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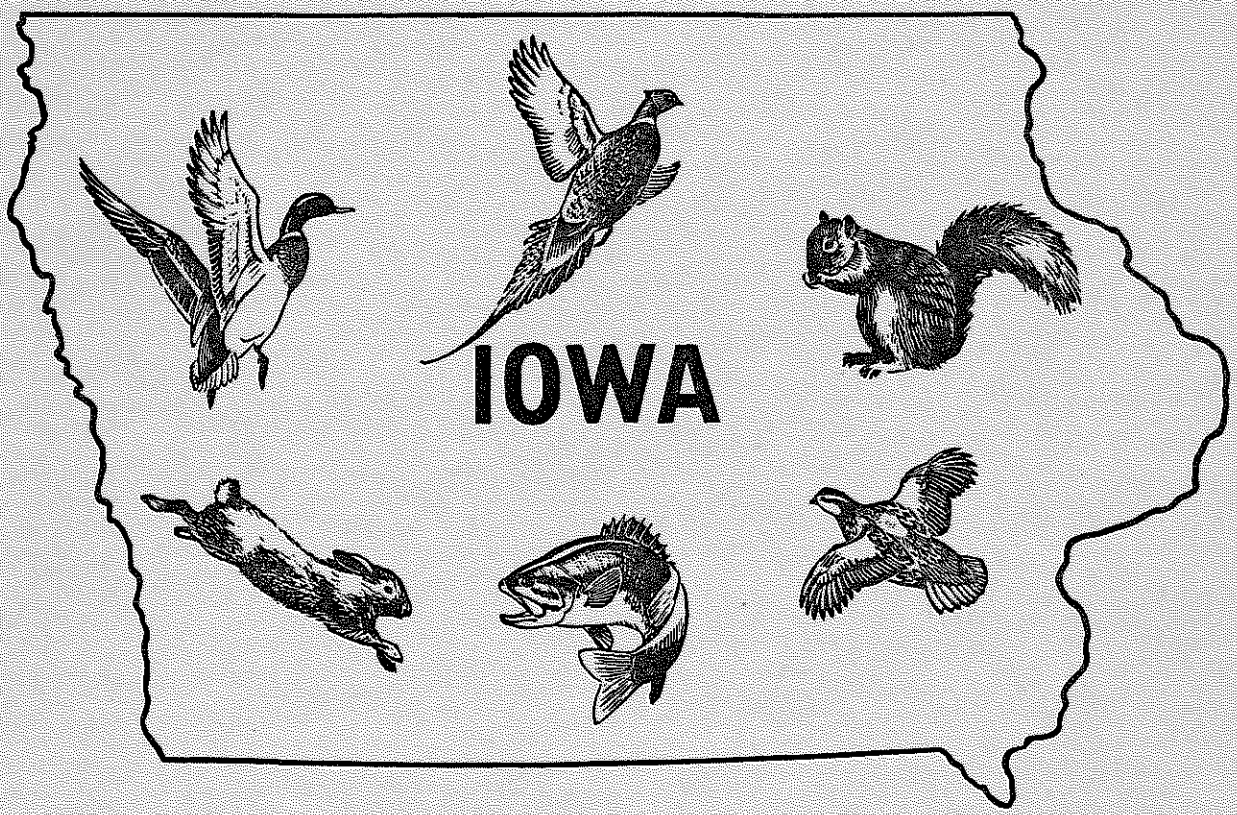
Jan-Feb-March 1954

QUARTERLY BIOLOGY REPORTS



ARTHUR HALE

FISH AND GAME DIVISION — BIOLOGY SECTION

STATE CONSERVATION COMMISSION

Q U A R T E R L Y B I O L O G Y R E P O R T S

January, February, March 1954

Vol. V No. 4

Submitted by

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SUMMARY OF 1953 VOLUNTARY CREEL CENSUS ON NORTHEAST IOWA STREAMS

R. E. Cleary
Fisheries Biologist *

A modified voluntary creel census covering the angling success and effort on northeast Iowa streams was started in 1950. A group of better-than-average fishermen were personally contacted on such a basis as to cover river angling activities in all the counties in the northeast Iowa river drainages. These anglers were asked to furnish a complete account of their activities, reporting on weekly basis, using franked creel census cards.

Despite the fact that only 102 of the 204 fishermen contacted sent in reports on their fishing success on northeast Iowa streams, it is felt that this year's stream coverage is the best since this project was initiated in 1949. With few exceptions, these being the Turkey and Maquoketa Rivers, we have fishermen reporting their angling success and effort from every county in the northeast and east-central portions of the state.

In 1953 anglers reported 9,405 hours of fishing in 3,089 separate trips. Both of these figures are "highs" for the duration of the project. At the same time the number of unsuccessful hours dropped slightly in proportion to successful hours, indicating a general rise in fishing success.

Table 1 - Success and Effort of Northeast Iowa Voluntary Creel Census Cooperators, 1953

Total No. Fishermen Reporting	Total Trips	Total Successful Hours	Total Unsuccessful Hours	Average No. Trips per Fisherman	Average Hours per trip
102	3,089	7753.7	1651.1	30.3	3.0

Despite low, clear water, the trout fishermen took 1.28 trout with a calculated average weight of .50 pounds in an hour's fishing (Table 2). This compares favorably with 1951, the best season we have on record, during which 1.35 trout with a weight of .48 pounds were creeled per fishing hour.

Warm-water stream fishing had a noticeable rise in the fish-per-hour take with .89 fish being creeled as compared with

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the previous .77 fish-per-hour high. The calculated weight-per-hour catch also rose to a high of .98 pounds as compared to the previous high of .91 pounds per-hour catch in 1950 (Table 2).

Table 2 - Totals for 1953 Voluntary Creel Census
Northeast Iowa Streams

Fishing Category	Total Hours Fishing	Total Fish Taken	No. per rod Hour	Total Pounds Taken	Pounds per rod Hour
Trout	2202.0	2817	1.28	1108.7	.50
Warm-water	7202.8	6359	.89	7045.7	.98

Comparing data in Table 3 with previous years' catch statistics (1950 to 1952), we find that 1953 set new records for the number of smallmouth, crappie and miscellaneous game fish constituting the mixed-creel category, taken per rod hour. By way of explanation, the mixed-creel (M.C.) category covers those game fish which are taken in various numbers and composition during a single trip. Contrasted to this, in other species categories only a single species made up the creel. Since we do not know (and neither does the angler, perhaps) just what species he is trying to take in this category, we have to add this "mixed-creel" category to our list of individual species success and effort. On the Mississippi River a mixed catch of panfish, such as crappies, bluegills, and silver bass is the usual breakdown. While on the inland rivers the mixed-creel category is usually composed of bass, northern and walleye, with an occasional crappie or catfish.

Table 3 - Fishing Success and Effort
by Individual Warm-water Species

Species	Total No. Caught	Total No. Lbs.	Total Hrs. Fishing	No. Caught per Rod Hour	Pounds per Rod Hr.
Catfish	1992	2869.6	2843.8	.67	1.01
S.M. Bass	964	1034.1	1479.3	.65	.70
N. Pike	145	399.3	322.5	.45	1.24
Walleye	124	201.3	317.5	.39	.63
L. M. Bass	178	241.8	266.8	.67	.91
Crappie	460	215.1	226.0	2.04	.95
Bluegill	214	87.9	112.5	1.90	.78
Sauger	130	234.7	73.5	1.77	3.19
Silver Bass	33	26.9	36.8	.90	.73
Bullhead	19	5.5	13.0	1.47	.42
Rock Bass	7	5.0	9.5	.74	.53
Mixed Creel	2098	1733.9	1517.2	1.33	1.14

In comparing various river systems on a fish-per-hour basis, all rivers, with the exception of the Shellrock and the Yellow, presented an average or well-above-average angling season in 1953. Certain species taken in very limited numbers, like the walleye and largemouth bass in the Upper Iowa River, bluegills and largemouth bass in the Cedar River, and northern pike and walleye in the Turkey River, give erroneous figures as to their actual "catchability" factor in those river systems. (Table 4).

Table 4 - Number of Warm-water Fish Per Rod Hour on River Systems of Northeast Iowa.

Stream	Cat.	N. Pike	W.Eye	S.M.	L.M.	B.G.	Crap.	M.C.	Weighted Total
Cedar	.69	.48	.56	.72	.63	2.09	3.64	1.54	.99
Iowa	.56	.52	.10	.77	-	-	.07	.90	.55
Maquoketa	.67	-	-	1.30	-	-	1.66	.82	1.11
Miss.	.34	.86	.19	.56	.67	1.81	1.13	2.11	1.39
Shellrock	1.01	.20	.39	.43	-	-	1.00	.81	.66
Turkey	.58	.63	1.00	.71	-	-	-	.86	.77
Upper Iowa	.25	.50	2.00	.66	.40	-	1.42	.81	.78
Wapsie	.60	.31	.47	.62	-	-	1.20	1.29	.68
Yellow	-	-	-	.30	-	-	-	.63	.38

Table 5 includes the average calculated weight of individual species creeled on a per-hour basis. These figures are derived by assigning weights to individual fish which are reported in total lengths or given weights by the cooperating angler. This is the weakest feature of the project since most fish are given an estimated length or weight. However, a check can be made on this feature by comparing the angler's data with that collected in netting surveys as to fluctuations in size trends for a particular season.

Table 5 - Calculated Weight in Pounds of Warm-water Fish Per Rod Hour on River Systems of Northeast Iowa.

Stream	Cat.	N.Pike	W.Eye	S.M.	L.M.	B.G.	Crap.	M.C.	Weighted Totals
Cedar	.84	1.54	.85	.72	.82	1.27	1.29	1.23	.93
Iowa	.92	1.65	.09	.84	-	-	.07	1.04	.99
Maquoketa	1.62	-	-	1.10	-	-	.66	.41	1.55
Miss.	.74	1.63	1.50	.57	.92	.57	.72	1.21	1.13
Shellrock	1.53	.55	.73	.64	-	-	.54	1.26	1.03
Turkey	.32	.82	1.00	.72	-	-	-	.53	.66
Upper Iowa	.42	1.00	3.00	.81	4.17	-	1.13	.85	.81
Wapsie	.96	.74	1.16	.62	-	-	.56	1.29	.89
Yellow	-	-	-	.33	-	-	-	.36	.34

The 1953 netting surveys indicated the following conditions as compared with those of 1952: the average catfish, walleye and smallmouth bass were smaller, the average northern pike and crappie larger, while largemouth bass and bluegills were not taken in sufficient numbers to permit comparison.

In comparing the weight of the average fish taken by anglers in 1952 with those of 1953, we find the following: walleye and smallmouth bass were smaller in 1953, northern pike and crappies larger in 1953, catfish approximately the same in both years. This would indicate the cooperators to be adequate judges of either the length or weight of the fish they creel. With the exception of the catfish, which should have averaged smaller in 1953 than in 1952, all other species paralleled net survey findings. One can rationalize the catfish situation by assuming that a good catfisherman keeps only the larger or "table-size" fish, releasing and consequently not reporting, his catches of small fish. Since there are more catfish in the rivers than other "game" species, anglers are more or less assured of being able to sort over their catch.

Table 6 indicates, with the exception of the Iowa and Upper Iowa, the rivers of northeast Iowa are fished (and reported on) in proportion to the size of their drainage systems.

Table 6 - Hours of Angling Reported for the Various River Systems of Northeast Iowa [1].

Stream	Hours	Drainage in Square Miles
Cedar	2315	
Wapsie	1263	2550
Mississippi	892	-
Iowa	866	-
Shellrock	708	-
Maquoketa	417	1903
Upper Iowa	379	832
Turkey	314	1696
Yellow	50	235

[1] Warm-water angling only

Summary

1. In 1953, cooperative anglers voluntarily reported on the greatest number of hours and trips in the four years the project has been in force.

2. Angling conditions being very favorable, these cooperators reported the highest per-hour catch in warm-water stream fish since the inception of the project in 1950.

3. Smallmouth and crappie fishing success in rivers and streams was the best it has been since records are available.

4. Of the nine watersheds in eastern Iowa, only the Shellrock and Yellow River catch data fell below the four-year average on a fish-per-hour basis.

5. Indications are, that despite the fact that the angler only estimates his individual catch on a length of weight basis in most cases, the trends in the average weight of certain species as taken in survey nets compare very favorably with the estimates reported by the angler.

6. With the exception of the Iowa and Upper Iowa Rivers, all other rivers in northeast Iowa were fished in proportion to the size of their individual drainages.

SMALLMOUTH BASS STUDIES, DES MOINES RIVER

By Harry M. Harrison *

Except for the Rock River in the northwest corner of the state, the westward and southern limits of the smallmouth bass, Micropterus d.dolomieu, range in Iowa is confined by the Des Moines River drainage. In this drainage, the preponderance of the bass population is restricted to the entire length of the North Raccoon and Boone Rivers, and to the Des Moines River from the city of Des Moines to Bradgate on the West Fork and to Livermore on the East Fork. Bass are also found in substantial numbers in many of the tributaries joining the streams within the reaches set forth. In addition to this distribution, scattered populations of smallmouth occur in the lower reaches of the Middle and South Raccoon Rivers, White Breast Creek in Marion County and in Chequist Creeks in Van Buren County.

North and east of the area just described, smallmouth bass become more numerous and their populations attain a greater degree of stability. Bass studies in that part of the state are conducted by Mr. Cleary and are reported upon by him in other quarterly reports.

The purpose of this report is to summarize the findings relative to certain phases of the life history of the smallmouth bass in the above designated ranges. For the most part, this work has centered around a study of distribution, relative abundance, spawning habits, reproductive success, and survival to fingerling sizes. In addition, some information dealing with sub-adult and adult populations has been obtained, but in such limited quantities as to have little significance.

The study has been of a more or less continuing nature since 1946, but with greater emphasis being given to the years of successful reproduction. The information collected since then is summarized in topical form as follows:

Abundance and Economical Importance: In the area under discussion the smallmouth bass ranks second in abundance among the pan and game fish and is outnumbered only by the channel catfish. From the standpoint of economics, however, it would rank no better than sixth and follow the channel catfish, walleye, bullhead, northern pike and crappie in that order of importance. The appraisal on abundance is based upon our stream survey conducted since 1946, whereas the evaluation of economic significance has been derived from a creel census of fishermen in the field. Over 500 fishermen were contacted

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on the streams in 1953 and not one of them was fishing solely for smallmouth. A few were fishing with live baits and would have liked to catch bass, but all attested to the fact that they were actually pursuing walleyes, northerns or crappies. Of the more than 500 fishermen contacted by the census clerks, two had one smallmouth each.

Distribution in the area: The limits of the smallmouth distribution in central and western Iowa are set forth in the frist paragraph of this report. However, within these, bass occur in wide latitudes of abundance. In a few areas they approach a semblance of stability, whereas in others they flucuate radically or are conspicuous by their absence. Because of this, it is believed worthwhile to give some consideration to areas unique for the presence or absence of bass.

Areas where bass have maintained themselves in quite large numbers since observations were begun in 1946 have occurred only in the Des Moines River. These areas are two in number and include two miles of stream on either side of the mouth of Beaver Creek in Humboldt County. These two areas have one thing in common, both lie adjacent to the mouth of a small tributary stream in which bass have spawned successfully in most years.

At the other extreme, Lizard Creek in Webster County, reported to have been a good smallmouth stream in years gone by, has never had a sizable bass population in eight years of observation. Yet the stream has the appearance of good bass habitat, but has not produced bass since 1946. Although the reason for this is not known, it is our opinion that the seed or parent stock was in some way destroyed, and that because of this, bass have never reestablished themselves in that stream.

Between the limits of where bass have sustained themselves to where they have been continually low since the inception of our observations, there are those areas where the bass population fluctuates greatly. In these, bass may from time to time occur in fair to good, or even large numbers. Generally speaking, the North Raccoon and Boone Rivers and the Des Moines River from the Ledges State Park to Humboldt fall in this category. In these areas bass spawned most successfully in 1948 and 1949, and the adult population reached its peak in 1950 and 1951. Since that time, however, the population has fallen to its lowest point since 1946.

Spawning: Much has been written on the spawning of smallmouth bass, but because neither time nor space permits, a review of the literature or other work is not possible for this report. In our surveys, however, considerable attention has been given the spawning success and habits of the

smallmouth in the area during the time of study. From the data assembled some conclusions have been forthcoming.

Of first importance, it has been found that the great bulk of successful spawning takes place in the tributary streams. In these, those streams having small watersheds are more apt to produce successful hatches than those of larger watersheds. The factor behind the greater success of the small streams over the larger ones, and over the main parts of the larger rivers, is believed to be directly attributed to the length or duration of floods. In the larger streams flood waters often persist during the entire smallmouth spawning season. Streams with small watersheds that lose their flood waters in a matter of hours often permit successful hatches and survival through the black fry stage between stream rises. Flood waters on the nest or fry in the black stage are without exception disastrous.

A list of the better bass spawning streams in the Des Moines River drainage is given in Table 1. In that table the arrangement of streams has been in accordance with their ability to produce successful hatches of bass up to the fingerling stage, and the streams with the highest continued productivity are listed from the top of the table. The county location of the streams and the river to which it is tributary is also given.

Table I.

List of the Better Smallmouth Bass Spawning Streams in Central Iowa.

Name of Stream	County location of stream	Tributary of
Bluff Creek	Boone	Des Moines River
Beaver Creek	Humboldt	Des Moines River
White Fox Creek	Hamilton	Boone River
Eagle Creek	Wright	Boone River
Buttrick Creek	Greene	Raccoon River
Hardin Creek	Greene	Raccoon River
Cedar Creek	Greene	Raccoon River
Purgatory Creek	Carroll	Raccoon River
Brushy Creek	Webster	Des Moines River
Prairie Creek	Webster	Des Moines River
Cedar River	Sac	Raccoon River
Indian Creek	Humboldt	Des Moines River
Boone River	Hamilton & Wright	Des Moines River

Spawning Success and Survival: Important to a continuing population of any species is the ability of that species to reproduce itself and survive the environment changes to which it is subjected. For this reason the spawning success and survival of smallmouth has been followed annually in the Des Moines River drainage since 1946. The technique used in making this study has been to compare the findings of four selected areas from one year to the next. The areas selected for study were chosen, one each, in what was believed to be the four best spawning streams in the Des Moines drainage. Spawning success is based on the number of active nests counted on the area in the spring together with a fingerling count comprising a slight census and netting survey in late summer or early fall. The success of survival to adulthood is based upon the number of adults that can be counted on the spawning grounds either just prior to or during the spawning activity.

These data are summarized in Tables 2, 3, 4, and 5. It should be pointed out that it has not always been possible to get complete data for each area for each spawning season. In many cases slight turbidity has impaired or made the adult counts impossible and in other instances the spawning activities either proceeded or followed our visits to the areas. In case of the fingerling counts, the data are believed to be quite comparable. These are made at a time of year when water conditions are at optimum for visual counts. Seine hauls are made over the same areas from year to year at water stages that vary but very little. Summarizing Table 2 through 5 briefly, it is evident that smallmouth reproduction has been sucessful , in only three years since 1946; 1948, 1949, and 1950. Of these, 1949 was by far the most successful and was followed by 1948 in successful production of bass. The years 1946 and 1952 were apparently complete failures, whereas small hatches occurred in 1947, 1951 and 1953.

Spawning Activity: As mentioned previously, the year 1949 was exceptionally good for smallmouth reproduction in the Des Moines River drainage. Attendant with this, stream conditions were also optimum for observing spawning activities. During that year the spawning season was relatively short and for the most part was begun and completed during the first week in June. Because the period was so short, nesting observation other than the counts reported upon elsewhere in this paper, were confined to Bluff Creek in Boone County. In this stream data were secured on 44 nests.

Table No. 2. Records, Smallmouth Bass Spawning Activity for Bluff Creek, Boone County for the Years 1946-1953.

Year	1946	1947	1948	1949	1950	1951	1952	1953
No. Adults on area	--	18	58	194	31	11	7	4
No. Nests	--	10	16	94	6	6	1	-
No. Fingerlings visual count/100 yds.	--	21	75	286	60	--	3	-
No. Fingerlings seined/100 yds.	--	15	31	84	13	12	1	3

Bluff Creek Area is one mile in length.

Table No. 3. Records, Smallmouth Bass Spawning Activity for Beaver Creek, Humboldt County for the years 1946-1953.

Year	1946	1947	1948	1949	1950	1951	1952	1953
No. Adults on area	3	6	10	16	11	12	3	10
No. Nests	-	-	6	7	9	--	-	1
No. Fingerlings visual count/100 yds.	-	-	--	88	--	--	3	16
No. Fingerlings seined/100 yds.	-	4	1	10	3	4	1	16

Beaver Creek Area is one mile in length.

Table No. 4. Records, Smallmouth Bass Spawning Activity for Eagle Creek, Wright County for the years 1946-1953.

Year	1946	1947	1948	1949	1950	1951	1952	1953
No. Adults on area	-	-	-	3	-	1	-	-
No. Nests	-	-	1	3	-	-	-	-
No. Fingerlings visual count/100 yds.	-	4	22	38	16	-	3	-
No. Fingerlings Seined/100 yds.	-	-	5	10	7	-	-	3

Eagle Creek Area is Two-thirds of a mile in length.

Table No. 5. Records, Smallmouth Bass Spawning Activity for White Fox Creek, Hamilton County for the years 1946-1953.

Year	1946	1947	1948	1949	1950	1951	1952	1953
No. Adults on area	2	2	4	1	-	2	-	-
No. Nests	-	-	-	3	1	-	1	1
No. Fingerlings visual count/100 yds.	-	1	31	39	11	20	-	4
No. Fingerlings seined/100 yds.	-	-	10	4	9	8	5	1

White Fox Creek Area is one-half mile in length.

Statements summarizing these data follow:

1. Adult bass were first observed on the spawning area on May 28.
2. Active nest with eggs were present the same day.
3. Young bass were first observed on June 2.
4. Height of spawning occurred between June 2 and June 6.
5. By June 8, most adult bass had left the stream and by June 10, no adults could be found in Bluff Creek.
6. Of six nests, on which the time of egg spawning and hatching were known, the incubation period was four days.
7. All young had passed through the "black" stage by June 10.
8. Nests occurred in water from eight to 22 inches deep. The average depth of water at the nest was 16 inches.
9. The maximum depth of water within 25 feet of the nests ranged from 10 to 30 inches. Of the 44 nests observed, only seven were in the deepest water within 25 feet of the nest.
10. Nests were placed from six inches to eight feet from shore, while stream widths at nest site varied from six to 30 feet.
11. The distance from the nest to the nearest escape cover varied between one and nine feet.
12. The distance from one nest to the next ranged from 12 to 200 feet.
13. Bottom types in the stream are composed of blue clay, sand, gravel and coarse rubble. On these bottom types, three nests were found on blue clay, seven on sand, twenty-one on gravel and thirteen on rubble.

Conclusions

1. Smallmouth bass are not of great economic importance in the Des Moines River drainage. They rank sixth among the game and pan fish sought by anglers.
2. The Des Moines River watershed at the present, furnishes only marginal habitat for smallmouth bass. This conclusion is based upon the fact that bass populations in the Des Moines River are given to wide flucuations and reproduction fails more often than it succeeds.
3. Reproduction of smallmouth in the Des Moines watershed is quite largely confined to the smaller tributary streams.
4. Since 1946, bass reproduced successfully in 1948, 1949 and 1950. Of these, 1949 was the most successful, whereas 1946 and 1952 were years of almost complete failure.

FOOD OF THE SHEEPSHEAD IN DICKINSON COUNTY LAKES

By Tom Moen *

The sheepshead or freshwater drum (Aplodinotus grunniens Rafinesque) is the only member of the family Scianidae found in the midwest. Sheepshead have been the object of many arguments among fishermen as to whether they should be classed as game fish or relegated to the rough fish group. Although sheepshead often takes both artificial and live bait, it is the present policy of the fisheries management section that the competitive aspects of this fish outweigh any gain in food or sport that might accrue to the hook and line fisherman. Therefore, these fish are removed from the inland waters of the state by rough fish removal crews.

The food habits of the sheepshead are often cited as extremely competitive with the more desirable game species, but there are few specific references involving a study of the food of sheepshead. The data presented here form a protion of a general study of rough fish initiated in 1946, and concern a comparison of the food taken by 378 sheepshead from four lakes during the period of 1946-1949 and supplementary data on the food of 155 adult sheepshead in 1940.

Description of Lakes

The four lakes from which sheepshead were collected are part of a chain of lakes in Dickinson County : Spirit Lake, East Okoboji, West Okoboji, and Lower Gar. These are all shallow (maximum depth 26 feet, except West Okoboji which exceeds 125 feet), glacial, eutrophic lakes. The surface area varies from 260 acres for Lower Gar Lake to 5,682 acres for Spirit Lake.

Methods and Procedure

Collections were made with a wide variety of gear, including gill nets, traps, and various lengths of large and small mesh drag seines. Drag seines. operated by the rough-fish-removal crews accounted for the majority of the fish. All fish were returned to the laboratory where routine data were recorded. All stomachs were either examined the same day of capture or preserved in formalin for later examination.

Food organisms found in each stomach were identified to genera and species where this could be readily accomplished. In the tables, and in much

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of the discussion that follows, the food organisms are grouped into orders and larger divisions. The volume of each species or higher unit of food was measured by displacement to the nearest tenth of a cubic centimeter. The result of each analysis was recorded by volume and occurrence.

The data from the analyses of 352 stomachs taken from four lakes during the period of 1946-49 are separated by lake, season, young and adult fish, and expressed as percentages of total volume and as frequencies of occurrence of food organisms in appendix tables 1, 2, 3, and 4. Twenty-six stomachs taken during the winter and found to be empty are not included in the tables.

Discussion of Food Consumed

General statements made in regard to the food of sheepshead indicate that they feed largely on molluscs. The disappearance of a large population of clams (Lampsilis siliquoidea) from Spirit Lake during the period of 1930-40, has been blamed upon the feeding of sheepshead. Though the pharyngeal teeth are well adapted for such a diet of molluscs, the bulk of the food taken by the fish examined in this study consisted primarily of insect larvae, fish, and crustaceans, in that order of importance.

Insect larvae were important in the food of sheepshead of all sizes throughout the period of open water, making up 46 per cent of the total volume of food taken by all adults examined. Insect larvae occurred more frequently in the stomachs of young fish than any other item. Sibley (1928) found insect larvae comprising nearly 100 per cent of the food of eleven sheepshead from one to four inches long. Among the seven orders of insect larvae identified from the stomachs, the larvae of Diptera and Trichoptera contributed nearly 75 per cent of the total insect volume. Larvae of the orders Neuroptera, Ephemeroptera and Hemiptera were less important, their combined volume exceeding ten per cent of the insect volume in only three collections.

Fish comprised 32 per cent of the total volume of food of adult sheepshead. Volume and occurrence of fish taken as food increased during mid-summer, constituting the most important food item of adults during the months of July and August. This feeding trend coincides with the peak of abundance of young fish each summer. Fish were found only occasionally in the food of young sheepshead. The young pan fish species supplied the bulk of the piscivorous diet, with the following species identified: yellow perch,

bluegill, black crappie, and black bullhead. The forage fish taken were unidentified darters and minnows.

Crustaceans were third in overall importance, contributing 12 per cent of the total volume of food. Small crustaceans (Entomostraca) were not important in the food of adults but occurred frequently in the stomachs of young fish. Ewers (1933) in a study of the food of young sheepshead from Lake Erie, found that small crustaceans made up 100 per cent of the diet of fish less than 25 milimeters in length but occurred less frequently as they increased in length. Large crustaceans found in the stomachs consisted of the amphipod, Hyalella azteca, and crayfish (Cambarus sp.). Amphipods occurred frequently but did not exceed seven per cent of the food taken by the fish of any one collection. Crayfish were not frequently taken as item of food but due to their bulk made up a large portion of the volume in certain collections, reaching a maximum of 55 per cent of the food of ten fish from Spirit Lake in June of 1947.

Molluscs, commonly thought of as the number one food of the sheepshead, occurred frequently but contributed only slightly more than three per cent of the total volume of food when all collections were combined. Molluscs were more important in the food of carp than in sheepshead (Moen 1953). Snails (Gastropoda) were the molluscs taken in spite of the fact that fingernail clams (Pelecypoda) made up one to two per cent of the diet of carp from the same lakes at the same time (Moen op.cit.).

Annelids, largely leeches, appeared frequently but did not contribute heavily to the diet except in the case of the individual fish. For instance, one fish from an East Okoboji collection made in May, 1947, contributed one-third of the food and nearly 100 per cent of the annelids recorded for that collection. This individual fish had apparently gorged on earthworms, perhaps from some fisherman's bait can.

Free living flatworms (Turbellaria) and water mites (Hydracarina) occurred occasionally but contributed very little in volume.

Plant material in the stomachs of sheepshead was apparently limited to occasional ingestion of green fragments, filamentous algae and debris, in the normal course of feeding or in securing the food items discussed above. The lack of green fragments of plants in the stomachs would tend to indicate that sheepshead feed largely on the bottom, either in

non-vegetated areas or without disturbing the vegetation.

Supplementary Stomach Analyses

During the summer of 1940 the writer examined 155 adult sheepshead from Spirit Lake, East Okoboji and West Okoboji Lakes. In examining these stomachs the food items were identified and recorded in numbers of organisms per stomach but no volumes were determined. The per cent of volume of each item was estimated, therefore the data were not included in the tables or foregoing discussion.

These fish were collected during the months of July, August and September. The bulk of the diet of 58 sheepshead from Spirit Lake and 26 fish from West Okoboji Lake consisted of young pan fish, amounting to 75 and 95 per cent respectively. Insect larvae, crustaceans and molluscs contributed the remaining 25 and 5 per cent of the food. Seventy-one sheepshead stomachs from East Okoboji contained 95 per cent insect larvae and five per cent crustaceans. Young fish of all kinds were scarce in East Okoboji and abundant in West Okoboji and Spirit Lakes in 1940; young fish were abundant in all three lakes in 1946 and 1947 (table 1).

Table 1.

Comparison of the average number of young fish per survey haul (500 feet of ¼ inch drag seine) and the per cent of fish in the diet of adult sheepshead taken from East Okoboji, West Okoboji and Spirit Lakes in the late summer months of 1940 and 1946-47.

Year	East Okoboji		West Okoboji		Spirit Lake	
	No. Young per haul	Per cent in diet	No. Young per haul	Per cent in diet	No. Young in haul	Per Cent in diet
1940	89	0.0	2,175	85	7,144	75
1946	6,030	8*			14,401	28
1947	5,645	60	3,742	69		

* several June stomachs included.

SUMMARY

The food habits of 378 sheepshead from four Dickinson County Lakes were investigated during 1946-49. The results were tabulated by lake, season and for young and adult fish. The food of sheepshead during the period of open water consisted of insect larvae, fish, and crustaceans, amounting to 46, 32, and 12 per cent of the total diet respectively.

Insect larvae, largely Diptera and Trichoptera, were important food items at all times. Young pan fish were the most important items of food during late summer months, corresponding to their peak of abundance each year. Small crustaceans were more important in the food of young sheepshead while amphipods and crayfish were the important crustaceans in adult food. Molluscs, contributed only three per cent of the total diet. Plant material was considered incidental to regular feeding.

Twenty-six stomachs taken during the winter months were empty, indicating little or no feeding during this period.

The food of 155 sheepshead taken from the same lakes in 1940 during late summer months indicated that young pan fish were the most important item in sheepshead diet from Spirit and West Okoboji Lakes, while 95 per cent of the diet of sheepshead from East Okoboji was insect larvae. Young pan fish were scarce in East Okoboji in 1940.

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APPENDIX

Table No. 1. Early summer food of adult sheepshead from East Okoboji Lake in 1946, 1947 and 1948, expressed as percentages of total volume of food organisms and as percentages of frequencies of occurrence.

Date of Collection	April-May 1946		May 1947		April 1948	
Number of stomachs taken	18		27		26	
Number of stomachs containing food	11		25		24	
Per cent of stomachs containing food	61		93		92	
Total volume of food (c.c.)	13.4		60.3		36.1	
Weight (lbs) mean	2.2		1.7		1.8	
Range	1.2-3.7		1.0-3.4		1.0-3.7	
	Per cent		Per cent		Per cent	
	Vol.	Occ.	Vol.	Occ.	Vol	Occ.
Animal	100	100	99	100	100	100
Fish	10	9	4	8	28	4
Game					28	4
Forage			4	8		
Unidentified	10	9	T	8		
Insects	81	100	36	96	66	88
Neuroptera (Sialis)	3	18	2	8	2	4
Ephemeroptera	33	54	4	20	T	12
Odonata			2	4		
Hemiptera	1	18				
Coleoptera						
Trichoptera	35	36	12	40	T	8
Diptera	9	64	16	76	64	88
Unidentified						
Crustacea	9	45	25	92	6	20
Entomostracans	7	9				
Cladocera	7	9	T	4	T	12
Copepoda						
Ostracoda						
Malacostraca	2	36	25	84	6	8
Hyalella	2	36	3	76		
Cambarus			22	12	6	8
Mollusca			T	8		
Gastropods			T	8		
Annelids	T	9	32	20	T	8
Hydracarina			T	4		
Turbellaria			2	44		
Plant				28		
Green fragments			T	4		
Algae (filamentous)			T	8		
Debris			T	16		

APPENDIX

Table No. 2. Mid-summer and late summer food of adult sheepshead from East Okoboji and West Okoboji Lakes in 1946 and 1947, expressed as percentages of total volume of food organisms and as percentages of frequencies of occurrence.

Lake	East Okoboji						West Okoboji	
Date of Collection	June-July 1946		July 1947		Aug.-Oct. 1947		July-Aug. 1947	
Number of Stomachs taken	32		29		20		17	
Number of stomachs containing food	23		27		18		15	
Per cent of stomachs containing food	75		93		90		88	
Total Volume of Food (c.c.)	8.5		19.5		27.0		41.1	
Weight (lbs) mean	0.8		1.1		1.2		1.8	
Range	0.4-3.0		0.1-1.4		0.9-1.7		0.8-5.0	
	Per cent		Per cent		Per Cent		Per cent	
	Vol.	Occ.	Vol.	Occ.	Vol.	Occ.	Vol.	Occ.
Animal	100	100	98	100	99	100	100	100
Fish	8	13	42	48	72	67	69	27
Game	8	13	12	7	31	39	61	14
Forage					1	6	7	7
Unidentified			30	44	40	39	1	7
Insects	82	95	49	93	20	72	11	80
Neuroptera (Sialis)	1	9			T	11		
Ephemeroptera	12	22	T	6	1	11	8	53
Odonata	1	4						
Hemiptera	22	52	8	3	T	6	T	7
Coleoptera					6	6		
Trichoptera	25	35	9	59	11	55	5	47
Diptera	21	61	32	70	1	11	1	40
Unidentified								
Crustacea	2	18	7	48	7	61	5	20
Entomostraca								
Malacostraca	2	18	7	48	7	61	5	20
Hyalela	2	18	7	48	7	61	T	7
Cambarus							5	14
Molluscs	8	13					14	33
Gastropoda	8	13					14	33
Plecypoda								
Annelids	T	13						
Plant	T	13	2	37	1	6	T	14
Green fragments			T	3	T	6	T	7
Algae (filamentous)					T	6		
Debris	T	13	2	37			T	7

APPENDIX

Table No. 3. Food of adult sheepshead from Spirit Lake in 1946, 1947 and 1948, expressed as percentages of total volume of food organisms and as percentages of frequencies of occurence.

Date of collection	April 1948		May-June 1946		June 1947		July 1946		July-Aug. 1947	
Number of Stomachs taken	5		10		10		13		12	
Number of Stomachs Containing food	3		9		9		13		10	
Per cent of stomachs containing food	60		90		90		100		83	
Total volume of food (c.c.)	3.7		52.2		5.4		56.1		50.3	
Weight (lbs) mean	4.7		4.1		2.3		5.0		4.2	
Range	2.7-5.7		1.4-5.9		0.6-6.5		1.5-8.0		1.4-7.3	
	Per cent Vol.	Occ.	Per cent Vol.	Occ.	Per cent Vol.	Occ.	Per cent Vol.	Occ.	Per cent Vol.	Occ.
Animal	100	100	100	100	96	100	97	100	100	100
Fish							28	54	66	100
Game							20	38	57	80
Forage							7	8	1	10
Unidentified							1	8	8	30
Insects	97	100	59	77	18	100	69	100	20	70
Neuroptera(Sialis)			1	22						
Ephemeroptera			T	22	6	44	11	38		
Odonata			T	11						
Trichoptera	97	100	23	55	12	33	58	85	20	70
Diptera			33	55	T	66	T	15		
Unidentified							T	8		
Crustacea			38	44	61	66	T	23		
Malacostraca			38	44	61	66	T	23		
Hyalella			T	22	6	66	T	15		
Cambarus			38	22	55	11	T	8		
Mollusca	3	33			2	22	T	8	14	40
Gastropoda	3	33			2	22	T	8	14	40
Annelids	T	33	3	22	15	11	T	15	T	1
Plant			T	11	4	11	3	8	T	20
Green fragments			T	11	4	11	3	8		
Algae (filamentous)									T	20
Debris										

APPENDIX

Table No. 4. Food of young sheepshead from several lakes, expressed as percentages of frequencies of occurrence of food organisms.

Lake	East Okoboji	Spirit Lake		Lower Gar Lake
Date of Collections	Oct. 1947	Aug. 1948	Sept. 1949	June 1948
Number of Stomachs taken	23	69	24	17
Number of stomachs Containing food	22	69	23	17
Per cent of Stomachs Containing food	96	100	96	100
Total Volume of food	not taken	not taken	not taken	not taken
Weight (gr.) mean	18	5.2	15.7	34
Range	10-34	2.8-8.2	8.4-18	22-51
	Per cent Occ.	Per cent Occ.	Per cent Occ.	Per cent Occ.
Animal	100	94	100	100
Fish		15		12
Unidentified		15		12
Insects	73	93	100	100
Neuroptera(Sialis)	79			
Ephemeroptera	9		47	29
Odonata			4	
Hemiptera	9			24
Trichoptera		5	57	41
Coleoptera	4			
Diptera	64	93	100	100
Unidentified		6		
Crustaceans	82	54	52	12
Entomostraca	77	6	52	12
Cladocera	82	6	47	6
Copepoda	9	1	18	12
Malcostraca	50	49	8	
Hyalella	50	49	8	
Mollusca				
Annelids	4			
Turbellaria	4		4	
Plant	4		4	6
Debris	4		4	6

WINTER FISHING IN THE IOWA LAKES

By E. T. Rose *

The fourth consecutive season of winter fishing in Iowa ended on February 15, 1954. A creel census was conducted as before, consisting of a spot-check of anglers observed each day throughout the season on West Okoboji and Spirit Lakes. These two lakes were the most heavily fished as usual, although some very good catches were reported from a few other areas.

As in the summer census, daily records of the census clerks were tabulated every 10 days including the total number of each species caught, together with the combined total of all species, the total number of anglers contacted and their combined hours of effort. From these data the average catch per man and per hour were computed and total seasonal data compiled. The significant points of the census are outlined in the following consideration of each lake's data.

West Okoboji

Due to late ice formation, angling did not start on this lake until December 14, 1953. This shortened the season just two weeks less than the previous year, and as will be pointed out, was a major factor in reducing the total catch this season.

The 10 day summary of this winter's angling is compiled in Table 1. The record contains no voluntary reports, all of the data were obtained by personal contact with fishermen. Those that had fished at least one-half hour or more and had caught no fish were recorded.

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Table No. 1. Ten Day and Seasonal Fish Census Summary Lake West Okoboji

SPECIES	Dec. 14-24	Dec.26 Jan. 4	Jan. 5-14	Jan. 15-24	Jan.25 Feb. 3	Feb. 4-13	Feb. 14-15	Totals
CRAPPIE	4	12	9	27	48	61		161
PERCH	1303	3330	1075	511	535	480	50	7284
NO. PIKE	49	124	85	53	85	96	12	504
L.M. BASS				1	2	2		5
WALLEYE	98	384	267	221	412	395	60	1837
S.M. BASS		4	3	5	6	32	13	63
BULLHEAD			1	1				2
WHITE BASS					2	2		4
BLUE GILL				5	11	4		20
SUCKER	1							1
GAR		1						1
TEN DAY TOTALS	1455	3855	1440	824	1101	1072	135	9882
TOTAL MEN	457	1136	824	712	956	752	107	4944
TOTAL HOURS	950	2677	1575	1512	2155	1700	333	10902
AVERAGE FISH/MAN	3.18	3.39	1.75	1.16	1.15	1.42	1.26	2.00
AVERAGE FISH/HOUR	1.53	1.40	0.91	0.54	0.51	0.63	0.40	0.906

NOTE. 32.3 per cent of anglers caught no fish when checked. All anglers had fished a minimum of one-half hour.

A comparison of the past winter's fishing on this lake with the previous three seasons is summarized in Table 2. and is used in the following comparisons with the data in Table 1.

Basic summaries of 4 winter fishing censuses on West Okoboji.

Table 2.

SPECIES	Winter 1950-51	Winter 1951-52	Winter 1952-53	Winter 1953-54
PERCH	14,150	14,244	15,914	7,284
WALLEYE	815	999	913	1,837
N. PIKE	236	133	281	504
CRAPPIE	48	3	16	161
S.M. BASS	18	8	7	63
L.M. BASS	17	7	6	5
BLUEGILL	13	2	3	20
WHITE BASS	0	1	2	4
BULLHEAD	9	1	0	2
SUCKER	1	0	0	1
GAR	0	0	0	1
TOTAL	15,307	15,398	17,142	9,882
ANGLERS CONTACTED	7,203	7,074	6,575	4,944
TOTAL HOURS OF FISHING	21,175	23,230	18,312	10,902
AVERAGE FISH/MAN	2.12	2.17	2.60	2.0
AVERAGE FISH/HOUR	0.72	0.66	0.93	0.91

In the last report on the winter creel census, it was pointed out that a striking uniformity in catch statistics prevailed for the three seasons. Obviously these niceties have been altered. A remarkable increase in catch prevailed in the walleye and northern pike, however, there was a correspondingly vast decrease in the catch of perch in 1953. However, the average catch per unit effort remained on a par with the previous season's high which is, of course, a very important criterion.

A partial explanation for the decided drop in catch of perch this season can be made. Early in January, a heavy pulse of Daphnia occurred which filled the lake with ideal perch food. As may be noted in the second 10 day period in Table 1, there were 3,330 perch recorded and the catch per hour was 1.40. In the third 10 day summary, only 1,075 perch were caught and the fish-per-hour dropped to 0.91.

A continued rapid decline in catches of perch prevailed throughout the rest of the season. All of the perch examined during this period had their stomachs packed with Daphnia. Many anglers commented on their inability to catch perch even though they saw large numbers of them. A similar situation occurred in the winter angling of 1952.

The catch of walleyes was apparently not influenced by the Daphnia, presumably due to the small size of these organisms as food items for these larger, more predaceous fish. The total recorded catch was roughly about twice as great as in any of the previous winter censuses (Table 1.) .

The census this season, as in all of the past three seasons, indicates that by far the best perch fishing occurs early in the winter. Inasmuch as the season this year was two weeks later than last and there was much less fishing pressure due to good early angling on neighboring Spirit Lake, the total catch declined this year.

A record was taken this season of those who had caught no fish. Of the 4,944 anglers contacted, there were 1,553, or 32 per cent, who had caught no fish. Of these 1,553 anglers, all had fished at least a minimum of one-half hour.

Spirit Lake

Angling was very good on this lake all winter. Fishing started on December 11 and continued through the season until February 15. Census methods were identical to the West Okoboji work and as reported previously.

The 10 day summary of the past winter's angling record is compiled in Table 3. No voluntary reports are included.

Table No. 3. Ten Day and Seasonal Fish Census Summary Spirit Lake

SPECIES	Dec. 11-20	Dec. 21-30	Dec.Jan. 31-9	Jan. 10-19	Jan. 20-30	Jan.31 Feb. 9	Feb. 10-15	Totals
CRAPPIE	4	106	19	1	2	2	52	186
PERCH	2219	2173	1123	622	662	1247	371	8417
NO. PIKE	49	57	30	9	29	18	28	220
L.M. BASS	4				1			5
WALLEYE	461	422	306	165	251	298	123	2026
S.M. BASS	2						1	3
BULLHEAD						1	2	3
TEN DAY TOTALS	2739	2758	1478	797	945	1566	577	10860
TOTAL MEN	560	547	647	512	477	623	313	3679
TOTAL HOURS	1446	1756	1611	1385	1425	2119	922	10664
AVERAGE FISH/MAN	5.8	5.04	2.29	1.56	1.98	2.5	1.84	2.95
AVERAGE FISH/HOUR	1.8	1.57	0.92	0.57	0.66	0.74	0.62	1.02

A comparison of Table 3 and Table 1 readily indicate better fishing in Spirit Lake than in West Okoboji during the last winter especially for the important species, perch and walleye. The total catch was greater, average catch-per-angler and average catch-per-hour surpassed West Okoboji in each of the 10 day periods and in the final summary. As in West Okoboji, the early season fishing for perch was the most productive.

The winter of 1952-53 was the first to have intensive fishing on Spirit Lake. A comparison of the two seasons records are included in Table 4. Basic summaries of 2 winter fishing censuses on Spirit Lake.

SPECIES	Winter 1952-53	Winter 1953-54
CRAPPIE		186
PERCH	7,216	8,417
NORTHERN PIKE	178	220
L. M. BASS	0	5
WALLEYE	1,085	2,026
S.M. BASS	19	3
BULLHEAD	0	3
TOTALS	8,498	10,860
ANGLER CONTACTS	3,937	3,679
TOTAL HOURS	11,785	10,664
AVERAGE FISH/MAN	2.15	2.95
AVERAGE FISH/HOUR	0.72	1.02

Significant variants in this season's record over last year's are obviously noted in the catch of crappie and a vast increase in the perch and walleyes. The catch per unit effort was considerably improved over last season's record for this lake.

Sex Ratios

A considerable number of fish from each lake was checked by the census clerks for sex determination. From West Okoboji a total of 64 walleyes were examined. Of these, 53 were males and 11 females, or 84 per cent males and 17 per cent females. Also, a total of 137 perch were checked of which 54 were males and 83 females, or 39 and 61 per cent respectively. A much larger sample of each species was examined

on Spirit Lake. A total of 126 walleyes were sexed, of which 109 were males and 17 females or 86 and 14 per cent respectively. This is almost exactly the ratio observed for West Okoboji. A total of 399 perch were examined on Spirit Lake of which 109 or 27 per cent were males and 290 or 73 per cent were females.

Occupation of Anglers

Between February 3 and 14, a total of 859 anglers were checked to determine their occupation. Farmers constituted 51.8 per cent of the anglers, followed by laborers, 24.2 per cent, business and professional people, 9.6 per cent retired men, 8.7 per cent and housewives 5.7 per cent.

Other Lakes Censused

During the past winter Trumbull Lake in Clay County was checked on 17 different days of the season. A total of two perch and 120 northern pike were recorded taken by 284 men. The average catch per man was 0.43 and the average catch-per-hour 0.11. These checks were taken by Howard Walsh, Area Game Manager at Ruthven, Iowa. The 1952-53 census on this lake was about three fold greater in catch-per-hour. Fishing at Lost Island was also poorer than it was last year. During the past winter the lake was checked on eight different days and a total of 43 northern pike and 20 walleyes were recorded caught by 164 men in 340 hours of fishing for an average of 0.38 fish-per-man and 0.19 fish-per-hour. Fishing was very good at Five Island Lake, Palo Alto County. A spot check on seven days during December, of 106 anglers resulted in a record of 10 crappies, 697 perch and two northern pike being taken in 122 hours of combined effort. This yields an average of 6.78 fish-per-man and 5.89 fish-per-hour, probably the best on record for any Iowa lake in winter. At Clear Lake, Merle Linquist, Hatchery Superintendent, collected census data for eight days during the past winter. A total of nine crappie, 765 perch, 84 northern pike, 22 walleye, three bluegill and 32 yellow bass were recorded caught by 532 men in 1,515 hours of fishing. This gives an average of 1.72 fish-per-man at the rate of .60 fish-per-hour. This is somewhat better than the record of last winter. Some excellent walleye fishing was reported from Storm Lake, however, no accurate records were taken for this report.

Conclusion

Winter fishing was again a very popular sport during the past winter. A total of 8, 623 men were contacted on the two lakes, West Okoboji and Spirit during December 11, 1953 to February 15, 1954 season. Success was about average or a little above for the past season on these two lakes. Five Island Lake at Emmetsburg in Palo Alto County was the most productive area; however, the majority of the fish caught were small perch.

Pheasant Age Ratio Study

by

Richard C. Nomsen*

A pheasant age ratio study has been conducted each fall for the purpose of collecting additional information concerning reproduction success. For the past few years there has been an inverse relationship between the results of this study and reproduction success.

Right legs of cock birds were collected by conservation officers, biologists and sportsmen. The spurs were measured to the nearest millimeter with calipers. The legs with spurs measuring over 20.5 millimeters were classed as adults and all those 20.5 and below were classified as young.

A total of 4,427 legs were checked after the 1953 season. There were 3,704 legs classed as young and 723 as adults. The age ratio of 512 young per 100 adults was slightly lower than the 1952 figure. Table 1 compares the age ratios by districts for the last five years.

Table 1. Pheasant Age Ratios - 1949 to 1953.

	Young per 100 Adults				
District	1949	1950	1951	1952	1953
1. Northwest	509	687	926	810	534
2. North Central	586	696	697	768	611
3. Northeast	656	593	1396	824	1131
4. West Central	360	579	870	411	426
5. Central	475	486	710	436	430
6. East Central	376	564	1050	406	649
7. Southwest	666	357	370	280	345
8. South Central		367	725	423	466
9. Southeast	292	566	818	212	577
STATE	482	596	819	549	512

The distribution table of pheasant leg measurements (Table 2.) lists the number of legs checked in each size group for each district.

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Table 2. Distribution Table of Pheasant Leg Measurements.
Sample frequency in State Agricultural Districts.

Length of Spur in mm		DISTRICT 1	2	3	4	5	6	7	8	9	Total for State
YOUNG	11	19	15	1	3	1	2	1	2	1	45
	12	19	17	1	2	1	2	0	0	0	42
	13	25	17	7	6	7	8	1	0	1	72
	14	68	49	17	9	16	18	12	2	1	192
	15	139	96	19	26	26	29	21	6	4	366
	16	224	137	25	62	46	35	38	3	4	574
	17	241	148	43	119	68	74	68	12	12	785
	18	217	139	32	107	81	74	100	10	12	772
	19	113	84	22	102	58	63	79	10	7	538
	20	72	44	14	50	36	39	42	11	10	318
	21	49	25	6	26	29	16	36	3	3	193
	22	48	24	1	29	18	6	23	4	2	155
	23	45	26	4	28	11	5	16	2	1	138
	24	26	17	1	17	9	8	10	3	1	92
	25	22	18	2	6	6	10	6	0	2	72
	26	14	9	1	5	4	4	5	0	0	42
	27	7	3	1	1	2	2	7	0	0	23
	28	2	0	0	2	0	2	2	0	0	8
Total Right legs		1350	868	197	600	419	397	467	68	61	4427
Total Young		1137	746	181	486	340	344	362	56	52	3704
Total Adult		213	122	16	114	79	53	105	12	9	723
Young per adults		534	611	1131	426	430	649	345	466	577	512

Table 3 lists the percentage of legs in each size group for the past five years. The peak of the 1953 hatch occurred slightly later than in 1952, but not as late as 1951. The overlap of young and adult birds in the 20, 21 and 22 millimeter groups was not as noticeable because of this late hatch. By appearance, only 24 per cent of the legs in the 21 millimeter group and 10 per cent in the 22 group were classed as young. In 1952, 59 per cent and 27 per cent of the two groups were classed as young. All adult size groups from 23 millimeter or larger increased this year.

Table 3. Percentage of Legs in Each Size Group 1949 - 1953.

Length In mm	1949	1950	1951	1952	1953
11	0.8	1.3	2.3	0.8	1.0
12	1.1	1.2	1.6	0.8	1.0
13	1.4	1.8	3.6	1.6	1.6
14	1.7	4.0	6.8	3.6	4.3
15	5.5	9.4	15.1	7.5	8.3
16	9.0	15.5	15.1	11.7	13.0
17	15.1	19.8	16.7	17.1	17.7
18	18.0	14.9	13.3	18.7	17.4
19	17.0	12.1	9.7	15.6	12.1
20	13.1	5.5	4.9	7.7	7.2
21	6.4	4.1	2.9	4.7	4.4
22	4.1	2.9	2.8	3.7	3.5
23	2.5	2.6	2.4	2.8	3.1
24	1.7	1.9	1.3	1.9	2.1
25	1.7	1.4	0.9	1.3	1.6
26	0.5	0.6	0.3	0.6	1.0
27	0.3	0.4	0.2	0.3	0.5
28	0.2	0.2	0.1	0.1	0.2

Discussion

A careful examination of age ratio data was made for the last five years. It was apparent that the age ratios should be adjusted to changes of the sex ratios in the brood stock. A population with a sex ratio of three hens per cock can obviously produce a higher young per adult ratio than one which contains a sex ratio of only two hens per cock. Table 4 lists the age ratios, sex ratios of the spring brood stock, and the age ratio divided by the sex ratio. This adjusted age ratio should then be comparable from year to year even though the sex ratios have changed.

Table 4. Adjusted Age Ratios 1949-1953.

Year	Age Ratio Young per 100 Adults	Sex Ratio Hens per Cock	Age Ratio/Sex Ratio Young per 100 Adults
1949	482	2.1	230
1950	596	2.9	205
1951	819	2.9	282
1952	549	2.7	203
1953	512	2.2	233

Table 5 compares the adjusted age ratios and the results of reproduction counts made by officers each summer. This inverse relationship was first noticed in 1951. The sex ratios were the same for 1950 and 1951 but reproduction counts indicated a poorer hatch in 1951 than in 1950. However, the 1951 age ratio was much higher than the young per adult figure of 1950. A lower rate of reproduction should result in a corresponding lower age ratio. It is evident that the age ratios obtained in this study do not reflect the age ratios of the fall populations.

Table 5. Comparison of Age Ratios and Reproduction Success.

Year	Age Ratio Young per 100 Adults	Reproduction Success Young per Hen
1949	230	4.4
1950	205	4.8
1951	282	3.9
1952	203	4.3
1953	233	3.4

There are several other factors which could affect the age ratio. It has been noted by most workers that the young birds make up a much higher percentage of the kill in the early part of the season. For example, Conservation Officer, Floyd Morley, collected 238 legs during the first week of the 1953 season. The age ratio of this sample was 12.2 young per 1 adult. The age ratio of the 143 legs collected by Morley during the rest of the season was only 4.7 young per 1 adult.

Another factor which is very difficult to measure on a state wide basis is hunting pressure. Most workers agree that hunting pressure will adjust to the population. In other words, hunting pressure will decrease as the population decreases and vice versa.

Table 6 lists data collected during the hunting seasons of 1949 - 1953. There appears to be a definite relationship between age ratios and hunting success. A decrease in the age ratio figure corresponds with a decrease in time required to bag a bird, and an increase in both the number of birds checked per 100 hunters and the number of legs collected. An upward trend in the age ratio is paralleled with more time per bird and fewer birds checked.

It is, therefore, believed that a pheasant age ratio study of this kind is an indicator of hunting success and/or hunter activity. This would include a combination of the pheasant population, hunting conditions, changes in season regulations and hunting pressure.

The inverse relationship between the age ratios and reproduction success can then be explained as follows: Poor reproduction success will result in a lower fall population, consequently, more time will be needed to bag a bird, hunting pressure will decrease and a higher age ratio will be obtained.

Table 6. Data From Pheasant Hunting Seasons 1949-1953.

Year	Age Ratio Young per 100 Adults	Hunting Success Hours per Bird Bagged	No. of Birds Checked per 100 Hunters	No. of Legs checked
1949	230	3.5	89	5041
1950	205	3.0	103	5800
1951	282	3.6	87	4034
1952	203	3.3	95	6042
1953	233	3.5	91	4427

Age of Quail in the Hunter's Bag
1953

By M. E. Stempel*

The age composition of the game take of hunters is one of the important factors in game management. This report is based on information obtained by examining 989 quail wings taken by hunters during the 1953 quail hunting season, and collected by Conservation Officers or turned in by the hunters.

Following the procedures set up by Petrides and Nestler, the wings of young quail can be classified as to days of age thus the dates of hatching can be established, and the hatching cycle can be compared to the weather cycle of the preceeding hatching period. Variation in calling by the male quail corresponds to the intensity of nesting, and looking back over data for previous years we can see that a long period of calling usually accompanies a long and successful hatching period which usually results in a successful hunting season. Length of the calling period apparently is increased by good spring and summer weather conditions.

Before the open season, letters are sent to Conservation Officers asking them to collect all quail wings from hunters contacted. In addition to this bulk collection, ten volunteer cooperators saved wings from each day's hunt. The wings were put in an envelope, and on the envelope was recorded the date of the hunt and the county in which the hunting was done. From this latter collection the data on hatch dates are obtained.

For study purposes the wings are first separated according to county of origin. Wings are then examined separately and the young to old ratio is derived. These data are shown in Table 1. Days of age, date of kill and the moult stage of adults are recorded elsewhere.

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Table 1. Young quail in the hunter's bag, 1946-1953.

Year	Per Cent of Young Quail
1946	85.7
1947	82.7
1948	87.2
1949	88.2
1950	83.1
1951	85.6
1952	87.0
1953	83.4

Of the 989 wings turned in from 30 of the counties open for hunting, information on date and place of kill was recorded for 315 of them. Of these, 82.2 per cent were young quail. These wings were collected from Appanoose, Clark, Davis, Decatur, Des Moines, Henry, Jasper, Linn, Lucas, Poweshiek, Ringgold, Taylor, Wapello, Warren, and Wayne counties. Data from the wings that were in good condition and that could be aged indicates that hatching got off to a slow start late in the spring.

The 1953 spring came early, but the weather was variable which may have caused the delay in the start of successful hatching. Data from the wings of young quail indicated that hatching started early in June, rose rapidly to a peak in July, and fell off rapidly to the last indicated hatch date in the fore part of September. The per cent of quail in three age groups for the years 1950 to 1953 is given in Table 2.

Table 2. Age variations in young quail bagged during November expressed as per cent of year class.

Hatching Year	1-120 days old	121-149 days old	150 days old or older.
1950	39	24	37
1951	59	27	12
1952	40	11	48
1953	37	24	37

The 1950 season was late, but hunting was good in the fall, whereas 1951 had a late cold spring and poor hunting. The 1952 spring was near normal, and the hunting was good. The 1953 season for hatching was similar to that of 1952; the hunting was good in some areas, poor in others which is believed to have been caused by locally heavy rainstorms during the height of the hatching season when the downpours may have killed some of the newly hatched quail. In spite of the late hatching peak, more than half of the young quail were of adult size by November 15 as shown in Table 3. Probably the harvest of younger quail during the November 1 to November 15 period is beneficial as the more mature birds should be better able to live through the winter.

Table 3. Number of immature, and per cent of matured-size young quail in the hunter's bag by hunting period during the 1953 season.

Hunting Period	No. over 150 days old	No. under 150 days old	Per cent over 150 days old
Nov. 1-15	53	98	35
Nov. 16-30	34	30	53
Dec. 1-15	40	4	90

It is suggested by Thompson and Kabat that the stage of moult in the adult quail should correspond to the stage of moult in the young quail. Early moulting and early maturing of primary feathers in both young and adults should follow an early hatching season. The percentage of adult wings with matured plumage was higher in 1953 than in 1952 and the peak of hatching was earlier in 1953 than in 1952. Many of the adult wings were taken on unknown dates and it is not known, in this case, how accurately the adult moult stage reflects the hatching period.

A partial record is available of the sex of quail killed by some of the cooperators in the project. From this partial kill record the kill by sex was: In 1951 the kill was 53 per cent cock quail, in 1952 and in 1953 the kill was 48 per cent cock quail.

Summary

1. In a sample of 989 quail wings from 30 Iowa counties 83.4 per cent of the wings were from quail hatched in 1953.
2. Quail hunting in 1953 was spotty but the age of young birds was about the same as in 1950 which was a good year for hunting.
3. Ninety per cent of the 1953 quail hatch had matured by December.

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3. Iowa Climatological Data, Summaries, 1950-53.

The Fall Status of Blue-winged Teal in Iowa (1948-1953)

by
James G. Sieh*

Nearly 3,000 recoveries of banded blue-winged teal, dating back to 1920, were examined by Stoudt (Aldrich and others, 1949). He stated, "Probably the main arterial route (of fall migrating blue-winged teal from the Canadian prairie provinces) could be still further narrowed down to include only the states of North and South Dakota, Minnesota, Iowa, Missouri, and Louisiana." The above statement, plus the fact that blue-wings in Iowa have occupied second place in numerical importance during the 1949-1953 open seasons, averaging 12.9 per cent of the 45,410 wild ducks and mergansers sampled, helps us to better understand and more accurately evaluate the fall status and importance of this species within the state.

Only 41 recoveries of banded blue-winged teal from Iowa have been made available to the State Conservation Commission since 1948. Of these, 20 were banded in three prairie provinces and the remaining 21 in seven nearby states; all 41 were recovered in 30 Iowa counties (Table 1). Eight blue-wings carried bands more than one year, while the remaining 32 carried bands less than one year (Table 2). Twenty-nine (70 per cent of the total) carried bands approximately three months or less and were recovered in the same calendar year in which they were banded. Even though the sample recovered is small, these direct recoveries provide irreputable data and support field observations.

Seven of the 41 banded blue-winged teal recovered in Iowa were direct recoveries banded in western Nebraska. Of the seven, one was recovered in 1951, one in 1953, and the other five in 1952. These five were killed in central and eastern Iowa during the same fall in which they were banded. This is a clear cut indication that blue-winged teal have moved eastward into Iowa from western Nebraska, and may indicate large scale movements of blue-wings from western Nebraska into and across Iowa from west to east.

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Table 1. Place of Banding and Location of Returns in Iowa

Place of Banding	Number Recovered in Ia.
Alberta	1
Illinois	5
Manitoba	16
Minnesota	1
Missouri	2
Nebraska	7
North Dak.	3
Ohio	1
Saskatchewan	3
South Dak.	2
10 states and provinces	41 recoveries

Location of Return (County)	Number of Returns
Allamakee	4
Bremer	2
Calhoun	1
Cerro Gordo	1
Clayton	4
Crawford	1
Des Moines	2
Dickinson	1
Guthrie	1
Hamilton	1
Hancock	1
Henry	1
Iowa	1
Jasper	2
Jefferson	1
Johnson	1
Jones	1
Lee	2
Linn	2
Louisa	1
Marion	1
Monona	1
Palo Alto	1
Plymouth	1
Pottawattamie	1
Sac	1
Scott	1
Van Buren	1
Winnebago	1
Wright	1
30 counties	41 recoveries

Table 2. Banded Blue-winged Teal Recovered in Iowa since 1948 and the Number of Months Each Band Was Carried.*

Months each band carried	1	2	3	4	5	6	7	8	9	10	11	12	13	14	37	38	73
Number of recoveries	9	15	5		3								3	2	1	1	1

* One recovery not dated and consequently not used in table.

Stoudt (op. cit.) mentioned, "There are apparently segments of the blue-wing population which do not follow the general pattern of migration. There appears to be an early movement of these teal into the Orland Park area near Chicago. From banding returns we find that these same birds move northwestward and northeastward for several hundred miles before finally departing for the wintering grounds. This may be a gradual movement out farther each day in search of better feeding grounds. About 6 per cent of the recoveries from birds banded in the Chicago area were recovered in Minnesota the same fall as they were banded."

In Iowa approximately 37 per cent of the banded blue-winged teal were recovered on the opening days of the waterfowl seasons (Table 3). Of the 5,886 blue-wings tallied in the waterfowl bag checks, approximately 58 per cent (3,407 birds) were checked on the opening dates, and an additional 11 per cent (654 birds) tallied on the second days of the seasons. These data clearly indicate that the harvest of blue-winged teal in Iowa takes place largely on the opening day, and that the number killed thereafter diminishes rapidly.

Table 3. The Number of Banded Blue-winged Teal recovered in Iowa on Each Date of the Open Seasons (1949-1953)*

Year	Month	Dates of Each Recovery
1949	October	21,
1950	October	20,22,
1951	October	12,12,12,12,13,13,14,14,14,18,19, November 1,
1952	October	8,8,8,10,11,12,12,21,26, November 22,
1953	October	8,8,8,8,9,10,12,17,18,22,24,

* Five recoveries not dated or not recovered during open season.

Only one banded blue-winged teal has been recovered after November 1st since 1949. Waterfowl bag check (Sampling data) data also indicated a much reduced harvest of blue-wings in Iowa after November 1st. In 1948, when the waterfowl season opened on October 29th, the state-wide sample harvest of blue-winged teal dropped to 2.9 per cent , far below the 1949-1953 sample average of 14.5 per cent. Neither banding data nor the blue-wing kill sampled each day of the open season during the last six years accurately indicates what percentage change in the blue-wing harvest can be anticipated when the waterfowl season opens, for instance, on October 8th, instead of October 12th. It is evident that the earlier opening date in 1953 was partly responsible for the large increased harvest of blue-wings in 1953; however, when the season opened on the same date in 1952 a much smaller total harvest resulted (Table 4).

From a percentage standpoint, the difference between the 1952 sample of 12.9 per cent blue-wings (810 birds), compared with the 1953 harvest of 23.6 per cent (2,031 birds) can be simply acknowledged as having happened, but on second thought, in the management of vulnerable species of waterfowl such as the blue-winged teal we should at least attempt to determine or speculate why it happened. Admittedly, our sources of information are extremely limited. Banding records show only 41 banded blue-wings recovered in Iowa from a known kill sample of 5,886 teal reported since 1948. These 41 recoveries represent only 0.6 of one per cent of the known sample kill, and certainly represent a much smaller fraction of one per cent of the total number of blue-winged teal killed within the state during the same period. Applying this information on a continental scale it is very doubtful that the number of blue-wings banded in North America has been adequate to properly represent the species in any sampling procedure within a single calendar year.

It is indeed unfortunate that limited banding of this species tends to display a random pattern of migratory movement, but fails to adequately delineate autumnal movements within calendar years which are most important from a management standpoint.

Lee (1954) stated after studying direct recoveries, that in Minnesota blue-winged teal, most of which were banded as flightless young within the state, a large proportion (86 per cent) was shot in Minnesota; however, the percentage of banded blue-wings recovered was quite low, 6.5 per cent. He further stated, "This possibly means that they fly quite directly to the wintering ground and few are shot along the way. If this is the case, it might be that we could shoot more blue-wings in Minnesota in order to adequately harvest the species."

Table 4. Blue-winged Teal Sampled in Iowa During Each Day of the Open Seasons 1948-1953.

October	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Totals
1948																						76	45	16	137
1949*														422	145	84	29	3	7	10	1	4	3	2	710
1950													295	148	45	14	34	36	12	5	6	4	3		602
1951					682	229	162	45	88	88	22	20	27	31	6	18	4	9	7	16	24	2		4	1484
1952	468	131	31	39	35	7	2	4	12	14	15	17	6	4	5	4			12		1		1		808
1953	1464	104	62	34	14	16	36	38	13	22	86	7	4		9	24	7	10	6	20	1				1977

November	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Totals
1948	3		2	2	3	4	5			2		1		1	2	1	1	1	1	4	2	1			1	37
1949	1		1	4	2	2	2		2	1	4															19
1950			5	3	3	3	2	2	12	1		1		1		1			1							35
1951	5	3	2	3							2	1						2								18
1952	1				1																					2
1953*	5	1																			1	1			1	9

* Three not dated in 1949 and forty-five not dated in 1953 sample.

From these comments it is apparent that species management of wildfowl will demand ever increasing emphasis on banding adequate samples of a species within a single calendar year on a continental or flyway basis. Until this banding is accomplished, flyway sampling will at best be of second rate value. Let us not attempt to answer what will be an adequate sample, banded or otherwise, because this will result from trial and error as we progress in the science of waterfowl management. For the first time waterfowl banding on the Canadian breeding ground by the states of the Mississippi Flyway, Waterfowl Council, and the federal goverment cooperating is to become a reality through the foresight of the Council and the Technical Section thereof.

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Sex and Age Ratios of Squirrels in the Bag and Hunter-Success as Reported by Hunters, 1953

by
Glen C. Sanderson *

The squirrel project initiated in 1950 with the aid of hunter-cooperators has been continued each year since then. More than 550 hunters were contacted in 1953, including employees of the Fish and Game Division of the Conservation Commission.

Prospective hunter-cooperators were contacted the week prior to the opening of the squirrel hunting season last fall. They were mailed letters, forms, and instructions similar to the ones used in 1950 and in addition each received a mimeographed summary of the results of the 1952 project.

This report includes the results of the 1953 project, including the hunter's ideas on abundance of squirrels, distribution of hunting effort and kill during the season, hunter success, sex ratios for both fox and gray squirrels, and the age ratios of fox and gray squirrels as determined by leg bones furnished by the cooperators. In addition, comparisons are made with similar information collected each year since 1950.

RESULTS

A few more hunters were contacted in 1953 than in 1952; however, the number of hunters reporting was approximately the same in each of the two years. Apparently the warnings as to which bones to save have finally been heeded since no squirrel humeri were received this year. On the other hand, while there has been some improvement, several hunters continue to send in feet rather than leg bones and some cut the bones so short that they are of no value to the project.

Population--Forty-two hunters replied to the question "Do you think there are MORE or FEWER squirrels than there were last year?" Approximately 60 per cent answered more, while more than 20 per cent said there were fewer, and less than 20 per cent said there were the same number as last year (Table 1). This table further shows that the cooperating hunters have believed that the squirrel population has been rising ever since the project was begun.

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Table 1. Hunter's replies as to whether there were more or fewer squirrels than there were last year.

	YEAR			
	1950	1951	1952	1953
Number of hunters reporting				63
Number of hunters answering the question.				42
Per cent who said MORE than last year.	47.3	53.8	59.6	59.5
Per cent who said FEWER than last year.	37.8	30.8	17.0	23.8
Per cent who said SAME as last year.	14.9	15.4	23.4	16.7

Kill Data -- Table 2. reveals that in 1953, as in past years, slightly more than half the squirrel hunting was done during the first one-third of the season. Information in this table also indicates that the percentage of squirrels bagged corresponds closely to the percentage of the hunting done during the particular period.

Table 2. Percentage of total hunting trips made and percentage of total kill made during the first, middle and last thirds of the open season, 1950, 1951, 1952, 1953.

	1 No. of trips and % of total				2 No. of squirrels and % of total			
YEAR	Sept. 15- Oct. 4	Oct. 5- Oct. 25	Oct. 26- Nov. 15	Sea- son	Sept. 15- Oct. 4	Oct.5- Oct.25	Oct.26 Nov.15	Sea- son
1950	55.5 [3] 294 [4]	29.4 156	15.1 80	530	54.7 1,025	29.2 548	16.1 302	1,875
1951	52.7 137	28.1 73	19.2 50	260	48.3 468	33.4 324	18.3 177	969
1952	51.3 209	25.1 102	23.6 96	407	53.7 734	21.2 290	25.1 342	1,366
1953	51.7 164	31.9 101	16.4 52	317	53.4 422	30.2 239	16.4 130	791

1 No. of trips by a hunting party whether one or a number of hunters.
2 Includes both fox and gray squirrels.
3 Per cent of total.
4 Number of trips or squirrels.

Table 3 reveals that during the entire season an average of 0.9 squirrel was bagged for each hour a party spent hunting. This is 0.4 squirrel per hour below the average of 1.3 squirrels per hour reported for 1952 and is the lowest hunting success reported for any of the four years. Again as in 1952, the extremely dry weather that prevailed over much of the state during the open squirrel season, may have had an adverse effect on squirrel hunting success last fall.

Table 3. Hunter success, number of hunters per party, hours hunted, and number of hunting trips made during the first, middle, and last parts of the open season.

	Sept. 15-Oct. 4	Oct. 5-Oct. 25	Oct. 26-Nov. 15	Sept. 15-Nov. 15
Total number squirrels bagged[1]	413	213	126	752
Av. No. bagged per party per hour	1.0	0.8	0.8	0.9
Av. No. bagged per party per trip	2.5	2.3	2.6	2.5
Av. No. seen per party per hour	2.5	2.0	1.8	2.2
Av. No. seen per party per trip	6.2	5.4	6.1	6.0
Av. No. hours hunted per party per trip	2.5	2.8	3.4	2.7

1 Both fox and gray squirrels.

An average of 2.5 squirrels was bagged by each party each time they went hunting compared to an average of 3.5, 3.7, and 3.2 for the 1950, 1951, and 1952 seasons respectively (Table 4).

Table 4. A comparison of the hunter success and number of squirrels seen per hour -- 1950, 1951, 1952, and 1953.

	YEAR			
	1950	1951	1952	1953
Av. no. bagged per party per hour	1.3	1.7	1.3	0.9
Av. no. seen per party per hour	2.7	3.2	2.8	2.2
Av. no. bagged per party per trip	3.5	3.7	3.2	2.5

It is believed that the low average hunting success in 1953 when compared with the other years was at least partly due to weather conditions (extremely dry) unfavorable for hunting in 1953; however, weather conditions during the open seasons of 1952 and 1953 were quite similar. Thus, the reduced hunting success for the latter year may be a reflection of a reduced population level although hunter reports on squirrel numbers (Table 1) and limited information from other sources do not bear this out. Most reports indicate that the 1953 squirrel population level was still high. Indications are that there was a good "carry over" of squirrels after the 1953 season closed.

The average number of hours spent per trip was 2.7 in 1953 compared to 2.5 in 1952. As in the past year, slightly longer trips were made toward the end of the season. The longer average hunting trips made in 1953 compared to the previous season doubtless reflect the poorer hunting success in 1953 when compared with the previous season.

Sex Ratio--Females comprised 46.7 per cent of 750 fox squirrels reported as to sex by the hunters. To put it another way, there were 114 males per 100 females in the fox squirrels bagged by the cooperating hunters in Iowa last year. The percentage of female fox squirrels shows a slight but consistent increase since this project was begun(Table 5.).

Females comprised 37.0 per cent of 54 gray squirrels reported as to sex. This is 170 males per 100 females in the gray squirrels; however, the number of gray squirrels reported is too small for the figures to have much meaning.

Table 5. A comparison of the sex ratios, age ratios, and percentage of fox and gray squirrels in the reported bag -- 1950, 1951, 1952, 1953.

SEASON	Fox Squirrels %FF	Fox Squirrels %Juvs	Fox Squirrels Juvs/AdF	Gray Squirrels %FF	Gray Squirrels %Juvs	Gray Squirrels Juvs/AdF	Per cent Fox Squirrels
1950	43.4	57.2	3.4	46.8	54.0	2.4	89.1
1951	45.7	52.5	2.4	47.8	50.9	2.2	87.2
1952	46.3	56.4	2.8	46.4	38.1	1.3	92.6
1953	46.7	59.0	3.1	37.0	59.4	4.0	94.4

The percentage of females killed during the first, second, and last parts of the season fluctuates for fox squirrels (Table 6). During the past three seasons the percentage of female fox squirrels killed has increased during the middle part of the season and then declined during the last part of the season to near or below what it was for the first part of the season.

Table 6. Sex ratio of squirrels bagged during the first, middle, and last part of the open season.

	MM	FF	%FF	MM/100FF	MM	FF	%FF	MM/100 FF
Sept. 15-Oct. 4	231	200	46.4	115.5	20	9		
Oct. 5-Oct. 25	107	99	48.1	108.1	10	7		
Oct. 26-Nov. 15	60	52	46.4	115.4	4	6		
Sept. 15-Nov. 15	398	351	46.9	113.4	34	22	29.3	154.5

Age Ratio-- Leg bones saved by hunters indicate 59.0 per cent juveniles among 639 fox squirrels bagged over the entire state (Table 5). This is slightly higher than the 56.4 per cent juveniles reported for 1952 and is the highest percentage of juveniles reported during any of the four years of the project.

Table 5 also shows 3.1 juveniles per adult female fox squirrel bagged compared to 2.8 for the previous year. These figures are computed using the sex ratios reported by the hunters . Only in 1950 when there were comparatively fewer female fox squirrels in the hunter's bag were there more juveniles per adult female than there were in 1953.

Juveniles comprised 59.4 per cent of 32 gray squirrels aged; however, the number examined was quite small.

Species Composition-- As usual, fox squirrels predominated in the hunter's bag in all sections of Iowa; however, in northeastern Iowa gray squirrels accounted for one-third of the squirrels reported. Over the state as a whole, fox squirrels made up 94.4 per cent of the bag. This is only slightly higher than the four year average (Table 5).

Again, as in 1952, it seems probable that the lack of gray squirrel data was influenced by weather conditions in 1953. Doubtless the grays were even more difficult than usual to bag during the extremely dry, noisy conditions which were present in the timber during most of the 1953 (and the 1952) squirrel season. Gray squirrels contributed 5.6 per cent to the hunter's bag while 7.0 per cent of the squirrels seen were of this species . Of course, the gray squirrels probably are both harder to see and harder to bag during the dry conditions than they are during "normal" conditions.

Type of Gun -- The .22 rifle continues to be the popular choice of Iowa squirrel hunters. Twenty-nine (65.9%) of the 44 hunters who replied to the question regarding type of gun used, chose the .22 rifle. Shotguns were used by 15.9 per cent of the hunters, 4.5 per cent used handguns for their squirrel hunting, and 13.6 chose a combination of weapons. One hunter used a shotgun part of the time and a bow and arrow for the remainder of his squirrel hunting.

SUMMARY

1. The squirrel project with cooperating squirrel hunters which was begun in the fall of 1950 was continued in 1953.

2. Approximately 11 per cent of the 564 hunters contacted in 1953 replied.

3. Approximately 60 per cent of the reporting hunters think that there were more squirrels in 1953 than there were the previous fall.

4. Slightly more than half the squirrel hunting was done during the first one-third of the open season, slightly less than one-third of the hunting was done during the middle one-third of the season, and the remainder of the hunting was done during the final one-third of the season.

5. The percentage of squirrels bagged in each part of the open season corresponds closely to the percentage of hunting done in the same part of the season.

6. An average of 0.9 squirrel was bagged per party per hour compared to an average of 1.3 in 1952 and 1.7 in 1951.

7. An average of 2.5 squirrel was bagged per party per hunting trip in 1953 compared to an average of 3.5, 3.7, and 3.2 in 1950, 1951, and 1952 respectively.

8. Females comprised 46.7 per cent of 750 fox squirrels reported as to sex compared to 46.3 per cent in 1952.

9. Females comprised 37.0 per cent of 54 gray squirrels reported as to sex.

10. Leg bones indicate 59.0 per cent juveniles among 639 fox squirrels aged compared to 56.4 per cent juveniles for 1952.

11. Leg bones reveal 59.4 per cent juveniles among 32 gray squirrels aged.

12. Fox squirrels comprised 94.4 per cent of the squirrels bagged and 93.0 per cent of the squirrels seen.

13. Again, nearly two-thirds of the hunters used a .22 rifle for their hunting while the rest used shotguns, handguns, or a combination of weapons.