviest: 94 ounces, taken in Bush River in 1951 by John W. Byer, Jr. (These fish are listed in the Maryland Tidewater News, January-February 1957).

## HARVEST BY ANGLING

We have found chain pickerel recorded in the catch on only two of the waters on which we have made estimates of total harvest (by angling).

(a) Potomac River. The creel census of 1954 estimated 50 pickerel taken by angling, but all too small (or perhaps unwanted) to be kept by the fisherman.

(b) Deep Creek Lake. In early 1956, 611 chain pickerel were planted -- these fish averaged two pounds and all were legal size (14 inches). The creel census of 1956 estimated that 140 of this plant were removed by angling.

(c) Magothy River (Tidewater). Creel census from April 15 through August 17, 1957, estimated 950 chain pickerel taken. Total catch for area was 103,000 fish of 17 species. It is believed that census did not cover period of best fishing for pickerel.

In the waters for which we have only spot-check creel-census records, we find chain pickerel taken from the following places:

Linchester Pond, Caroline Co., 1952.
Harmony Pond, Caroline Co., 1952.
Smithville Pond, Caroline Co., 1952, 1951.
Garland Lake, Caroline Co., 1952, 1951.
Fairlee Lake, Kent Co., 1952.
13 Wicomico Co. ponds. Data not broken down by lake. 1952.
6 Worcester Co. ponds. Data not broken down by lake. 1952.
Millington Pond, Kent Co., 1951.
Wagners Pond, Anne Arundel Co., 1952, 1953.
South River, Anne Arundel Co., 1953. (Tidewater).
Shumakers Pond, Wicomico Co., 1953.
Seneca Creek, Baltimore Co., 1953. (Tidewater).
Severn River, Anne Arundel Co., 1953. (Tidewater).
Middle River, Baltimore Co., 1953. (Tidewater).
Johnson's Lake, Wicomico Co., 1953.
Tonytank Lake, Wicomico Co., 1953.

(Note that none of these records are subsequent to 1953. This is because we abandoned this type of creel census after 1953).

## STOCKING RECORDS

Chain pickerel are stocked in Maryland only for special purposes. There is very little demand from the fishermen for stocking this species, even though they seem to be a highly prized fish. This species was originally restricted to Coastal Plain freshwaters and upper tidal estuaries. It has since been stocked in inland streams and reservoirs.

Pickerel were stocked in Deep Creek Lake in 1930, 1931, 1956 and 1957.

1930. About 5000 six to twelve inch pickerel were stocked. These fish came from Fairlee Pond in Kent County.

1931. About 1½ million pickerel fry were planted in the lake. The source of these fish is unknown. See page 2 in Deep Creek Lake Report, 1948-52.

1956. 611 pickerel weighing, in total, about 1000 pounds were planted in Deep Creek Lake in March of 1956. The creel census estimated that 140 were harvested by angling in the period June 1 to Labor Day. These fish came from the tidal water at the head of the Bay. They were planted in Deep Creek Lake as part of a program of corrective stocking -- the scheme being to plant as many predators as possible in an effort to reduce the overabundant population of yellow perch. At this date we do not know whether the pickerel are feeding on yellow perch or not.

1957. 723 pickerel planted -- same source and general size. Creel census for this year not yet analyzed.

HATCHERIES. During the 1920's and 1930's a hatchery for shad and yellow perch was maintained at Fairlee in Kent County. This hatchery apparently also produced chain pickerel fry (and probably other species) but it is thought that this was a very minor part of its operation.

MARYLAND DEPARTMENT OF RESEARCH AND EDUCATION
Inland Resources Division
Solomons, Maryland

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# MAGOTHY RIVER CREEL CENSUS, 1957

by Harold J. Elser
Fishery Biologist

## MAIN POINTS

1. The rate of catch in the Magothy River was higher than that usually found in fresh waters of Maryland, but lower than that found in the only other similar survey in Maryland tidewater. See Table IV.

2. Fishing pressure was relatively light on a per-acre basis. See Table IV and Figure 4.

3. Recreational crabbing was almost as important as fishing during mid-summer. See Figure 3.

4. White perch and spot dominated the catch. See Table I. This was surprising because the River has a reputation for providing excellent fishing for yellow perch and chain pickerel.

5. There was a marked difference in the rate of catch of the five most important species as the season progressed. See Figure 2.

6. The heaviest fishing pressure occurred during the week which included the Fourth of July. See Figure 1.

7. Still-fishing from a boat and using natural bait was by far the most popular method of fishing. See Table II.

8. Casting was better than either still-fishing or trolling for catching yellow perch and white perch. See Table III.

9. Striped bass and largemouth bass were among the least important fish in the total catch. See Table I.

10. Seventy percent of the fish caught were year-round residents of the Magothy River (the other 30 percent were migratory). See Table I.

This report presents the results of a creel census conducted on the Magothy River, Anne Arundel County, Maryland, from April 15 through August 17, 1957.

A creel census, in its strictest sense, is an inventory of the angler's catch. This census, like most of those conducted in Maryland, is also a study of fishing pressure, of the angling population and the number and species of fish caught but returned to the water. In addition, data were gathered relative to methods of fishing, baits used and the number of people engaged in recreational crabbing.

The tables and figures are presented with a minimum of discussion; however, titles and subheadings are very carefully worded and definitions of doubtful terms are included.

The Magothy River is a tidewater tributary of Chesapeake Bay, located about 15 miles south of Baltimore. With its own tributaries it covers an area of about 5300 acres (see Figure 4). Its water ranges from fresh to moderately saline (from 0.0 up to 15 parts per thousand of salt depending on time of year) and its tide rises and falls about $1\frac{1}{2}$ feet.

The census was a joint effort by the Fish and Game Committee of the Magothy River Association (a property-owners organization) and the Maryland Department of Research and Education (a state agency). The Department planned the census and analysed the data, while the Association hired Mr. Willis Bilderback of Annapolis, Maryland, who did the field work.

The field work consisted of two parts: (a) interviews with fishermen to establish the average catch per man, the average number of hours per fishing trip, the time of day that people fished and several other statistics, and (b) counting fishermen on a rigid schedule to establish a basis for estimating the number of fishermen for the entire day. The analysis consists of estimating the average catch per man and the number of fishermen and multiplying the two figures to obtain an estimate of the total catch. A total of 1787 anglers, which is about a 14 percent sample, were interviewed during the season.

## DEFINITIONS

Certain categorizations in this report may leave the reader in doubt as to their exact meaning, therefore, this brief glossary is included. These definitions are exactly as set forth in the instructions to the creel-census field man.

Fisherman (or angler): Anyone who has a hook in the water -- this includes children.

Unsuccessful fisherman: One who has not caught any keeping-size fish by the time to stop fishing. This includes people who throw back all fish regardless of size.

Permanent resident: One who lives on (or within two miles) of the Magothy for at least six weeks each year. Also one who lives on the River week-ends only for at least ten weeks per year.

Temporary resident: One who resides on the River less than six weeks per year or less than ten week-ends per year. People who rent a cottage for less than six weeks come under this category.

Still fishing: Sitting still with bait stationary or moving slightly. Includes skittering, trot lining and bush-bobbing.

Casting: Casting, spinning or fly-casting. Bait is thrown out and retrieved.

Trolling: Any method in which the bait is towed behind the boat rather than thrown out and retrieved.

Boat fishing: Fishing from boats, rafts, airplanes, etc., whether drifting or anchored.

Bank fishing: Fishing from banks, piers, bridges, trees, rocks, boats tied to shore or to a pier and people wading in the water.

Natural bait: Fishing with worms, minnows, insects, etc. (any living organism). Also material such as crab meat, dough balls, pork rind on a plain hook (where emphasis is on taste or smell rather than on action).

Artificial bait: Any manufactured lure where the emphasis is on action rather than taste or smell. Combinations such as pork rind on a spoon are classed as artificial bait.

Fish kept: Fish caught and not returned alive to the water. Sometimes eels or toadfish are killed before being thrown back -- these were counted as fish kept.

Fish thrown back: Fish returned alive to the water.

TABLE I

ESTIMATES OF FISHING PRESSURE AND HARVEST, MAGOTHY RIVER, ANNE ARUNDEL COUNTY, MARYLAND. April 28 through August 17, 1957.

## FISHING PRESSURE

| | | |
|---|---|---|
| Number of angling trips | 12,600 | |
| by men | 10,000 | 79 % |
| by women | 1,500 | 12 |
| by children | 1,100 | 9 |
| Total number hours fished | 57,000 | |
| Average hours per trip | 4.5 | |
| Percent of unsuccessful trips * | 10 | |

| Residence of anglers: | |
|---|---|
| Permanent residents * | 44 % |
| Baltimore City | 34 |
| Anne Arundel Co. | 9 |
| Temporary residents * | 7 |
| Baltimore Co. | 6 |
| Other Maryland | ** |
| Out-of-state | ** |
| | 100 % |

## HARVEST

Fish caught per man-hour (keeping size) 1.8

Fish caught per fishing trip (keeping size) 8.2

Fish caught, by species: ***

| | Fish Kept | | Fish Thrown Back | |
|---|---|---|---|---|
| White perch | 56,000 | 54 % | 21,000 | (27 % of catch) |
| Spot | 30,000 | 29 | 8,600 | (23 " ) |
| Yellow perch | 6,800 | 7 | 710 | ( 9 " ) |
| Pumpkinseeds | 3,700 | 4 | 1,600 | (30 " ) |
| Brown bullheads | 2,900 | 3 | 490 | (15 " ) |
| Eels | 1,200 | 1 | 370 | (23 " ) |
| Chain pickerel | 950 | 1 | 650 | (41 " ) |
| White catfish | 670 | 1 | 150 | (18 " ) |
| Atlantic croakers | 510 | ** | 3,000 | (33 " ) |
| Bluegills | 260 | ** | 210 | (45 " ) |
| Striped bass | 220 | ** | 3,000 | (93 " ) |
| Toadfish | 180 | ** | 430 | (30 " ) |
| Silver perch | 150 | ** | 110 | (42 " ) |
| Carp | 30 | ** | | |
| Spottail shiner (Gudgeon) | 30 | ** | 30 | (50 " ) |
| Largemouth bass | 10 | ** | 20 | (67 " ) |
| Flounders (unidentified) | | | 20 | |
| Garfish (unidentified) | | | 50 | |
| | 103,500 | 100 % | 41,000 | |

Number of fish (keeping size) taken per 100 hours of fishing, 9 species:

| | | | |
|---|---|---|---|
| White perch | 99 | Eels | 2 |
| Spot | 52 | Chain pickerel | 2 |
| Yellow perch | 12 | Striped bass, keepers | 2 |
| Pumpkinseeds | 7 | Striped bass, throw-backs | 5 |
| Brown bullheads | 5 | | |

Number of fish harvested per acre 19.5

Period covered by estimates 16 weeks

* See text for definition.

** Less than $\frac{1}{2}$ of 1 %.

*** Nomenclature follows American Fisheries Society recommendations.

TABLE II

PERCENT OF VARIOUS TOTALS ACCORDING TO THE METHOD OF FISHING, MAGOTHY RIVER, MARYLAND, April 15 through August 17, 1957.

| Fishing method: | Number of Anglers | Hours Fished | Total Fish Kept | White Perch | Spot | Yellow Perch |
|---|---|---|---|---|---|---|
| Still fishing | 80 % (a) | 82 % | 76 % | 68 % | 90 % | 78 % (d) |
| Casting | 19 | 17 | 23 (b) | 32 | 10 | 21 |
| Trolling | 1 | 1 | 1 | 1 | * | * |
| Boat fishing | 92 % | 92 % | 97 % | 97 % | 97 % | 98 % |
| Bank fishing | 8 | 8 | 3 | 3 | 3 | 2 |
| Natural bait | 82 % | 83 % | 76 % | 67 % | 89 % | 79 % |
| Artificial bait | 18 | 17 | 24 | 33 | 11 | 21 |
| Various combinations of methods: | | | | | | |
| Still - Bank - Natural | 6 % | 7 % | 2 % | 2 % | 1 % | 2 % |
| " - " - Artificial | * | * | * | 1 | ** | * |
| " - Boat - Natural | 72 | 73 | 70 | 61 (c) | 85 | 75 |
| " - " - Artificial | 2 | 2 | 3 | 4 | 3 | 1 |
| Cast - Bank - Natural | 1 | 1 | * | * | 1 | ** |
| " - " - Artificial | 1 | * | * | * | * | ** |
| " - Boat - Natural | 3 | 3 | 3 | 4 | 2 | 2 |
| " - " - Artificial | 14 | 14 | 20 | 28 | 7 | 20 |
| Troll - " - Natural | * | * | ** | ** | ** | ** |
| " - " - Artificial | 1 | 1 | * | 1 | * | * |
| | 100 % | 101 % | 98 % | 101 % | 99 % | 100 % |

* Less than ½ of 1 %.
** None reported.

EXPLANATION: Totals do not always add up to 100 percent because figures are rounded off to nearest one percent; thus, a calculation of, say, 1.51 percent will be reported as 2 percent.

INTERPRETATION: Example (a) 80 percent of all the anglers contacted were still-fishing.

Example (b) 23 percent of all the fish kept were taken by people who were casting.

Example (c) 61 percent of the white perch kept were taken by people who were still-fishing from a boat and using natural bait.

Example (d) Warning: Do not confuse these figures with rate of catch. 78 percent of the yellow perch were taken by still fishing but this does not mean that this was the best method - it means only that 78 percent of the yellow perch were taken that way. Actually, Table III, showing fish caught per 100 hours of fishing, indicates that casting was the better method for taking perch.

TABLE III

FISH KEPT PER 100 HOURS OF FISHING, BY SPECIES AND BY METHODS OF FISHING, MAGOTHY RIVER, MARYLAND, April 15 through August 17, 1957.

| Fishing method: | Totals | White Perch | Spot | Yellow Perch | Pk & Bg | Cat-fish | Pick-erel | Eels | Rock kept | Rock ret'd |
|---|---|---|---|---|---|---|---|---|---|---|
| Still fishing | 158 (a) | 79 | 55 | 8 | 6 | 6 | 1 | 2 | * | 4 |
| Casting | 231 (b) | 176 | 30 | 11 | 5 | 4 | 1 | 1 | 1 | 7 |
| Trolling | 110 | 74 | 13 | 5 | ** | ** | ** | ** | 8 | 3 |
| Boat fishing | 179 | 100 | 53 | 9 | 11 | 17 | 3 | 9 | * | 5 |
| Bank fishing | 69 | 39 | 17 | 2 | 3 | 4 | 1 | 2 | ** | 1 |
| Natural bait | 158 | 77 | 85 | 5 | 4 | 6 | 1 | 1 | 1 | 4 |
| Artificial bait | 245 | 189 | 32 | 11 | 4 | 4 | 1 | 1 | 1 | 8 |
| Various combinations of methods *** | | | | | | | | | | |
| Still - Bank - Natural | 57 | 32 | 10 | 2 | 3 | 5 | 1 | 3 | ** | 1 |
| " - Boat - " | 163 | 79 | 58 | 9 | 6 | 6 | 1 | 2 | * | 4 |
| " - " - Artificial | 294 | 205 | 90 | 5 | 4 | 3 | 1 | 1 | 1 | 15 |
| Cast - Bank - Natural | 189 | 130 | 40 | 2 | 3 | ** | ** | 2 | ** | 5 |
| " - Boat - Artificial | 247 | 195 | 26 | 12 | 5 | 5 | 1 | 1 | 1 | 8 |
| Troll - " - " | 110 | 74 | 13 | 5 | ** | ** | ** | ** | 8 | 3 |

* Less than $\frac{1}{2}$ of 1.
** None reported.
*** Sample sizes for some combinations were too small to be significant and so were not included in the table.

EXPLANATION: The above table lists the number of fish taken for every 100 hours of fishing by all the anglers contacted during the study.
All species caught are not listed, so the figures for the separate species in the table add up to something less than that reported under "totals."
"Pk & Bg" means pumpkinseeds and bluegills.
"Catfish" means brown bullheads and white catfish.
"Rock kept" means striped bass caught and kept.
"Rock ret'd" means striped bass thrown back in the water (usually because they were undersized).
See text for definitions of methods of fishing; for instance, exactly what is included in such categories as "casting."

INTERPRETATION:

Example (a) There were 158 fish of all species taken per 100 hours of still fishing; 79 of these fish were white perch, 55 were spot, 8 were yellow perch, etc.

Example (b) As between still fishing, casting and trolling, casting appears to be best inasmuch as 231 fish were taken per 100 hours by this method, whereas still fishing yielded only 158 and trolling 110. However, trolling was the best for keeping-size rock as 3 were taken per 100 hours versus 1 for casting and less than $\frac{1}{2}$ of 1 by still fishing.

TABLE IV

## COMPARISON OF RATE OF CATCH AND OF FISHING PRESSURE IN VARIOUS BODIES OF WATER IN MARYLAND.

| Rate of catch expressed as fish kept per man-hour of fishing: ** | Per man-hr. |
|---|---|
| MAGOTHY RIVER, Anne Arundel Co., Md., 1957, 16 weeks, Apr. 15-Aug.17. | 1.8 |
| *Patuxent River at Solomons, 1952. Summer season. | 5.3 |
| Catwalk at Conowingo Dam, Cecil Co., 1955. 15 weeks, June 1-Sept. 12. | 0.9 |
| Catwalk at Conowingo Dam, Cecil Co., 1957. 29 weeks, Apr. 1-Oct. 19. | 1.0 |
| Susquehanna River, tidewater to dam, 1955. 15 weeks. | 0.2 |
| Susquehanna River, tidewater to dam, 1957. 29 weeks. | 0.4 |
| Deep Creek Lake, Garrett Co., Md. 1951-1956. June 1-Labor Day. | 0.2-0.6 |
| Potomac River, Oldtown, Md., to D.C. line, 1954. 22 wks. June to Nov. | 0.5 |
| Loch Raven, Balto. Co., 1952. 26 weeks, May 3-Nov. 2. | 0.8 |

* This was a volunteer-type census and its figures are felt to be higher than those which would have resulted from the type of census used on the Magothy River in 1957.

** Only the first two rivers are tidewater.

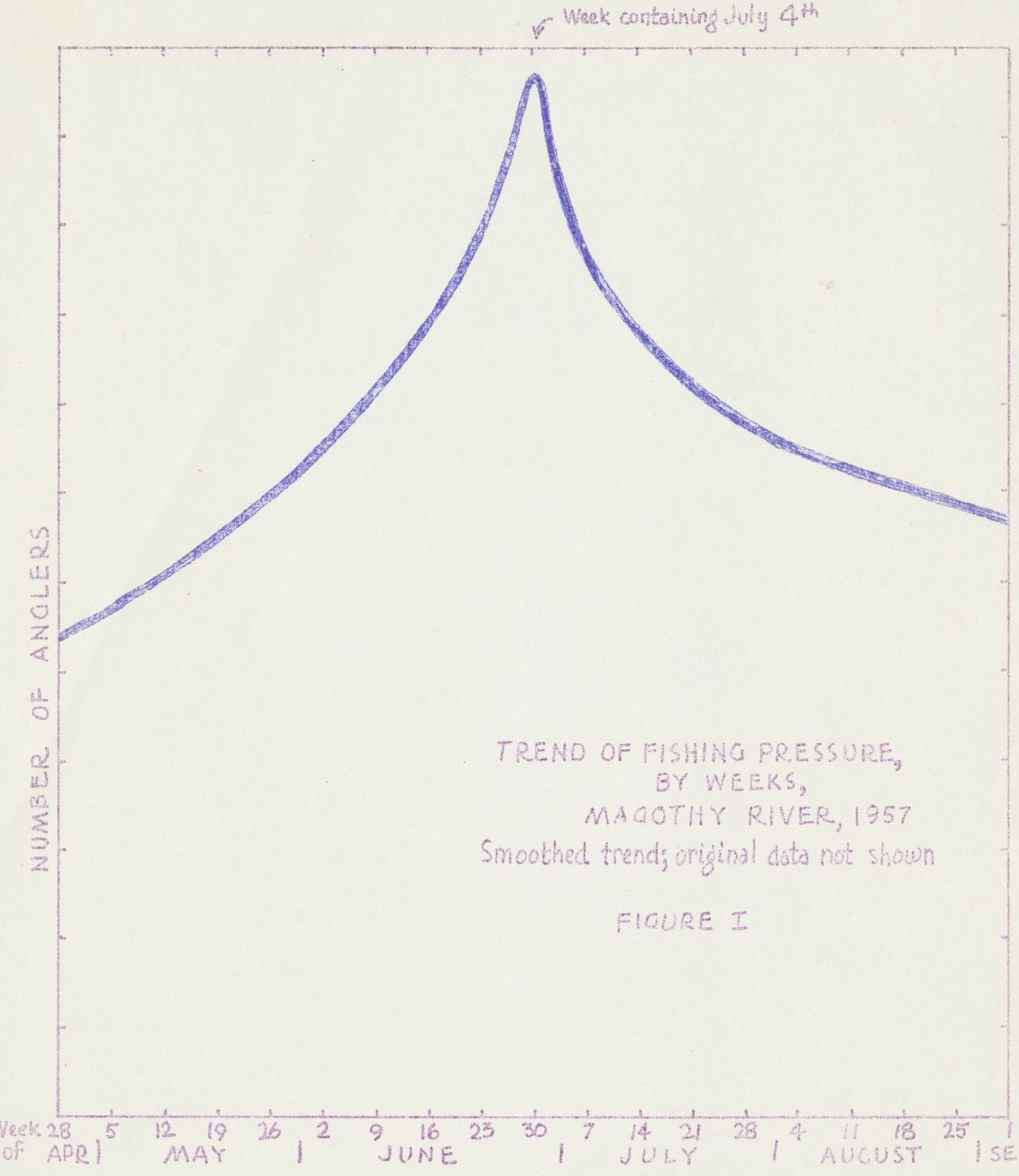
Fishing pressure expressed as number of fishing trips per acre for the period studied.

| | |
|---|---|
| MAGOTHY RIVER, 1957. 16 weeks. | 2.4 trips per acre |
| Susquehanna River, tidewater to dam, 1955. 15 weeks. | 18 |
| Susquehanna River, tidewater to dam, 1957. 29 weeks. | 44 |
| Deep Creek Lake, 1951-1956. 13 or 14 weeks. | 2.6 - 4.7 |
| Loch Raven, 1952. 26 weeks. | 4.1 |

Number of fishing trips and trips per acre, by zone, on Magothy River during census of 1957.

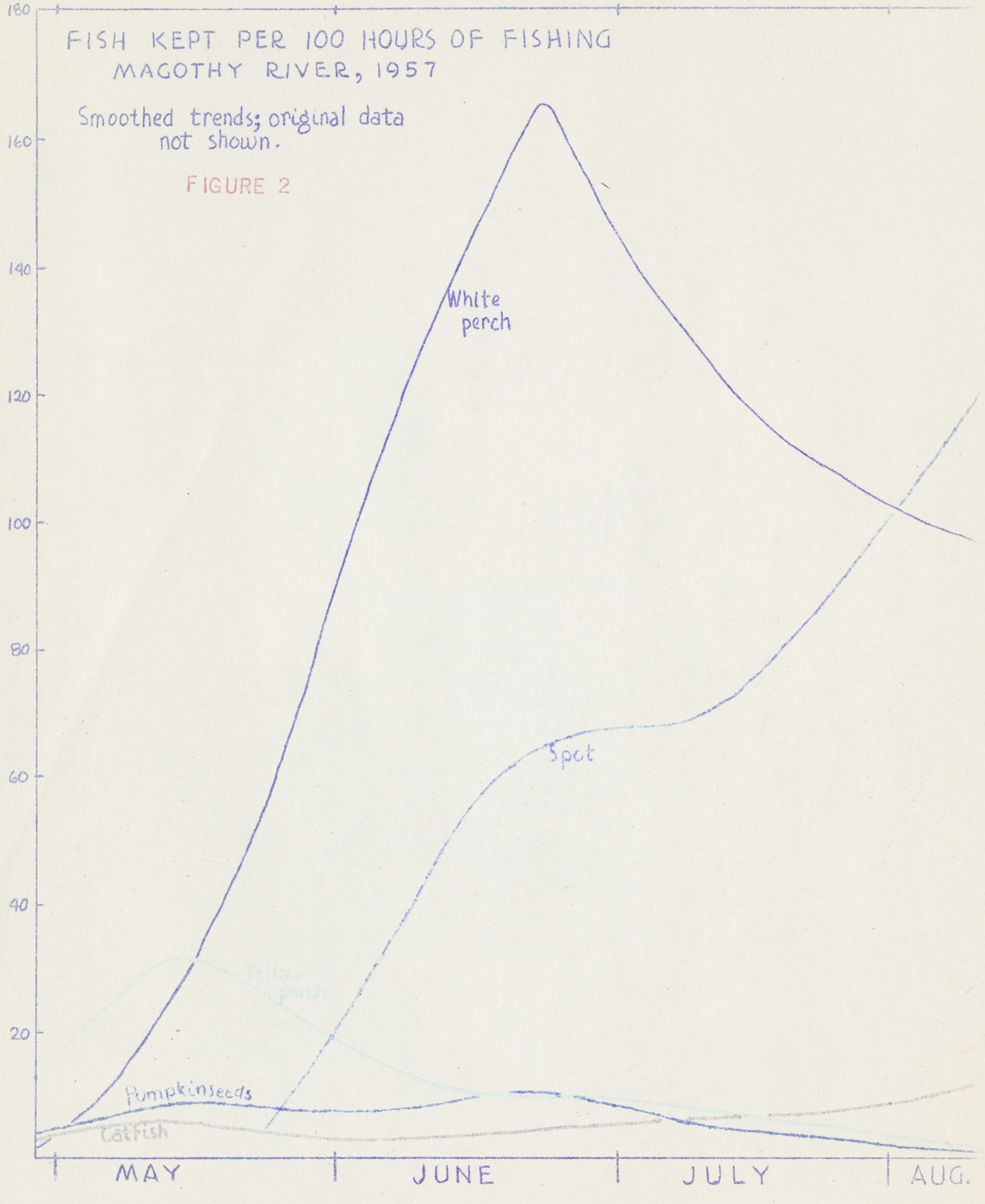
| Zone | Location | Approx. acres | Estimated trips | Percent of total | Trips per acre |
|---|---|---|---|---|---|
| A | Lower Magothy *** | 2010 | 2500 | 19.6 | 1.2 |
| B | Deep Creek | 74 | 140 | 1.1 | 1.9 |
| C | Sillery Bay | 800 | 1260 | 10.0 | 1.6 |
| D | Magothy Narrows | 230 | 650 | 5.2 | 2.8 |
| E | Cornfield Creek | 110 | 550 | 4.4 | 5.2 |
| F | Gray's Creek | 43 | 150 | 1.2 | 3.5 |
| G | Park Creek | 25 | 100 | 0.8 | 4.0 |
| H | Broad Creek | 190 | 500 | 4.0 | 2.7 |
| I | Forked Creek | 59 | 520 | 4.1 | 8.7 |
| J | Spriggs Pond | 11 | 80 | 0.6 | 6.9 |
| K | Middle Magothy | 720 | 1400 | 10.8 | 1.9 |
| L | Black Hole Creek | 54 | 90 | 0.7 | 1.6 |
| M | Dividing and Mill Creeks | 90 | 540 | 4.3 | 6.0 |
| N | Cypress Creek | 80 | 680 | 5.4 | 8.4 |
| O | Upper Magothy | 500 | 1300 | 10.6 | 2.7 |
| P | Cattail Creek | 137 | 920 | 7.3 | 6.7 |
| Q | Cockey Creek | 68 | 360 | 2.9 | 5.4 |
| R | Old Man Creek | 65 | 420 | 3.3 | 6.4 |
| S | Extreme Upper Magothy | 78 | 470 | 3.7 | 6.0 |
| | Totals | 5200 | 12,600 | 100.0 | 2.4 Average |

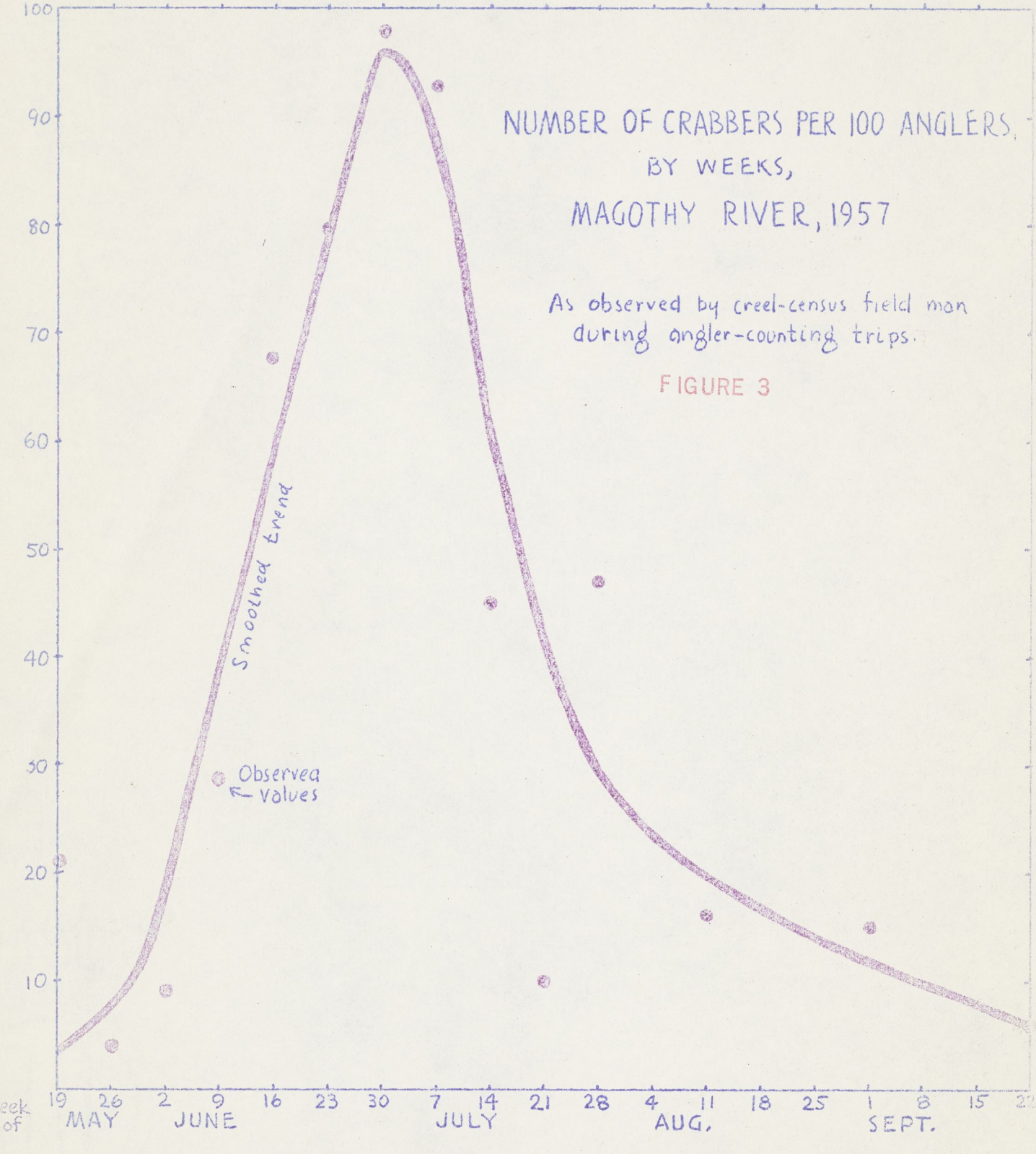
*** See Figure 4 for Zone boundaries.




TREND OF FISHING PRESSURE,
BY WEEKS,
MAGOTHY RIVER, 1957
Smoothed trend; original data not shown

FIGURE I

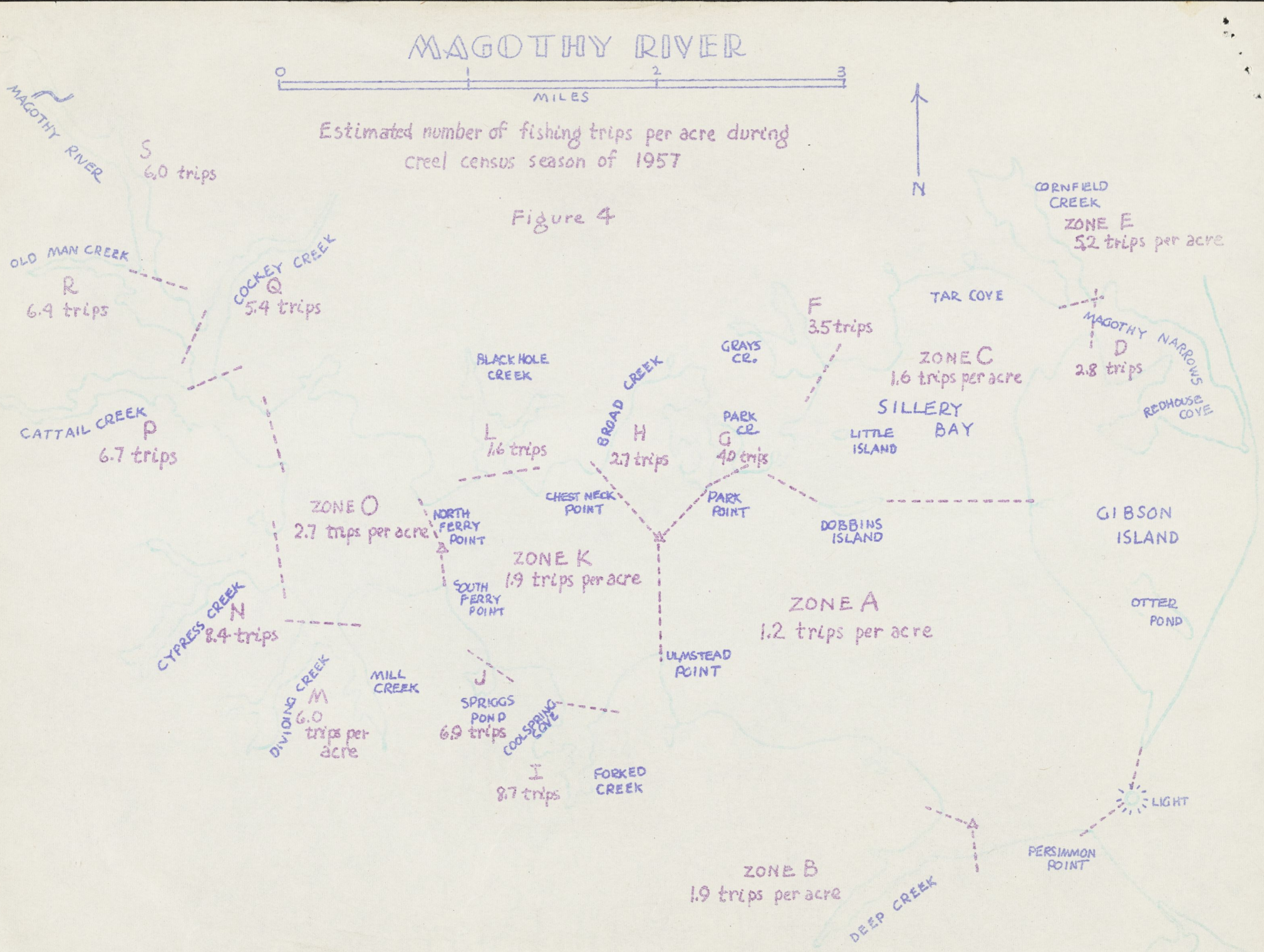

FISH KEPT PER 100 HOURS OF FISHING
MAGOTHY RIVER, 1957
Smoothed trends; original data not shown.
FIGURE 2
180
160
140
120
100
80
60
40
20
White perch
Spot
Yellow perch
Pumpkinseeds
Catfish
MAY
JUNE
JULY
AUG.




NUMBER OF CRABBERS PER 100 ANGLERS, BY WEEKS, MAGOTHY RIVER, 1957

As observed by creel-census field man during angler-counting trips.

FIGURE 3


MAGOTHY RIVER
0
1
2
3
MILES
Estimated number of fishing trips per acre during creel census season of 1957
Figure 4
N
MAGOTHY RIVER
S
6.0 trips
OLD MAN CREEK
R
6.9 trips
COCKEY CREEK
Q
5.4 trips
CATTAIL CREEK
P
6.7 trips
BLACK HOLE CREEK
L
1.6 trips
BROAD CREEK
H
2.7 trips
GRAYS CR.
PARK CR.
G
4.0 trips
F
3.5 trips
TAR COVE
ZONE C
1.6 trips per acre
SILLERY BAY
LITTLE ISLAND
CORNFIELD CREEK
ZONE E
5.2 trips per acre
MAGOTHY NARROWS
D
2.8 trips
REDHOUSE COVE
ZONE O
2.7 trips per acre
NORTH FERRY POINT
CHEST NECK POINT
PARK POINT
DOBBINS ISLAND
GIBSON ISLAND
ZONE K
1.9 trips per acre
SOUTH FERRY POINT
CYPRESS CREEK
N
8.4 trips
ZONE A
1.2 trips per acre
OTTER POND
ULMSTEAD POINT
DIVIDING CREEK
M
6.0 trips per acre
MILL CREEK
J
SPRIGGS POND
6.9 trips
COOLSPRING COVE
I
8.7 trips
FORKED CREEK
LIGHT
PERSIMMON POINT
ZONE B
1.9 trips per acre
DEEP CREEK