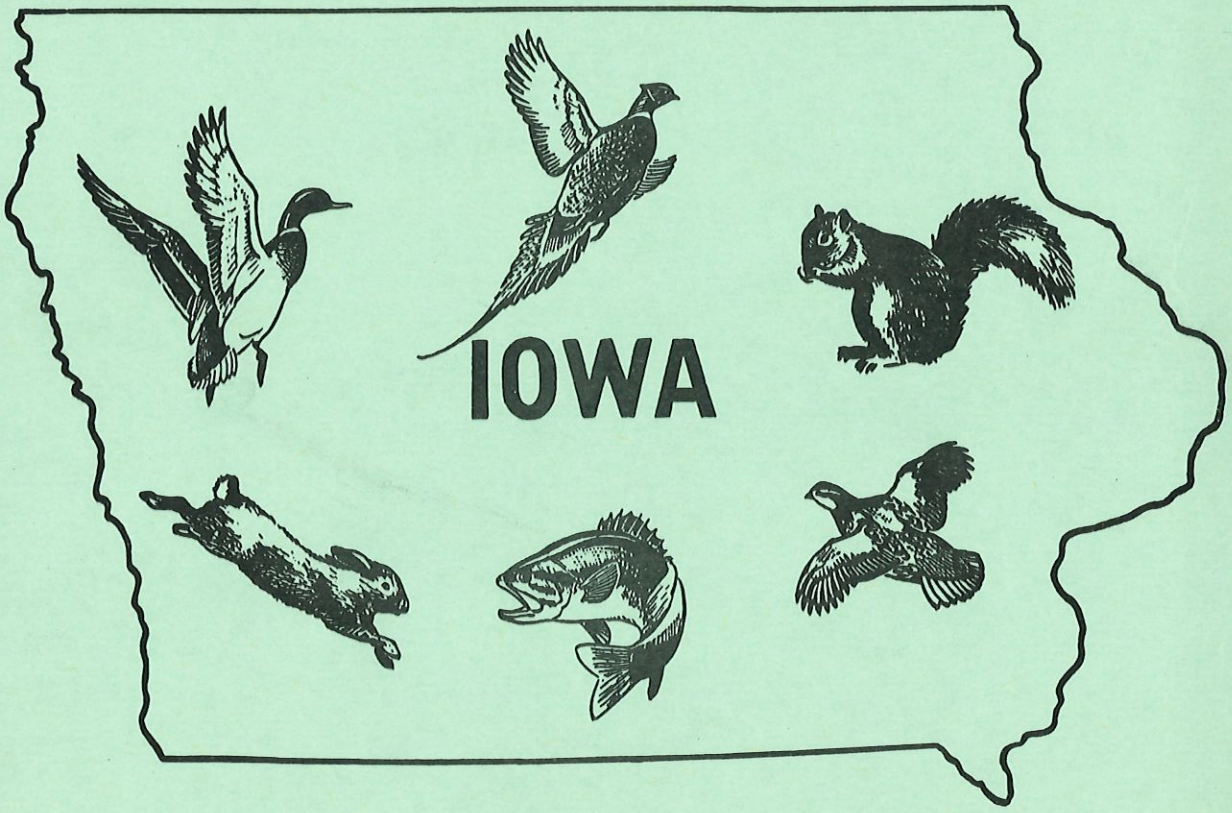
1961

QUARTERLY BIOLOGY REPORTS



FISH AND GAME DIVISION — BIOLOGY SECTION

STATE CONSERVATION COMMISSION

QUARTERLY BIOLOGY REPORTS

July, August, September

Vol. XIII 1961 No. 3

Submitted by

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BY

Eugene D. Klonglan
Game Biologist

A total of 680 pheasants, 277 cocks and 403 hens, was stocked in late March in northwestern Jefferson County as the first step in an experimental program aimed at establishing pheasants in southeastern Iowa in numbers sufficient to provide good hunting. By mid-May only 10 cocks and 15 hens per section remained on a 13-section area centering around the original release area. This was a decrease from 100 birds per section to 25 birds per section. At least five broods per section, or a total of 65 broods, were raised. It was generally felt by farmers on the area that the released birds were excessively tame and were poorly adapted for survival in the wild. More time must elapse before an evaluation of the long range success of this particular stocking can be made.

CALLING QUAIL IN IOWA - 1961

BY

M. E. Stempel
Game Biologist

During July 1960 and 1961 when cock quail were calling in Iowa, these birds were counted along selected routes in 47 counties in the quail range. Data from a short, frequently checked route near Ottumwa indicated the peak calling period. In Iowa increases or decreases in calling quail have indicated corresponding changes in hunting success the following fall. Examples of some extreme changes in the numbers of calling quail are: 1958, 1.7 per mile; 1960, 0.9 per mile; 1961, 1.2 per mile. In the mail Iowa quail range a 1961 increase of about 20 percent in calling quail was indicated. Quail also increased in marginal ranges.

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BY

Richard C. Nomsen
Game Biologist

Results of the spring survey indicated that the pheasant population was stable or slightly higher in the western half of the state. There was a slight decline in eastern Iowa but a part of this decrease was due to poor census conditions.

Weather conditions during the critical months of April and May were unfavorable for nesting activity. The results of summer brood counts showed that reproductive success was best in the western third and in southern Iowa. The production of young was apparently lowest in northeast and north-central Iowa. Many young broods checked during late August and early September were probably hatched in diverted acres and should add substantially to the total rooster harvest.

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BY

Eldie W. Mustard
Game Biologist

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BY

James G. Sieh
Game Biologist

The Mississippi Flyway Council and the Technical Section thereof initiated a cooperative wood duck banding program in 1959. In 1960, cooperatiors in the U.S. and Canada banded 10,563 wood ducks, a 49 percent increase over the number banded in 1959. Seventy-two percent of the continental total was banded in the Mississippi Flyway states. Seventy-six percent of the Flyway total was banded in five states (Wisconsin, Illinois, Indiana, Ohio, and Iowa). In 1959 and in 1960 almost all of the wood ducks banded in Iowa were captured along the Upper Mississippi National Wildlife Refuge and at Union Slough National Wildlife Refuge. In 1960, personnel of the Iowa Conservation Commission captured and banded 146 wood ducks throughout the State.

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BY

Paul D. Kline
Game Biologist

July roadside counts for 1961 revealed a slight increase in cottontail populations over much of Iowa. The statewide index increased from 4.5 in 1960 to 4.8 in 1961. All areas except the Wisconsin drift and driftless area showed increased rabbit populations. A moderate decline appeared in the Wisconsin drift following relatively high populations in that area in 1960. Cottontails were most abundant in the southern loess area as during five previous years. Lowest population again appeared in the driftless area. The population is very near the average for 11 previous years. Reproduction was poorer than any year since 1951. The age ratio

of 2.27 was considerably below the average of 2.59 for previous surveys. The fall population index of 3.79 as compared to 2.73 in 1960 indicates hunting will be somewhat improved over 1960. High survival of a breeding population through the winter of 1960-61 is believed responsible for the higher fall population index. The index of jackrabbits per 10 miles of route (0.2) was lower than each of three previous years. However, as the roadside counts were designed for cottontail census they may not be especially dependable for censusing jackrabbits.

RESULTS OF THE 1961 CREEL CENSUS ON THREE SOUTHERN IOWA ARTIFICIAL LAKES

BY

Jim Mayhew
Fisheries Biologist

A creel census was conducted on Thayer Lake, Green Valley Lake, and Red Haw Lake from April 15 to July 31, 1961. A total of 1,714 anglers were contacted. They caught 3,515 fish after fishing 3,128 hours. Rate of angling success varied from 0.88 fish per hour at Green Valley to 2.07 fish per hour at Red Haw. Crappie ranked first in abundance at Green Valley and Red Haw; whereas, green sunfish were caught most frequently at Thayer Lake. More anglers expressed a desire to catch bullheads at Green Valley and Thayer Lakes while most fishermen were fishing for crappie and bluegill at Red Haw. The average driving distance to fish in the three lakes varied from 14 miles at Thayer Lake to 58 miles at Green Valley Lake. Information posted at Green Valley and Red Haw Lakes concerning the location of fish shelters and the thermocline met with limited success in attempting to increase angling harvest and success.

A BRIEF REVIEW OF THE USE OF TOXAPHENE IN IOWA LAKES

BY

Tom Moen
Fisheries Biologist

Toxaphene has been applied to nearly 6,000 acres of water in Iowa since the first lakes was treated with this chemical in the fall of 1957. These treatments have covered 8 shallow, glacial lakes of northern Iowa, 5 marshes, 1 artificial lake, 6 gravel pits, and 15 small strip mine ponds in southern Iowa. In all but one instance the chemical was administered to obtain a complete fish kill. The one selective kill of young fish was considered successful and did not kill all the adult walleyes. Turbidity as well as other chemical and physical properties was considered as the important factor in toxicity and length of time prior to detoxification. Dosage rates ranged from 0.01 to 0.25 ppm. No adverse effects were noted in the associated wildlife populations.

PROGRESS REPORT, RENOVATION OF THE WINNEBAGO RIVER, WORTH COUNTY, IOWA

BY

Harry M. Harrison
Fisheries Biologist

During the winter of 1958-59, the Winnebago River above the town of Fertile in Worth County was treated with toxaphene to eradicate an existing fish population. Prior to the eradication project, the fish population of the Winnebago consisted of 23 species. Following the kill, game fish including channel catfish, smallmouth bass, northern pike, largemouth bass and walleye were introduced by stocking. Surveys for the purpose of following the development of the fishery have been conducted annually. Three years after the chemical treatment, all species formerly inhabiting the stream have become re-established. In addition, high populations of northern pike and good populations of smallmouth and walleye are present. Channel catfish appear to be declining rapidly and the largemouth bass stocking failed to produce a population of consequence.

EXPERIMENTAL PHEASANT STOCKING IN JEFFERSON COUNTY, SOUTHEASTERN IOWA

BY

Eugene D. Klonglan
Game Biologist

INTRODUCTION

An experimental pheasant stocking program has been initiated in southeastern Iowa in hopes of establishing permanent pheasant populations in numbers sufficient to permit good pheasant hunting in this section of the state. There are several areas in this region which appear to have all the characteristics of good pheasant habitat, but which at present have few, if any, birds. Thousands of pheasants and pheasant eggs have been distributed in southern Iowa in past decades, but little has been accomplished since most of this part of the state still supports a very low pheasant population. The exception to this occurs in southwestern Iowa in the Creston -Greenfield vicinity, where an excellent pheasant population has maintained itself for the past decade.

This population nucleus centering around Adair County is serving as the beginning point for the experimental stocking program. Though the theory that perhaps these southwestern Iowa pheasants are better adapted to southern Iowa conditions than birds from northern Iowa is as yet unproved, the possibility that such might be true is an important part of the over-all plan. Brood stock will be wild-trapped from this area and used to obtain large enough numbers of birds of this southwestern stock to make mass plantings in southeastern Iowa . These birds will be hatched and reared at the Wildlife Research & Exhibit Station near Boone.

At present, the program is just getting underway. Poor trapping conditions last winter resulted in only 35 wild-trapped southern hens being on hand at the beginning of the past breeding season. From these hens about 275 chicks have been raised, and these are being held for brood stock for the coming year. Further attempts at live-trapping will be made in the Creston-Greenfield area this winter. By next fall and the following spring, sufficient stock should be on hand to make the first mass releases--presently planned for northeastern Henry County.

However, a preliminary step in this program resulted from the necessity of disposing of the old brood stock at the Wildlife Research & Exhibit Station. Rather than distribute this adult brood stock in haphazard fashion in small releases, it was decided to make a mass planting in one area in southeastern Iowa--even though these birds were not of southern Iowa origin. This could then serve as a comparative "check" on later releases of southern stock, and perhaps give some evidence on the theory of different strains of pheasants in relation to their ability to exist in southern Iowa.

FIELD PROCEDURE

An area in northwestern Jefferson County about 13 miles northwest of Fairfield, or 3 miles west of Packwood, was selected for this initial stocking. The birds were released in an area centering within sections 3, 7, 8, 9, 10, 16 and 17 of Polk Township. Selection of this particular area was based on a study of soil types and cover

conditions, with special effort being made to duplicate the habitat in the Creston-Greenfield area as much as possible. It is located on a flat to gently rolling ridge between the Skunk River and Big Cedar Creek and includes the best farm land in the county.

The 680 adult pheasants (277 cocks and 403 hens) were released on the afternoon of March 29, having been placed in crates at the Wildlife Research & Exhibit Station in the forenoon and immediately transported to the selected area. The weather on the day of release and the two following days was ideal for the season, warm and sunny with little wind. Groups averaging 30 cocks and 50 hens were liberated from the road at eight different sites in the 7 sections mentioned above, with the remaining 40 cocks being released in the center of this area. Thus, an average of about 100 pheasants per section was stocked.

RESULTS

Immediate Post-release (March)

On the afternoon of the 30th, about 24 hours after release, many of the birds were along the road ditches--mostly in separate groups of cocks and hens. Many would simply stand and stare or run for just a few feet. The investigator was able to easily catch one hen in a group of four that crouched in the ditch when the car was stopped alongside. This hen flew over 500 yards when released, so was apparently in good health. Most of the birds would not fly unless practically "kicked in the tail"--preferring to run instead. This may have resulted from their having been brailed over the winter in an open pen where the only predators they had to worry about were avian. Most of the birds could fly normally if forced, but apparently did not like to do so --perhaps because the wing was still somewhat stiff from disuse, or from force of habit formed over the winter. As an example, one bird was killed shortly after release by a farm dog. Though the bird had flown about 75 yards on release from the crate, it attempted to elude the dog by running and made no further attempt to fly. This occurred in a hayfield with as yet no cover at all for the bird to escape into by running.

Many birds were sighted still within 50 yards of their liberation site 24 hours after being turned loose. Several hens could be heard giving their chirping "I'm lost" call. Some were even uttering the call though they were in small groups of two to four birds. The obvious conclusion to be drawn from observations made the day after the release was that the birds were quite tame and at somewhat of a loss to know what was happening.

Early Nesting Season (May)

In mid-May, two cock crowing counts were made on the stocked site and surrounding territory. A 15-stop route was laid out, with one half including the release area and the other half located along the southeastward extension of the previously men mentioned flat ridge. This latter half also coincided with about half of the Conservation Officer's crowing count route in the northern part of Jefferson County. The two counts indicated a mean of 6 cock calls per stop on the stocked area and 1 call per stop off the area (Table 1). Counts made in this part of the county by local Conservation Officers have averaged 0.9 calls per stop in the previous 4 years, with a range of 0.4 to 1.4. This compares closely with the count off the release area, indicating little or no movement into this territory which lies about 2 to 9 miles southeast. The Officer counts for the 7 years preceding this (1950-1956) averaged only 0.3 calls per stop, with a range of 0.2 to 0.6.

Table 1. Results of two spring cock crowing counts in northwestern Jefferson County, May 1961.

Date	Stocked area			Off stocked area		
	No. stops	No. calls	Calls per stop	No. stops	No. calls	Calls per stop
May 12	7	49	7.0	8	10	1.2
May 17	7	35	5.0	8	6	0.8
Mean	7	42	6.0	8	8	1.0

If fairly heavy movement into areas up to 1½ miles from the release sites is assumed, the pheasants would be distributed rather evenly over about a 13-section area. This ignores those individuals who no doubt wandered farther (to date two records have been made of banded birds being seen 4 miles from the boundary of the stocked area). Evaluation of the crowing counts and other concurrent observations during mid-May indicated that about 125-150 cocks remained on the 13 sections. This was about 50 percent of the original release, and about 10 cocks per section. If the same rate is assumed for hens, about 200 were still present at this time--nearly 7 weeks after being liberated. Thus there was an average of only about 15 potential nesting hens per section on the area in mid-May, by which time most initial nesting attempts should have been well under way.

The estimate of 10 cocks per section may appear inconsistent with a mean crowing count of 6 calls per stop. However, the wind on the two mornings the counts were taken was at the maximum permissible level of 5-8 mph., occasionally gusting higher. It was thus seldom possible to hear calls much over one-half mile away. Also, some cocks were seen in fields but not crowing. Whether this was due to the wind (which seemed unlikely) or because as pen-raised birds they had not as yet adjusted to life in the wild was not known. In any event, the estimate of 10 cocks per section in mid-May was the best that could be made with the crowing count and sight record data available. With the 15 hens per section estimated present, the 100 birds per section liberated on the 7-section area had decreased to 25 per section on a 13-section area. Numbers of pheasants outside this area were probably too small to be of significance. Though it is certain some of the stocked birds wandered onto these sections, few birds were seen or heard. The fact that the release was made at the end of March, just at the onset of the breeding season, may have lessened such movement, as opposed to the possible movements of birds liberated during the fall.

Mid-nesting Season (June)

Many of the farmers, particularly those in the 7-section stocked area, were contacted at least once during the last half of June. This contact was made to coincide with the finish of the mowing of the first crop of hay. However, the farmers found little evidence of nesting in hayfields. Only one brood of young was reported during this series of interviews, but it was not known if the hen was banded. Since a very few pheasants were already present (certainly fewer than 5 per section), the possibility existed that the brood came from a resident hen. Only three hens, all banded, were reported killed by mowers, and no other nests were found in hayfields. One nest with 17 eggs was found in a road ditch. Two hens had been seen near it, but the nest had been abandoned, possibly having been a dump nest. There was a large acreage of good nesting cover in pastures, small grains and diverted "feed grain" fields, so it was not surprising that few nests were seen in hayfields by farmers. No doubt some nests were present but were not seen.

The farmer reports at this season followed a similar trend. All reported having seen many birds during the 6 weeks or so after their liberation. They were still seeing cocks frequently but had seen few hens in the last 3 or 4 weeks (beginning about mid-May). This pattern would be expected. Relatively sparse cover during the time the farmers were planting their fields would enable them to see birds rather easily. As the season progressed, growth of vegetation would make sighting them more difficult. The apparent disappearance of hens in the weeks just before the interviews would coincide closely with the incubation of nests.

Another general trend in farmer opinions was the view that the pheasants were excessively tame. This was echoed almost unanimously by everyone contacted. Some felt that it was even a mistake to turn such tame birds loose! Many people said one could walk right up to the birds and almost catch them. A considerable, though unknown, number of birds was apparently auto victims. Drivers reported it often necessary to completely stop and practically chase the pheasants out of the way. This was particularly true right after the release. Most auto drivers could not, or made no effort to stop and the road kills resulted. One farmer reported several birds had been struck by trains on one of the railroad tracks that crosses the area.

Several other instances pointing toward the tameness of the pen-raised birds could be cited. One farmer found one of the banded hens had fallen into a small basement window well beside his house. He caught the hen and placed her in his chicken house where she remained--eating and roosting with the chickens--for several days before she apparently wandered back to the field. A farmer's wife told of three or four pheasants coming into her chicken yard close to the house and eating out of the chicken feeders. Another related that birds had been sitting under her rose bushes beside the house. A farmer who was checking his cattle watering tank in a pasture reported a banded hen jumped up on the tank edge and took a drink--no more than 6 feet from him and apparently unconcerned over his presence! Several farmers expounded on the apparent lack of fear on the part of the birds toward tractors and machinery in the fields. One told of nearly running over a banded hen with the tractor and then being forced to stop quickly when the hen failed to move out of the way of the harrow being pulled behind.

The most unusual example of tameness, however, was registered by a cock who established his crowing territory on the open front porch of a farm house (no dogs, cats, or other stock present on the premises). The floor was rather smooth, so when he went into his crowing and wing-fluttering act his momentum often carried him bouncing and thudding across the porch. The old farm couple residing in the house stated this peculiar noise was rather aggravating at times--particularly at 5 a.m. Though they were tempted to get rid of the bird, the novelty of the situation prompted them to spare him!

Many people expressed the belief that foxes were killing large numbers of the released pheasants. In view of the large number of road kills and frequent reports of farmers finding dead birds in the field, it is not unlikely that most of the foxes on the area tasted pheasant during the spring and summer. No doubt many of the pen-raised birds were easy prey for foxes and other predators, particularly in the first weeks following the release--as witness the earlier reported cases in which the farm dog easily captured one of the birds and where the investigator was able to catch one of the hens barehanded. One farmer saved three bands he had picked up at a fox den, and a few other similar instances were reported. One unverified report of 22 bands being found in a den that was dug out was received. Ten days later a different source placed the number at 32, and a couple weeks after that it had grown to 42! The treatment that must be accorded such reports is obvious.

Post-nesting season (August)

Four early morning roadside counts were run on a circuitous 30-mile route through and around the stocked area. A total of 38 birds was sighted on these four mornings,

or an average of 0.32 pheasants per mile (Table 2). This compares to a total of only 14 pheasants sighted on 19 such counts in the 7 years the Conservation Officer counts had been taken in early August. This is an average of only 0.02 birds per mile over this span. Of the 14 birds, 13 were seen in the 2-mile terminal portion of one route which ends at the southern edge of the stocked area. This further indicated that apparently this northwestern part of Jefferson County presents the most favorable chance for establishing a pheasant population in this county.

No broods have been sighted during the 7 years of Officer counts, but six were seen on the four counts of this study. All were sighted within the 7 sections of the original release. In two instances the hen's band could readily be seen; in one the hen was in tall grass so it could not be determined if she was banded; in the other three the hen was not seen, only the incomplete brood at the field edge. The hatching dates for the six broods were calculated as follows: May 25, May 31, June 1, June 1, June 8, and June 14. This would indicate a hatching pattern similar to that found in the Union-Adair Counties area and thus earlier than in northern Iowa.

The band could be seen on four of the five cocks sighted; the fifth was in a stubble field where no such determination could be made. Of the five hens, two were definitely banded, two were unknown, and one was definitely not banded. The latter bird was the only one sighted known to be a native of the area.

Table 2. Results of four late summer roadside counts in the northwestern Jefferson County area stocked with pheasants.

Date	Cocks	Hens	Young	Total Birds	Birds /mile	No. broods	Dew fall
July 26	2	3	14	19	0.63	2	3
August 3	1	1	14	16	0.53	4	6
August 7	1	0	0	1	0.03	0	5
August 8	1	1	0	2	0.07	0	2
Total or mean -	5	5	28	38	0.32	6	4

On August 7 and 8 a final interview of farmers on the area was conducted. Of the 44 farmers residing in the 13-section area centering around the release sites, 20 were contacted during the 2 days. Each of the 20 was asked how many broods of young pheasants he knew to be present on his farm and had he seen any on neighboring farms or along the road. This information was then plotted on a map and the data evaluated in terms of the number of separate broods represented. Obviously, several broods were seen by more than one person. For example, six people reported sighting a brood at the same road intersection. It was assumed in the evaluation that only one brood was involved whenever such duplication arose. In this manner, an estimated 30 individual broods were reported during the survey. If it is assumed that the 24 farmers not contacted would have reported broods at the same rate as the 20 interviewed, an over-all estimate of 65 broods on the 13 sections could be made, or an average of 5 broods per section.

This is, of course, a very rough estimate, but it is believed more likely to be a minimal figure than too high. Though farmers in this area where pheasants had previously been so scarce were quite conscious of any sighting of birds in the field, there was no assurance that they had seen all broods that may have hatched on their farm.

Cover during the summer months is quite heavy and furnishes excellent concealment for young broods. Also, the investigator may have been overly critical in evaluating the farmer reports by assigning only one brood to a specific area where several people had sighted chicks. Further difficulty was encountered in evaluating a few individual reports. For example, one hired man enthusiastically reported seeing at least 10 broods while combining a small oat field. However, the farmer, who was also in the field, felt there were only 3 or 4 different broods and these were being flushed repeatedly. The lower figure was used, though which was the more accurate would be open to speculation.

The number of chicks per brood was obtained from 13 broods on which good counts were believed to have been made. They averaged 6.8 chicks per brood, with a range of 3 to 12. Their average age was not certain, but from farmers' descriptions was estimated at about 6 to 10 weeks. A mean of 6.8 per brood at this age would be considered normal.

DISCUSSION

It was apparent that a significant amount of successful nesting was accomplished by the released hens. However, if one remembers that 403 hens were originally liberated, only a small percentage was ultimately able to bring off a hatch. This remains true even if allowance is made for movement off the release area, since the majority apparently remained on the 13-section area. The estimated 15 hens per section present in mid-May apparently brought off 5 broods per section; that is, one-third were successful. However, this 15 per section represented only half of the original number stocked. Thus, if some allowance is made for hens wandering outside the 13-section area, only about 20 percent of the hens were successful--even though stocked in apparently prime health right at the beginning of the nesting season.

The important question remaining to be answered is whether the production that did occur will be sufficient to provide an adequate brood stock next spring. The fact that some broods were raised by no means proves that this mass release will be successful in the long run. Many environmental factors will exert their pressures on the survivors during coming months.

The next evidence of the progress of this release will be obtained this winter. An attempt will be made to make a direct count of pheasants on at least 5 sections if enough snow and inclement weather occur. This will be followed next spring by cock crowing and roadside counts. With such data at hand, it should be possible to have a good indication of the prospects for production next year.

SUMMARY

1. A stocking program has been initiated with the aim of establishing pheasants in southeastern Iowa in numbers sufficient to provide good hunting.

2. As the first phase, 680 adult game farm pheasants (277 cocks and 403 hens) were liberated in late March in northwestern Jefferson County.

3. The birds were very tame and suffered high mortality within a short period after release.

4. The population remaining in mid-May on the 13 sections centering around the release area was estimated at 10 cocks and 15 hens per section.

5. At least five broods per section were raised on the 13-section area, with time of hatch and brood size being normal for southern Iowa.

6. More time must elapse before this stocking can be fully evaluated in terms of long range success.

CALLING QUAIL IN IOWA - 1961

BY

M. E. Stempel
Game Biologist

This report contains data from 47 counties in which calling quail were censused in July by Conservation Officers. In addition, the biologist made repeated counts in selected areas to determine the dates of the beginning, peak and end of calling by bobwhite cocks. A partial evaluation of data is included in this paper. This is based on data from 1961 and some previous years and on spring and summer weather and crop reports. This combined information on bobwhites indicates the spring preparation for nesting, the summer brooding peak and the end of extensive nesting in late summer. The method used is described in the Seminar Report for July 1959.

RESULTS

The earliest 1961 count by Officers was June 28 and a total of 45 counties was checked by July 27; thus the checks began during the peak whistling period which was from late June into early July. In 1960 a total of 43 counties was checked. The calling peak was shorter than in 1961. Forty-one counties censused in 1961 had also been censused in 1960. Each year there is a change in the number of counties because of personnel shifts or because of the need to have additional data from the certain areas.

The statewide average for 1961 was 1.2 calling male quail per mile, which is an increase of 33 percent since 1960 and a decrease of 16 percent from the 10 year average. The majority of counties had increases over 1960 and those that had decreases were mostly outside the main quail range. Results from some other representative years are given in Table 1.

Results in some Representative Counties

Throughout the quail range a general increase was noted; however there were some decreases for which there are several possible reasons. A few of these are: (1) irregular calling; (2) a late census data; (3) unsettled weather which delayed calling; and (4) there were not quail.

There is a small amount of additional variation because in this type of census the number of calling quail is counted, while in censusing calling pheasants the number of calls is counted; sometimes the instructions are confused, which results in the number of quail calls being counted instead of the number of quail. It is known that at least once in 1960 and possibly in 1961 the number of bobwhite calls was recorded. This indicated more quail than were actually present since a bird may call several times during the listening period.

While decreases were recorded in some instances, there was increase elsewhere.

In the secondary and marginal quail range an increase was noted in 12 counties with decrease in 11. For example, in Monona and Jackson the increase was notable, with the reverse true in Marshall and Story. In moderately good range there was increases in the numbers of calling quail in Adams, Montgomery and Polk with proportionate drops in Jasper, Mahaska and Warren.

Twelve counties in the southern three tiers of Iowa counties were checked in 1960 and 1961. All were within the better quail range and there was notable increase in 8 of the 12, with the best advance in Wapello and Clarke while there was decrease in Jefferson and Lee.

Use of Data from a Special Check Area

The count of whistling quail must be made when most of the quail are calling. It must also be made when summer weather conditions are stabilized. To get an indication of when these conditions existed, a record of spring and summer calling was made from May into September on a 9-mile route south of Ottumwa, where calling quail were counted once or more per week. The work was done by the biologist at one listening stop in each mile, and most counts were begun at sunup with supplemental counts at midday and at sundown.

The 1961 spring was dry but cold enough that field crop growth was delayed. This affected quail calling, which begain in May, for temperatures near 35°F, retarded or stopped the calling. Until late June, unfavorable winds of over 10 miles per hour were usually blowing by sunup, and from daylight until sunup, censusing was difficult because of a great volume of singing by such birds as robins, jays, larks, redwings, grackles and cardinals.

Weather improved through June when crop growth was nearly up to the average growth stage for Iowa at this date. Along with this warming trend, the calling by male bobwhites increased to a peak in late June. During July the calling deminished and it ceased in early September. Calls from individual males never were frequent, and the number of "bobwhite" calls averaged below three per minute with some birds calling less than once each 5 minutes, which was similar to the pattern for 1959 and 1960. Data from my records indicates that from 1953 through 1958 the calling rate was three or more calls per minute per cock. This decrease in rate of calling occurred during a period when quail numbers were decreasing (1959-1960) and it continued during the beginning of recovery (1960 and 1961). The 1961 counts by Officers throughout the quail range began when, in late June, the calling was at a peak. They were advised to listen 5 minutes instead of the usual 3 minutes because of the low rate of calling per bird indicated on the Wapello county check route.

At the time of peak calling by male quail in the best quail range in the southern three tiers of counties, sampling was begun in 12 counties in this area in both 1960 and 1961. (There are two routes in most of the counties.) A short 1960 peak was indicated by data from the Wapello County check route. All were not sampled on a comparable basis but nine of the routes were censused during the late June to early July peak period, and nine were censused after the July decline began. The 1961 counts were begun during the much longer calling peak which was indicated on the Wapello County check route. Five counts were completed when calling was at a peak, while 14 others were made after the peak calling period; thus more counts were made during the 1960 peak than during the 1961 peak. In other words, the average 1960 count may have tended to be high because it was taken at or near the peak, whereas in 1961 less than half were taken during the peak, and the tendency may have been to be low. However the 1961 averages were highest, indicating that the 1961 population surely must have been greater than that of 1960.

Davis and Monroe counties are among the 12 that were sampled in the best quail range. Results from these two are directly comparable since in 1961 the counts were taken at the same high point in the calling cycle. (This peak was indicated by data from the Wapello check route). The 1961 increase in these two southern Iowa counties is similar to the general trend toward increase.

Table 1. Whistling quail counts and hunting results for some typical years

Year	Type of Production Season *	Results of Hunting	Average Number of Calling Quail per Mile
1955	Short Summer	Fair	1.2
1958	Long Summer	Good	1.7
1959	Average Summer	Fair	1.5
1960	Short Summer	Poor	0.9
1961	Long Summer		1.2

* The type of production season description is based on personal records, on Iowa Climatological Data and on Iowa Weekly Weather and Crop Bulletins.

A Partial Evaluation of the Count of Calling Quail

A comprehensive evaluation of the calling quail census would require long study. However the following brief evaluation is based on this report.

Results to Date

1. Trends in the July breeding quail population and resulting trends in production are shown. Maximum value is obtained from this census by combining the statewide counts with length of calling period and amount of favorable weather (Table 1).

2. This method indicates the best quail areas in a minimum of time.

3. An estimated 600,000 acres of quail range is sampled in a minimum of time by the statewide count.

4. Frequent local checks indicate the peak of calling.

How to Improve the Calling Quail Census

1. Make all checks at the same point of the calling cycle.

2. If deadlines are impractical, several counts can be made on each chosen route to be sure that both low and high periods are checked. All material would then be comparable.

3. Ascertain the full significance in changes in the number of calls per minute.

4. Make mathematical and statistical analyses of data on hand.

PHEASANT REPRODUCTION IN IOWA - 1961

BY

Richard C. Nomsen
Game Biologist

The annual summer pheasant surveys were continued in 1961 to determine reproductive success. Surveys were made by Conservation Officers, Rural Mail Carriers and Biologists.

Spring counts indicated a slight decrease in the breeding population. However, a part of this decrease was due to poor census conditions. The pheasant population was stable or slightly higher in the western one-third of the range. A substantial increase was noted in the central district.

Some of the most severe winter weather occurred during March. Several northern areas reported 15-20 inches of new snow on March 7 and 8. Freezing rain preceded this storm and the icing caused temporary difficulty to some pheasants. Temperatures were relatively mild and averaged a few degrees above normal for the month.

Weather conditions during the critical months of April and May were unfavorable for nesting activity. April was cold, windy and cloudy; May remained cool but was dry. Temperatures averaged 3-6 degrees below normal, which discouraged early nesting. The last freeze of the season was reported on May 26th. Nesting was probably retarded this year by the adverse weather conditions. June temperatures were near normal.

The first summer count to determine reproductive success was conducted by rural mail carriers during the week of July 24th - 29th. Due to accidental destruction of the carriers mailing list, it was necessary to contact all post offices and obtain the names of volunteer cooperators. The response was excellent and nearly doubled our original list.

According to this survey, pheasant reproduction was best in the western third of Iowa including the southern part of the pheasant range. Production appeared to be about normal in central areas but below normal in north-central and northeast Iowa. Comparisons with results obtained during previous surveys were not made because of the great change in the list of cooperators.

Conservation Officers conducted their annual summer brood counts from August 1st - 15th. They reported 1,650 broods with 9,895 chicks and 976 hens without broods. According to this survey, pheasant production was best in west central and southwest Iowa (Table 1). The production of young was apparently lowest in the northeast and north-central districts and about normal in other areas. The statewide average for 1961 was 3.8 young per hen which was slightly lower than in 1960. The percentage of hens reported with broods decreased this year, but there was a noticeable increase in the number of chicks per brood. The average number of chicks per brood was 6.5 in the west and south but only 5.1 birds in the northeast section.

Table 1. District Results for Conservation Officers' Brood Counts, 1961, With Statewide Results for 1956 - 1961

District	Young per adult hen	Average brood size	Percent of hens with broods
1. Northwest	4.0	6.2	64%
2. North Central	3.0	5.5	56%
3. Northeast	2.9	5.1	58%
4. West Central	4.7	6.4	74%
5. Central	3.9	6.5	60%
6. East Central	3.8	6.0	64%
Southern 3 Districts	4.6	6.6	71%
State 1956	4.2	5.9	71%
State 1957	4.4	5.9	74%
State 1958	4.5	6.2	72%
State 1959	3.5	5.5	64%
State 1960	4.1	5.6	72%
State 1961	3.8	6.0	63%

There were several significant changes in nesting cover this year. The 1961 feed grain program added three million acres of much needed nesting cover. Although most of this acreage was clipped early, which destroyed initial nesting attempts, much of the retired land was left idle during the rest of the summer. This undisturbed acreage furnished excellent cover for renesting attempts. Many young broods checked during late August and early September were probably hatched in the diverted acres. These young birds should add substantially to the total rooster harvest this year. Also, the State Highway Commission delayed mowing cover along primary roads until after July 1st, allowing early nests to hatch. This no doubt saved thousands of hens and increased nesting success along the primary roads.

IOWA DEER POPULATION ESTIMATES - 1961

BY

Eldie W. Mustard
Game Biologist

INTRODUCTION

Annual estimates have been made of Iowa's deer population since 1947. The method used to obtain this information consists of asking the Conservation Officers to estimate the number of deer in each county of their respective territories. The Officers are also asked to delineate those areas where deer tend to concentrate and to estimate the number of deer in each delineated area.

The technique, while admittedly crude, has enabled us to at least follow the trend of the Iowa deer population. It has also provided us with a basis for the formulation of management regulations and a means to determine the effectiveness of these regulations. The use of concrete figures to describe the Iowa deer population is, of course, open for criticism, but the trend data are still applicable and are probably somewhere near the truth in regard to the direction of population changes in the Iowa deer herd. No better method for obtaining deer population estimates for an area the size of a county or a state has yet been determined to my knowledge.

It should be noted that the Winter Deer Census is conducted at a time when the Iowa deer population is at the lowest point in the annual population cycle.

RESULTS

Reported 1961 Winter Deer Population

The Iowa deer population is at the highest point since estimates were first conducted in 1947, with a total population of 14,155 deer reported in the 1961 Winter Deer Census (Table 1). The estimates for the several counties ranged from 0 to 1,155, with a mean reported population of 143 per county. Table 1 shows the 1961 winter deer population, by county, as reported by the Conservation Officers.

Comparison of 1960 vs. 1961 Winter Population Estimates

The reported winter deer population in 1960 was 13,101, while in 1961 a population of 14,155 was indicated (Table 1). This represents a numerical increase of 1,054, or about an 8 percent gain during the 1-year period.

Comparison of the 1960 vs. 1961 estimates, by county, shows that the deer population in 65 counties increased or were stable, while those in 34 counties decreased. Fifty-six counties, compared to 59 in 1960, reported deer populations of 100 animals or less. Ten counties, compared to 11 in 1960, reported deer populations in excess of 250 animals.

Comparison of 1961 Estimates with Mean for Preceeding 5 years

Figure 1 shows graphically the trend of Iowa's deer population from 1947 to 1961 as indicated by the annual Winter Deer Census. From 1947 to 1953 the population

increased rapidly. The data suggest the population was relatively stable from 1955 to 1958 and in 1959 began an upward trend which is apparently continuing.

Comparison of the 1961 estimate with the mean estimate for the preceeding 5-years of record (1956-1960) shows a 25 percent increase in the base, or winter, deer population. The 1961 estimate of 14,155 was 2,846 deer greater than the 5-year mean of 11,309.

Anticipated Deer Population - Fall 1961

Data gathered at deer check stations during the 8 years which seasons have been held indicate that the reproductive rate of the Iowa deer herd is exceptionally good. These data show that Iowa deer produce an average of over 63 fawns for each 100 deer in the breeding herd.

Projection of the reproduction data on the 1961 winter deer population estimate yields an anticipated Fall 1961 deer population in excess of 23,000 animals; this estimate is probably conservative. The anticipated Fall 1961 deer population for each of the several counties is also given in Table 1.

A Brief Analysis of Population Changes in the Iowa Deer Herd During 1960

The following is a brief resume of the changes in the deer population which took place in 1960. This is one way we can use some of the data obtained from the various sources during the course of a single year to see if we can more or less "balance the books" on the Iowa deer herd for that year.

It must be realized, however, that there are many losses which are never, nor will ever, be reported. These losses include illegal kills, unreported traffic kills, accidental kills, wounding losses, unreported legal kills, natural deaths, and undoubtedly others. That the population "balanced" as well as it did was frankly quite surprising to me.

Reported Winter 1960 Population	13,101
Eight-Year Mean Reproductive Rate	63.1 fawns/100 adults
Anticipated Fall 1960 Populations	21,368
Hunting Losses	4,269
Accidents, Illegal, Traffic, Dogs, Misc.	753
Total Known Losses	5,022
Number Surviving	16,346
Winter 1961 Population	14,155
Number of Survivors Unaccounted For	2,191

DISCUSSION

Continual censusing is a very important aspect of the deer management program for obvious reasons which are not necessary to discuss here. It is also a very difficult aspect.

The local Conservation Officer is the key man in a censusing technique such as that applied to the Iowa deer herd. To successfully estimate the number of deer, or even evaluate the trend of the deer population, the Officer must know his territory extremely well. He must further have good rapport with the people of his territory, because, in the final analysis, he relies to a great degree on information furnished to him by these people concerning the local deer population situation.

It takes time to gain a good working knowledge of his territory and to gain the confidence of the people in it - essentially it takes time before a new Officer, or an Officer assigned to a new territory, can anywhere near accurately assess the deer situation. From a game management standpoint, and especially for deer management where the census techniques are not refined, longevity of the individual Officer in a given territory is both desirable and necessary. With this longevity or tenure in a given territory, estimates can be made in which a relatively high degree of confidence can be placed, at least in the use of these estimates to evaluate population trends. Without this longevity in a given territory, the estimates will soon have little or no meaning in the interpretation of population levels.

I am especially enheartened over the increases in the reported deer populations from certain areas of the state where in former years the estimates have been, in my opinion, unrealistically low.

SUMMARY

1. The Iowa deer population is at the highest level since the Winter Deer Census was initiated in 1947. A winter deer population of 14,155 was reported: this is an increase of about 8 percent over the 1960 estimate.

2. Comparison of the 1961 deer population estimate with the mean-estimate for the preceeding 5-years of record indicates a 25 percent increase in the base, or winter, deer herd.

3. Projection of the 1961 winter population data and the expected reproduction indicate an anticipated Fall 1961 deer population in excess of 23,000 deer. This estimate is probably conservative.

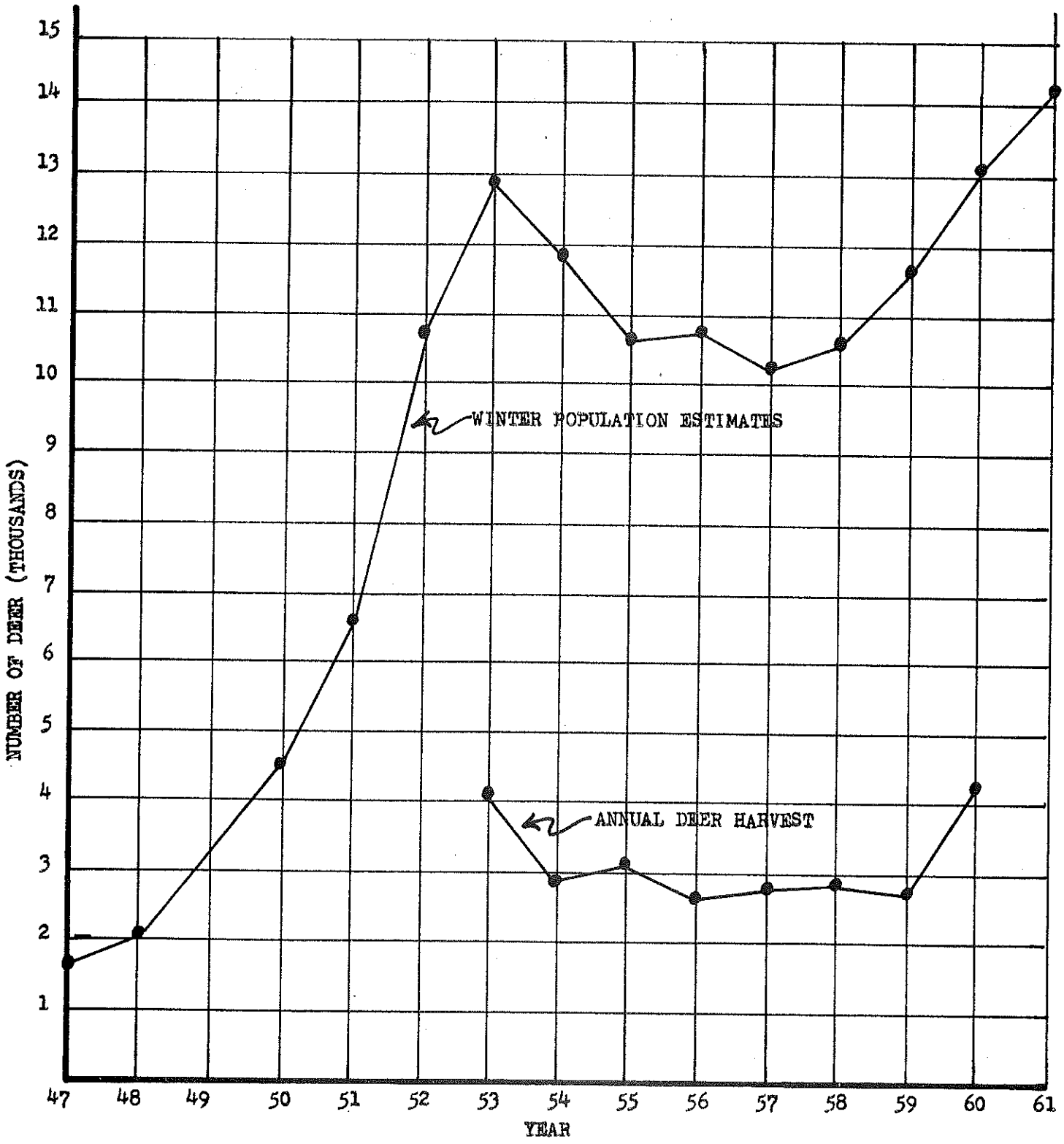

Figure 1.--WINTER DEER POPULATION ESTIMATES, IOWA, 1947-1961, AND ANNUAL DEER HARVEST, 1953-1960.

Table 1.--Winter Deer Population Estimates and Anticipated Fall Populations, Iowa, 1960 and 1961.

County	1960 Winter Population Estimates	1961 Winter Population Estimate	Anticipated 1961 Fall Estimate
Adair	137	144	235
Adams	26	32	52
Allamakee	1000	800	1305
Appanoose	15	94	153
Audubon	10	30	49
Benton	105	73	119
Black Hawk	69	100	163
Boone	77	81	132
Bremer	45	43	70
Buchanan	101	65	106
Buena Vista	30	38	62
Butler	275	140	228
Calhoun	20	25	41
Carroll	42	29	47
Cass	48	143	233
Cedar	114	130	212
Cerro Gordo	20	25	41
Cherokee	98	94	153
Chickasaw	53	44	72
Clarke	150	165	269
Clay	42	69	112
Clayton	485	635	1036
Clinton	140	149	243
Crawford	118	135	220
Dallas	186	152	248
Davis	30	85	139
Decatur	190	205	334
Delaware	185	135	220
Des Moines	70	99	162
Dickinson	65	57	93
Dubuque	250	230	375
Emmet	31	50	82
Fayette	225	80	130
Floyd	125	145	236
Franklin	65	55	90
Fremont	150	162	264
Greene	94	66	108
Grundy	0	0	0
Guthrie	420	462	754
Hamilton	100	106	173
Hancock	96	98	160
Hardin	95	112	183
Harrison	238	198	323
Henry	52	39	64
Howard	208	206	336
Humboldt	114	63	103
Ida	12	19	31
Iowa	100	85	139
Jackson	560	1000	1631

Table 1.--(con't)

County	Winter 1960	Winter 1961	Fall 1961
Jasper	75	50	82
Jefferson	150	100	163
Johnson	95	80	130
Jones	120	265	432
Keokuk	94	108	176
Kossuth	25	32	52
Lee	80	109	178
Linn	140	170	277
Louisa	75	40	65
Lucas	335	340	554
Lyon	78	100	163
Madison	226	170	277
Mahaska	70	99	161
Marion	99	129	210
Marshall	86	98	160
Mills	132	147	240
Mitchell	120	130	212
Monona	310	410	669
Monroe	115	107	174
Montgomery	65	90	147
Muscatine	75	35	57
O'Brien	14	22	36
Osceola	25	30	49
Page	80	81	132
Palo Alto	70	45	73
Plymouth	145	167	272
Pocahontas	39	46	75
Polk	95	120	248
Pottawattamie	1175	1155	1884
Poweshiek	35	40	65
Ringgold	59	67	109
Sac	25	37	60
Scott	58	47	77
Shelby	213	164	267
Sioux	127	128	209
Story	42	44	72
Tama	49	89	145
Taylor	14	29	47
Union	48	52	85
Van Buren	39	124	202
Wapello	32	177	288
Warren	111	105	171
Washington	196	180	294
Wayne	78	65	106
Webster	90	105	171
Winnebago	45	47	77
Winneshiek	356	445	726
Woodbury	252	385	628
Worth	53	58	94
Wright	90	100	163
TOTALS	13,101	14,155	23,135

A RESUME OF WOOD DUCK BANDING IN IOWA AND IN THE MISSISSIPPI FLYWAY, 1959-1961

BY

James G. Sieh
Game Biologist

Waterfowl banding in Iowa and in the North American continent is a cooperative endeavor. Scientifically speaking, the values accruing from banding efforts hinge largely upon the recovery of an adequate sample of banded birds (recoveries). The Mississippi Flyway Council and the Technical Section thereof initiated a cooperative wood duck banding program in 1959. In 1960, cooperators in the U. S. and Canada banded 10,563 wood ducks, a 49 percent increase over the number banded in 1959 (Kaczynski and Geis, 1961). Seventy-two percent of the continental total was banded in the Mississippi Flyway states. Lack of an even distribution of banding effort was reported in that banders in five states (Wisconsin, Illinois, Indiana, Ohio, and Iowa) banded 76 percent of the Flyway total. In 1959 and in 1960 almost all of the wood ducks banded in Iowa were captured along the Upper Mississippi National Wildlife Refuge and Union Slough National Wildlife Refuge (Table 1). In 1961, a determined effort by the Game Section with the assistance of other personnel of the Iowa Conservation Commission resulted in the capture and banding of 146 wood ducks throughout the state (Table 2). These bandings, in addition to those birds banded on the Federal Refuges in Iowa, constitute a valuable contribution to the continental banding effort.

Kaczynski and Geis stated, "The banding of an adequate sample of immature and adult wood ducks in late summer and early fall, before the hunting season, could provide data for estimating mortality rates, for measuring the importance of hunting as a mortality factor, and determining the effects of regulations on the kill. Estimates also could be made of the size of the pre-hunting season population. Since this is the kind of information most urgently needed, pre-season banding is considered the most important". These same writers indicated that an adequate distribution of the banded sample within the flyway may be of even greater importance than the sample size. Wood ducks reportedly were sampled inadequately in almost all of the southern U. S. and in portions of the northern states in 1959 and in 1960. It is also necessary to band flightless young (locals) or adult nesting birds in order to relate production areas to harvest areas. For example, in 1959-60 a total of 676 locals were banded in Ohio and only 16 were recovered. The writers further stated "Unless more efficient procedures for capturing locals can be devised, it may not be feasible to band enough locals to provide useful data".

Iowa has made two known attempts to devise more efficient procedures for capturing wood ducks in the last several years. In 1961 Unit Mgr. Richard Toltzman adapted a drive trapping effort at night in a wood duck roost and captured 27 wood ducks capable of flight and several coot. Subsequent catches in the same roost netted only 3 and 2 ducks respectively. Burgess and Sieh failed to succeed in temporarily blinding and capturing wood ducks at night on a roost at Union Slough using a portable aircraft landing light. Individual initiative, coupled with effort and ingenuity, is the only suggested answer to devising more efficient methods of capture. Bait trapping still remains the most practicable trapping method in Iowa, but the selection and operation of traps in successful trapping sites appears to be the key to success.

Drive trapping of waterfowl in Iowa's sloughs and marshes in 1961 has proved a successful and efficient method of capturing ducks and coot. This method provided a

banded sample of most of the common nesting waterfowl in Iowa, and contributed to the distribution of the sample of banded wood ducks within the state. Most of the ducks captured are locals or flightless (moulting) adults which can be considered as birds nesting locally. Drive trapping in areas in southeastern Iowa known to have young flightless wood ducks in June and July may have possibilities. It is desirable that the size and distribution of the sample of banded wood ducks be increased in 1962.

LITERATURE CITED

Kaczynski, Charles F. and Aelred D. Geis

1961 Wood Duck Banding Program Progress Report, 1959 and 1960. U.S. Fish and Wildlife Service., Spec. Sci. Rept. Rept. ---- Wild. No. 59.

Table 1. Summary of Wood Duck Banding, 1959 through Spring, 1961 (after Kaczynski and Geis)

State and Permittee	Year	Month	Adult	Immature	Local	Unknown	All Ages
Iowa:							
Upper Mississippi River NWR	1959	Aug.	3	62	0	0	65
		Sept.	13	34	0	0	47
		TOTAL	16	96	0	0	112
	1960	June	6	0	11	0	17
		July	4	0	47	0	51
		Aug.	15	407	0	0	422
		TOTAL	25	407	58	0	490
Union Slough NWR	1959	July	4	26	8	2	40
		Aug.	14	24	10	0	48
		Sept.	10	9	0	0	19
		TOTAL	28	59	18	2	107
	1960	July	8	0	39	0	47
		Aug.	8	4	13	0	25
		Sept.	0	3	0	0	3
		TOTAL	16	7	52	0	75
Mark Twain NWR	1959	Aug.	0	4	0	0	4
		Sept.	1	19	0	4	24
		TOTAL	1	23	0	4	28
	1960	Aug.	0	21	0	0	21
Dept. of Conservation	1960	July	0	3	0	0	3
		Aug.	0	3	0	0	3
		Sept.	0	4	0	0	4
		Dec.	0	18	0	0	18
		TOTAL	0	28	0	0	28

Table 2. Summary of Wood Duck Banding in Iowa, 1961

Unit and Location	Year	Month	Adult	Immature	Local	Unknown	All Ages
Missouri River Unit	1961		5	0	1	0	6
Horseshoe Lake		July	3	0	1	0	4
Round Lake		"	8	0	2	0	10
Bays Branch Unit	1961		11	0	3	0	14
Goose Lake		July	2	0	11	0	13
Long Pond			13	0	14	0	27
Ingham-High Unit	1961						
Little Iowa Lake		Aug.	5	0	3	0	8
Ingham-High Lakes	July,	Aug., Sept.	12	11	28	0	51
Jemmerson Slough		Aug.	0	0	1	0	1
Prairie Lake		July	0	0	1	0	1
Burr Oak Lake		Sept., Oct.	25	11	0	0	36
			42	22	33	0	97
Rice Lake Unit	1961						
Myre Slough		July	1	0	3	0	4
Harmon Lake			2	0	0	0	2
Ventura Marsh			0	0	1	0	1
			3	0	4	0	7
Area 11 Game Crew	1961						
Tama Pond		July	0	0	1	0	1
Lake Odessa Unit	1961						
Lake Odessa		Sept.	2	2	0	0	4
Statewide Totals (All Units)			68	24	54	0	146

RESULTS OF THE JULY, 1961 ROADSIDE RABBIT SURVEYS

BY

Paul D. Kline
Game Biologist

INTRODUCTION

The annual July roadside count was continued in 1961. The survey has been conducted with slight modification every summer beginning in 1950. It is made by Conservation Officers and biologists who drive predetermined routes 30 to 40 miles long on gravelled roads. Participants drive 25 miles per hour starting at sunrise and count and record all rabbits seen along the routes. The July counts were developed for use in surveying cottontail populations. However, starting in 1958, jackrabbits were counted as well.

For each survey, beginning in 1958, records are kept of temperature, wind velocity, percent cloudiness, and date of last rain. It was hoped that recording these weather factors might aid in evaluation of weather influence on early morning, roadside rabbit activity. Use of dew blocks to measure dew was discontinued in 1960 after 5 years of trial. Dew, as measured along the survey routes, was not found to correlate with cottontail roadside activity. Each participant in the roadside survey was asked to record numbers of adult and juvenile cottontails observed during the survey period (July 10-20). These age ratio surveys have been conducted annually in conjunction with the roadside surveys.

RESULTS

Sixty-nine routes totaling 2,347.6 miles were surveyed. In all, 1,124 cottontails were seen for an index of 4.8 cottontails per 10 miles of route (Table 1). Cottontails were most abundant in the southern loess area where they were also most abundant every year starting in 1956 (Table 2). A very high index was obtained from the Tazewell drift area, but cannot be held very reliable as only two routes were reported from that area. The Missouri loess area from southwest Iowa yielded a relatively high index of 5.2. The lowest index came from the driftless area of northeast Iowa where rabbits are known to have consistently low populations. Low indices were obtained also from the Iowan drift and Mississippi loess areas. All areas except the Wisconsin drift and driftless areas gave higher indices than in 1960. The Wisconsin drift returned to the level of 1959 when a similar index was obtained (Table 2).

The statewide index indicates rabbit populations are on the increase after consistent decline starting in 1959. From a high of 6.86 in 1958 the index of cottontails per 10 miles dropped to 6.21 in 1959, and to 4.49 in 1960 (Table 3). The average for 11 years previous to 1961 is 4.64. Hence, the rabbit population for 1961 seems near the average of the past 11 years.

Forty seven jackrabbits were counted (Table 1). The index for jackrabbits (0.2) was less than for each of the three previous seasons during which it was recorded: 0.33 for 1960, 0.44 for 1959, and 0.23 for 1958. These indices may or may not be indicative of population changes of jackrabbits as the survey is designed for cottontails specifically and not for jackrabbits. Jackrabbits were observed from the Tazewell drift, Missouri loess, Wisconsin drift, and Iowan drift areas

(Table 1). These areas correspond with the known range of jackrabbits, although some are found in areas where none were observed during the 1961 surveys.

Of 3,171 cottontails aged, 2,201 were juveniles for a ratio of 2.27 juveniles seen per adult (Table 4). This ratio is down from 1960 (2.42) and 1959 (2.75) and certainly indicates low production for 1961. The average ratio for 11 previous years has been 2.59 juveniles per adult. Rate of production as indicated by these surveys has been poorer than every year since 1950 and 1951. Best reproduction occurred in the Wisconsin drift; poorest in the driftless area. Other areas did not vary much from the state average.

The fall population index, which is obtained by multiplying the age ratio obtained along the survey routes during the actual roadside counts (2.14) by the number of adults seen per ten miles of route (1.77) was 3.79, compared to 2.73 for 1960, 4.07 for 1959, and 4.51 for 1958 (Table 3). This indicates rabbit hunting in Iowa will be somewhat improved over 1960, but not as good as in 1958 and 1959.

DISCUSSION

At first glance it appears difficult to explain the slight increase in rabbit populations over much of Iowa since 1960. July age ratios have been low the past 2 years. It would seem that with declining production expressed by age ratios, the population should continue to fall from 1960 to 1961.

However, the age ratios express production per adult only. They do not take into account the number of adult breeders available. When a comparatively large number of cottontails survive one breeding season (as probably happened during the winter 1960-61), possibly because of a mild and favorable winter, production may be high even though the age ratios do not express it.

Another study in progress indicates actual production per female has not been as high during the past three breeding seasons as in 1958. Embryonic litter sizes dropped from 6.1 per litter in 1958 to 4.7 in 1959, 5.0 in 1960, and 4.7 again in 1961. This means that our fall population index, which takes into account the breeding population as well as rate per adult expressed as age ratios, probably gives our best picture of rabbit populations available for hunting this fall. If this is so, we can expect a successful hunting season for 1961.

Although we take into account litter sizes, age ratios, and breeding populations our picture is not complete. For instance, how can we supplement litter sizes with number of litters per female? Only this can give a truly representative picture of production effort. Also, we have no measure of rabbit survival during late summer and autumn. It is conceivable to have a high July population, but with very high mortality following, so that the hunting population is relatively reduced and small. Such phenomena as severe rainstorms during the breeding season may wipe out many if not most nestling cottontails over any area encompassed by these storms. Or long periods of wet cold weather may wipe out practically all nestlings over a vast area. These are some things we know relatively little about and, most important, have as yet no way of measuring.

Table 1. Results of July 1961 Roadside Rabbit Surveys

Area	Number of Route	Total Miles	Cotton-tails Observed	Cottontails Observed/ 10 Miles	Jack-rabbits Observed	Jackrabbits Observed/ 10 Miles
Tazewell Drift	2	71.0	54	7.6	3	0.4
Missouri Loess	8	267.7	139	5.2	17	0.6
Wisconsin Drift	15	541.6	242	4.5	21	0.4
Iowan Drift	16	503.2	190	3.8	6	0.1
Driftless Area	3	101.4	17	1.7	--	---
Mississippi Loess	9	313.0	107	3.4	--	---
Southern Loess	16	549.5	375	6.8	--	---
Statewide	69	2347.6	1124	4.79	47	0.2

Table 2. Comparisons of July Roadside Rabbit Surveys, 1956 through 1961

Area	Cottontails Seen per 10 Miles of Route					
	1956	1957	1958	1959	1960	1961
Tazewell Drift	3.5	3.8	6.5	5.4	4.1	7.6
Missouri Loess	3.1	4.0	9.4	8.6	4.7	5.2
Wisconsin Drift	2.8	2.9	4.6	4.5	5.4	4.5
Iowan Drift	3.5	4.4	4.5	3.6	3.6	3.8
Driftless Area	2.6	2.6	2.7	1.5	1.9	1.7
Mississippi Loess	4.3	5.3	6.7	6.1	2.8	3.4
Southern Loess	6.2	8.5	13.6	10.9	5.8	6.8
Statewide	3.94	4.89	6.86	6.21	4.5	4.79

Table 3. Comparisons of July Rabbit Indices, 1950 through 1961

Year	Number of Cottontails Seen per 10 Miles of Route	Number of Juveniles per Adult	Fall Population Index
1950	4.28	2.2	---
1951	3.91	2.0	---
1952	4.17	2.6	---
1953	3.30	2.4	---
1954	3.35	2.5	---
1955	5.67	3.0	---
1965	3.94	2.7	---
1957	4.89	3.2	---
1958	6.86	2.67	4.51
1959	6.21	2.75	4.01
1960	4.49	2.42	2.73
1961	4.79	2.27	3.79

Table 4. Age Ratios of Cottontails Observed During July 1961 counts

Area	Number of Adults	Number of Juveniles	Ratio of Juveniles/Adults
Tazewell Drift	24	57	2.4
Missouri Loess	163	336	2.1
Wisconsin Drift	206	553	2.7
Iowan Drift	152	344	2.3
Driftless Area	30	52	1.7
Mississippi Loess	87	181	2.1
Southern Loess	307	678	2.2
Statewide	969	2201	2.27

RESULTS OF THE 1961 CREEL CENSUS ON THREE SOUTHERN IOWA ARTIFICIAL LAKES

BY

Jim Mayhew
Fisheries Biologist

A creel census was conducted on three, state-owned, artificial lakes during the summer of 1961. The impoundments censused were Thayer Lake and Green Valley Lake in Union County, and Red Haw Lake in Lucas County. A modification of the stratified sampling design described by Mayhew (1956) was employed as the basis for the project. The census period extended from April 15 to July 31.

During the interview with each fishing party, information was requested on the number and kind of fish caught and kept, number of hours fished, species fished for, and the distance traveled to the lake. Additional information was recorded at Green Valley Lake on the number of anglers using marked fish shelters in an effort to increase the catch, and at Red Haw Lake on the number of fishermen using posted information on the location of the thermocline. Since stratification is not complete at Red Haw until the early part of June, this information was not requested until the lake was devoid of oxygen below a depth of 14 feet.

In all, 1,714 individual fishermen were contacted during the 14 week census period. This is an average of 20 fishermen per visit at each lake. During the last census in 1957 a mean of 24 fishermen was contacted per visit.

Thayer Lake

In 1959, Thayer Lake was designated as a special fisheries study area for the development of a fishery to maximum production levels. The existing fish populations were totally eradicated by chemical treatment and the impoundment restocked with largemouth bass, crappie, bullhead and channel catfish. There is also a residual population of green sunfish.

During the census period a total of 112 fishermen were interviewed at Thayer Lake. With the exception of four fishermen, all these contacts were made on shore anglers. A total of 263 fish was recorded after these people had fished 150 hours. This is a mean catch rate of 1.75 fish per hour. Angling success would undoubtedly have been much better, but extreme water turbidity in the spring and dense submergent vegetation beds during July made angling difficult. There is a vast population of largemouth bass that could be harvested by hook and line, particularly if more boat angling could be encouraged.

Green sunfish comprised 62.0 per cent of the total catch. Most of these were caught incidentally while fishing for other species, but were exceptionally large and were taken home for consumption. Bullhead was the second most important species of fish, making up 28.2 per cent of the anglers harvest. Species composition of the remainder of the catch is listed in Table 1.

Table 1. The Recorded Anglers Catch at Thayer, Green Valley, and Red Haw Lakes from April 15 to July 31, 1961.

Lake	Total Men	Total Hours	Total Fish	Per Cent Species Composition							
				Bass	B'Gill	Crappie	B'Head	Ch.Cat	Walleye	Perch	Sunfish
Thayer	112	150	263	3.8	1.5	4.5	28.2	--	--	--	62.0
GreenValley	1,196	2,444	2,174	1.4	9.9	56.3	25.6	0.5	1.4	5.1	
Red Haw	406	544	1,128	2.8	42.4	42.4	2.8	7.3	--	3.5	

Of the 112 anglers interviewed as to what species they were fishing for, 85.8 per cent expressed a desire to catch bullheads. Only one individual was fishing for channel catfish; whereas, 12 were fishing for anything or for more than one species.

Unlike most of the artificial lakes in southern Iowa a majority of the anglers contacted were from the general vicinity of Thayer Lake. Mean driving distance was 14 miles.

Green Valley Lake

During recent years there has been much angling interest at Green Valley Lake from fishermen throughout southern Iowa. Game-fish populations have developed rapidly and remained static since the opening of the impoundment to public angling in 1954.

In the 14-week creel census in 1961, 1,196 anglers were contacted and 2,144 fish were caught in 2,444 hours. This is a catch rate of 0.88 fish per hour. Further analysis of the data revealed that 83 per cent of the anglers caught at least one fish. Crappie were caught more frequently than any other species, making up 56.3 per cent of the total catch (Table 1). Bullhead, bluegill, perch, largemouth bass, and walleye comprised 25.6, 10.9, 5.2, 1.5, and 1.5 per cent of the harvest, respectively.

Although crappie were the most frequently caught fish, only 34 per cent of the fishermen contacted expressed a primary desire to catch this species. Most of the anglers (37 per cent) were fishing for bullheads. Twenty-two per cent of the anglers said they were fishing for more than one species or for anything that would bite. The remainder were largemouth bass, walleye, and bluegill fishermen.

In the 1957 creel census most of the fishermen were from the immediate area, but in this census the average driving distance was 38 miles.

One important phase of the creel census was to determine the effectiveness of posted fish shelter signs to direct anglers to shelter locations where fish would be concentrated. Twelve newly constructed fish shelters (sunken red cedar trees) were marked with either shoreline or buoyed signs. It was hoped that these shelters would act as concentrators of crappie and bluegill and angling success for these two species might be increased by anglers fishing in the immediate vicinity of the shelters. Of the 245 parties contacted only eight per cent said that they made use of the posted information in an attempt to increase their fishing success.

Red Haw Lake

Fishing success was generally considered excellent during 1961. Information was received from 406 anglers who caught 1,128 fish after fishing 504 hours. Bluegill and crappie each comprised 42.4 per cent of the total catch. Channel catfish ranked third in importance representing 7.3 per cent of the total fishery. The remainder of the catch consisted of largemouth bass, perch, and bullheads (Table 1).

The miscellaneous data received from the anglers revealed that 64 per cent were fishing for bluegill or crappie, and many times a party would be fishing for both species. The remainder had the following preference: 19 per cent, anything; 6 per cent, channel catfish; 11 per cent, bullheads; and 3 per cent, largemouth bass.

Although Red Haw is located a considerable distance from Des Moines (56 miles), 38 per cent of the anglers interviewed indicated they were from that vicinity. Only 14 per cent of the anglers were from local communities. Average driving distance to the lake was 56 miles.

This year for the first time the location of the thermocline was posted at all accesses to the lake. It was hoped that this information might aid the angler in locating the depth at which fish are concentrated during stratification. It is not uncommon to find as many as 50 per cent of the anglers at Red Haw fishing in oxygenless water stratum where there is little chance of catching fish. Of the 98 parties contacted after the lake was stratified and the information was posted, only 9 per cent made use of the service. All of these people were fishing for channel catfish and their mean rate of success was eight times greater than those who ignored the location of the thermocline.

DISCUSSION

In general, angling was considered good in the three artificial lakes censused in 1961. Angling success was somewhat curtailed by extremely turbid waters in all three impoundments early in the spring, but by June water clarity had returned to normal. Shore angling at Red Haw and Thayer Lakes was also difficult during July because of massive beds of submergent aquatic vegetation.

Angling success varied greatly in the three lakes. Red Haw had exceptionally good fishing with an average rate of catch of 2.07 fish per hour. This was primarily due to heavy exploitation of crappie and bluegill. These species comprised in excess of 84 per cent of the total fishery. Largemouth bass angling was considered good in the early portion of the census, but in early summer a golden shiner hatch of considerable magnitude, which served as forage for this species, caused bass fishing to become non-existant.

A residual population of green sunfish following chemical eradication of the fish population in 1959 carried the major portion of the fishery at Thayer Lake. This is considered atypical since this species rarely contributes materially to hook and line harvest in other artificial lakes. This species will undoubtedly decline in abundance after the newly developed game-fish populations become stabilized.

The angling success in Green Valley Lake has improved vastly since the last creel census in 1957 when the mean rate of success was 0.18 fish per hour. Although bullheads were the most sought after fish (37 per cent of the anglers), crappie carried the bulk of the angling exploitation. This species contributed over 54 per cent of the total catch. For the first time since the lake was opened to public angling the walleye exceeded the largemouth bass harvest. This species has apparently replaced the bass in both abundance and angler harvest.

As stated before, one important phase of the creel census in Red Haw and Green Valley Lakes was to determine the success of increasing angling success and harvest by posting information concerning the location of thermoclines and fish shelters. Both of these met with very limited success. At Green Valley only eight per cent of the anglers made use of the newly installed fish shelters. In Red Haw, nine per cent of the anglers used the posted thermocline information. From general observations

there is little doubt that these angling services would be useful to the sport fishermen to increase their fishing success. At Red Haw only channel catfish anglers used the information, and only a small percentage of this group tried the method. However, those that did caught eight times more fish than those who did not use the method. Similarily, at Green Valley Lake during the annual fisheries inventory an electric fish shocker produced 57 crappie, 15 bluegill, nine largemouth bass, and two walleye from the immediate vicinity of a fish shelter. With concentrations of game-fish of this magnitude in a confined area such as a fish shelter, angling success should certainly be increased by fishing in this vicinity. However, only a few anglers used this important service.

SUMMARY

A creel census was conducted on Thayer Lake, Green Valley Lake, and Red Haw Lake from April 15 to July 31, 1961. The results were as follows:

1. A total of 1,714 anglers were contacted. They caught 3,515 fish after fishing 3,128 hours.

2. Angling success ranged from a high of 2.07 fish per hour at Red Haw to 0.88 fish per hour at Green Valley.

3. Crappie ranked first in abundance at Red Haw and Green Valley; whereas, green sunfish were the most abundant species in the anglers' bag at Thayer Lake.

4. Bullheads were the most sought after fish at Green Valley and Thayer Lake while most anglers preferred crappie and bluegill at Red Haw.

5. The average distance driven to fish in the individual lakes varied from 14 miles at Thayer Lake to 58 miles at Green Valley.

6. Information posted at Green Valley and Red Haw Lakes concerning the location of fish shelters and the thermocline met with limited success in attempting to increase angling harvest and success.

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A BRIEF REVIEW OF THE USE OF TOXAPHENE IN IOWA LAKES

BY

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With the increased use of chemicals in fish management, fisheries biologist and managers have recently been accused of working against the conservation of fish and embarking upon a campaign to destroy the native fresh-water fauna in favor of game fish or whatever fish the sportsmen's groups think they want. Regardless of the pros and cons of this criticism, a review of the use of chemicals in fish management is in order as would be true in any other management practice.

Toxaphene is one of the more potent of the new chemicals used in fish management and due to the fact that it can be toxic to all forms of life, it is imperative that all factors be carefully considered prior to any application. The possibility of secondary or "side effects" should also be given consideration in any application of a potent chemical.

Although laboratory results have been rather consistent, the literature concerning the field-use of toxaphene in fisheries management indicates that a wide variety of results have been obtained. The application in Iowa lakes and ponds have been made under a variety of conditions with a corresponding variety of results.

Toxaphene has been applied to nearly 6,000 acres of water in Iowa since the first lakes was treated in the fall of 1957 (Table 1). These treatments have covered 8 shallow, glacial lakes of northern Iowa, 5 marsh areas, 1 artificial lake, 6 gravel pits, and 15 small strip mine lakes in southern Iowa. In all but one instance the chemical was administered to obtain a complete fish kill.

It is the purpose of this paper to briefly discuss these applications and the results obtained.

Shallow glacial lakes: Lakes in this category varied in area from 12 to 3,000 survace acres, and from 2 to 8 feet in average depth. Storm Lake (3,000 acres) was treated after an ice cover had formed, all the others were treated during open water periods, usually late fall. These lakes were treated with toxaphene concentrations ranging from 0.05 ppm to 0.25 ppm, except North Twin Lake which received only 0.02 ppm to eradicated a population of small fish.

Table 1. A List of Iowa Waters Treated with Toxaphene, 1957-60

Category	Name	Acres treated	conc. used - ppm
Shallow glacial lakes	Pleasant Lake	77	0.1
	Welch Lake	55	0.2 (twice at 0.1)
	Diamond Lake	160	0.1
	Center Lake	264	0.05
	Silver Lake	600	0.1
	Sunken Lake	12	0.2 (twice at 0.1)
	Storm Lake	3,000	0.25 (under ice)
	North Twin Lake	600	0.02 (partial kill)
Marshes	Bays Branch	50	0.1
	Mc Cord Pond	80	0.2 (twice at 0.1)
	Dunbar Slough	250	0.1
	Sweets Marsh	390	0.15
	Little Wall Lake	100	0.1 (under ice)
Artificial Lakes	Swan Lake	130	0.2 (under ice)
Gravel Pits	Six ponds	12	0.05 (under ice)
Strip Mine Ponds	15 ponds	39	0.01 to .1
Total acres		5,819	

Turbidity was usually the primary factor in the decision as to what concentration of toxaphene would be used. But in reviewing the results obtained it appears that the average depth of the water may be nearly as important as turbidity, with the deeper lakes requiring lighter dosages than shallow lakes of the same turbidity. Center Lake for instance, with an 8 foot average depth, was successfully treated at 0.05 ppm while Welch Lake, with a 4 foot average depth, required 0.02 ppm for successful treatment. The turbidity of Welch Lake was slightly greater than in Center Lake but not four times greater. This depth factor was also brought out in the treatment of Storm Lake under the ice. A portion of the west end of the lake averaged a 1 foot depth under the ice while the east end averaged closer to 2 feet. The entire lake was treated at the rate of 0.25 ppm; thus the concentration of toxaphene applied to the west end was nearly twice as great as that in the east portion. Observations of caged fish indicated less toxicity in the shallow end of the lake in spite of the increased toxaphene.

As far as could be determined the watershed treatment of this lake was successful but the treatment of the main lake failed to bring about a complete kill. No live fish could be found with seine or trawl but a moderate hatch of carp was observed during the summer, indicating the survival of a few adults. This carp hatch was considered about one-tenth the magnitude of the carp hatch that occurred in the spring of 1959 following what was considered a severe winter kill. A heavy stocking of walleye fry in the spring of 1960 failed to produce any detectable population of fingerlings, indicating the probability of a slight toxic condition at the time of stocking.

In general the toxicity that one could expect in the spring following a fall treatment of toxaphene was hard to predict. As a rule of thumb the shallow lakes, even though treated at higher concentrations were less toxic than deeper lakes. Advanced largemouth bass fry stocked in Center Lake in early June failed to survive, but a stocking of fingerling in September was successful. Stocking of adult bullheads about the same time that walleye fry were planted in Storm Lake was successful, and excellent growth and reproduction was noted.

These lakes supported little or no vegetation at the time of treatment. General observations indicate that bottom fauna is adversly affected but makes a rapid recovery. Zooplankton has always been abundant at the time of fry stocking in the spring even though the lake was slightly toxic to the fry. No deaths of any associated wildlife such as muskrats or ducks were observed in the treatment of the lakes in this category. Dissolved oxygen concentrations are always high during the winter period following an application of toxaphene, even though the lake has a consistent history of low oxygen each winter.

There is considerable evidence that a selective fish kill can be achieved with light dosages of toxaphene, selective in that small fish are less tolerant of toxaphene than large fish. This type of selective kill was attempted at North Twin Lake in the fall of 1960.

A moderately severe winter kill during the winter of 1959-60 had reduced the overall fish population to adult carp, buffalo and bullheads. The resulting hatch of young was considered too large to handle with conventional methods in future management. Predator fish stocking during 1960 failed to produce the desired results.

Because of past experience with attempts at complete kills and persistent toxicity, the recommendation was made to treat for removal of the young fish and have non-toxic conditions the following spring. The lake was treated with toxaphene at approximately 0.02 ppm on November 1, 1960. The young fish were killed along with a good portion of the adult carp, buffalo and bullhead. Northern pike fry and walleye fry were successfully stocked in the spring of 1961. The carp, buffalo and bullhead brought off another hatch but not in the strength of the 1960 hatch.

Walleyes were known to be present in the lake prior to the treatment but in small numbers. Twenty walleyes, all less than one pound, were estimated as killed by the treatment, yet a number of 3 to 5 pound walleyes were caught on hook and line during the early part of 1961. Toxaphene may be a chemical that can be used in walleye waters.

Marshes: Five marshes have been treated with toxaphene in an effort to obtain complete fish kills and thus better management of the aquatic plants. These areas with vegetation present more of a problem in both the application of the chemical and in detoxification by the combination of shallow water and plants. It was necessary to re-treat one area and in another only an 80 per cent kill was achieved even with a 0.15 concentration. A severe winter kill assisted the reclamation of this latter area, and detoxification was evident by the successful stocking of northern pike fry in April and largemouth bass fry in June. There were no known adverse effects of toxaphene treatments on these marshes, with concentrations up to 0.2 ppm in one area.

Artificial lakes: Only one artificial lake has been treated with toxaphene at this time. Swan Lake is a small, shallow lake with a mud bottom. In most respects it compares with the shallow glacial lakes discussed in the first category. This lake was treated at 0.2 ppm to eradicate a high population of stunted bullheads. The treatment was carried out under about 4 inches of ice. The treatment was considered very successful. The success might be connected with the fact that the lake lost its ice cover shortly after treatment, permitting better mixing. Largemouth bass fry were successfully stocked the following spring.

Muskrats were common in the upper end of this lake and were observed to be feeding on dead bullheads. Two dead muskrats were found by the local park custodian but no examination was made to determine cause of death. Even if their deaths could have been attributed to the chemical treatment, the population was not harmed; there was no lack of muskrat activity the following spring.

Gravel pits: The six gravel pits, totalling 12 acres, occurred in the watershed of Storm Lake. These were treated while covered with ice. These pits had a rather low turbidity and an assumed low plankton population. They averaged 6 to 10 feet in depth. These factors led to a treatment at 0.05 ppm for all six pits. Excellent results were obtained but toxic conditions remained longer than in Storm Lake.

In all prior toxaphene treatments there were not noticeable migrations of effected fish toward shore as is often noted in rotenone treatments. In these gravel pits the adult carp and a few individuals of other species appeared to make a definite migration toward shore. These fish did not live even though they found an area of freshwater seepage.

Strip mine lakes: The treatment and physical characteristics of these 15 pounds have been described in detail by Mayhew (1959). Mayhew's conclusion that the physical and chemical characteristics of the body of water were more important in determining toxicity or time elapsed before detoxifying than the actual concentration of the chemical would appear to agree with the findings in the northern Iowa glacial lakes and marshes.

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PROGRESS REPORT: RENOVATION OF THE WINNEBAGO RIVER, WORTH COUNTY, IOWA

BY

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In the fall of 1958 and during the winter that followed, the Winnebago River system above the town of Fertile in Worth County, Iowa, was treated with toxaphene to eradicate a vast population of noxious fish. This was done to create a void into which game fish would be stocked in an attempt to develop a sport fishery in that stream.

A progress report which outlines the scope of the project, the proceedures and techniques used, and the results obtained through the fall of 1960, is contained in the April, 1961, Quarterly Biology Reports.

The present paper is a second progress report. It will concern only the fisheries aspect of the project. Its purpose is to review by species the relative abundance and importance of each species inhabiting the Winnebago River prior to the eradication program, recovery through three growing seasons, and present status.

Naming of species and order of listing will follow that of Bailey (1956).

Northern pike: Northern pike occurred as a rare species in the Winnebago before chemical treatment. Fry plantings, amounting to 255,000 in 1959, 140,000 in 1960, and 250,000 in 1961, have resulted in excellent populations for each year. Three definite length groups occur; they average approximately 9 inches in total length for the 1961 stocking, 15 inches for 1960, and 22 inches for 1959.

A northern fishery began in the spring of 1960, and present populations of fish ranging between 18 and 25 inches in length and weighing up to 4 pounds are at sufficient levels to furnish more fishing than is presently being done.

Quillback carpsucker: Quillback have never been a species of consequence in the Winnebago River during the time of this investigation. They were found in small numbers in a limited reach of stream between the towns of Forest City and Fertile prior to chemical treatment. A single specimen from the same area identified in the 1960 surveys constitutes a post-treatment occurrence for the species.

River carpsucker: Prior to our eradication program this species was widely distributed, although in rather limited numbers, throughout the area. Population estimates at that time indicated that carpsuckers made up approximately 3 per cent of the population by weight. Recent surveys reveal the species again widely distributed in the area. They do not, however, occur in as large a number as before.

Golden redhorse: Golden redhorse are found in diminutive numbers in the reach between Forest City and Fertile. Their occurrence increases downstream, and attains maximum numbers in the limestone outcrops immediately above the Fertile impoundment. The species probably exerts little influence upon the fishery. Present populations closely resemble those found prior to chemical eradication.

Northern redhorse: The northern redhorse appears throughout the length of the area. They are ordinarily found in small numbers and are usually of small size. Individuals longer than 10 inches are rare. Because of limited size and number, the species is not regarded important to the over-all economy of the stream. Present populations resemble those of pre-treatment times.

White sucker: This species is ranked as common in the Winnebago. It is second in abundance among the various suckers, but despite this rate of occurrence, it makes up less than 1 per cent of the total fish population. Post and pre-treatment populations are similar.

Carp: Carp are by far the most prominent fish in the Winnebago River system. They were estimated to comprise a minimum of 95 per cent of the total fish population prior to chemical eradication. In three growing seasons they have, in most stretches, returned to their former abundance. An exception occurs in the reach extending from the dam at Forest City downstream to the vicinity of the Hancock-Cerro Gordo County line. In this area carp are numerous, but probably make up less than 80 per cent of the fish population.

Golden shiner: This species is widely distributed in rather small numbers in the Winnebago. Post and pre-treatment populations are similar. The species is apparently living in marginal habitat. Individual specimens longer than 2 inches total length have not been observed.

Creek chub: Creek chubs are among the more numerous cyprinids inhabiting this stream. However, they do not occur abundantly. The minnows as a group are not now and have not been plentiful in this stream. Excessive carp populations, past and present, together with current high northern populations, tend to suppress the entire cyprinid family.

Northern common shiner: This is the second most abundant cyprinid appearing in the renovated area. It is distributed quite evenly over the course of the stream. Present and post populations are not greatly different. With individual size ranging up to 6 inches total length, the common shiner seems to be among the better adapted cyprinids in the Winnebago.

Big mouth shiner: The populations before and after eradication are similar. This species occurs only in small numbers.

Sand shiner: Found only in limited numbers in the Winnebago. Post and pre-treatment populations approximate each other.

Topeka shiner: This is known to be present from the finding of only one specimen, which was taken in the 1961 fall surveys.

Brassy minnow: This species occurs in small numbers throughout the area. Present populations resemble those prior to eradication.

Bluntnose minnow: This species is the most abundant cyprinid inhabiting the stream. It occurs in relatively large numbers along the entire course. Individual sizes are quite small when compared with specimens in other areas. Individuals longer than 2 inches total length are quite rare.

Fathead minnow: The fathead was present in small numbers prior to chemical treatment. It became abundant in the early recovery population, but its present numbers are down. Experience with fathead populations in Iowa streams indicates that the species does not flourish in the presence of high populations of other fish.

Black bullhead: According to poundage, the black bullhead is the third most abundant species in the Winnebago. It occurs in its maximum numbers in the headwaters and in the impoundments at Forest City and Fertile. Post and pre-treatment populations are similar. The species furnishes the bulk of the angling in the area. Increases in individual size resulting from the eradication program were not detected; if any occurred, they were minor and of short duration. The average bullhead taken by angling is approximately 7 inches total length.

Yellow bullhead: This is an unimportant species in the Winnebago. It generally appears as a single specimen among several hundred black bullheads.

Channel catfish: This species was not present in the Winnebago for many years prior to chemical treatment. Channel catfish stocking since has been as follows: 946 adults, 8,198 yearlings and 34,650 fingerlings in 1959; 2,000 yearlings and 140,000 fry in 1960; and 15,000 fingerlings in 1961.

Extensive surveys conducted in the fall of 1960 failed to produce evidence of the 1960 stocking, and only a remnant of the 1959 introductions persists to this date. Fingerlings introduced in August of 1961 were found in good numbers below the Forest City dam a month later.

Tadpole madtom: The madtom is a rather common species in the upper reaches of the study area. Its current population resembles that prior to the kill of 1959.

Stonecat: This species is presently abundant in all areas where boulders or limestone make up the stream bed. Former populations were much the same as those found now.

Smallmouth bass: Prior to our chemical treatment, smallmouth bass were confined in small numbers to a short reach of the Winnebago in Cerro Gordo and Hancock counties. An introduction of 7,750 fry and 2,175 fingerlings in 1959 established fair numbers of smallmouth from the Iowa-Minnesota state line to the impoundment at Fertile. These fish attained a length of 9 inches by the fall of 1960, and were 13 inches long one year later. No evidence of survival of 14,000 fingerlings stocked in 1960 appeared in the 1961 surveys.

Largemouth bass: This species was not found prior to our 1959 chemical kill. A single specimen 10 inches long, taken at Forest City, constitutes the only record of survival for 25,000 fingerlings introduced in 1959.

Green sunfish: The green sunfish is a rather common species. It occurs in small numbers along the entire stream. Present and pre-treatment populations of green sunfish are not greatly different.

Walleye: Walleye were not found in the Winnebago prior to the eradication program. They now occur in good numbers in the reach below Forest City. The species gained entrance to the Winnebago by escaping through an outlet of a gravel pit adjacent to the stream. These fish are of the 1961 year class, and average 6 inches total length.

Blackside darter: This species appears as scattered individuals, but only in the downstream reaches.

Johnny darter: The johnny darter occurs abundantly in the upstream reaches of the study area; it is common in the lower reaches. By the fall of 1961, the populations of this species had recovered to levels approximating those found prior to our eradication program of 1958-59.

DISCUSSION

Twenty-seven species of fish are now known to be in the Winnebago River. Twenty-three of these occurred prior to our eradication work. The remaining four have been found since; of those, three (channel catfish, walleye and largemouth bass) were introduced by stocking. The fourth, the topeka shiner, no doubt occurred before, but due to its small numbers must have been missed in our original surveys. Two other species, northern pike and smallmouth bass, are at this time far more abundant and wide-spread in the area than before. The abundance has resulted from stocking.

With minor or barely detectable exceptions, the twenty-three species that populated the area previous to the 1958-59 wintertime kill had, by the fall of 1961, returned in a general way to their former status.

A point of significance that comes from this study would be an answer to widespread concern that stream renovation work presents a veritable danger of obliterating specific populations. On the basis of this and other renovation projects that I have worked on, the aforementioned danger seems highly unlikely.

The eradication program of the present project literally devastated the fish population in the Winnebago. Extensive post treatment surveys employing chemicals failed to produce more than a fraction of a pound of fish in several miles of stream. Yet the survival of all species was sufficient to repopulate the stream until it now approximates its original state. This was accomplished in three growing seasons, and in the face of heavy stockings of predacious fishes.

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