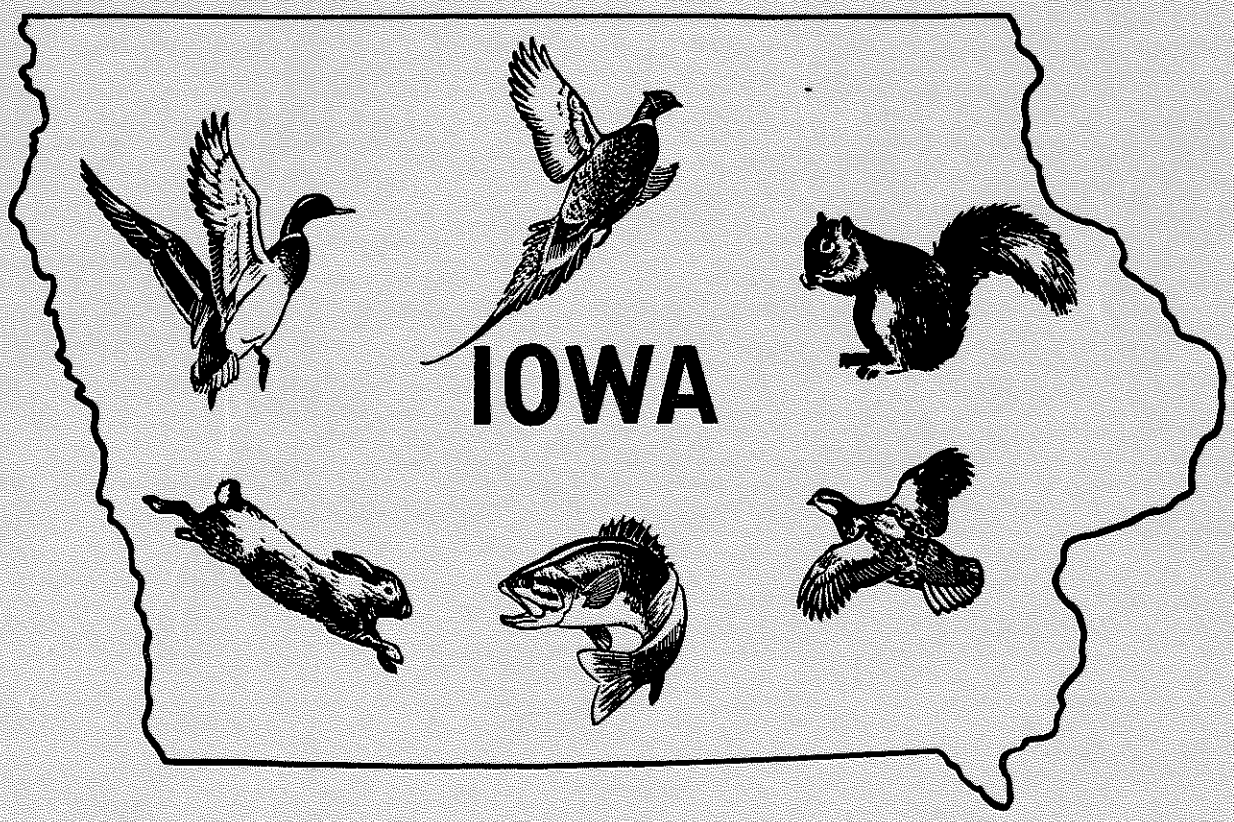
1959

QUARTERLY BIOLOGY REPORTS



FISH AND GAME DIVISION — BIOLOGY SECTION

STATE CONSERVATION COMMISSION

QUARTERLY BIOLOGY REPORTS

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Submitted by

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Without Permission

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by
Richard Nomsen
Game Biologist

Iowa's 1959 spring brood stock of pheasants was much higher than normal - but severe weather last spring delayed nesting activity which reduced the production of young. Cooperating farmers reported more nests in hayfields and more hens were injured or killed. Rural mail carriers reported an average of 1.8 young per hen which was much below normal for this count. Conservation officers checked 2,407 broods in 1959 compared with 2,980 in 1958 with a young per hen index of 3.5 compared with 4.5 young per hen in 1958. Production was near normal throughout the Southern two thirds of the state. The estimated 1959 corn acreage increased 2,000,000 acreas which no doubt reduced the acres of safe nesting cover.

Results of the July, 1959, Roadside Rabbit Surveys

by
Paul D. Kline
Game Biologist

Roadside rabbit counts during July, 1959, revealed a small decline in cottontail populations in all portions of Iowa. However, the index of rabbits per 10 miles used in comparing populations indicated rabbits were more abundant in most areas than for all years prior to 1958. During which the survey has been conducted (starting in 1950). Cottontails were especially abundant in Southern and Western Iowa, less abundant in Northern and Eastern Iowa, and comparatively scarce in the extreme Northeast corner of the state. Production was slightly better during 1959 than during the average of 10 recent years as indicated by the juvenile - adult ratio. More jackrabbits were seen than during the 1958 survey. Analysis of dew-fall readings revealed no recognizable correlation between amount of dew and numbers of rabbits observed. However, the data did indicate the presence of dew was necessary for successful rabbit counting.

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by
E. M. Stempel
Game Biologist

A count of calling male bobwhite quail was made between July 10th and 31st in counties that have quail. Two twelve-mile routes were used in counties checked. Routes were checked at sun-up on fair days, and some additional counts were made throughout the summer.

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by
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Game Biologist

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by
Harry M. Harrison
Fisheries Biologist

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by
Bill Tate
Fisheries Biologist

Following extensive and severe winter kill, largemouth bass adbanced fry were transported from hatcheries in plastic bags and stocked in the three Segments of Sweet Marsh and in three Cedar River impoundmentsat Nashua, Charles City and Mitchell.

These areas were surveyed with electro-fishing gear to determine the survival of the largemouth advanced fry. The rate at which young of the year largemouth were turned in a minute of shocking was used to compute a survival index, or, the number of young of the year largemouth turned in an hour of shocking for each 10,000 advanced fry stocked.

Largemouth bass, stocked as advanced fry, survived in adequate numbers with the exception of the Charles City pool and the upper end of the Mitchell pool on the Cedar River. In all areas the growth of the surviving fry was good to excellent.

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by
R. E. Cleary
Fisheries Biologist

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by
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by
Delmar Robinson
Fisheries Biologist

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by
James Mayhew
Fisheries Biologist

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PHEASANT REPRODUCTION IN IOWA - 1959

by
Richard C. Nomsen
Game Biologist

Studies were continued in 1959 to determine pheasant reproduction success. This report includes the surveys made by conservation officers, rural mail carriers, cooperating farmers and biologists.

The 1959 brood stock of pheasants was higher than normal. The spring hen index increased 30 per cent above 1958, and was the highest in the past 10 years. The ratio of hens to cocks was 3.1, which was equal to the previous five year average.

Weather conditions during the early spring months play an important role in the production of Iowa's number one game bird. Severe weather last spring delayed nesting activity, which reduced production of young. Three March snowstorms dumped an average of 16 inches of snow over the pheasant range, with several areas in northeast Iowa reporting 36 inches. Another snowstorm moved across the state on April 19 - 20. May was warm and wet - tornadoes, hailstorms and heavy rain were common throughout this period of nesting activity. Temperatures were slightly above normal for April and May, but the favorable temperature was offset by the other severe weather factors.

The Weekly Weather and Crop Bulletin reported that 50 per-cent of the alfalfa had been cut by June 15th. This may be compared with 60 per-cent reported last year on the same date and ten year average of 50 per-cent.

Cooperating farmers reported more nests in hayfields this year, and a considerable increase in the number of hens hit with the cutting bar (Table 1). The number of hens reported injured and killed per 100 acres increased 43 and 31 per-cent, respectively. Most of this increase reflects the high spring population of hens but was also due to later nesting which increased the nest density in alfalfa. Only three broods were reported compared with thirty-three in 1958, which also indicated a later hatch in 1959, (Table 1).

Rural mail carriers conducted their annual game count during the week of July 20-25, which was at least a week early considering the later hatch. This would tend to lower results of this survey. Carriers reported an average of 1.8 young per hen, and was much below normal for this count (Table 2).

Conservation officers conducted their annual summer brood counts from August 1st - 15th. They reported 2,407 broods with 13,228 chicks and 1,383 hens without broods. Nearly 3,000 broods were checked in 1958 and 2,183 in 1957. According to this survey, both the average brood size and the percentage of hens with broods decreased this year. The state-wide average of 3.5 young per hen was much lower than the excellent results obtained in 1958 and also somewhat below the previous six-year average of 4.2 young per hen (Table 3).

Counts from different parts of the state varied considerably - from 2.5 young per hen in northeast Iowa to 5.0 young per hen in the west central area. The reproduction index also decreased in the other two northern districts while production was normal or above normal throughout the southern two thirds of the State.

According to the author's survey, reproduction success in Franklin county and vicinity also decreased this year (Table 4). There were 71 broods observed closely enough to estimate their ages during this study. The peak of hatching in this area occurred during the fourth week of June - the same as 1958. However, 50 per-cent of all broods observed had hatched after this peak in 1959 compared with only 21 per-cent following the peak of a year ago. Three and four week-old chicks were common during the regular survey in August which is quite unusual.

Farm crops also affect pheasantnesting success in Iowa. The estimated 1959 corn acreage increased about two million acres, which no doubt reduced the acres of safe nesting cover - oats in particular. Nesting studies at the Winnebago Research Area show that in most years, about 70 - 75 per-cent of all successful nests are found in oat fields. In our prime pheasant range, the major portion of young birds are hatched in oat fields and any reduction of the small grain crop would decrease the production of pheasants. Safe nesting cover was increased in some localities through the conservation reserve program.

Table 1. Results of Farmer Cooperator Nesting Survey 1958 - 1959:

	1958	1959
Acres of hay cut	3,062	2,188
Number of nests seen	251	195
Nests seen per 100 acres	8.2	8.9
Average number of eggs per nest	8.9	8.7
Number of nests hatched	30	23
Number of hens reported injured	40	72
Hens reported injured per 100 acres	2.3	3.3
Number of hens reported killed	59	54
Hens reported killed per 100 acres	1.9	2.5
Number of broods reported	33	3
Average number in each brood	8.6	7.8

Table 2. Rural Mail Carriers Brood Counts 1954 - 1959:

	1954	1955	1956	1957	1958	1959
Average brood size	6.5	6.1	6.0	5.6	5.8	5.2
Per-cent of hens with broods	38%	43%	38%	43%	43%	30%
Young per adult hen	2.5	2.7	2.3	2.4	2.5	1.8

Table 3. District Results for Conservation Officers Brood Counts 1959: State-wide Results for 1954 - 1959:

District	Young per Adult Hen	Average Brood Size	Per-cent of Hens with Broods
1. Northwest	3.3	5.3	62%
2. Northcentral	2.8	4.6	60%
3. Northeast	2.5	4.9	51%
4. Westcentral	5.0	6.5	78%
5. Central	4.1	6.4	63%
6. Eastcentral	4.7	6.7	70%
Southern 3 Districts	4.6	6.1	75%
State 1954	3.7	5.7	64%
State 1955	5.2	6.8	77%
State 1956	4.2	5.9	71%
State 1957	4.4	5.9	74%
State 1958	4.5	6.2	72%
State 1959	3.5	5.5	64%

Table 4. Pheasant Reproduction Success in Franklin County 1954 - 1959:

Year	Young Per Adult Hen	Average Brood Size	Per-cent of Hens With Broods
1954	4.6	6.3	74%
1955	5.2	6.7	78%
1956	4.3	6.1	71%
1957	5.2	6.2	84%
1958	5.0	6.5	77%
1959	3.0	5.3	56%

RESULTS OF THE JULY 1959 ROADSIDE RABBIT SURVEYS

by
Paul D. Kline
Game Biologists

Introduction

The annual July roadside rabbit count was continued in 1959. The survey has been conducted with slight modification every summer beginning in 1950. The survey is run by conservation officers and biologists who drive predetermined routes 30 to 40 miles in length on gravelled roads. Participants drive 25 miles per-hour, starting at sunrise, and count and record all rabbits seen along the routes. The July counts were developed for use in surveying cottontail populations. Starting in 1958, jackrabbits were counted as well as cottontails. Jackrabbits had not been included in previous surveys.

Records were kept of temperature, wind velocity, per-cent cloudiness, and date of last rain, first in 1958. These records were continued in 1959. It was hoped that recording these weather factors might aid in the evaluation of weather influences upon early morning, roadside rabbit activity. Dew was measured by all personnel. Dew readings have been included as part of the annual counts since 1955. Dew gauges and photograph keys were furnished by Richard Nomsen, Pheasant Biologist. The data were compiled by ecologic areas as explained by Kline (1958).

All participants in the roadside surveys were asked to record adult and juvenile cottontails seen during the survey period (July 10-20). These age ratio surveys have been conducted annually in conjunction with the roadside survey. As indicated by Wight's (1959) findings in Missouri, the age ratio for any one year multiplied by the index of adult cottontails seen per-mile during the roadside counts gives an index useful in predicting hunting success for the following season. This index is based upon the assumption that hunting success, among other factors, reflects rabbit abundance, and that abundance is dependent upon number of breeders and reproductive success.

Results:

Sixty-eight routes totaling 2,362.1 miles were surveyed. In all, 1,466 cottontails were seen for an index of 6.21 cottontails per 10 miles of route (Table 1). Cottontails were most abundant in the southern loess and Missouri loess areas where they also had been abundant the previous year. The Tazewell drift and Mississippi loess areas had moderately high indices. Lowest indices were obtained in the Wisconsin and Iowan drift areas, and in the driftless area. These areas also had comparatively low indices in 1958.

Comparisons of the data from three previous seasons (Table 2) indicate cottontails have declined somewhat in all ecologic areas since 1958. The statewide index of cottontails - 10 mile dropped from 6.86 in 1958 to 6.21 in 1959. However, the index was higher than for all indices prior to 1958 (Table 3). Since 1956 the data indicated cottontails have increased throughout Iowa until a peak was reached during the summer of 1958.

One hundred and five jackrabbits were counted (Table 1). The index for jackrabbits for 1959 (0.41) was twice as great as that for 1958 (0.23). Most jackrabbits were seen in the Tazewell and Wisconsin drift areas where the indices per 10 miles were, respectively, 1.58 and 1.20. A few jackrabbits were observed in the Iowa drift, none elsewhere. These data coincide with the known geographic range of the species in Iowa.

Of 4,306 cottontails aged, 3,156 were juveniles for a ratio of 2.75 juveniles seen per adult (Table 4.) This ratio was up slightly from 1958 when the ratio was 2.67 juveniles per adult (Table 3). It was a higher ratio than obtained for all years except 1955 and 1957. The data indicate that best reproduction occurred in the southern loess and Iowa drift areas where the ratios of juveniles per adult were respectively 3.58 and 3.33. Average ratio for ten years is 2.6 juveniles per adult. This indicates reproduction for 1959 was slightly above normal.

The fall population index (Wight, op.cit.) for 1959 was 4.07 as compared to 4.51 for 1958. This would indicate rabbit hunting can be expected to be less profitable during 1959-60 than during the previous seasons.

An analysis of roadside counts correlated with dew fall readings is presented in Table 5. The table reveals considerable inconsistency in the data. Low dew readings some years correlated with high indices of rabbits - 10 miles - other years with low indices. - when compared with state-wide averages. The same can be said for high dew readings. Two facts appear from the data. First, roadside counts made when dew is not present very likely will result in fewer rabbits seen than when dew is present. Second, surveys made after rainfall probably will reveal fewer rabbits than those made when rain has not fallen.

For dew readings 1 through 6 the five years of data reveal no consistent influence upon cottontail roadside counts. Dew readings 7 and 8 indicated more rabbits seen per mile. However, during the five years only four and three counts were made respectively after dew readings of 7 and 8. These data, therefore, are not sufficient.

Discussion

After ten years trial the July roadside survey appears to have evolved into a reliable means of estimating rabbit populations. It has revealed an upward trend in cottontail abundance during the past four years, culminating in a peak during 1958. That rabbits actually have been abundant during recent seasons can be attested to by hunters, particularly those who have pursued rabbits in southern Iowa. For all of the seven ecologic areas since 1956, the data show a similar trend - more rabbits each year until 1959 when a decline appears to have begun.

Although rabbits numbers may be down some from 1958-59, a highly successful season is in prospect for 1959-60. Southern and western Iowa appear still to have relatively high rabbit populations. Hunting success will be determined to a considerable extent by climatic factors, primarily by snow. For, as all good rabbit hunters know, snow on the ground makes pursuit of rabbits more rewarding.

The roadside counts appear to be established as reliable. However, the writer does not feel the age ratio survey taken during the same period gives entirely accurate data. There appears to be too much variation in data from adjoining counties. For example, one observer reports having seen five adults and 45 juveniles; while an adjoining observer reports 20 adults and 30 juveniles. While these variances may be due to chance, the writer feels they often result from differences of opinion when rabbits are classed as adult or juvenile. Probably there are real differences in the ability of the observers in correctly classifying the age of rabbits.

Some observers consistently, year after year, report a high juvenile adult ratio; others a low ratio. This adds credence to the writer's belief that a real problem exists. A program of education whereby the observers are taught fundamental differences in appearance and behavior between adult and juvenile cottontails seems the logical solution. The most samaging evidence regarding the age ratio survey appears when comparing age ratios and rabbits 10 miles indices. The age ratio for 1959 was higher than for 1958; hence, an increase in rabbit numbers should be expected. Actually a decline occurred. For 1958 the juvenile adult index was down from 1957, but the roadside counts were much higher.

The use of dew blocks apparently has not materially increased the effectiveness of the roadside survey. The writer is well aware of pit-falls in measuring dew. Over a 30-40 mile route any careful observer may distinguish distance variances in dew fall. Therefore, dew measure will depend upon, among other factors, the location of the dew block. Too often, dew blocks are placed in the backyard of the observer, sometimes late in the evening after dew has already fallen. The practice is not conducive to accurate and consistant dew readings.

The writer believes dew measure need not be continued during future surveys. After all, dew is a resultant of certain climatic conditions. Dew usually accumalates during nights when skies are clear and wind velocity is negligible. Those same factors seem to control early morning, roadside rabbit activity. The rabbit counts average higher when dew is present than when it is not. However, in view of the effect of clear skies and wind velocity, they can be used as controls in making roadside surveys. It is a simple matter for an observer to check cloudiness and wind velocity before making a survey.

Summary:

1. July roadside counts were conducted in 1959 as they have been for nine previous years.

2. The index of cottontails seen per 10 miles of route was lower than the 1958 index, but higher than those from all previous years.

3. Cottontail populations appeared higher in the southern, Missouri, and Mississippi loess areas than in more northern and eastern portions of Iowa.

4. All areas experienced small population declines.

5. Almost twice as many jackrabbits were seen during the survey as in 1958.

6. The ratio of juveniles-adult was slightly higher than the ten-year average.

7. An analysis of the effect of dew fall readings upon roadside rabbit counts for five years revealed no correlation between amount of dew and numbers of rabbits seen. However, the data indicated lack of dew or rainfall plus dew lessence roadside rabbit activity.

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Table 1. Results of July Roadside Rabbit Surveys for - 1959:

Area	Number of Routes	Total Miles	Cotton-tails Observed	Cottontails Observed 10 Miles	Jack-Rabbits Observed	Jackrabbits Observed 10 Miles
Tazewell Drift	3	101.0	54	5.35	16	1.58
Missouri Loess	8	266.1	230	8.64		
Wisconsin Drift	18	674.2	305	4.52	81	1.20
Iowan Drift	16	539.7	195	3.61	8	0.15
Driftless Area	1	41.0	6	1.46		
Mississippi Loess	9	266.0	161	6.05		
Southern Loess	13	474.1	515	10.86		
State-wide	68	2,362.1	1,466	6.21	105	0.44

Table 2. Comparisons of July Roadside Rabbit Surveys for Years - 1956 thur 1959:

Area	Cottontails Seen Per 10 Miles of Route			
	1956	1957	1958	1959
Tazewell Drift	3.5	3.8	6.5	5.4
Missouri Loess	3.1	4.0	9.4	8.6
Wisconsin Drift	2.8	2.9	4.6	4.5
Iowan Drift	3.5	4.4	4.5	3.6
Driftless Area	2.6	2.6	2.7	1.5
Mississippi Loess	4.3	5.3	6.7	6.1
Southern Loess	6.2	8.5	13.6	10.9
State-wide	3.94	4.89	6.86	6.21

Table 3. Comparisons of July Rabbit Indices for Years 1950 thru 1959:

Year	Number of Rabbits Seen Per 10 Miles of Route	Number of Juveniles Per Adult
1950	4.28	2.2
1951	3.91	2.0
1952	4.17	2.6
1953	3.30	2.4
1954	3.35	2.5
1955	5.67	3.0
1956	3.94	2.7
1957	4.89	3.2
1958	6.86	2.67
1959	6.21	2.75
Average	4.66	2.6

Table 4. Age Ratios of Cottontails Observed During July Counts for 1959:

Area	Number Adults	Number Juveniles	Ratio of Juveniles/Adults
Tazewell Drift	64	165	2.58
Missouri Loess	203	525	2.59
Wisconsin Drift	299	563	1.88
Iowan Drift	147	490	3.33
Driftless Area	12	63	5.23
Mississippi Loess	140	329	2.35
Southern Loess	285	1,021	3.58
State-wide	1,150	3,156	2.75

Table 5. Effect of Dew Upon Indices of July Roadside Counts for Years - 1955 thru 1959:

Dew Reading	Index of Cottontails Seen/10 Miles						Total Routes	Years Recorded
	1955	1956	1957	1958	1959	Average Index		
0	2.44		4.73			3.58	27	2
1	3.87	4.24	5.07	9.06	9.61	6.37	50	5
2	7.78	4.20	3.31	5.64	4.46	5.08	83	5
3	8.13	3.54	5.88	6.47	5.75	5.95	64	5
4	4.60	4.34	4.38	6.74	6.29	5.27	33	5
5	3.96	5.15	10.26	8.49	3.53	6.28	21	5
6	3.57	3.30	3.00	6.49	6.66	4.60	21	5
7	3.14		7.19	13.01		7.78	4	3
8	12.76				7.33	10.04	3	2
*R/D	6.15	1.03	4.60	3.53	0.19	3.10	8	5

* R/D Refers to Rain Plus Dew.

CALLING QUAIL 1959

by
M. E. Stempel
Game Biologist

Calls of the male "Bobwhite" quail in Iowa are a feature of nesting, brooding and hatching periods. Calling begins in April and increases until late June or early July. A state-wide count of whistling males is conducted after July 10th because on earlier dates, some notes of other common birds can be confused with those of quail; in addition, so many song birds call in spring and early summer that it is difficult to concentrate on listening for the bobwhites.

This type of count can be made quickly. When used by individuals who have had a minimum of instruction, it is sufficiently objective to yield data that can be used as a basis for setting seasons. It has been used in Iowa for over ten years, and it was used in Alabama, Indiana, Florida, Georgia, Missouri, Nebraska, and South Carolina. Usually it is supplemented by other field studies.

Method:

Early in July, letters of instruction and forms for recording results were mailed to cooperating officers in counties that have quail in shootable numbers. In each county checked, two twelve-mile long routes were chosen; where possible these were so arranged that they ran through representative portions of the various soil types. After July 10th each cooperator was asked to begin his check of the routes, beginning at sun-up on a clear, calm morning. The first stop was made one-half mile from the beginning of a route. There the auto engine was turned off, the checker got out, listened for three minutes then recorded the number of quail that called "Bobwhite". The same procedure was repeated thenceforth at a stop at the end of each mile.

Results: State-wide:

The 1959 summer calling of quail in Iowa began in late spring, became extensive in June and reached a peak in July, then continued into the third week of September. Birds along the twelve-mile routes were counted between July 10th and 31st. Results are presented in table 1 below.

Some decline is indicated in the number of calling quail since 1958. However, on a route checked several times by the writer, as many quail were calling in 1958 as in 1959. It was noted, nevertheless, that cocks at times failed to call during the designated three minutes listening time. It is probable that checkers failed to hear some quail.

Results: District:

Indication of general areas where there were declines of calling quail may be located by reference to table 2 below.

Within the main quail range, the decrease in the South-central amounting to 0.1 calling quail per mile, was in only two of five counties and in the Southeastern section, which was the same both years, there was decrease in one of six counties. Decrease in the East-central part of Iowa was in two of three counties that were checked.

Results: Within Counties: Increases:

Below in table 3 are counts of quail as reported from some of the key counties; also there are counts from three counties that will be opened for hunting for the first time in recent years.

Greene county in 1958, on a sample route, had six calling quail at eight stops. In Boone and Carroll counties the sampling was done at widely separated points to learn whether the population occupied more than just a few areas.

Decreases in Some Key Counties:

Some key counties in typical portions of the quail range had less calling quail than in 1958. Some of these are listed below in table 4.

While there were decreases in some areas, nearby counties remained the same or had increases. The amount of calling was traced throughout the summer on a sample route south of Ottumwa. A few counts were made in typical areas elsewhere in order to have information on several aspects of calling.

Below in table 5, is a compilation of results from three stops on the Wapello County route.

Figures are given wherever there was a record made. In some cases no record could be made because of other commitments or unfavorable weather.

Calling by Iowa quail in August was more extensive in 1957 than in 1959; increased September calling indicated increased nesting activity over that taking place in September 1957. This September activity is reported as rare in Missouri as well as in Iowa, but some did occur in 1950 and 1952 as well as in 1959.

Normal rate of calling for a male is 3.5 calls per minute in July. In 1959 in areas where birds were checked frequently during summer, many called at the rate of only 2.5 to 3 calls per minute. During some intervals no bobwhites were heard in places where several cocks did call later or earlier in the day.

Weather Preceeding and During the Nesting Period:

During March there were heavy and repeated snowstorms, some of which left 18 inches of snow. Early April weather was pleasant. On the 20th there was snow, and the temperature was unpleasant and below normal. By May 4th there was a temperature increase, but on May 18th the temperature fell. The June 1st period was near normal until June 8th when there was a cooling trend, by the 15th it was normal again. On June 22nd a cooling trend spread across the state. Early in July there was a cool, wet period, and again in August there were some violent local storms that were classified as damaging to crops.

The 1958 and 1959 seasons had similar patterns, but May 1958 was warmer. Damaging storms occurred both years at sometime in the hatching and rearing season for quail.

SUMMARY

1. A 1959 July count of whistling male quail was made along 1015 miles of route.

2. The state-wide average of calling birds per-mile dropped from 1.5 in 1958 to 1.4 per-mile in 1959.

3. Some decline was only apparent, and not real since quail called less frequently in 1959.

4. Within the main quail range the decline in the south-central was slight, while there was no decline in the southeast.

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TABLES AND CHARTS:

Table 1. Results of Summer Quail Counts, 1958 - 1959:

	1958	1959
No. of Counties	36	42
No. of Routes	67	77
Miles of Route	894	1015
No. of Calling Quail	1374	1392
Birds Per-Mile	1.5	1.4

Table 2. Calling Quail Per Mile by Districts, 1958 - 1959:

	1958	1959
South-Central	2.4	2.3
Southeast	2.6	2.6
East-Central	1.8	1.3
Border or Low* Population Counties	1.0	1.0
Three New Counties Not Previously Hunted		0.8

* These counties lie outside the main quail range and are located inland from the border rivers, the Mississippi and the Missouri, and North of the Southern three tiers of counties.

Table 3. Calling Quail Per Mile in Some Key Counties:

		1958	1959
Counties in the Main Range	Davis*	6.0	6.0
	Lee	2.9	2.9
	Jefferson	2.8	2.8
Border Counties	Harrison	1.8	2.8
	Fremont	1.8	2.2
	Story		2.0
New Counties	Boone		1.0
	Greene		0.9
	Carroll		0.5

* The Davis County count is high because parts of the routes are through rough areas where several soil types adjoin and where good cover is near food. Often several covey ranges are adjoining.

Table 4. Counties From Which Decreases were Reported:

		1958	1959	Amount of Decrease
Counties in the Main Range	Clarke	2.8	2.2	-0.6
	Dubuque	1.0	0.4	-0.6
	Jackson	3.1	2.0	-1.1
Border Counties	Allamakee	0.9	0.2	-0.7
	Audubon	0.1	0.0	-0.1
	Bremer	0.4	0.0	-0.4
	Fayette	1.0	0.0	-1.0
	Pottawattamie	0.9	0.2	-0.7
	Woodbury	2.8	1.6	-1.2

Table 5. Rate of Calling, Lake Wapello Road:

Date of Count	Average No. of Quail Heard Per Trip		
	1957	1958	1959
June 15th	10	10	10
June 30th	9	17	14
July 15th	13		16
July 31st		12	4
August 15th	7		2
August 31st			
September 15th	0		7

AN INDICATION OF THE ABUNDANCE OF MOURNING DOVES IN IOWA IN 1959

by
James G. Sieh
Game Biologist

In July of 1959 Mourning Doves (Zenaidura Macroura) were counted by personnel of the Iowa Conservation Commission during routine rabbit censuses over predetermined routes. Approximately 2324 miles of secondary roads were traveled during this survey and 9035 doves were counted. This was an average of 4 doves per-mile, and this figure multiplied by 74,414 miles of gravel surfaced secondary roads totaled 297,656 doves. This total represented only those doves counted along lineal census routes, and the total expanded figure indicates only a fraction of all the mourning doves present in Iowa.

Most census routes were gravel surface secondary roads, each about 40 miles in length. Routes were to be traveled at 25 miles per-hour and the census was to start at sunrise. Counts were made from July 10 - 20 inclusive. If difficulties were encountered when counting large flocks of doves, estimates of the number of doves observed were requested. Estimates on ten routes indicated more doves were observed than could be accurately counted. Overall, the estimates were higher than the actual counts indicating a slightly higher population index than the 4 doves-per-mile figure. Dove counts were reported from 61 counties providing good state-wide representation of the mourning dove population in 1959 (see appendix).

APPENDIX: The Number of Mourning Doves Osberved in 61 Iowa Counties During The July Roadside Rabbit Census in 1959:

County	Miles Censused	Doves Counted	/Per/Mile	Doves Estimated	/ Per Mile
Appanoose	36.5	203	5.6		
Benton	30.8	63	2.1		
BlackHawk	38	12	0.3		
Boone	30.5	139	4.6		
Boone	35	137	3.9		
Bremer	29.9	186	6.2		
Buchanan	25*			75	3.0
Buena Vista	34	266	7.8		
Butler	29	52	1.8		
Cass	38.8	104	2.7		
Calhoun	38	107	2.8		
Cerro Gordo	40	265	6.6		
Chickasaw	40	85	2.1		
Clay	43	103	2.4		
Clinton	41	78	1.9		
Davis	35.2	158	4.5		
Decatur	34	309	9.0		
Delaware	36	227	6.3		

Cont. next page

County	Miles Censused	Doves Counted	Per Mile	Doves Estimated	Per Mile
Des Moines	41	121	3.0		
Dickinson	39	142	3.6		
Dubuque	35	41	0.8		
Emmet	31	214	7		
Fayette	41	76	1.8		
Fremont	33	78	2.4		
Franklin	33	52	1.6		
Greene	34.5	134	3.9	160	4.6
Hancock	41	68	1.9	80	2.0
Hardin	33	151	4.6		
Harrison	36.6	132	3.6		
Howard	36	81	2.2		
Humboldt	34.8	114	3.2		
Iowa	30	67	2.2		
Iowa	28	65	2.3		
Jackson	25	6	0.2		
Jefferson	40	225	5.6		
Keokuk	31	80	2.6		
Kossuth	54	220	4.0		
Lee	30*			95	3.2
Linn	32	115	3.6		
Lucas	40	204	5.1		
Madison	30	130	4.3		
Mahaska	35	155	4.4		
Marshall	31	56	1.8	100	3.2
Mills	30	223	7.4	700	23.3
Mitchell	30	113	3.7	163	
Muscatine	43	142	3.3		
O'Brien	28	80	3		
Osceola	39	267	6.8		
Palo Alto	40	231	5.8		
Palo Alto	33.4	201	6.0		
Polk	35	353	10.1		
Pottawattamie	31.7	108	3.4		
Poweshiek	25*			100	4.0
Sac	45	187	4.1		
Scott	31	219	7.0		
Sioux	34	319	9.4		
Shelby	27*			475	17.6
Story	29	106	3.9		
Tama	20	71	3.5	121	6.0
Taylor	29	139	4.8		
Union	34	158	4.6		
Van Buren	35	203	5.8	300	8.6
Wappello	51	20	0.4	30	0.6
Warren	33	132	4		
Wayne	31.4	201	6.4		
Winnebago	40	63	1.5		
Woodbury	40	278	6.9		
TOTALS	2,324.1	9035	4.0		

* Miles subtracted from total when calculating average number of doves counted per mile.

DES MOINES RIVER CREEL CENSUS, 1959

by
Harry Harrison
Fisheries Biologist

A creel census of Des Moines River fishermen's catch was carried on in 1958. This is an annual extension of a project initiated in 1953.

The census involves interviews in the field with fishermen at frequent but irrigular intervals from the start of fishing in the spring, usually early in April, until the end of September. The information secured from each angler includes; the date, time and place of the interview; the length of time spent fishing up to the instant of contact; the kind and number of fish creeled; the variety of fish that the contact wished to catch; and the kind of bait used. This information was recorded on separate census cards for each fisherman interviewed.

A 130 mile section of the Des Moines River, extending from the Scott Street Dam in the city of Des Moines to Humboldt, was the area censused.

The data gathered in 1959 are given in Tables 1 and 2, which also include the related information for each year since the beginning of the project. Table 1 is a summation of the total number of contacts made each year together with: the number of hours fished; the number of fish caught; and the number of fish caught per man-hour. Table 2 displays the rate of catch of the important species caught by all anglers during the seven years of study.

Comparing the catch from year to year, angling success in the Des Moines River seems to maintain a success of about .70 fish per-hour. This has been true throughout the census except for the drought years 1955 and 1956, during which fishing success dropped approximately 50 per-cent.

The 1959 angling year had the highest rate of catch since the study was initiated. The catch rate has increased Annually since 1955.

This increase in angler success only reflects quantity. Since the quality of the harvest is equally important, or more so, than rate of catch, it must also be considered.

An increased take of carp and bullheads is entirely responsible for the increasing catch rate since 1956. Channel catfish have been caught in decreasing numbers over the same period.

Carp entering the creel are typical of those inhabitating central Iowa streams. For the most part, they range from 10 to 14 inches in total length; they are of slender conformation but not of poor quality. Bullheads are small; they appear to be in good body condition, but the major part of the population is less than six inches long.

Channel catfish observed on the stringer range from 6 to 20 inches, with the great majority running between 10 and 12 inches. They appear to be in good body condition, but growth studies reveals them to be slow growing.

Until this year, channel catfish have been the most sought after species in the river. Of all anglers who fished specifically for one kind of fish in 1959, 34 per-cent were cat-fishermen, 47 per-cent carp fishermen, and 8 per-cent each for bullheads and walleye.

At the time of interview, 17 per-cent of those anglers fishing only for channel catfish were successful; 55 per-cent of the carp fishermen had caught carp prior to being contacted; 70 per-cent of the "bullheaders" had been successful, 22 per-cent of the walleye fishermen had caught the species of their choice.

On the basis of effort, it required approximately one hour in 1959 to catch a carp, six hours to get a channel catfish, one-half hour for a bullhead, and three hours for a walleye.

Viewing the 1959 catch from the Des Moines River in the light of quality fishing, it cannot be denied there is much to be desired. Even though the rate of catch is now at its highest, the poor quality of the fish being taken leads only to the conclusion that fishing is now the poorest that it has been since this project began in 1953.

Discussion

The creel census of the Des Moines River has been running for seven years. In that length of time it should begin to show a pattern of harvest or at least an indication of what might be expected of the stream by the way of producing fish for the creel.

A point of interest in connection with this is the consistancy of the catch per-hour. In the years 1953, 1954, 1957, 1958 and 1959, stream conditions in central Iowa were relatively normal. There were no extended periods of extreme flooding, droughts, high water temperatures or other observable factors which might result in adverse circumstances for fish life. In those five years angling success only varied 0.17 fish per-hour. This would indicate that the Des Moines River under reasonably normal circumstances is capable of producing fish for the average angler at a rate of something in the neighborhood of 0.7 fish per-hour.

A second point of significance in relation to the pattern of harvest is seen in the composition of the catch. The take of catfish was at its highest in 1953 and 1954. It dropped in 1955 and 1956, rose again in 1957 and has been declining since. The catch of carp over the same period has varied inversely with that of the channel catfish. Since the catfish is much preferred by our stream fishermen, the indications are that unsuccessful cat-fishermen turn to carp fishing or give up fishing altogether.

Surveys of fish populations in the Des Moines River conducted by electrical shocking methods reveal a very large population of fish including carp, quillback, and a variety of suckers and channel catfish in that order of importance. 1/

Electrical shocking techniques do not lend themselves for precise species composition determinations, but they do show in general terms, gross trends in populations. Viewing our shocker data in this light, results of the past two years have indicated relatively stable, high populations of carp and quillback; a strong upward surge of suckers in the Moxsostoma group; and a trend downward in channel catfish populations. This downward trend in the catfish seems to be manifested more in a smaller individual size than a reduction in numbers. In other words, the catfish population has not changed much number-wise, but the average fish is noticably smaller.

Table 1. Rate of Catch of Fish From The Des Moines River For The Years 1953 through 1959:

Year	Fishermen Contacted	Total Hours Fished	Number Fish Caught	Fish Per Hour
1953	884	1,847	1,142	.61
1954	648	1,421	1,073	.75
1955	797	1,588	581	.37
1956	1,050	1,510	595	.39
1957	1,146	2,193	1,358	.62
1958	785	1,394	977	.70
1959	195	351	275	.78

Table 2. A Comparison of Rate of Catch By Species of Fish Caught From The Des Moines River For The Years 1953 Through 1959:

No. Anglers	884	648	797	1,050	1,146	785	195
No. Hrs. Fished	1,847	1,421	1,588	1,510	2,193	1,394	351

	Number Caught Per Man Hour						
Year	1953	1954	1955	1956	1957	1958	1959
SPECIES:							
Channel Catfish	.33	.29	.13	.16	.28	.18	.10
Carp	.13	.11	.16	.40	.21	.43	.44
Bullhead	.08	.28	.04	.08	.09	.33	.20
Walleye	.03	.02	---	---	.01	.02	.03

Footnote--- 1 - In addition to these named species, there is a wide variety of other kinds of fish (between 40 and 50 species), but in bulk they would not make up more than an estimated 1 or 2 per-cent of the entire weight of the total population.

SURVIVAL OF LARGEMOUTH BASS ADVANCED FRY IN SOME EASTERN IOWA WATERS

by
Bill Tate
Fisheries Biologist

Following extensive and severe winter kill in the Cedar River and Sweet Marsh, largemouth black bass advanced fry were stocked to re-establish the species. The fry were transported in plastic bags from the Lake Wapello Hatchery and from the Fish and Wildlife Service Hatcheries at Genoa, Wisconsin and Guttenburg, Iowa to the stocking sites; the three (3) Segments of Sweet Marsh and the Cedar River impoundments at Mitchell, Charles City and Nashua.

Segment C of Sweet Marsh was stocked with an estimated 80,000 fry on 19 May and 4 June and was surveyed by electro-fishing gear on 15 July.

Most of the young of the year bass turned, ranged from 4.8 to 7.2 inches in length. Another size group from 1½ to 2 inches in length was assumed to be late reproduction of the few largemouth from 9.2 - 9.7 inches taken in April surveys, that had survived the winter kill. Segment C was stocked with 80,000 advanced fry on 4th and 9th of June and in 95 minutes shocking the 5 to 7 inch largemouth were turned at a rate of 2.97 per minute. Using this rate, a survival index of 17.80 was computed as the number of fish shocked in an hour for each 10,000 fry stocked. (Table 1).

Segment B was stocked in early June with 85,000 largemouth advanced fry. As part of the waterfowl management program Segment B was lowered and seeded to millet. During the survey on 24 July, 1959, 75 minutes were spent shocking and young of the year largemouth were turned at a rate of 0.69 per minute. The survival index, computed as above, was 4.52. The largemouth in Segment B were apparently not as abundant and were not as large as in the other two Segments. Lowered water levels and competition from a very dense population of young of the year of rough fish, chiefly buffalo, could have slowed growth rate and affected the survival of the fry.

Segment A which was stocked in early June with 100,000 largemouth fry is divided into two sections joined by a boat canal which is passible for small boats, at crest water levels. Segment B drains into the west portion of Segment A and when Segment B was lowered young of the year buffalo apparently entered with the overflow. Large numbers of young of year buffalo and some young of the year carp were "turned" during the survey, but the largemouth fry had survived and made excellent growth. The east portion of Segment A was surveyed prior to the west portion and contained fewer buffalo and carp young of the year than the west portion of Segment A or Segment B. Largemouth bass were numerous and had made excellent growth. Segment A had been toxaphened prior to winter kill and there was no evidence that any game fish had survived the winter in over two (2) hours shocking in a previous spring survey. In 140 minutes of shocking on the 24th and 29th July, 1959 young of the year largemouth were turned at a rate of 2.97, for a survival index of 17.82.

The Nashua impoundment of the Cedar River was stocked with 40,000 largemouth advanced fry and in 80 minutes shocking, young of the year largemouth were turned at a rate of 1.51 per minute indicating a survival index of 23.40. The Nashua pool was surveyed on 20th August and the first five young of the year largemouth picked up with the net ranged from 6.5 to 7.7 inches in total length. Young of the year carp were extremely abundant in the Nashua pool.

The Charles City pool of the Cedar River was stocked with 10,000 largemouth advanced fry, and in 75 minutes, shocking, young of the year largemouth were turned at a rate of 0.07 fish per minute with a survival index of 4.20. Three young of the year picked up with the net ranged from 5.9 to 7.4 inches in total length. Survival in the Charles City pool was apparently poor with the survivors showing good growth.

The Mitchell impoundment is long and narrow and was surveyed near the dam at Mitchell and toward the upper end near St. Ansgar. A total of 155 minutes was spent shocking in the Mitchell pool on the 4th and 10th of September and young of the year largemouth were turned at a rate of 0.36 per minute with a survival index of 43.20; only 5,000 advanced fry were stocked in the Mitchell pool. Six young of the year largemouth ranged from 5.3 inches to 6.2 inches in total length. The upper end of the pool had a very low population of largemouth, (0.07 per minute of shocking) the lower end of the pool had a much higher largemouth population, (0.77 per minute of shocking.).

With the exception of Segment B of Sweet Marsh, the Charles City impoundment on the Cedar River and the upper end of the Mitchell Pool, largemouth bass stocked as advanced fry survived in adaquate numbers. In all areas the growth of the young of the year was good to excellent.

At Sweet Marsh, young of the year bass (1959) were harvested by fall fishermen. Most of the fish were 8 to 9 inches in length with an occasional bass of 10 inches or longer. All were in excellent condition and heavy for their length.

Table 1. Survival Index* for Largemouth Black Bass Stocked As Advanced Fry:

Location	Minutes Shocked	Fish Per Minute	Survival Index
Sweet Marsh			
Segment A	140	2.97	17.82
Segment B	75	0.69	4.52
Segment C	95	2.50	18.75
Nashua Pool (Cedar River)	80	1.51	22.65
Charles City Pool	75	0.07	4.20
Mitchell Pool	155	0.36	43.20

* Number of fish turned in one hour of shocking computed from fish per minute of shocking for each 10,000 fry stocked.

WEEK-END
CREEL CENSUS AND ECONOMIC EVALUATION OF NORTHEAST IOWA RIVERS - 1959

by
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Fisheries Biologist

From June to September 1959 the Wapsipinicon River from Highway 63 Bridge in the vicinity of New Hampton to below the dam at Anamosa was censused by a creel clerk one day each week-end. Similar coverage was afforded the Maquoketa River from Strawberry Point to the city of Maquoketa.

During the first half of the census period the clerk contacted anglers from 8 a.m. to 5 p.m. on three Saturdays and two Sundays on the Wapsie and one Saturday and a single Sunday on the Maquoketa.

By the end of June it was readily apparent that most areas of concentrated fishing activities gave way to boating and water skiing on Sundays so from July 5th on coverage was made only on Saturdays.

From mid-July to September the clerk adjusted his contact day to the period between 1 and 10 p.m. to get better coverage of the evening cat-fisherman. Thus, 6 of 13 census days covered the evening cat-fisherman.

Areas covered their relative importance to the fishermen and the importance of public access to fishing waters are indicated in Table 1.

As can be seen from Table 1, the fishing spots having public access areas are the source of the heaviest angler usage. Both Delhi Lake and the Littleton Dam have commercial access areas.

Over 91 per-cent of the fishing pressure on the Wapsipinicon River takes place from the Littleton Dam, downstreams on the Maquoketa, it is the upstream reaches and associated impoundments which bear the brunt of the fishing pressure; 69 per-cent taking place above Delhi Dam.

Over 50 per-cent of the anglers contacted were "just fishing", while those fishing specifically for a certain species were after catfish, panfish, bass and carp in that order (Table 2).

It was surprising that even with the great number of impoundments in the upper reaches of these rivers, the 1959 Boat - Bank fishermen ratio (2 in 10) is quite comparable with that taken in the unimpounded rivers in Southeastern Iowa in 1958 (1 in 10).[1] The data in Table 3 indicate that despite the surge in boating, 8 to 10 anglers still fish from the banks of streams.

Footnote - 1 - Cleary, R. E. - Inland Creel Census and Angling Evaluation, Southeast Iowa, 1958. Iowa Conservation Commission - Quarterly Biology Reports, XI: 1 (Processed).

Both the 1958 and 1959 studies showed that 8 of 10 anglers were male. In the Maquoketa River, panfish (crappies, bluegills and white bass) made up over 60 per-cent of the catch; bullheads, 16 per-cent; and channel catfish 13 per-cent. (Table 4)

Catches in the Wapsie River ran strongly to Bullheads 50 per-cent; Channel cat 25 per-cent; and panfish 15 per-cent. Despite the fact that over 70 per-cent of the bullheads came out of a lateral impoundment in the upper Wapsie drainage, Sweet Marsh, this fish was second only to catfish in abundance downstream.

As an addendum to the intangible recreational values, a dollar-and-cents evaluation of the actual expenses incurred in fishing these rivers was included in this project.

Since the angler's home town was determined, and since he was asked how many trips he made to the river, it became a simple matter to figure his transportation expenses (Table 5). The replacement value of the gear the angler was using while fishing was amortized over a five-year period and miscellaneous expenses such as the cost of bait and license were added. Since most anglers were found to come from less than 60 miles away to fish, and usually brought their own lunch, no room or meal expense was added to their angling expenditures. The average river angler in this area made 43 trips per year. There is an inherent bias in these data, with the "everyday" fisherman being contacted more often than the casual fishermen, his replys to the "number of trips per year" question tends to swell this figure.

With so many factors influencing angling success and effort, it is sometimes a dangerous procedure to compare Qualitative catch data from different years, however, fishing expenditures are a more stable basis for comparison and there is a great dissimilarity between the Northern and the Southern anglers in Eastern Iowa. In 1958 the angler on Southeast Iowa rivers annually spent $32.00 on his sport; in 1959 in Northeast Iowa, the average angler spent $86.00 a year.

The major differences in these two areas came in the number of times the angler went fishing in a year (5 in Southeast Iowa and 43 in Northeast Iowa); and in the cost of the individual angler's gear ($7.00 in Southeast Iowa and $23.00 in Northeast Iowa).

The quality of the fishing, with only 61 per-cent of the catch in Southeast Iowa being game species, and in Northeast Iowa 95 per-cent of the catch being game species, probably caused more anglers to spend more time fishing in Northeast Iowa. With the numerous large impoundments in the upper reaches not only was there a 100 per-cent increase in boat fishermen, but their boats and motors were of the larger and more expensive variety.

Table 1. Location of Points of Angler Pressure and Comparison of Usage on The Wapsipinicon and Maquoketa Rivers, 1959:

Location	Times Clerk Visited Area	Average Number Anglers
	Wapsipinicon	
Highway 18 Br.	2	0
Highway 346 Br.	1	0
Highway 63 Br.	2	0
Indian Pond*	3	4
Frederika Dam*	2	1
Sweet Marsh Pond**	3	17
Tripoli	1	0
Highway 3 Br.	2	0
Dunkerton Br.*	1	11
Cutshaw's Br.**	5	6
Littleton Dam	6	11
Otterville Br.**	5	7
Independence Pond*	3	24
Independence Dam*	9	19
Quasqueton Dam*	4	5
Troy Mills Pond*	3	2
Central City Dam	6	7
Anamosa Dam**	4	11
	Maquoketa	
Backbone Lake**	4	7
Backbone Dam**	4	13
Quaker Mill Pond*	7	7
Manchester dam	7	1
Bailey's Ford*	7	5
Delhi Lake	3	51
Hopkinton Dam	2	0
Monticello Dam*	3	8
Ebes Mill Br.	1	0
Pictured Rocks**	1	0

* - Public Access Areas Present
** - State Owned Access

Table 2. Species Preference Stated by Anglers on Upper and Middle Reaches of Wapsipinicon and Maquoketa River, 1959:

Species Sought	Upper Maquoketa	Middle Maquoketa	Totals	
Anything	180	18	198	59%
Channel Cat	39	4	43	13%
Bluegill	33	--	33	10%
Crappie	20	--	20	6%
Black Bass	15	2	17	5%
Northern Pike	--	--	--	
Walleye	1	--	1	Tr.
Bullhead	2	2	4	1%
Carp	18	--	18	6%
Suckers	--	--	--	
	308	26	334	

Species Sought	Upper Wapsie	Middle Wapsie	Totals	
Anything	70	253	323	56%
Channel Cat	6	161	167	29%
Bluegill	--	2	2	Tr.
Crappie	5	16	21	3%
Black Bass	5	23	28	5%
Northern Pike	--	---	---	
Walleye	--	---	---	
Bullhead	24	5	29	5%
Carp	1	10	11	2%
Suckers	--	---	---	
	111	470	581	

Tr. - Less than 1%

Table 3. Angler Type of Sample of Northeast Iowa River Fishermen:

River	Boat Fisherman	Bank Fisherman	Totals
Upper Maquoketa	125	183	308
Middle Maquoketa	0	26	26
Upper Wapsie	7	104	111
Middle Wapsie	61	409	470
	193	712	915

Table 4. Angling Success and Effort on Wapsipinicon and Maquoketa Rivers:

Species	Catch in Numbers: Up. Maq.	Mid. Maq.	River Total	Up. Wapsi.	Mid. Wapsi.	River Total	Totals	Area: Percent of Catch
Walleye	1	-	1	-	-	-	1	Tr.
Crappie	68	-	68	1	37	38	106	10
Bluegill	163	-	163	6	50	56	249	25
L.M.Bass	12	-	12	4	10	14	26	3
S.M.Bass	-	-	-	-	6	6	6	Tr.
White Bass	11	-	11	-	-	-	11	1
Channel Cat	49	1	50	3	144	147	197	19
Bullhead	14	46	60	214	86	300	360	36
Northern	-	-	-	-	3	4	4	Tr.
Carp	4	1	5	1	26	27	32	3
Suckers	4	-	4	1	13	14	18	2
Brown Trout	2	-	2	-	-	-	2	Tr.
	328	48	376	231	375	606	982	-
No. Success Anglers*	123	15	138	41	153	194	332	
No. Unsuccess Anglers*	133	6	139	36	224	260	399	
No. Success Hours*	434.0	41.5	475.5	98.5	447.2	545.7	1021	
No. Unsuccess Hours*	262.0	6.0	288.0	50.5	351.2	401.7	690	
Fish/Success Hours*	.76	1.16	.79	2.35	.84	1.11	.96	
Fish/Angler Hours*	.47	1.01	.49	1.55	.47	.64	.57	

* Of the 915 Anglers Interviewed, 184 Had Fished Less Than 1/2 Hour and Were Not Counted In These Catergories.

Table 5. Inland River Fisheries Evaluation - Northeast Iowa Rivers, 1959:

River	Number Anglers Contacted	Average Trips To River	Average Miles Traveled to Fish 1/	Average Travel Expense Per Year 2/	Average Cost of Gear Per Year 3/	Average Miscell. Cost Per Year 4/	Average Annual Expense
Upper Maquoketa	308	41	54	$76.23	$17.52	$22.50	$116.25
Middle Maquoketa	26	62	11	23.31	5.34	33.00	61.65
Totals	334	42	48	$72.13	$16.58	$23.00	$111.71
Upper Wapsie	111	23	43	$33.92	$ 4.83	$13.50	$ 52.25
Middle Wapsie	470	49	24	40.67	9.40	26.50	76.57
Totals	581	44	25	$39.41	$ 8.45	$24.00	$ 71.86
Area Totals	915	43	34	$51.28	$11.42	$23.50	$ 86.20

1/. Round Trip
2/. Based on $3\frac{1}{2}$ ¢/mile (AAA Operation Cost only.)
3/. Based on a Five-Year Depreciation Schedule on Estimated Replacement Value.
4/. Based on Trips/Year X 50¢ (bait), Plus Fishing License at $2.00.

NOTES ON THE GROWTH OF BULLHEADS

by
Tom Moen
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Creel census data for the natural lakes of northwestern Iowa during the past fourteen years consistently show that the black bullhead comprises 50 to 60 per-cent of the catch even where management efforts were directed primarily toward game fish species. Bullheads are, of course, the most numerous species in the lakes subjected to periodic winter oxygen depletion. In addition, all the natural lakes of Iowa are subject to occassional development of large year classes of bullheads, regardless of the efforts at management or the type of lake.

When large year classes appear, the problems of fish management increase. Slow growth and stunting of the bullheads are accompanied by noticeable changes in habitat and in the general welfare of other species. At this point they are little different than carp, except that if they are of fair size they are more acceptable than carp as a hook and line species. If the growth is decidedly slow, management measures are often taken to increase the growth rate, bringing the fish to a more desirable size and to improve habitat conditions for other species. It is the purpose of this paper to present data on the growth of bullheads under various conditions in several lakes of northwest Iowa.

Lost Island Lake

The successful bullhead fishing at Lost Island Lake is widely known. During the past 15 years this lake had two dominant year classes. The 1941 year class was discussed in a paper by Rose and Moen (1951) wherein they presented data showing that during the five year period of 1941-45 the average bullhead of that year class attained a length of 6.0 inches and a weight of 0.15 pound. There was no growth in these fish from 1944 to 1945. This represents an average of 1.2 inches per year in length and 0.03 pound in weight. During the next three year period, 1946 through 1949, in spite of their small size, fishermen removed 63.5 pounds per acre per year. In addition to this, an accellerated rough fish removal program removed an average of 53 pounds of carp per acre per year. During this period the bullheads grew an average of 0.8 inches per year and 0.05 pound. A few of these fish were collected in 1950 and they averaged 10.4 inches and .63 pound.

In order to test the growth rate under other growing conditions a group of these fish were stocked in a one acre pond. On June 17, 1947, 81 bullheads of this year class were marked and stocked in this pond. Three and one-half months later the pond was drained and the fish removed. The average weight of the bullheads had increased from 0.22 to 0.56 pound. The pond contained 484 pounds of fish at the time the bullheads were recovered.

Another dominant year class hatched in 1954. These fish showed signs of slow growth late in their third summer of growth (6.1 inches) but not as slow as the 1941 year class. Due to the small size of the fish, the fishing pressure was light during 1956. In the latter part of the 1956 season the fish management section removed 50 pounds of bullheads per acre. The size increases somewhat

during 1957 and the fishermen removed 85 pounds per acre from this year class. From August 31, 1956 to September 9, 1957 the average bullhead grew 1.2 inches in length. During 1958 fishing season fishermen removed 165 pounds per acre and the fish management section removed 50 pounds of carp per acre. From September 9, 1957 to September 8, 1958 the average bullhead gained 0.9 inch in length and 0.07 pound in weight. During 1959 fishermen removed approximately 300 pounds of bullheads per acre and the fish management crews removed 16 pounds per acre, in addition to approximately 75 pounds of carp per acre. From September 8, 1958 to September 23, 1959 the average bullhead grew only 0.2 inch; no weight increase was discernable. Thus over a three year period of heavy exploitation by hook and line, plus removal of competing species, these bullheads grew only 2.2 inches and did not quite double their weight.

It is also interesting to not that the average number of bullheads per five minute trawl haul dropped from 140 in October 1957 to 72 in September 1959. There is no evidence of recruitment to this year class. The influence of receding water levels during the past three years is difficult to evaluate.

East Okoboji Lake

A severe freeze-out occurred in East Okoboji Lake during the winter of 1955-56. Bullheads were the principle survivors. They took advantage of the situation and brought off a hatch that has completely dominated the fish population since that time. By September 18, 1958, after three year of growth they averaged only 5.4 inches in length and ran 14 to the pound. On this date the average five minute trawl haul collected 850 bullheads.

During the 1959 season a serious attempt was made to reduce the population of bullheads in order to increase the growth rate. As of September 1, 1959, 512 pounds of bullheads per acre had been removed by seine, along with 112 pounds of carp per acre. On September 21, 1959 the average trawl haul collected 422 bullheads in five minutes. On this date the average bullhead measured 7.2 inches in length and weighed 0.19 pound (5 to the pound), a gain of 1.8 inches in length and 300 per-cent improvement in weight.

Silver Lake (Dickinson Co.)

On July 27, 1958, Silver Lake was treated with copper sufate to control blue-green algae. This treatment lead to a severe oxygen depletion, following decomposition of the algae, and an estimated 60 per-cent of the total poundage of fish, mostly bullheads, suffocated. Bullheads were the dominant species due to a severe freeze-out during the winter of 1955-56. Following the freeze-out and prior to the summer kill the growth rates were excellent, bullheads reached 5.0 inches in less than two summers of growth. At the time of the summer kill the yearling bullheads were 5.2 inches long and weighed 0.09 pound; about one year later (August 12, 1959) these fish averaged 7.9 inches and 0.27 pound.

On June 18, 1959, 9,765 bullheads from East Okoboji Lake were finclipped and stocked in Silver Lake. On that date these bullheads averaged 5.7 inches in length (range 4.9 to 6.3) and weighed 0.08 pound (range .05 to .12). A sample of 123 collected on August 12th averaged 7.3 inches (range 5.2 to 8.8) and 0.19 pound (range 0.09 to .32). Thus these marked bullheads grew as much in two months as those in East Okoboji did in one year. On September 22nd a sample of three marked fish from Silver Lake averaged 7.6 inches in length and 0.25 pound in weight.

Discussion

The above data indicate that bullheads have the capacity to grow to a desirable size in much less time than the usual conditions permit. Dominant year classes are particularly subject to stunting or at best a slow growth rate. Management pointed toward maintaining satisfactory growth is costly, especially where seining is necessary, because of the pounds per acre that has to be removed before growth is appreciably effected. More effective means of controlling large year classes of bullheads should be considered in order to prevent that year class from dominating the entire fish habitat of a lake during the subsequent two to five years. The judicious use of chemicals to control newly hatched fry and/or small fingerling should be considered. The application of chemicals should be considered following periods of freeze-outs or other phenomena that drastictly reduce the parent population; the resulting hatch of young fish are more vulnerable to control methods than a high population of adult or sub-adults. The removal of adult bullheads by any mechanical means can lead only to better growth rates.

Literature Cited

Rose, E. T. and Tom Moen- 1951 - Results of Increased Fish Harvest in Lost Island Lake. Trans. Am. Fish. Soc., Vol. 80 (1950), pp.50-55.

A BRIEF ELECTRO-SURVEY OF THE IOWA WATERS OF THE MISSOURI RIVER

by
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The first phase of an intensive investigation of the fish populations of the Missouri River in Iowa was initiated in October 1958. The ultimate goal of this investigational work is to accumulate a backlog of basic information concerning fish populations including species present, distribution, abundance, and rate of growth. Routine habitat and water chemistry studies will be correlated with this project.

Although a wide variety of gear such as trammel nets, hoop nets, gill nets, seines, and trawls will be used in this study, this report includes only the results of the initial survey in which an electric shocking device was used as the fish collecting gear.

The electrical current was provided by a Home-lite Model 8HY portable generator. This generator is designed to operate 180 cycle, 230 volt, 3-phase, AC tools and/or 110 volt DC equipment. Total load limit of this generator is 3000 watts. AC current, only, was being used to shock fish. Two "broom" type electrodes each consisting of nine strands of number twelve copper wire are used to conduct the electrical current into the water. The shocking device is mounted on a fifteen foot, Model Hull, Arkansas Traveler boat powered by a ten horsepower outboard motor.

In this project, all stunned fish, regardless of species or size were picked up in dip nets and identified. Total lengths and weights were obtained and recorded from all game species collected. Scales were taken from each game fish species on a representative basis so as to completely cover the total length range.

A total of 1984 fish were collected in 27 and 1/2 hours of actual shocking time. Fish were collected at a rate of 72 fish per shocking hour. Some difficulty was encountered in collecting fish in channel areas of the river due to the swift (6 to 7 mile/hour) current encountered in the river channel. Consequently the species range is not as wide as might have been expected in this study. Other fish collecting devices will be employed in the channel areas during future work of this type.

As shown in Table 1, 28 species of fish representing twelve families were collected in this study.

Secchi Disk readings ranged from a low of 6.5 inches to a high of 15 inches. The average diskreading for the river was 7.2 inches. The higher readings indicating less turbidity were found behind pilings and in the "cut-off" lakes.

Preliminary examinations of the distribution of species, as recorded in this study, shows a marked difference in the qualitative fish populations in the river below Council Bluffs - Omaha, and the reach north to Sioux City. The river below Council Bluffs - Omaha has been stabilized by the Army Corps of Engineers, since the late 1930's while above is now being straightened and stabilized.

Table 1. Species, Number Collected, and Relative Abundance of Fish Collected in Electro-Survey of The Missouri River:

Species	No.	Collected Abundance
Short Nose Gar	2	Common
Long Nose Gar	1	Rare
Gizzard Shad-*1	80	Abundant
Goldeye	14	Common
Blue Sucker	4	Rare
BigMouth Buffalo	33	Common
SmallMouth Buffalo	29	Common
Plains Carp-sucker	3	Rare
River Carp-sucker	291	Abundant
Northern Redhorse	9	Rare
Carp	835	Abundant
Silvery Minnow	1	Rare
Black Bullhead	1	Rare
Channel Catfish	26	Common
Flathead Catfish	44	Common
American Eel	1	Rare
White Bass	1	Rare
LargeMouth Bass-*2	151	Common
Green Sunfish	49	Common
Bluegill	36	Common
Orange Spotted Sunfish	5	Rare
White Crappie-*3	105	Common
Black Crappie-*4	44	Common
Walleye	13	Rare
Sauger	134	Common
Yellow Perch	11	Rare
Fresh-water Drum	60	Common
Burbot	1	Rare

-*1 --- Adult Only
-*2,3,and 4 ---- Above Council Bluffs Only

RESULT OF ONE AERIAL RECREATIONAL SURVEY OF THE MISSOURI RIVER IN IOWA

by
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On Sunday, September 13, 1959 an aerial flight was made by Iowa Conservation Commission personnel down the Missouri River from Sioux City to the Iowa-Missouri boundary. The purpose was to derive some numerical counts of the people utilizing the river for recreation on a typical week-end. The trip lasted from 10:00 a.m. until 2:45 p.m. and covered approximately 300 miles of river. The flight was made at an altitude low enough for the observer to readily ascertain whether the individual boater was fishing, pleasure boating, or working(usually building duck or goose blinds).

The observer recorded the number of fishing boats, the number of occupants in each fishing boat, the number of bank fishermen, the number of pleasure boats, and the occupants in each pleasure boat. Both the Iowa and Nebraska banks were observed for bank fishermen, these figures were separated in the final tabulation.

Total Number of Fishermen and Boaters Counted During One Aerial Survey of the Missouri River:

Total Bank Fishermen (Iowa)	85
Total Bank Fishermen (Nebraska)	43
GRAND TOTAL BANK FISHERMEN	128
Total Boatloads of Fishermen	53
Number of Boat Fishermen	94
GRAND TOTAL ALL FISHERMEN	222
Total Pleasure Boats	103
Total Occupants of Pleasure Boats	311
Other Boats (Working on Blinds)	29
Sail Boats	1
Commercial Boats	3
GRAND TOTAL MISCELLANEOUS BOATS	33
GRAND TOTAL ALL BOATS	189
GRAND TOTAL ALL PEOPLE COUNTED	544
GRAND TOTAL ALL PEOPLE (Include those occupant of Miscellaneous boats)	650

NOTES ON THE 1959 ARTIFICIAL LAKES AND RESERVOIR FISHERIES SURVEY

by
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An inventory of fish reproduction and adult populations is conducted annually on most of the artificial impoundments in Southern Iowa. This survey is a basic step in most fisheries management programs. Although sampling is limited and suited only for gross analysis, it is the best method to determine specific remedial needs; such as predator stocking, and hints at the kind and scope of problems needing more detailed study.

The methodsand equipment utilized in this inventory have been essentially the same for the past five years. Electro-fishing, with a "boom-shocker", is employed as the principal tool for sampling. If additional data is desired from a specific area, pound nets or drag seines are also used. The mechanical feature of the survey has been discussed at length in previous reports and is not included in this report (See Quarterly Biology Reports, October 1955, 1956, 1957).

As an addendum to the fisheries inventory, a study of physical and chemical properties of the water is also conducted on each impoundment. In 1959, tests for the presence of thermal or chemical stratification were completed on 35 lakes. Total alkalinity and PH determinations were also obtained.

The artificial lakes in Southern Iowa have been constructed for two basic purposes: recreation; and/or water supply. Lakes that have been constructed by the State Conservation Commission are primarily recreational areas. In a few instances, contracts between municipalities and the state were negotiated for multiple water use. Fishing in the city-owned reservoirs in this region is considered a by-product of the basic water use. However, the city water reservoir system is extremely valuable to the angler, serving to greatly reduce the distance the sportsman must travel to fish.

An important phase in the fisheries management program for southern Iowa impoundments is a classification system which allows a grouping of lakes into discrete management units. It is impossible for each lake to receive detailed biological investigation for individual management. Through a classification system management policies can be formulated from gross investigations.

The artificial lakes in Southern Iowa can be divided into four basic groups. These groups are based on primary differences in physical and chemical characteristics. Fish population structures are employed only as a secondary criteria if an impoundment approaches the borderlines between two different groups. Although the fish population structure is considered important in classification, routine investigations indicate that the populations are more characteristic of the physical and chemical properties of the impoundment than the physical and chemical characteristics are of the fish population.

Group 1.

This group includes most of the state-owned artificial lakes and several municipal water supply reservoirs. The lakes are characterized by wooded shorelines, deep basins, and steep sloping bottom contours. All lakes in this group exhibit varying degrees of thermal and chemical stratification. Fish populations in this group are relatively stable, and vary insignificantly from year to year depending on the development of strong year classes. Lakes in this group include: Geode, Lacey-Keosauqua, Wapello, Red Haw Hill, Keomah, Ahquabi, Nine Eagles, MacBride, Thayer, Springbrook, Viking, Ellis, Williamson, Cold Springs, and Dale Moffett Reservoir.

Two of these lakes, Thayer and Williamson Pond, are being artificially manipulated to adjust and are in various phases population development. Lake Keomah and Lake MacBride have recently been renovated by chemical treatment or drainage and have not developed stable populations.

Reproduction during 1959 was considered above the five year average (Table 1). Largemouth bass and bluegill reproduction were found in all lakes except those that had been recently renovated. Crappie reproduction was only fair. Game fish populations, especially largemouth bass, crappie, and bluegill are extremely high. Growth of all species was above the average for Southern Iowa waters.

Group 2.

This group of lakes is classified as having unwooded open shorelines, shallow basins, and gentle sloping bottom contours. Most of the lakes in this group do not stratify in the summer, but may have temporary oxygen depletions near the bottom. Lakes included in this group are: Darling, Green Valley, Allerton, Rock Creek, Three Fires, Lock Ayr, Morris, Diamond, Seymour, Fisher, Fairfield No. 2, and West Osceola.

Reproduction in 1959 was below average for this type of lake (Table 2). Although the frequency of occurrence of game fish reproduction was greater than in any previous survey. Management of these impoundment is much more diversified than in the Group 1 lakes: the deciding factor being habitat and/or ecological condition. Several lakes in this group are managed primarily for channel catfish and bullheads. Since natural reproduction is not sufficient to perpetuate these species, fingerlingsor adults must be stocked in the annual basis to maintain the fishery. Suitable largemouth bass, bluegill, and crappie fishing is available periodically in lakes with desirable habitat, but the success of these species is dependent upon the development of abundant year classes. Over-abundance and retarded growth is a common occurance in lakes in this group.

Group 3.

This group is comprised of municipal water supply reservoirs. Public fishing agreements are obtained from city officials before fisheries management is initiated in any reservoir. They are generally characterized by low fertility,

rapidly fluctuating water levels, and absence of vegatative growth. One primary characteristic is the periodic treatment with copper sulfate for the control of filter clogging algae in the water supply. A number of these lake stratify during the summer, dependening upon depth and protection from the wind. Lakes surveyed in 1959 belonging to this group include: Fairfield No. 1., Lower Albia, Upper Albia, Corydon, Mt. Ayr, Greenfield, McKinley, Afton, Humeston, Upper Centerville, and East Osceola Reservoirs.

Reproduction of game fish species was considerably below the five year average (Table 3.). At the same time, rough fish reproduction was the highest ever observed. Bluegills were the only species with any widespread success. Adult game fish populations vary considerably in abundance. Many of these lakes have management problems resulting from reproductive failure or over-abundance and stunting due to the development of a strong year class. However, due to human consumption of the water, management has to be confined to corrective stocking which is generally an impossible task. Fish growth also varies considerable between reservoirs. In areas of good habitat growth is satisfactory. Rough fish also cause ill-balanced populations more frequently in this group than in any other type of lake.

Group 4.

This group consists of the river oxbows and man-made river bottom impoundments. All these areas are relatively turbid, shallow, and slough type habitat. Lake Manawa and Lake Odessa are natural lakes: whereas, North and South Colyn lakes are artificial. Brown's Slough in Lucas county and Walnut Creek Slough in Ringgold County were not surveyed because of renovation projects and have not been stocked.

Reproduction of game fish was poor in 1959 (Table 4). Adult fish populations are relatively stable in this group. Rough fish populations are high in the natural lakes, and intensive mechanical or chemical control are continuous projects. In spite of this, gizzard shad and carp populations continued to increase. More widespread use of chemical control is imperative in the future if these species are to be controlled.

General Observations and Discussions:

In general reproduction of game-fish in Southern Iowa Artificial Lakes and impoundments was slightly below average; while reproduction of rough fish, gizzard shad and carp, was above average in 1959. Increased water volumes following the drought of 1956 and 1957 are thought to be partially responsible for this, in that the increased reproductive success in those years would now be producing the adult fish crops. Another factor for consideration is the increased turbidity of water in 1959 due to excessive spring rainfall. With increased turbidity electro-fishing success also increases. This factor may also be considered in the reduction of reproductive success.

The lakes in Group 1 have the most stable populations of the four groups described. Over-abundant year classes do exist, but they are usually not serious and of short duration. Group 2 lakes are more stable than the two remaining groups, but flucuate more rapidly in fish population structure than group 1. One species will dominate the population structure for a short period of time and will be replaced by a secondary year class or in many instances with another species. Basic productivity is highest in this group.

Problems of over population and low "predator fish" reproduction occur most frequently in group 3 lakes. Excessive copper sulfate treatment may be the primary factor in reproductive failure. Bottom and plankton samples taken in the treated lakes produce very few organisms. It is assumed that chemical treatment is the deterring factor in this low productivity. Small fish immediately out of the yolk sac stage of development are dependent upon these micro organisms for food. Without this source of food, production of fish life is limited. Another indication of low productivity of bottom organisms can be noted in bullhead populations. This species, primarily a bottom feeder is stocked in great numbers in most of the municipal reservoirs, despite this, bullheads are never found in the quanitity that they are in untreated lakes.

As stated before, the annual fisheries survey is not only useful to determine stocking needs, but is also a valuable tool in determining problems that are in need of further study. There is further need for basic knowledge of fish populations structure in all four groups of impoundments. This has already been initiated in the two special study lakes in Group 1. These projects have been of great value in gaining the basic fish population characteristic of this type of habitat. However, there is a distinct need for further studies of this nature in the other types of impoundments.

Table 1. Relative Abundance of Young-of-the-Year, Yearling, and Adult Fish Captured by Electro-Fishing and Netting in Group 1 Lakes, 1959:

Lake	Size (Acres)	L.M.Bass			Bluegill			Crappie			Bullhead			Catfish			Carp			Perch		
		yg	yr	ad	yg	yr	ad	yg	yr	ad	yg	yr	ad	yg	yr	ad	yg	yr	ad	yg	yr	ad
Geode	205	A	C	C	A	A	A	C	R	A	*	*	C	*	*	*	*	*	*	*	*	*
Keosauqua	30	C	C	R	A	A	A	*	*	R	*	*	R	*	*	R	*	*	*	*	*	*
Wapello	287	C	C	A	A	A	A	R	*	A	*	*	C	*	*	R	*	*	C	R	*	A
Red Haw	72	A	A	A	A	A	A	C	R	A	*	*	C	*	*	R	*	*	*	R	*	A
Keomah-1/	82	*	A	*	*	*	*	*	*	*	*	*	R	*	*	*	*	*	*	*	*	*
Ahquabi	150	A	A	C	A	A	A	C	C	A	*	*	R	*	*	*	*	*	*	*	*	A
Nine Eagles	56	A	A	C	A	A	A	*	*	*	*	*	A	*	*	C	*	*	*	*	*	*
MacBride-1/	990	A	R	A	*	*	R	*	*	*	*	*	A	*	*	*	*	*	R	*	*	*
Springbrook	30	A	C	R	A	A	A	*	*	R	*	*	*	*	*	*	*	*	*	*	*	R
Viking	150	C	R	A	A	R	R	*	*	A	*	*	A	*	*	*	*	*	*	*	*	*
Ellis	65	A	C	C	R	C	A	A	R	A	*	*	A	*	*	C	*	*	A	*	*	*
Thayer-1/	10	*	A	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Williamson	27	R	A	A	A	R	A	*	*	*	*	*	*	*	*	C	*	*	*	*	*	*
Dale Moffett	250	A	A	A	A	A	A	A	R	A	*	*	*	*	*	*	*	*	*	*	*	R
Cold Springs	10	R	A	A	R	A	A	*	*	C	*	*	*	*	*	*	*	*	C	*	*	*

-1/. Lakes have Been Renovated By Chemical Treatment or Drainage and Are In Various Phases of Fish Population Development.

A. Abundant C. Common R. Rare *. Not Captured in Surveys

Table 2. Relative Abundance of Young-of-the-Year, Yearling, and Adult Fish Captured By Electro-Fishing and Netting in Group 2 Lakes, 1959:

Lake	Size (Acres)	L.M.Bass yg yr ad	Bluegill yg yr ad	Crappie yg yr ad	Bullhead yg yr ad	Catfish yg yr ad	Carp yg yr ad	Y.Bass yg yr ad	Walleye yg yr ad
Darling	302	C A A	A A A	* * A	* * A	* * C	* * *	* * *	* * *
Green Valley	400	C C A	C C A	C R A	A * A	* * A	A * *	* * *	* R A
Rock Creek	640	A C A	A A A	* R A	* * A	* * A	* * *	* * *	* * *
Allerton-1/	150	C C A	R R A	R R R	* * A	* * *	* * A	* * *	* * *
Three Fires	150	* C C	* * A	R C A	* * R	* * C	A * A	* * *	* * *
Fairfield No.2	50	C C A	A A A	R * A	* * A	* * *	* * *	* * *	* * *
Lock Ayr	100	* C A	* * A	* * R	* * *	* * *	C * A	* C A	* * *
Fisher	75	* * A	* * A	* * A	* * *	* * *	* * A	* * A	* * *
Morris	102	* * A	* * A	* * A	* * *	* * *	* * A	* * *	* * *
Diamond	115	A A A	A A A	R R A	* * *	* * *	* * *	* * *	* * *
Seymour	65	C C A	C A A	A R C	* * C	* * *	* * R	* * *	* * *
West Osceola-1/	100	C A A	A A A	R C C	* * C	* * R	* * *	* * *	* * *

-1/. Lakes Have Recently Been Reconstructed To Increase Water Volume and Are Now Redeveloping Their Fish Populations.

Table 3. Relative Abundance of Young-of-the-Year, Yearling, and Adult Fish Captured By Electro-Fishing and Netting in Group 3 Lakes, 1959:

Lake	Size (Acres)	L.M.Bass yg yr ad	Bluegill yg yr ad	Crappie yg yr ad	Bullhead yg yr ad	Y.Bass yg yr ad	Carp yg yr ad	Perch yg yr ad
Fairfield No.1	75	* * C	A A A	* * R	* * A	* * *	* * *	* * *
Lower Albia	25	R * A	* C A	* * *	* * C	* * A	* * *	* * A
Upper Albia	35	* * C	* A A	* * *	* * *	* * A	* * C	* * *
Corydon	125	R C A	* * A	C C A	* * C	* * A	* * A	* * *
Mt. Ayr	15	* A A	A A A	* * *	* * C	* * A	* * *	* * *
Greenfield	50	R * C	A A A	* * C	* * *	* * *	* * *	* * *
McKinley	50	C A A	A C C	* R A	* * C	* * *	* R A	* * *
Afton	30	A A A	A C A	* * R	* * C	* * *	* * R	* * *
Humeston	75	R R A	C A A	* * A	* * A	* * C	* * *	* * *
Centerville	100	C C A	C A A	* C A	* * C	* * A	* * C	* * *
East Osceola	25	* R A	* A A	* * C	* * C	* * *	* * *	* * *

A. - Abundant C. - Common R. - Rare *. - Not Captured in Survey

Table 4. Relative Abundance of Young-of-the-Year, Yearling, and Adult Fish Captured By Electro-Fishing in Group 4 Lakes, 1959:

Lakes	Size (Acres)	L.M.Bass yg yr ad	Bluegill yg yr ad	Crappie yg yr ad	Bullhead yg yr ad	Catfish yg yr ad	Carp yg yr ad	G.Shad yg yr ad	Y.Bass yg yr ad
Odessa	2700	* * A	* * A	* * A	* * C	* R A	A R A	A A A	* * *
Manawa	957	* R C	R * A	* * A	* * C	* * R	* * A	C C A	C C A
North Colyn	199	A A A	C A A	* * *	* * A	* * *	* * R	* * *	* * *
South Colyn	100	A C A	R C C	* * *	* * A	* * *	* * *	* * *	* * *

A. - Abundant C. - Common R. - Rare *. -Not Captured in Survey