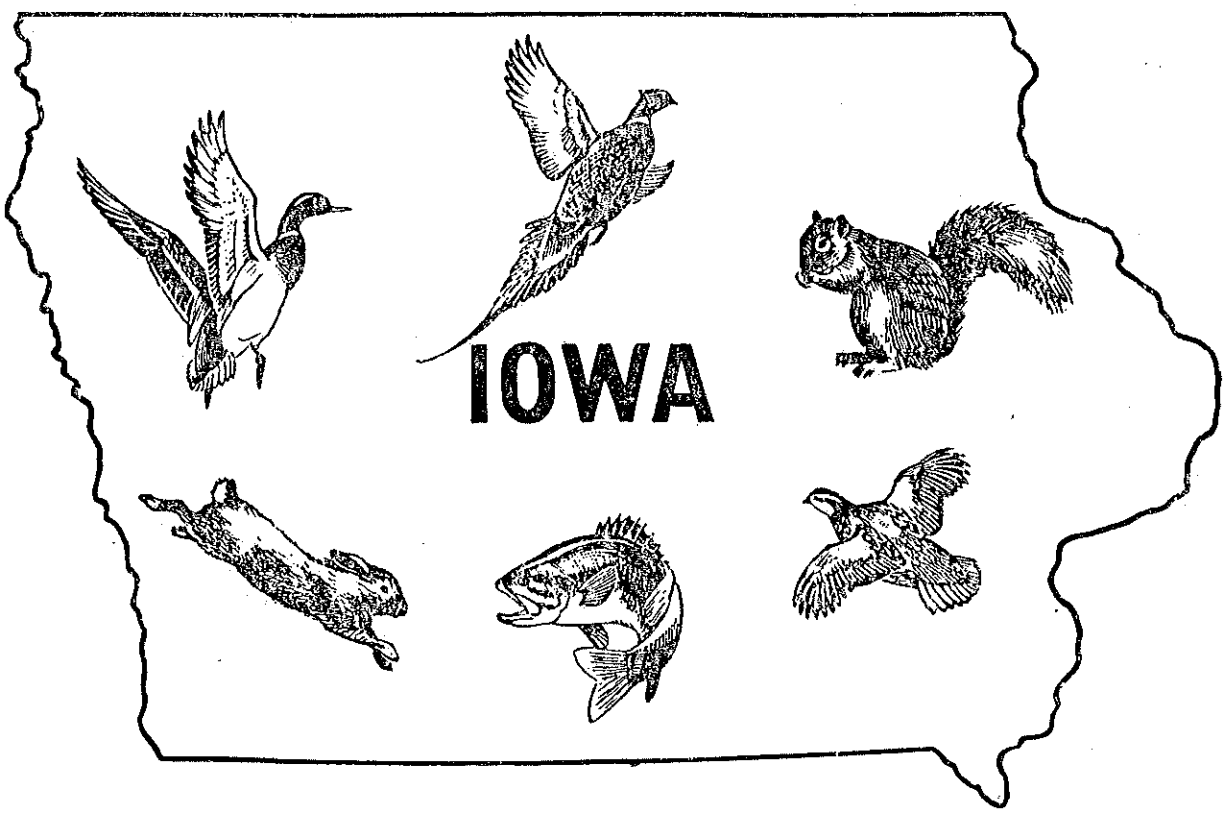
Vol. 7 No. 2

1955 returned to: S.E. district office

QUARTERLY BIOLOGY REPORTS



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

July, August, September 1955

Vol. VII No. 2 3

Submitted by

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TABLE OF CONTENTS

PHEASANT REPRODUCTION - 1955

Richard C. Nomsen*

Iowa's year round pheasant program includes several studies designed to evaluate pheasant reproductive success. Results of each study are compared with those of previous years in order to determine the relative success of the present hatch. In addition to the conservation officer's regular counts, volunteer checks are made by rural mail carriers and farmers.

Pheasant nesting activity, prompted by mild temperatures got an early start last spring. Warm weather persisted on most days during April producing an average temperature of 56.4 degrees - 7.6 degrees above normal for that month. Higher than normal temperatures also continued through May. Rainfall averaged 34 per cent above normal during April and 31 per cent less than normal for May.

The Weekly Weather and Crop Bulletin reported that over three fourths of the first crop of alfalfa was cut by the middle of June. The average for that time is 40 per cent and only 25 per cent had been mowed by June 15, 1954.

A total of 163 cards were returned by farmer cooperators last spring with information on nests and broods seen while cutting the first crop of hay. There were 44 broods seen compared with 20 a year ago which indicated an earlier hatch this year. Table 1 lists the results of this survey for 1954-1955.

Table 1. Results of Farmer Cooperator Nesting Survey for 1954 - 1955

	1954	1955
Acres of hay cut	3795	4892
Number of nests seen	251	330
Number of nests seen per 100 acres	6.6	6.7
Average number of eggs per nest	9.5	9.6
Number of nests hatched	33	30
Percentage of all nests hatched	12%	9%
Number of hens reported injured	68	74
Hens reported injured per 100 acres	1.8	1.5
Number of hens reported killed	42	65
Hens reported killed per 100 acres	1.1	1.3
Number of broods reported	20	44
Average number in each brood	7.3	10.5

These same cooperators were contacted later in the summer and asked their opinion as to the 1955 pheasant hatch. The majority agreed that this year's hatch was better than in 1954.

*Pheasant Biologist, Hampton, Iowa

Only 17 per cent thought the production of young was poorer while 51 per cent stated that it was improved over last year.

Rural mail carriers made their summer reproduction count during the last week of July. They saw a total of 505 broods along their regular routes during that period. The carriers reported an average of 2.7 young per hen compared with the 2.5 average in 1954. According to this survey, the percentage of hens seen with broods increased while the average brood size decreased. Table 2 shows the 1955 results and compares them with previous counts. The average young per hen figure for this survey during the period 1948-1954 was 2.5.

Table 2. Rural Mail Carriers Brood Counts 1951-1955

	1951	1952	1953	1954	1955
Average brood size	5.9	6.3	5.9	6.5	6.1
Per cent of hens with broods	39%	41%	36%	38%	43%
Young per adult hen	2.3	2.6	2.1	2.5	2.7

Our primary reproduction survey was taken by conservation officers from July 15th to August 15th. Results of this count indicated an excellent pheasant hatch. Officers recorded 1763 broods while making the August roadside survey and 551 during the sight record check the last two weeks of July. For both surveys, they reported 690 hens without young, and 2314 broods with a total of 15,689 chicks. There was a total of 1732 broods checked for the same period in 1954. The young per hen figure increased from 3.7 in 1954 to 5.2 in 1955, which was also much above the previous five year average of 4.0 young per hen. Both the average brood size and percentage of hens seen with chicks increased this year. Officers reported an average of 6.8 juveniles per brood and 77 per cent of all hens seen had broods. Pheasant reproduction figures were uniform and appeared to be very good in all parts of the state. Results of this survey are outlined in Table 3.

Table 3. District Results for Conservation Officers Brood Counts for 1954 - Statewide Results for 1950-1955

	Young per Adult Hen	Average Brood Sizes	Percentage of Hens with Broods
1 Northwest	5.0	6.5	77%
2 North Central	5.1	6.6	78%
3 Northeast	5.1	6.7	77%
4 West Central	5.2	6.6	79%
5 Central	6.0	7.7	78%
6 East Central	5.7	7.5	76%
Southern 3 Districts	5.4	7.3	73%
State 1955	5.2	6.8	77%
State 1954	3.7	5.7	64%
State 1953	3.4	6.4	53%
State 1952	4.3	6.6	66%
State 1951	3.9	6.2	62%
State 1950	4.8	7.0	69%

Reproduction success in Franklin county was much improved this year according to results of the author's survey in this area. An average of 5.2 young was observed for each hen recorded. This compares with 4.6 in 1954 and only 3.1 young per hen in 1953. Table 4 compares the results obtained during the last five years in Franklin county.

Table 4. Pheasant Reproduction Counts in Franklin County for Past Five Years.

	Young per Adult Hen	Average Brood Size	Percentage of Hens with Broods
1951	3.7	6.4	57%
1952	5.3	6.5	82%
1953	3.1	6.0	52%
1954	4.6	6.3	74%
1955	5.2	6.7	78%

The peak of hatching in Franklin county occurred two weeks earlier than in 1954 and was the earliest hatch since observations were begun here in 1950. A total of 119 broods was aged by sight in this area to determine the period when most broods were coming off the nest.

SUMMARY

1. This report includes results of all pheasant reproduction studies made in 1955.

2. Pheasant nesting activity got off to an early start this year.

3. Farmer cooperators reported 44 broods compared with 20 in 1954. In their opinion, the 1955 hatch was better than the previous year.

4. Results of the rural mail carrier count indicate better than average reproduction.

5. Officers reported 2,314 broods during their regular survey. Reproduction success appeared to be much better than average in all parts of the state.

6. The pheasant hatch was excellent in Franklin county and was the earliest since observations were begun here in 1950.

A BRIEF RESUME OF THE COOPERATIVE WATERFOWL BANDING PROJECT IN ALBERTA - SUMMER 1955

By James G. Sieh*

During the summer of 1955 banding crews were simultaneously working in many of the accessible waterfowl producing areas in Canada. The Iowa State Conservation Commission, along with other state and provincial departments, cooperated with the Mississippi Flyway Waterfowl Council, providing technical assistance and man-power for these banding crews. The banding operations throughout Canada were supervised and directed by personnel of the U. S. Fish and Wildlife Service. U. S. Game Management Agents acted as crew leaders and directed the field operations of the banding crews. From Iowa, Mr. Tom Berkley, Area Game Manager, and Mr. James Sieh, Game Biologist, were assigned to banding crews in Alberta.

Dr. Fred Glover of the U. S. Fish and Wildlife Service briefed crew personnel in Lethbridge, Alberta on July 2, 1955 concerning the organization, purposes, and anticipated results of the cooperative project. Equipment was distributed to each crew, and after securing and loading their gear, crews headed toward their assigned banding areas. Banding gear included bands, pliers, record sheets, and other miscellaneous paraphernalia to facilitate actual leg banding in the field. Drive-trapping equipment included hoop-net like traps made of fish-netting, rolls of chicken wire to be used as V-shaped leads, and aluminum rods to stake out both the trap and the leads (figure 1).

The procedure of drive-trapping first demanded a workable trap site in a marsh, slough, lake or pothole where ducks could be driven into the trap via the leads. Generally, a trap site with some emergent cover was preferred to one without any cover because molting and young flightless waterfowl appeared to drive more easily through sparse stands of emergents than across open water. Extremely heavy cover was avoided because it was difficult if not impossible to drive ducks through or out of some stands of heavy vegetation.

After a suitable location was selected, chicken wire leads were unrolled and staked out in the marsh and the trap staked out and braced. Crew members were then deployed in such a fashion as to drive birds out of hiding and into the trap. With a little practice crews were able to drive birds with a minimum of verbal confusion from crew leaders. Usually traps and leads were staked out and the drives made immediately following the set. Occasionally a set was made late in the afternoon and the drive made the following morning with excellent results. Immediately following the drive the trap-net containing ducks was hauled ashore and the birds segregated according to species, age and sex. Banding got underway immediately and each

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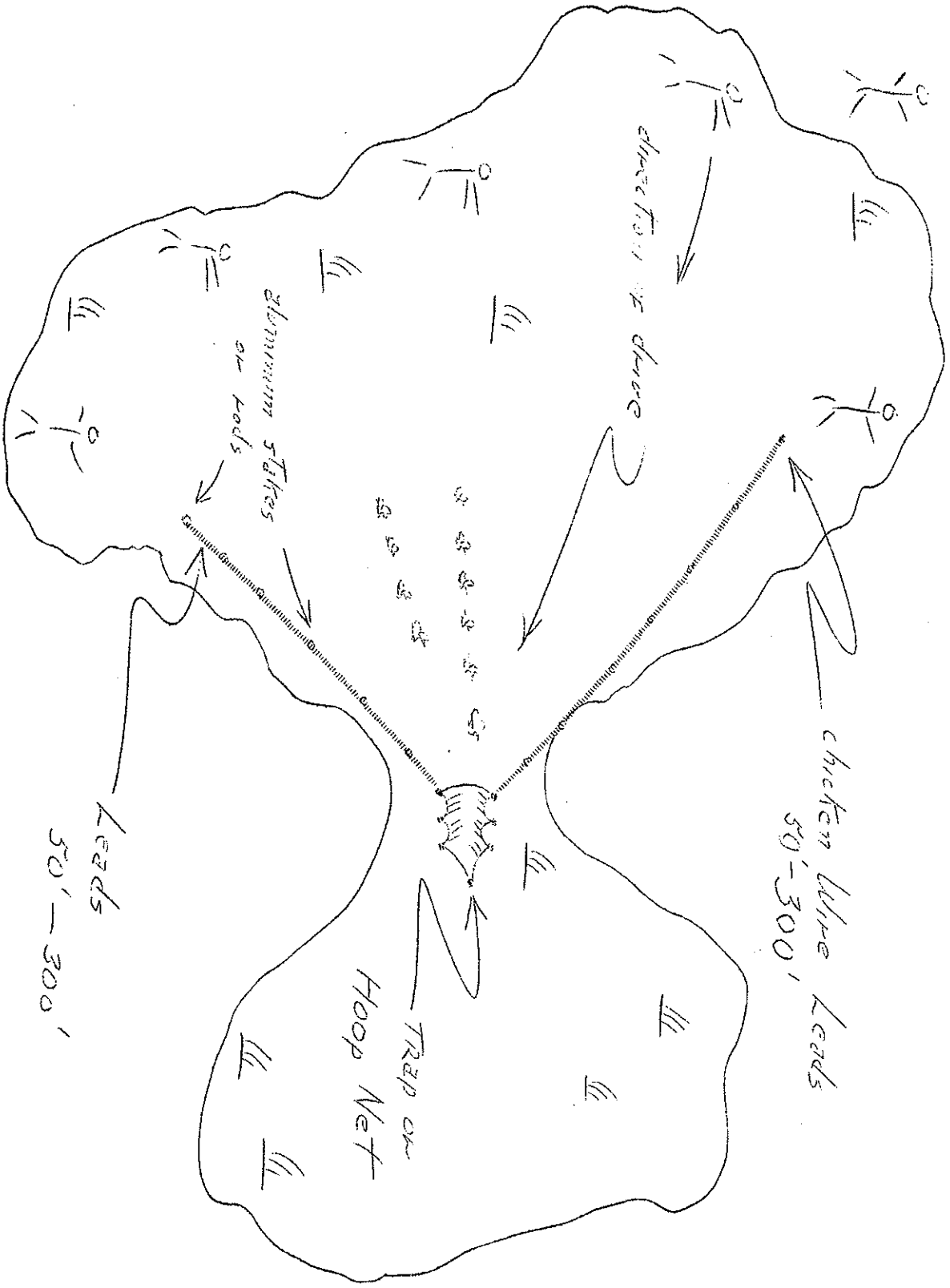

Figure 1. Diagrammatic Sketch of Trap Set and Drive to Catch Waterfowl

catch usually netted from a few dozen to several hundred waterfowl.

Two crews were originally scheduled to operate in Alberta. Crews of 4 and 5 men were soon found to operate less effectively than a combined crew of 9 men so the two crews usually worked together. From Lethbridge, in southern Alberta, the crews worked east and west across the prairies and northward into the parklands. Nesting habitat did not cover the entire area, but wet lands were usually concentrated in local areas. Chronologically, banding began on July 4, 1955 and continued via Claresholm, High River, Strathmore, Brooks, Hanna, Oyen, Coronation, Provost, and terminated at Camrose, Alberta on August 2, 1955. A total of 4,862 waterfowl were captured and banded and many ducks too young to band were released (table 1). Species composition of the ducks nesting in the areas is roughly indicated by the number of each species captured. There would be some discrepancy because some species are more difficult to capture than others; furthermore, diving species were banded when captured, but no special effort was expended to capture them. No attempt was made to capture large concentrations of moulting males because juvenile birds were desired.

Table 1. Summary of Waterfowl Bandings in Alberta - 1955.

Species	ADULTS		Total:	JUVENILES		Total:	Grand Total
Mallard	62	41	103:	253	234	487:	590
Pintail	173	187	360:	542	453	995:	1,355
Gadwall	0	2	2:	58	92	150:	152
Baldpate	3	3	6:	192	148	340:	346
BW Teal	457	90	547:	642	384	1,026:	1,573
GW Teal	51	17	68:	78	31	109:	177
Shoveller	5	6	11:	274	312	586:	597
Redhead	0	0	0:	4	7	11:	11
Canvasback	0	1	1:	1	4	5:	6
Scaup	1	4	5:	27	23	50:	55
TOTALS	752	351	1,103:	2,071	1,688	3,759:	4,862

These banded waterfowl should provide a small sample of ducks raised in Alberta. Returns from these ducks killed on down the flyways will aid in determining the percentage of juveniles harvested in 1955, and where they were killed. These data will accrue and year by year establish production-harvest data of a statistical nature upon which management and regulations must be based. The cooperative waterfowl banding program in Canada is a step in the right direction.

SOME OBSERVATIONS ON IOWA QUAIL

By M. E. Stempel*

The Iowa quail season was closed in 1916 because it was assumed that overshooting had caused a decline in the quail population.

Leopold's survey in Iowa, and six years work by Hamerstrom and Errington (1936) indicated that where in southern counties of the state there was suitable stable environment, there was a fall surplus of quail that would perish naturally if not taken by hunters.

As a result of research on the problem, in 1933 through legislation the Iowa Fish and Game Commission allowed quail hunting on 14 experimental management areas totaling 24,252 acres. The first management areas were in the counties of Appanoose, Davis, Van Buren, Jefferson, Keokuk, Monroe, Wapello and Wayne, and 132 farmers operated the land opened that season. Thirteen deputy game wardens, and 14 assistants were overseers for the first hunting. The areas were opened for periods that varied from three to ten days. There was a daily bag limit of six quail. Shooting started on November 15.

During the first controlled experiment on shooting quail it was reported that 799 coveys were flushed, and 11,145 quail were seen. Sixteen per cent of the birds flushed were reported shot. Some coveys may have been flushed more than once; it is equally possible that all coveys were not flushed. Average weight of quail was six and three quarters ounces and it took a hunter 1.8 hours to bag one quail.

By the next fall an early census with the aid of dogs revealed that the quail had recovered from the hunting, and in 1934 the management units were increased to 104 in number, and they contained a total of 257,833 acres. The size of individual areas ranged from 640 to 3,600 acres.

Since 1933 the season has been opened some time during each fall. The first hunting was on management areas in eight counties; this increased to management areas in 38 counties in 1935 when the limit of birds for the day was increased to eight per hunter. In 1936 twenty entire counties were opened for shooting from November 15 through December 15. In 1937 twelve counties were opened for the same period of time.

Since 1937 there has been a general tendency to expand the open season territory. In 1939 shooting was legal from November first to December first, and since 1943 shooting has been permitted between November first and December fifteenth. Counties having the most quail enjoy a 45 day season, and where

*Game Biologist, Ottumwa, Iowa

there are less quail, hunting is allowed for 15 days. In 1954 there were 60 counties open for hunting including both long and short season zones.

When Should the Shooting Season Begin

From earlier experience and from research done by many workers since, it is evident that the surplus quail can be safely taken by hunters. This surplus is determined by the amount of cover and food that remains in winter. The season should, therefore, be opened about the first of November when cover is at or near the maximum. Birds should be taken out in proportion to the decrease of cover.

Basis for Shooting Hours and Length of Season

Shooting hours are from 8:30 to 4:30 p.m. which allows quail to scatter from the night roost before shooting begins, and except on cloudy days, and in stormy weather this will limit shooting to the hours when quail are not gathering in the roost.

The season's shooting should be over before the storm period of winter arrives as this period causes birds to retreat to the last available woody cover that is close to food. Until this time they have been scattered in many available feeding places. During the transition period when ranges become limited, food scarce, and weather is adverse, many of the less hardy are eliminated whether or not hunting is permitted. Thus coveys are reduced naturally or by shooting to the ideal size for winter feeding, roosting and travel.

The Present Iowa Hunting Season and Bag Limits

The Iowa quail season now opens November first, and in the counties having most quail it continues through December 15. In counties having fewer birds the opening date is the same, but shooting is permitted for only 15 days. The daily bag, and the possession limit are six birds.

Hunting Pressure

During the fore part of the Iowa quail season the cover is heavy, and usually the weather is warm, therefore hunters using dogs state that they prefer to wait until a later date to do their hunting. Probably most hunting of quail occurs after November 10. Sportsmen report taking about three birds per trip per man. Those having equipment especially suited to quail shooting make about two trips per week, and there are indications that at the opening of the pheasant season, quail hunting pressure is lessened except in a few counties having both kinds of game. Hunting diminishes when a hunter must spend more than two hours per bird.

Effect of Shooting

During a 45 day season, on some areas, less than ten per cent of birds are shot while an estimated 50 per cent will be taken of other check areas. If most of the quail hatched early they are fully developed and they readily escape the dog, and the hunter, by flying long distances, and flushing wild. Late hatched young are more easily taken.

Where do Quail Survive Best

In open country where a hunter can quickly shoot in any direction, more quail will be killed than in places where open grain fields adjoin heavy brush into which birds escape. Most hunters are reluctant to hunt quail in tall brush or in timber, and when sought on brushy areas few are killed.

General Observations on Quail Survival

Quail survive because of ability to elude pursuit, and to this may be added the fact that in most neighborhoods there are some farms where hunting is strictly regulated. During most of the feeding periods the coveys are scattered, and at this time the quail are hard to find. If located when eating, birds usually are flushed in small groups, or as singles. Most hunters report that they do not shoot quail if coveys are small since most literature encourages the belief that it takes three pairs of nesting quail to successfully raise one covey of young. This is due to the fact that there is extensive destruction by man and other agencies.

Because many hunters work only the edges of coverts a certain per cent of quail are never found. When put to flight the last bird out is most certain to be shot and since this usually is a weaker bird the shooting becomes more difficult as the slower are eliminated. Where there is an unusual amount of hunting as is the case near cities, the slower are quickly shot, the others do not hold well, and they fly far when flushed. Often the hunter never sees them again. Since there is this tendency toward eliminating the unfit, hunting does have a beneficial effect.

Method of Determining Changes in the Number of Quail

The 1933 estimates on quail numbers were based on fall surveys made with the assistance of bird dogs. The percentage of increase and decrease in quail humbers is now detected by using results of conservation officer's counts of birds in selected ranges. One count is made during each of the four yearly seasons. To these statewide counts are added estimates based on work done locally by the biologist, and mail carriers also report on the number of birds seen.

Winter counts of birds assure us that there is the minimum

necessary number of brood quail. Our first indication of probably fall population comes from an early morning July count of whistling males along about 700 miles of route. In addition, the amount of hatching success during the summer is estimated after observing the number of weeks during which there is a high rate of calling by the cocks. For example, if a high rate of calling persists for a twelve weeks period that would indicate more quail hatching success than had the calling at a high rate persisted for only six weeks. A fall flush count of quail in check ranges is the final tally before opening the season. Hunter contacts are the basis for computing the take of birds.

Habitat, Weather, and Hunting Success

Throughout the nation there has been an increase of 50 per cent in land under cultivation between the years 1909 and 1919. In Iowa it is reported that from 1909 to 1919 there was an increase of 10 per cent in the amount of land under cultivation. There was a like increase between 1919 and 1949. Much of this has been due to more intensive use of land already in use. Some poorer land was abandoned. In spite of the increase of cultivation there have been some outstanding years for production of quail.

Seed stock as indicated by extensive summer counts of whistling cocks, has varied little in late years. Hunting success has varied because some falls were damp. Added to this is the fact that some late hatching seasons produced few young. Take by the hunter has therefore, varied both with the weather and with the amount of successful hatching.

Farmer Attitudes

Quail often are regarded as friendly, trusting, easily shot birds which, if not hunted, will live indefinitely. Some farmers simply do not allow hunting. Some believe that the gunner using a bird dog can quickly take every quail in the covey. It follows that sentiment against shooting is due to the fact that many rural dwellers have simply not bothered to learn whether or not some of the same management principles apply to both game and domestic stock. Often it is found that where there is little environment there is much opposition to shooting because there is not much game. Generally where there is more than a covey to the section of land there is not much sentiment against killing quail.

It must be called to attention then, that controlled hunting will not eliminate game and that wild birds seldom die of old age since 80 per cent of quail shot are less than one year old.

The well aimed charge of shot is painless. It has a training influence on the escaping members of the flock.

Many farmers know that the lives of wild animals are usually ended violently, often painfully, and they see the wisdom of a reasonable harvest of quail.

JULY COUNT OF WHISTLING QUAIL

M. E. Stempel*

The July count of calling cock quail has been carried on in Iowa since the end of World War Two. Compilation of the figures collected has resulted in not only enabling us to make summer estimates of adult populations, but the probable number of young can be established by noting for how many weeks the males call regularly at a high rate. Extended activity indicates a long and successful nesting period, and the adults calling at any given time will signify the number of old males. This male element makes up a fairly constant portion of the total quail population.

Methods

Letters of instruction for taking the census, and forms for recording results are mailed to conservation officers two weeks prior to the starting date. Officers taking the census are asked to complete the two twelve mile courses between July 10 and 23. The prominent types of soil are most heavily sampled. Roads used are at least five miles apart and in 1955 over 900 miles of route was sampled in 36 counties. The work is done in July because at earlier dates the call of other birds are a source of confusion.

Each route is started at sunup on a clear, calm day. At the beginning the checker records his car mileage, he then drives one-half mile and stops. At this point the officer will hear calling birds along the first mile. Thereafter he stops at one mile intervals, and records the number of callers.

Routes run several times during the summer by the writer reveal peak activity periods. These disclose the progress of summer nesting.

Statewide Count of Whistling Quail

Although some samples were taken earlier, most of the work was completed between July 11 and July 21. Weather was generally favorable. Rainfall was moderate. Temperatures were high but it is not believed they effected calling.

Over the entire state the population trend was upward. A nine per cent rise in calling cocks per mile of route shows a tendency toward increase: it should be mentioned, however, that this is not a great enough rise to mean a noticable increase in every part of the quail range.

The Count by Districts

To show various population densities the state is divided

*Game Biologist, Ottumwa, Iowa

into the following four areas; the south central, southeast and east central agricultural districts and the border counties which are those having limited populations of quail. Table one gives the results of the counts in the districts.

Table 1. Calling Quail Per Mile, 1954-1955.

Agricultural District	Calling Quail Per Mile 1954	1955
East Central	1.2	1.7
South Central	2.1	1.9
Southeast	2.0	2.2
Border Counties	.6	.6
State Average	1.5	1.6

Bearing in mind that this count indicates the comparative size of the population of adults present; this year the east central, the southeast and border counties increased or remained about the same while some decrease is indicated in the south central. In the southeast the increase was nine per cent, and in the east central part of the state the gain was thirty per cent. Border counties were the same as in 1954. No variation was great enough to indicate any sizeable change in the adult population. However the tendency was toward more birds per mile.

The decrease of nine per cent indicated in the south central part of the state is not great enough to be considered serious.

Counts in Individual Counties

During July 1954 and 1955 the same officers made counts of calling male quail in 24 counties and here 628 miles of route were driven. In 11 counties routes were run by the biologist or assistance was given the officers. Seven counties were censused this year that were not checked in 1954.

Of counties censused both years by the same men, 11 showed increases, three had the same counts as in 1954 and ten had less birds.

For all of the counties checked, increases were reported in Bremer, Buchanan, Clayton, Dallas, Davis, Johnson, Jones, Lee, Mahaska, Monroe, Montgomery, Polk and Scott, while Fremont, Jasper, and Louisa had the same number as last year. Adair had the most noticable drop of from 1.4 down to 0.2 birds per mile. Clark county and Henry went down about one per mile. Jackson, Jefferson, Linn, Mills, Page, Pottawattamie, Ringgold, Story, Warren and Wayne had lower counts than last year.

One hundred seventy five miles of route were run by

officers some of whom had not previously made this type of check; in this classification, within the hunting zone open previously, Dubuque, Fayette, Marshall and Winneshiek were not checked in 1954. Marshall had the high count of two birds per mile.

Officers in Woodbury, Monona and Harrison counties had reported previously that they had some good quail populations. These were first censused in 1955.

Woodbury had 0.3 of a bird per mile. This is a low count but additional spot checks revealed good localized populations. Best areas were the Missouri river breaks south of Sioux City and some places along the Little Sioux river near the town of Oto.

In Harrison county the count was higher. Calling quail were well distributed along 14 miles of route in the vicinity of Magnolia, and 14 miles near Logan. The count was 1.1 birds per mile. In comparison, Ringgold county, within the primary quail range, had 1.8 calling quail per mile.

Monona county had 1.1 birds per stop. Here there was two routes of 12 miles each: one was in the vicinity of Blencoe where calling quail were heard at every stop. On a second near Castana the count showed a fairly well distributed population though quail were not heard at all of the stops.

Duration and Intensity of Calling

In 1955 calling of cock quail began in March and was last heard in late September. Early morning calling was well established by May 30 at which time on sample routes, 50 per cent or more of potential callers were active. This feature has occurred during some good hatching seasons although in other successful brooding periods the rate of calling has not been this high by May 30. Peak of the calling occurred this year between June 1st and July 15th which is nearly the same as last year.

During the poor hatching year of 1951, however, calling was at a lower level by the same time of the month. Table 2 gives the per cent of calling quail that were active by May 31 in the years 1950 through 1955.

Table 2. Percentage of Cock Quail Calling by May 31

Year	
1950	59%
1951	16%
1952	50%
1953	31%
1954	30%
1955	60%

The summer of 1951 arrived late, and the following fall reflected the poor hatching that followed the low rate of calling that existed late in May.

In addition, during the better years of 1950, 1952, 1954 and 1955, calling by quail was at a high rate for 10 weeks or more. During the summer of 1951 the calling was at the 50 per cent or higher rate for only four to six weeks.

Summary

1. The 1955 summer count of whistling quail involved the counting of calling birds along about 900 miles of route in 36 counties.

2. Counts were made between July 11 and 21, and an upward trend in the population was shown.

3. Over the state the south central part is the only one showing a decrease.

4. Woodbury county was censused for the first time in 1955, with some good local populations indicated.

5. Harrison and Monona counties had good numbers of calling cock quail and huntable numbers of birds are present.

JULY AGE RATIO AND ROADSIDE RABBIT COUNTS 1949 - 1955

By Glen C. Sanderson*

Introduction

The Iowa rabbit population was at a low point during 1949; however, during the following two years it did appear to be recovering. In 1952, 1953 and early 1954 the majority of the rabbit surveys made in the state indicated a declining population; however, after July of the latter year, counts began to show an imporved situation. The Commission's July 1954 roadside surveys indicated a very slight increase in the population level; however, more than 91 per cent of the cooperating hunters thought that there were more rabbits during the hunting season than there were the previous year. Average hunting success increased substantially last fall. While the mail carrier roadside surveys have shown little change in the rabbit abundance the past year, with perhaps even a slight decline indicated, the Commission's February counts for 1955 indicated an increase of 82 per cent.

This report presents the results of the roadside counts made July 15-2 8, 1955 and results of the age ratio counts made during the entire month of July. A total of 2,486.6 miles was driven in 71 of Iowa's 99 counties and 1,411 rabbits were seen. From 88 counties there were 5,765 rabbits reported as to age during the month long age ratio survey.

This year dew blocks were used for the first time to measure the dew fall. Each observer was asked to put the dew block out near the start of his route the night before the rabbit count was to be made. The reading was then taken prior to the start of the survey and recorded on the data sheet.

Results

Results of the roadside drives are recorded for each county so that the figures will always be available for reference; however, for this report, only a summary of the data will be given. Averages from several counties are necessary to eliminate variations in the individual counts.

Relative population densities for the various agricultural areas, as determined by the average number of rabbits seen for each 10 miles of driving, are shown in Table 1. The figures show a statewide average of 5.67 rabbits per 10 miles. This is an increase of more than 69 per cent over the 1954 level. The results of this survey agree with both the February survey and general reports and observations that the rabbit population was at its highest level in recent years.

*Mammalogist, Formerly Marion, Iowa, now in Urbana, Illinois.

Table 2 indicates a higher rabbit population than during any of the previous five years.

Table 1. Results of the July 1955 roadside rabbit drives made by Commission personnel.

AREA	MILES DRIVEN	NO. RABBITS SEEN	R/10 MILES	% ↗ or ↘*
I	266.0	104	3.91	
II	270.4	132	4.88	
III	351.2	186	5.30	
IV	237.0	57	2.41	
V	276.3	109	3.94	
VI	340.5	189	5.55	
VII	212.0	303	14.29	
VIII	217.5	148	6.80	
IX	315.7	183	5.30	
TOTALS	2,486.6	1,411	5.67	↗69.3%

As shown by most recent surveys, the highest densities appear to be in south western and south central Iowa. In this survey the south west area had the highest indicated density, largely because of the high counts reported for Cass and Adams counties.

Table 2. A comparison of the relative population densities, 1951 to 1955, as determined by the average number of rabbits seen per 10 miles in July.

YEAR	MILES DRIVEN	NUMBER RABBITS SEEN PER 10 MILES	% CHANGE FROM PREVIOUS YEAR
1950	2,392.3	4.28	-------
1951	2,283.4	3.91	↘ 8.6%
1952	2,388.7	4.17	↗ 6.6%
1953	2,296.9	3.30	↘ 20.9%
1954	2,468.2	3.35	↗ 1.5%
1955	2,486.6	5.67	↗ 69.3%

As shown in Table 3, on the basis of these counts there appears to be a correlation between dew fall and the number of rabbits seen along the roads. More data and a more critical analysis of the information will be necessary before all the effects of dew on rabbit activity can be known. It appears that the heavier the dew fall the more rabbits are seen along secondary roads up to a dew reading of "3". At this point rabbit activity appears to decline as the dew fall increases. Perhaps with heavy dew the rabbits "sit tight" until the vegetation dries. According to these figures, this decline continues up to a reading of "8", but with this reading

and "R +/- D" (rain plus dew on the block) there was an increase in the number of rabbits seen.

Table 3. Effect of dew fall on number of rabbits seen.

"DEW BLOCK" READING	NO. OF ROUTES	NO. MILES DRIVEN	NUMBER RABBITS SEEN	RABBITS PER 10 MILES
0*	13	446.9	109	2.44
1	14	478.4	185	3.87
2	20	696.3	542	7.78
3	6	198.0	161	8.13
4	2	69.5	32	4.60
5	4	146.8	58	3.96
6	2	70.0	25	3.57
7	1	35.0	11	3.14
8	2	58.0	74	12.75
R +/- D**	3	74.0	60	6.15

* No Dew. ** Rain plus Dew.

Age ratio information collected during the month of July is shown in Table 4. There were 3.0 juveniles per adult in 1955 or 75.0 per cent juveniles compared to 2.5 juveniles per adult in 1954. The table shows that this was the highest percentage of juveniles reported during the six years the surveys have been made. The rabbits were classified as either young or adult according to size, with observers being asked to list the doubtful ones as age unknown. Perhaps many of the rabbits listed as age unknown were not observed closely enough for accurate age determination. The form for recording age ratio data should be changed in order to learn which of these are really age unknown and which were not observed well enough for age determination.

Table 4. A comparison of the July age ratios since 1950.

	RABBITS SEEN					
YEAR	ADULTS	YOUNG	NO. AGED	AGE UNKNOWN:	Juvs/Ad	%Juvs.
1950	1,635	3,528	5,163	387 (7.0%)	2.2	68.3
1951	1,692	3,333	5,025	438 (8.7%)	2.0	66.3
1952	1,242	3,223	4,465	517 (10.4%)	2.6	72.2
1953	1,240	3,009	4,249	410 (8.8%)	2.4	70.8
1954	1,349	3,372	4,721	597 (11.2%)	2.5	71.4
1955	1,443	4,322	5,765	565 (8.9%)	3.0	75.0

SUMMARY

1. Results of the July 1955 roadside rabbit drives made by Commission personnel are presented.

2. Nearly 2,500 miles were driven in 71 counties during the survey and 1,411 rabbits were seen.

3. There was a statewide average of 5.67 rabbits per 10 miles of driving.

4. According to this survey, July rabbit populations were nearly 70 per cent higher in 1955 than they were in 1954.

5. Nearly 5,800 rabbits from 88 counties were reported as to age during the month of July.

6. There were 3.0 young per adult reported for July compared to 2.5 for 1954. This is the highest percentage of juveniles per adult reported for any of the past six years.

7. On the basis of information collected this year, it would appear that the possibilities are good for the highest rabbit population this fall than we have had during the past six years.

FACTORS AFFECTING ANGLING IN NORTHEAST IOWA STREAMS

By R. E. Cleary*

One of the fundamental problems facing fisheries technicians and conservationists is, and always has been, how to promote or insure an adequate angling harvest. Toward the solution of this problem restrictive measurements have been enacted and enforced and subsequently liberalized. Fish have been stocked, conditions improved in lakes and streams, undesirable species removed, and other managerial manipulations attempted. Studies on life histories, factors promoting growth and well-being, and population estimates have been conducted. Through the various information media, the angling public has been informed, cajoled and instructed. And yet no one has ever come up (and probably never will) with the answer to what it takes to consistently catch a fish. In an age of subsidies, parities and guaranteed wages, this does not set so well with the angling public.

Admittedly, there have been numerous investigations on what it takes to promote good fishing. One can fish by moon phases, time of day, days of the week or month; fish by temperature, dissolved oxygen, and when the fish are most active. The trouble is that the results of many of these investigations have been based on techniques not normally used by the angler, and those which have been based on angling results either lack public acceptance or do not work to the advantage of the angler on a consistent basis. The human element in these techniques is evidently incapable of being assayed and worked into the technique as an integral part.

Specifically, a trained investigator can take great numbers of fish with nets, poison, electro-fishing devices, etc. Since he himself has never seen so many fish at one time and not being able to consieve the actual numbers present, he concludes that there is a great abundance of fish in a given body of water; that his job and that of the conservation agency for which he works is over; and that is now up to the fisherman. He has done all he can; he has proved to himself, at least, that the fish are there---if the angler can't catch them, it must be the angler's fault. The reasoning is logical when estimations of 20,000-plus catfish per mile of stream are available, and when 350-plus adult trout per mile are left in a "fished out" stream in the fall. The only trouble is that additional reasoning or rationalization along these lines fails to explain why those fish won't "bite" or can't be taken by anglers. How many fish does it take to make good fishing? If numbers are no criteria, then what factors, aside from the human element, promote or inhibit successful angling? In this business of promoting or inhibiting factors the investigator is groping in the dark since there are so many unknowns, the

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complete physiology of fish being a little-understood science.

To the solving of this abstraction, an effort was made to determine whether or not catch statistics secured in netting surveys were in any way comparable to river angling statistics. At the same time, an effort was made to determine whether any "cause and effect" relationships could be observed between certain climatic factors and catches made by river anglers over a five-year period.

Table 1 gives a comparison between netting and angling catches of catfish on an area-wide basis, while Table 2 refines the coverages and deals specifically with catch comparison on certain rivers. Statistics on catfish were used in this comparison because of a preponderance of data on catfish populations as compared to other river species.

Table 3 is the "shotgun treatment" of the effect that two basic climatic factors, air temperature and precipitation, have on seasonal catches of certain river species. The climatic data used give an area average based on information gathered at 31 weather stations in northeast Iowa. The angling data come from a modified voluntary creel census conducted on northeast Iowa streams.

Tables 4 through 7 are more specific treatments of the comparison between annual angling success of certain species and these climatological data. Instead of using eight months' data, a normal angling year, we have attempted to "fix" a comparison using the data of the best three months for fishing based on a five-year average, and the best three months during the year they occurred, the latter being a more concise treatment of the angling data than the former.

Tables 1 through 7 are found in an appendix to the text of this paper. There are notes under each table giving the pertinent facts about the comparison or relationship.

Briefly stated, there was no comparison between angling and netting catches of channel catfish in this study, indicating that the treatment of the data was on too broad a scope, or there are certain groups of fish specific to certain gear only, i.e. those that can be taken by hook and line and those which will enter fixed entrapment devices. At the same time, it may be that available numbers are no critera in determing angling success. There is, however, a rough comparison between fluctuations in the average size of catfish taken by angling and netting. Certain rivers are more positive in this comparison than others.

From these data it was evident that during this series of angling years there was little apparent relationship in the fluctuations of general angling success and average monthly temperature during the "open water" months of April to November.

It seemed apparent that precipitation during the "open water" months has direct relationship on trout fishing only. Evidently the more turbid conditions, the result of heavier than average rainfall, make the trout more susceptible to angling.

Each species of fish reacts differently to temperature and rainfall. These relationships are discussed in the notes under Tables 4-7.

Although much of the results of this investigation is negative, there are indications that renewed emphasis should be placed on gathering more accurate and more copious catch statistics. Perhaps then a comparison between netting and angling harvest will be more apparent; and other factors suspected of influencing angling success will show a more obvious relationship.

Table 1 - Comparison Between Angling and Bait Net Catches of Catfish in Northeast Iowa Rivers, 1952-1954.

Date	No./Rod Hr.	No./Net Hr.	Lbs./Rod Hr.	Lbs./Net Hr.	Av.Wt.Fish Angling	Av.Wt.Fish Nets
1952	.61	.54	.83	.21	1.36	.40
1953	.67	2.03	1.01	.42	1.44	.21
1954	.69	1.09	.94	.26	1.37	.24

Notes on Table 1---
1. No comparison between No./Rod Hr. and No./Net Hr.
2. There is a general trend of comparison between Wt./Rod Hr. and Wt./Net Hr., but fluctuations are more violent in the latter.
3. No comparison between average weight of fish taken by angling and by netting.

Table 2 - Comparison Between Angling and Bait Net Catches of Catfish on Certain Rivers in Eastern Iowa.

River	No./Rod Hr.			No./Net Hr.			Av. Wt. in Lbs. Angling			Av. Wt. in Lbs. Netting		
	'52	'53	'54	'52	'53	'54	'52	'53	'54	'52	'53	'54
Cedar	.60	.69	.64	.13	.48	.50	1.40	1.22	1.35	.56	.42	.46
Wapsie	.66	.60	.60	.82	4.06	1.82	1.30	1.60	1.50	.36	.18	.20
Iowa	.47	.56	.68	.66	1.29	1.06	1.31	1.64	1.20	.38	.13	.20

Notes on Table--2
1. There seems to be little, if any, comparison on any of the rivers in numbers caught per rod hour and numbers caught per net hour.
2. There is a good comparison between average size of fish taken in bait nets and angling on the Cedar River. No comparison on the other two rivers---in fact they present an inverse picture.

Table 3 - Comparison Between Seasons' Angling Take of Certain Species of Fish and Some Climatic Factors in the Streams of Northeast Iowa, 1950-1954.

Item	1950	1951	1952	1953	1954
1. Av. Monthly Temp., April-Nov.	57	56	59	60	60
1a. Av. Monthly Temp., Sept.-Nov.	51	46	49	54	52
2. Av. Monthly Prec., April-Nov.	3.2	4.3	2.6	2.7	3.8
3. No. Catfish/Rod Hour	.70	.57	.61	.67	.69
4. No. Trout/Rod Hour	1.22	1.35	1.18	1.28	1.07
5. No. Smallmouth Bass/Rod Hour	.62	.48	.48	.65	.67
6. No. Crappie/Rod Hour	1.20	1.65	1.56	2.04	2.40

Notes on Table 3 --
1. No "cause and effect" relationship between Item 1 and Items 3, 4, 5, and 6.
2. Fair "cause and effect" relationship between Item 2 and Item 4.
3. Fair "cause and effect" relationship between Item 2 and Items 3 and 5.
4. No "cause and effect" relationship between Item 2 and Items 3 and 5.
5. Good "cause and effect" relationship between Item 1a and Items 3 and 5.

Table 4 - Comparison Between Some Climatic Factors and Angling Success for Catfish in Northeast Iowa Streams, 1950-1954.

Item	1950	1951	1952	1953	1954
1. No. Catfish/Rod Hour	.70	.57	.61	.67	.69
2. Av. Temp. for 3 "Best Months Based on Five-year Average	65	66	68	68	68
3. Av. Precip. for 3 "Best" Months Based on Five-year Average	5.2	5.0	4.0	4.2	4.2
4. Av. Temp. for 3 "Best" Months in each Calendar Year	65	67	69	68	66
5. Av. Precip. for 3 "Best" Months in each Calendar Year	5.2	5.0	2.7	4.3	4.4

Notes on Table 4 --
1. Inverse "cause and effect" relationship between Items 1 and 2.
2. Direct "cause and effect" relationship between Items 1 and 3 except for 1951.
3. Fair inverse "cause and effect" relationship between Items 1 and 4.
4. No "cause and effect" relationship between Items 1 and 5.

Table 5 - Comparison Between Some Climatic Factors and Angling Success for Trout in Northeast Iowa Streams, 1950-1954.

Item	1950	1951	1952	1953	1954
1. No. Trout/Rod Hour	1.22	1.35	1.18	1.28	1.07
2. Av. Temp for 3 "Best" Months Based on Five-year Average	66	64	69	69	69
3. Av. Precip. for 3 "Best" Months Based on Five-year Average	3.5	4.5	3.0	2.9	5.0
4. Av. Temp. for 3 "Best" Months in each Calendar Year	66	58	68	64	70
5. Av. Precip. for 3 "Best" Months in each Calendar Year	3.5	4.0	3.8	2.1	3.7

Notes on Table 5--
1. No "cause and effect" relationship between Items 1 and 2.
2. First 3 years show some "cause and effect" relationship but not 1953 or 1954 between Items 1 and 3.
3. Good inverse "cause and effect" relationship between Items 1 and 4.
4. Same relationships as in Item 2 between Items 1 and 5.

Table 6 - Comparison Between Some Climatic Factors and Angling Success for Smallmouth Bass in Northeast Iowa Streams, 1950-1954.

Item	1950	1951	1952	1953	1954
1. No. Smallmouth/Rod Hour	1.62	.48	.48	.65	.67
2. Av. Temp. for 3 "Best" Months Based on Five-year average	67	66	69	70	70
3. Av. Precip. for 3 "Best" Months Based on Five-year Average	3.1	4.3	2.7	2.8	3.7
4. Av. Temp. for 3 "Best" Months in each calendar year	63	66	69	70	70
5. Av. Precip. for 3 "Best" Months in each calendar year	2.8	4.3	2.7	1.3	3.7

Notes on Table 6--
1. Fair "cause and effect" relationship between Items 1 and 2 with exception of 1952.
2. Fair "cause and effect" relationship between Items 1 and 3 with exception of 1951.
3. No "cause and effect" relationship between Items 1 and 4.
4. No "cause and effect" relationship between Items 1 and 5.

Table 7 - Comparison Between Some Climatic Factors and Angling Success for Crappie in Northeast Iowa Streams, 1950-1954.

Item	1950	1951	1952	1953	1954
1. No. Crappie/Rod Hour	1.20	1.65	1.56	2.04	2.40
2. Av. Temp. for 3 "Best" Months Based on Five-year Average	56	54	50	61	61
3. Av. Precip. for 3 "Best" Months Based on Five-year average	2.8	4.3	3.7	3.0	4.2
4. Av. Temp. for 3 "Best" Months in each Calendar Year	61	59	51	52	61
5. Av. Precip. for 3 "Best" Months in each Calendar Year	3.9	5.7	1.9	2.5	3.5

Notes on Table 7--

1. No "cause and effect" relationship between Items 1 and 2.
2. Fair "cause and effect" relationship between Items 1 and 3 with exception of 1953.
3. No "cause and effect" relationship between Items 1 and 4.
4. Fair "cause and effect" relationship between Items 1 and 5.

LAKES CREEL CENSUS FOR 1955

By E. T. Rose

One of the major recommendations of the Iowa Twenty Five Year Conservation Plan (1933) for fisheries was a determination of angling success in the lakes of this state. As a result, the Iowa Conservation Commission has conducted creel censuses on several lakes annually since 1944. These provide a means of comparison from season to season in evaluating harvests, populations, management practices and trends which otherwise would not be feasable.

The 1955 census was conducted on a somewhat expanded scale over previous years and was operated under the Dingell-Johnson program. Previously census clerks obtained their data by contacting as many shore and boat fishermen as possible and recorded the catch records separately on field forms. These were then tabulated by the Biology personnel with an adding machine. This year four categories of fishermen were considered instead of the former two. Anglers were divided into shore, dock, wader and boat types and the field records of angler catches transferred to I.B.M. cards after each day's work. These were machine tabulated in 10 day intervals providing total catch for each species per day together with the total angler contacts and hours fished in each category. These were further tabulated to include total catch and hours fished of all anglers in the four types of contacts. The 10-day grand totals of each species, all species combined, total anglers and their hours of effort provided basic comparative data with past years. From the daily totals, catches of fish in each category were later obtained by using an adding machine. This was overlooked in setting up the project with the I.B.M. Company and can be incorporated in the future as well as the tabulation of species composition of these catches.

No attempt was made to determine total harvest data by using statistical methods. In this, data from a small number of completed fishing trips is expanded to include a calculated total number of anglers using the lake. Further study of the methods in use in other states will continue and perhaps some system adopted that is practical for Iowa.

This year the census was conducted on Spirit, East and West Okoboji, Clear, Storm, Blackhawk, Lost Island and Rock Creek lakes. The census period reported here extended from May 15 to July 15. This sixty day period includes one of the best seasons of the year for angling in the Iowa lakes. A consideration of the record for each of the above lakes is outlined in the following discussion.

*Fisheries Biologist, Spirit Lake, Iowa

Spirit Lake

This is Iowa's largest natural lake and is one of the most important fishing areas in the state. The record of the catches made at this lake in the sixty day period--May 15 to July 15 is included in Table 1, together with the similar summaries from the other lakes censused in this period.

Fishing pressure was considerably greater this season with over 10,000 angler contacts being made by the census clerk. This is the fourth highest number in the eleven years of census and the highest since voluntary reports were discontinued in 1952. The total recorded catch of 38,847 fish was also the best since 1952. Most significant is the average catch per hour of 1.34 which is the highest since 1951. The main species caught this season were bullheads, perch, and walleyes. The lack of good reproduction this year reduced forage and had undoubtedly caused the increased success.

Table 1. Lakes Creel Census Summaries, May 15 to July 15, 1955.

LAKE	SPIRIT	WEST OKOBOJI	EAST OKOBOJI	CLEAR	STORM	BLACKHAWK	LOST ISLAND	ROCK CREEK	TOTAL OF ALL LAKES
CRAPPIE	1,397	651	1,429	2,842	938	1,007	11	35	8,310
PERCH	5,640	1,957	1,005	545	168	78	96	0	9,489
N. PIKE	214	346	41	166	1	8	72	0	848
L. M. BASS	406	107	31	49	1	62	0	958	1,614
WALLEYE	4,679	2,351	3,265	417	50	283	33	0	11,078
S. M. BASS	0	229	0	0	0	0	0	0	229
BULLHEAD	25,538	4,439	17,619	15,632	1,541	4,281	13,500	596	83,146
WHITE BASS	260	395	417	0	136	31	0	80	1,319
BLUEGILL	593	1,723	248	7,369	2	263	0	4,663	13,861
YELLOW BASS	0	0	0	15,160	0	0	0	0	15,160
CHANNEL CAT.	0	0	0	14	122	401	0	0	537
SHEEPSHEAD	120	435	355	0	0	0	0	0	910
CARP	0	0	0	0	0	537	8	0	545
ROCK BASS	0	0	1	0	0	0	0	0	1
SEASON TOTALS	38,847	12,633	24,411	42,194	2,959	6,951	13,720	6,332	146,818
TOTAL ANGLERS	10,432	4,687	6,655	14,281	3,252	7,068	2,673	7,741	56,789
TOTAL HOURS	28,943	10,750	18,493	39,314	8,339	17,264	8,013	17,946	149,062
AVERAGE FISH/HOUR	1.34	1.18	1.32	1.07	0.35	0.40	1.71	0.35	0.98

Table 2 includes the record of fishing by the four categories. As indicated by the catch-per-hour, dock fishermen were the most successful. Boat fishermen caught the most fish; however, their average catch-per-hour was the lowest.

Table 2. Record of catch by categories, Spirit Lake, Iowa.

Type	No.Fish	No.Anglers	No.Hours	Av.Fish/Man	Av.Fish/Hour
Shore	7,524	2,308	5,430	3.26	1.39
Dock	5,673	1,361	3,641	4.17	1.56
Wader	349	112	245	3.12	1.42
Boat	25,301	6,651	19,627	1.28	1.29
Totals or Average	38,847	10,432	28,943	3.72	1.34

West Okoboji

Seasonal totals of the creel census on this lake are included in Table 1. Fishing was much improved this year for the walleye, perch and bluegill fishermen. Many comments have been received, mostly complementing the increased stocking effort made by the Commission. Explanations that this has remained basically the same for many years is difficult for many to comprehend.

As in Spirit Lake, a considerable increase in fishing pressure was apparent. A total of 4,687 contacts of anglers was made this season--more than twice as many as last year's similar period and nearly twice as many fish were caught this year. The average catch-per-hour remained about the same as last which was the highest in the ten years of census work. Species showing the most improvement in catch were walleyes, perch, smallmouth bass, white bass and bluegills.

The record of the angler's catches in the four categories is included in Table 3. Waders had the greatest success per unit effort but caught the least fish. As in Spirit Lake, boat fishermen caught the most at the lowest rate.

Table 3. Record of catch by categories, West Okoboji, Iowa.

Type	No.Fish	No.Anglers	No.Hours	Av.Fish/Man	Av.Fish/Hour
Shore	968	258	599	3.75	1.61
Dock	2,572	1,182	2,160	2.18	1.19
Wader	190	66	108	2.88	1.76
Boat	8,903	3,181	7,883	2.80	1.13
Totals or Average	12,633	4,687	10,750	2.70	1.18

East Okoboji

This is the eleventh season of creel census work on this lake, and the third in which no voluntary reports have been included. As in the above lakes, fishing pressure was increased this year, with nearly 7,000 angler contacts in the sixty day period. This number was exceeded only in 1946 (included voluntary reports from liveries). The record of the 1955 season's angling is included in Table 1.

This season the walleye catch of 3,265 is a vast increase over the eleven year average of 1,847. There were no significant changes in other species except in the white bass which had a 63 per cent increase over last year.

As indicated in Table 4, the few waders that used the lake had the greatest success per unit effort. Most of the waders fish the lake prior to May 15 for crappies; however, after this period crappie move out of the shallows and anglers use the docks and boats.

Table 4. Record of catch by categories, East Okoboji, Iowa.

Type	No.Fish	No.Anglers	No.Hours	Av.Fish/Man	Av.Fish/Hour
Shore	3,222	1,120	2,998	2.88	1.07
Dock	2,310	716	1,556	3.23	1.48
Wader	242	42	79	5.76	3.06
Boat	18,637	4,777	13,860	3.90	1.34
Totals or Average	24,411	6,655	18,493	3.67	1.32

Clear Lake

This is the eighth season of census on this lake, including the third in which all records are from personal contact of anglers on the lake. Nearly five times as many anglers were contacted than in the 1954 season and more than three times as many as in 1953. This further indicates the increasing number of anglers using the Iowa lakes and the importance of providing good angling. The catch statistics for this lake are included in Table 1. The 42,194 fish recorded is considerably above the previous seven year average of 25,789. This was a banner season for the yellow bass and bluegill anglers who caught more than in any previous period on record. The catch of bullheads was very good, the record considerably exceeding the 7 season average. Declines were noted in the walleye and northern pike catches, the latter doubtless reflecting a decreasing population.

The best success per unit effort was had by waders with 2.38 fish-per-hour. This was doubtless due to the yellow bass and bluegill angling which was superb at Clear Lake this summer. The record of the four categories is included in Table 5.

Table 5. Record of catch by categories, Clear Lake, Iowa.

Type	No.Fish	No.Anglers	No.Hours	Av.Fish/Man	Av.Fish/Hour
Shore	694	457	863	1.51	0.80
Dock	9,217	3,840	7,862	2.40	1.18
Wader	2,132	507	896	4.20	2.38
Boat	30,151	9,477	29,693	3.11	1.02
Total or Average	42,194	14,281	39,314	2.95	1.07

Storm Lake

Anglers had the poorest season in the nine years of census at this lake. The record is included in Table 1. While game fish populations are deemed adequate to provide good angling, it is doubtful that sifnificant improvement will be made until adequate gizzard shad control measures are instituted. Experimental selective poisoning is a possibility and apparently about the only available resort. This lake is too large to permit adequate seining for shad control even if this method proved suitable. Only fifty walleyes were recorded caught this year as contrasted with 3,700 last season and since the

species is important here, much need for intensive management is indicated.

Dock fishermen had the best success (?) with 0.69 fish per hour being taken. Table 6 includes the catches by each type.

Table 6. Record of catch by categories, Storm Lake, Iowa.

Type	No.Fish	No.Anglers	No.Hours	Av.Fish/Man	Av.Fish/Hour
Shore	1,230	1,401	3,358	0.81	0.36
Dock	1,484	827	2,141	1.79	0.69
Wader	10	32	79	0.30	0.13
Boat	235	992	2,761	0.24	0.09
Totals or Average	2,959	3,252	8,339	0.91	0.35

Lost Island

The census here was conducted on a part-time basis, the clerk working every third day and all holidays with assistance from the local Conservation Officer, Harold Johnson. Bullhead angling was fairly good; however, the vast population of small bullheads made it difficult to catch larger fish. The census record is included in Table 1 and Table 7 contains the catch by categories indicating that boat fishermen were most successful.

Table 7. Record of catch by categories, Lost Island Lake, Iowa.

Type	No.Fish	No.Anglers	No.Hours	Av.Fish/Man	Av.Fish/Hour
Shore	4,352	1,332	3,294	3.27	1.32
Dock	41	10	25	4.00	1.64
Wader	0	0	0	0.00	0.00
Boat	9,372	1,331	4,694	7.00	1.99
Totals or Average	13,720	2,673	8,023	5.13	1.71

Blackhawk Lake

Another poor season was experienced by anglers at this lake. The chronic complaint, "shaditis", is continuing to fulfill the usual prognosis. The department's intensive management practices of seining and heavy predator stocking has largely failed to curb shad densities sufficient to produce better angling. Game fish populations are high; however, until substantial reductions in forage can be achieved minimal angling success is indicated. If selective poisoning is contemplated this lake would probably be as well adapted as any in the State for the project. The catch record for the season is included in Table 1, and the category record in Table 8 which shows a slight advantage for the shore fishermen.

Table 8. Record of catch by categories, Blackhawk Lake, Iowa.

Type	No.Fish	No.Anglers	No.Hours	Av.Fish/Man	Av.Fish/Hour
Shore	6,374	6,315	15,462	1.00	0.41
Dock	384	474	1,058	0.81	0.36
Wader	78	79	220	1.00	0.35
Boat	115	200	524	0.58	0.22
Totals or Average	6,951	7,068	17,264	0.98	0.40

Rock Creek Lake

This is a new artificial lake, the largest in Iowa, covering approximately 650 acres. It is located in Jasper County, within easy driving distance from several urban areas including Des Moines, Marshalltown, Newton and Grinnell. Since this was the first season for angling in the lake a fairly comprehensive census was desired to determine angler and management success.

The lake was opened for fishing on May 30, with the expected mad influx of anxious bass fishermen present who for the most part expected and obtained some phenomenal fishing. A total of 535 largemouth were recorded caught the first day. At the end of the first four days a total of 694 had been recorded. At the end of the census season on July 15, a total of 958 bass had been tallied. Thus, 55 per cent of all the bass taken were caught the first day. None of the ten-day summaries indicated good fishing, ranging from a low of 0.18 to 0.68 fish-per-hour. The season's record included in

Table 1. Boat fishermen had the best success, averaging 0.56 fish-per-hour and shore fishermen caught the most fish at the slowest rate--0.18 per hour. These data are included in Table 9.

Table 9. Record of catch by categories, Rock Creek Lake, Iowa.

Type	No.Fish	No.Anglers	No.Hours	Av.Fish/Man	Av.Fish/Hour
Shore	1,763	4,789	9,537	0.39	0.18
Dock	5	4	14	1.25	0.36
Wader	100	174	409	0.58	0.24
Boat	4,464	2,771	7,986	1.61	0.56
Totals or Average	6,332	7,738	17,946	0.81	0.35

Conclusion

This year's annual report of angling in Iowa lakes covered a period from May 15 to July 15, on seven natural and one new artificial lake. This census was fifteen days longer than formerly due to the new program of operation under the Dingell-Johnson program. Comparatively the fishing was quite similar to last year, with good catches in the major lakes, Spirit, Okobojis, Clear and Lost Island. Poor results were expected and prevailed in Storm and Blackhawk lakes due to the gizzard shad problem. All data were tabulated by I.B.M. Their reports had numerous errors that were difficult to determine and very time consuming.

A total of 146,818 fish were recorded caught from the eight lakes by 56,789 anglers who were contacted on the lakes. These fishermen had spent 149,062 hours angling for an average of about one fish per hour--exactly the same as in 1954; however, the fishing pressure was 65 per cent greater in 1955 as indicated by comparative total hours. As usual, bullheads were the most abundant species in the catch in most of the lakes with 56 per cent of the total catch recorded in this species. Yellow bass, bluegill, walleye, perch and crappie followed in importance respectively.

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DES MOINES RIVER CREEL CENSUS 1955

By Harry M. Harrison*

In 1953 a project relating to angling success of the Des Moines River fisherman was added to the investigations being pursued on that body of water. The census techniques used and the results obtained for 1953 and 1954 have been presented in previous seminars. This paper summarizes a part of the data for 1955 and compares it to some of the information secured during the other years of the study.

To review briefly, the techniques used are as follows: Conservation Officers and members of the Biology Section interview anglers on the river at various times during the fishing season, and question them with respect to what they have caught, how long they have fished, the bait used and the principal species sought. In addition, the date, time and place fished is logged for each contact.

The information thus assembled is summarized each year and this, in turn, is compared with that of the previous seasons of study. The technique employed is, then, a sampling method which, at best, shows only trends in fishing success and does not in any way project totals.

For comparisons, the data collected by the Biology Section and that of the Conservation Officers are handled separately. The fact that the officer contacts are made at quite regular intervals and in the same territories gives a stream-and-season wise picture of the fishing success. Because other endeavors prevent continued attention to creel census, such a picture is not possible from the census taken by the Biology Section.

The catch statistics gathered by Biology personnel are given in Tables 1 and 2. Table 1 summarizes the total number of contacts made each year, together with the total hours fished, total fish caught and fish caught per rod hour. Table 2, on the other hand, shows the rate of catch by species for the three years.

Table 1. Rate of catch of fish from the Des Moines River for 1953, 1954 and 1955 from a census conducted by Biology Section personnel.

Year	Fishermen Contacted	Total Hrs. Fished	Total Fish Caught	Fish Caught Per Rod Hr.
1953	884	1,847	1,142	.61
1954	648	1,421	1,073	.75
1955	797	1,588	581	.37

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Table 2. A comparison of the species of fish caught from the Des Moines River in the Biology Section census for the years 1953, 1954 and 1955.

Species	1953		1954		1955	
	884 anglers fishing		648 anglers fishing		797 anglers fishing	
	1,847 hours fishing		1,421 hours fishing		1,588 hours fishing	
	No. Caught	Caught/hr.	No. Caught	Caught/hr.	No. Caught	Caught/hr.
Catfish	602	.33	424	.29	200	.13
Carp	237	.13	150	.11	265	.16
Bullhead	141	.08	407	.28	68	.04
Walleye Pike	61	.03	25	.02	2	xxx
Crappie	45	.02	36	.03	13	.01
N. Pike	49	.02	3	xxx	3	xxx
Misc.	7	xxx	28	.02	30	.02
Tot. or Aver:	1142	.61	1073	.75	581	.37

Beginning with the 1953 season, Table 1 reveals the rate of catch to be .61, .75 and .37 fish per rod hour in that succession for the years of study. Attention is invited to the fact that in the previous report on this project it was pointed out that the increased rate of catch for 1954 over 1953 developed largely from a local situation near Humboldt, where, for approximately three days, bullheads were caught in exceptionally large numbers. Had it not been for this, the angling success for the two years would have been at about the same level; this, a figure close to .60 fish per rod hour.

Coming now to 1955, Tables 1 and 2 show a considerable drop in fishing success. The factors contributing heavily to this reduced catch are believed to have resulted from the prolonged drought of this summer, accompanied by falling stages and unusually high water temperatures. With respect to the reduced water stage, the upper reaches of the stream were nearly dry, and fishing was at a minimum. In the other years these areas produced the best fishing in the entire river and, with their loss, the fishing success for the present season in the Des Moines River suffered considerably.

Game fish losses ascribed to unusually high water temperatures were wide spread in Iowa during the summer. In Table 2 it will be noted that the game fish catch was at a much reduced rate in 1955. It seems very possible that if water temperatures were high enough to kill fish, the same situation would most certainly have a depressing effect upon their feeding activity and, consequently, the rate of catch would be influenced likewise.

During 1955, Conservation Officers along the Des Moines River turned in 1,919 fisherman contacts. Because of obvious discrepancies in some of these contacts, it is not possible

to report upon this part of the project at this writing.

In addition to that part of the creel census involving rate of catch, information concerning the length of time fished per trip, the number of fishing trips made per week, the value of tackle being used and the distance traveled on each excursion, was compiled for most of the contacts made by the Biology Section. Due, however, to certain biases that arose in summarizing the data, averages were not considered valid. As a consequence, the data are presented in block form. By topics, the information secured, follows:

Length of time fished per trip: At the time of contact, fishermen were asked how long they had fished and, in addition, how much more time they expected to continue fishing on that trip. Of 466 replies, 106 said that they would fish less than two hours on that particular excursion; 129 were going to fish two to three hours; 72, three to four; 60, four to five; 45, five to seven; 39, seven to ten; and 15, over ten hours.

Number of fishing trips per week: During the census 678 anglers were asked how many times they fished each week. Seventy-two contacts professed to fish every day; nine fished six times a week; thirteen, five times; thirty, four times; 81, three times; 160 fished twice and 158, once. Sixty went fishing twice a month, while 67 reported that they fished once a month. Ten individuals fished three times a year, 8 twice, and ten others fished once each year.

With the exception of those contacts that reported fishing every day the figures show a reasonable progression to one or two fishing trips per week, and this, in turn, is followed by similar regression to those anglers that fish only once every year. Just why over 10 per cent of the contacts reported that they fished every day is not understood. Nonetheless, that figure is considered to reflect a considerable bias.

Value of Tackle: During the time of interview, an estimate was made of the "on the spot" value of the equipment being used. These estimates are subject to some error, but in every case they were held toward the conservative. In all, 526 appraisals were made and, of these, 144 outfits were considered to be worth less than five dollars. One hundred sixty-five rigs were appraised between five and ten dollars; 171 between 10 and 20; 41 between 20 and 50; and five outfits in excess of 50 dollars. The most expensive gear was surmised to be worth approximately 300 dollars. Only in sight equipment was appraised and in addition to actual fishing gear, such things as boats, motors, tents, car-top carriers, etc. were included.

Round-trip distance traveled: Four-hundred forty-eight parties were interviewed with respect to the round trip distance between the port of fishing and their residences.

Of these, 173 parties traveled less than five miles; 103, from five to ten miles; 96, eleven to twenty-five; 53, twenty-six to fifty; 21, fifty-one to one-hundred; and two parties had traveled over 100 miles to fish the Des Moines River. As a point of interest the greatest distance traveled was just short of 400 miles. The figures show that the bulk of the fishing is local, but, on the other hand, the Des Moines River attracts a few fishermen from considerable distances.

THE OCCURENCE OF BLINDNESS IN THE BULLHEAD POPULATION OF EAST OKOBOJI LAKE, IOWA

By Jim Mayhew*

In 1954, during the early summer bullhead fishing there were several reports of blind bullheads being caught in East Okoboji. Eventually one of these specimens was brought to the laboratory for examination. Blindness of course, is not uncommon in fishes, but this was apparently due to the complete absence of functional eyes. With evidence pointing to the fact that this blindness was rather common, special attention was given the bullheads taken during the annual fisheries survey of the lake. During 1954, in six seine hauls, 2,753 bullheads were examined and 27 blind individuals taken. One additional specimen was caught in Upper Gar lake, which is connected with East Okoboji on the south.

This year special attention was again given to the bullheads taken during survey. In six seine hauls 1,753 young-of-the-year, 2,166 sub-adults, and 3,646 adults were captured. Of these, 31 adult sightless fish were obtained. The blind and normal fish were easily separated since the skin of the non-seeing individuals is very heavily pigmented which makes them appear much darker than usual. Approximately ten more were reported in anglers catches by the creel census clerk.

Fourteen blind bullheads were preserved or frozen in an effort to determine, (1) the cause of the apparent lack of functional eyes, (2) the age and growth in comparison to normal bullheads, and (3) the condition or "K" factors of the normal and blind fish to determine if the blindness had effected feeding habits enough to alter the physical well-being of the fish.

Examination of the Eye

Several blind fish were examined by dissecting the eye in an effort to determine the cause of the blindness. A binocular dissecting microscope was used for examination of the internal eye. A normal eye was also examined for comparative purposes.

The eye of the blind bullhead is covered with a thick layer of epidermis similar to that of the body. Apparently this replaced the lens and cornea since neither could be located. The optic nerve was well contained within the optic stalk and appears normal. Muscles of the eye appear functional. Internally the eye is heavily pigmented and when dissected the pigment appears as a dark mass in the center of an abnormal cartilagenous sclera. The vitreous fluid of the eye is much less viscous than normal.

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Age and Growth

The pectoral spine cross section method as described by Sneed (1950) and the vertebral method used by Lewis (1949) were employed in aging the blind bullheads. Only the pectoral spines were used in calculating growth rate. In the assessment of age there was no discrepency between the two methods.

As in most studies, microprojection was used to enlarge the spine image, and the annual growth marks transposed on paper tagboard strips. The standard length at the end of each year of life was then computed by the use of a nomograph.

All the blind bullheads possessed four annual growth "rings" or belonged to the 1951 year class. The average calculated standard length from the first to the fourth year was 2.4, 5.3, 6.6, and 7.6 inches. This can be compared with the findings of Lewis (1950) at Red Haw Hill Lake, Iowa where the average total length was 5.1, 7.1, 10.2, and 14.8 inches at the second, third, fourth, and sixth years of life respectively. Additional comparative growth rates, except for small ponds, could not be found.

Condition Factors

The condition of "K" factor has often been used to express the plumpness or physical well-being of fish. Although several methods can be used to determine this factor, reciprocals of the standard length were used in this study.

The condition factors of the fourteen blind bullheads ranged from 1.96 to 3.35 and averaged 2.81. This can be compared with a mean "K" of 2.81 and a range of 2.46 to 3.43 for fifteen normal bullheads from the lake. Using this factor as a measure, the physical condition of the fish was apparently not adversely effected by the blindness. The condition factors of bullheads from five other Iowa lakes are listed in Table 1.

Table 1. Comparison of "K" factors of normal and blind bullheads from East Okoboji with other Iowa Lakes.[1]

Lake	No. of Fish	Range of S.L.	Ave. "K"	Range of "K"
Clear	3	150-170	1.79	1.61-2.19
Ahquabi	3	211-279	2.78	2.71-2.83
Little Wall	180	71-275	2.29	
Lost Island				
(Worst year)	114		2.37	
(Best Year)	107		3.07	
East Lake	13		2.34	
East Okoboji				
(Normal)	15	195-254	2.81	2.46-3.43
(Blind)	14	168-216	2.81	1.96-3.35

[1] Taken from Carlander (1950) and Rose and Moen (1950)

Discussion

After the internal examination of the eye there is little doubt the fish were completely without sight. The epidermis covering the eye is so thick that penetration of any quantity of light would be negligible. It is believed the bullheads were probably blind from the time of hatching, and possibly came from the same nest. In this case the cause is thought to be from the failure in development of the lens, cornea, and nervous tissue during embryology.

Since bullheads are primarily sense or bottom feeders it is doubtful if the blindness greatly effected their feeding habits. Although the rather wide range in condition factors would indicate some were more effected than others. The mean "K" was exactly the same as normal bullheads and compared favorably with bullheads from other Iowa lakes. Growth rates were found similar to normal bullheads.

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SURVEYS OF SOUTHERN IOWA ARTIFICIAL LAKES AND RESERVOIRS

By Tom Moen*

During the summer of 1952 a definite effort was made to expand the survey program for the southern Iowa state owned artificial lakes and the city reservoirs where the Conservation Commission maintained management agreements. Through the cooperation of the fisheries management section a southern Iowa survey crew was organized. This crew consisted of the writer and one to three men from the Lake Wapello hatchery. During the first season there were eleven state owned lakes and eight city reservoirs surveyed. The number of lakes checked have increased each year with 15 state owned lakes and 21 city reservoirs visited this past season.

Equipment and Methods

Sampling equipment used in southern Iowa has undergone considerable change in the past four seasons. During the 1952 and 1953 seasons 250 feet of ¼ inch seine and four pound nets were used for all fish collecting. Seining and netting are extremely difficult in the artificial lakes and samples taken with this gear were seldom satisfactory. At the start of the 1953 season an attempt was made to use a boat shocker (described by Larimore, et.al. 1950) with a 110 volt generator as the source of electricity. Due to the low electrolytic qualities of the surface waters of southern Iowa this shocker failed to stun fish of any species. At the start of the 1954 season a 220 volt (2,500 watt) generator was available and the boat shocker proved to be an excellent sampling device. This shocker was used for the major portion of the sampling during the 1954 and 1955 seasons. An electrified trawl and an electrified push seine were used to good advantage in certain situations, usually deep water in case of the trawl and turbid water for the push seine. Night shocking with a light on the front of the boat produced excellent results in lakes with extremely low turbidity. The shocker was suplemented by 50 feet of ¼ inch seine for shore hauls where they could be made. Longer seines and traps were used only for special surveys.

The extent of chemical and thermal stratification has been determined for each of the lakes surveyed during the past four years. Thermal stratification was determined through the use of three maximum-minimum thermometers attached to a plastic cord marked at one foot intervals. Determination of chemical stratification consisted of collecting a sample of water at the desired depth with a Kemmer water bottle and checking for amount of dissolved oxygen and pH. Methyl orange and phenolphthalein alkalinity was determined for several lakes during the 1954 surveys.

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The volume of potential fish food organisms, as determined through bottom samples made with a Peterson dredge, was an important part of the survey of each lake during the first two years. This part of the survey work has been limited to problem lakes during the past two years.

General notes were recorded on turbidity, species and abundance of vegetation, water levels, and fish success.

General Results

In looking back over four years of survey work on the artificial lakes there are a few general facts that stand out. With few exceptions the state owned artificial lakes of southern Iowa have shown better fish populations, growth rates, and fishing success than the city reservoirs. Those lakes that receive the most fishing pressure seem to be the best lakes in respect to fish populations, growth rates, and balance of species. Continual and persistent turbidity seems to be the most serious limiting factor in the artificial lakes. Also those lakes (city reservoirs) that are treated with copper sulfate have a definite problem that seems to involve the food chain of small fish. Clear water lakes consistently produce more black crappies than white while the turbid lakes have high white crappie populations. In the artificial lakes with high populations of largemouth bass, the bullheads can not maintain their numbers through natural reproduction; thus periodic stocking is necessary to produce any amount of hook and line fishing. Although perch and yellow bass are common to abundant in a large number of the artificial lakes in southern Iowa their growth rates are extremely poor and they provide relatively little sport in the way of hook and line fishing. The use of the electric shocker has shown that there are excellent populations of adult largemouth bass in many of the lakes with rough population estimates running as high as 40 pounds per acre in some cases.

Thermal and chemical stratification takes place in most of the lakes and reservoirs with the epilimnion extending from 6 to 15 feet in depth. Dissolved oxygen is usually absent in the hypolimnion early in July and below the concentration necessary for fish life in the thermocline. A more detailed report on the stratification of southern Iowa lakes is planned for a future seminar report.

As mentioned above, bottom fauna samples have been limited to problem lakes during the past two years. Earlier work had shown that most of the lakes were well supplied with potential fish food organisms. Although the lakes receiving copper sulfate treatments usually had fewer organisms than the untreated lakes they often maintained more than o.1 cubic centimeters of bottom organisms per square foot, thus they were not considered poor in potential food, only comparatively so. More detailed study is necessary to determine the importance of this situation.

Brief Notes on the 1955 Survey

State Owned Lakes:

Rock Creek: Not stratified, good oxygen to the bottom. Vegetation abundant, making seine hauls and shocking difficult. A seine haul with 300 feet of ½ inch web netted 8 largemouth bass (6 to 7 inches long), 7 yearling bluegills, and one black crappie. Many young bluegills went through the net. Sixteen minutes of shocking indicated a high population of 6 to 8 inch bass with as many as 21 picked up on a 5 minute run. Bluegill reproduction common but not abundant. Young largemouth bass were common.

Geosauqua: Strongly stratified with good oxygen down to 9 feet, only 0.1 pp at 12 feet. Daylight shocking produced very little here but evening and night shocking indicated good populations of largemouth bass and bluegills of all sizes. For the first time in the history of surveys on this lake there were some large bass taken. In 20 minutes of shocking there were six bass over 12 inches with one weighing 6 pounds and 5 ounces.

Lake Odessa: A difficult lake to sample with any type of gear. Daylight and night shocking produced a long species list. Largemouth bass from 8 to 10 inches long were abundant, no large bass were taken, indicating a strong comeback of this species. Rough fish of all kinds were abundant.

Lake McBride: Considerable change in the physical condition of this lake. The water is quite clear and water lilies have grown out to a depth of 6 and 8 feet. Bluegills and bass in good condition with the bluegills showing good growth this year and last year. White crappies still numerous and show very little improvement. Several large bass were taken and reproduction was good but no intermediate sized bass were noted. Carp are abundant.

Three Fires: Poorly stratified thermally but insufficient oxygen for fish below 9 feet. Night shocking indicated an excellent population of bass of all sizes. Early evening work with the push seine picked up about 10 crappies per minute (90% white).

Red Haw Hill: Strongly stratified, 4.5 ppm oxygen at 9 feet and only 0.6 ppm at 12 feet. Lake in excellent condition with food size range on bass, bluegills, and crappies. Night shocking proved to be a big help on this lake. Reproduction on bass and bluegills excellent.

Lake Darling: This lake shows the biggest improvement since completion. There was good reproduction on bass and bluegills and some indication of reproduction on bullheads last year. Crappies are abundant and may reach a desirable

size in a year or two. With continued drouth conditions this lake would continue to improve. Several large bass (up to two pounds) were taken for the first time.

Lake Ahquabi: This lake was stratified for the first time since thermocline checks have been in effect, there was 7.0 ppm of oxygen at 9 feet and 0.8 at 12 feet. Lake in excellent shape. Although we were not successful in picking up a large sample of fish all indications point to a continued improvement here.

Allerton Reservoir: This lake does not stratify. Very little change in fish populations. We did find more adult bass present than in previous surveys. Very little reproduction on anything but white crappie.

Williamson Pond: Sharply stratified with a 15 degree drop in water temperature between 6 and 9 feet in depth. The water has been clear all summer. The bass and bluegill population is coming along in good shape. Yearling bluegills are abundant but not considered too abundant at the present time. No northerns were collected.

Nine Eagles: This lake was stratified as usual with good oxygen down to 12 feet. The lake is in good shape, fishing still holding up as good or better than could be expected. Largemouth bass and bluegill reproduction moderate, yearling of both species common to abundant.

Green Valley: Slightly stratified, not in temperature, but there was only 3 ppm of oxygen at 15 feet (near the bottom for the deep part of the lake). Relatively few bluegills but there was a solid stream of orange spotted sunfish behind the electrodes in several localities. Green sunfish are much less common than a year ago. Nine to 12 inch bass very common. At one point we picked up 1.6 bass per minute (night shocking). All bass were in excellent condition. No walleyes or catfish were collected.

Geode: This lake stratified with 6.0 ppm of oxygen at 15 feet and 3.4 ppm at 18 feet. A definite effort was made to get a complete survey of this lake. Several types of sampling gear were used. The lake appears to be in excellent condition and not harmed by the two year draw down. There are good populations of largemouth bass, bluegills, and crappies. At the present the crappies may be on the verge of being too small to be considered good hook and line size, but they are growing satisfactorily. Although smallmouth bass appear to have failed to maintain themselves I would recommend trying once more to establish this species.

Lake Keomah: A late fall survey made here and there was no stratification. The lake is in excellent condition with good reproduction on bass and bluegills. Good populations of

intermediate sizes of bass, bluegill, and crappie.

Lake Wapello: Late fall survey made here also; no stratification noted. The fall turnover occurred here about September 20. Good populations of all the important species.

City Reservoirs

West City Reservoir at Osceola: This lake was in slightly better condition than it has been in recent years, probably due to drouth conditions. High turbidity still continues to be the main problem here. White crappie abundant and there was a fair hatch of white crappie, bluegills and largemouth bass.

East City Reservoir at Osceola: Lake extremely clear with a Secchi disk reading of 8 feet. Strongly stratified with 6.0 ppm of oxygen at 6 feet and only 2.0 ppm at 9 feet. This lake appears to be in a slump at the present time with the possibility that night shocking would have given us a better picture. Probably the most important change in this lake was the lack of reproduction on any species. Vegetation was abundant even out to 12 and 15 foot depths.

Morse Lake at Chariton: A very brief survey made here. Good reproduction on bass and bluegills and there were good numbers of yearling bass and bluegill.

Crystal Lake (Chariton Gun Club): This was the first survey for this lake. White crappie and yellow bass are abundant. Some reproduction on largemouth bass but no larger sized bass were collected.

Des Moines City Reservoir: Very little change noted here except that there were more yearling bass and fewer crappies. The stunted 1950 year class of crappies seemed to have disappeared. There was some evidence of crappie reproduction.

Nodaway Lake (Greenfield): Vegetation was so abundant that there was no possibility of making a seine haul of any kind. The lake was stratified with good oxygen down to 9 feet. No reproduction of any species noted. There were no intermediate sized bass but there was a large population of adult bass of two pounds and up in size.

Lake McKinley (Creston): This lake does not stratify. The fish sample was not as complete as in 1954 but there were plenty of largemouth bass present of all sizes and there was low reproduction on all species. Bluegill of all sizes were scarce. Carp appear to be more abundant each year but are not too serious as yet.

Afton Reservoir: The water level here is still very low. Vegetation is very abundant. There was no reproduction on any

species. Bluegills and yellow bass common to abundant and largemouth bass (two years and older) were common. A return to normal water level should put this lake in much better condition.

Corydon Reservoir: This lake does not stratify. This lake is not responding favorably to the rehabilitation program that was carried out in 1953. Yellow bass are common to abundant, other pan fish seem to be scarce. Fair populations of adult bass noted in night shocking.

Lock Ayr: This lake appears to be in better shape than in 1954. Yellow bass were not so evident; intermediate sizes of largemouth bass were common and largemouth bass reproduction was good.

Old City Reservoir at Mt. Ayr: Heavy vegetation prevented efficient shocking. Relatively little reproduction noted. Yearling and older bluegills were abundant. Intermediate sized largemouth bass were common.

Old City Reservoir at Corning: This lake is stratified. Heavily treated with copper sulfate, even the rooted aquatics were effected. No reproduction of any kind noted. Bluegills three to five inches long were abundant.

Binder Lake at Corning: This lake was not stratified. The shocker turned up a solid streams of bluegills and small black crappies along shore. Largemouth bass population was not adequately sampled.

Silver Lake at Delhi: Apparently recent fish kills here have eliminated everything but bullheads and a few carp. The bullheads were starved.

Lake Hurst: This lake was very turbid. Rough fish were abundant. A large hatch of white bass was noted. Adult game fish rather scarce.

Albia Reservoir (Upper Lake): Water level up to normal this year. Three to five inch bluegills common; reproduction poor. Small fish in poor condition. A high population of largemouth bass adults.

Albia Reservoir (Lower Lake): Water level down ten feet or better. Very poor shocking results. Poor reproduction on all species. There were indication of a good adult bass population.

Montezuma Reservoir: This lake has shown considerable improvement. Most of the bass of the 1953 hatch are of legal length and last years stocked bass are 7 to 9 inches in length. There is a good crop of crappies that should provide some excellent fishing next year.

Centerville Reservoir (lower lake): This lake was very turbid at the time of our visit and a poor sample of fish was obtained. Reproduction was poor on all species and there were relatively few intermediate sizes of fish. Yellow bass are common to abundant here.

Centerville Reservoir (Upper lake): There has been considerable improvement in this lake. The biggest improvement is shown in the crop of largemouth bass coming on. Three to five inch bluegill were common. Reproduction fair on bass and bluegills. Yellow bass are abundant here.

Fisher Lake (Bloomfield): There has been a vast improvement in the largemouth bass population, especially adults. There was poor reproduction on all species. The crappies and bluegills are in poor condition; there seem to be a lack of food for small fish.