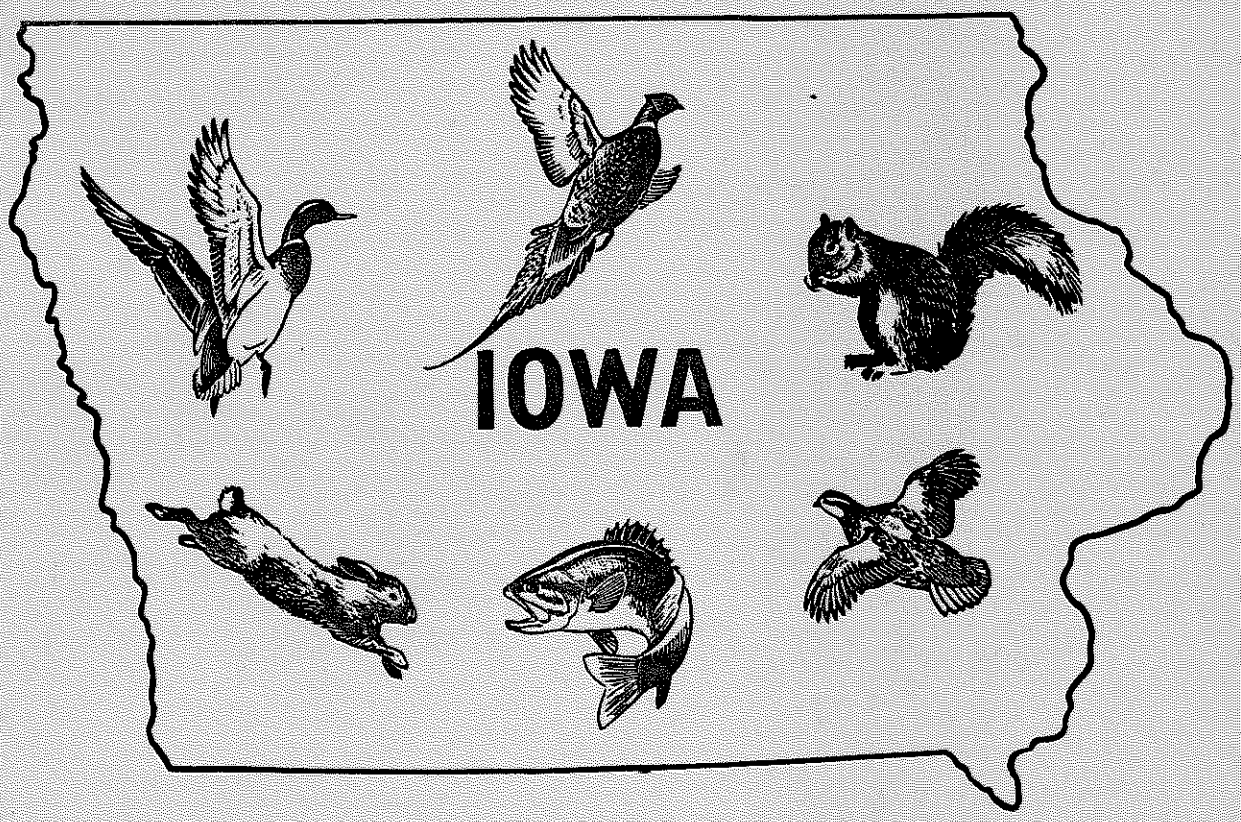
1959

QUARTERLY BIOLOGY REPORTS



FISH AND GAME DIVISION — BIOLOGY SECTION

STATE CONSERVATION COMMISSION

TABLE OF CONTENTS

ABSTRACTS OF QUARTERLY BIOLOGY REPORTS

The Contribution of Stocked Fingerling Walleyes To the Adult Population in Spirit Lake (Progress Report)

by
E. T. Rose
Fisheries Biologist

Further studies concerning results of a heavy stocking of fin clipped fingerling walleyes in Spirit Lake indicate high survival to maturity. Shocker tests in 1959 show around 20 per cent of the 1959 year class were from the stocked component. Creel census data include about 10 per cent of this year class as marked fish.

Progress Report of Fish Populations Humboldt Study Area

by
Harry Harrison
Fisheries Biologist

A 5 and one-half mile stretch of the Des Moines River between two hydro-electric dams in Humboldt County was treated with rotenone in 1956, to eradicate an undesirable fish population. The area was restocked with game fish, and these together with a population of bullheads that survived the chemical treatment and the re-entry of rough fish from upstream, have developed into the population now occupying the area. Information pertinent to the development of the present population includes: (a) establishment of game fish populations by management stocking, (b) re-establishment of rough fish by re-entry into the treated area, (c) acclerated growth for the first growing season following the eradication program, and (d) a leveling off of growth rates as the population approached and attained carrying capacity.

Commercial Fishing Statistics Iowa Waters of the Missouri River - 1958

by
Delmar Robinson
Fisheries Biologist

Commercial fishermen licensed 542 items of gear for use in the Iowa waters of the Missouri River in 1958. This included 210 residents of Iowa and four non-residents.

Hoope nets (286 licensed), trot lines (127 licensed), and trammel nets (61 licensed) were the three most common types of commercial gear licensed.

Harrison County with 79 operators had more than twice the number of licensed commercial fishermen than any other county in the watershed.

Twenty-eight fishermen, or 13% of the total licensed fishermen reported a commercial catch of 18,677 pounds from the Missouri River in 1958.

II

Summary of Hatchery Studies, Spring, 1959

by
Tom Moen
Fisheries Biologists

This is an annual report concerning certain phases of walleye and northern pike hatchery operations as they apply to the three major pike hatcheries of Iowa. The discussion presents a summary of basic production data and results of some experimental hatchery work.

The Spirit Lake Hatchery produced about 100,000 northern pike fry and 68 million walleye fry while the Clear Lake station produced no northern pike and 23 million walleye fry. The Lansing station produced about 6 million northern pike fry and about 2 million walleye fry.

Experimental work was conducted evaluating hormone injections of both northern pike and walleye females. Considerable success was attained with carp pituitary solution injected into northern pike females while a commercial preparation (APL) was unsuccessful in the first trial. Carp pituitary injections in walleye females was less striking than in northerns.

The use of plastic bags to haul northern pike and walleye fry is discussed.

The Development of a Walleye Population in an Artificial Lake

by
Jim Mayhew
Fisheries Biologist

Walleyes stocked in Green Valley Lake, Iowa from 1954 through 1959. Evidently this stocking has resulted in the establishment of a fairly stable population capable of producing fair angling success. The lake is considered only fair walleye habitat because of the lack of gravel or rock shoals. In other artificial lakes natural reproduction has been the limiting factor in the establishment of walleyes.

Two, 200' X 6' gill nets (two inch mesh, bar measure) were fished for 192 hours in the spring of 1959 to determine the peak of spawning activity as indicated by peak catch of female fish. These data were later delineated into dates and temperature ranges. This peak occurred between April 5 and 11 when water temperatures ranged from 44 to 54 °F. Fecundity and morility were apparently normal and satisfactory. However, the hatching success and survival of young were not determined.

Growth of walleye in the artificial lakes is considerably above average for other Iowa waters. The largest fish examined in this study grew 24 inches total length in five years.

Creel census data for the past three years revealed that walleye have comprised up to 2.8 per cent of the annual harvest of fish in Green Valley, Lake.

Results of the 1959 Conservation Officers' February Deer Census

by
Eldie Mustard
Game Biologist

The Conservation Officers' February Deer Census has been conducted annually since 1947. Each officer submits a report which includes an estimate of the number of deer in his county or counties, and a map on which major deer areas in his territory are delineated.

Results of the 1959 census indicate that Iowa had a February deer population of 11,705, or about a 10 percent increase over the 10,643 reported in the 1958 census. A comparison of the 1958 vs. 1959 deer population estimates indicates that 60 counties experienced increases, 34 counties experienced decreases, and five remained the same. The majority of these changes were less than 25 percent.

Deer were reported in all counties except Grundy, with estimates for the several counties ranging from 0 to 1,400. An average deer population of 118 per county was indicated. Sixty-two counties reported February deer populations of 100 animals or less, with eight reporting over 250 animals.

Commencement of Breeding Activities of The Cottontail in Iowa

by
Paul Kline
Game Biologist

A review of the literature and an intensive study of 191 Iowa cottontails - box-trapped, retrieved as road kills, and shot - indicated that mating in the species commences late in February. However, only six of 63 females were found to have bred as early as February. The earliest detected mating occurred February 23rd. Snow cover and temperature seemed to control early season breeding activities.

Rabbit hunting in February should not interfere with breeding. Most hunting is done with the ground snow-covered. During late springs with snow cover in late February, hunters would pursue cottontails if permitted. However, the snow and cold probably would delay mating until sometime in March. During early-warming springs, with warm temperatures and no snow, the rabbits would begin breeding some late in February; but hunting effort would be inconsequential.

Age of Quail Shot by Hunters

by
M. E. Stempel
Game Biologist

Several quail hunters from southern Iowa voluntarily saved wings from quail shot during each open season for quail. Ages of most of the young taken prior to November 15th were determined by a study of primary feather growth. From a sample of 1253 wings, 83 percent were young. Hatching began in May and was at a peak in July. By December 15th, 76 percent of the young and over 90 percent of the adults had fully developed primary flight feathers.

In the spring of 1958 a survey was made in an Ottumwa, Iowa junior high school to determine the extent of quail hunting among students. In the ninth grade 70 boys and 30 girls reported they hunted 910 times for all kinds of game. Eighty-four percent of boys hunted. Fifty-five percent of these reported they hunted quail: 24 percent of the girls hunted, only two percent hunted quail.

IV

Pheasant Crowing Count and Hen Index Spring 1959

by
Richard C. Nomsen
Game Biologist

Pheasant crowing activity continued at a high level this spring. Officers heard an average of 11.7 calls per stop which was only 3 percent below the record 12.1 calls per stop recorded in 1958. The hen index indicated a very high spring population. The state-wide hen index of 36.3 established a new high for this survey and indicated an increase of 30 percent above the 1958 population. Substantial gains were recorded in the northern third of Iowa and for district four in the west central part of the state. The pheasant population in the rest of the state remained stable.

RESULTS OF THE 1959 CONSERVATION OFFICERS' FEBRUARY DEER CENSUS

by

Eldie Mustard
Game Biologist

Introduction

One of the integral parts of Iowa's deer management program has been the annual Conservation Officers' February Deer Census which has been conducted since 1947, with the exception of 1949. The primary purposes of the census are:

1. Indicate deer population trends from year to year, and for the several years, both on a State-wide and county basis.

2. As an aid in forecasting the expected fall deer population.

3. To determine the distribution of deer within the State.

Methods

In February each Conservation Officer submits an estimate of the number of deer in the county or counties constituting his territory. County maps are also supplied to the Officers who are asked to delineate areas of major deer concentrations in their respective territories. Estimates and maps are then forwarded to the Biology Section where the data is compiled and analyzed to obtain the State-wide picture of the deer population trend.

Results

Reported February, 1959 Deer Population

State Conservation Officers reported a total deer population of 11,705 in the February, 1959 deer census. Estimates for the several counties ranged from 0 to 1,400, with a mean or average deer population per county of 118. Figure 1 includes the February, 1959 deer estimates, by county, as reported by the Officers.

Table 1 indicates the number of counties reporting estimated numbers of deer, with increments of 50 animals. It will be noted from the table that 62 counties reported deer populations of 100 animals or less, with only eight reporting deer populations in excess of 250 animals.

Distribution

Resident deer were reported in all counties of the State except Grundy, with the greatest populations occurring in NE and SW portions of the State (Figure 1).

Comparison of 1958 vs. 1959 February Deer Populations

The reported total deer population in 1958 was 10,643, while in 1959 it was 11,705. These figures indicate an increase of 1,062 deer, or about a 10 percent increase for the State as a whole. Deer populations, as reported in 1958 and 1959, by county, are indicated in Figure 1. Also included is the reported change in the deer populations between the two years for each county.

A comparison of the reported deer estimates, 1958 vs. 1959, indicates that 60 counties experienced increases, 34 counties experienced decreases, and five counties remained stable. As indicated in Table 2, the majority of the population changes between the two years were small, with most of the changes less than 25 percent.

Comparison of the Mean February Population, 1955 through 1958, with the February 1959 population:

Figure 2 shows graphically that the size of the Iowa deer population rose rapidly until 1953, and has remained relatively stable since 1955, with only slight annual deviations. For this reason it seems valid to compare the mean population for the years 1955 through 1958 with the reported 1959 population. Figure 3 indicates the four-year mean population, and the 1959 population for each county, with the apparent changes also indicated.

The data indicates that the deer populations in 48 counties have increased, while those in 51 counties have decreased during the period under comparison. As shown in Table 3 the majority of these changes have been relatively small, with most of them less than 25 percent.

The mean population for the State as a whole during the four-year period was 10,603 compared to the 1959 population of 11,705. This would seem to indicate that our February 1959 deer population has risen 10 percent above the four-year average, with a numerical increase of 1,102.

Discussion

Censusing of game populations is probably the most arduous, but also one of the most important tasks which the game manager, by necessity, must perform. Leopold (1933) said: "...finding out how many there are left is the least of the purposes of game census. Measuring the response of game populations to change - deliberate or accidental - in their environment is the big purpose. Continuous census is the yardstick of success or failure in conservation."

Iowa's annual deer census, better known as the Conservation Officers' February Deer Census, began in 1947 when it became apparent that our deer population was increasing. So far as I know, Iowa is the only state which attempts a complete census of its deer population, with most states being hard-put to determine trends in their deer populations.

Our Conservation Officers have, for the most part, and to the best of their ability, attempted to show the number of deer in their territories. Most of them have taken presence of deer sign, hunter kill, accidental kills, and numerous other indicators of deer into account when attempting an "educated guess" at the deer population in their counties. Those officers in counties with a low deer population, say less than 100 deer, can probably give a close estimate. Those in areas of higher deer concentrations can probably evaluate if the population is up or down, but an accurate numerical estimate in these cases is probably almost impossible.

Many methods for determining deer populations are available, but for the most part they are practical only on relatively small experimental tracts, and most certainly would show shortcomings when used to determine the total deer population for a whole state. Our present method, therefore, with all of its apparent weaknesses, should be maintained until it can be implemented by more scientific estimates.

As we have no better estimate of our deer population presently available, we must accept the results of the present method which, I believe, is accurate enough to offer a reliable estimate of population trend, i.e. up, down, or stable but is not based on techniques which are refined to the point where we can accurately disclose actual deer numbers. As indicated in Figure 2, our deer population for the past several years, and our total deer kill have remained about stable. This it seems, would give some credulence to the estimates use, at least as an indicator of trend.

Summary

1. The Conservation Officers' February Deer Census has been conducted annually since 1947, with the exception of 1949: primary purposes of the census are (a) indicate deer population trends, (b) determine deer distribution, and (c) as an aid in forecasting expected fall deer population.

2. A total February, 1959 deer population of 11,705 was reported, with estimates ranging from 0 to 1,400 for the several counties.

3. Population estimates for 1959 indicated about a 10 percent increase over the 1958 estimates.

4. All counties except Grundy reported deer.

5. Comparison of 1958 vs. 1959 deer estimates, by county, indicates 60 counties experienced increases, 34 counties experienced decreases, and five remained stable: most changes were relatively small.

6. While the average number of deer per county was 118, 62 counties reported a deer population of 100 animals or less, with eight reporting populations of over 250 animals.

7. Comparison of the 1959 population estimate with the mean population estimate for the preceeding four years of record, indicates that the present deer population is about 10 percent greater than the four-year mean population.

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Table 1. Number of Counties Reporting Various Numbers of Deer, With Increments of 50 Animals, From Conservation Officer's February Deer Census, Iowa, 1959.

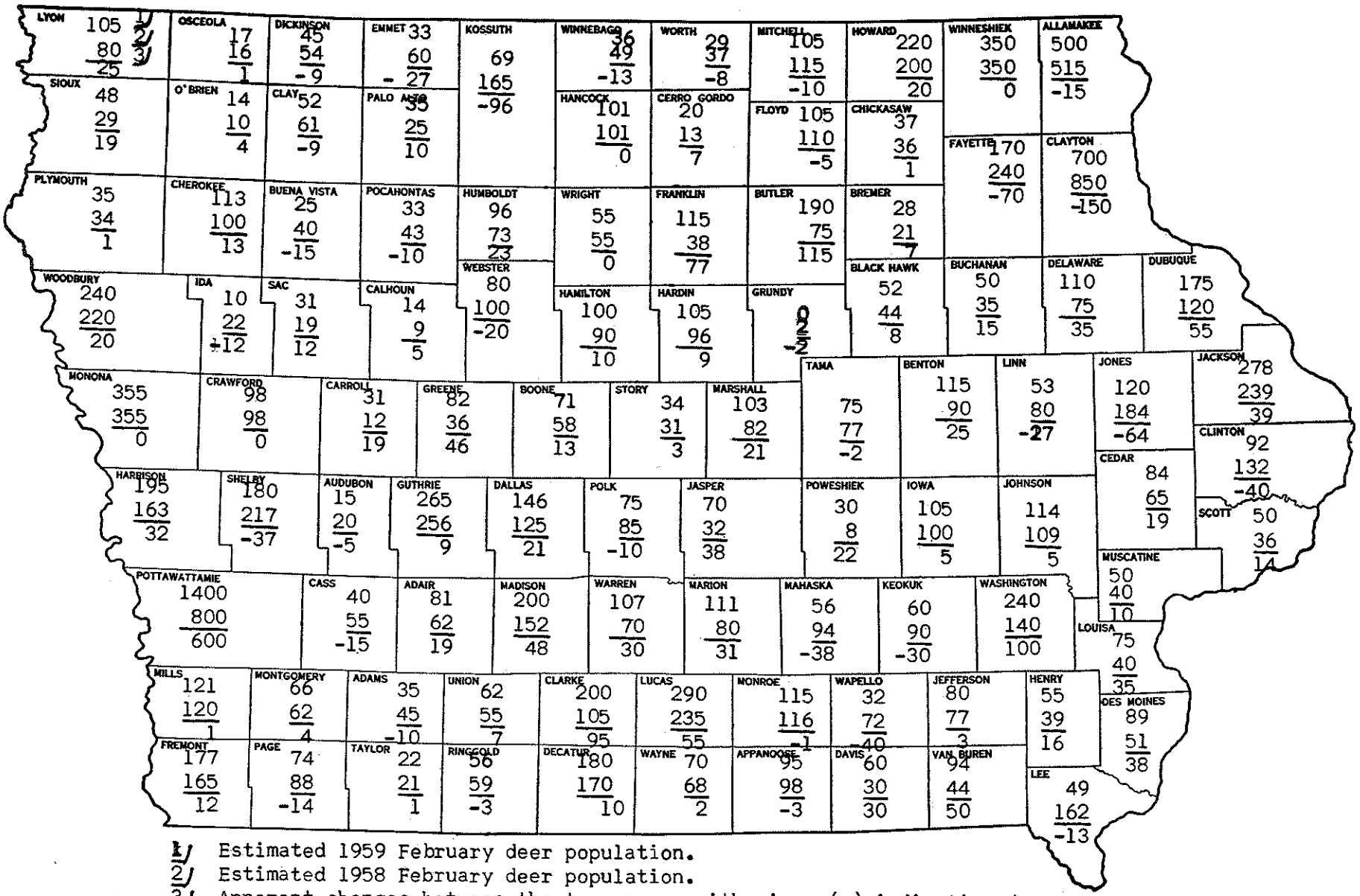
Number of Deer	Number of Counties Reporting
0 - 50	30
51 - 100	32
101 - 150	17
151 - 200	9
201 - 250	3
Over 250	8

Table 2. Percent Changes in Reported Deer Populations, 1958 VS. 1959 Showing Number of Counties Reporting Changes (With 25 Percent Increments).

Number of Counties Reporting Increase or Stable Population	Percent Changes	Number of Counties Reporting Decrease in Population
32	0 - 25	19
15	26 - 50	10
8	51 - 75	4
3	76 - 100	1
7	Over 100	0
Totals 65		34

Table 3. Percent Changes in Reported Deer Populations When Average Population For Years 1955, 1956, 1957, and 1958 is Compared With 1959 Population Estimate, Indicating Number of Counties Reporting Changes (With 25 Percent Increments).

Number of Counties Reporting Increase in Population	Percent Changes	Number of Counties Reporting Decrease in Population
19	0 - 25	26
9	26 - 50	17
8	51 - 75	6
5	76 - 100	2
7	Over 100	0
Totals 48		51



1/ Estimated 1959 February deer population.
2/ Estimated 1958 February deer population.
3/ Apparent changes between the two years, with minus (-) indicating decrease.

CP-11021 **Figure 1.** Comparison of 1958 vs. 1959 February deer population estimates, by county, with apparent population changes as determined from Conservation Officers' February Deer Censuses, Iowa 1958 and 1959.

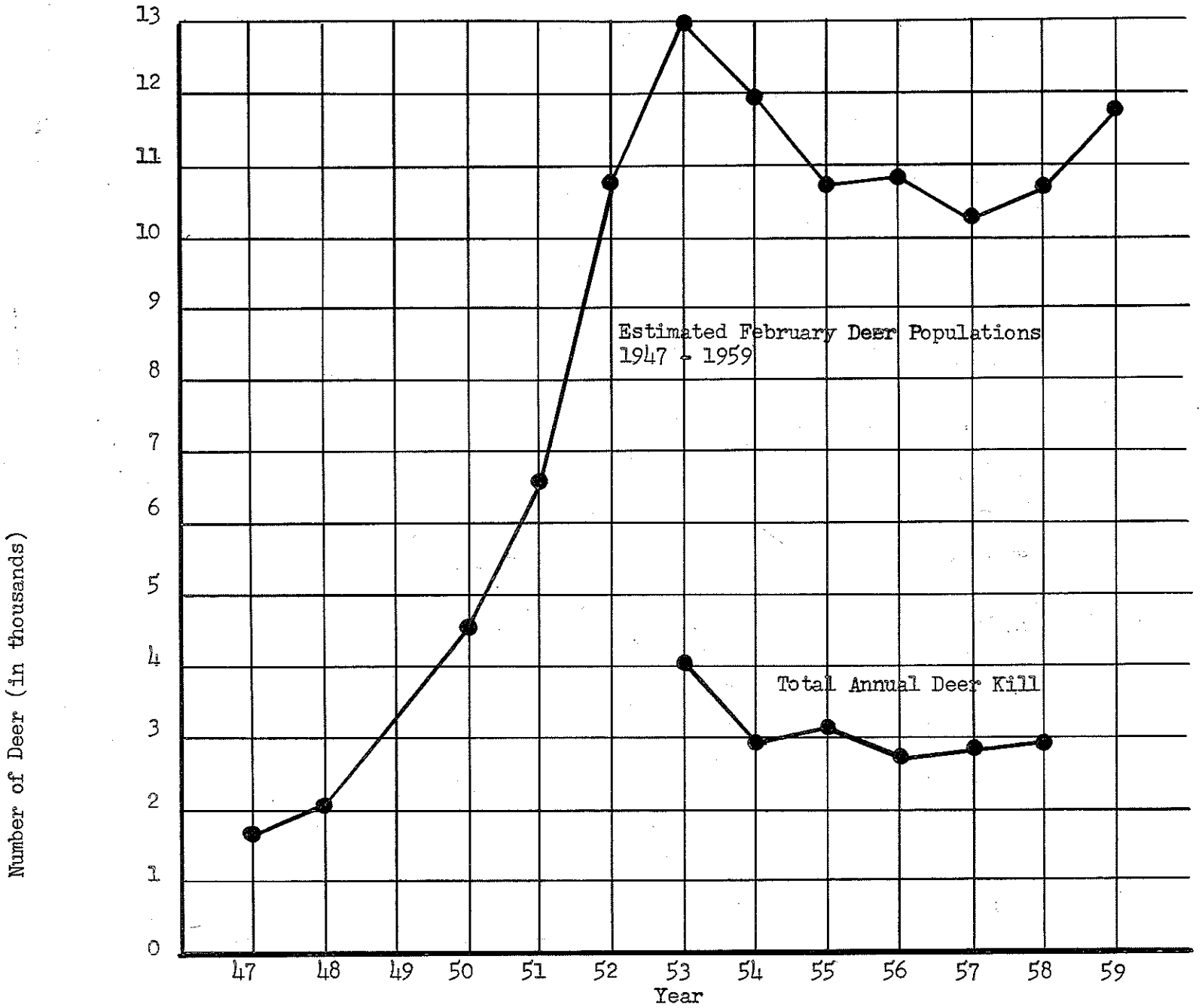
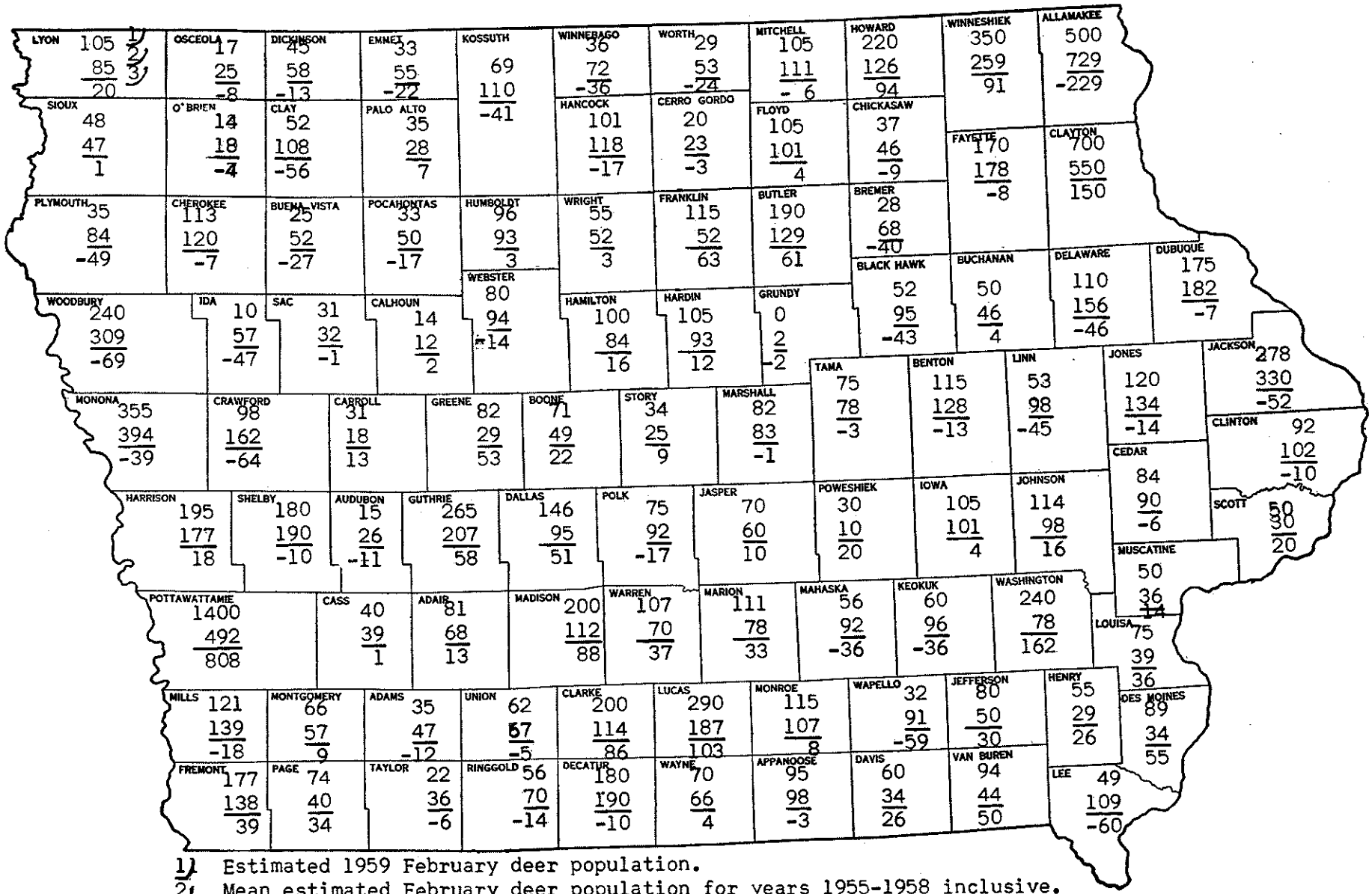


Figure 2. February deer population estimates, from Conservation Officers' February Deer Census, 1947 - 1959, and Total Annual Kill, 1953 - 1958.



1/ Estimated 1959 February deer population.
2/ Mean estimated February deer population for years 1955-1958 inclusive.
3/ Apparent changes between the 1959 estimate and the four-year mean estimate, with minus (-) sign indicating decrease.

CP-11021 Figure 3 Comparison of 1959 vs. four-year (1955-1958) February deer estimates, by county, with apparent population changes as determined from Conservation Officers' February Deer Censuses, Iowa, 1959-1955.

COMMENCEMENT OF BREEDING ACTIVITIES OF THE COTTONTAIL IN IOWA

by

Paul D. Kline
Game Biologist

This study has been prompted by a paucity of information regarding commencement of the cottontail (Sylvilagus floridanus mearnsii) breeding season in Iowa. Knowledge of the breeding cycle of a game animal is important in proper wildlife management. Public opinion generally holds that an animal shall not be shot while engaged in rearing young. Hunting seasons usually are limited, at least partially, by this concept. Hence, early breeding dates for the cottontail can be important factors in setting closed season regulations.

A few workers have written on early breeding of cottontails in Iowa. Hendrickson (1943) noted population of a pair of semi-captive cottontails February 19, 1937. The nest was found March 18th, another pair apparently mated sometime during the last three days of February 1937; and the nest was found March 31st. Writing of cottontails not in pens, Hendrickson stated that search for nests in March were always unsuccessful. In an earlier paper, Hendrickson (1940) wrote, " In course of general observations of our cottontails during the past five years April 13 was the earliest date of an observed nest, and it contained five young with their eyes open."

Wallace (1950) working in central Iowa during the spring of 1949, estimated the first litter came off the nest April 27th. Using an average gestation period of 28 days and an in-the-nest period of 15 days, it appears this litter was conceived March 15th. Wallace wrote of a litter seen in the city limits of Ames out of the nest on March 6th. Apparently he actually did not see the rabbits himself. It is possible breeding within small towns may commence earlier than in the open country where less protection against climate is offered.

Hubbard (1952) estimated the first 1951 litter on his study area in south-central Iowa was born March 28th. Linder (1955), working on the same area, first found an occupied rabbit nest April 14th. It contained young with their eyes closed. These records indicate for the two years 1951 and 1955 respectively, mating first took place about February 28th and March 10th on that study area.

Considerable work on breeding seasons of cottontails has been done in states adjacent to Iowa, or within the same latitudinal range. Trippensee (1936) appears to have been the first writer. He wrote of four pregnant females taken in southern Michigan, January 25, 1933. These rabbits were not observed by him. Most workers agree that little cottontail breeding takes place as early as indicated by Trippensee.

In his study in southern Michigan, Allen (1938) found only one female, taken February 21st, pregnant during January or February. One young rabbit, just off the nest, was retrieved by him on April 4th. It probably had been conceived about February 20th. These were his earliest records. Hamilton (1940), in New York, found no evidence of mating prior to early February; and most early mating seemingly occurred late in February or early in March. In Connecticut, Dalke and others (1942) noted only one pregnant female in March while working with S. transitionalis and S. floridanus mallurus. Only three of 204 Pennsylvania cottontail litters examined by Beule and Studholme (1942) were calculated to have been born in March 1939 and '40. This would indicate all other matings occurred after February during those seasons in Pennsylvania.

Haugen (1942) found no pregnant females prior to March 14, 1939, in southwestern Michigan. On that date, three of six females had uterine swellings. As these swellings would be difficult to detect prior to about ten days development, the three females probably were bred sometime during the first week of March. Haugen concluded from his work that the breeding season extended from early March to mid-September. Schwartz

(1942) agrees. Working in central Missouri, he found earliest dates of capture for 43 females containing uterine swellings were March 15th and 17th; and these embryos were 10-14 days old.

More recent writers corroborate these findings. Smith (1950) calculated the average of his five earliest New York nests found in 1941 were conceived about March 25th. In 1942 from seven records he calculated the average early breeding date of March 11th. Ecke (1955), working with Illinois cottontails, discovered no pregnant females or females which had recently ovulated prior to February 22nd. Of six early litters two were calculated to have been conceived during the last week in February and four between the 17th and 21st of March. Another Illinois worker (Lord, 1958) found the 1957 breeding season began the last week of February when 18 percent of the females examined showed early pregnancy. A Wisconsin writer (Anonymous, 1956) found the earliest birth date records taken from 82 road-killed females gathered 1951-55 was during the March 21st to 31st period; the first litter peak fell between April 21st and 30th. These dates indicate some breeding occurs in Wisconsin during the last week of February with the first peak during late March.

All of these papers indicate that in the general latitude of Iowa, cottontails breed only rarely before the last week of February. Mating does occur late in February during some years. In all instances March seems to be the month when breeding commences on an extensive scale. Two writers (Trippensee, op. cit.; and Hamilton, op.cit.) mention weather as a controlling factor which may establish early or late mating.

Method of Study

The present investigation began December 28, 1957, and has continued until now. On that date, when the hunting season remained open, a series of rabbits were taken from Mahaska and Keokuk Counties. Another lot were secured by hunting in Iowa, Mills, and Fremont counties, January 28th to 30th, 1958. During 1958 and continuing until the present, road-killed rabbits have been picked up by the writer for use in the study. Particular attention has been given road kills during the months February through April as these were judged most critical for studying early breeding habits of cottontails.

Rabbits were captured in box traps on two areas, one in Benton County and one in Davis county, during the spring of 1959. The two study areas in east central and south east Iowa respectively were chosen as representative of good rabbit habitat in parts of the state separated by a latitudinal range of slightly more than 100 miles. It seemed advisable to study two areas in order to demonstrate, if possible, any difference in breeding dates that might be attributed to latitude. The areas were chosen partially because the landowners were especially cooperative. Box trapping in Benton County was started March 1st and was continued with one interruption through April 6th. No trapping was conducted in Benton County during the March 19th to 24th period. On the Davis County area, trapping continued from March 4th through March 20th.

During the study, 191 cottontails were examined. Of these, 98 were females and 93 were males. A number of additional males were examined but were not recorded in the continuous numbering system used to record data. Male rabbits shot December 28th 1957 and January 28th-30th, 1958, were examined but not included in these records. None had descended testes. Notes on one female rabbit securred February 27, 1957, were included in the data. Of the total, 79 cottontails were road kills, 33 were shot (22 during season), 75 were captured in box traps, and three were obtained from miscellaneous sources. Sixty-three total females were examined by the writer during the period judged critical for early breeding - February through April.

Rabbits were sexed by the methods described by Petrides (1951). Age, juvenile or adult, was determined by examination of the humerus (Hale, 1949). Whenever possible

weights to the nearest 1/10 pound were recorded. Numerous recovered road kills were so badly mangled as to be useless to the study and were not recorded.

For males, particular attention was paid the condition of the testes. They were recorded as: Testes decended, partially decended, or not decended. All males whose testes were decended were judged capable of mating. However, following the work of Ecke (1955) actual mating dates were considered controlled by the females. Except for one accidentally killed, males captured in box traps were released unharmed after examination.

Records for females were kept of condition of the vaginal membrane - whether or not intact; lactation and condition of the hair about the nipples; presence, number, and size of uterine swellings; and, during 1959, number of ovarian eruptions. Three females taken in box traps were released after having been found not pregnant by palpation (Haugen, op. cit.). These rabbits were marked with ear tags to prevent subsequent confusion from recaptured. Uterus and ovaries of most females were removed and preserved for further laboratory examination.

Presence of the vaginal membrane in females was considered evidence that mating had not occurred. However, the writer experienced considerable difficulty in using this technique and gained little confidence in the results obtained. A female was judged to have borne a litter when hair was pulled and matted about the nipples, and when the nipples were enlarged and yielded milk. Pregnancy was usually indicated by uterine swellings. However, two females were considered in the very early stages of pregnancy when eruptions were found on their ovaries, and uterine swellings were not visible. In many pregnant females both uterine swellings and ovarion eruptions were found; and in every instance the number of eruptions corresponded with the number of swellings.

Notes were kept on condition, visible parasite infestations, and on any abnormalities noted. Fleas were noticeably abundant on rabbits from both study areas in 1959. Tapeworm larvae were detected frequently. No evidence of tularemia was found, nor were any rabbits believed sick when handled by the writer.

Uterine swellings were measured in Millimeters (mm) through their longest axis. This was found, when swellings measured 25mm. or greater, to measure accurately about two mm. more than head-rump lengths used by Schwartz (1942) to determine embryonic age. For smaller uterine swellings a table (Table 1) was developed from actual measurements of seven sets of uterine swellings and head-rump lengths. From this table the probable head-rump lengths were read from known uterine swelling diameters, and the probable embryonic age calculated as in Schwart's paper.

Results

For convenience in presenting the 1959 data, they were divided into two groups; One from southeast and one from east-central Iowa. This formed a convenient and natural division as all rabbits examined during 1959 were taken in one of the study areas, or in counties adjacent to one or the other.

Examination of the 63 females taken sometime during the period February through April indicated the earliest mating occurred February 23, 1958. A pregnant female found as a road kill in Benton County on March 12th contained embryos judged to be 17 days old. In 1959, the first detected mating in southeast Iowa occurred on February 26th; and in east-central Iowa on March 19th.

By March 2, 1958, only three of 14 females secured in various portions of Iowa had been bred. Six of 14 had mated prior to March 12th; and by April 6th all of the fourteen had produced a litter or were mated. Coincident with the time difference in earliest breeding found in southeast and east central Iowa in 1959, the east-central area, mating activity lagged until early April. In the southeast, 11 of 21 females were bred by March 12th; and by March 27th all were bred. By contrast, in east central Iowa, only half (five of ten) of the females had mated by March 22nd, and it was April 6th before all had conceived young. Precentages of pregnant females for two years and localities at successive five day intervals can be seen in Table 2.

The obvious descrepancy between dates for breeding in east central Iowa for 1958 and 1959 may be explained by contrasting weather conditions for the two years. As compared to 1959, the spring of 1958 was moderately early, with warmer early temperatures and little snow. This may have been conducive to early cottontail matings. In contrast, the spring of 1959 was late, with cool temperatures and late melting snow. This may have delayed matings. In addition, a heavy blizzard which swept Iowa during the first week of March may have delayed mating activities even more.

Discussion

The importance of this study is related to the possibility of detection of pregnancy in females by hunters during the open season. The general repugnance held by most persons for shooting of game during the breeding season has already been mentioned. The data indicates Iowa cottontails could be hunted during February with small chance of public disfavor from this source. Although mating does occur in February, it is not considerable; only six of 63 females examined were pregnant as early as February. It requires about ten days development before pregnancy can be detected in the cottontail by any but the most careful and astute observer. Even 10 day-old embryos appear only as hazel-nut sized swellings in the uterus. Females which might contain such swellings and shot on February 28th would have been bred February 18th or before. The earliest mating detected in this study was February 23rd.

Most wildlife workers agree, Iowa hunters take cottontails mostly when snow covers the ground. This has an important bearing on the possibility of February rabbit hunting. As pointed out before, there is considerable evidence that early season mating of cottontails may be weather controlled. Also, late snows or cold rains in early spring have been blamed for considerable deaths of cottontail nestlings (Smith, op.cit; Bruna, 1951; and Trippensee, op. cit.). During late springs, when the ground is snow covered, hunters may actively pursue cottontails. However, because of the cold and snow, chances are, very little breeding activity will take place. Conversely, if snow is absent and temperatures are high, the rabbits may breed early, but at the same time, they will not be pursued by hunters. Young rabbits conceived before late February have little chance of surviving March blizzards.

Summary

1. A review of literature pertaining to the commencement of cottontail mating in spring is presented.
2. More than 191 rabbits were examined and recorded during the study. Of the total, 79 were road kills, 33 were shot, 75 were captured in box traps, and three were taken from miscellaneous sources.
3. From the 98 females, data regarding presence of and stage of pregnancy were obtained.
4. Head-rumpt lengths of embryos were used to calculate probable breeding dates for females.

5. Of 63 females examined during the period of February through April, only six were found to have bred before March 1st. The earliest date of conception was calculated as having occurred February 23rd. Series of cottontails examined in December and January indicated no mating occurred in those months.
6. The study indicated hunting of rabbits in February would not seriously conflict with their breeding season.
7. Evidence that seasonal climatic factors regulate mating is presented.

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Table 1. Comparison of Diameters in mm. of Seven Uterine Swellings With Head-Rump Lengths of Enclosed Embryos.

Cottontail Number	Diameter of Uterine Swellings	Head-Rump Lengths
124	9	None
103	17	3
131	17	6
133	22	13
136	22	14
139	22	19
145	40	38

Table 2. Percentages of Cottontails Pregnant by Five-day Intervals for 1958 and from Two Study Areas for 1959.

Date	1958, Entire State	1959 Southeast	1959, East Central
February 15	14*- 00.0	25 - 00.0	27 - 00.0
February 20	14 - 00.0	25 - 00.0	27 - 00.0
February 25	15 - 6.7	25 - 00.0	25 - 00.0
March 2	14 - 21.4	24 - 16.7	24 - 00.0
March 7	14 - 35.7	23 - 43.5	23 - 00.0
March 12	14 - 42.9	21 - 52.4	18 - 00.0
March 17	14 - 57.1	18 - 66.7	12 - 00.0
March 22	14 - 64.3	14 - 85.7	10 - 50.0
March 27	14 - 85.7	14 -100.0	10 - 80.0
April 1	14 - 85.7		9 - 88.9
April 6	14 -100.0		8 -100.00

* Numbers preceding dashes in all instances pertain to number of females used in claculating percentages.

QUAIL HUNTING AMONG 100 JUNIOR HIGH STUDENTS

by
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Game Biologist

Records of past and present quail hunting activity are one basis for management. Future use of this resource will be by those now in public schools. It is well, therefore, to have an estimate of how intensively these birds may be hunted by future shooters.

This paper explains the nature, and the results of an experimental questionnaire administered to ninth grade science classes in an Ottumwa school. Primary purpose was to test a method of administering the questionnaire. This was also a test of a type of question.

Literature

Some pertinent studies in the same field are: Crossley Survey (1955) included hunters 12 years old. Allen (1957) found that in Indiana 28 percent of licensees answering a questionnaire hunted quail. Crawford (1959) in Missouri found that over 20 percent of hunters took quail. Stempel (1955) made a small scale survey similar to the one explained in this paper.

Materials, Methods and Technique

Duplicated questionnaires were used in this check: at the head of the sheet was a brief explanation of the purpose. There were five questions as follows:

1. Did you hunt any game in 1958?
2. How many times?
3. Did you hunt quail in 1958?
4. Circle below the figure nearest to the number of times you hunted quail in 1958. 1234567890.
5. Did you use a trained dog?

Permission to put out the questionnaires was obtained from the city superintendent of schools. After the junior high principal was consulted, the teacher who was interested in hunting, distributed the questionnaires to his ninth grade science classes since he had previously set the project up as a regular class activity. He also picked up the completed papers.

No names were required on the papers. However, each student was asked to indicate whether she or he was girl or boy. Though the papers were given to the pupils in the spring, and it was late to collect information on a fall activity, the primary purpose was to learn about the test itself.

Results

One hundred papers were put out and all were received back. All 70 boys in the ninth grade classes were asked to complete the questionnaire. Enough girls were asked to participate to complete the sample of 100.

All kinds of local game were hunted by 63 of the pupils; they hunted a total of 910 times. Of those who hunted, 55 percent hunted quail and of this group, 30 percent used trained dogs.

Four boys reported that during the six weeks season they made one trip each for quail. Two or more trips were made by 32 boys; 13 made six or more trips or they hunted once or more per week. Three boys in 1958 made 10 or more trips for quail.

Seven of the girls hunted; the others reported no hunting. Of the girls, one reported she made 20 hunting trips for all kinds of game in 1958. Two trips during 1958 were the most any one girl made to hunt quail.

Conclusions

A questionnaire on quail hunting can be administered where public school personnel will cooperate. Results are along lines indicated by previous studies. Four of the questions were easily understood by the students. The fifth question concerned use of a trained dog: Some misunderstood this question.

1. Through cooperation of Ottumwa school personnel, 100 pupils in ninth grade science classes filled out questionnaires on quail hunting.
2. Sixty-three percent of the pupils said they hunted some kind of game in 1958. Of those who hunted, 55 percent made one or more trips for quail.
3. Eighty-four percent of the boys did some hunting, and 55 percent of these hunted quail.
4. Twenty-four percent of girls hunted during 1958. Two percent of the girls hunted quail in 1958.

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AGE OF QUAIL SHOT BY HUNTERS

About 80 percent of the quail bagged by Iowa quail hunters are less than one year old. Further calculations determined hatching dates. Originally age identification was used as a means of selecting young, tender birds for the table; they were known by their more pointed outer primary feathers.

Wings were first classified as to adult or juvenile; then according to age of young. There are exceptions to this standard and for several years information has been gathered on adults that have not shed all primaries and on those quail that show both adult and juvenile characteristics.

Use of wing samples to aid in dating events in quail populations has been accomplished by observing several different criteria: Haugen (1955) stated that age of most young birds could be determined through development of flight feathers though some were atypical. Leopold (1939) suggested standard procedures for identifying plumage of birds in different age groups. Petrides and Nestler (1943) published tables for use in determining age. Stoddard (1931) also suggested some methods of distinguishing old quail.

Material, Method, Techniques

Before the quail shooting season, letters were sent to officers who cooperated in collecting quail wings from birds killed by hunters. Experienced quail shooters again aided in this project by saving one wing from each quail which they shot.

In former years, wings were collected throughout the open season, but in 1958 a request was made that only those from birds killed on known dates, and of birds shot prior to November 15th be saved. Before that date a high percentage of the young have growing primary flight feathers. Cooperators were contacted each week of the season, if their identity was known.

Wings were first divided into adult and young categories. Those which were damaged or atypical were culled from the sample.

Data were recorded as to age in days, as indicated by stage of growth of primary flight feathers. Next, the approximate hatching date was established using a computing device as suggested by Kabat (1950). This was made up of two scales. It was preferable to the older, slower method of counting back through the days shown on a calendar.

Results: Statewide

Data were obtained on 1005 young and 248 adult wings. On 887 young and 129 adult wings there was no information on date of kill. With some wings there was information to the effect that the birds were shot during a two week long period. In this statewide sample, 83 percent were young: 87 percent of the undated wings were from young; 80 percent of the dated were young.

Data from the wings of young quail that could be aged indicated that hatching began in May, was fairly high by June 30, and at a peak the first two weeks in July. Nesting remained high until July 31st, then declined about five percent and dropped further after September 15th. The latest hatching date indicated in the sample was between September 16th and 30th.

Of the group over 150 days old, 87 percent were less than 150 days old by November 1st, and 24 percent were less than 150 days old December 1st to 16th. Thus it was indicated that there was a steady progress toward maturity.

Adult Quail

It is believed that the plumage of adults is retained until after the hatching season. In 1958 during the period November 1st to 15th, only one of a total of 163 adults had fully matured plumage. Of those shot between November 16th and December 1st, one out of 26 adults had matured plumage; and from December 1st to 15th, of 13 adults, 12 had mature primary flight feathers.

An unusual number of quail wings had characteristics of both old and young. The reason for this is not known, but it did occur in Oklahoma also. If may reflect some food or weather condition: it may occur regardless of age or conditions.

Results: Regional

The highest number of wings was collected in south-central Iowa since this area has some of the best quail range, and the cooperators have kept records and contributed wings to projects carried out in previous years. There was a large percentage of 150 day old wings in central Iowa. Also this district had the highest rate of hatching by June 30; however, the sample was small and results were inconclusive; see Table 1.

There was no apparent relationship between y/a and the percentage over 150 days of age. As far as is known, a positive relationship would be demonstrated if the same percentage of hunters could be contacted in each area of the state.

Results by County

Wayne county contributors collected and turned in a total of 157 wings; Lucas county contribution was 123; Appanoose, 110; Taylor, 75 and Davis, 64. Hunters who went quail shooting nearly every day during the season accounted for some of the high returns. When compiled, that data revealed that in Wayne county the hatch was high in June, highest in July. In Lucas county, hatching success was low in June, highest in August; while in Appanoose; hatching success as indicated by wing samples in 1958, was low in June and highest in August. In Taylor county success was low in June, highest in July. Davis county had a fairly high hatch of birds in June, the highest in August. Most of the open season counties made some contributions to the sample.

Some Comparisons with 1957

Information from study of dated wings indicated that over the entire state in 1957, 87 percent were young, while in 1958, 80 percent were young. In Lucas county in 1957, 86 percent were young, in 1958, 83 percent. In 1957 in Appanoose, Lucas and Wayne counties, by November 15th 21 percent of young were over 150 days old while in 1958, 10 percent were over. Many of the wings were collected by the same hunters during the two years, 1957 and 1958. Significance of changes is not known since good hunting was reported both years.

Conclusions

1. Most important of the results of study of data from quail wings is the opportunity to find effects of weather.
2. Some supplementary information is needed. This could be obtained by field checks in early summer.

Summary

1. Until November 15th, a large percentage of quail wings taken by hunters will reveal the age of birds.
2. In 1958 there were 1253 wings collected on which there was also information on date of kill.
3. In 1958 the peak of hatching was the first two weeks in July.

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Table 1. Young to Adult Ratio and Percent of Older Young.

District	Percent y/a	Percent over 150 days old by November 15th
SC	23	11
SC	22	18
SW	24	19
CENT.	21	20

PHEASANT CROWING COUNT AND HEN INDEX SPRING 1959

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Game Biologist

The annual spring pheasant crowing count was taken by conservation officers during the month of May. Results of this survey indicate changes in the spring breeding population and pheasant distribution.

The 1959 peak crowing period apparently occurred later than in 1958. Special routes were checked by biologists to establish the peak period of crowing activity but variable weather conditions limited the number of counts. Most routes taken by the officers were completed during the first two weeks of May which would be well within the limits of the maximum crowing period.

Crowing activity continued at a high level this spring (Table 1). Officers completed 144 routes and recorded 33,828 calls at 2880 stops. They heard an average of 11.7 calls per stop which was only three per cent below the record 12.1 calls per stop recorded in 1958. Although the harvest of ringnecks was much higher during the past season than in 1957, the population of cocks after each of the seasons was about the same.

The hen index, which is determined by multiplying the observed sex ratio from winter counts by the results of the crowing count, indicated a very high spring population (Table 1.) The statewide spring hen index of 36.3 established a new high for this survey and indicated an increase of 30 per cent above the 1958 figure.

Crowing activity remained stable in all areas of the state except district three (northeast Iowa) where the average number of calls heard per stop decreased 37 per cent. It should be noted that our most favorable harvest of roosters occurred in this area; 76 per cent of the cocks was taken by hunters during the 1958 season compared with only about 60 per cent in other parts of the state. Also, some birds died during the late severe snow storms. But most important, the hen population in district three continued to increase. The results of the 1959 spring population check are listed for each district in Table 2, and a comparison with previous counts is made in Table 3.

The pheasant population in northwest and west central Iowa has fully recovered from the severe loss during the drought of 1956. Crowing intensity and the hen index for each district are above the 1956 counts. Populations have climbed steadily the past two years. For example, the hen indices for northwest Iowa for the years 1957 - 1959 were 41.5; 48.1; and 60.0, respectively.

The spring hen index was again highest in north central Iowa. Results from this area indicated substantial gains this year and the spring population was the largest in recent years.

No major changes occurred in the other districts of Iowa. Counts in central Iowa show a slight decrease this year. Populations in all other districts remained the same or increased slightly.

Table 1. Statewide Results of the Crowing Count and Hen Index 1955-1959

Year	Average Number of Calls per Stop	Sex Ratio Hens per Cock	Spring Hen Index
1955	8.5	3.6	30.6
1956	8.4	3.3	27.7
1957	7.9	3.3	26.1
1958	12.1	2.3	27.8
1959	11.7	3.1	36.3

Table 2. District Results of the 1959 Crowing Count and Hen Index.

District	Number of Calls Heard	Number of Stops	Average Number of Calls per stop	Sex Ratio	Spring Hen Index
1. Northwest	9,597	400	24.0	2.5	60.0
2. North Central	8,602	280	30.7	3.0	92.1
3. Northeast	4,901	320	15.3	4.9	75.0
4. West Central	3,102	240	12.9	3.0	38.7
5. Central	4,149	460	9.0	3.0	27.0
6. East Central	1,716	200	8.6	3.3	28.4
7. Southwest	791	300	2.6	4.2	10.9
8. South Central	692	340	2.0	3.0	6.0
9. Southeast	278	340	0.8	Est.2.0	1.6
STATE	33,828	2,880	11.7	3.1	36.3

Table 3. Comparison of Crowing Count Results and Spring Hen Index 1957 - 1959

Districts	Year	Av. Number of Calls Heard	Spring Hen Index
1. Northwest	1957	12.2	41.5
	1958	22.9	48.1
	1959	24.0	60.0
2. North Central	1957	21.9	54.8
	1958	32.2	64.4
	1959	30.7	92.1
3. Northeast	1957	13.1	53.7
	1958	24.3	58.3
	1959	15.3	75.0
4. West Central	1957	6.1	23.8
	1958	10.1	20.2
	1959	12.9	38.7
5. Central	1957	7.6	35.7
	1958	9.2	28.5
	1959	9.0	27.0
6. East Central	1957	6.9	25.5
	1958	8.2	25.4
	1959	8.6	28.4
7. Southwest	1957	2.6	8.1
	1958	3.5	10.9
	1959	2.6	10.9
8. South Central	1957	1.5	2.9
	1958	3.0	4.2
	1959	2.0	6.0
9. Southeast	1957	0.5	1.0
	1958	0.5	1.4
	1959	0.8	1.6

THE CONTRIBUTION OF STOCKED FINGERLING WALLEYES TO THE ADULT POPULATION IN SPIRIT LAKE (PROGRESS REPORT)

by
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INTRODUCTION

A paper covering preliminary details of this study was included in Volume 10, No. 3, of the Quarterly Biology Reports. Briefly, the paper described efforts in 1958 to determine results from a 1956 stocking of 125,000 marked fingerling walleyes in Spirit Lake. It included data concerning the percentages of marked walleyes in the 1956 year class that prevailed in the 1958 catches. Various methods of catch were used to determine these percentages including otter trawl, shocker, seine and creel census. The shocker and trawl catches indicated that around 18 per cent were stocked fish; however, creel census and seine surveys showed considerably fewer with only six to seven per cent of the 2 year old walleyes being marked. Since most of these fish were fairly small (7.8-12.4 inches), anglers returned some of them to the lake and doubtless biased the census data. It was felt that a further continuation of this study in 1959 would provide more definite conclusions regarding the status of the stocked fish. This paper contains all of the pertinent information gathered so far in 1959, including growth rate and catch ratios of the marked and unmarked 1956 year class walleyes.

Growth of the 1956 Year Class

During the spring walleye hatchery operations at Spirit Lake, routine shocker runs were made at night to: obtain brood walleye counts; supply the hatchery with fish if needed; and in the last two seasons, to determine growth rates as well as survival of the marked fingerlings stocked in 1956.

A total of 62 marked fish of the 1956 year class were measured and scale samples taken for age and growth study during 1959. These were obtained from the shocker and creel census. To compare growth, similar information was taken on an additional 53 unmarked walleyes from the 1956 year class. The length distribution of bothstocked and naturally produced fish are included in Table 1 and suggests very poor growth as may be partially explained later.

Last year, 84 per cent of this year class of fish was between 8.9 and 12.4 inches in total length. By April, 1959, only 8.3 per cent had exceeded 12.2 inches. This indicates a very poor growth during 1958.

Average calculated annual growth rates on the fin-clipped and unmarked walleyes were practically identical, ranging from 6.6, 8.9 and 10.4 inches for the marked and 6.5, 8.4 and 10.4 for the unmarked. This is the lowest growth rate reported for this species in Spirit Lake (Rose, 1951) and doubtless reflects the poor forage conditions prevalent during the recent drouth years. Summer lake surveys in 1957 and 1958 indicated the lowest production of forage fish since 1948. Regardless of the comparatively slow growth, a considerable survival of these stocked fish in apparent in shocker catches and angler's creels.

The Marked Three-Year Olds

As mentioned previously, in the spring of 1959, several nights were devoted to sampling the adult population of walleyes by shocker. Primarily, this was to determine the extent of survival of the 1956 year class walleyes that had been fin-clipped and stocked. Results of these catches and those observed in the anglers catches are outlined in Table 2. The higher percentages of marked fish obtained by the shocker than in the census suggests a continued bias in creel sampling. Anglers are still releasing considerable numbers of these small "Hammer Handles" although not to the extent observed last year.

Discussion

Spirit Lake is one of the major walleye lakes in the state. Angler catches in the past three years have ranged from a calculated total of 34,000 to 47,000 pounds, which is comparable to some of the nation's best walleye lakes.

The lake has received annual heavy fry and/or fingerling plants of walleyes for many years in order to maintain high populations of this valuable predator species. Heretofore, no evidence was available to justify these fingerling stocking programs.

The data presented here indicate that the heavy planting of marked fingerlings have survived to maturity in numbers of considerable magnitude. It suggests existing ratios of from 1:10 or more, of the 1956 year class is composed of stocked fish. Presumably, if annual plants of 125,000 fingerlings were made, eventually the entire adult population could be approximately 10 per cent nursery reared. Creel census data from May 9 to July 1, 1959 indicate that less than two per cent of the angler catch of all year classes is composed of the marked walleyes. In order to definitely prove the value of stocking fingerlings, annual plants of marked fish must be made. And in addition, census data must indicate correspondingly heavier harvests; otherwise the stocked segment may merely be existing as replacements of naturally produced fish. However, until these refinements are available, we know the walleye nursery program has contributed to the angler catch in measurable quantity.

Table 1. Length Distribution of the 1956 Year Class Walleyes in Spirit Lake.

Number of Fish	31	38	30	26	8	8	2	2	
Length Range In Inches	9.1 to 9.7	9.8 to 10.3	10.4 to 10.9	11.0 to 11.5	11.6 to 12.1	12.2 to 12.7	12.8 to 13.3	13.4 to 13.9	

Table 2. The Number of Marked and Unmarked 1956 Year-Class Walleyes Observed in 1959.

Date	Method	Number Marked	Number Not Marked	Per Cent Marked
4-21-59	Shocker	0	26	0.0
4-22-59	Shocker	7	30	23.3
4-23-59	Shocker	6	33	18.2
4-24-59	Shocker	8	44	18.4
5-11 & 6-30-59	Census	20	213	9.4
Totals and Average Per Cent		41	346	11.8

PROGRESS REPORT OF FISH POPULATIONS HUMBOLDT STUDY AREA

by
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In October 1956, the Humboldt Research Area was treated with rotenone to destroy a large population of rough fish. The purpose of the treatment was to create a void into which game fish were to be subsequently introduced in an effort to develop a sport fishery in that stretch of stream.

Former Quarterly Biology Reports describe the area and discuss the conditions existing prior to and through the eradication program. Progress reports since then have considered such things as growth, catch and the population status of the different species inhabiting the area at progressing intervals.

This paper is another progress report which brings up to date the status of the various species occupying the area through the spring of 1959.

The status of the population is for the most part appraised by electrical shocker surveys run each spring and fall. The device used to make the survey is a 230-volt, 2500-watt, three phase A.C. generator. This is carried in a boat rigged with three forward projecting booms equipped with electrodes that deliver the current into the water. The survey is accomplished by cruising the shore line and cover areas and counting fish by species as they are observed. This is accomplished by a recorder standing in the bow of the shocker boat. The area surveyed is a two and one-half mile segment of the study area which extends from the "Daggy" riffle downstream to a point one-half mile above the Humboldt dam. Approximately one-third of this segment is unimpounded water, while the remaining two-thirds fall within the reach impounded by the Humboldt hydro-electric dam.

Data pertinent to this report are given in Tables 1 and 2. Table 1 is a compilation of information collected by shocking and recorded by species; seasons and years are expressed in amount of time shocked and number of fish shocked per minute. Table 2 shows the range in size of the more important game fish taken over the same period.

With reference to Table 1, experience with shockers in Iowa's warm water streams has revealed limitations as a method of showing changes in a specific population or for demonstrating species composition. Physical factors in the environment that are in a constant state of flux, and variations in vulnerability to our shocking technique either by species and/or individual fish, may result in considerable differences from one time to another. For these reasons, the status of a population as determined by shocker, is primarily a qualitative entity, with little quantitative exactness. Generalizations pertaining to the development and status of the various species or groups of related species now in the area follow:

Black bullhead. A large population of stunted bullheads living in the area survived the chemical treatment. This population exploded in the void created by the chemical eradication of vulnerable species, and it has persisted to the present time. Although not as abundant number-wise as the bluegill, the bullhead is the most abundant species from the standpoint of total weight or pounds per acre residing in the area today.

Bullheads have furnished the bulk of the angling since the project began. By July of 1957, the species reached a size acceptable to fishermen. During the ensuing time they have furnished excellent angling of good to fair quality. Catches of 25 to 100 bullheads per angler per day; have been common place, and on one census day in May of this year, 1,187 bullheads were caught by 110 bullhead fishermen.

Bullhead growth seems to have completed a cycle from stunted population to one of good quality and then back to stunting. During the spring of 1957, bullheads averaging four to six inches long grew to a length of between eight and ten inches. This size maintained itself until the summer of 1958, at which time average size of the individual fish began to decline. In the spring of this year, the population looks very similar to that preceeding the renovation program. It is believed that inter-specific competition for food and space between the bluegill, sub-adult channel catfish and a growing population of forage and rough fish is exerting a depressing effect upon the bullhead.

Channel catfish: Catfish stocking included 20,100 sub-adults and 106 adults in the fall of 1956. This was followed by 67,000 fingerlings in the summer of 1957. Hoop netting in 1957 revealed an excellent survival of the initial planting, and the presence of many young fish since then indicate successful reproduction on the part of the adults stocked in 1956. Results with the shocker have remained quite constant (Table I), but at low levels. The channel catfish is a species difficult to observe with shocker technique, and low fingures per unit of effort certainly cannot be construded to mean small populations.

Growth studies on the catfish were covered in the April seminar of 1958. Essentially that report revealed growth far in excess of normal. Data pertaining to subsequent growth are not yet complete, but the indications are that it is not proceeding at the acclerated rate of the first season after treatment.

Angling for catfish in the area was considered poor in the years 1957-58. Catfish are being caught in larger numbers in 1959, but the catch yet remains below that expected.

Walleye: During the year following chemical treatment, 45,000 fingerlings and 250,000 walleye fry were stocked in the Humboldt area. Surveys conducted during 1957 revealed these plantings wholly successful and the species doing well. By the onset of ice cover in 1957, walleye in excess of twelve inches in total length were everywhere abundant.

The population remains at a high level and from all appearances are doing better than any of the other game species now occupying this reach of stream.

Angling for the walleye started in the fall of 1957 and good catches by anglers fishing specifically for them have continued since.

Walleye growth has been excellent. During the first year, fingerlings stocked at five to six inches in total length reached a maximum of fourteen inches. After two seasons of growth some individuals have reached 20 inches and fish weighing 2.5 - 3.0 pounds are common.

Bluegill: This species was not present in the Humboldt area prior to the late fall of 1956 when 870,000 were stocked. From that planting, the bluegill became firmly established and it has flourished to the point that it is now numerically the most abundant species. Growth has been good (Table II), and it has reproduced successfully in both 1958 and 1959. Angling for bluegills has been good since the fall of 1957 for those anglers that fish specifically for them.

Largemouth bass: Largemouth bass were indigenous to the Humboldt area, but natural stocks disappeared prior to the late 1940's. Stocking of approximately 25,000 fingerlings in the year following the eradication program has resulted in re-establishing the species. Shocker success (Table I) shows a considerable drop in the number of largemouth bass shocked per unit of effort since 1957. This is related to population dynamics involving natural mortality as the population has evolved from one including a large number of small fish to one of involving mature fish and a wide range in size.

Largemouth bass reproduced successfully in 1958, but reproduction success in 1959 is questionable. A few fingerlings, one to two inches in total length, were observed in June of this year. They were believed to be too few in number to develop a significant year class.

Growth during 1957 was excellent. Fish averaging four inches in total length and stocked in the fall of 1956 were ten inches long a year later. Growth in 1958 was at a slower rate. Bass 9 - 11 inches long in the spring of 1958 gained only two inches during the ensuing season.

Small mouth bass: Thirteen thousand small mouth bass fingerlings were released into the area in the fall of 1956. Sampling in the spring of 1957 revealed an excellent over-winter survival. Shocker success for the fall of 1957 and the year 1958 indicated a stable population at a rather high level, but none were taken in the spring surveys of 1959. A reason for this may be found in that a gravel pit operation adjacant to the river was opened up during the past year, and during high turbid waters this spring many small mouth moved into the clean waters of the pit. Anglers fishing other species reported catching many smallmouth bass from the pit prior to the opening of the bass season. It may be that a large block of the small mouth population in the area have now moved into the pit which is outside of our test segment.

Small mouth reproduction in 1958 was of little significance, and evidence of reproduction for this year has not been observed.

Growth has followed the pattern of the largemouth--rapid in 1957, much slower in 1958.

Crappie: Both black and white crappie were introduced into the area. These were stunted fish rescused in another fish management activity. Thirteen thousand were stocked, but significant mortality resulting from handling in hot weather occurred. As a consequence, it is not known what part of the original planting survived but from all appearances, it would have been a rather small percentage.

Our shocker surveys have shown the number of crappie shocked per unit of time to be stable but in low numbers. Crappies in Iowa waters are difficult to observe by shocking, and in all probability there may be more crappie present than indicated by shocker surveys.

Crappie reproduced in large numbers in both 1957 and 1958, but none were observed in 1959.

Adult crappies examined in the fall of 1957 showed them to have recovered from their stunted condition.

They were in excellent physical shape and growing rapidly. By August of 1957 they averaged nearly ten inches length.

The relative few adult crappies examined since 1957 show them to be fast growing, vigorous fish. Twelve inch crappies have been reported on several occasions by anglers. Angling for crappies has been sporadic since the fishery developed.

Northern pike: In the spring of 1957, 2,150 fingerlings and 150,000 northern-pike fry were introduced into the Humboldt study area. Subsequent surveys have demonstrated at least a fair survival of this planting.

Northern pike populations in Iowa waters are difficult to appraise by use of the electrical shocker. The species seems adept at avoiding the electrical field, and experience indicates that if a few northerns can be observed regularly with the shocker, the population may be relatively high.

Upon occasion, northerns are caught in fair numbers. Several fishermen have reported catching as many as three on a single trip.

Northern pike growth in the area is not too well known. We have only measured three fish and these after the first summer of growth. At that time the three fish measured 16, 18 and 21 inches in total length. Anglers reported catching four to five pound northerns in 1958 and a nine pounder was reported in June of this year.

Rough fish: Observations shortly after "rotenoning" revealed a survival of a few rough fish. They included the usual varieties inhabitating the Des Moines River; carp, quillback (three varieties), buffalo and redhorse. Surveys during the succeeding summer and fall exhibited some reproduction success of all species but the main recovery is believed to have come via rough fish re-intering the area through the hydro-electric wheels at Rutland. Carp and carpsuckers or quillback, Carpiodes sp. have made a substantial recovery in the area (TableI), but they do not yet dominate as in the past.

Minnows: A variety of minnows, fatheads Pimephales promelas and shiners Notropis sp. were liberated in the area in the fall of 1956. These were introduced as a food supply for game fish. The success of that specific planting is not known, but the forage fish population seems to be established. Large numbers of minnows of a wide variety are seen while shocking in the shallow waters.

Table 1, Fish shocked per minute, Spring and Fall, 1957 through 1958 and Spring 1959.

Year	1957				1958				1959	
Season	Spring		Fall		Spring		Fall		Spring	
Time shocked in minutes	165		742		515		435		140	
Species	No. Indiv. Counted	No. Min.	No. Indiv. Counted	No. Min.	No. Indiv. Counted	No. Min.	No. Indiv. Counted	No. Min.	No. Indiv. Counted	No. Min.
Bluegill	157	.96	2281	3.08	812	1.59	1309	3.01	67	.48
L. M. Bass	78	.47	370	.50	36	.07	99	.20	10	.07
S. M. Bass	186	1.13	183	.25	112	.22	103	.24	--	--
Walleye	39	.24	298	.40	80	.15	151	.34	50	.36
Crappie	18	.11	43	.06	7	.05	7	.02	5	.04
Northern Pike	--	---	26	.03	13	.02	6	.01	3	.02
Bullheads	21	.13	164	.22	40	.07	70	.16	49	.48
Channel Catfish	4	.02	36	.05	7	.01	17	.04	5	.04
Carp	--	---	133	.18	104	.20	287	.66	84	.60
Quillback	--	---	251	.34	118	.23	126	.29	25	.18
Suckers (various sp.)	10	.06	--	--	4	.01	2	--	1	tr.

Table II. Number of game fish measured and range in total length by species of fish taken by shocking from the Humboldt area; Spring and Fall shocking 1957 through Spring of 1959 inclusive.

Species		Spring 1957	Fall 1957	Spring 1958	Fall 1958	Spring 1959
Bluegill	No. Measured	84	70	66	90	30
	Range tot.lg	1-2	3-6	4-6	4-7	4-5
Crappie	No. Measured	12	40	21	5	4
	Range tot.lg.	4-6	8-10	8-11	7-11	7-11
Small Mouth	No. Measured	45	76	54	58	0
	Range tot.lg.	3-5	6-10	7-10	6-12	---
Large Mouth	No. Measured	50	55	23	41	10
	Range tot.lg.	3-5	7-11	6-11	5-13	8-13
Walleye	No. Measured	41	92	56	77	21
	Range tot.lg.	4-7	5-14	6-12	8-16	7-21
Black Bullhead	No. Measured	21	50	31	44	30
	Range tot.lg.	5-6	4-10	4-10	5-9	4-7

COMMERCIAL FISHING STATISTICS
IOWA WATERS OF THE MISSOURI RIVER - 1958

by

Delmar J. Robinson
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During 1958, there were 210 Iowans who had obtained commercial fishing licenses to fish in the Missouri River. Four non-resident commercial licenses were issued which raised the total number of licensed commercial operators on the Missouri to 214.

As shown in Table 1, the central Missouri River counties dominated the license sales with Harrison County having more than twice the number of commercial operators than any other county.

Five hundred and forty-two items of commercial gear were licensed for use in this area in 1958. Of this gear, hoop nets were the most popular with 286 licensed; followed by trot lines and trammel nets in that order (Table 2.)

Based on reports received, 13 percent or 28 of the 210 licensed operators reported their 1958 commercial catch as required by Iowa law. Of the 28 reporting, 12 reported "no fishing", and 16 reported a catch. As expected, carp led all other fish in the reported catch, with 10,550 pounds. (Table 3.) Catfish were second with 4,695 pounds. In 1958 the highest reported catch took place during the early summer months of May and June, as outlined in Table 3.

According to catch reports and amounts of gear licensed to individual fishermen, it is doubtful if there is a single licensee on the Iowa waters of the Missouri River who can be classified as a "full-time" commercial operator, or one who makes his entire living by commercial fishing. The average Missouri River commercial fisherman is either a farmer or small business man who fishes only for his own table use or for recreation. He licenses one or two hoop-nets, a trot line, or a trammel net and fishes in his spare time. Although a few commercial fishermen do have fish peddlers licenses, little effort is made to market the catch other than locally.

Table 1. Commercial Fishing License Holders by County, Missouri River, 1958.

County	Number of License Holders
Harrison	79
Pottawattamie	34
Fremont	30
Monona	25
Woodbury	24
Mills	11
Page	4
Ida	2
Sioux	1

Table 2. Commercial Fishing Gear by County, Missouri River, 1958.

Type of Gear	Number Licensed	Counties								
		Fremont	Harrison	Ida	Mills	Monona	Page	Pott.	Sioux	Woodbury
Hoop Net	286	62	57	0	37	26	1	61	0	42
Trot Line	127	20	41	2	8	9	4	30	3	10
Trammel Net	61	7	14	0	5	15	0	12	0	8
Basket Trap	56	4	41	0	0	3	0	7	0	1
Seine	3	0	1	0	0	1	0	1	0	0
Gill Net	3	1	0	0	0	0	0	0	1	1
Dip Net	3	0	0	0	0	0	0	0	0	3
Fyke Net	2	0	0	0	0	0	0	2	0	0
Pound Net	1	1	0	0	0	0	0	0	0	0
Total	542	95	154	2	50	54	5	113	4	65

Table 3. Commercial Fishing Catch by Pounds, Species, and Month, Missouri River, 1958

Month	Total by Month	Carp	Cat-fish	Buffalo	Sucker and RedHorse	Sand Sturgeon	Sheeps-head	Bull head	N Pike	Misc.
Jan.										
Feb.										
Mar.	0	0	0	0	0	0	0	0	0	0
Apr.	1823	812	444	324	171	21	0	0	52	0
May	4190	2280	927	640	278	0	35	0	0	30
June	3873	2345	985	370	0	20	133	20	0	0
July	1682	1050	455	131	0	0	46	0	0	0
Aug.	1773	974	505	222	0	0	0	72	0	0
Sept.	1302	784	408	110	0	0	0	0	0	0
Oct.	2734	1742	236	661	0	90	5	0	0	0
Nov.	1114	398	714	0	0	0	2	0	0	0
Dec.	186	165	21	0	0	0	0	0	0	0
TOTAL	18,677	10,550	4,695	2,458	449	130	221	92	52	30

SUMMARY OF HATCHERY STUDIES, SPRING, 1959

by
Tom Moen
Fisheries Biologist

This is an annual report concerning certain phases of walleye and northern pike hatchery operations. Each spring routine data are collected during the hatching season and experimental studies are conducted. The discussion that follows presents a summary of the basic data on hatchery production and the results of experimental work at the Spirit Lake, Clear Lake and Lansing hatcheries. The data concerning each station and the experimental work will be discussed under appropriate headings.

Spirit Lake Hatchery

Northern Pike: T his season marked the fifth consecutive year that low water levels and little or no runoff prevented a normal spawning run of northern pike. There were no northern taken from carp traps and only a half dozen fish, taken incidental to other work, were available for use in the hatchery. Approximately three quarts of eggs were secured. The resulting 100,000 fry were stocked locally.

Walleye: Gillnetting for walleyes started on April 11th in East Okoboji Lake, April 13th in Spirit Lake and April 19th in West Okoboji Lake. There were eleven nights of gillnetting in East Okoboji, 16 nights in Spirit and 9 nights in West Okoboji. The gillnetting crews collected 2,269 walleyes from the three lakes in 149 crew - nights of fishing for an average of 15.2 fish per crew per night. East Okoboji crews collected an average of 23 fish per night per crew. The biology shocker crew supplied approximately 250 male walleyes for hatchery use.

A total of 599 quarts of eggs was taken from 1,383 females for an average of 0.44 quart per female. These eggs averaged 142,000 per quart. A total of 488 quarts survived to the hatching stage, representing an 81 per cent hatch and 68 million fry. Water temperatures during the incubation period averaged 54°F (range 46 to 68). The first eggs were "put up" on April 13th, and the last group of eggs on the 29th; all hatching was completed by May 9th and all fry stocking had been completed by May 13th.

Fry stocking was carried out in three major catagories: nursery lakes and/or freeze-out lakes; rivers (as part of the alternate year stocking program); and the more or less normal stocking of the larger natural lakes plus two artificial lakes. Ten nursery lakes received 6,700,00 fry; rivers were stocked with 6,500,000 fry distributed at 22 separate localities along the length of four rivers; normal stocking accounted for 52 million fry, including a special plant of 15 million by the biology crew in Spirit Lake.

* The author wishes to express his appreciation for the help and data provided by Fay Fronk, Robert Cooper and John Spinner, superintendents of the Spirit Lake, Clear Lake, and Lansing hatcheries respectively.

Clear Lake Hatchery

Northern Pike: No northern pike were hatched at the Clear Lake hatchery in 1959. This is the third year that low water has prevented a normal spawning run of northern pike into the carp trap at the west end of the lake.

Walleye: Under a new cooperative agreement between the Iowa Conservation Commission and the Iowa State College Fisheries Research Unit, walleyes will be hatched two consecutive years instead of alternate years as in the past. Inasmuch as 1958 was a hatching year in the older plan, 1959 became a hatching year in the new plan.

Gillnetting crews fished 46 crew nights to obtain 2,184 walleyes for an average of 47.4 fish per crew night in contrast to 97.2 fish per crew per night during 1958 season. The only plausable explanation for the lowered catch rate is the abnormally low water stage that may have forced the walleyes to use other spawning grounds. The 704 females taken by the gillnetting crews produced 220 quarts of eggs for an average of 0.31 quarts per female. 180 quarts of eggs were brought through to the hatching stage for an 86 per cent hatch; an exceptionally fertile group of eggs. These 180 quarts produced 23,400,000 fry (130,000 eggs per quart). Fry stocking included 16,600,000 placed directly into Clear Lake; 5,500,000 were stocked in rivers; 1,200,000 were stocked in artificial lakes, and 100,000 used for a small nursery pond.

Lansing Station

Most of the time spent at the Lansing Station was spent in experimental studies. A limited amount of routine checks on eggs size and fertility were made but the final results of hatchery production for this station are not included in this report. The northern run was about average at the station; however the walleye run was very poor for the second straight year. Thirty quarts of walleye eggs were put up in 1958 and about half the number in 1959.

Experimental Studies

Hormone injections: At the Lansing Station the injection of female northern pike with carp pituitary solution was continued and the study expanded to include injections of a commercial hormone for comparative effects. The commercial preparation was a human chorionic gonadotrophin with the trade name of APL (Anterior Pituitary Like), produced by the Ayerst Laboratories, New York.

Sixty female northern pike were divided into three groups of 20 each. These fish were taken from a larger group of 200 females that had been held in the hatchery for a period of at least two days, a few of them for three days. They had been checked for spawning purposes each day following capture, thus most of the ripe fish had been removed. In selecting the 60 fish at random there were only three ripe ones (5 percent).

Each fish in group one was given five cubic centimeters of carp pituitary solution (one gland in five cc. of distilled water). Those in group two were each given two cubic centimeters of APL; and group three was used as control with no injection. Fourteen hours later all the fish were examined, and there was but one ripe female which was in group number two. Following the examination the injections were repeated. Twenty-four hours following the second shot there was no evidence of ripe fish in any of the three groups. Fourty-eight hours

following the second shot there were no ripe fish in groups two and three, but all the fish in group one were spawnable, and produced ten quarts of eggs. Subsequent fertility checks indicated that there was no appreciable difference between these eggs and those taken from uninjected fish.

The commercial hormone, APL, was injected at an average of 800 I.U.s (International Units) per pound of fish as recommended by Kermit Sneed (personal communication) who had found this ratio effective in spawning channel catfish. Possibly a higher ratio or more injections would prove effective but from an economic viewpoint the carp pituitaries are less expensive than the commercial preparation at the present time.

The carp pituitary solution was also used on an experimental group of walleyes at the Spirit Lake hatchery. The fish selected were green females picked at random from a larger group of fish having had a maximum confinement of 48 hours and a minimum of 24 hours. This experiment involved twenty-ine fish and extended over a period of five days. A group of ten fish was kept under observation with additions made as fish ripened. Injections were given at twenty-four hour intervals. If an individual fish did not release its eggs 24 hours after the second injection it was returned to the lake.

Limited tank space prevented setting up additional groups and controls and thus the results were not too conclusive. No attempt was made to keep track of the percent of green fish ripening in the primary holding tank. Hatcher superintendent Fay Fronk estimated that about 50 per cent of the females that were not rip at the time of cature failed to rippen after 48 hours in the holding tanks. These fish were then returned to the lake. Among the injected groups 30 to 60 percent of the fish were ripe 24 hours after the first injection and about the same percentage ripened among those receiving the second injection. Thus 60 to 80 percent of those receiving carp pituitaries produced eggs.

Sperm Storage: Limited attempts at walleye sperm storage were as unsuccessful as those made during the 1958 season. Personal communication with Kermit Sneed indicates that it will be necessary to adjust the concentration of the Ringer's solution to correspond to the tonicity of the sperm being stored. In the experiments during the last two years our Ringer's solution has been used at normal concentration.

Plastic bag transportation of fry: It costs money to transport fish and the cost per pound of fish moved usually increases as the size of the fish decreases. Transportation of fish in polyethelene bags has received considerable attention during the past three years as a means of cutting the cost of shipment of small fish and improving on certain handling aspects.

Transportation of northern pike fry from the Lansing Station to several inland points during the 1959 season marked our first attempt at using plastic bags. Later in the season, walleye fry were transported to a number of location across the State in Plastic Bags. Both the Clear Lake and the Spirit Lake hatcheries were involved, each moving about 10 million walleye fry in plastic bags. Approximately four million northern pike fry left the Lansing station in plastic bags.

Several experimental shipments of northern pike fry were made with various sizes and weights of bags, a few with ice and one trial with antibiotics (sulfadiazine) added. Details of these trials will not be discussed at this time, only a summary of successful techniques. The best bag was a rather heavy (0.4mm) polyethelene bag, 20 by 24 inches, sealed at both ends. Larger bags of good quality were satisfactory but no apparent advantage. One corner of the bag was opened to permit introduction of water and fish, and approximately two gallons of water and 50,000 northern pike fry were placed in each bag. The air was exhausted and replaced with oxygen. All bags of northern pike were placed in

cardboard boxes for hauling. A double handfull of crushed ice in a small plastic bag placed in the box beside the bag of fish maintained temperatures very well except in one case where the water temperature was six degrees lower than at the start of the trip. Dead fry and infertile eggs were detrimental but the exact relationship was not determined. In two instances where fry appeared to be nearly a total loss upon arrival at Spirit Lake from Lansing (five hours) they were placed in screen trays in fresh water and the loss was found to be only about 50 percent instead of the apparent 80 to 90 percent. Four bags of northern fry were hauled successfully for eleven hours (400 miles), all other trips were of shorter duration.

Most of the walleyes were packaged the same as the northerns, except that they were not placed in boxes. During a few of the shipments the bags were covered with wet burlap bags but in most cases the bags were laid loose on the floor of the car or station wagon. Most of the walleye fry transported in plastic bags were picked up by Conservation Officers at the hatchery and stocked in waters of his territory. These were usually in units of five bags. One experimental bag of fry was placed between wet burlap bags in the trunk of the author's car, transported to Clear Lake and back (230 miles), left in the trunk overnight, and were found to be in excellent condition the next morning after 25 hours in the plastic bag. Another bag of fry was held at the hatchery for 48 hours with less than a 20 percent loss. In general, the walleye fry were much easier to move in the plastic bags than the northern pike fry. Additional experiments with anitbiotic and buffers will be carried out next season but preliminary work indicated that these additives may not be necessary for sack fry transportation.

THE DEVELOPMENT OF A WALLEYE POPULATION IN AN ARTIFICIAL LAKE

By Jim Mayhew
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The walleye has received much attention through research and fisheries management in Iowa during the past decade. Anglers regard this species as one of the most prized catches, and spend thousands of hours annually in quest of the walleye. In areas where the walleye is abundant the economic values offered to the community by anglers fishing for this species cannot be ignored. Most of the walleye waters are located in the natural lakes and inland streams in the northern part of the state, and large populations are present in the upper regions of the Mississippi River.

The Fisheries Section of the State Conservation Commission operates three hatcheries primarily for the artificial propagation of walleye. Although the walleye is one of the most desireable species of fish there was no attempt to establish populations in the vast network of artificial lakes in southern Iowa since 1932. This was because most of the artificial lakes were not considered walleye habitat and the fish would fail to perpetuate themselves in the man-made impoundments. During 1954 a pilot project was initiated in Green Valley Lake, in Union County, to attempt to develop a walleye population. This is a report on the development and status of that population during the first five years of the project.

Green Valley Lake is one of the largest state-owned artificial lakes in Iowa. At crest elevation the dam impounds 390 surface acres of water. Construction was started in 1952 and completed late the following year. Unlike most other state-owned artificial lakes, Green Valley is relatively shallow with gentle sloping bottom contours and numerous mud shoal areas. Maximum depth is approximately 20 feet. The lake does not stratify thermally, and has sufficient oxygen in the deep regions to support fish life throughout the year. There are only sparse wooded areas in the watershed with the major portion of the shoreline completely open. Due to the lack of gravel bars and rock shoals the impoundment was considered only fair walleye habitat. Along the face of the earthen dam there is considerable rock fill which constituted suitable walleye habitat.

The first walleyes were stocked during the second year of impoundment. This planting consisted of 1,500 finglering and 1,000 yearlings (Table 1). The yearling walleye were from 10 to 12 inches in length that had escaped nursery pond seining the previous year. Two plantings of fingerling largemouth bass, and one stocking of adult bluegill and adult crappie had preceeded the introduction of walleye. Bullheads were present in the watershed prior to impoundment and also inhabitat the lake. Channel catfish fingerlings were also stocked several months prior to the walleyes.

Walleye fry have been introduced each year except 1956 when they were not available. The largest fry stocking was completed in 1959 when 1,000,000 fry were stocked. To date a total of 2,550,000 fry have been planted over the five year period. Both fingerlings and yearlings were released annually for the first four years. The largest planting of fingerling was in 1956 and 1958 when 5,000 were stocked each year. Yearlings were released in the largest quantity in 1957.

In the spring of 1959 efforts were made to determine the approximate date, water temperature and sex ratio at the time of spawning. Two, 200' x 6' gill nets with two inch mesh (bar measure) were fished for a total of 192 hours. The netting was done on four different dates. Total length, weight, condition of gonads were recorded for each date and individual specimen. The sequence of spawning in relation to water temperature, date, and reproductive conditions was as follows:

March 20: Ice cover had been out of the main body of the lake for three days. The nets were fished on two mud shoals for 48 net hours. Water temperature was 40 degrees F. on the surface. Four ripe male walleyes were captured.

March 31: The nets were fished for 48 net hours in the identical areas as March 20. Water temperature had increased slightly to 44 degrees F. Twenty-eight walleyes were captured of which 26 were ripe males and two unripe females.

April 5: The nets were again fished for the identical time and area. Water temperature had increased to 54 degrees F. On this date four ripe males and one ripe female were captured. The female produced an abundance of eggs when slight external pressure was applied to the lower abdomen.

April 11: The nets were set in the identical areas as before. Cold weather had reduced the water temperature to 52 degrees F. Twelve adult walleyes were caputred. Four of these were ripe males, two were ripe females, and six were spent females. The peak of spawning activity had passed.

From this information it was evident that the adult walleye population in the lake was capable of spawning. It can be assumed that the preliminary stages of spawning, releasing of eggs by the female and efforts at fertilization, took place. Therefore, any failure of natural reproduction should be the result of failure of eggs to hatch or young to survive. Apparently the peak of spawning activity occurred between April 5 and 11 when water temperatures ranged from 44 to 54 degrees F. There was an acceleration of activity and an increase in net catches nearer the higher temperature ranges. A total of 49 adult walleyes were taken during the netting period. No effort was made to recover fry or fingerling produced by the spawning activity since it would be impossible to differentiate between natural reproduction and fry planted on May 5.

Scale samples for age and growth analysis were obtained from 40 of the walleyes captured during the netting. Microprojection of the scale image was used to assess the age of individual specimens. Mean total length for each year class of fish was determined for each age group individually. Twelve of the fish were from the original stocking or five years old. The remainder were divided by age groups as follows: 12--IV, 12--III, and 4--I. There was a complete lack of two year old fish in the sample. Mean total length for the first, third, fourth, and fifth years of life was 11.0, 19.6, 22.1, and 24.3 inches respectively. This is considerably above the growth reported in other Iowa waters. Normally it requires four or five years for a walleye to reach 19 inches in total length (Rose, 1949; Cleary 1947; Mayhew, 1957). The significance of the first years growth in rearing ponds is not considered as a part of this rapid growth.

A creel census was conducted at Green Valley Lake in 1956, 1957, and 1958. The method of censusing is described by Mayhew (1956). During the first year of the census walleyes comprised 1.8 per cent of the harvest. The following year drought condition reduced the water level by approximately eight feet, and angling success was minimal for all species. In 32 census periods only four walleyes were recorded in the catch. Walleye fishing success improved greatly in 1958 comprising 2.8 per cent of the total harvest. Miscellaneous data requested from the anglers as to what species of fish they were fishing for is quite interesting. The 32 walleyes caught during the summer census period were caught by 15 different parties. Twelve of these were fishing strictly for walleye, and the remainder were caught incidently by crappie or largemouth bass fishermen. One other angler contacted was fishing for walleye and had caught other species. Only two anglers expressing the desire to catch walleyes were unsuccessful. Certainly this would indicate that the angler possessing the equipment, and the ability, or "know-how" were successful in their attempts to catch walleyes in Green Valley Lake.

Summary

1. Walleyes have become well established through annual stocking in Green Valley Lake and are capable of producing fair angling success.

2. The peak of spawning activity occurred between April 5 and 11 when water temperatures ranged from 44 to 54 degrees F.

3. The preliminary stages of reproduction are apparently successful, however, hatching success and survival of young is undetermined at the present.

4. Growth has been above normal for Iowa waters; with fish reaching a total length of 24 inches in five years.

5. Angling success for walleye reached its highest peak in 1958 when this species comprised 2.8 per cent of the total catch.

6. Miscellaneous data requested from anglers in 1958 revealed that the fishermen specializing in walleye fishing were quite successful. Incidental catches of walleye were uncommon.

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Table 1. Walleye stocking in Green Valley Lake from 1954 to 1959.

Year	Date of Stocking	Number and Age of Walleye Stocked		
		Fry	Fingerling	Yearling
1954	October 29		1,500	1,000
1955	May 9	300,000		
	September 30		800	200
1956	September 20		5,000	
1957	May 1	500,000		
	May 31		3,000	
	August 30			2,000
1958	April 29	750,000		
	May 15			820
	October 23		5,000	
1959	May 5	1,000,000		