V Minnow.

IOWA STATE CONSERVATION COMMISSION
DIVISION OF FISH & GAME
914 Grand Avenue
Des Moines, Iowa

B I O L O G Y S E M I N A R

Held At

D E S M O I N E S, I O W A

J U L Y 11, 1950

Vol. I NO. 3

Fish & Game papers

Results of Spring Pheasant Crowing Count

By

Richard C. Nomsen

Check routes were begun early in April to establish the peak crowing period. Glen Sanderson set up his check route in Linn County north of Marion. My route was in Butler County west of Clarksville. Twenty seven checks were made on these routes. Maximum crowing was reached the morning of April 15th and continued for about one month. Counts were started by Officers as soon as they were notified the peak of crowing had been reached.

Counts were continued on these check routes to determine the duration of maximum crowing and to observe the variation of total calls heard caused by weather conditions. No definite conclusions or corrections can be determined from the results of the 14 counts that were taken on check routes during the period of maximum crowing. But, weather such as we had during the last half of April and the first half of May definitely lowered the counts on these check routes.

The following seemed to be indicated during the repeated checks on these routes. Temperatures from 22° to 53° had little or no effect on the count. Winds of over 8 miles per hour sharply lowered the count. Winds of 6 miles per hour or lower had very little effect on the total count. During maximum crowing we had several short periods of cool, wet, windy weather. Counts taken during these periods or immediately following them produced lower counts. Weather on the day preceeding the count seemed to have a noticeable affect on a count taken the next morning.

These are the results of the five counts taken by Glen Sanderson during the period of maximum crowing:

Date	Total of Calls Heard
April 15	150
April 17	160
April 20	144
April 28	150
May 12	141

The results on the route in Butler County are:

Date	Total of Calls Heard	Roadside Count Hens	Roadside Count Cocks
April 15	252	79	36
April 21	249	57	38
April 28	191	77	37
May 2	211	76	47
May 7	218		
May 11	263		
May 12	238		
May 14	237		
May 15	223		

Counts by Officers were taken between April 20th and May 22nd. The main purpose of this count is to obtain index numbers representing the pheasant population to be compared from year to year. Officers heard 29,828 calls at 3,778 stops. At 2.7 hens per cock -- the total figure is 111,628 birds. The sex ratio obtained from the Winter Sight Record Project is used to complete the count. Table 1 shows results by districts.

Records are kept for individual counties and of the Officer taking the counts. Only those routes repeated by the same Officers should be used for comparison next year. The difference in ones ability to hear calls would reduce the accuracy of this count. As long as routes are repeated by the same Officers -- whether he hears all or half of them -- the percentage increase or decrease should be indicated in the results of each succeeding count.

Results of this count can also be used to construct a pheasant distribution map. The first five stops of each route are averaged to give one figure; and so on for each succeeding five stop groups. The four figures for each route are then placed on a map along the route. Lines are drawn to enclose areas of different population densities as indicated by the average number of calls heard. The intervals used for this map of Iowa are:

Less than one call per stop
From 1 to 10 calls per stop
From 11 to 20 calls per stop
Over 20 calls per stop

Changing these intervals would, of course, change the appearance of this map.

Results of this count seem to be fairly good. I think we can improve on the accuracy by giving Officers more detailed instructions concerning weather conditions. We should instruct them not to take counts during or the day following periods of unfavorable weather such as sleet, snow or rain. Also, high winds are less likely to be encountered during periods of fair weather.

Results of Spring Pheasant Crowing Count - 1950
April 20 - May 22

Table I

District	Number of calls Heard	Number of Stops	Average Number of Calls Per Stop	Sex Ratio of Winter Count - Hens per Cock	Total Number of Birds Represented by Count
1. North West	7993	428	18.7	2.4	27,176
2. North Central	7424	397	18.7	3.0	29,696
3. North East	3277	433	7.6	3.4	14,419
4. West Central	3399	440	7.7	2.0	10,093
5. Central	3450	480	7.2	3.2	14,490
6. East Central	2435	360	6.8	3.5	10,958
7. South West	826	360	2.3	1 & 1.6	2,045
8. South Central	685	440	1.6	1 & 1.6	1,533
9. South East	339	440	1.0	1,1.6,3.5	1,218
State	29,828	3,778	7.9		111,628

Pheasant Hunting Success - Fall 1949

This report includes the results of a post-season questionnaire which concerned hunter activity and of 1,793 hunter interviews made by Officers during the season. Hunter interviews are used to calculate the time to bag each bird and the percentage of birds lost for hunters with and without dogs.

Most hunters were out opening day and the first weekend. The only extensive weekday hunting was in central and east central Iowa. Seventy three percent of

the Officers said that weekday hunting was not extensive. Exactly half of all hunters interviewed were contacted in a county other than his county of residence.

Roadside hunting increased again this year. Of 32 Officers reporting, three reported less, eight said the same and 21 estimated an average increase of 30% in roadside shooting.

The increased use of dogs was pretty general throughout the State. In 1948, 24% of the parties used dogs or one dog to eleven hunters -- compared with 28% of parties with dogs and one dog to 10 hunters in 1949. North Central and West Central Iowa experienced the greatest increase in the use of dogs.

Officers made 1,793 interviews in the field during the 1949 pheasant season. The 5,673 hunters contacted worked 17,349 hours to bag 4,967 birds or an average time per bird bagged of three hours and thirty minutes. The time per bird was three hours and eighteen minutes in 1948.

All studies made in 1949 agreed that the pheasant population was up from 1948. It could be expected then, that it would take less time to bag each bird. But these figures indicate that is not always true. South Dakota experienced similar results last Fall. In the past, their time per bird decreased while the pheasants increased -- as could be expected. However, in 1949, the time per bird increased along with their estimated increase in pheasants.

The early crop harvest probably affected the hunting success in Iowa. As of November 12, 1949, 90% of the corn had been picked. In 1948, 74% was picked by November 8th. Hunters were forced to work in lighter cover than usual and most birds flushed out of range.

Although it took more time to bag each bird, more birds were checked per hunter in 1949. There were 89 birds for each 100 hunters in 1949; and in 1948, there were 81 birds per 100 hunters. Thus, birds per hunter increased 10% but it took the average hunter 6% more time to get each bird.

Hunters using dogs in 1949 had better success than in 1948, while those without dogs required more time to bag each bird.

Table I compares the hunting success of hunters using dogs and those who did not.

Table I

Hunting Success - With and Without Dogs

	With Dogs		Without Dogs	
	1948	1949	1948	1949
Hours per bird bagged	2.8	2.7	3.4	3.9
% of birds shot down and not found	11%	9%	20%	21%
Birds in bag for each bird lost	8.4	11.4	4.1	4.1

In 1949, hunters with dogs required one hour and twelve minutes less time to bag each bird than the hunters without dogs. Those with dogs lost only 9% of all birds shot down while dogless hunters lost 21%. Dogs saved a dozen birds out of each 100 shot down that otherwise would have been lost.

This saving of time and increased utilization of birds has also been shown from data on hand from past seasons. These data were processed further to determine the birds lost by hunters using the different type dogs. Table 2 lists the types of dogs used and the percentage of birds lost for the 1948 and 1949 seasons.

Table II

Type of Dog	Percent of Birds Shot Down and not Found		Average
	1948	1949	
Labrador	9.6%	5.4%	7.0%
Chesapeake	6.9%	7.9%	7.4%
Pointer	7.1%	9.4%	8.2%
Springer	10.9%	7.3%	9.1%
Setter	13.8%	6.1%	10.0%
Cocker	11.0%	14.2%	12.6%
Mongrel	23.0%	10.2%	16.6%
All Dogs	11.0%	9.0%	

Labradors, Chesapeakes and Springers lost fewer than average each year -- pointers also lost fewer than average in 1948 and setters lost below average in 1949. Averages for the two years place the dogs in the order listed in Table II.

Table III lists by Districts the hours per bird bagged for all hunters contacted during the 1949 season.

Table III
Hours Per Bird Bagged -- Fall 1949

District	Hours per bird bagged
1 North West	3.2
2 North Central	3.1
3 North East	3.5
4 West Central	3.6
5 Central	4.3
6 East Central	4.1
All Countes open 7 days	3.9
State	3.5

According to the Sight Record Project last Winter, the sex ratio was reduced to 35 cocks per 100 hens during the 1949 season.

1950 Spring Quail Activity
by

M. Elden Stempel

Near the time of the 1950 winter check on quail, the coveys began to split up and to range more widely. Following quail during the spring and summer periods is not the simple routine of winter when weather and food conditions cause quail to remain within well defined areas.

Spring 1950 was late. The department of agriculture stated that crops were several days later than normal. The temperature average for March is given by Iowa Climatological data as 5° below normal, and March was among the 25% of the coldest Marches on record. There were a total of only 6 spring-like days during March. Crops in July are estimated as being 10 days later than normal, but some of the early trees, by records kept by the biologists, were leafing at about the same date as in 1949 and 1948.

Since early May 1949 was warm, and in a small sampling of quail in the 1949 season, one of 7 coveys was not completely matured, it may be that there will be a higher percent of immatures in the fall of 1950.

April was 6.3° below normal, and the most backward since 1920. There was a brief warm period the middle of the month after the 15th, however, and at that time paired quail were observed by the biologist and by Conservation Officers and other observers over much of the quail range. The last large covey reported was seen on April 13th by Conservation Officer Bill Boswell, in Appanoose County.

Pairing

Ordinarily some pairing occurs temporarily in late February or in early March, there is regrouping of coveys and the breakup is permanent by mid May.

On the Wapello county check area it was noted in late February that trails of pairs of birds were frequently encountered when in suitable snow for tracking, often it was indicated that two birds had flown into an area near the feeding grounds, had alighted near one another, and had continued together for some time wandering about and finally rejoining the main flock. None of the pairs were seen, but because of the date, it was assumed that this was early pairing. The biologist saw the first pair of quail in Keokuk county on April 15th. Since then four pairs have been

observed on the Wapello County check area. In late winter this area contained 35 quail.

Earliest Observed Pairing of Quail, 1950

County	Date
Keokuk	April 15
Davis	April 16
Appanoose	April 22
Wapello	May 7
Benton	May 8

Pairs observed on the Wapello county check area were frequently seen by both the biologist and by the farmers on the area until June 10th. Since that time the quail pairs have not been so much in evidence. Usually single males are now seen.

The week of April 15 to April 22 well distributed reported indicate that pairing neared completion, and on May 8th, Bob Cleary reported that on an area under observation he found only paired quail. The last covey was reported seen in Appanoose county on April 13th.

It is assumed, until brood counts are possible, that because single quail are usually seen since June 10th, that brooding was then well under way, and some young birds will be old enough to locate with a dog by the third week in July.

Klimstra found that his study on the Eldroa area, that coveys had permanently broken up in 1946 and 1947 by May 16th. Spring 1950, was similar in seasonal advancement to 1947.

Calling

Calling of quail begins with the first warm weather indicating that winter is on the way out. Early calling is irregular. Warm spring weather comes before regular calling occurs. Calling is most frequent from daylight to 8 a.m., and from about 4 p.m. until sundown. Occasional "bobwhite" calls may be heard through the day, but not at regular intervals. Under ideal conditions when undisturbed, the male may call at regular intervals. Many times calling has been heard at ten second intervals. There is much variation from this pattern, however. In March and April 1950, calling was irregular. On areas sampled by the biologist, there were several days at a time when, during morning and evening listening periods, no calling was heard. Clyde Updegraff, at the state game farm at Boone, reported the first calling quail in early March. Scattered areas reported occasional calling during March and April but it was not until April 7th when the high temperature was

68° F. that enough calling was heard to indicate that calling was general among cock quail.

Cloudy or windy days seem to affect the calling of quail and a late, dark or rainy morning may be the cause of delay in morning calling, or it could cause earlier afternoon calling. An example of this is the calling heard from one station on the Wapello county check area at 6 a.m. on July 3rd. Five calls from all quail calling during one minute at 6:50 a.m. At 7 a.m. from from 7:00 till 7:01, 21 calls per minute. During the first period, at 6:50 there were clouds over the sun. At 7:00 it was clear. Temperature was about 75°.

Bob White calls can be heard on a calm day for about one half mile. In census work only the full noted "Bob White" calls are counted as certain call notes of larks, robins, cardinals, and starlings can be confused with other quail notes. "Bob white" calls are imitated by starlings, but this is done mostly in winter and in summer only an occasional faint, slurred "Bob White" call is given by the starling.

It is anticipated that the 1950 peak of calling will come the middle of July. Except for the "Bob White" call both hen and cock quail sound most of the notes in the quail vocabulary. Klimstra records a hen as having given a faint "Bob White" call. Stoddard lists eleven calls as being given by quail. These notes resemble in purpose, the calls of other fowl, and the tone, number and pitch of various notes indicate to even a novice, loneliness, feeding, alarm, fighting, and so on. Except for the "Bob White" call the other quail call notes can be heard throughout the year. The dawn call of coveyed quail is common on quiet days, and most quail hunters are familiar with the plaintive call of young birds after the covey has been scattered early in the season. Since calling accompanies and corresponds in intensity to the progress of the mating and nesting season, it is believed that the "Bob White" call is the result of stimulation peculiar to the coming of warm spring and summer weather. After the middle of July, the calling falls off, and it is seldom heard after early August.

In studies on the Eldon Area in Davis County, Klimstra stated that both mated and unmated cock birds were calling. Clyde Updegraff stated to the biologist that both mated and unmated birds called on the game farm. Stoddard wrote that calling cocks were largely unmated birds.

Quail Calling 1950 Earliest Recorded Date

March (early)	Boone County
"	Keokuk County
"	Davis County
April 7	Appanoose County (first general calling)
April 17	Story County
April 17	Lee County

Morning Calling of Cock Quail Wapello Co. Check Area

Late May	4 calling birds
June 6	6 " "
June 7	8 " "
June 26	8 " "
July 3	8 " "

Counts of calling cock quail were made from three stations on the Wapello County check area, and there was five or more listening time minutes at each station. Usually the same number of quail were calling in the morning and in the evening. Few of the quail were heard calling from the center of the area. One quail that had a hoarse voice was heard to call at various times from different places, but always in the south end of the area. Points from which he called were separated by a distance of as much as one half mile.

Besides work done on the Wapello county check area, one route has been run twice in Wapello county. First run on Jun 1 at 6 p.m. when 9 birds were calling. On July 5th the route was run again, and 16 birds were calling. The route is 12 miles long, and stops one mile apart. One minute listening time at each station. On the dates of July 5, four was the most birds heard calling from one station. On July 1 three birds was the most heard calling from one station. On the Linn County area Lloyd Kiefer reported four birds calling recently, in the early morning. This area contained 19 birds during the later winter. On the Wapello county check area, eight birds have been calling during early morning. There were 35 birds in this area at the time of the winter check.

It seems probable that the greater increase occurred on the Wapello county check run than in the area because listening was done on the area for longer periods at each station.

Nesting and Young 1950

To date about 25 acres of alfalfa has been mowed in the Wapello county area, and no quail nests were seen. One nest was plowed under in corn stubble on June 5th. Conservation Officers Charles Olafson,

Cecil Schomer and William Boswell have reported seeing young quail in 1950.

Nesting data for 1949
Keokuk County June 9th nest of 15 eggs.
Keokuk County June 23rd nest of 16 eggs.

Young Seen - 1949	Estimated Hatching Date
Clarke County	June 1
Warren County	July 20
Keokuk County	July 30
Keokuk County	September 15

Nesting Data - 1950

Date reported	County	No. of Broods	Est. Hatch Date
June 5	Mahaska	1	June 1
June 5	Wapello	1 (nest)	June 25
June 12	Davis	2	June 5
June 23	Appanoose	1	June 10
July 7	Wapello	1	June 1
July 7	Mahaska	1	June 1

The figures for 1949 show the distribution of hatching dates. First numerous reports of young in 1949 were received during August. It would appear that in spite of a late cold spring in 1950 the early hatch parallels that of 1949.

Summary

1. Spring 1950 was classed by the Department of Agriculture as being about 10 days later than normal.
2. Pairing of Iowa quail in 1950 was under way by April 15, 1950.
3. Calling of quail was general by the middle of April.
4. Earliest reports of quail hatch in 1949 was bout June 1 and near the same date in 1950.

Literature Cited

Stoddard, H. L. and others 1931 - The Bob White Quail; Its Habits, Preservation and Increase. Charles Scribner's Sons, New York, 550 pp.

Klimstra, W. D. 1950 Notes on Bob White Nesting Behavior Reprint from Iowa Bid Life, Vol. XX No. 1, pp 2-7.

Iowa Climatological Data U. S. Dept. of Agriculture

The 1949-1950 Raccoon Season

By

Glen C. Sanderson

In October, 1949 all Conservation Officers were asked to supply the names of several raccoon hunters from their respective areas. In addition to the names furnished by the Officers, the names of several hunters were secured by the writer during his trips around the State. Thus, more than 630 raccoon hunters were contacted by letter which explained the purpose of the project and outlined the information the hunters were asked to collect. A form for recoeding their information was sent with the letter. The hunters were asked to return their completed blanks soon after the close of the hunting season (January 10, 1950). By May 10, 1950, 49 of the more than 630 hunters contacted has reported. Table I shows the information these hunters collected and reported.

Although only 49 (slightly less than 8 per cent) of the hunters reported, Table I reveals that the 49 hunters did contribute valuable information to bhe raccoon project. The table further shows that 25 of the 49 hunters saved 255 raccoon penis bones. Answers given by the hunters reveal that the average hunting party contained three people, that the party hunted an average of 3.3 hours, that the party caught slightly more than half a raccoon per hour of hunting (.57), and that the party caught two raccoons per trip. Their answers further show that the average hunter hunted 10 times, that 50 per cent of the hunting was done during the first 10 days of the open season, that only six per cent of the hunting was done during the last 10 days of the open season, that 57 per cent of the raccoons were caught during the first half of the season, and that only four per cent of the catch was taken during the last 10 days of the season. These figures show that the catch was roughly in proportion to the number of trips made; however, there was a slightly higher catch <u>per trip</u> early in the season, especially during the first 10 days of the season. However, the hunting success <u>per party per hour</u> remains fairly constant throughout the season; in fact the last 10 days of the season shows the highest return per hour of hunting (Table I). This bit of evidence seems to refute the idea that Iowa raccoon hunters have poor hunting success late in the season because of unfavorable weather conditions. Of course, it must be realized that these average figures are probably not representative for the majority of the raccoon hunter in the entire state, because the more successful hunter usually send in their reports in a higher proportion than do the less successful hunters.

A minimum figure for the number of raccoon hunters in the state may be computed from the information available. Fur buyers report a total harvest of 58,500 raccoons for 1949-50 (Table II). Figuring that the average hunter took 18 racooons during the season (Table I), this means a total of 3,300 raccoon hunters in the state. This figure undoubtedly represents only a tiny fraction of the total racoon hunters in the state, because only the better hunters were contacted in the first place, and on the basis of other hunter reports, and as noted above, it is usual for the more successful hunters to report in a high proportion than the less successful hunters.

The age-ratio, as determined from the penis bones, of the 255 males for which information is available, is 1.77 young per adult. To state it another way, young males comprised 64 per cent of the male harvest. Figures are not available for the females, but in the absence of evidence to the contrary, it is assumed that the age-ratio is the same in the male and female components of the population. This age-ratio compares to an age-ratio of 1.28 (56 per cent young) young males per adult male in Missouri for the 1948-49 season and 1.4 (59 per cent young) young males per adult male for raccoons taken near Burlington, Iowa over a period of years prior to the 1948-49 hunting season (Sanderson, 1949).

If it is true that a rising population is associated with an increase in the percentage of young in the population, then this information is an indication that the racoon population may be higher this year than it was in 1948-49. The hunters were asked if they believed the raccoon population was HIGHER or LOWER in 1949-59 than it was in 1948-49. Thirty-six replied to this question; 53 per cent believed the population was higher in 1949-50 than in 1948-49, 39 per cent believed it was lower, and eight per cent said the population was the same. Fur buyer's reports show a slight decline in the harvest from 1948-49 to 1949-50 (Table II), but these figures may not be a true indication of the abundance of raccoons because of the low value of raccoon fur (Table II) and other factors.

It is interesting to note that since 1939 (when information is first available in Missouri) the raccoon population in Missouri and Iowa (as revealed by fur reports in Iowa and fur reports and tag data in Missouri) show similar population curves, except for a higher total harvest in Missouri. This is true in spite of the fact that the regulations in the two states have varied. Since 1931 Iowa has apparently had a 60 day season on raccoons with no bag limit or other restrictions. Iowa's season opened on November 10th and closed January 10th during

this entire period. While on the other hand, Missouri reduced their open season from 46 to 31 days in 1940; this reduced season remained in effect until the 1943-1944 hunting season when it was increased to 46 days again. The 31 day seasons opened on December 1, as did the 46 day seasons for all years except 1939. In 1939 the Missouri season (46 days) opened on November 15th. Missouri also instituted a bag limit of 10 raccoons per hunter in 1940. Ten free tags were issued to each hunter to gain information on the raccoon population and as a means of enforcing the bag limit. The tags were not required for the 1946-47 hunting season, but the bag limit of 10 raccoons per hunter was not removed until the 1948-49 season (Sanderson, 1949 for details of the Missouri information given above).

This information seems to indicate that restrictive regulations had little effect on the raccoon population in Missouri. This may be true, but it must be realized that there are other factors to consider. In Iowa, the weather usually restricts hunting somewhat during the latter part of the open season. This probably acts as a natural check on the racoooon harvest here. On the other hand, the Missouri weather is more open and hunting continues until the season closes on January 15th. Without the restrictive regulations imposed in Missouri, the raccoon population might have recovered more slowly than it did. It is appareht that a reduction of the open season from 46 to 31 days and the institution of a bag limit, drastically reduced the Missouri harvest from 1939 to 1940 (Table 4).

The sex composition of the raccoon population is believed to be another key to whether the population is increasing or decreasing. Raccoon hunters reported the sex of 840 raccoon--424 females and 416 males (Table I). In addition to these, the writer examined 901 cased pelts in fur houses--489 females and 412 males (Table III). The totals for the state are 913 females to 828 males or 90.7 males per 100 females. There are no Iowa figures available for comparison, but this compares to 100 males per 100 females in Missouri last year. The Iowa ratio is believed to be a more favorable condition for an increasing populatioh, so far as sex compostion goes, than the Missouri ratio because the raccoon is a polygamous animal.

Table III further reveals that there are 116 parous females and 373 non-parous (did not give birth to young) females in the 901 cased pelts examined. If 65 per cent of the pelts examined were young of the year (Table I), then there were 577 young to 116 parous females or an average of 5.0 young (of both sexes) per parous female in the harvest. This compafes to 78 parous females

in a sample of 266 cased female pelts examined in Missiouri during the 1948-49 season, for an average of 3.8 young per parous female (Sanderson, 1949). This may indicate a higher average litter size for this year in Iowa than for last year in Missouri, or it may indicate that Iowa hunters take a higher proportion of young animals throughout the season than do the Missouri hunters. Probably it indicates that both statements are true. That the second factor probably has an effect on the number of young animals per parous female in the harvest is indicated by the fact that Iowa's hunting season opens 20 days earlier than Missouri's season. Young animals are taken in a higher proportion during the early part of the season (Sanderson, 1949) than they are during the latter part of the season. During the latter part of the season when the older animals are sexually active and wandering quite a bit, and are thus more vulnerable to capture, winter weather often prevents Iowa hunters from going out, while the milder weather in Missouri allows a continued harvest there. Figures for Iowa reveal that only a small percentage of the harvest is taken after December 10th (Table I). There are no comparable figures available for Missouri, but it is expected that Missouri would show a higher proportion of the harvest taken later in the season when the adults are more active.

Thus, in spite of the fact that reports from fur buyers show a slight decline in the raccoon harvest (Table II), it is believed that the raccoon population is still on the increase in Iowa or is near a peak. There are no indications that the population is on the decline. A comparison of the data for succeeding years may reveal what the Iowa raccoon population is doing. At the present time the only information available for comparison is the limited information available from Burlington, Iowa for a period of years prior to the 1948-49 hunting season and the Missouri raccoon information. However, conditions in the two states should be similar enough to allow a valid comparison of the two raccoon populations.

SUMMARY

1. Of more than 630 raccoon hunters contacted by letter, only 49 replied.

2. Information reported by the 49 hunters revealed that a hunting party caught .57 raccoon per hour of hunting, that 50 per cent of the hunting was done during the first 10 days of the open season, that 57 per cent of the raccoons were caught during the first 10 days of the open season, that 88 per cent of the catch was taken during the first half of the season, and that the hunting success per party per hour remains fairly constant throughout the season, although there is a slightly

higher catch per trip early in the season.

3. The age-ratio, as determined from 255 penis bones, is 1.77 young per adult.

4. Of the 36 hunters who replied to the question, 53 per cent believed that the population was higher in 1949-50 than it was in 1948-49, 39 per cent believed that it was lower, and eight per cent believed that it was the same.

5. Since 1939 at least, the Iowa and Missouri raccoon population trends have been quite similar in spite of differences in the regulations in the two states.

6. The sex ratio of 1,741 raccoons (as reported by hunters and examined as cased pelts in fur houses) was 90.7 males per 100 females (828 males and 913 females).

7. There were 577 young raccoons to 116 parous females or an average of 5.0 young per parous female in the harvest as determined by an examination of cased pelts.

8. It is believed that Iowa's raccoon population is still on the increase or that it is at or near its peak.

Table I - Data From The 1949-50 Raccoon Hunter's Reports.

Total No. Hunters Reporting	49	
No. Hunters Who Took no 'Coons	3	
No Hunters who Saved Penis Bones	25	(Saved 255 bones)
A. No. in Hunting Party	2.94	(360 parties totaled 1059 hunters)
Av. No. Hours Hunted by each party	3.35	(360 parties hunted 1207 hours)
Av. No. Coons Taken per hour per party	157	(688 'coons taken in 1207 hours)
Av. No. 'coons taken per Hunting Trip	1.91	(688 'coons taken by 360 hunting parties).
Per Cent of Catch that were Females	50.5	(840 'coons reported as to sex 424 F - 416 M).
% of Juveniles in Male Catch (Penis Bone Criterion)	63.9	(255 bones:163 juvs. - 92 ad.)
Per Cent of Hunters Who Reported more 'coons this Year Than Last	53	(39% said fewer, 8% said same; 36 reported).
Av. No. Times Each Hunter Hunted	10.4	(34 hunters reported 355 times)
Per Cent Hunting Trips Made During 1st 10 days of Season Nov. 10-19 incl.	49.9	(177 trips of 355 total trips).
Per Cent Hunting Trips Made During 1st half of Season (Nov. 10-Dec. 9 incl.)	83.9	(298 trips of 355 total trips.)
Per Cent Hunting Trips Made During Last 10 days of Season (Jan. 1-10 incl.)	6.2	(22 trips of 355 total trips.)
Per Cent of Catch Made During 1st 10 Days of Season (Nov. 10-19 incl.)	57.3	(407 'coons of 710 reported as to date).
Per Cent of Catch Made During 1st Half of Season (Nov. 10-Dec. 9 incl.)	87.7	(623 'coons of 710 reported as to date).
Per Cent of Catch Made During Last 10 days of season (Jan 1-10 incl.)	4.4	(31 'coons of 710 reported as to date).
Total N. Hunters Contacted by Letter	630	This is a minimum figure because some conservation Officers contacted hunters.
Per Cent of Hunters Contacted Who Returned the Form	7.8	(49 hunters of 630 contacted).

Table I - Continued

Total Number of Raccoons Reported by the 49 hunters	889	
Average Number of Raccoons Caught by Each Hunter Reporting	18.1	
AV. No. 'Coons Taken Per Party Per Hour During 1st 10 days of Season (Nov. 10-19)	.66	(407 'Coons in 619 party-hours)
Av. No. 'coons taken per party per hour During 1st Half of Season (Nov. 10-Dec. 9)	.58	(623 'coons in 1078 party-hours)
Av. No. 'coons Taken per Party per Hour During Last 10 Days of Season (Jan. 1-10)	.69	(31 'coons in 45 party-hours)

TABLE II - Raccoon Harvest and Average Value Received Per Pelt in Iowa From 1930-31 to Date - as Reported By Fur Buyers.

SEASON	No. of Pelts Bought By Dealers	Av. Value Per Pelt	Total Value
1930-31	11,740	$ 4.50	$ 52,830.00
1931-32	12,951	4.40	56,984.40
1932-33	10,468	2.60	27,216.80
1933-34	15,447	3.45	53,292.15
1934-35	14,719	3.50	51,516.50
1935-36	19,353	3.95	76,444.35
1936-37	15,037	4.00	60,148.00
1937-38	13,287	3.65	48,497.55
1938-39	15,014	2.80	42,039.20
1939-40	16,465	2.45	40,339.25
1940-41	19,756	3.71	73,294.76
1941-42	22,513	4.90	110,308.80
1942-43	20,128	3.65	73,467.20
1943-44	38,303	7.25	277,696.75
1944-45	36,803	2.75	101,208.25
1945-46	41,084	2.89	118,732.76
1946-47	61,880	1.97	121,903.60
1947-48	55,601	2.61	145,118.61
1948-49	61,419	2.23	136,964.37
1949-50	58,527	1.95	114,127.65
20-YEAR TOTALS	560,494		1,782,130.95
20-YEAR AVERAGE	28,025	3.29	89,106.55

TABLE III - Sex-ratio and breeding history information of the 1949-50 raccoon population obtained by the examination of cased pelts in fur houses, and from reports submitted by hunters.

	A From Cased Pelts	From Hunters	Totals
MALES	412	416	828
FEMALES:	(489)*	424	913
Parous	116		
Non-parous	373		
	901	840	1,741

Computed from the above data:
No. of young of the year animals[1] --------- 577
which gives
5.0 young raccoons per parous females in the harvest.

Sex-ratio: 90.7 males per 100 females in the harvest
or
52.5 per cent of the harvest was females.

*Total of the parous and non-parous females.

[1] Obtained by multiplying 901 by 64% (The per cent of young in the harvest.)

Table IV - Racconn Harvest as reported by fur buyers and Regulations Concerning the Harvest in Missouri, 1939 to 1949.

SEASON	No. of Pelts Bought By Dealers	Length of Season (days)	Opening Date	Bag Limit	Tags Required
1939	29,000	46	Nov. 15	None	No
1940	11,000	31	Dec. 1	10	Yes
1941	13,517	31	Dec. 1	10	Yes
1942	14,547	31	Dec. 1	10	Yes
1943-44	30,644	46	Dec. 1	10	Yes
1944-45	38,106	46	Dec. 1	10	Yes
1945-46	53,347	46	Dec. 1	10	Yes
1946-47	77,564	46	Dec. 1	10	No
1947-48	71,804	46	Dec. 1	None	No
1948-49	79,000	46	Dec. 1	None	No

Iowa Waterfowl Migration
Spring 1950

Weather conditions during the spring of 1950 caused delay in the arrival and departure of waterfowl in Iowa. Early migrants (Mallards, Pintails, and American Mergansers) reached the Ruthven Area following the first spring thaw of March 4-7. Several thousand ducks and a few flocks of geese were reported in northwestern Iowa prior to March 7, 1950. This date, however, marked the first major advance of migratory waterfowl across Iowa. There were earlier reports of some migrants working northward along the major rivers of the state, but these few were harbingers of migrants yet to come.

On the afternoon of March 7, 1950 low cumulus clouds gathered rapidly in northwest Iowa causing rain followed by snow. By night blizzard conditions prevailed with 70 mile per hour winds. These weather conditions and continued freezing temperatures during the two week period of March 7-21 caused a retreat of migratory waterfowl from northwest Iowa and from the remainder of the state according to all available reports. On March 22nd thawing weather returned to northwestern Iowa, and by March 23rd waterfowl were again present. The migratory flight appeared to move rapidly into Iowa, and the concentration of both ducks and geese caused by a late spring and ice conditions farther north may have given a false impression as to the actual size of the migratory flight in Iowa. In the northwestern part of the state concentrations of ducks and geese were more impressive than last spring, but there was no evidence to support an actual increase in total migratory numbers over last year. Certainly the concentrations were larger and more impressive, with more birds present in local areas for a short period of time.

This year the duration of the migratory flight was shorter than last year. The main flight began about March 25th and began to diminish appreciably by April 20th in northwestern Iowa. Mallards and Pintails were the most abundant species; and diving ducks, with the exception of Lesser Scaup and Ruddy Ducks, were present only for a very few days during the second and third week of April. The Green-winged Teal flight overlapped somewhat beyond the limits of the aforementioned species, while the Blue-winged Teal and Ruddy Duck flight continued beyond May 15th.

The Blue-winged Teal flight was estimated to be larger (total number of migrants) than last spring with approximately the same number of resident (breeding) birds remaining in Iowa. More Richardson's or Hutchin's

Geese (B. canadensis hutchinsi) were observed in northwestern Iowa this year. Wilson's snipe (Capella gallinago) and Wilson's Phalarope (Steganopus tricolor) also appeared more numerous this spring than during the spring of 1949. Coot populations were again low and approximately the same number of migrants were observed as in 1949.

Iowa Waterfowl Production
Spring 1950

A study has been in progress to determine the number of breeding waterfowl present on several of Iowa's state owned marshes. Waterfowl counts on the same marshes year after year may provide useful dara in determining the population trend of Iowa waterfowl and become a useful contribution in determining the population trend of waterfowl in North America prior to the open season each year.

The enclosed waterfowl counts (See Table I) are only partial indicators of comparative waterfowl abundance (trend) in Iowa. This is attested to by the following example:

During the nesting season of 1949 thirty (30) Coots were counted on West Hottes Lake, Dickinson County. In 1950 no Coots were counted on the same lake because a reduced water level had eliminated practically all nesting sites for this species. Roundstem bulrushes (S. acutus and S. validus) were growing on dry land in 1950 (in water in 1949) and consequently the area was unfit for Coot nesting requirements in 1950. The absence of Coots from West Hottes Lake in 1950 does not indicate any change whatsoever in the trend of Iowa Coot populations. With the exception of the Coot count in West Hottes Lake the other counts are comparable for waterfowl population density in 1949 and 1950.

Only one possible suggestion can be given for the reduction of Ruddy Ducks on the Round Lake, Clay County, area. During 1950 a colony of over one-hundred (100) Black-crowned Night Herons moved into Round Lake. It is possible that the desired nesting habitat of the Ruddies was occupied by the herons and therefcre not suitable to the Ruddies. If Ruddy Ducks and Black-Crowned Night Herons are compatible neighbors during the nesting season no satisfactory explanation of this considerable decrease in Ruddy population in Round Lake can be offered.

So many complex problems are involved in an intensive population study of this nature that no further comments at this time can be made. Other areas not

listed in Table I have been censused for the first time this spring. They will provide additional data in 1951.

From field studies conducted during the past two years the writer feels that there is little indication of change in the overall population of nesting waterfowl in Iowa between 1949 and 1950. It is the opinion of the writer at this time that the trend of Iowa waterfowl populations is up very slightly for Mallards and Redheads. The trend for Blue-winged Teal is about the same as last year with no indication of any decrease in populations. Data would indicate the Ruddy Duck population to be slightly downward.

The late spring of 1950 has caused the Blue-winged Teal in Iowa (as a species) to nest within a more restricted period this year than last. More birds began to nest about the same calendar date and broods are expected to appear (hatch) closerto the same claendar date. The effect this may have on survival or re-nesting is not known. Weather and cover conditions to date have been favorable for a successful hatch. Only one brood (Mallards) has been observed by the writer by June 25, 1950. Several authentic reports of Wood Duck broods have been received.

TABLE I

Iowa Waterfowl Counts
Population (1949-1950) Trend Data

Area Censused	Round Lake				Four Mile Lake				Jemmerson Slough			
County	Clay				Dickinson				Dickinson			
Acres	450				219				100			
Year	1949		1950		1949		1950		1949		1950	
Sex	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Mallard	2	1	3	1	6	2	6	3			1	1
Black Duck												
Gadwall												
Baldpate												
Pintail	1	1	1				1					
GW Teal												
BW Teal	8	2	4		12	4	9	2	3	2	5	5
Shoveller							1	1				
Wood Duck			6*			1	1					
Redhead							4	5				
Ring-neck												
Canvasback												
Lesser Scaup					6	2						
Golden-eye												
Bufflehead												
Ruddy Duck	14	2	2				1					
Merganser												
Total Ducks	25	6	17		24	9	23	11	3	2	5	5
Coot	74		100		72		80		12		10	
Florida Gallinule	1											
Pied-billed Grebe	6		2				8				2	
BC Night Heron			100									
Upland Plover												
Snow Goose												

* Sex unidentified

TABLE I

Area Censused	Dewey's Pasture (Ruthven Area)						West Hottes Lake			
County	Clay						Dickinson			
Acres	406						312			
Year	1948		1949		1950		1949		1950	
Sex	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Mallard	2	2	2	2	3	3			1	
Black Duck										
Gadwall	1	1								
Baldpate										
Pintail										
GW Teal										
BW Teal	8	8	6	6	8	7	8	6	6	1
Shoveller					1					
Wood Duck										
Redhead	2	2	3	3	3	3				
Ring-neck										
Canvasback										
Lesser Scaup					2	2				
Golden-eye										
Bufflehead										
Ruddy Duck	2	2	3	3	5	1				
Merganser										
Total Ducks	15	15	14	14	22	16	8	6	7	1
Coot	20		20		25		30		None	
Florida Gallinule										
Pied-billed Grebe										
BC Night Heron										
Upland Plover										
Snow Goose										

Table I

Area Censused	Stony Lake				North Slough Mud Lake			
County	Dickinson				Emmet			
Acres	160							
Year	1949		1950		1949		1950	
Sex	Male	Female	Male	Female	Male	Female	Male	Female
Mallard	1	1			5	5	8	5
Black Duck								
Gadwall								
Baldpate								
Pintail								
GW Teal								
BW Teal	8	6			8	3	9	6
Shoveller	1	1						
Wood Duck								
Redhead					3	1	4	2
Ring-neck								
Canvasback								
Lesser Scaup	1	2			4	2		
Golden-eye								
Bufflehead								
Ruddy Duck	1				2	1		
Merganser								
Total Ducks	12	10			22	12	21	13
Coot	55				21		1	
Florida Gallinule								
Pied-billed Grebe					1			
BC Night Heron								
Upland Plover								
Snow Goose								

TABLE I

Area Censused	Cheevers Lake		Eagle Lake		Trumbull Lake	
County	Emmet		Hancock		Clay	
Acres	341		906		1229	
Year	1950		1950		1950	
Sex	Male	Female	Male	Female	Male	Female
Mallard	7		6	2	1	
Black Duck						
Gadwall						
Baldpate						
Pintail						
GW Teal	1	1				
BW Teal	11	2	3			
Shoveller						
Wood Duck					3	3
Redhead			3	1		
Ring-neck						
Canvasback						
Lesser Scaup	2	3	3			
Golden-eye						
Bufflehead						
Ruddy Duck					1	
Merganser						
Total Ducks	21	6	15	3	4	3
Coot	80		100		0	
Florida Gallinule						
Pied-billed Grebe						
BC Night Heron						
Upland Plover						
Snow Goose						

Iowa Waterfowl Summary
Spring 1950

1. A late spring in 1950 caused large concentrations of migratory waterfowl in Iowa, but there is no conclusive proof that would indicate larger total numbers of waterfowl passed through Iowa in 1950 than in 1949.

2. The 1950 migratory flight was of shorter duration than in 1949.

3. The migratory flight of Bluewinged Teal, Hutchin's Goose, Wilson's Snipe, Wilson's Phalarope was estimated to be larger in total numbers in 1950 than in 1949.

4. Migrant Coot populations were estimated to be low and approximately the same number of migrants were observed in 1950 as in 1949.

5. It is the opinion of the writer that the population trend of Mallards and Redheads in Iowa is slightly upward. The Blue-winged Teal population trend is about the same as last year with no indication of any decrease in Iowa population.

6. Waterfowl nesting in Iowa began later in 1950 than in 1949 and the result of this condition is not known.

7. Iowa waterfowl nesting conditions have been satisfactory to date and a good hatch is expected.

Wood Duck Nesting Box Success

By

James G. Sieh

Following the nesting season of 1949 approximately thirty Wood Duck nesting boxes were distributed in the lake and marsh areas of northwest Iowa. From all available information these housing projects were completed by the joint cooperation of the Pittman-Robertson and Game Section personnel. Approximately thirty Wood Duck nesting boxes were installed and were in usable condition during the nesting season of 1950. Twenty-five of these nesting boxes have been check prior to July 7, 1950, to determine the number of boxes occupied by nesting Wood Ducks, and when possible, to explain or determine the factors contributing to their success or occupancy.

Of the twenty-five nesting boxes examined one box was not in usable condition because the cover was inside the box. Of the remaining twenty-four nesting boxes in usable condition only one contained the nest and eggs of a Wood Duck. Three other nesting boxes showed signs of Wood Duck activity. Of these three only one showed definite signs of nesting activity indicated by the presence of nesting material (Wood Duck down) in the box. This box was located about 100 yards from the box with eggs; and in the opinion of the writer the same female Wood Duck had probably frequented both boxes pirot the laying, but had selected the former box instead of the latter to actually nest in. Both of these nesting boxes were located in the northwest bay of Prairie Lake, Dickinson County, Iowa.

The remaining two nesting boxes indicating Wood Duck activity were located in the west arm of Mud Lake Slough, Emmet County, Iowa; but neither box showed definite signs of nesting use. Both boxes contained Wood Duck feathers (not down) and were located about seventy-five years apart. The box to the west was occupied by a Tree Swallow (Iridoprocne bicolor) with a nest containing seven newly hatched young. The cup-like nest was constructed of Wood Duck feathers which formed the depression in the shavings inside the nesting box. No attempt was made to sift the shavings to search for Wood Duck egg shells in this box, but in the unoccupied box containing Wood Duck feathers the shavings were sifted and no egg shells or pieces thereof were found. It was concluded that Wood Ducks had frequented these boxes, but there was no positve indication of nesting. The presence of a single identifiable

pigeon (Rock Dove-Columba livia)feather in the nest box occupied by the swallow family was of interest and complicated the situation slightly.

Of the remaining twenty-one nesting boxes, two were occupied by Yellow-shafted Flickers (Colaptes auratus). One box contained eight flicker eggs on July 3, 1950 and another contained two recently hatched young flickers with 3 eggs still unhatched on July 8, 1950. Nineteen nesting boxes appeared uninhabited except for an occasional feather or dropping. It has been the experience of others reporting on Wood Duck nesting box success that a greater percent of occupancy can be expected after the first year. The percent of occupancy has always been reported to be low. The local change in population caused by nesting boxes is not known. In northwest Iowa where nesting trees are supposedly at a premium and breeding adults are present, nesting boxes should be conducive to increased production. To my knowledge few Wood Duck broods have been recorded from northwest Iowa, but a considerable number of adults are present throughout the breeding season.

The two largest concentrations of Wood Ducks recorded by the writer in 1950 in northwest Iowa were located at the north end of Trumbull Lake and in Round Lake both in Clay County, Iowa. It is hoped that if there are any Wood Duck nesting boxes remaining, that some could be installed in these locations.

A cursory study of this nature prohibits any positive recommendations at the present time. It is felt that an annual check of nesting box success should be continued and coupled with the general waterfowl production picture in northwest Iowa, some final conclusions may be forthcoming.

Wood Duck Nesting Boxes-Houses Checked

Area	Unoccupied	Occupied	Not Visited
Sunken Lake, Dickinson Co.	2		
Mud Lake, Emmet Co.	9 2 with Wood Duck feathers.	1 T. Swallow	
Twelve Mile, Emmet	2		
Little Spirit, Dickinson County	5	1 Y. Flicker	4
Prairie Lake, Dickinson County	1	1 Wood Duck 1 Y. Flicker	
	21	4	4

THE FOODS USED BY SOME COMMON FISH OF THE DES MOINES RIVER DRAINAGE

By

Harry M. Harrison

As a part of the investigation of the fishes of the Des Moines River Drainage, a study has been made of the foods consumed by several of the more important species living in the watershed. It is the purpose of this paper to summarize the data collected. All total, the visceral contents from 1,185 individuals represented by 23 species were analyzed and 930 of these contained food.

METHOD

In general, the fish used for food habits study were taken from nets during routine survey work. However, in the case of the large game fish, such as walleyes, channel catfish, and smallmouth bass, the viscera were supplied by anglers contacted along the streams or otherwise taken with legal fishing gear. The viscera of all large fish were removed in the field, labled, tied in cloth wrappings and preserved in 10% formilin. Small fish were preserved directly in the field with the subsequent removal and study of the visceral contents being accomplished in the laboratory.

Since live fish regurgitate much of their stomach contents during death convulsions in formilin, individuals were allowed to dry in the open air before being preserved for food studies. In the laboratory, the food contents of the viscera were removed and placed in petri dishes containing water. The materials were carefully separated with teasing needles and tweezers and then washed with water to get a clear-cut separation of the various food items. The foods were then separated into five catagories as follows: fish remains, insects, invertebrates other than insects, plants, and undetermined organic material. Subsequently, the volume of each catagory was ascertained by water displacement and the percentage calculated. Following this, the various foods that occurred in each catagory were identified as closely as possible, counted and recorded on cards along with other information such as the day, the time, the place where the fish was caught, its length, and weight. In those cases where the food eaten was of insufficient quantity to be measured reliably by water displacement, the items were separated on paper towels and a visual estimate made as to the per cent of the total food comprised by each of the above mentioned catagories.

DATA

Arranged by total lengths of the specimens studied, the major groups of the foods used by the various species are compared in Tables I through V. The number of each consuming the different foods are also shown in the same tables, and the per cent of the total diet comprised by each of the major divisions is given. A further breakdown of the items used as food by the different fish is presented in the text.

Bigmouth Buffalofish. Megastomatobus cyprinella. Five specimens ranging in total length from 11 to 16 inches were studied. In these, bottom ooze made up 62% of the diet. Twenty six per cent of the remainder was insects with blood worms in preponderance. One fish had eaten 500 of these while a second contained 400. Additional insects found in the viscera included other aquatics such as mayflies, water boatmen, and backswimmers. A small portion of a butterfly (Lepidotera) was found in one while another had fed upon a terrestrial bettle (Coleoptera). Two fish had eaten plant material consisting of filamentous algae and a few small weed seeds.

Quillback and Carpsuckers. Carpiodes carpio, Carpiodes cyprinus, Carpiodes velifer. Because no differences were noted in the kinds of foods used by the three species of carpsuckers inhabiting the Des Moines River, the information concerning the diets of all the carpsuckers are handled here together.

The quillback is a rather filthy feeder, swallowing large volumes of bottom ooze from which it digests out much of the decaying matter of the stream bottom. Because of the nature of its feeding habits, only small amounts of identifiable materials are found in the visceral contents. Of the 47 specimens examined which ranged in length from 5 to 12 inches, 86% of the food was undeterminable debris from the river bottom. Twelve per cent of the diet was plant material consisting of algae while the remaining 2% was insect remains with a trace of other invertebrates. Very small bloodworms sometimes occurring by the thousands, were the only insects found intact in the digestive system. Other insects were represented by partial remains such as larvae cases, detached legs, wings, and so forth.

Common Sucker. Catostomus c. commersonnii. Of the 12 individuals examined, raning from 6 to 13 inches long, all had comsumed insects which made up 69% of the total food consumed. The insects were represented by a wide variety of both aquatic and terrestrial forms. Eighteen percent of the diet was

plant material including filamentous algae, parts of green leaves from terrestrial plants, small twigs and rootlets. The remaining 13% of the foods consisted of bryozoa, earthworms, and fish eggs. Three specimens had ingested the eggs of other fish. The first one had eaten 132 eggs, the second 34, and the third had eaten 2 eggs.

Hogsucker. Hypentelium nigricans. The diet of the hogsuckers examined consisted of 91% insects which all were aquatic forms inhabiting both fast-flowing and slow-moving waters. Seven per cent of the food was bottom ooze probably ingested accidentally with the insects. Filamentous algae made up 2% of the diets.

Golden Mullet. Moxostoma erythrurum. Of nine fish studied eight had eaten insects which comprised 42% of the total diet. The insects were all aquatic forms composed largely of dipterous flies. Filamentous algae made up 24% of the diet and was the only plant material found. Undetermined organic material (bottom ooze) made up 31% of the food while 3% of the diet was crayfish.

Silver Mullet. Moxostoma anisurum. The foods of the 11 specimens analyzed consisted of 64% insects, 21% plants, 8% organic material, 4% fish, and 3% crustaceans. The insects were of a wide variety of bottom forms including mayflies, stoneflies, caddice flies, dipterious flies, back swimmers, water boatmen, beetles, and a few terrestrial insects were also taken. The plant material was all filamentous algae. Two individuals had preyed upon spotfin shiner fry and another contained a scale of a large fish. One specimen had eaten part of a crayfish.

Redhorse. Moxostoma aureolum. Twenty-four redhorses ranging in length from 4 to 16 inches were examined. Of these, 76% of the visceral contents was composed of insects, 18% plant material, 6% organic material, and 5% invertebrates other than insects. The remaining 5% was composed of fish remnants. The insects were of a wide variety of both aquatic and terrestrial forms. Of the aquatics, stoneflies, mayflies, caddice flies, and dipterous flies were the preponderant forms. The terrestrial insects were represented by ground beetles and leafhoppers. The plant materials were composed largely of algae with a few traces of green leaves. Portions of crayfish and earthworms were eaten by several individuals and one had fed on bryozoa. Fish as food were represented by scales in two individuals, a spotfin shiner fry in one, and a single fish egg in another.

Carp. Cyprinus carpio. The foods of 87 carp ranging in total length from 6 to 22 inches were studied. In these 53% of the food was insect, 32% plant material, 9% invertebrates other than insects, 4% organic material and 1% fish. The insects eaten were of a wide variety, but the bulk was largely aquatic forms of slow-moving waters, and included mayflies, and dipterous larvae. Caddice larvae, aquatic beetles (Coleoptera) and bugs (Hemiptera) were also taken freely. Terrestrial insects, that had fallen in the water, were used by many individuals but from the standpoint of total bulk were rather insignificant. The plant materials used were also of a very wide variety consisting of a diversity of green leaves from low land trees and grasses, twigs, rootlets and green algae. Goosebeeries, grapes, and redhaws were eaten in season. Bryozoa, crayfish remnants, and earthworms, were the common invertebrates aside from insects found in the viscera. Undetermined organic materials were bottom ooze and mud. The fish foods were usually scales, however, the fry of the spotfin shiner and the bullhead minnow were identified in the diet of the carp.

Northern Creek Chub. Semotilus a. atromaculatus. The foods of 44 creek chubs 4 to 10 inches long were studied. Insects both aquatic and terrestrial made up 63% of the diet of the chub. Twenty-two per cent of the food was fish while plants, undetermined organic material, and invertebrates other than insects comprised 11, 2 and 1 per cent respectively. As the size of chubs increased, the foods consumed changed from a diet of wholly insects and plant material in small fish to a diet of fish, insects and other invertebrates in the larger individuals. The insects utilized were mostly aquatic, however, a larger proportion of the insects eaten were of terrestrial origin than was found in the other species studied. Fish identified in the food of the chub included, spotfin, common and bigmouth shiner, bullhead and fathead minnows and a johnny darter. Fifteen chubs, taken from small streams containing an exceptionally large smallmouth bass fry population, were examined for predacity on bass. None of these contained any bass fry.

Common Shiner. Notropis c. frontalis. Sixteen common shiners less than 6 inches in total length were examined. In these the diet was 71% plant, 18% insect, 8% fish and 2% organic debris. The plant material was almost wholly filamentous algae with a trace of green leaves, twigs and rootlets of terrestrial origin. Insect foods were mostly aquatic forms with a few terrestrial

forms appearing in the stomach. Fish identified in the viscera of the common shiner included topeka shiner, an undetermined minnow and several scales. Organic material was all bottom ooze.

Channel Catfish. Ictalurus l. punctatus. The food habits of 435 channel catfish ranging in length from less than an inch to 24 inches long were studied. Tables I through V shows the percentage breakdown on the foods used by small and large channel catfish are markedly different. Small insects constitute the bulk of the food of the young fish, where as the diet of adult fish is more diversified and is dominated by organisms of larger size. Small insects mostly tendipedids and bottom ooze with a little filamentous algae made up the food of catfish less than two inches long. Between 2 and 6 inches, the foods were dominated by insects and again those were usually small forms such as caddice and dipterous larvae. Fish from 6 to 10 inches began to feed on a wider variety of foods including larger insects such as mayflies, stoneflies, nymphs, aquatic beetles and bugs. Plants became a more important item and included green leaves, fruits, and seeds. Fish remains were represented by scales only.

Fish longer than lo inches had eaten large insects such as hellgrammites, large stoneflies and mayflies. Portions of green plants of terrestrial origin, filamentous algae, stems, twigs, and rootlets were used freely. Fish remains were found in approximately one third of the specimens examined and made up 17% of the diet. Fish foods consisted of various minnows and shiners, scales and chunks of larger fish.

Northern Black Bullhead. Ameiurus melas melas. The foods eaten by 50 black bullheads were analyzed. These ranged in length from 2 to 10 inches. Fifty-nine per cent of the food of the black bullhead was insect material, 19% invertebrates other than insects, 13% plant material, 5% fish, and 4% organic materials. Insects were almost wholly aquatic species of slow-moving water and included may, stone, caddice, and dipterous fly larvae. Invertebrates other than insects were represented by mostly crayfish fragments. Plants consisted of debris of terrestrial origin and filamentous algae. Fish remains were scales and chunks of larger fish found dead on the stream bottom. The remainder of the food was bottom ooze.

Northern Yellow Bullhead. Ameiurus natalis natalis. Two specimens were studied and these had eaten only insect foods which included stonefly and mayfly nymphs.

Stonecat. Noturus flavis. The foods consumed by 22 stonecats ranging from 2 to 10 inches long were analyzed. Insect material was the important items in the diet and constituted 64% of the food eaten. Fourteen per cent was fish, 9% invertebrates other than insects, 7% plant and 5% undetermined organic material. The insects were all aquatic and forms inhabiting riffle areas. Fish remains consisted of two spotfin and common shiner and a single bullhead minnow. Crayfish and earthworms were the only invertebrates other than insects found. Plant materials included filamentous algae and a few weed seeds of terrestrial origin.

Northern Smallmouth Bass. Micropterus d. dolomieu. One hundred and forty-five smallmouth bass ranging in length from 2 to 17 inches were studied. In these, fish, insects, and crayfish made up the bulk of the food. Insects dominated the diet of small individuals with minnow fry and minnows used in increasing amounts as the fish increased in length. Crayfish were a more important item after the smallmouth bass reached 5 inches. Because of the wide difference manifested in feeding habits from small to large individuals, the reader is asked to refer to the tables for the percentage breakdown on the foods consumed by smallmouth bass. The insects eaten by all sizes of bass embraced a wide variety of species with the mature forms appearing in the large numbers during the emergence of the adults from an aquatic life. The quality of minnows composition in the area thus demonstration that the smallmouth is probably non-selective in its preference for fish foods.

Green Sunfish. Lepomis cyanellus. The food used by 8 green sunfish from the Des Moines River was 56% insect, 33% crayfish, and 11% plant debris. Except for a single terrestrial bettle all insects were aquatic species. Plant materials included filamentous algae along with several weed seeds of terrestrial origin.

Orange Spotted Sunifish. Lepomis humilis. The diet of 6 orange spotted sunfish analyzed was 100% insect remains. For the most part, these were aquatic forms, but a portion of a butterfly and terrestrial bettle were also observed among the visceral contents.

Northern Rock Bass. Ambloplites r. rupestris. The visceral contents of five individuals were examined. Of these, four had eaten only aquatic insects including mayfly, caddice fly, and dipterous larvae while the fifth had eaten only crayfish.

White Crappie. Pomoxis anularis. Only two fish were examined. In these, 95% of the food was fish including a spotfin shiner and a minnow digested beyond recognition. Five per cent of the food was insect composed only of unidentified fragments.

Yellow Perch. Perca flavescens. Only three specimens were examined. In these, 67% of the food was fish remains too small to identify or digest beyond recognition. Thirty-three percent was insect and included three mayfly nymphs and a stone fly.

Walleye. Stizostedion v. vitreum. The stomachs from 4 individuals were analyzed. Fish remains constituting 98% of the diet of these were identified as follows: two spotfin shiners, 1 johnny darter and 4 undetermined minnows of the Notropis group. A single large stonefly nymph was the only other item found in the four fish studied.

SUMMARY

The foods consumed by 930 fish representing 23 species from the Des Moines River watershed had been represented. For the sake of simplicty, the foods utilized by the various fishes have been grouped into five major catagories including fish, insects, and invertebrates other than insects, plants, and organic material. From these, a diversity of fish, insects and plants constitute the bulk of the diet of all fish. The data shows that all fish are in direct competition for the same foods, and this competition has very little regard for size of fish. For example, adult buffalo carp, suckers, carp, and quillbacks are using the same foods as young game fish whereas the food of adult game fish is also being utilized by stonecats, bullheads and carp.

TABLL I: Food Habits of Some Des Moines River Fish Ranging from 0" to 2" in Total Length

SPECIES	No Fish Examined	Foods									
		Fish		Insects		Invertebrates other than insects		Plants		Organic Material	
		Number Containing Food Items	Percent of Total Food Taken	Number Containing Food Items	Percent of Total Food Taken	Number Containing Food Items	Percent of Total Food Taken	Number containing Food Items	Percent of Total Food Taken	Number Containing Food Items	Percent of Total Food Taken
Common Shiner Notropis c. frontalis	7			5	25%			6	72%	3	3%
Channel Catfish Ictalurus l. punctatus	62	2	1%	43	56%			6	3%	33	40%

TABLE II: Food Habits of Some Des Moines River Fish Ranging from 2" to 4" in Total Length

SPECIES		Foods											
		Fish			Insects		Invertebrates other than insects		Plants			Organic Material	
		Number containing Food Items	Percent of Total Food Taken		Number containing Food Items	Percent of Total Food Taken	Number containing Food Items	Percent of Total Food Taken	Number containing Food Items	Percent of Total Food Taken		Number containing Food Items	Percent of Total Food Taken
Golden Redhorse *Moxostoma erythrurum*	4				3	29%			1	12%		4	59%
Northern Creek Chub *Semotilus a. atromaculatus*	8				7	83%			2	17%			
Channel Catfish *Ictalurus l. punctatus*	201	9	1%		193	83%	3	1%	38	5%		54	10%
Black Bullhead *Amciurus m. melas*	9				9	81%	1	8%	1	1%		1	10%
Stonecats *Noturus flavis*	2				2	100%							
Smallmouth Bass *Micropterus d. dolomieu*	80	26	21%		74	79%							
Green Sunfish *Lepomis cyanellus*	1				1	100%							
Orange Spot Sunfish *Lepomis humilis*	6				6	100%							
Rockbass *Ambloplites r. rupestris*	1				1	100%							

TABLE III: Food Habits of Some Des Moines River Fish Ranging From 4" to 6" In Total Length

SPECIES		Foods									
		Fish		Insects		Invertebrates other than insects		Plants		Organic Material	
		Number containing Food Items	Percent of Total Food Taken	Number containing Foos Items	Percent Of Total Food Taken	Number containing Food Items	Percent of Total Food Taken	Number containing Food Items	Percent Total Food Taken	Number containing Food Items	Percent of Total Food Taken
Golden Mullet (Redhorse) Moxostoma erythrurum	4			4	52 %			3	36 %	3	12 %
Silver Redhorse Moxostoma anisurum	5			7	25 %			3	52 %	3	23 %
Northern Redhorse Moxostoma aureolum	5			5	100 %						
Northern Creekchub Semotilus a. atromaculatus	26	9	17 %	25	67 %	1	2 %	10	13 %	1	1 %
Common Shiner Notropis c. frontalis	9	3	16 %	4	13 %			7	69 %	1	2 %
Channel Catfish Ictalurus I. punctatus	17	1	6 %	16	89 %			3	3 %	2	2 %
Black Bullhead Ameiurus melas melas	11			11	51 %	5	25 %	5	13 %	4	11 %
Yellow Bullhead Ameiurus matalis matalis	1			1	100 %						
Stonecats Noturus flavis	7			4	46 %	2	27 %	1	14 %	2	13 %

TABLE III Continued: Food Habits of Some Des Moines River Fish Ranging From 4" to 6" in Total Length

Species		Foods									
		Fish		Insects		Invertebrates other than insects		Plants		Organic Material	
		Number containing Food Items	Percent of Total Food Taken	Number containing Food Items	Percent of Total Food Taken	Number containing Food Items	Percent of Total Food Taken	Number containing Food Items	Percent of Total Food Taken	Number containing Food Items	Percent of Total Food Taken
Walleye *Stizostedion V. Vitreum*	1	1	100 %								
Smallmouth Bass *Micropterus d. dolomieu*	51	37	61 %	32	34 %	3	2 %			2	3 %
Green Sunfish *Lepomis cyanellus*	7			6	49 %	3	38 %	1	13 %		
Rockbass *Ambloplites r. rupestris*	2			2	100 %						
White Crappie *Pomoxis annularis*	2	2	95 %	1	5 %						

TABLE IV: Food Habits of Some Des Moines River Fish Ranging From 6" to 10" in Total Length

Species		Foods									
		Fish		Insects		Invertebrates other than insects		Plants		Organic Material	
		Number containing Food Items	Percent of Total Food Taken	Number containing Food Items	Percent of Total Food Taken	Numbers containing Food Items	Percent of Total Food Taken	Number containing Food Items	Percent of Total Food Taken	Number containing Food Items	Percent of Total Food Taken
River Carpsucker Carpiodes carpio	5							2	40 %	3	60 %
Bluntnose Carpsucker Carpiodes velifer	7			2	7 %			2	21 %	5	72 %
White Sucker Catostomus c. commersonnii	5	3	5 %	5	89 %			3	6 %		
Hog Sucker Hypentelium nigricans	4			4	91 %			1	2 %	2	7 %
Silver Redhorse Moxostoma anisurum	2			2	95 %			1	5 %		
Northern Redhorse Moxostoma aureolum	10			8	66 %	3	14 %	1	1 %	2	19 %
Carp Cyprinus carpio	8	2	2 %	8	40 %	2	11 %	7	47 %		
Northern Creekchub Semotilus a. atromaculatus	10	7	52 %	9	39 %	1	6 %	2	2 %	1	1 %
Channel Catfish Ictalurus I. punctatus	52	9	3 %	44	52 %	5	5 %	28	36 %	9	4 %

TABLE IV Continued: Food Habits of Some Des Moines River Fish Ranging From 6" to 10" in Total Length

Species		Foods											
		Fish			Insects		Invertebrates other than insects		Plants			Organic Material	
		Number containing Food Items	Percent of Total Food Taken		Number containing Food Items	Percent of Total Food Taken	Number containing Food Items	Percent of Total Food Taken	Number containing Food Items	Percent of Total Food Taken		Number containing Food Items	Percent of Total Food Taken
Black Bullhead													
Ameiurus melas melas	29	4	5 %		26	58 %	12	20 %	12	17 %			
Yellow Bullhead													
Ameiurus natalis natalis	1				1	100 %							
Stone cats													
Noturus flavis	13	5	25 %		12	68 %	1	1 %	3	5 %		1	1 %
Yellow Perch													
Perca flavescens	3	2	67 %		1	33 %							
Walleye													
Stizostedion v. vitreum	3	3	98 %		1	2 %							
Smallmouth Bass													
Micropterus d. dolomieu	12	10	73 %		4	3 %	3	24 %					
Rockbass													
Ambloplites r. rupestris	2				1	50 %	1	50 %					

TABLE V: Food Habits of Some Des Moines River Fish Ranging From 10" and Over

SPECIES	Number	Foods: Fish		Insects		Invertebrates other than insects		Plants		Organic Material	
		Number containing Food Items	Percent of Total Food Taken	Number containing Food Items	Percent of Total Food Taken	Number containing Food Items	Percent of Total Food Taken	Number containing Food Items	% of Total Food Taken	Number containing Food Items	Percent of Total Food Taken
Bigmouth Buffalofish											
Megastomatobus cyprinella	5			4	26%			2	12%	5	62%
Quillback											
Carpiodes cyprinus	3			3	12%					3	88%
River Carpsucker											
Carpiodes carpio	10			8	26%	1	10%	9	64%		
Bluntnose Carpsucker											
Carpiodes velifer	10			6	22%			8	35%	6	43%
White Sucker											
Catostomus c. commersonnii	7			7	55%	5	15%	4	30%		
Golden Redhorse											
Moxostoma erythrurum	1			1	50%	1	30%	1	20%		
Silver Redhorse											
Moxostoma anisurum	5	2	9%	5	84%	1	5%	1	2%		
Northern Redhorse											
Moxostoma aureolum	9	1	1%	8	83%	2	2%	4	14%		
Carp Cyprinus carpio	79	6	1%	67	64%	27	10%	56	31%	4	4%
Channel Catfish											
Ictalurus l. punctatus	99	29	17%	70	39%	31	16%	44	21%	23	7%
Black Bullhead											
Ameiurus melas melas	1	1	100%								
Smallmouth Bass											
Micropterus d. dolomieu	2	1	50%	1	10%	1	40%				

THE 1950 FISH CENSUS

By

E. T. Rose

Biologists are almost universally comparing the fish production of lakes and streams to domestic animal production of farms. They point out that the products of the aquatic pastures, which are the fish, are analagous to the production of beef on the land pastures. A well managed pasture with rich soils, adequate climate and free of noxious weeds will produce an annual return of a maximum amount of high-quality beef. And, of course, the reverse situation prevails in pastures with poor soil, weeds, and poor quality beef. There is little doubt that Iowa has a lions share of the richest land in the world, and by the same token our lakes and streams are likewise equally rich. These aquatic pastures, then, under proper management should rank among the foremost in production of fish with any on the face of the earth. Otherwise such analogists should not be drawn and are erroneous.

A question was asked recently, "What is the most important item needed in Iowa to improve fishing--is it more law enforcement, more hatcheries, more rescue work, more biologists, more dredging, less pollution, or more or less of this or that, that is needed?" This was a tough one for me to answer, however, I replied that in the light of our present knowledge, I believe the answer must be twofold. We must have better answers from the biologists, and more funds for carrying out their recommendations. We have had as much as six years of creel census work on some of our important fishing lakes and from 3 to 5 on others, evaluating the harvests from our aqutic pastures. We have had 10 years of biological survey, or perpetual inventory, on most of our fishing lakes. Yet, we can't point with pride to a steady increase in the harvests that should have resulted from the application of recommendations to the management section. Fortunately, our average production has not fallen off precipitously anywhere; however, we have problem lakes that have consistently remained unresponsive to our recommended treatment and fishing remains poor. Even though we think we have diagnosed the trouble in these lakes there remains a monstrous task for the management section to follow remedial recommendations. Most of our lakes are infested with rough fish. These are automatically placed on the list for managment control. If they are not adequately controlled, these "thistles in the aquatic pasture" will transform a clear, clean lake with good stands of aquatic vegetation and splendid populations of game fishes into a veritable hog wallow. These undesirable weed species do not occupy just a small, unused niche in the

environment, but transform the entire environment into a habitat suitable only for, and dominated by them. We cannot boost our standing crops or surplusses of game fish species without more rigid control of particularly the carp. Just as blue grass and thistles do not thrive in the same environment or pasture, Black Bass, walleyes and Northern Pike cannot thrive in carp infested waters.

The foregoing account is related to this seasons creel census work as will be pointed out in the following short discussion of each lake's harvest as compared with former years, and the biological problems yet unsolved on each lake.

Spirit Lake

The 45 day census here shows a considerable increase in the catch over the previous five years. This is attributed to the good catches of crappie and bullheads as prevailed last year. Declines in perch, northerns, black bass, white bass and bluegills are significant. Walleyes are about holding their own. The average catch of 2.46 fish per hour indicates excellent fishing, however, the decline in predator harvest indicates the need of careful observation for over-populations of crappe and bullheads, and the basic problem of further carp control. Approximately 338,962 pounds of carp have been removed from this lake in the year July 1-July 1, and a return of vegetation in the denuded areas has occurred. This season 8,896 anglers caught 103,316 fish in 41,939 hours. The average catch per angler was 11.62 fish, at the rate of 2.46 fish per hour.

IOWA LAKES CREEL CENSUS
SPIRIT LAKE

SPECIES	1945	1946	1947	1948	1949	1950
CRAPPIE	109	3,390	2,823	13,533	16,063	13,298
PERCH	614	5,921	2,019	32,958	3,802	656
N. PIKE	308	3,607	825	2,936	655	178
WALLEYE	70	12,917	7,685	4,185	6,923	4,091
L.M. BASS		3,092	1,452	1,922	326	94
S.M. BASS		493	219	357	105	6
BULLHEAD		57,019	41,691	69,227	82,157	84,642
WHITE BASS	1,444	11,262	2,189	5,091	1,004	152
BLUEGILL		1,530	314	2,544	1,337	245
YEARLY TOTALS	2,545	99,121	59,217	132,754	112,372	103,316
No. Anglers	1,115	20,937	9,951	22,171	15,614	8,896
No. Hours	4,157	66,354	43,570	101,382	66,339	41,939
Fish Per Angler	2.28	4.73	5.95	5.98	7.19	11.62
Fish Per Hour	0.61	1.49	1.36	1.31	1.69	2.46

Storm Lake

Fishing has been better in Storm Lake this yeap than last. An increase in walleye, bullhead and white bass catches occurred, and particularly in the walleye. Crappie harvest has declined significantly each year since 1947. A total of 11,431 fish were recorded taken in 5,396 fishing trips. Fishermen averaged 2.12 fish per man, at the rate of 1.03 fish per hour. The table contains the basic summary for the past four years of census.

East Okoboji

The 1950 season has been about normal for this lake when compared with the previous 5 years census. Angling pressure has been significantly less than former years except in 1945. This has been due primarily to the adverse weather conditions almost entirely. High winds kept the shallow upper portion very turbid until just recently. A total of 12,340 fish were taken by 2,812 anglers, for an average of 2.35 fish per man, at the rate of 1.09 fish per hour of effort. This is about average for Each Okoboji during the 45 day season's census.

Lost Island

A very favorable increase in the harvest of fish occurred this year over last year. A vast increase in the walleye take occurred, which was a happy circumstance since the bullheads did not bite well until the last 20 days of the season. A 58% increase in bullhead take over last year occurred. A total of 90,554 fish were caught by 12,753 recorded anglers, for an average of 7.02 fish per man, and at the rate of 2.03 fish per hour. A total of 61,494 pounds of fish were taken, or at a harvest of 48.80 pounds per acre in 45 days. This is more than double the harvest in pounds per acre over last year, and about one half the harvest of 1948, at which time no areas were closed for spawning purposes.

Blackhawk

This lake remains consistently poor in fishing success, although a slight increase in the take of crappie occurred this year. Carp angling is about holding its own with last year. Bullhead stocking has been heavy, but the take has been slight in comparison with the year's that they were not stocked. Black bass and bluegill fishing has dropped very significantly during the past season. A total of 9,464 fish were caught by 7,338 anglers, for a total average of 1.31 fish per man, at the rate of 0.85 fish per hour. The gizzard shad remains as the number one problem here. Game fish stocked are high according to survey records, but the excessive forage provided by the shad preclude angler success. Additional precator fishes as well as constant shad removal operations are indicated as necessary for this lake.

IOWA LAKES CREEL CENSUS
STORM LAKE

SPECIES	1947	1948	1949	1950
CRAPPIE	6,241	5,313	2,109	1,277
PERCH	3	539	110	79
N. PIKE	12	46	32	13
WALLEYE	247	2,833	1,906	3,427
CHANNEL CAT.		132	74	183
S.M. BASS	1	0	0	0
L.M.BASS	3	2	2	17
BULLHEAD	3,815	12,754	2,391	5,065
WHITE BASS	473	1,851	1,141	1,370
BLUEGILL	0	7	0	0
YEARLY TOTALS	10,796	23,297	7,765	11,431
No. Anglers	2,092	7,756	5,784	5,396
No. Hours	7,574	24,104	21,871	10,142
Fish/Angler	5.11	3.00	1.34	2.12
Fish/Hour	1.43	0.96	0.35	1.03

IOWA LAKES CREEL CENSUS
EAST OKOBOJI

SPECIES	1945	1946	1947	1948	1949	1950
CRAPPIE	6,904	22,899	9,704	4,660	2,637	3,562
PERCH	26	438	251	2,113	4,464	742
N. PIKE	93	247	126	294	117	55
WALLEYE	1,608	4,704	1,792	6,148	705	1,120
S.M. BASS		15	13	63	37	29
L.M. BASS	98	296	153	276	27	47
BULLHEAD		5,404	3,394	5,785	13,380	5,072
WHITE BASS	405	1,102	1.016	1,912	745	428
BLUEGILL		219	117	486	1,166	1,184
CHANNEL CAT.						1
YEARLY TOTALS	9,134	35,354	16,566	21,737	23,287	12,240
No. Anglers	2,759	9,119	4,725	6,125	3,789	2,812
No. Hours	9,080	31,346	18,566	25,947	15,566	11,143
Fish/Angler	3.31	3.88	3.51	3.55	6.14	4.35
Fish/Hour	1.01	1.13	0.89	0.84	1.46	1.09

IOWA LAKES CREEL CENSUS
Lost Island

SPECIES	1946	1947	1948	1949	1950
CRAPPIE	0	0	5	2	250
PERCH	56	51	285	19	22
N. PIKE	23	50	131	478	366
WALLEYE	130	359	760	106	2,266
L.M.BASS	0	0	0	2	0
BULLHEAD	100,111	169,344	346,954	51,482	87,646
TOTALS	100,320	169,804	348,135	52,089	90,554
TOTAL WEIGHT	16,893 lb.	42,336 lb.	130,108 lb.	25,741 lb.	61,494 lb.
No. Anglers	3,378	7,495	25,917	10,842	12,753
Fish per Angler	29.69	22.61	13.42	4.81	7.02
Fish per Hour	5.27	5.23	2.98	0.92	2.03
Lb. Per Acre Harvest	13.40	33.60	103.34	20.43	48.80

Clear Lake

This has been an extremely disappointing season here. A vast decline in harvests of all species is evident except the bullhead. See Table. The catch per hour and per man remained about the same as last year; however, this is due only to the bullhead catch. Crappie, perch, walleye and yellow bass were taken in pitifully poor numbers. Adverse weather conditions prevailed throughout most of the season which may account for some of the decline. Supplies of walleyes are known to be high; however, excessive forage may have influenced the catch of all predators. A total of 15,359 fish were taken by 4,169 anglers for an average of 3.68 fish per man, and at the rate of 1.12 fish per hour. Carp control has been vigorously and effectively carried on all spring, which should result in better environment conditions next season.

West Okoboji

Fishing on West Okoboji this season showed a considerable decline over last year. This was especially noticeable in the crappie, perch and bluegill species. As on most lakes censused this year, angling pressure was much less than last due principally to the cold, windy weather. A total of 9,187 fish were taken by 3,540 anglers, or an average of 2.6 fish per man and 0.82 per hour.

Center Lake

The data on Center Lake has not been tabulated for comparative purposes, due to the lack of time. Fishing has been very poor this year, however, due principally to the lack of fishermen. The poor fishing last year, and the continued small size of the bullheads is responsible for this. Bass fishing has been excellent at times here, and several of the expert fishermen have taken limit catches within a very short time. A special study has been underway on this lake for several years, and indications have pointed toward over-populations of bullheads. This year's net census does not bear this out, however; indicating a possible need for more intensive study.

IOWA LAKES CREEL CENSUS
CLEAR LAKE

SPECIES	1948	1949	1950
CRAPPIE	2,401	1,464	1,151
PERCH	3,541	250	39
N. PIKE	401	159	17
WALLEYE	2,299	2,004	468
YELLOW BASS	12,673	8,944	3,764
S.M. BASS	213	45	21
L.M. BASS	130	229	126
BULLHEAD	13,643	5,670	9,379
WHITE BASS	1,624	481	259
BLUEGILL	866	295	134
YEARLY TOTALS	37,800	19,531	15,359
No. Anglers	10,215	6,253	4,169
No. Hours	30,463	17,523	13,722
Fish/Angler	3.69	3.12	3.68
Fish/Hour	1.24	1.11	1.12

IOWA LAKES CREEL CENSUS
WEST OKOBOJI

SPECIES	1946	1947	1948	1949	1950
CRAPPIE	5,310	2,661	3,682	2,405	1,421
PERCH	876	2,589	4,217	6,815	1,001
N. PIKE	924	646	1,160	658	657
WALLEYE	1,599	1,073	4,018	1,956	1,270
L.M. BASS	706	613	581	650	710
S.M. BASS	113	39	425	329	321
WHITE BASS	125	79	405	242	158
BULLHEAD	456	1,496	1,756	3,721	2,062
BLUEGILL	313	350	1,339	1,601	583
TOTALS	10,422	9,546	17,583	18,377	9,187
No. Anglers	3,292	2,417	5,860	5,975	3,540
No. Hours	9,878	8,942	21,485	21,192	11,145
Fish/Angler	3.19	3.95	3.00	3.07	2.60
Fish/Hour	1.03	1.06	0.82	0.86	0.82

IOWA LAKES CREEL CENSUS
BLACKHAWK LAKE

SPECIES	1947	1948	1949	1950
CRAPPIE	14,359	12,507	5,059	6,577
PERCH	1,924	2,014	406	21
CHANNEL CAT.	14	333	201	63
CARP		2,477	491	499
WALLEYE	0	6	0	0
S.M. BASS	2	5	22	0
L.M. BASS	34	390	476	72
BULLHEAD	4,649	2,422	1,250	1,944
WHITE BASS	5	11	3	5
BLUEGILL		1,140	388	64
N. PIKE	0	0	0	1
TOTALS	20,987	21,206	8,296	9,646
No. Anglers	7,704	7,829	9,005	7,338
No. Hours	21,587	16,474	16,824	11,395
Fish/Angler	2.76	2.68	0.92	1.31
Fish/Hour	0.97	1.37	0.49	0.85

SUMMARY

Tables have been prepared to show a comparison of the 1950 creel census data, with those of previous years, on seven Iowa lakes. About an average season was experienced in the 45 day sample census. Adverse weather conditions prevailed throughout most of the season resulting in a decreased angling pressure and consequently decreased take. Some comments are made concerning the possibility of increasing our catchable surpluses and standing crops of game fishes. Outstanding among these are:

1. A continuation and extension of the present vigorous campaign aginst the rough fish.

2. Where super-abundant forage exists, such as Blackhawk, North Twin and Five Island, additional stocks of predatory species are advocated in addition to removal of brood forage species.

3. An extension of efforts by the survey crews in certain problem lakes. Our present inventory system is good and covers the major needs adequately. However, their time is limited in order to cover all lakes in the State. A special crew may be needed for this assignment.

RIVER SURVEYS - N. E. IOWA

By
R. E. Cleary

In keeping with present day ideas of fisheries surveys, more emphasis has been placed on "what and how many" fish are present in a given body of water in Iowa. There are numerous types of biological surveys on aquatic environs, each being modified this way or that to best fit the type of water being surveyed. Many modifications of techniques depend largely on the credance the individual researcher has in this or that method.

This is especially true in river or stream surveys where the variables are such as to preclude a standardization of techniques. Of these techniques, the most common is the "mark and recapture" method in which fish are taken by devious means, marked by either fin clipping or tagging and returned to the river. The number of marked specimens returned through subsequent catching methods gives a statistical basis for judging given populations.

In small streams, where the entire body of water can be covered with fish taking devices such as an electrical shocker or a supervised and intensive creel census, the margin of error is negligible. However, as the size of the stream increases so does the sampling error until nothing positive can be stated on numbers of fish inhabiting a particular river. Present day sampling techniques can show little more the relative density between species and little, if any, light can be shed on reasonable accurate figures for a specific river population. Large stream and river inventory, therefore, has to be carried on a trend basis and even this involves much of "by guess and by God".

Before selecting a method to sample the streams of N. E. Iowa, we shopped around quite a bit, reviewing various techniques and trying to fit them into our scheme of things. When Dr. Wm. Ricker was asked what would be a statistically adequate number of samples and he informed us that there were too many variables and it would involve too much work to even dream of sampling a major river population statistcially. That out of the way, our next problem was how to take the fish. Electrical fishing methods demand clear water, which our major rivers lack in most areas, seining with sizable nets to get coverage would necessitate a crew and the obstructions in most reaches of our rivers preclude the use of this method. Creel census on rivers was also discarded as unwieldy. We finally borrowed part of Harry Harrison's methods and part of John Funk's from Missouri and came up with a combination "mark and recovery" through the use of 2' x 4' frame nets, 1" mesh, and 30 foot leads, and a 30' seine to give us an insight into the reproductive success.

Ten survey stations were established at various points

om the major rivers in N. E. Iowa. The stations were picked according to the physical requirements of the fishing gear but primarily with an eye toward fishing pressure, since these are the areas which will determine, in a sense, our future management plans. Inaccessible and little utilized area, while they may be important to the river as a whole, do not figure in the fisherman's scheme of things and consequently we must direct our attentions to areas which bear the brunt of angling pressure. These are the "hotspots" which decides in the sportsman's mind whether or not we are doing our part in maintaining his fishing success. This, of course, does not constitute random sampling of the river, but science can be pure only to the point where it conflicts with common sense.

We use ten nets and place them according to the physical features of the river. No effort is made to set in particularly good habitats as this would result in catching a preponderance of the species inhabiting that particular habitat and bias the resultant data. We try to cover as many of the habitats as are present and fish some of our nets without leads under a cut bank or in a brush pile. Five days are spent at each station, with the nets being lifted once every 24 hours. Some nets have to be replaced after being washed out or when falling water prevents them from fishing properly. Beaver, mink, muskrats and even cows keep the mending twine on the expendable list and leaves, brush, etc., often plug up the nets to where they just won't fish. We have learned through experience that this type of net does its best job of taking fish from June to September. Earlier than June most of the game fish just aren't moving around enough to be taken and the high water with its trash load makes it almost impossible to hold nets in the river.

In the latter part of September the water is clear and the fish seem to avoid the nets, there is a general slowing down of fish movement, and the rivers are full of leaves which plug up the throats and build up on the nets and leads causing them to be torn out by water pressure.

All game fish and suckers are counted, weighed, fin clipped and returned to the stream beyond the nets actual fishing range. In the case of important scaled game fish, growth data and scales are taken. Samples of abundant species of pan fish are also processed to determine if they are "problem populations" of stunted fish or just a large year class. Catfish are divided into length frequency groups in the notes and arbitrarily by size are listed as "fiddlers", "sub-adults", and "adults". This gives some index as to population balance. Rough fish are weighed and removed and disposed of by devious means.

At the completion of the five day netting period, total numbers and weights of various species are listed and reduced to a "catch per unit effort" basis. In our surveys we use number of fish and number of pounds per net

fishing hour. This data is tabulated further into four categories, game fish, rough fish, forage fish and total fish. These figures are then used as a basis for our year to year trend check. It must be understood that variations due to time of year, water conditions and the lake are more the rule than the exception but in analyzing the data, the survey technician must take into account these unstable conditions and reserve judgement on his findings accordingly. Efforts are made to so calander these surveys that they approach as near as possible the same physical conditions prevailing in the previous year. If there is a large discrepency in populations from year toyear, rationalization of the changed conditions and possible limiting factors is a very important part of the survey. In other words, it is equally important to know the reason behind a high or low population as it is to know that the population is high or low.

The use of a minnow seine gives an additional insight into population trends, as barring unforeseen calamities, a high peproductive success should be indicative of a population on the increase. Forecasts as to future fishing success may result in some tongue biting since fishing success is related strongly to the anglers techniques. However, if we know the fish are present we can switch our management plan to improve fishing techniques instead of needless stocking and the lake. Since only five stations have been revisited of last years sequence and since trends aren't obvious with a years comparative data, not much can be said for the picture on the N. E. Iowa rivers. In the table below, all the data which has been gathered since the inception of the survey is listed. These, however, are unadjusted figures and should be treated as such.

What constitutes a good harvestable surplus in a stream is a good question and one to which we will probably never be able to answer. We are, at present, involved in a volunatary creel census survey started this year as a check against the findings of our various surveys. If we find a population on the increase, decrease or static condition, this fact should show up in angler success. With this in mind the officers of the drainage counties east of the Iowa Riverrfurnish us with the names of five reputedly good fishermen, from each of their counties, who were known tp be cooperative with a venture of this type. These "cooperators" as we have termed them, were briefed as to our desires and plans and given report forms which they in turn would turn in weekly as to their fishing success. It is too early to judge the success of this completely voluntary creel census but with poor fishing conditions prevelent, it is surprising this how many have faithfully turned in their reports. Even reports stating "no fishing this week - river muddy" or the like are being received. Off and on during the season we plan to and have done some "jacking up" by letter and b y personal contact.

The individual cooperator lists his fish for the week by species, gives either length or poundage and the number of hours fishing per trip and on what stream and in what county the fishing was done. At the close of the normal fishing season, the data will be tabulated and copies of the results sent to each active cooperator with the invitation to join the project again next year and asking his opinions on the season as a whole and what if any suggestions he may have to make.

1949 - 1950 RIVER SURVEY

STREAM	COUNTY	NO. FISH/ NET / HR. GAME	ROUGH	FORAGE	TOTAL	NO. LBS/ NET / HR. GAME	ROUGH	FORAGE	TOTAL
		1949							
Cedar R.	Mitchell	.84	.03	.16	1.03	.19	.12	.20	.51
Cedar R.	Blackhawk	.37	.01	.05	.43	.13	.01	.08	.22
Cedar R.	Benton	.33	.57	.02	.92	.34	.37	.01	.72
Wapsie R.	Linn	.19	.22	.05	.46	.06	.21	.07	.34
Wapsie R.	Buchanan	.37	.01	.05	.43	.13	.08	.01	.22
Iowa R.	Marshall	.41	.43	.08	.92	.27	.15	.04	.46
Maquoketa R.	Delaware	2.15	.01	.04	2.20	.41	.07	.04	.52
U. Iowa R.	Winneshiek	.08	.01	.83	.92	.02	.01	.28	.31
Turkey R.	Clayton	.27	.08	.24	.59	.14	.24	.18	.56
		1950							
Cedar R.	Mitchell	.21	.01	.05	.27	.05	.04	.05	.14
Cedar R.	Blackhawk	.10	.31	.14	.55	.06	.50	.09	.65
Cedar R.	Benton	.42	.50	.07	.99	.26	.45	.04	.75
Maquoketa R.	Delaware	.57	.004	.04	.61	.20	.01	.03	.24
Iowa R.	Marshall	.11	.22	.10	.43	.14	.18	.04	.36

NOTES AND SUMMARY OF HATCHERY OPERATIONS
Spirit Lake and
Clear Lake Hatcheries
Spring of 1950

Tom Moen - Fisheries Biologist - Okoboji
Fay Fronk - Hatchery Superintendent - Spirit Lake
D. H. Huey - Hatchery Superintendent - Clear Lake

The following is a routine report that covers the operations of the Spirit Lake hatchery as it is concerned with the artificial hatching and the stocking of Northern Pike, Esox lucius, Linn.; the operations of the Spirit Lake and Clear Lake hatcheries as they are concerned with the artificial hatching and the stocking of Yellow Pike Perch, Stizostedion v. vitreum, Mitchell. The data for the Clear Lake hatchery covers the first year in a series of alternate year operations designed to assist in evaluating walleye hatcheries.

NORTHERN PIKE
(At Spirit Lake Hatchery)

Adult Northern Pike used in the hatchery were collected entirely from carp traps during the Northern Pike spawning run, with most of them taken from the Hinshaw Bridge trap located between East Okoboji, and Upper Gar Lakes. The first Northerns were collected on the 30th of March. The first female was stripped on the 4th of April and the last one on the 16th of April. A total of 78 females produced 38 quarts of eggs, thus an average of .5 quart per fish (1949 ave. was .6 qt. per fish). Although more experimental work is needed on hatching northerns, very little was completed during the 1950 season. Most of the eggs were handled according to the method determined during the 1949 season as the best of several methods tried at that time.

In spite of the late spring and generally colder weather the water temperatures during the northern hatching were slightly above those for the 1949 season with an average of 46.6°F, compared to 44.5°F for last year. The air temperatures were slightly colder with an average of 41.2°F compared to 42.6°F for the 1949 season. The first northerns hatched on the 24th of April and all eggs were hatched by the 9th of May, with an average hatching time of 21 days.

Egg checks were made every other day to determine fertility and numbers per quart with a total of 41 counts being completed (Table No. 1). Both green and eyed egg

determinations showed that the northern eggs were slightly larger and, therefore, fewer per liquid quart than during the 1949 season, and contrary to last year's determinations the green eggs were larger than the eyed eggs. We have no immediate explanation at this time. The figure of 60,000 per quart was again this year for the purpose of setting aside eyed eggs in order that certain numbers of fry could be expected for stocking. Individual fertility checks ran from 50% to 94% and the final hatch was set at 71% on the basis of 38 quarts of green eggs put up and 27 quarts of eyed eggs brought through to hatching time.

Table I.
Number of Northern Pike Eggs Per Liquid Quart Determined for the 1948, 1949 and 1950 Seasons.

Year	Age of Eggs	No. of counts	Ave. per Quart	Range
1948	All ages	9	71,072	65,680 - 84,130
1949	1 to 3 days	14	61,325	56,239 - 67,670
1949	eyed	9	60,316	56,239 - 67,670
1949	All ages	58	61,623	56,239 - 74,146
1950	1 to 3 days	26	57,080	49,490 - 76,486
1950	eyed	12	58,252	56,239 - 61,925
1950	All ages	41	57,600	49,480 - 76,486

From the Spirit Lake hatchery Northern Pike fry were stocked as follows:

Lost Island Lake	100,000
Spirit Lake	150,000
North Twin Lake	100,000
Silver Lake (D. Co.)	100,000
West Okoboji Lake	100,000
East Okoboji Lake	200,000
McClellans Slough	50,000
Lower Gar Lake	100,000
Five Island Lake	150,000
Lake Cornelia	100,000
Eldora Hatchery (Pond	50,000
Lanesboro Pond	50,000
Trumbull Lake	100,000
Silver Lake (P. Alto Co.)	100,000
Iowa Lake (Emmet Co.	225,000
Spirit Lake Hatchery	15,000
	1,690,000

YELLOW PIKE-PERCH
(Spirit Lake Hatchery)

Gill-netting for walleyes commenced on April 13th in East Okoboji Lake and on April 14th in Spirit Lake and terminated on the 25th and 26th respectively. There was no gill-netting for walleyes on West Okoboji Lake this year. All gree fish from both Spirit Lake and East Okoboji were transported to the Spirit Lake hatchery; no spawn-taking was completed at the stripping station as in former years.

The first eggs were put up on the 16th of April and the last on the 26th. All eggs hatched between May 14th and May 19th. Water temperatures and air temperatures, taken 4 times daily for the period of hatching, were as follows: Average water temperature, 48.9°F (1949 - 52.0°F) with a range of 37 to 58.7. Average air temperatures, 44.3°F (1949 - 51.3) with a range of 20.5 to 58.7. The relatively cooler water and air temperatures during the time of incubation were responsible for a much longer season than normal.

The usual gill-netter's reports were filled out and the usual hatchery records were kept, recording the number of eggs put up, number of eyed eggs after final screening, number of eggs per quart, and fertility.

The summaries of the gill-netter's reports are attached to this report as Appendix B-1 and B-2. A total of 412 quarts of eggs were put up. Due to the fact that all eggs were taken at Spirit Lake, the quarts of eggs for each lake could not be determined. Based on the number of females reported caught by the gill-netters (1,212) the production would be .34 quart per female. A special check made to determine something about the production per female revealed that 111.5 quarts of eggs were taken from 206 females. The latter figure is more nearly correct because an unknown number of green or unspawned females were returned to the lakes from the holding tanks. In other words all the females recorded as caught were not used. This means that 60 to 75 thousand eggs were taken from the average female. Eddy and Surber (1947) give 49,614 eggs as the average production per female on the basis of several thousand records of the Bemidgi spawning station.

Diameter counts were made on both green and eyed eggs to determine the numbers per liquid quart. Forty-six counts of green eggs and 25 counts of eyed eggs were made during the hatching season. These counts revealed that both green and eyed walleye eggs were

running considerably larger this year with green eggs averaging 145,026 per quart and eyed eggs averaging 143,805 per quart. The most logical explanation for this situation is the fact that the females run larger, and larger fish have larger eggs. There was considerable comment among hatchery employees to the effect that the walleyes were running larger this year than in former years.

Production and percent of hatch were calculated as follows:

412 quarts of green eggs x 145,000 - 60,740,000 eggs put up
364 quarts of eyed eggs x 144,000 - 52,416,000 eyed eggs

The eyed eggs had a fertility of 98% thus producing 51,368,000 fry. This represents an overall hatch of 84.5%. Sixteen quarts of "hospital" eggs having a fertility of about 50% were considered used to make up for the undetermined loss of fry before stocking. Attached to this report is Appendix - A which gives the schedule on where and how many walleye fry were stocked from the Spirit Lake hatchery. The discrepancy between the number of fry stocked and the number of fry available as calculated above was incurred by a "rounding off" of the numbers stocked.

Yellow Pike-Perch
(Clear Lake Hatchery)

Gill-netting for walleyes in Clear Lake commenced on the 14th of April and terminated on the 24th of April. Appendix B-3 attached to this report summarized the gill-netting records for the 1950 season. All ripe fish were "camp-stripped" only those fish that would become ripe within a day or two were hauled to the hatchery.

The first eggs were put up on the 15th of April and the last on the 25th. All eggs hatched between May 14th and May 19th. Water temperature and air temperatures averages were as follows: Water temperature average 44.9 with a range of 34.7 to 56.0. The air temperature average was 48.5°F with a range of 30.8 to 64.2.

A total of 318 quarts of green eggs were put up, and 267 quarts brought through to the eyed stage. Diameter counts to determine the number of eggs per liquid quart revealed that the Clear Lake eggs were quite large with 40 counts of green eggs averaging 131,500 per quart and 25 counts of eyed eggs averaging 124,500. Here again the most logical explanation is the decidedly larger average size of the females.

Production and percent of hatch were calculated as follows:

318 quarts of green eggs x 131,500 - 41,817,000 eggs put up
267 quarts of eyed eggs x 124,500 - 33,241,500 eyed eggs

The eyed eggs had a fertility of about 97% after the final screening, thus leaving a production of 32,244,255 fry. For all practical purposes this can be rounded off to 32,244,000 fry for a hatch of 77.2%. A few quarts of "hospital" eggs were used to make up for loss of fry after hatching, etc.

Aside from a few fry stocked in the Hampton rearing ponds, the entire production from the Clear Lake hatchery was stocked in Clear Lake.

APPENDIX - A

Walleye Fry Stocking From Spirit Lake Hatchery for Spring of 1950

NURSERY PONDS

Humboldt Hatchery (2 ponds)	- 50,000	
Dolliver Park Pond	- 25,000	
Virgin Lake	- 200,000	
Pickerel Lake	- 500,000	
Welch Lake	- 500,000	
Lake Park Pond	- 50,000	
Total	-1,825,000	
		1,825,000

RIVERS

Iowa River (@ Alden)	- 50,000	
Des Moines (@ Fraser)	- 50,000	
Des Moines (@ Camp Dodge)	- 50,000	
Total	- 150,000	
		150,000

LAKES

East Okoboji Lake	- 17,000,000	
West Okoboji Lake	- 17,000,000	
Five Island Lake	- 1,000,000	
Lost Island Lake	- 50,000	
Spirit Lake	- 15,000,000*	
Total	- 50,050,000	
		50,050,000
Grand Total.....		52,025,000

*This is the second consecutive year in which 15 million walleye fry were stocked in Spirit Lake. (The 1949 season was the first year for walleye fry stocking in Spirit Lake since 1943). Again, as last year, the fry were stocked from a slowly moving boat or barge. The distribution covered the 3 day period of May 15-18 at the following points:

Sand Bar and vicinity	-	95 cans x 67,000	- 6,365,000
South Shore	-	45 cans x 67,000	- 3,015,000
Red Nose Point and Vic.	-	21 cans x 67,000	- 1,407,000
East of Big Stony Pt.	-	21 cans x 67,000	- 1,407,000
Jackson Point & Vic.	-	21 cans x 67,000	- 1,407,000
Marble Beach Area	-	20 cans x 67,000	- 1,340,000
		223 cans	14,864,000**

**Number of fry per can was rounded off from 67,264 to an even 67,000, thus showing a shortage of 126,000. The 15,000,000 were set up on a special battery.

APPENDIX B-1
Spirit Lake

Fish Catch Compiled From Gill-netter's Reports for 1950

NUMBER OF YELLOW PIKE-PERCH

Date	Males	Females	Total	Stripped on Lake Males	Stripped on Lake Females	No. of Crews	Fish Per Crew
April							
14	11	2	13	-	-	1	13
15	9	10	19	-	-	1	19
16	22	11	33	-	-	2	16.5
17	58	41	99	-	-	5	19.8
18	38	42	80	1	1	5	16.0
19	28	31	59	-	-	5	11.8
20	16	24	40	4	2	5	8.0
21	61	81	142	1	1	5	28.4
22	77	69	146	6	6	5	29.2
23	35	42	77	7	7	5	15.4
24	32	40	72	-	-	5	14.4
25	(Did not fish)						
26	15	5	20	-	-	5	4.0
Totals	402	398	800	19	17	49 - Crew nites	
Fish/C/ nite	8.2	8.1	16.3				

TOTALS OF OTHER FISH CAUGHT DURING GILL-NETTING

GAME FISH

Northern Pike	- 52
White Bass	- 16
L.M. Bass	- 18
Yellow Perch	- 54
Bullheads	- 30
Crappie	- 6
Suckers	-226
Redhorse	- 8
	410 - 8.2 fish per crew per nite.

ROUGH FISH

Carp	-831
Buffalo	- 2
Gar	- 5
	838 - 17.1 fish per crew per nite.

1,248 - 25.3 fish per crew per nite.

APPENDIX - B-2
East Okoboji Lake

FISH CATCH COMPILED FROM GILL-NETTER'S REPORTS FOR 1950
NUMBER OF YELLOW PIKE-PERCH

Date	Males	Females	Total	Stripped on Lake Males	Stripped on Lake Females	No. of Crews	Fish per Crew
April							
13	16	9	25	-	-	2	12.5
14	47	25	72	-	-	2	36.0
15	84	33	117	2	1	5	23.4
16	49	115	87	-	-	4	21.7
17	104	102	219	14	13	6	36.5
18	51	59	153	12	9	5	30.6
19	48	110	107	7	6	5	21.4
20	49	173	159	10	10	5	31.8
21	73	74	246	12	16	5	49.2
22	45	19	119	8	9	5	23.8
23	41	46	60	15	8	5	12.0
24	33	11	79	4	4	5	15.8
25	5		16	-	-	5	3.2
Totals	645	814	1,459	84	76	59-Crew nites	
Fish/C/nite	10.9	13.8	24.7				

TOTALS OF OTHER FISH CAUGHT DURING GILL-NETTING

GAME FISH

Northern Pike	-	375
White Bass	-	22
L.M. Bass	-	13
Yellow Perch	-	990
Bullheads	-	533
Crappies	-	5
Suckers	-	877
Redhorse	-	28
S.M. Bass	-	2
Bluegill	-	1
Catfish	-	1
		2,847 - 48.2 fish per crew per nite

ROUGH FISH

Carp	-	23
Sheepshead	-	21
Quillback	-	1
		45 - .7 fish per crew per nite

2,892 - 48.9 fish per crew per nite.

APPENDIX B-3
Clear Lake

FISH CATCH COMPILED FROM GILL-NETTER'S REPORTS FOR 1950

NUMBER OF YELLOW PIKE-PERCH

DATE	Males	Females	Total	Stripped on Lake Males*	Stripped on Lake Females	No. of Crews	Fish per Crew
April							
14	146	14	160	21	6	2	80.0
15	358	21	379	21	6	4	94.7
16	407	34	441	56	13	4	110.2
17	353	70	423	94	23	4	105.7
18	310	102	412	99	25	4	103.0
19	392	79	372	75	19	4	93.0
20	241	93	334	110	34	4	83.5
21	521	252	773	391	133	4	193.2
22	116	226	342	277	120	4	85.5
23	181	155	336	271	116	4	84.0
24	76	79	155	133	59	4	38.2
Totals	3,002	1,125	4,127	1,548	554	42 Crew nites	
Fish/C/ nite	71.4	26.8	98.2				

*Males were often hauled to camps from the hatchery.

TOTALS OF OTHER FISH CAUGHT DURING GILL-NETTING

GAME FISH

Northern Pike	-	5
Black Bass	-	1
Bullheads	-	5
Silver Bass	-	1
Yellow Bass	-	1
Crappies	-	1
Redhorse	-	1
Suckers	-	824
		839 - 19.9 fish per crew per nite.

ROUGH FISH

Carp	-	351
Buffalo	-	2
Quillback	-	19
		372 - 8.8 fish per crew per nite

1,211 - 28.7 fish per crew per nite

NOTES ON THE NATURAL SPAWNING OF WALLEYES IN SPIRIT LAKE

By
Tom E. Moen

Sooner or later in the course of any discussion concerning the values of the walleye hatcheries we find that there are a number of questions on the nature and success of natural spawning. In other words, how does the hatchery compare both in quantity and fertility with that of Spirit Lake under natural conditions, and what are the limiting factors? The discussion that follows is the result of an attempt, and a very weak attempt at that, to answer a few of these questions.

One of the first arguments brought out in favor of hatcheries is the statement that the percentage of hatch in the hatchery is almost infinitely better than that under natural conditions, thus making up what the hatchery might lack in numbers by a higher fertility. It is relatively easy to calculate the percentage of hatch obtained under hatchery conditions, but not so easy to determine for eggs deposited under natural conditions. The logical approach to the problem of fertility was to secure a sample of these eggs and examine them for fertility. As you know, walleyes are random spawners; they scatter their eggs in shallow water 2 to 10 feet in depth and leave them unattended. If time permitted, a dredge, such as a standard Eckman or Peterson dredge would be the most accurate, but several trials with a dredge would net only one or two eggs and often several hours were spent without collecting a single egg. The most successful method consisted of dragging a weighted Surber stream bottom sampler behind a slowly moving boat. As many as 129 eggs were collected in an estimated 1000 ft. of towing over sand shoal areas. All material collected in the sampler was taken to the lab. Here the eggs were separated from sand and other material and checked for fertility. The results covering the years 1946 through 1950 appear in Table No. I.

From this table we find that the number of eggs collected during any one season varied from 21 to 216; the percent of fertile eggs varied from 2.5% to 42%; (hatchery fertility runs 70 to 90%). Little or no correlation or consistency could be demonstrated as far as egg fertility was concerned. It is quite probable that the samples are very adequate in number and the sampling technique may have influenced the results. In regard to the infertile eggs, one thing did appear to be important.

Table No. I. Number collected and percentages of fertility and infertility of naturally spawned walleye eggs collected from Spirit Lake.

Year	Total Number Collected	Fertile		Infertile			Per-Cent	Total Per Cent Infertile
		Number	Percent	-White	Percent	-Holes		
1946	198	32	17	82	41	84	42	83
1947	216	75	35	96	44	44	21	65
1948	79	2	2.5	31	39.2	47	59.3	97.5
1949	50	21	42	28	56	1	2.0	58
1950	21	3	14.3	18	86	0	0	86

In 1946, during the course of examing these eggs for fertility, a large percentage of the eggs collected were found to be parasitized or preyed upon in a very characteristic manner. During the three year period of 1946-1948, 21% to 59% of the eggs taken from Spirit Lake were nothing but empty shells and each shell had one or more small irregula r holes giving the appearance of having been preyed upon by some species of animal or organism having chewing mouthparts. Other infertile eggs were a normal color of either white or yellow.

No definite conclusions could be made as to just what was responsible for this egg destruction. The amphipod, or "scud" as it is often called, with the generic name of Hyalella was strongly suspected but could not be proven guilty. Several things that could be called circumstantial evidence pointed to this organism as the logical culprit. The first evidence was the fact that Hyalella was by far the most numerous organism taken during this period of egg laying. Large numbers of Hyalella were taken during 1946, 1947 and 1948 with a relatively high percentage of destruction due to this cause followed by low numbers of Hyalella and low percentage of parasitism during 1949 and 1950. (Table No. I) Brief checks in East Okoboji, Silver Lake and Lost Island Lakes showed no parasitism and few or no scuds were taken. But there was no evidence of egg destruction when a large number of scuds were put in the same container with fresh hatchery eggs.

The importance or value of this finding is, of course, quite questionable. The reduction of parasitism during 1949 and 1950 was not accompanied by a great increase in egg fertility. This also held true for the other lakes mentioned above; the fertility was also low in these lakes where there was no parasitism.

Without much thinking it is easy to see that the total number of eggs deposited in the lake would be equally as important as the fertility. To arrive at this figure we need the help of another set of figures. During 1947 on the basis of 550 tagged pike, E. T. Rose (1947) obtained a population estimate of 30,544 walleyes for Spirit Lake. If we assume a 50-50 sex ratio the female population would number 15,272. The 1947 hatchery record gives each female walleye an average production of .43 of one quart. The product of females times quarts result in 6,565 quarts of eggs spawned. Again referring to the hatchery records we find that the Spirit Lake eggs ran 140,000 per liquid quart. The product of number of quarts times number per quart gives us 6,827, 600,000 eggs and 35% (the percent of fertility determined for 1947) of this astronomical figure equals 2,389,660,000. This is about 50 times as many fry as produced by the hatchery the same year.

Again, the importance of these figures is questionable. There is little doubt that these figures, both for fertility and production, vary a great deal. We know that the number of females will vary from year to year and the fertility is subject to great fluctuations as we have seen in Table No. I covering a period of 5 years.

But when all the angles are considered in the light of what we think we know the hatchery still seems to be putting a very small portion back into the lake. Rose has stated (1946) that even when the natural hatch is included the survival rate of the walleye fry is less than .1 of 1 per cent.

There is one more question bearing on this general subject that I would like to at least partially answer. The question concerns how much egg predation there is during spawning time by other fish. During the 1946, 1947, and 1948 spawning season, stomachs from several species of fish were examined to determine if walleye eggs were being taken. Fish from both East Okoboji and Spirit Lake were examined. From East Okoboji; 34 sheepshead, no eggs found; 2 suckers, no eggs found; L. M. Buffalo, 21, no eggs found; 2 carp, 9 eggs found in one stomach. From Spirit Lake; 10 sheepshead, no eggs found; 16 suckers eggs found in 2 fish; 51 carp, no eggs found; 8 white bass, no eggs found; bullheads 36, eggs found in 2 fish, with a total of 241 eggs for the two fish; 24 perch, eggs found in 3 fish, with a total of 86 eggs. It would appear from these figures that a combination of high populations of the species preying on the walleye eggs and low natural food would result in an important reduction in the possibly walleye productions.