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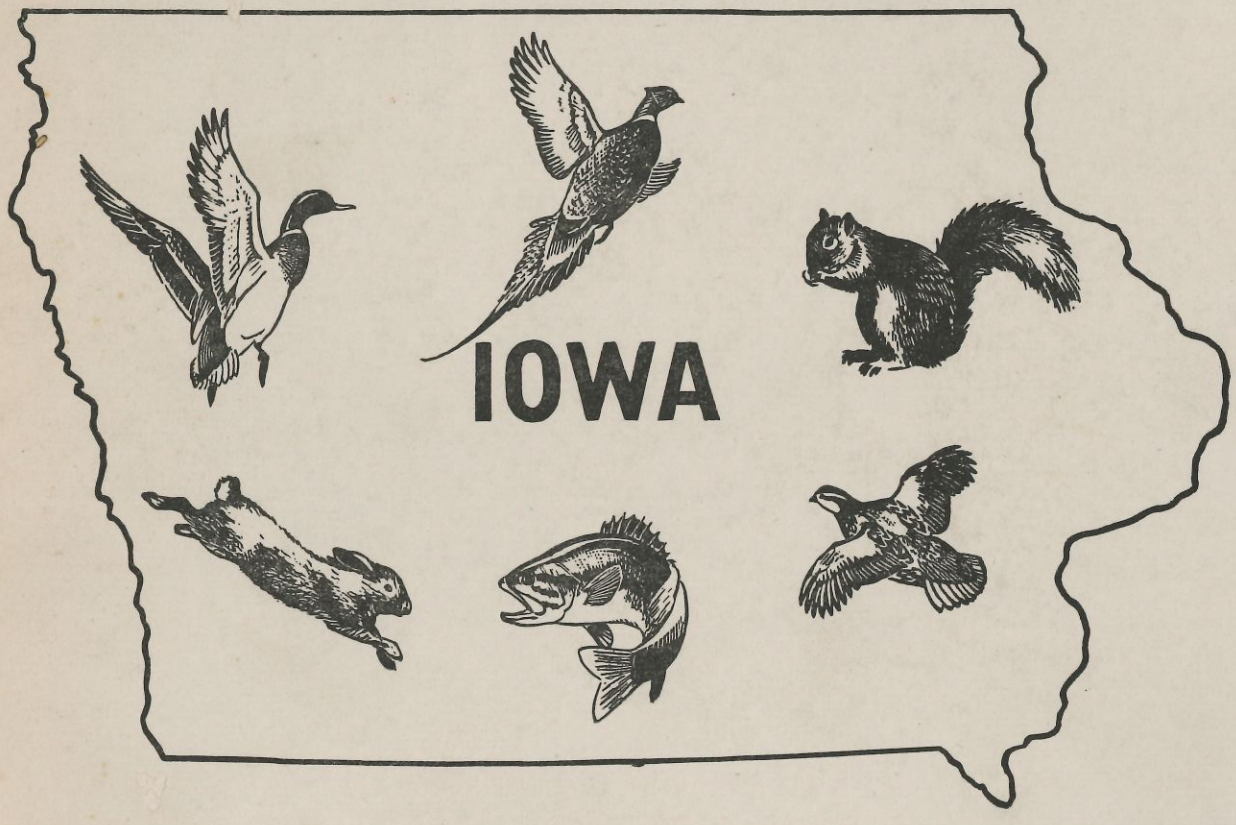

FISH AND GAME DIVISION — BIOLOGY SECTION

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

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Results of Year-round Quantitative Creel Census

of Spirit Lake

Earl Rose
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Introduction

Iowa has conducted censuses of angling on the important natural fishing lakes for many years. Heretofore, all have been of the so-called "spot" or incomplete type which are now generally regarded as inadequate to properly appraise a sport fishery. This report includes the results of the first year-round census on any lake in Iowa in which quantitative harvest data was obtained.

The methods involved in any quantitative creel census whereby data from a sample of completed angling trips are expanded to include the calculated total of all angling is necessarily complex and detailed. The type used at Spirit Lake was presented in detail in a previous Quarterly Biology Report (Rose, 1956) and need not be repeated here.

The census dates included in this report are for the 12 month period from February 15, 1956 to February 15, 1957. Essentially it involves the periods from May 1 to February 15, since little angling is done between the close of the season on major game species on February 15 until the opening on the closest Saturday preceeding the 15th of May.

The principle purposes of the quantitative census are to obtain estimates of total catch of each species in numbers and weights; total fishing pressure (number of anglers and hours of effort); data concerning productivity per acre and the average angler success in numbers and pounds of fish caught, per angling trip.

Size of Sample

In any census it is imperative that an adequate sample size be obtained to calculate a reasonable estimate of the entirety. Of course the greater the sample size the more valid the exploded data obtained. Table 1 contains the monthly summary of angler interviews and their expansions together with the interview percentages. It will be noted that early season percentages are considerably lower than in late season and winter. This was necessarily true due to later decrease in angling pressure.

It is believed that the sample size was ample to justify the expansions in anglers and their catches during the past year. Open water interviews averaged 10.6 percent with a low of 3.3 percent and a high of 25.3. During winter an average of 19.4 percent of the ice fishermen were interviewed.

Seasonal Catch Record

Included in Table 2 are the open water and winter catch record summaries for Spirit Lake from May 1, 1956 to February 15, 1957. Records of each species caught and their weights are compared numerically and in seasonal percentages.

The estimated total catch of 168,494 fish which weighed a total of 124,641 pounds represents a harvest of about 30 fish per acre and approximately 22 pounds per acre. 1/

Table 1. Monthly angler interviews, expanded total anglers and percentage interviewed.

Month	Angler Interviews	Calculated Total Anglers	Percent Interviewed
May (1956)	1028	12,908	7.9
June	918	27,540	3.3
July	2510	18,321	13.1
August	2051	13,726	15.0
September	1497	7,665	19.5
October	892	4,836	18.4
November	167	660	25.3
December	579	1,854	31.2
January (1957)	595	3,472	16.6
February	509	3,248	15.4
Totals	10,746	94,230	11.4 (av.)

A consideration of individual species harvested on a per acre basis may be of interest. The management of walleyes is heavily stressed at Spirit Lake. This year, walleyes were second only to the bullhead in total numbers caught and practically identical in pounds harvested. There were about six walleyes caught per acre or a production of a little more than eight pounds per acre. Yellow perch were next in importance with about six fish caught per acre and a poundage production of nearly 4 pounds per acre.

1/ Spirit Lake - 5684 acres.

As further indicated in Table 2, the open water angling accounted for nearly ninety percent of the total fish caught, while winter fishing produced only a little over ten percent. On the other hand, the variance in seasonal percentages of perch was slight (55.5 in summer and 44.5 in winter); however, less than ten percent of the total number of anglers fished in winter. Winter angling for walleyes and other predators was relatively unproductive during this past season. For example only 3.2 percent of the total walleyes were caught by winter anglers. This is important, if the season was typical, since it indicates the harvest is minimal during this period, having little effect on the standing crop.

Fishing Pressure and Angler Success

The fishing effort expended at Spirit Lake during the year is outlined in Table 3. Included are the number of fish and average angler success by method in terms of fish-per-angler and unit-effort. The calculated total of 94,000 anglers represents about seventeen fishing trips per acre and approximately fifty hours of angling per acre during the past year. Again, we have no back-log of data for comparison; however, the previously mentioned report by the Minnesota Department (loc. cit.) indicates only one of their walleye lakes exceeding Spirit in total fishing pressure.

Discussion

In this report of a year-round complete creel census, we now have some concept of the magnitude of angling that prevails in one of our popular fishing lakes. There are many inadequacies in the census techniques but refinements will eventually provide some compensatory devices to reduce these to a minimum. However, the data presented here is minimal and advancements will only provide a more complete coverage and increased size of the fishing pressure. Next year, it is planned to eliminate much of the drudgery of the biological bookkeeping by utilizing an electronic computor to process the field data.

Literature Cited

Johnson, Merle W. and Jerome H. Kuehn

1956. Annual report of the statewide creel census of 14 Minnesota Lakes. Investigational Report No. 174. (Mimeographed).

Rose. Earl T.

1956. The quantitative creel census methods at Spirit Lake. Quarterly Biology Reports, Vol. VIII, No. 2.

Table 2. Angler harvest of fish from open water and winter (ice) from May, 1956 to February 15, 1957.

Species	Open Water Harvest Number	Pounds	Winter Harvest Number	Pounds	Total Number	Total Weight	Percent from Open Water	Percent from Ice Fishing
Crappie	5,926	3,386	667	433	6,593	3,819	89.9	10.1
Perch	17,783	10,052	14,254	8,543	32,037	18,595	55.5	44.5
Walleye	31,215	43,399	2,060	3,641	33,275	47,040	96.8	3.2
Bullhead	91,097	47,721	0	0	91,007	47,721	100.0	0.0
L. M. Bass	609	920	7	35	616	955	98.7	1.3
N. Pike	609	1,829	66	591	675	2,420	90.1	9.9
S. M. Bass	51	68	9	27	60	95	85.0	15.0
White Bass	1,524	1,517	18	27	1,542	1,544	98.8	1.2
Sheepshead	2,192	2,083	0	0	2,192	2,083	100.0	0.0
Bluegill	345	133	0	0	345	133	100.0	0.0
Carp	62	235	0	0	62	235	100.0	0.0
Catch and Weight	151,413	111,413	17,081	13,297	168,494	124,640	88.8	11.2

Table 3. Number of anglers, hours of effort, and average success. On Spirit Lake from May 1956 to February 15, 1957.

	Boat Anglers	Shore Anglers	Ice Anglers	Totals
Number	50,501	35,155	8,574	94,230
Hours Effort	179,514	75,483	29,390	284,387
No. Fish by Method	103,216	48,197	17,081	168,494
Av. Fish per Angler	2.0	1.4	2.0	1.8
Av. Fish per Hour	0.58	0.64	0.58	0.59

NOTES ON THE SIZE OF WALLEYE EGGS FROM IOWA LAKES

Tom Moen
Fisheries Biologist

The determination of egg size and number of eggs taken has been a routine part of walleye hatchery investigations during the past decade. Results of these determinations have been recorded in yearly reports, listing the number of quarts of eggs handled, number of eggs per liquid quart of both eyed and green eggs, and the total number of eggs.

The average number of eggs per quart forms the basic figure for calculating production and for estimating fry to fulfill stocking requirements. Considerable variation has been noted in these figures, both among individual samples and among the averages reported for each year. Naturally there were several questions to be answered in regard to these differences. This paper represents a preliminary attempt to explain some of these deviations.

Collecting Egg Samples

One to three samples of each day's take of eggs were checked for fertility and size of egg (number per quart). An individual sample was secured by inserting a glass tube, with the index finger over the upper end, to about midpoint in the jar of eggs, releasing the finger long enough to allow 4 or 5 c.c. of eggs to enter the tube. This was repeated in several jars, the number increasing in proportion to the number of jars on the battery bearing that particular date. Egg size was determined by finding the average diameter in tenths of inches of the eggs in each sample. This was accomplished by averaging a series of counts of the number of eggs needed to span the edge of a three-inch glass slide. The number of eggs per liquid quart was then determined by the use of Von Bayer's table for finding the number of fish eggs of a given diameter per liquid quart.

Egg size versus fish size: Casual observations seemed to indicate that walleye eggs varied in size with the size of the fish, larger fish having larger eggs. In order to check this hypothesis it was necessary to determine the size of the eggs from fish of known weights. Eggs from thirty-eight females were used in this experiment. Eggs from each fish were collected and hardened (unfertilized) at least 12 hours. Each group of eggs was then checked three times to obtain an average egg size for that particular fish.

Usually the eggs from a single fish were of uniform size, showing relatively little variation. Seven females, 18 per cent of the total, produced eggs of uneven size. Of these seven, only three (7 percent) contained eggs that produced a different number of eggs per quart on each of the three determinations and these were small variations of less than 5,000 eggs.

There was considerable range in the number of eggs per quart among fish of the same size. For example, four walleyes, each weighing 2.5 pounds produced eggs ranging from 143,000 per quart to 190,000

per quart. Nevertheless some correlation was obtained by comparing the means of the number of eggs per quart for these fish grouped by one pound weight classes (Table 1). An even better view of the general trend of increasing egg size with increasing weight of the fish is shown by fitting a straight line to the means plotted on a graph (Figure 1).

Therefore the average number of eggs per quart as listed for the season may be helpful in determining the average size of the female walleyes used in the hatchery for any particular day or for the season, and possibly from one season to another.

Eggs from Spirit Lake walleyes have averaged 149,000 per quart over the past eleven years with a range of 139,000 to 161,000. Based on these averages we might say that the average walleye taken from Spirit Lake for spawning taking purposes during that eleven year span ran from four to six pounds. From personal observations this at least appears reasonable, but when we try to apply these observations to the Clear Lake data, a completely unreasonable size is obtained. The Clear Lake walleye eggs have averaged 134,000 per quart over the last 5 years of hatching (10 year period due to alternate hatching years) with a range of 131,000 to 142,000. This would place the average female walleye from Clear Lake at more than eight pounds. There are no current average weights of hatchery fish available with which comparisons can be made. Apparently such an index can not be used from one lake to another.

Fertile versus infertile eggs: During the routine procedure of determining egg size no effort was made to separate infertile from fertile eggs. In most of these determinations the general observations indicated that the infertile eggs appeared to be smaller in size than the fertile eggs. If this were true there would be an explanation for the fact that eyed eggs were usually larger, i.e. fewer per quart than the green eggs. 1/

Determinations of the size of fertile and infertile eggs were completed on eleven samples. Seven samples contained infertile eggs that were 5 to 10 thousand eggs per quart smaller than the fertile eggs of the same sample. Results of two samples indicated that the fertile eggs were even smaller than the infertile eggs, and two samples indicated no difference. In each sample the standard count did not show any correlation with either of the other two counts, apparently depending almost entirely on chance inclusion of exclusion of infertile eggs.

An examination of the variation of size between green and eyed eggs over the past ten years indicates that these differences range from zero to 10,000 per quart with no relationship between the percentage of hatch and these differences. Whether or not we use one or the other of these figures is more academic than practical as far as the Spirit Lake hatchery is concerned where the maximum difference would seldom amount to more than three million eggs for one season.

1/ In Iowa hatchery procedure the infertile eggs are siphoned off leaving nearly 100 per cent fertile eggs at the eyed stage.

Table 1. The number of eggs per liquid quart as determined from thirty-eight female walleyes placed in eight weight classes.

Weight Class	Number of fish	Average Weight	Number of eggs per quart (thousands) average	range
0.6-1.5	2	1.45	175	154 - 197
1.6-2.5	10	2.33	171	143 - 190
2.6-3.5	7	3.04	167	154 - 181
3.6-4.5	6	4.04	151	142 - 160
4.6-5.5	3	4.93	155	149 - 160
5.6-6.5	3	5.86	156	148 - 173
6.6-7.5	4	7.17	144	118 - 160
7.6-8.5	3	8.23	144	137 - 154

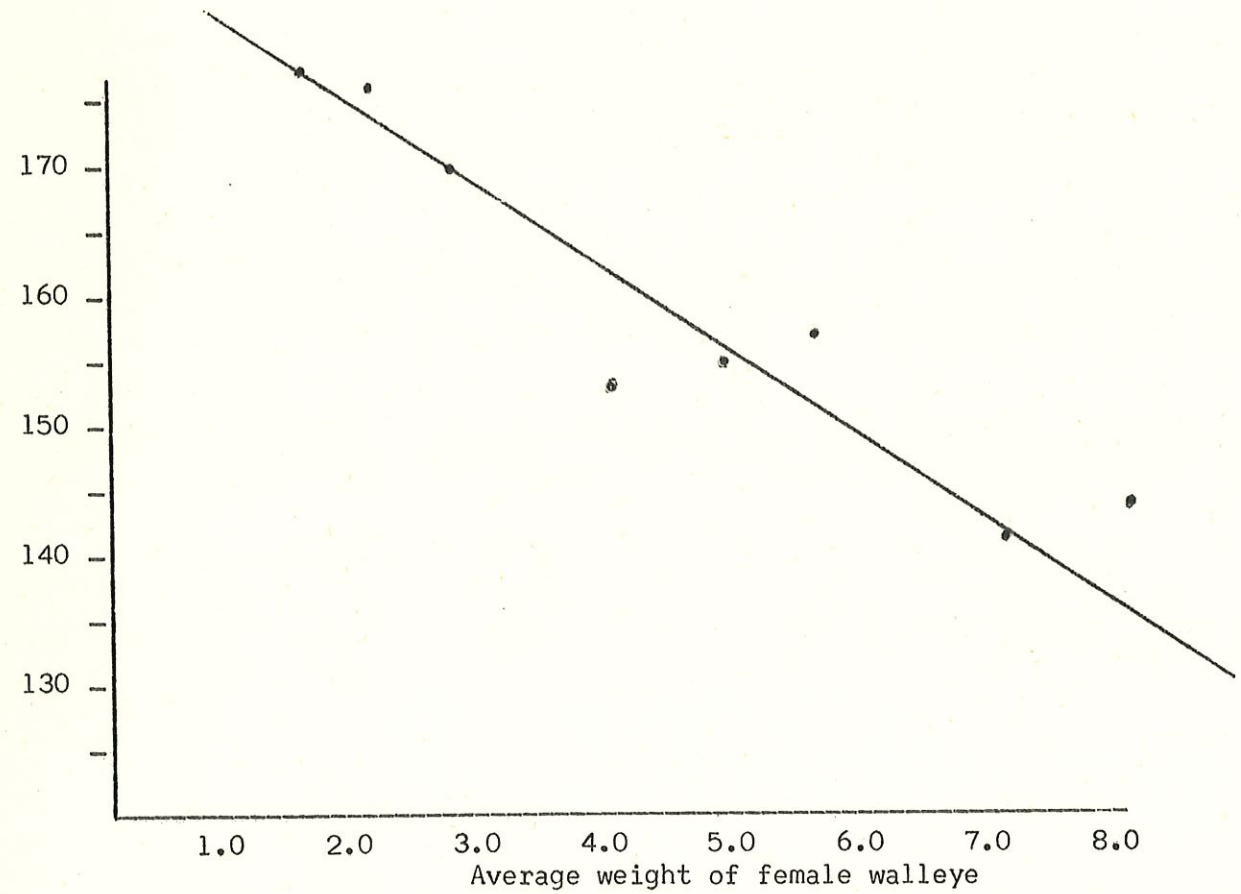

Figure 1. Graphical representation of data in table 1 showing regression of egg size with an increase in size of the female walleye.

Statistical analysis: In evaluating these egg counts it is easy to visualize the fact that perhaps the difference between eyed and green eggs for any one year may not be statistically significant. There are several statistical methods of approaching this problem. One of these involves solving (t) in the following formula:

$$t = \frac{x - y\sqrt{n}}{\sqrt{N_x \Delta_x^2 + N_y \Delta_y^2}} \quad \sqrt{\frac{N_x N_y}{N_x N_y}}$$

Where: X is the mean of one sample and Y of the other

N_x is the number in one sample and N_y the number in the other.

S_X^2 is the standard deviation squared of one sample and

S_Y^2 of the other

n equal N plus N -2

During the 1949 season, an average year for egg variation, the means of the counts of green and eyed eggs differed by 6,512. If we apply the determinations for that season to the above formula we find that t is equal to 1.159 and therefore not significant. Thus in spite of the fact that most of the infertile eggs, presumably smaller eggs were the two populations remained essentially the same.

EFFECTIVENESS OF VARIOUS KINDS OF BAIT FOR CATCHING CHANNEL CATFISH AND CARP IN THE DES MOINES RIVER

Harry M. Harrison
Fisheries Biologist

Of the many questions to cross the fisherman's mind the one concerning which is the best bait to use ranks well toward the top of those most often asked. An answer, if there is one, is most difficult, and becomes especially involved if one is to consider more than a few of the many and complex ramifications of the problem. Such things as habitat differences; the little understood ability of a fish or species to select food (which might be bait) to supply its nutritional requirements; or the seasonal variations in both the supply of and demand for a particular item of food make "best bait" questions difficult for the fisheries biologists. Since, however, the subject of bait is so important, any information, even though it falls short in answering the whole question, is believed worthwhile.

A part of the creel census conducted on the Des Moines River since 1953 concerned the relative merits and success of various baits for taking fish. In this phase of the work, fishermen were interviewed with respect to the kind of bait they were using, the length of time the bait was utilized, and the kind and number of fish caught. From this information, it was possible, to determine the rate of catch by species for each kind of bait and, further, to determine the percentage of successful fishermen using each of the various baits.

The findings of the study are tabulated in Table 1, for the channel catfish and in Table 2 for the carp. Channel catfish and carp are the only species caught in the Des Moines River in numbers large enough to supply meaningful data.

In addition to the success of the individual baits, the success achieved by fishermen employing more than one kind of bait on a fishing trip also was studied. In the Tables just mentioned, where more than one form of bait was used by an angler, these are grouped as "combination" as opposed to "single", in cases where only one type of bait was employed. In otherwords, "combination" implies that the contacts were using two or more kinds of bait at the time of interview, whereas, "single" indicates that only one sort of bait was in use.

In evaluating the information contained in Tables 1 and 2 attention is directed to several points of possible or probable bias. Prominent in the list of bias is the human element. Because each and every fisherman is an individual capable of planning or reasoning differently from any other, the values of averages are questionable. For example, when evaluating bait used to catch channel catfish, cert in of these such as blood, frogs, minnows or carp guts, are more apt to be used by an expert catfisherman than by the average or novice angler. This would have a definite tendency to increase the average effectiveness of these baits. At the other extreme, the novice would probably use the easily procured commercial cheese bait or worms which would tend to supress the calculated effectiveness of these items of averages were to be the criterion of measure.

In the instance of the channel catfish, the problem of the "human element" is believed, by the author, to be very significant in the case of single versus a combination of baits. The data show the rate of catch to be considerably higher for anglers using single baits. A greater number of successful fishermen also favor single bait as compared to combinations. This conclusion is in direct opposition to the "accepted methods" of success for catfishing. Many years of catfishing experience by the writer and a decade of studying the success and techniques employed by good catfishermen indicate without question, that it is much better to fish for the channel catfish with a variety of baits than with one kind. A partial explanation for this variance may be found in the fact that many adroit catfishermen know that at certain times of the year blood, grasshoppers, cheese or frogs are particularly effective and uses only the one bait on those trips. A second explanation may be that cheese and blood bait fishermen catch large numbers of small fish (8-10 inches long) which increases the "numerical" effectiveness of the bait. A third reason may lie in the premise that the novice makes up for his lack of "knowhow" by using a multitude of different baits and is usually found fishing in a way and in places where it would almost be impossible to hook a fish. Hence, the value of the combinations of bait is depressed.

Another consideration regarding the effectiveness and desirability of one bait over another has to do with the size of fish which are caught with it. Cheese, worms and blood take all sizes of catfish, and because of this, their effectiveness would be much increased by the catch of small fish which are much more numerous in the population than are the large individuals. Frogs, crayfish and minnows, on the other hand, take only larger fish which would decrease their rate of catch by virtue of the fact that there are smaller numbers of large fish to be caught. In connection with this, a point of interest is that both frogs and minnows demonstrated a good rate of catch in this study. This should rank them high as good catfish baits. Not only because they caught catfish at a relatively rapid rate, but by the nature of the baits, the fish caught would have to be of rather large size.

With regard to the various baits used for catching channel catfish, the most significant finding of the study is the fact that although certain baits may tend to catch more catfish than others, there is probably not any one bait superior to all others. Furthermore, minnows, worms, cheese, chicken and carp guts and frogs long regarded as good catfish baits, have relatively equal success quotients. In analyzing the baits used in carp fishing, Table 2 shows that doughball to be the most popular but least effective. Doughball on the basis of 700 hours of fishing time, took carp at an average rate of one fish for every two rod hours. Considering the vast population of carp inhabitating the Des Moines River, it would seem that this rate of catch was rather slow.

Bread, corn, and worms all caught carp at a more rapid rate than did doughball, but none of these were used extensively.

Table 1. Rate of catch and percentage of successful fishermen angling for channel catfish with various kinds of bait in the Des Moines River, Iowa.

Number of Fishermen	792
Total hours fished	2049
Number catfish caught	821

Bait	No. users	Hours bait used	Fish caught	Fish caught per hr.	Number successful fishermen	Number unsuccessful fishermen	Percent successful	Percent unsuccessful fishermen
Combination	270	874	255	.30	103	167	40%	60%
Single	518	1174	576	.50	240	278	46%	54%
Minnows	78	184	129	.70	46	32	60%	40%
Worms	86	189	78	.42	33	53	38%	62%
Cheese bait	138	315	183	.58	64	74	46%	54%
Shrimp	57	81	29	.36	15	42	26%	74%
Chicken guts	30	50	25	.50	15	15	50%	50%
Melt	9	19	2	.10	2	7	22%	78%
Blood	16	33	25	.76	10	6	62%	38%
Crayfish	7	54	4	.07	3	4	43%	57%
Liver	7	18	8	.44	6	1	85%	15%
Carp guts	28	65	27	.41	14	14	50%	50%
Cutbait	42	133	52	.39	24	18	57%	43%
Frogs	9	25	12	.50	7	2	77%	23%

Table 2. Rate of catch and percentage of successful fishermen angling for carp with various kinds of bait in the Des Moines River, Iowa.

Number of fishermen	298
Total hours fished	829
Number carp caught	447

Bait	No. users	Hours bait used	Fish Caught	Fish caught per hr.	Number successful fishermen	Number unsuccessful fishermen	Per cent successful	Per cent successful fishermen
Combination	40	129	68	.53	25	15	60%	40%
Single bait	258	700	379	.54	125	133	49%	51%
Doughball	232	645	314	.49	106	126	46%	54%
Bread	12	19	23	1.21	8	4	66%	33%
Worms	9	15	12	.80	6	3	66%	33%
Corn	5	21	30	1.44	5	0	100%	00%

Population Studies: II. The Use of Various Types of Sampling Gear in a Lake with a Known Fish Population

Jim Mayhew
Fisheries Biologist

One of the major problems in modern fisheries biology is the sampling efficiency of the different types of fishing gear. The sampling of most lake fish population is restricted to four different types of equipment. These are: drag seines, gill nets, fyke nets, and electro-fishing. To adequately sample a population of fish it is expedient that the biologist uses the gear fitted best for a specific purpose, and yet minimize the selectivity of each sampling device.

Late in the fall of 1956, Lake McBride, a 132 acre state-owned artificial lake in Johnson County, was drained to facilitate reconstruction work on the dam. At the time of drainage the fish population was established by trapping the fish as they passed through the outlet structure. This phase of the project was designed to: (1) estimate the standing crop of adult and sub-adult fish; (2) determine species composition of the fish population, and (3) determine the year class structure of each specific population. An additional phase of the project was designed to study the efficiency of sampling gear in a lake with a known fish population. (Mayhew, 1957).

Prior to drainage of the lake considerable time was spent sampling the fish population with drag seines, trap nets, and electro-fishing. All fish caught were weighed (individually and in aggregate), measured, and representative scale samples obtained from each age group. Year class structure of each species was then determined by use of length-frequency nomgraphs. In this manner the effectiveness of sampling gear in obtaining a representative sample of year class structure was determined in addition to the factors of selectivity and efficiency in relation to the population structure.

Drag Seine

A total of seven seine hauls were made on four consecutive days in two different areas of the lake. The seine used was a 300 foot, one-quarter inch bar measure, drag seine. As in most Iowa artificial lakes, seining was difficult because of deep water, excessive submergent vegetation, and stumps, debris, and fish shelters situated throughout the bottom of the lake.

In all, a total of 779 fish, weighing 251 pounds were captured by seining. Five of the seven species present in the lake were sampled by this method. Bullheads and channel catfish, representing 13.6 and 1.3 per cent of the standing crop by number respectively were not sampled. Bluegills were the most numerous fish caught but occurred in only 28 per cent of the samples. Adult and sub-adult crappie were the most frequently occurring fish in the combined seining operations. The selectivity of the seine by species rank of abundance was as follows: crappie, bluegill, carp, largemouth bass, bigmouth buffalo, and as stated previously bullheads and channel catfish were absent from the sample (Table 1).

Table 1. Sampling efficiency of drag seine, (7 hauls, 300 foot one quarter inch bar measure seine) in Lake McBride. (Known species composition in parenthasis).

Species	Occurrence No. Samples	Per Cent Occurrence	Sampling Efficiency by Number Total No.	Per Cent Composition	Sampling Efficiency by Weight Total Weight	Per Cent Composition
L. M. Bass						
Adult	3	43	23	3.1 (0.2)	74	29.5 (1.3)
Sub-Adult	3	43	41	5.2 (2.3)	8	3.1 (0.9)
Bluegill						
Adult	2	28	197	25.3 (11.9)	27	10.7 (3.4)
Sub-Adult	4	57	205	26.3 (11.6)	13	5.2 (1.4)
Crappie						
Adult	4	57	196	25.3 (50.2)	28	11.2 (13.3)
Sub-Adult	3	43	88	11.3	5	1.6
Bullhead	-	--	--	-- (13.6)	-	-- (12.2)
Carp	3	43	23	3.0 (6.2)	69	27.5 (38.8)
Buffalo	2	28	6	0.8 (2.7)	27	10.7 (26.4)
Channel Catfish	-	--	--	-- (1.3)	--	-- (2.3)

Although there was no correlation between the species composition of the seine hauls and actual standing crop, the relationship of adult and sub-adult age groups is very similar (Table 1). Correspondingly, the ratio of black and white crappie is significant. The actual ratio was 85 percent white compared to 79 percent in the sample seine hauls.

Fyke Nets

During the project seven net sets, totaling 112 hours of fishing were used as a sample. The gear used were fyke nets with one inch bar measure web, with single leads to the frame. The young age group were not sampled because of the size of the webbing on the nets, allowing them to pass out of the trap. Steep bottom contours hindered the efficiency of most of the traps, but most available areas were sampled by this method.

Crappies were the most numerous and frequently occurring species taken by the fyke nets. Of the 279 fish captured, 86 percent were crappies. The species in order of sampling occurrence and number were as follows: crappie, bluegill, bullhead, and carp (Table 2). Largemouth bass, buffalo, and channel catfish were not sampled.

Table 2. Sampling efficiency of seven fyke nets in Lake McBride. (Known species composition by number and weight in parenthesis).

Species	Occurrence No. Samples	Per Cent Occurrence	Sampling Efficiency by Number		Sampling Efficiency by Weight	
			Total No.	Per Cent Composition	Total Weight	Per Cent Composition
L. M. Bass	-	--	--	-- (0.2)	-	-- (1.3)
Bluegill	5	63	23	8.2 (11.9)	4	6.2 (3.4)
Crappie	6	86	239	85.6 (50.2)	34	53.1 (13.2)
Bullhead	3	43	10	3.6 (13.6)	5	7.6 (12.2)
Carp	2	28	7	2.5 (6.2)	21	34.2 (38.8)
Buffalo	-	--	--	-- (2.7)	-	-- (26.4)
Ch. Catfish	-	--	--	-- (1.3)	-	-- (2.3)

Electro-fishing

The electric fish shocking device used in the project was a "boom" shocker. Electrical current for this fish sampling device was supplied by a 230 volt, alternating current generator. The most distinct advantage of this equipment was its superior mobility in all areas of the lake. Sampling fish populations was only restricted in areas where visibility into the water made it impossible to see the paralyzed fish.

A total of 528 fish, weighing 492 pounds were obtained in 210 minutes of electrofishing. Bluegills and carp were the most numerous species of fish captured, and both occurred in all of the sampling periods. Five of the seven species occurred in more than 50 percent of the sample periods. As in the case of the drag seine, bullheads and channel catfish were not sampled by the shocker (Table 3). Correlation of species composition by actual count and electro-fishing was negative, but the ratio of adult to sub-adult was very similar.

Discussion

In sampling the fish population of Lake McBride 2,072 fish, weighing 807 pounds were captured by seining, fyke netting, and electro-fishing. Of the three different types of gear used, the electric shocker took the most diversified sample, and the fyke nets were the most selective. None of the gear sampled the channel catfish population. However, this species comprised only 1.3 percent of the known population by number and 2.3 per cent by weight.

The drag seine and electric shocker were very similar in their over all efficiency. Each was capable of sampling five of the seven species on the lake. The shocker was more effective in taking largemouth bass, bluegill, and carp; whereas, the seine was more adapted to capturing crappie and buffalo. Neither was suited for bullhead and channel catfish sampling

Table 3. Sampling Efficiency of Electro-fishing in Lake McBride. (Known species composition by number and weight in parenthasis).

Species	Occurrence No. Samples	Per Cent Occurrence	Sampling Efficiency by Number Total No.	Per Cent Composition	Sampling Efficiency by Weight Total Weight	Per Cent Composition
L. M. Bass						
Adult	3	75	24	4.6 (0.2)	77	15.6 (1.3)
Sub-adult	3	75	41	7.8 (2.3)	8	1.6 (0.9)
Bluegill						
Adult	4	100	96	18.3 (11.9)	17	3.5 (3.4)
Sub-adult	2	50	191	36.4 (11.6)	12	2.4 (1.4)
Crappie	3	75	55	10.5 (50.2)	8	1.6 (13.3)
Bullhead	-	--	--	-- (13.6)	-	-- (12.2)
Carp	4	100	108	20.5 (6.2)	324	68.8 (38.8)
Buffalo	2	50	10	1.9 (2.7)	46	9.3 (26.4)
Ch. Catfish	-	--	--	-- (1.3)	-	-- (2.3)

under the existing conditions in the lake.

The fyke nets used in the study were extremely effective in sampling crappies, and moderately successful in taking carp, bullheads and bluegills. Largemouth bass, buffalo, and channel catfish were not sampled by this method.

In sampling the standing crop of fish by the combined efforts of the three pieces of gear, crappie and bluegills occurred most frequently. Crappies were present in 72 percent of the samples, while bluegill occurred in 61 percent. These two species were also the most numerous in the actual population of the lake. Correspondingly, the channel catfish, which was not sampled by any method had a decidedly low population. The other species varied in the relationship of occurrence and number. The frequency of occurrence in sampling and numerical position in population structure are listed in Table 4.

The structure of year classes within a specific fish population is extremely important to fisheries management. Angling harvest is often supported by one extremely abundnat year class. The fisheries management policy for each impoundment is based on the expected longevity of these year classes. Although there was no correlation between the various samples and the actual fish population, year class composition was very similar. A comparison of these factors are presented in Table 5.

Table 4. Frequency of Occurrence of Fish in Combined Sampling Methods and Known Species Abundance in Lake McBride.

Species	Occurrence No. Samples	Per Cent Occurrence	Abundance Rank by Frequency Occurrence	Known Abundance Rank in Total Population
L. M. Bass	6	33	4	6
Bluegill	11	61	2	2
Crappie	13	72	1	1
Bullhead	3	17	6	3
Carp	9	50	3	4
Buffalo	4	22	5	5
Ch. Catfish	0	0	7	7

Table 5. Age Composition of the Fish Population Sampled by Seine, Fyke Nets, and Electro-Fishing in Lake McBride. (Age composition of actual population in parenthasis).

Species	Total Number	Percent in Age Group						
		1	2	3	4	5	6	7
L. M. Bass	129	33	30	9	12	12	-	4
		(61)	(31)	(2)	(4)	(4)	-	(T)
Bluegill	712	29	26	21	14	10	-	-
		(26)	(24)	(19)	(16)	(13)	(1)	(1)
Crappie	578	3	12	T	85	T	-	-
		-	(10)	(T)	(87)	(T)	(2)	-
Bullhead	10	-	-	-	95	5	-	-
		-	-	-	(99)	(T)	-	-
Carp	179	-	33	27	40	-	-	-
		-	(33)	(33)	(30)	(2)	-	-
Buffalo	16	-	-	80	-	(11)	20	-
		-	-	(70)	(2)	-	(17)	-
Ch. Catfish	0	-	-	-	-	(42)	-	-
		-	-	-	-		(58)	-

Summary

Prior to the drainage of Lake McBride, a 132 acre state-owned artificial lake, population samples were taken by drag seining, fyke netting, and electro-fishing. The project was designed primarily to determine: (1) sampling efficiency and selectivity of each type of gear, (2) species composition of the samples in comparison to the actual standing crop, and (3) age composition of the sample in relation to the actual population.

The results of the study are as follows:

1. Drag seines and electro-fishing had a very similar sampling efficiency, with the shocker giving a slightly more diversified sample.

2. Fyke nets were the most species selective of the gear tested.

3. Electro-fishing was the most effective for taking largemouth bass, bluegill, carp, and buffalo.

4. Seines were the most effective type of gear for crappie and bluegills.

5. Fyke nets were the most effective gear for sampling crappie and bullheads.

6. For adequate samples, of gross fish populations no one type of gear can be employed.

7. A wide variation occurred in the species composition of the samples and actual population.

8. All types of gear failed to sample the channel catfish population.

9. Age composition of the samples and actual population were very similar.

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PROGRESS REPORT ON ALTERNATE YEAR WALLEYE FRY STOCKING PROGRAM - NORTHEAST IOWA RIVERS

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Introduction

In the spring of 1951, a research project was initiated to appraise a fisheries management procedure in which walleye fry were stocked in specified locations in eastern Iowa rivers on an alternate year (odd-numbered years only) basis.

Most of the fry stockings were made in pools in which a Biology Section inventory survey was an established, annual procedure. It was anticipated that any changes in year-class strength would be apparent in the net catches and validated by a year-class analysis of scales from the trapped specimens. It soon became evident that trapnets, gillnets and hoopnets used in the river surveys were not capable of supplying enough specimens for a valid analysis of this management technique.

While the original project had been established to analyze the net-evident structure of the walleye population in the rivers of northeast Iowa, the project did not lose its scientific exactness when it was decided to use the angler's catch as a basis for year-class analyses. (Actually, since management is directed toward a greater angler utilization of a given species, perhaps more management appraisals should be based on the changes they manifest in the anglers' catches or utilization).

The project was changed in 1954 to allow for angler participation, but despite general angler cooperation it soon became evident that the scope of the project was too broad to furnish enough data from one river, much less from five. Thereafter, special consideration was given to age-class analysis of that portion of the walleye population caught by anglers in the Waterloo-Cedar Rapids pool of the Cedar River. This pool was selected because of its reputation as being premium grade, walleye water and because of the number of good walleye fishermen working it.

While similar data from different rivers and different pools in the Cedar were analyzed each year, it was quite apparent (Table 1) that these data were too scant to bear up under even a simple mathematical cause-and-effect study. They are included in this report only as an interest feature and will not enter this discussion.

Table 1. Source of Scale Samples for Walleye Fry Stocking Analyses - Northeast Iowa.

River	Location	Number Caught for Year-Class Analysis 1953	1954	1955	1956
Cedar	Waterloo-Cedar Rapids	59	291	152	184
Cedar	All other pools	-	44	26	4
Wapsie	Ind.-Anamosa pool	-	6	1	4
Iowa	Marshalltown-Marengo pool	-	7	6	0
Shellrock	Shellrock - Greene	-	30	6	22

A total of 842 walleyes have been aged and assigned to year classes or the years in which they were spawned. Each angler year was used as a spearate entity and it is possible to trace year-class strength from year to year in Table 2.

Year-class Abundance

As stated previously, the alternate year walleye fry stocking was begun in 1951 when 500,000 fry were stocked; while in 1953, 500,000 and in 1955 450,000 additional fry were stocked. Stocking was completely restricted to newly hatched fry, and any significant change in the year-class abundance as manifested by the hook and line fishery could not be expected until the fish were at least two years old.

Actually there are innumerable factors which affect the fry stocking success other than the number stocked. Probably the most important of these is the suitability of environmental conditions natural reproduction and survival were successful in this pool. Year-class strength could therefore, be at a peak without artificial introduction of walleye, if conditions of the habitat were at the optimum.

The study was started too late to adequately assay the importance of the 1950 year class; however, it comprised 34% of the catch in 1954 and averaged 15% of the four- years catch (1953-1956).

The 1951 year class was undoubtedly a very successful group. This year class has averaged 44% of the anglers' catch for the past four years (Table 2). In 1955, it was replaced as the dominant group in the anglers' harvest and remained the sub-dominant year class in 1956, despite the fact that they were five-year-old fish and approaching the life expectancy for this species.

The 1952 year class, occurring in a non-stocking year as did the 1950 age group, also has been important to the stream angler. In 1955, 67 per cent of the catch was comprised of this age group. Apparently it was not generally as abundant through the years as the 1951 year class, averaging slightly over 36 per cent of the catch during the study period.

The stocking year, 1953, apparently did not produce large numbers of catchable fish. This year class has not been important to the population until 1956 when 22 per cent of the walleye catch was comprised of this age group.

It may be too early in the project to evaluate its importance to the angler, but the 1954 year class has failed to produce more than 2 per cent of the total catch. It is not unlikely that natural reproduction was insignificant in that year.

Factors Affecting Year-class Strength

Proceeding on the assumption that the abundance of certain year classes of walleyes might also be affected by factors other than artificial hatching and stocking, attempts were made to establish simple relationships between the year-class composition of walleyes taken by anglers in the Cedar Rapids-Waterloo pool during the study period and certain climatic conditions which might have been determinents in the success or failure of these year classes. (Table 3).

Table 2. Year-class Abundance in Anglers' Catch, Waterloo-Cedar Rapids Pool - 1953-1956

Cedar River

1953			1954			1955			1956		
Year Class	No. in Year Class	% in Year Class	Year Class	No. in Year Class	% in Year Class	Year Class	No. in Year Class	% in Year Class	Year Class	No. in Year Class	% in Year Class
1955	*	*	1955	*	*	1955	0	0	1955	26	14
1954	*	*	1954	1	(T)	1954	0	0	1954	4	2
1953	0	0	1953	15	5	1953	1	(T)	1953	40	22
1952	0	0	1952	20	7	1952	102	67	1952	62	34
1951	46	78	1951	155	54	1951	37	24	1951	38	21
1950	6	10	1950	90	34	1950	11	7	1950	13	7
1949	3	5	1949	7	2	1949	1	(T)	1949	1	(T)
1948	1	2	1948	0	0	1948	0	0	1948	0	0
1947	0	0	1947	1	(T)	1947	0	0	1947	0	0
1946	0	0	1946	0	0	1946	0	0	1946	0	0
1945	0	0	1945	1	(T)	1945	0	0	1945	0	0
1944	3	5	1944	1	(T)	1944	0	0	1944	0	0
Total	59			291			152			184	

Total for pool, 686

* - Year class not present in population for given year.
(T)- Less than 1%.

Table 3. Comparison Between Year-class Abundance of Walleyes Taken by Anglers in 1953 to 1955 and Certain Climatic Factors in Waterloo-Cedar Rapids Pool of Cedar River, 1948-1953

	Item*	1948	1949	1950	1951	1952	1953
1.	Year-class Abundance (in numbers)	1	11	107	238	122	16
2.	Average Air Temp.-April & May	56.2	56.0	51.7	53.8	54.8	52.2
3.	Average Air Temp.-April-July	63.6	65.2	54.7	61.5	64.7	65.4
4.	Average Monthly Discharge per Annum in Sec. Ft.	4,798	4,694	4,977	11,597	6,182	3,076
5.	Average Discharge, March-July	3,347	3,378	3,853	9,877	4,742	2,798
6.	Average Runoff in Inches (March-May)	1.06	1.03	1.09	2.53	1.35	.68
7.	Average Runoff, March-July	.74	.74	.85	2.15	1.04	.64
8.	Total Annual Snowfall in Vicinity of Pool	31.1	31.8	33.7	66.4	48.9	28.9

* Items 2 and 3 are based on weather data from stations at Waterloo-Vinton and Cedar Rapids.

Items 4, 5, 6, and 7 are based on flow sheets data from Waterloo gauge station only.

There was apparently no relationship between year-class abundance and the average air temperature in April and May, the spawning season, or in April through July, the incubating period. However, with the exception of a slight deviation in the 1949 data, the average monthly runoff and river discharge for these spawning and incubation periods show a trend to relationship with year-class strength. Actually, the vagueness of the relationships between these climatic factors and year-class strength may be due to the fact that the three weather stations furnishing these data are at the extreme upper, lower and middle of a 74-mile pool. In other words, there may be a lack of specificity in the treatment of some of these climatic data.

Snowfall (Item 8), because of its "build up" or "single-action release," is a more specific natural factor. In addition, the amount of snow cover is a critical factor in determining the magnitude of the spring runoff and March floods. It is this flood which has the most effect on the river of either of the other normal annual floods (June and September). The molar action of the ice gouges out new pools and renovates old ones. It exposes rocks and builds gravel bars. Attending this flood there is very little terrestrial sediment brought into the stream since the soil is usually in a partially frozen condition. Ecologically, this is a "beneficial" flood.

Item 8 is based on the climatological data (total snowfall) from seven weather stations located directly on the Cedar River or one of its tributaries. There is an uncommonly close relationship between the annual snowfall and the size of a given year class of walleyes.

In addition to the above there is available [1.] but uncorrelated, for the period January 1944 to September 1954. The daily noon water temperature; the daily suspended sediment concentrations; the daily mean discharge; and a chemical analysis of the water covering 14 separate dissolved solids, calicum carbonate hardness, and the specific conductivity of the water in the Cedar River at Cedar Rapids, Iowa. These chemical tests were run every ten days.

Under present plans, the project should be ready for a completion report after the 1958 catch data have been analyzed. It is doubtful whether at that time, with only four sequences expired, we can make any hard and fast statement as to the effect of walleye fry stocking.

Summary

1. While the original project had been established to appraise the effect of alternate-year fry stocking of walleyes through the use of survey nets, it was changed to utilize the angler's catches as a basis for year-class analyses.

2. The scope originally covering the four major walleye rivers in eastern Iowa, has been refined to analyse only the data gathered in the Waterloo-Cedar Rapids pool of the Cedar River.

3. Walleye fry were stocked in the odd-numbered years only, averaging nearly 500,000 per annual stocking in various locations in this pool.

4. A total of 842 walleyes were caught by anglers and their scales turned in for aging to the Biology Section. Of this number, 686 came from the Waterloo-Cedar Rapids pool.

5. The 1951 year class of walleyes was the most important contributor to the anglers' catch; followed by 1952, 1950, and 1953 in that order. The 1954 year class was apparently very unspectacular.

6. In attempting to find a cause-and-effect relationship between year-class strength and certain variable climatic factors, it was apparent from our data that there was no relationship considering the average air temperature in April through July. There was a trend to relationship between year-class strength and average monthly runoff and river discharge for this same period. There was an uncommonly close relationship between year-class strength and total annual snowfall which in effect determines the magnitude of the March and April floods, which in turn determined the availability of spawning habitat.

1.) Furnished by Iowa Geological Survey.

PHEASANT CROWING COUNT AND HEN INDEX
SPRING 1957

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The year-round survey of Iowa's pheasant population includes the crowing count to determine the spring breeding population. This count also indicates changes in local pheasant abundance as well as a graphic picture of pheasant distribution throughout the state. This report presents the results of the 1957 crowing count survey and compares them with the results of previous surveys.

The seasonal peak of crowing activity was again determined by check routes which were taken by biologists. This peak occurred late in April and officers were promptly notified to begin counts in their areas. Nearly all routes were checked during the last week in April and the first two weeks in May.

Weather conditions were generally favorable for this survey. Temperatures during the last half of April were warm and rainfall was below normal which stimulated crowing activity. Less favorable conditions existed after May 6th; however, most counts had been taken by that time.

The results of the 1957 crowing count indicated a decrease in Iowa's spring pheasant population (Table 1). Officers completed 182 routes and recorded 29,737 calls at 3,623 stops for an average of 7.9 calls per stop. This figure was six per cent below the 1956 statewide average. The spring hen index, which was determined by multiplying the average number of calls per stop by the observed sex ratio, decreased from 27.7 to 26.1 hens this year. This figure was equal to the previous seven-year average indicating an adequate supply of hens.

Table 1. Statewide Results of the Crowing Count and the Hens Index 1950 - 1957.

Year	Av. No. of Calls Heard	Sex Ratio	Spring Hen Index[1]
1950	7.9	2.9	22.9
1951	8.1	2.9	23.5
1952	9.3	2.7	25.1
1953	9.4	2.2	21.7
1954	8.5	2.8	23.8
1955	8.5	3.6	30.6
1956	8.4	3.3	27.7
1957	7.9	3.3	26.1

1. Av. calls times sex ratio.

Although only a minor change was reflected in the statewide pheasant population, major differences were recorded for individual districts. The results by districts for the 1957 spring count are listed in Table 2 and these figures are compared, with previous surveys in Table 3.

Pheasant populations in districts one and four in the western part of the state dropped sharply during the past year. Crowing activity decreased 30 percent in both areas. The spring hen index was down 20 per cent in northwest Iowa and had dropped 30 percent in the west central district.

This part of our major pheasant range experienced a severe drought last year. The Iowa Weekly Weather and Crop Bulletin stated that June, 1956, was the hottest and driest since 1933 and one of the hottest and driest on record with the greatest departure from normal in the northwest and west central districts. The peak of pheasant hatching occurs during June and the hot dry weather was probably the factor which lowered production in this area.

Crowing activity remained nearly the same in north central Iowa but the hen index decreased because of the fewer hens per cock seen during the winter sex ratio count. The population in this district remains well above the state average.

In contrast to the western third of Iowa, the districts along the eastern border recorded substantial increases the past year. Crowing activity and the hen index increased 30 percent in northeast Iowa and were double the 1956 figures in the east central part of the state. The hen index in district three was the second highest in the state and the average number of calls heard per stop was second only to north central Iowa. Figures obtained in east central Iowa were again near the state average as a result of the population increase in that area.

A slight gain was reported in southwest Iowa following a considerable decrease a year ago. The results from the remaining two southern districts remain low.

Table 2. District Results of the 1957 Crowing Count and Hen Index.

District	No. of Calls Heard	No. of Stops	Av. No. of Calls per stop	Sex Ratio	Spring Hen Index
1. Northwest	5870	480	12.2	3.4	41.5
2. North Central	9541	436	21.9	2.5	54.8
3. Northeast	4274	327	13.1	4.1	53.7
4. West Central	2302	380	6.1	3.9	23.8
5. Central	3667	480	7.6	4.7	35.7
6. East Central	2470	360	6.9	3.7	25.5
7. Southwest	737	280	2.6	3.1	8.1
8. South Central	646	440	1.5	1.9	2.9
9. Southeast	230	440	0.5	2.0	1.0
State	29,737	3,623	7.9	3.3	26.1

Table 3. Comparison of Crowing Count Results and Spring Hen Index

1955-1957

Districts	Year	Av. Number of Calls Heard	Spring Hen Index
1. Northwest	1955	18.6	53.9
	1956	18.4	51.5
	1957	12.2	41.5
2. North Central	1955	20.3	54.8
	1956	21.6	71.3
	1957	21.9	54.8
3. Northeast	1955	11.2	49.3
	1956	10.0	38.0
	1957	13.1	53.7
4. West Central	1955	9.1	37.3
	1956	9.0	36.0
	1957	6.1	23.8
5. Central	1955	6.5	31.2
	1956	7.4	34.0
	1957	7.6	35.7
6. East Central	1955	3.9	17.6
	1956	3.3	12.5
	1957	6.9	25.5
7. Southwest	1955	4.9	24.0
	1956	2.1	6.3
	1957	2.6	8.1
8. South Central	1955	1.4	4.6
	1956	1.6	3.8
	1957	1.5	2.9
9. Southeast	1955	0.4	0.8
	1956	0.5	1.0
	1957	0.5	1.0

QUAIL BAND RETURNS 1955-1956

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Movement of quail must be considered when estimating their numbers. The purpose of this paper is to present data on movement patterns as represented by recapture of banded birds released in 1955 and 1956. This information will be useful as a guide when perfecting censusing techniques, or for working out other field problems.

Young bob-whites, hatched at the state game farm, were raised and released by sportsmen's organizations in several Iowa counties. In addition, a few adults were also used for this purpose.

Bird production was under the guidance of Paul Leaverton, Superintendent of Game. Records from that office were made available for the extraction of this information.

Game farm production of the young began in early summer and continued into July. Before release, the young were banded by the organizations responsible for the quail and reports on both band numbers and release sites were sent in to the Des Moines office by the responsible parties.

Similarities in movements of wild and pen-raised quail, and other features brought out in marking programs are discussed in publications on experimental banding projects in Iowa and in other states. Hanson (1947) reports that in Oklahoma only 722 quail were recovered from 47,000 banded during the years 1942-1946: McDowell (1949) states that in Pennsylvania there was a survival of 45 per cent in nearly 5,000 pen-raised birds released on 23,000 acres. He attributes this high survival to favorable winter weather.

Steen (1940) wrote that three years of improvement of Missouri sites increased populations after stocking the same sites failed to do so. This indicated a tendency to leave undesirable areas. Murphy and Baskett (1952) and Lewis (1954) reported that their studies in Missouri indicated that trapped and banded wild quail moved short distances, but visited several areas, some of which were on nearby, though separate farms.

Boenke (1954) indicated that there was a loss of 23 per cent in banded wild quail from his study area in southern Iowa. Some of the loss was believed to be due to quail leaving the area.

Methods

Information on the recapture of banded quail in Iowa, for the years 1955 and 1956 came from officers who sent to the office the bands collected. Bands were taken off of the legs of quail shot, or found dead. Hunters or other interested persons found the bands and gave them to the conservation officers. Information was then transmitted to the Des Moines office for compilation. This record in the Des Moines office also includes data on adult banded quail which were released by state game officials. Other

information that is recorded, concerns band numbers, names of sponsoring clubs that raised birds, and names of the local conservation officers.

Results

In 1955 a total of 6,996 young was released. Fifty-four band recoveries were reported. In 1956, after release of 5,942 young, returns were received on 52 banded quail. During both years young were released as early as July first. Over half were stocked in July while most of the balance was released in August.

Releases were made in what the local conservation officer considered suitable habitat and when the birds were considered old enough to survive in the wild. The sex of liberated birds was not given in most cases. This could be due to the fact that most were set free when too young to show typical coloring of either cock or hen.

From a 1955 release made on July 1st in Union County, four birds were later shot in the same county. Birds were killed from releases made at fairly uniform intervals between the above date and a release date of August 7th. In 1956 the earliest release from which birds were killed was also one made on July 1st. One of these had been released in Delaware County, while five were set free in Buchanan County. Other birds were reported shot from plantings made at intervals from July 1st to August 11th. This paper is the result of work done to determine the amount of movement as indicated by band returns, therefore no study of a best release date was made. Limited information in the record permits little expansion of data. It is known that releases were made at many points throughout both state and the individual counties.

Quail bands were turned in from birds that were found or shot from July 10 of the year of release to June 10 two years later. However, most were shot during the period of November 11 to 26 in the year of release.

In 1955 there were three returns from the period of November 1st to November 11th. Twenty-four were reported killed from November 11 to 20 and eight from November 21 to 30. Three were shot in December. In addition, one bird was killed by a predator, and no cause was given for the loss of two others.

Band returns in 1956, from November 1 to 10 indicated that six quail were shot during this period. Twenty-five were shot from November 11 to 20, and November 21 to 30 the kill was 16. In December the reported take was two banded quail.

If known, the point of release and point of capture were given. Distance and direction of travel were computed. There seemed to be no significance to the direction moved. Probably this was influenced by terrain and land cover. Approximate distances moved are given in Table 1.

Table 1. Reported Distances Moved by Banded Quail 1955 - 1956.

Distance from point of Release to point of Recovery	Number of Banded Quail 1955	1956
Miles 1	4	9
2	4	0
4	8	0
8	1	0
9	1	0

Travel distances of from 15 to 30 miles are indicated by a few cases, but in at least two of these instances the bird was reported taken in the vicinity of a town, and it is assumed that the finder of a bird merely gave a home address and not the location of the spot where a bird was killed. It appears that short movements are the rule.

In both years most of the captured quail were eight weeks of age when released with other releases, ranging from 6 to 12 weeks after hatching.

Time elapsed between release and capture is given in Table 2.

Table 2. Number of Months Between Release and Recovery of Banded Quail, 1955 and 1956.

Number of Months Elapsed Between Recovery and Release	No. of Banded Recoveries During 1955	1956
1	1	0
2	1	0
3	6	10
4	24	31
5	3	0
6	0	1
12	1	0
13	1	0
22	1	0

For 14 of the quail that were recovered from the 1955 planting no information was supplied. Of birds recovered from the 1956 planting, it was interesting to note that four were auto fatalities within three weeks of the time they were released.

Most of the recoveries made in the year 1955 were from counties having low quail populations. These counties were: Adams, Adair, Black Hawk, Buchanan, Dubuque, Linn, Polk and Scott. In counties of higher populations recoveries were made from releases made in Ringgold, Union, Van Buren and Warren.

In 1956 in the secondary quail range, recoveries were made from quail released in the following counties: Benton, Bremer, Buchanan, Grundy, Jasper, and Polk. In better range, recoveries were made from releases within the counties, Ringgold and Union. In the succeeding list of counties there was less information on where quail had been released before hunting season, but kills of quail were recorded from all of them; these latter counties are, Adams, Black Hawk, Cass, Cedar, Chickasaw, Crawford, Delaware, Fayette, Guthrie, Keokuk, Mills, Montgomery, Page, Scott, Tama, Van Buren, Wapello, Warren and Washington.

Of the banded young quail recovered during two study years, 96 were shot, one was believed killed by a predator, four killed by unknown causes and four were killed by auto.

In addition to the release of young quail, 1,067 adult quail were released in 1955. There is a record of only two of these being collected.

In 1956 there 880 recorded adult releases to the wild. Only one record of a recovery was noted when the record was examined.

While this paper is written only as a means of compiling information that will be of value to the program of censusing quail, it is also noted that few recoveries of banded birds are reported. This may be due to lack of interest: it may also be due to a low kill of quail in general. If the latter is true it would indicate that there is not an extensive harvest of wild quail. Further investigation would show the true picture.

Summary

1. This paper is a compilation of data on 1955 and 1956 releases and recaptures of pen-raised quail in Iowa.

2. Information on quail band returns came from conservation officers.

3. In 1955 and 1956 a total of 12, 938 young and 1,947 adult quail were released.

4. In 1955 and 1956 most recorded kills of banded quail were November 11 to 20.

5. Seventeen of 41 banded quail killed were shot within one mile of where they were released.

6. On eighty banded quail killed there was information on time of kill. Fifty-five of these were shot four months after liberation.

7. Low recovery points to either a lack of interest in reporting banded quail kills; to reluctance to make this known; or to a low take in the quail population.

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AN ANALYSIS OF SQUIRREL HUNTER REPORTS FOR 1956

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Observations and spot counts of squirrels during April and May of 1956 indicated a large stock of adult squirrels were available in most parts of Iowa. First litter reproduction seemed good as many young squirrels were to be seen during May. Dens occupied by litters of spring reproduction were easily found in most timbers.

It become quite apparent that a shortage of mast was to be expected by mid-August. In the northeast and east central areas where the mast shortage was most severe, nuts and acorns were very scarce. Only a few burr oaks yielded acorns; a few black walnuts could be found, mostly in towns; and some pignut hickory nuts could be located with difficulty. Black and white oaks, and shagbark hickories, our most important mast bearing trees, yielded nothing.

The situation was not so bad in southern Iowa where other species of oaks yielded some acorns and in western Iowa where the predominant burr oaks produced a few acorns. In other areas squirrels were able to turn to corn to a greater extent than in extreme northeast Iowa where the amount of squirrel inhabited woodland exceeds the amount of soil planted to corn.

The mast shortage apparently caused squirrels to move around more than normal. Abnormal numbers were found dead on highways. Numerous reports were received of squirrels swimming the Mississippi River; many drowning in the attempt. This suffle appeared to amount to a general emigration of squirrels in the northeast. There is little doubt squirrel numbers suffered as a result.

The annual squirrel season was open September 15 through November 15, 1956. Hunting was permitted for fox and gray squirrels throughout the state as in all recent years. Daily bag and possession limits remained at six and twelve respectively.

A list of known squirrel hunters throughout the state was compiled as during the past six years. Each hunter on this list was mailed a form which he was to fill out and return at termination of his 1956 squirrel hunting. The form provided space to record for each hunting trip the number of squirrel killed, crippled, and observed; sex of squirrels in the bag; number of hunters per party; number of hours hunted; whether or not a dog was used; county hunted in; and type of gun used. Each hunter was asked to compare his hunting success for 1956 with 1955; and in turn, 1955 success with that of 1954. In addition, all were asked to save the right forelegs of bagged squirrels and return them with the forms.

A total of 387 known squirrel hunters were mailed forms. In addition, all conservation officers, biologists, and unit game managers were sent the same forms. Fifty usuable records were returned with data from which this report is compiled.

Results

Hunting Success: A breakdown of hunting success (Table 1) reveals squirrel hunting in 1956 was poor in some of our best areas - notably in the north-

east and east central agricultural areas. Hunters from these areas reported observing slightly more than 0.8 squirrels per hour of effort as compared to the statewide average of 1.5 squirrels observed per hour. They bagged 0.5 and 0.4 squirrels per hour respectively for the northeast and east central areas as compared to 0.7 squirrels per hour statewide average. Best hunting was achieved in the southeast where cooperators bagged one squirrel and observed 2.6 per hour of hunting. Success in other areas fell between these extremes with good hunting reported from the north central, west central, and southwest areas. Fewer squirrels were seen and bagged per hour of hunting in 1956 compared with 1955 and 1954 when 1.8 squirrels were seen per hour and, of these 0.8 added to the bag.

Table 1. Hunting success for nine agricultural areas.

Agricultural Area	Fox Squirrels			Gray Squirrels			Total Trips	Total Hours Hunted	Squirrels Seen/ Hour	Squirrels Bagged/ Hour
	Seen	Crippled	Bagged	Seen	Crippled	Bagged				
Northwest	384	6	249				48	310.0	1.24	0.80
North Central	25	0	10				4	15.0	1.67	1.00
Northeast	137	2	83	101	4	53	50	286.5	0.83	0.47
West Central	167	0	94				16	102.0	1.60	0.92
Central	287	21	168				81	210.3	1.32	0.80
East Central	69	0	42	40	3	7	23	130.0	0.84	0.38
Southwest	171	5	90				21	82.8	2.07	1.09
South Central	625	11	195				52	306.5	2.04	0.63
Southeast	241	14	80	138	11	65	27	147.5	2.56	0.98
Statewide	2,106	68	1,009	279	18	125	322	1,590.6	1.49	0.71

Data from hunters reports were divided into two parts, those hunting trips completed before October 16 and those from October 16 to the season's end. A total of 1,274.3 man hours were recorded for the first half season, and 316.3 hours for the second half. In other words about 80 percent of all squirrel hunting was completed during the first 31 days. Hunters killed 0.72 and 0.70 squirrels per hour respectively for the first and second halves of the season. This indicates no essential difference and corroborates similar data from previous seasons. However, 1.57 squirrels were seen per hour during the first half as compared to 1.14 for the second. This may indicate squirrels, once located, are easier to bag during late season when leaves are gone from the trees.

Summary

1. Spring spot counts and observations revealed a sizeable population of of squirrels present early in 1956.

2. A severe mast failure apparently caused squirrels to emigrate from their normal habitat and mortality appeared high as a consequence.

3. As a result hunting success for 1956 was poorer than for 1955 and 1954. Hunters bagged only 0.7 squirrels per hour of effort as compared to 0.8 for the two previous seasons.

4. No difference could be detected in the data for success of early and late season hunters.

5. Those hunters who used dogs had slightly more success than non-dog-users. Dogs were apparently most benficial during the second half of the 1956 season. Dog-hunters crippled fewer squirrels than those who did not use dogs.

6. Fox squirrels totaled 88.8 percent of the total bag.

7. More female fox squirrels were killed (47.5 percent of the species in the bag) than in previous years.

8. Of 374 fox squirrels aged, 56.1 percent were juveniles. This is only slightly more than 55.7 percent obtained from six previous years.

9. Eighty-eight percent of the hunters thought more squirrels were available in 1956 than in 1955.

10. The majority of hunters used .22 caliber rifles.

THE STATUS OF THE WOOD DUCK IN IOWA IN 1957

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Wood duck stream surveys were undertaken in Iowa to provide some indication of the resident status of this species (Table 1). In recent years the wood duck nesting population has declined in this state, and in most of our neighboring states within the Mississippi Flyway.

Table 1. Wood Duck Stream Survey Data

Year	Stream Miles Censused	Males	Females	Pairs	Unident.	Total	Dates of Census
1953	66	11	8	10	12	51	May 5 - 14
1954	78	9	5	3	8	28	May 5 - 13
1955	90	8	1	0	6	15	April 26-May 16
1956	26*	0	1	1	12	15	May 3-June 9
1957	44*	2	0	0	5	7	May 18-June 3

*Many streams too dry to float in 1956 and 1957.

Wood duck nesting boxes have been checked at Lake Odessa since 1950. These nesting boxes provide some idea of the amount of change in the resident nesting population in southeastern Iowa (Table II).

Table II. Wood Duck Nesting Box Occupancy at Lake Odessa, Louisa County, Iowa.

	Number of Nesting Boxes Checked		Number of Nesting Boxes Occupied	
Year	Wooden	Metal	Wood Duck	Merganser
1950	26		18	
1951	36		13 and 9*	
1952	24		18	
1953	30		15	
1954	22	50	7	4
1955	12	44	5	1
1956	6	42	5	3
1957	3	38	3	0

*There were 13 nesting boxes occupied prior to flooding and nine afterwards.

Several factors have influenced the rise of wood duck numbers in the Mississippi Flyway prior to 1952. Hunting pressure within the flyway is one important factor contributing to the population decline of the species since 1952. Recorded kill samples of wood ducks harvested in Iowa since 1949 indicate the harvest status of the species (Table III).

A Brief Record and Forecast of Prairie Marsh Conditions in the Lakes Region of Iowa in 1957.

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Iowa's state-owned prairie marshes constitute a most important reservoir of native aquatic habitats. These plant communities and their animal inhabitants are in constant flux obeying the dictates of ecology. The typical prairie marsh is in a constant state of change governed largely by water levels.

During dry periods, such as the interval 1954-56, the exposed edges and drying marsh bottom provided optimum conditions for the growth and development of rooted emergent aquatic seedlings. The heavy rains and runoff during June of 1957 replenished the water supply of practically all state-owned marshes. This water invading the dense growths of emergent aquatics has provided excellent habitats for aquatic wildlife. This change from dry to wet, or vice versa, is the normal sequence of events in marsh ecology. A rapid recovery in the local populations of muskrat, mink, frogs, and other aquatic animals can be anticipated providing water levels remain favorable.