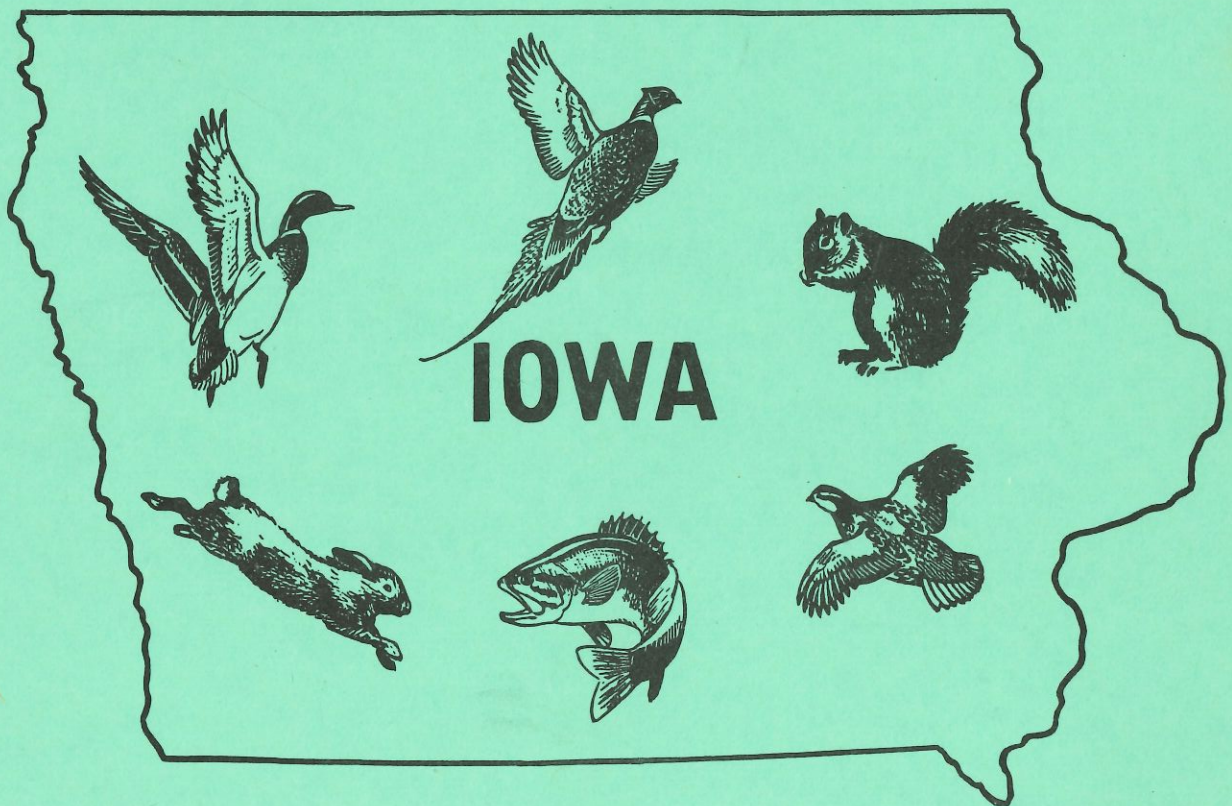


1966

QUARTERLY BIOLOGY REPORTS



FISH AND GAME DIVISION — BIOLOGY SECTION
STATE CONSERVATION COMMISSION

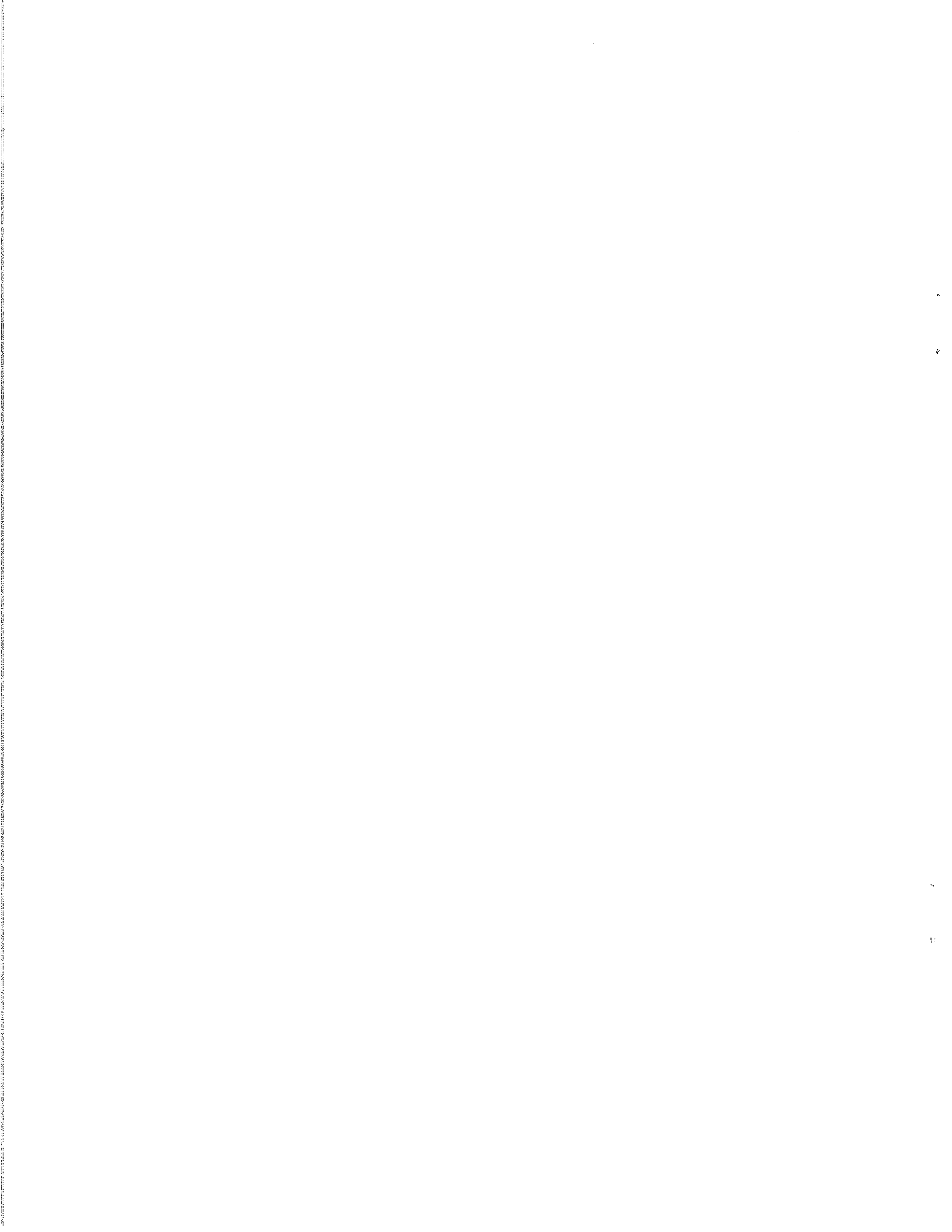


TABLE OF CONTENTS

ABSTRACTS

ABSTRACTS OF ALL PAPERS PRECEDE THE PAPERS IN THE REPORT.....(Page I-VI)

FISHERIES

PAGE NO.

1. Results of Intensive Netting for Commercial Fish Species in the Des Moines River and Coralville Reservoir
Jim Mayhew and Larry R. Mitzner, Fisheries Biologists----- | - 9
2. Progress Report on Habitat Improvement Structures in a Small Western Iowa Stream
Bill Welker, Fisheries Biologist----- 10 - 11
3. Evaluation of the Iowa River Renovation Project in Hardin County
Robert Schacht, Fisheries Biologist----- 12 - 15
4. Clear Lake Walleye Study - Progress Report
Robert Hollingsworth, Fisheries Biologist----- 16 - 17
5. Creel Census Results from Clear and Black Hawk Lakes, 1965
Robert Hollingsworth, Fisheries Biologist----- 18 - 22
6. 1965 Commercial Fishing Statistics for the Mississippi River Bordering Iowa
Don R. Helms, Fisheries Biologist----- 23 - 25
7. Successful Renovation of a Small, Natural, Iowa Lake
Terry Jennings, Fisheries Biologist----- 26 - 33
8. Six Years of Officer Creel Contacts on Natural Lakes, 1960-65
Larry Dunham, Biologist Aid-----34 - 44

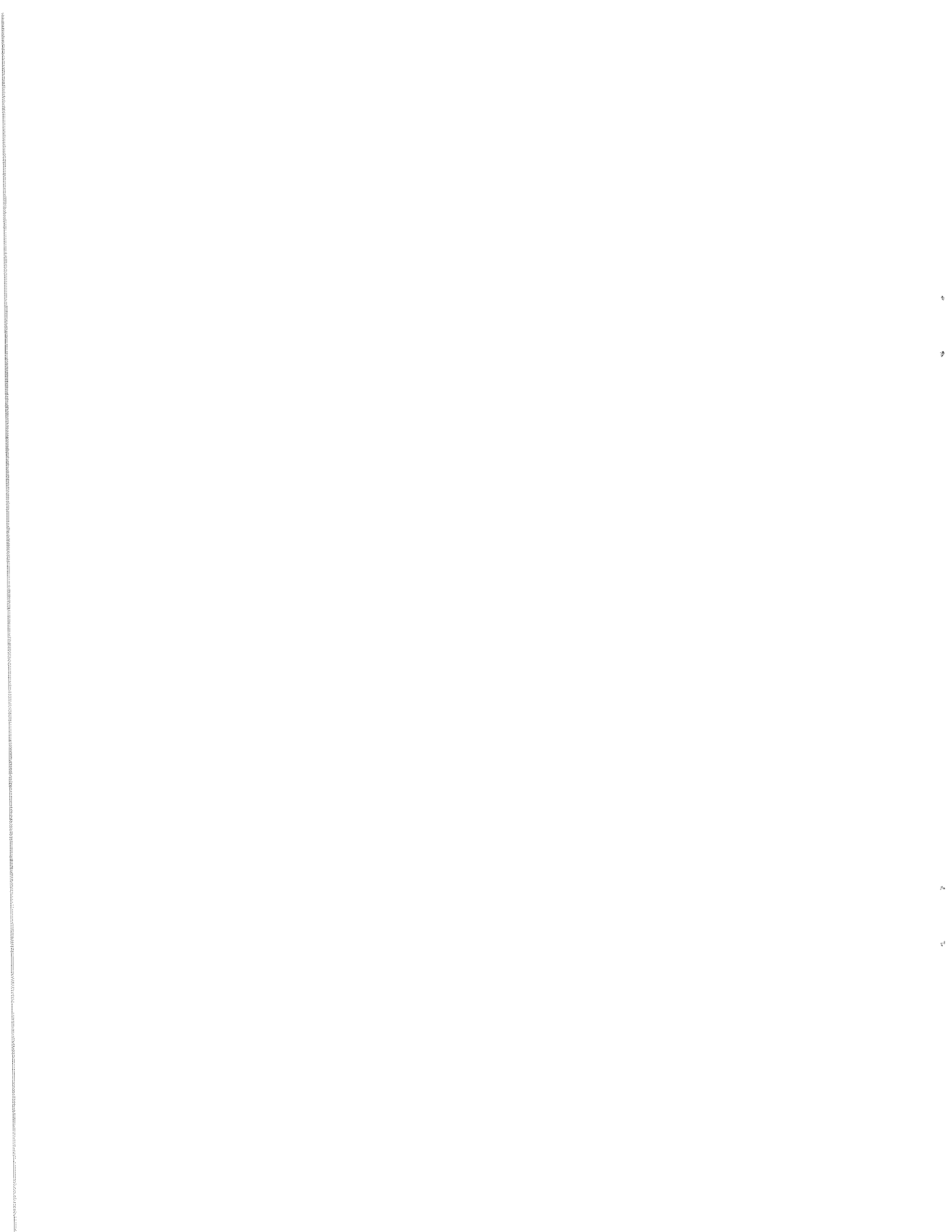
GAME

1. Factors Influencing Production in Fox Squirrels
Richard McCloskey, Grad. Asst., I.S.U. and Robert Phillips, Game Bio.-45 - 51
2. Iowa Quail Populations, 1966
M. E. Stempel, Game Biologist-----52 - 58
3. Iowa's Late Summer Pheasant Population 1966
Richard C. Nomsen, Game Biologist-----59 - 65
4. Results of 1966 Rabbit Surveys
M. E. Stempel, Game Biologist-----66 - 70
5. Reeves Pheasant Stockings and Observations, 1966
Gene Hlavka, Game Biologist-----71 - 77



6. 1966 Iowa Waterfowl Breeding Pair Survey
Richard Bishop, Game Biologist----- 78 - 82

7. Ruffed Grouse Investigations in Northeast Iowa
Wayne Porath, Grad. Asst. I.S.U, Keith D. Larson, Game Biologist----- 83 - 91



I

RESULTS OF INTENSIVE NETTING FOR COMMERCIAL FISH SPECIES IN THE DES MOINES RIVER AND CORALVILLE RESERVOIR

Jim Mayhew
Fisheries Biologist

and

Larry R. Mitzner
Fisheries Biologist

Studies to determine the suitability of establishing commercial fisheries at Coralville Reservoir and Des Moines River were initiated under a federal-state cost sharing project. To achieve this objective, intensive sampling programs were started in June. In the Des Moines River 16,642 fish weighing 11,958.1 pounds were captured. The population sample was dominated by channel catfish. Numerically this species comprised 86 per cent of the sample. By weight 70 per cent of the catch was channel catfish. Carp, carpsucker, flathead catfish, crappie, gizzard shad, bigmouth buffalo, northern redhorse and goldeye made up the remainder of the sample. All fish were marked by removing the right pectoral fin and released. Twelve per cent of the channel catfish, 10 percent of the carp, and 9 percent of the flathead catfish were recaptured. The channel catfish population was estimated between 82,800 and 117,400 fish in the 20 mile study area. No estimates were made of other populations. At Coralville Reservoir 11,690 fish weighing 14,044 pounds were caught in the conservation pool and headwaters. Species composition of the catch by weight was: carp, 49.2 per cent; carpsucker, 25.7 per cent; buffalo, 9.1 per cent; channel catfish, 6.2 per cent; and other species 9.8 per cent. Only 60 of the 8,456 fish marked were recaptured. Population estimates were 86,000 carp, 30,500 carpsucker, and 41,700 channel catfish. Means of expanding the exploitation of fish from the study areas is discussed.

PROGRESS REPORT ON HABITAT IMPROVEMENT STRUCTURES IN A SMALL WESTERN IOWA STREAM

Bill Welker
Fisheries Biologist

Gabions and diversion dams were installed in the Maple River on an experimental basis, to provide catfish habitat during low water periods. Pools developed below these structures and were maintained through mid-summer. However, during late summer and fall these pools were ruined by siltation. Since this stream is characteristically a low-flow stream, it is doubtful any type of structure could provide adequate habitat during low flow.

EVALUATION OF THE IOWA RIVER RENOVATION PROJECT IN HARDIN COUNTY

Robert Schacht
Fisheries Biologist

In 1966 a survey was conducted in the Iowa River between Alden and Steamboat Rock, in order to evaluate the results of a chemical treatment project that was accomplished in 1960. Five hours and 50 minutes of electro-fishing was completed in this section of the river. Bait nets were fished for a total of 1,204 hours. Results of the survey showed rough fish to be at pre-treatment densities. An increase in the sucker population is noted to be responsible. Rough fish comprised approximately 97 per cent of the population sample by weight. Baited nets fished in the Alden pool took no catfish in 484 hours. In the Iowa Falls pool 114 catfish were taken in 360 hours. Seventy-five per cent of these fish ranged between 5.5 and 8.4 inches. In the Steamboat Rock pool 360 hours of netting produced 147 catfish. Ninety-four per cent of these fish ranged between 5.0 and 7.4 inches. Because of the absence of permanent benefits to the sport fishery, the renovation project must be considered a failure.

CLEAR LAKE WALLEYE STUDY - PROGRESS REPORT

Robert Hollingsworth
Fisheries Biologist

A study is in progress to estimate the number of walleyes over 12 inches long in Clear Lake. A total of 2,222 walleyes were marked, 1,400 by jaw tags and 822 by fin-clipping. Recoveries for a Petersen estimate are being obtained from fishermen by a full time creel census clerk. Additional recoveries are being affected through periodic electro-fishing. In the first four months of the season, the clerk observed 298 walleyes of which 41 were marked. This gives a preliminary estimate of 16,106 fish with no adjustment for recruitment. Data are also being collected on age and growth, exploitation, movement, and mortality. A secondary estimate of the number of walleyes over 16 inches total length is also planned.

CREEL CENSUS RESULTS FROM CLEAR AND BLACK HAWK LAKES, 1965

Robert Hollingsworth
Fisheries Biologist

Data are presented on the 1965 comprehensive creel census from Clear and Black Hawk Lakes. The Clear Lake census period extended from May through September while Black Hawk Lake was censused from May through October. Estimated total harvest from Clear Lake was 214,544 fish which were caught at the rate of 1.65 fish per hour. The average surface acre of the lake was fished for 10.1 hours and yielded 18.3 pounds of fish. Yellow bass dominated the catch. Black Hawk Lake yielded an estimated 93,472 fish at the rate of 1.77 per hour. Each acre of Black Hawk sustained 57 hours of fishing and produced 65.7 pounds of fish. Crappies provided excellent fishing and were the most abundant fish in the creel.

1965 COMMERCIAL FISHING STATISTICS FOR THE MISSISSIPPI RIVER BORDERING IOWA

Don R. Helms
Fisheries Biologist

Commercial catch on the Mississippi River as reported by 57.8 percent of the 384 licensed operators of commercial fishing gear was 2,399,346 pounds for the calendar year 1965. Thirty-nine percent were carp, 29 percent buffalo, 17 percent catfish and 12 percent drum. The remaining 3 percent were made up of suckers, bullhead, sturgeon, paddlefish, bowfin, gar and eel. Harvest was 2.5 times greater in Pool 9 than in the next highest producer (Pool 18) with 744,698 pounds. The remaining pools ranked in order of production as follows: 13, 11, 14, 19, 10, 17, 12, 16, 15, and 20. Species composition was similar in all pools.

SUCCESSFUL RENOVATION OF A SMALL, NATURAL, IOWA LAKE

Terry Jennings
Fisheries Biologist

Center Lake, a 264 acre lake, is located in northwestern Iowa. During 1958 fish management problems in the form of stunted bullheads and carp along with very poor fishing, indicated the lake should be renovated. During October, 1958 toxaphene was applied at a rate of 0.05 ppm. A complete kill was obtained. This paper discusses species and numbers stocked into Center Lake during the years following chemical treatment. Also discussed are resulting population sizes and growth rates of the major species. During 1962 a population estimate of the 1960 bluegill year class was made. Apparently, nearly one million bluegills or about 680 pounds per acre were present. The 1962 black crappie population was estimated at 200,000 fish or about 100 pounds per acre. Based on a comprehensive creel census conducted on the lake during 1963, 1964, 1965, and 1966, approximately 124,200 angler trips totaling nearly 311,500 hours were made to the lake during the four-year period. During these trips an estimated 1,054,853 fish weighing 291,305 pounds were caught. An average year produced an estimated angler harvest of 275 pounds per acre. The high harvest rate occurred during 1964 when an estimated 480 pounds per acre were creeled.

SIX YEARS OF OFFICER CREEL CONTACTS ON NATURAL LAKES, 1960-1965

Larry Dunham
Biologist Aid

Iowa Conservation Officers contacted 16,947 fishermen at 20 natural lakes during the six-year period from 1960 to 1965. These fishermen caught 61,536 fish after fishing 33,764 hours for a mean catch rate of 1.82 fish per hour. Each fisherman averaged 3.63 fish per trip. Bullhead was the most predominant fish in the creel with crappies ranking second. Walleye and channel catfish ranked next in importance. When comparing the comprehensive type of creel census with the Officer contact type of creel census on individual lakes, wide discrepancies occurred.

GAME ABSTRACTS

FACTORS INFLUENCING PRODUCTION IN FOX SQUIRRELS

Richard J. McCloskey, Graduate

Assistant, Iowa State University, and

Robert Phillips, Game Biologist

A reproductive study on fox squirrels was initiated to determine chronology of production of spring and fall litters of fox squirrels and relative importance of each as contributors to fall population; the project was also designed to relate the chronology of production and success of production to climate and mast abundance. Trap success was 1.26 percent on study area I (Wildlife Research Station) and 0.7 percent on area II (private area near Station). Of 79 squirrels handled 40 were trapped on study areas and 26 of these were back- and ear-tagged and released. Of 59 adult females examined in 1963, 1965, and 1966, 17 were lactating and 3 pregnant. Placental scars on the uteri of 15 adult females averaged 3.33. Back dating of juvenile squirrels showed conception as early as January 8 in Iowa. During March through September adult squirrels' weight ranged from 434 to 916 grams and juveniles from 118 to 654 grams. Nineteen nests and 9 dens were examined. The majority of leaf nests were in white oaks and average height of all nests was 31 feet. Mast count on 108 white oak resulted in 0.63 acorns per twig. Thirty-four hickories yielded 0.54 nuts per twig.

IOWA QUAIL POPULATIONS, 1966

M. E. Stempel
Game Biologist

Winter and spring 1966 quail counts indicated more brood stock than a year ago. July counts of calling quail also indicated more breeding quail than in 1965. Combined results from the July rabbit, July calling quail and August pheasant counts showed more quail than in 1965. A count by rural mail carriers in late July also indicated an increase in quail compared to their 1965 counts. It is thus concluded that there is a sizeable increase in the numbers of quail as compared to last year and other recent years, and this should be a good quail hunting year.

IOWA'S LATE SUMMER PHEASANT POPULATION - 1966

Richard C. Nomsen
Game Biologist

The August roadside pheasant count is the primary source of information on the status of the pre-hunting season pheasant population. The winter of 1965-66 was quite mild and snowfall was below normal. Observers recorded 10,610 pheasants or 1.92 birds per mile - an increase of 16 per cent over the 1965 count. Lower reproductive success was indicated by the various surveys - however, the population increased as a result of the substantial increase in the spring brood stock. The highest pheasant population was in southwest and west central Iowa.

RESULTS OF 1966 RABBIT SURVEYS

M. E. Stempel
Game Biologist

The July roadside rabbit survey for 1966 indicates a high rabbit population and good prospects for the current hunting season. The 6.07 rabbits per 10 miles is well above the long-term average of 4.97, being exceeded only three times in the past 15 years (1958-6.86, 1959-6.33, 1964-6.69). Highest populations by far, as usual, are to be found in southern Iowa. The number of rabbits seen on the August pheasant survey, a secondary source of rabbit fall population information, was the highest in the 4 years this data has been recorded. A mild winter resulted in a good carryover of breeding stock - with over 30 per cent more rabbits being seen on the 1965 spring pheasant counts as compared to 1965. All indications point to a good rabbit hunting season this year.

REEVES PHEASANT STOCKINGS AND OBSERVATIONS, 1966

Gene Hlavka
Game Biologist

The Reeves pheasant was first introduced into Iowa in 1963 in the Stephens State Forest in Lucas County in south central Iowa. By September, 1966, over 4600 Reeves had been stocked in an approximately equal ratio of hens and cocks. Nearly half of these birds (nearly 2200) were stocked in 1966 alone. The 1966 releases in September disposed of the last of these "Ohio game farm" strain of birds from the program. Results from these birds of pen-reared history were not as good as hoped for this past summer. Five broods were reported, the same as in 1965. Thus a "wild French strain" of Reeves was obtained from Tennessee (7 cocks and 20 hens). These birds are considerably more wild in behavior and "streamlined" in appearance compared to the "Ohio" Reeves. Stock for later release will be raised from this nucleus of birds.

1966 IOWA WATERFOWL BREEDING PAIR SURVEY

Richard Bishop
Game Biologist

The brood production survey flown in July 1965, designed to obtain an idea of the waterfowl produced in Iowa, was changed in 1966 to a breeding pair survey. It is believed that the breeding pair survey will give us more reliable data and establish better trend index information. The survey was flown in middle to late May and all ducks and wet potholes were counted for 1/8 mile on each side of the airplane. Ten transects were flown covering an area from the Minnesota border south for 50 miles. The transects were roughly 130 miles long and covered roughly 6,500 square miles. Expanded data indicated 2900 wet potholes and small marshes in the 6500 square miles (exclusive of state marshes) and 1240 pair of mallards and 960 pair of blue-winged teal. The survey showed a large breeding population of mallards and is probably more accurate for mallards than for teal. The survey will be flown again in 1967 to measure trends in breeding pairs of waterfowl.

RUFFED GROUSE INVESTIGATIONS IN NORTHEAST IOWA

Wayne Porath, Graduate Assistant,

Iowa State University

Keith D. Larson, Game Biologist

The primary objectives of this study are to determine the density of the ruffed grouse population on a study area representative of grouse habitat in northeast Iowa, and to determine the relationship of ruffed grouse to habitat types during the summer and early fall.

The study area is located on the upper portion of Paint Creek Unit, Yellow River State Forest. The area comprises 360 acres, divided almost equally into two parts by Little Paint Creek. The bottomland is composed mainly of ungrazed bluegrass meadow. The flat upland areas have been cleared for farming where possible, leaving the inaccessible edges of hills and the slopes as existing grouse coverts. Mixed mature hardwoods, bottomland hardwoods, second growth hardwoods, early successional hardwoods, and conifer-hardwoods dominate the habitat groupings.

RESULTS OF INTENSIVE NETTING FOR COMMERCIAL FISH SPECIES IN THE
DES MOINES RIVER AND CORALVILLE RESERVOIR

Jim Mayhew
Fisheries Biologist

Larry R. Mitzner
Fisheries Biologist

Public law 88-309 was passed by the United States Congress on May 20, 1964, establishing federal aid for research and development of commercial fisheries. The law would allow the U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries to participate in federal-state cost sharing research and development projects. Iowa received approval of a 3 year, \$60,000 project in June, 1966, to conduct research on the potential of commercial and industrial food fish populations in large inland streams and reservoirs. Substantial commercial fisheries presently exist in the Mississippi and Missouri Rivers. Commercial fishing is statutorily prohibited in inland rivers and lakes.

The study was designed to determine the suitability of establishing commercial fisheries at Coralville Reservoir and the Des Moines River. The objective of the study is to evaluate the populations of various species of fish that could have commercial exploitation potential. To achieve this objective, intensive sampling programs were initiated in the summer of 1966. All types of commercial fishing gear including hoop nets, fyke nets, gill nets, slat traps, and trammel nets were utilized in an effort to catch as many fish as possible. All fish captured were marked and released in the immediate vicinity. Scale and spine samples were obtained monthly for population age, structure and periodicity of growth studies.

The Des Moines River study area is located in Marion County, Iowa, approximately 45 miles downstream from metropolitan Des Moines near the incomplete Red Rock Dam and Reservoir. Netting was conducted on a 20 mile stretch of stream 9 miles above and 11 miles below the Highway #14 bridge. Detailed physical descriptions of the area were given by Harrison (1963) and Ackerman (1965). Previously, creel census and fish population survey projects were completed for this location. Ackerman (op. cit.) also tagged numerous catfish in this area to study movement. Fish population surveys indicated a vast population of carp sucker, carp, and channel catfish.

Coralville Reservoir is a large flood control impoundment on the Iowa River near Iowa City, Iowa. At conservation pool the reservoir contains 1,820 surface acres.

1. This paper is a contribution of project II-4-R-1, U. S. Fish and Wildlife Service, Bureau of Commercial Fisheries and State Conservation Commission participating.

Detailed physical descriptions of the lake environment can be found in Mayhew (1963) and Helms (1964). Preliminary fish survey data also indicated the population was dominated by rough fish species.

DES MOINES RIVER INVESTIGATIONS

Actual field netting started on June 6 and continued daily until September 28, 1966. The only exception was 10 consecutive days in early June when high water levels made it impractical to continue netting. During this time nets and traps remained in the river but were not closed or baited.

Seven baited hoop nets and 7 baited slat traps were used in paired sets for more than 34,000 net hours. These nets were placed in 20 miles of the river until August 18. After this date low stream velocity and resulting exposed sand bars prevented navigation of the entire study area; hence netting was confined to approximately 8 miles of stream.

Nets were raised and rebaited at 24 hour intervals except on weekends when nets were neither baited or closed. All fish captured except those in distress from holding were marked by removing the right pectoral fin, weighed in aggregate by species, and released.

Two 2-inch bar measure gill nets and several trammel net floats were also tried in late September. Low stream velocity, debris, and lack of pool depth made use of these gear ineffective and impractical. They were generally incapable of taking large quantities of fish because of low flow.

During the netting study 16,642 fish weighing 11,958.1 pounds were captured (Table I). Numerically, channel catfish dominated the sample, making up more than 86 percent of the total catch. Carp and flathead catfish comprised 11.4 and 1.6 per cent of the sample respectively. Carpsucker, northern redhorse, crappie, bigmouth buffalo, gizzard shad and goldeye were also caught but amounted to less than 1 per cent of the total catch.

By weight, channel catfish was also the most important species occupying more than 70 per cent of the sample. Carp, because of their greater average weight, comprised 26 per cent of the catch. Other species were of minor importance.

There was considerable variance in relative catch success throughout the study period. Bi-weekly catch statistics in Table 2 indicated stream flow was the primary factor responsible for fluctuation of relative catch success. Normally, expended effort was static from one bi-weekly period to the next. As water levels increased to near flood stage in early June, the rate of catch diminished rapidly from the early spring flows until it was lower than any other period. Extremely low flows in early August also lowered net efficiency. During period of gradual but progressive stream flow, catch success was greatest. There appears to be very little selectivity of species by the fishing gear at certain flow rates. When catch success was low for channel catfish, it was also low for carp, carpsucker, and flathead catfish.

Table 1. Catch statistics of intensive netting surveys in 20 miles of the Des Moines River.

| Species | Total Number Caught | Total Weight | Mean Weight | Number Marked | Number Recaptured |
|------------------|---------------------|-----------------|-------------|---------------|-------------------|
| Carp | 1,865 | 3,182.4 | 1.70 | 1,678 | 160 |
| Carp sucker | 88 | 92.5 | 1.05 | 88 | 0 |
| Channel Catfish | 14,371 | 8,437.1 | 0.55 | 14,098 | 1,742 |
| Flathead Catfish | 307 | 227.6 | 0.76 | 286 | 23 |
| Other* | 11 | 19.2 | 1.75 | 1 | 0 |
| Total | <u>16,642</u> | <u>11,958.8</u> | | <u>16,151</u> | <u>1,907</u> |

* Includes gizzard shad, goldeye, crappie, bigmouth buffalo, and northern redhorse.

During the study 16,151 fish were marked in the 20-mile study area by removing the right pectoral fin. Of these, 1,907 were subsequently recaptured. By individual species approximately 12 per cent of the channel catfish, 10 per cent of the carp, and 9 per cent of the flathead catfish were recaptured within the study area. Ackerman (1965) also tagged 4,972 channel catfish in the previous year to study movement. Two hundred and seventy three (5.5 per cent) of these fish were also recovered.

Table 2. Catch of fish at bi-weekly intervals in the Des Moines River

| Period | Carp | | Ch. Catfish | | Fl. Catfish | | Carp sucker | | Others* | |
|----------------------|--------|--------|-------------|---------|-------------|--------|-------------|--------|---------|--------|
| | Number | Weight | Number | Weight | Number | Weight | Number | Weight | Number | Weight |
| June 6 - June 19 | 14 | 41.7 | 419 | 361.6 | 6 | 3.7 | 1 | 0.9 | 1 | 1.7 |
| June 20 - July 3 | 168 | 458.3 | 1,966 | 1,923.7 | 15 | 10.2 | 12 | 14.0 | | |
| July 4 - July 17 | 116 | 118.7 | 1,661 | 1,171.0 | 76 | 50.2 | 15 | 16.0 | | |
| July 18 - July 31 | 656 | 682.3 | 3,167 | 1,528.8 | 117 | 96.6 | 22 | 23.1 | | |
| Aug. 1 - Aug. 14 | 433 | 556.2 | 2,293 | 1,274.1 | 35 | 18.5 | 4 | 4.7 | | |
| Aug 15 - Aug. 28 | 106 | 159.6 | 948 | 616.9 | 24 | 10.8 | 4 | 6.0 | | |

Table 2. Continued

| Period | Number | Weight | Number | Weight | Number | Weight | Number | Weight | Number | Weight |
|------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Aug. 29 - | | | | | | | | | | |
| Sept. 11 | 256 | 642.9 | 1,613 | 788.5 | 15 | 19.0 | 16 | 12.7 | 10 | 17.5 |
| Sept. 12 - | | | | | | | | | | |
| Sept. 28 | 116 | 522.7 | 2,031 | 772.5 | 19 | 18.6 | 14 | 15.1 | | |

* Others include gizzard shad, bigmouth buffalo, crappie, goldeye, and northern redhorse.

Channel catfish provided the only adequate data for estimating population magnitude. The ratio of marked to unmarked fish in separate biweekly sampling periods ranged from 0.007 in the first period, June 6 - 19; to 0.241 during the August 15 - 28 sampling period (Table 3). Cumulative fish recapture ratios of marked to unmarked channel catfish ranged from 0.026 to 0.121, with a progressive increase in the ratio of marked to unmarked fish as the sample size increased. Individual population estimates ranged from 82,800 to 117,400 channel catfish in the 20-mile study area. These estimates appear valid because there is a direct correlation between cumulative number of fish marked, illustrated in Figure 1, and the ratio of marked to unmarked fish in the cumulative sample.

Table 3. Recapture of marked channel catfish at biweekly intervals in the Des Moines River

| Period | No. Marked | No. Marked Fish Recap. | Ratio M/Un. | Cumulative No. Marked | Cumulative No. Fish Recap. | Ratio M/Un. |
|------------|------------|------------------------|-------------|-----------------------|----------------------------|-------------|
| June 6 - | | | | | | |
| June 19 | 419 | 3 | .007 | | | |
| June 20 - | | | | | | |
| July 3 | 1,966 | 58 | .029 | 2,385 | 61 | .026 |
| July 4 - | | | | | | |
| July 17 | 1,661 | 146 | .088 | 4,046 | 207 | .051 |
| July 18 - | | | | | | |
| July 31 | 3,167 | 285 | .089 | 7,213 | 492 | .068 |
| Aug. 1 - | | | | | | |
| Aug. 14 | 2,293 | 440 | .190 | 9,506 | 932 | .091 |
| Aug. 15 - | | | | | | |
| Aug. 28 | 948 | 238 | .240 | 10,454 | 1,170 | .112 |
| Aug. 29 - | | | | | | |
| Sept. 11 | 1,613 | 273 | .170 | 12,067 | 1,443 | .118 |
| Sept. 12 - | | | | | | |
| Sept. 28 | 2,031 | 299 | .150 | 14,098 | 1,742 | .121 |

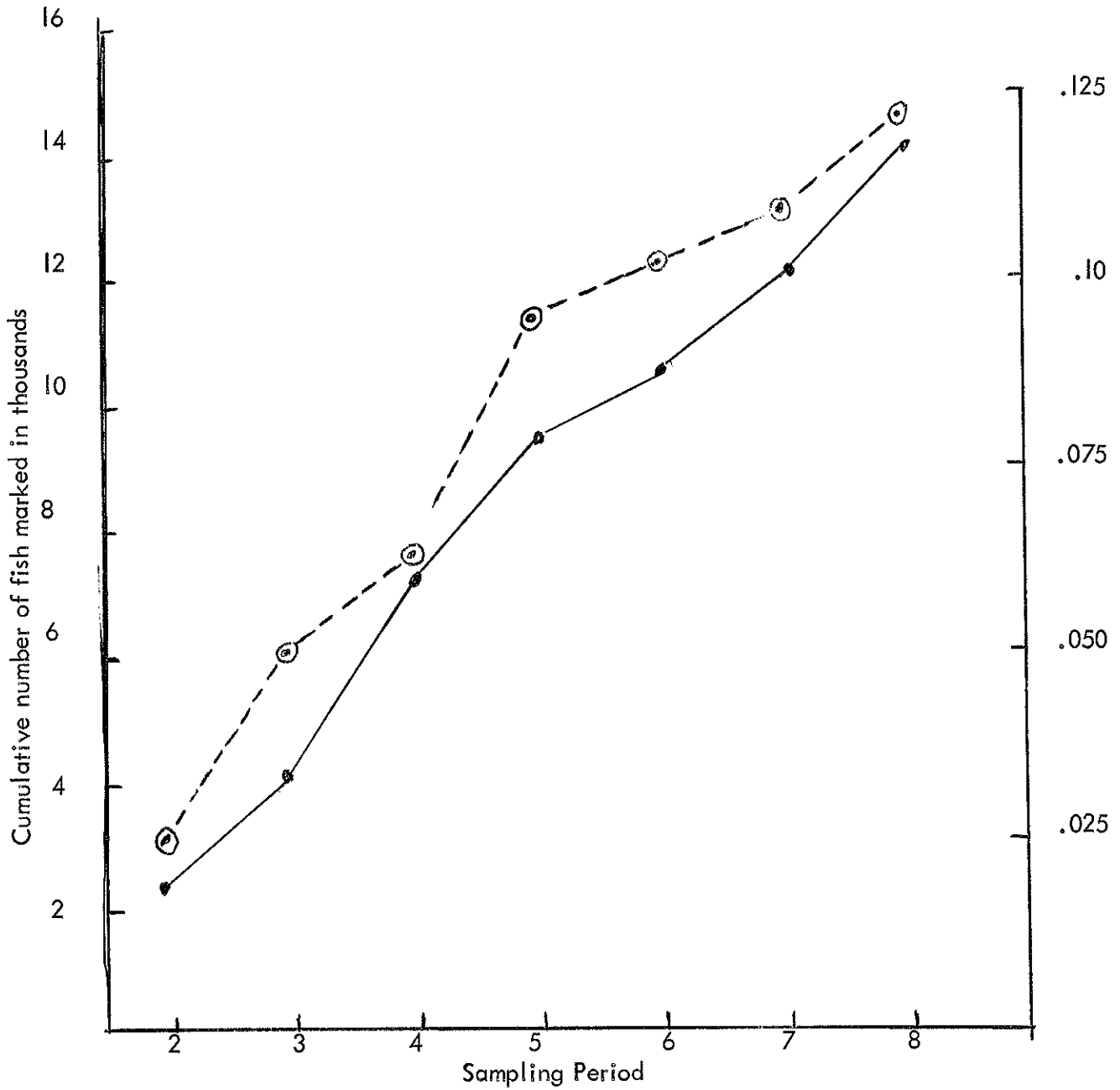


Figure 1. Relationship of cumulative number of channel catfish marked and ratio of marked to unmarked fish at bi-weekly sampling intervals in the Des Moines River. Solid line represent number marked in thousands. Broken line represents the ratio of marked to unmarked fish in the sample.

CORALVILLE RESERVOIR INVESTIGATIONS

From June 6 to September 23, 1966, 11,690 fish weighing 14,044 pounds were caught in the reservoir and headwaters (Table 1). These fish were taken by slat traps, hoop nets, fyke nets, buffalo nets, and gill nets. Early in June efforts were concentrated to catch channel catfish and carp with baited slat traps and fyke nets. Later in the summer buffalo nets, fyke nets and gill nets were the primary fishing gear. Again in the late summer and early autumn baited hoop nets were used in the headwaters, while gill nets were used in the main body of the reservoir. Species composition of the catch by weight was as follows: carp, 49.2 per cent; Carpsucker, 25.7 per cent; buffalo, 9.1 per cent; channel catfish, 6.2 per cent; and crappie, bluegill, largemouth bass, walleye, northern pike, white bass, bullhead, and redhorse, 9.8 per cent.

Table 4. Catch of fish from June 6 through September 23 including conservation pool and headwaters of Coralville Reservoir

| Species | Total Number Caught | Total Weight | Mean Weight | Number Marked | Number Recaptured |
|-----------------|---------------------|---------------|-------------|---------------|-------------------|
| Carp | 5,569 | 6,916 | 1.24 | 5,172 | 31 |
| Carpsucker | 2,380 | 3,616 | 1.52 | 2,210 | 16 |
| Buffalo | 390 | 1,271 | 3.26 | 366 | 1 |
| Channel Catfish | 811 | 869 | 1.07 | 708 | 12 |
| Other* | 2,490 | 1,372 | 0.55 | 0 | 0 |
| Total | <u>11,640</u> | <u>14,044</u> | | <u>8,456</u> | <u>60</u> |

* Includes: crappie, bluegill, large-mouth bass, walleyed-pike, northern pike, white bass, bullhead and red horse.

Biweekly computation of the catch statistics indicated that water levels and type of gear used were the primary factors influencing species composition and catch success. At the beginning of the study when the reservoir was near the 5-year flood frequency (El 690) net efficiency and catch success were relatively high. This period was also particularly productive for channel catfish in the headwaters. River discharge into the reservoir was naturally high during this period, the reservoir was expanding, and baited hoop nets in this area worked with maximum efficiency. As flow was reduced and there was further surface area expansion of impounded waters, net success for channel catfish declined abruptly. As shown in Table 5 more than 85 per cent of the total sample of channel catfish was caught in the first 25 days of the study.

During the second and third sampling periods, June 18 through July 15, the reservoir reached near flood capacity (El. 707 - m.s.l.) and netting success declined steadily. After water levels stabilized at near flood pool, fyke nets and gill nets were extremely effective for carp and carpsucker. Approximately 50 per cent of the carpsucker were taken in this 14-day interval.

As water levels lowered in late summer, catch success was again reduced with gill nets the most effective gear.

Eight thousand four hundred and fifty-six fish were marked during the summer. Only 60 of these fish were recaptured. The number of fish marked and recaptured by individual species was as follows: Carp - 5,172 marked and 31 recaptured; Carpsucker - 2,210 marked, 16 recaptured; buffalo - 366 marked; one recaptured; channel catfish - 708 marked, 12 recaptured. Recapture samples are undoubtedly too small to make valid population estimates, but if cumulative recapture and marked fish figures are expanded the population magnitudes in Coralville Reservoir are 86,000 carp, 30,500 carpsucker, and 41,700 channel catfish.

Table 5. Catch of fish at biweekly intervals in Coralville Reservoir including conservation pool and headwaters

| Period | Carp | | Ch. Catfish | | Buffalo | | Carpsucker | |
|-----------------------|--------|--------|-------------|--------|---------|--------|------------|--------|
| | Number | Weight | Number | Weight | Number | Weight | Number | Weight |
| June 6- June 17 | 920 | 1,370 | 448 | 428 | 65 | 258 | 110 | 182 |
| June 18- July 1 | 776 | 1,232 | 227 | 254 | 106 | 490 | 302 | 467 |
| July 2- July 15 | 529 | 648 | 51 | 93 | 18 | 72 | 345 | 435 |
| July 16- July 29 | 1,023 | 975 | 25 | 11 | 129 | 269 | 1,065 | 1,561 |
| July 30- Aug. 12 | 739 | 519 | 2 | 2 | 3 | 10 | 83 | 127 |
| Aug. 13- Aug. 26 | 903 | 1,230 | 11 | 20 | 32 | 125 | 173 | 300 |
| Aug. 27- Sept. 9 | 477 | 558 | 37 | 40 | 3 | 8 | 184 | 303 |
| Sept. 10- Sept. 23 | 202 | 384 | 10 | 21 | 34 | 39 | 118 | 241 |
| Total | 5,569 | 6,916 | 811 | 869 | 390 | 1,271 | 2,380 | 3,616 |

DISCUSSION OF RESULTS

Intensive netting programs in the Des Moines River and Coralville Reservoir in a 4-month period produced more than 26,000 pounds of fish of commercial or industrial value. This catch would have undoubtedly been higher if crews were not responsible for obtaining detailed population data that interfered with a maximum effort fishery. The fishery could also have been increased by increasing the number of pieces of gear used, but time involved with individual fish measurements, weighing, and spine samples prevented further effort.

Despite the fact Harrison (op. cit.) found fish population in the Des Moines River dominated by carp and carpsucker, species composition in the present study was dominated by channel catfish. This is a result of gear selectivity. Application of Harrison's information to the present study indicates that vast quantities of carp and carpsucker were unharvested. Gill nets and trammel nets were rather effective of these species, but low stream velocity and bottom debris made their use difficult and impractical. Other methods of exploiting these populations should be sought in future phases of the project.

Species composition of the catch at Coralville Reservoir is probably indicative of true population structure. Studies by Mayhew (op. cit.) and Helms (op. cit.) revealed large populations of buffalo, carp, and carpsucker in the reservoir and headwaters.

Most types of gear used in the reservoir were successful for taking commercial species of fish. Baited nets and traps were effective for channel catfish in the headwaters until stream velocity diminished because of reservoir expansion. Catch success could be increased significantly by continually moving net sets into flowing waters.

Although more than 22,700 fish were marked by fin clipping in both study areas, only 1,967 fish were recovered. The highest recapture rate was approximately 12 per cent for channel catfish in the Des Moines River. This population was estimated between 82,800 and 117,400 fish. Intensive netting exploited only a small portion of the total population. Less than 6 per cent of the carp population was also caught. The carpsucker population was for the most part unharvested because gear used failed to catch this species in significant quantity.

At Coralville Reservoir individual population estimates were carp, 86,000; carpsucker, 30,500; and channel catfish, 41,700. Less than 5 per cent of these populations were exploited by concentrated netting efforts. Catch success could have been increased greatly by utilizing flow changes to increase gear efficiency and employing different types of gear at specific times of the year taking advantage of spawning activity and fish movement.

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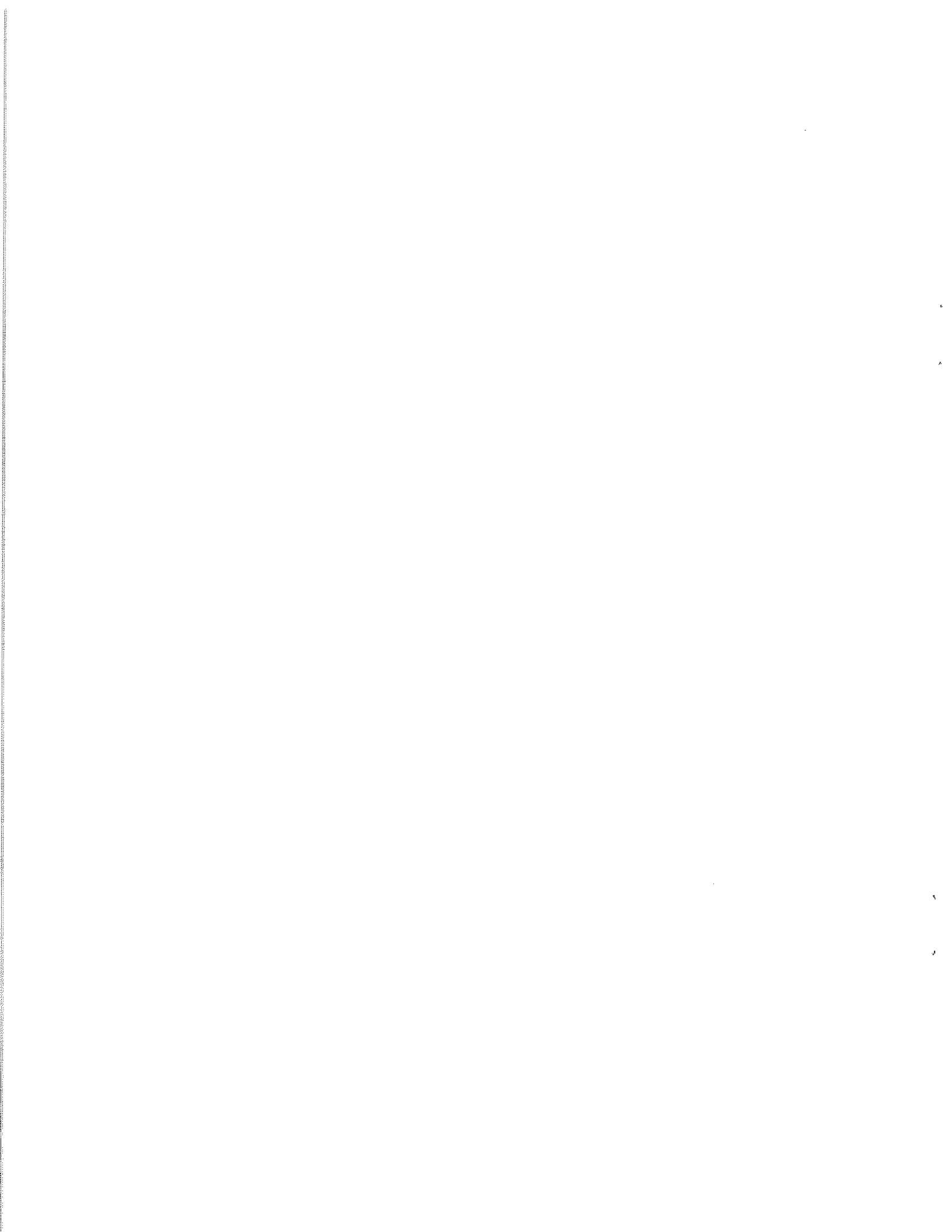
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PROGRESS REPORT ON HABITAT IMPROVEMENT STRUCTURES
IN A SMALL WESTERN IOWA STREAM

Bill Welker
Fisheries Biologist

Habitat improvement structures have been used very successfully in Iowa's trout streams. However, little work has been done in non-trout streams. During late fall of 1965, two different types of structures were placed in the Maple River in the vicinity of Ida Grove. Although this work was experimental, it was hoped the structures would provide adequate catfish habitat for late summer and provide areas for the fish to over-winter.

The structures were constructed in flat bottom-land and land is intensively farmed to the edge of the river bank. The river banks are steep and with very little brush or other obstructions in the stream bed.

Two types of structures, gabions and diversion dams, were installed in the stream bed. Gabions were constructed by driving two parallel rows of steel fence posts (rows about five feet apart) into the stream bed at right angles from each bank. Each row of posts extended about 6 feet toward the center of the stream. The two rows of posts on each side of the stream were then enclosed with woven wire forming a wire basket. Pieces of concrete were placed into the baskets to a level of approximately one foot above the water. The effect of this device was to constrict the stream flow to a narrow funnel in the stream center. This eroded the stream bottom immediately below the gabion forming a pool. Although the diversion dams were constructed differently, their general form was the same as the gabion in that they also funneled the stream through a narrow open section. The diversion dams were constructed of railroad planks and sections of soft-wood logs. These pieces were driven into the streambed from each bank toward the stream center where an opening was left for the stream flow. Each piece in the "wooden wall" was nailed to another long piece of log placed parallel to, and just above the water level. One gabion and three diversion dams were constructed along 13 miles of stream.

The structures were first checked during April, 1966, after spring high water levels. Gabions appeared in the same condition as right after construction; however, a pool with a depth of 2 to 3 feet had formed immediately below the structure and extended for approximately 12 to 15 yards downstream. Diversion dams had been slightly damaged by ice and high water levels, although they could still fulfill their function. There was a pool below each dam similar to the pool below the gabion. Depth above and below the pools was between 1 1/2 and 2 feet.

The next survey of the structures was made August 24, 1966. Although the water level had decreased, the condition of the structures and pools appeared essentially similar to that found during the April survey. There was no noticeable siltation in the pools.

The last survey was conducted September 15, 1966. At this time, siltation had formed in all pools except for possibly a few feet in the lower ends. Mean depth was about 6 inches in the entire pool.

It is apparent these structures did not fulfill their function of providing habitat for catfish during late summer and fall. Possibly, a series of these structures along the stream banks (gabions preferred), approximately 20 to 40 yards apart, would provide pool areas throughout the year with adequate water depths to attract catfish. However, this is doubtful.

I believe the main consideration is being over-looked - this being the fact the Maple River is a low-flow stream during the fall and winter. Since there is little available habitat for catfish during these periods, some of them leave moving downstream into the deeper water areas of the Little Sioux and Missouri Rivers. Results from tagging and fin-clipping studies in both the Maple and Little Sioux Rivers indicated this movement. During spring and summer periods of high water levels, catfish move back upstream in the Maple River until the cycle begins again in autumn.

It would not be possible to provide enough habitat, if, indeed, the structures did fulfill their function. Some good catches of catfish are made during spring and summer. This is possibly the best we can hope for considering low-flow characteristics.

EVALUATION OF THE IOWA RIVER FISH POPULATION RENOVATION PROJECT IN HARDIN COUNTY

Robert Schacht
Fisheries Biologist

In autumn 1960, a segment of the Iowa River was treated with a fish toxicant to eliminate excessive numbers of rough fish. The treated area extended from Alden to a point below Steamboat Rock. Approximately 650,000 pounds of fish were reported to have been killed in the experimental area.

In surveys of the Alden pool one month after treatment Cleary and Moen (1961) found carp and suckers present in unknown numbers. In the Iowa Falls pool they found only fish that had been stocked after detoxification.

Surveys by Schoumacher (1962) indicated fish populations in the Alden pool about the same as before treatment. The stream between Alden and Iowa Falls dam had a fishery for northern pike and bass. Channel catfish taken in the survey were small.

ALDEN POOL

Surveys in the Alden pool in 1966 indicate channel catfish have not become established. Hoop nets were fished for 484 hours but did not take catfish. A 65 minute electro-fishing survey took 87 per cent rough fish by numbers and 98 per cent by weight. The majority of the rough fish were carp, white sucker and northern redhorse. The carp captured were large, several of which weighed 13 pounds. Seven crappies ranging from 6.5 to 8.0 inches; 2 largemouth bass 9.6 and 10.0 inches; and one northern pike, 10.5 inches were also taken. No largemouth bass or crappie were taken in the 1962 survey.

Fish populations in the Alden impoundment were similar to pre-treatment densities (Table I). Bullheads provide the only fishery in the impoundment. Stocking of channel catfish, largemouth bass, smallmouth bass, white crappie, and bluegill failed to produce fish in sufficient quantity to be beneficial as a sport fishery.

ALDEN DAM TO IOWA FALLS DAM

The section of stream between the Alden Dam and the Iowa Falls Dam continues to produce angling for northern pike and bass. Electro-fishing for 25 minutes sampled northern pike ranging from 11.7 to 19.3 inches. Two smallmouth bass were also counted. Redhorse comprised over 50 per cent of the sample followed by carp and white sucker. Rough fish comprised 88 per cent by number and 80 per cent by weight of all fish taken.

The Iowa Falls pool was also surveyed with hoop nets and shocker. Catfish nets took 114 catfish in 360 hours. They range from 5.5 to 17.9 inches. Seventy-five per cent of these fish were between 5.5 and 8.4 inches. Two hours and ten minutes of shocking also took large numbers of redhorse carp and white sucker. In all, rough fish comprised 94 percent by number and 97 per cent by weight of the sample. Game-fish captured included smallmouth bass, white crappie, largemouth bass, and northern pike.

TABLE 1. Per cent by weight of game fish and rough fish taken at Alden and Iowa Falls pools of Iowa River

| Pool | Year | Type of Survey | Per cent Game fish | Per cent Rough Fish |
|------------|------|----------------|-----------------------|------------------------|
| Alden | 1960 | Shocker | 3 | 97 |
| Alden | 1961 | Shocker | 10 | 90 |
| Alden | 1961 | Trap net | 20 | 80 |
| Alden | 1962 | Trap net | 12 | 88 |
| Alden | 1966 | Shocker | 2 | 98 |
| Alden | 1963 | | 12 | 88 |
| Iowa Falls | 1960 | Shocker | 2 | 98 |
| Iowa Falls | 1961 | Trap net | 9 | 91 |
| Iowa Falls | 1961 | Shocker | 6 | 94 |
| Iowa Falls | 1962 | Trap net | 33 | 67 |
| Iowa Falls | 1962 | Shocker | 22 | 78 |
| Iowa Falls | 1966 | Shocker | 3 | 97 |
| Iowa Falls | 1963 | | 3 | 97 |

TABLE 2. Officer contact creel census for the Iowa River - Hardin County

| Year | Fisher- men | Hours Fished | No. Fish | Fish Hour | Bull head | Ch. Cat | Suck- er carp | Misc. sp. |
|------|----------------|-----------------------|-------------|--------------|--------------|------------|---------------------|-----------|
| 1962 | 121 | 370.5 | 135 | 0.37 | 71 | 13 | 17 | 23 |
| 1963 | | No data for this year | | | | | | |
| 1964 | 170 | 300.0 | 330 | 1.10 | 241 | 37 | 13 | 16 |
| 1965 | 101 | 196.0 | 108 | 0.55 | 32 | 34 | 23 | 6 |
| | 392 | 866.5 | 573 | .66 | 344 | 84 | 53 | 45 |

IOWA FALLS DAM TO STEAMBOAT ROCK DAM

A 25 minute shocker survey below Iowa Falls at Crosses Ford took 98 per cent rough fish. Redhorse was most numerous followed by carpsucker, carp, hog sucker, white sucker, northern pike, and smallmouth bass.

In the Steamboat Rock pool one hour and twenty-five minutes of electro-fishing took only one game fish. Redhorse comprised over 95 per cent of all fish taken followed by carp, carp-sucker, white sucker, and hog sucker. Baited hoop nets took 147 catfish in 360 net hours. Ninety-four per cent of the catfish ranged between 5.0 and 7.4 inches.

DISCUSSION OF SURVEY RESULTS

In the first few years after treatment the number of rough fish was somewhat reduced. However, sucker populations have expanded greatly since treatment creating a population similar to pre-treatment densities and composition.

Records of angler success have been recorded by Conservation Officer creel census contacts. Angler catch data are available for the Iowa River in Hardin County since 1962. This creel census also includes a section of the river that did not receive chemical treatment. The composition of the catch should give some indication for the area that did receive the renovation Table 2. A total of 392 fishermen were contacted over the three years. Five hundred seventy-three fish were caught in 866.5 hours or at a rate of .66 fish per hour. Bullhead comprised 60 per cent of the catch. Other game fish taken included channel catfish, smallmouth bass, northern pike, bluegill, largemouth bass, and walleye. They comprised 21 percent of the catch. Carp and suckers made up 18 per cent of the catch.

SUMMARY

1. Recent surveys show rough fish populations are comparable to pre-treatment levels. An increase in the sucker population has off-set the increase of game fish in the population noted shortly after treatment.
2. Channel catfish stocking has been unsuccessful in the Alden pool.
3. Catfish are small in the Iowa Falls pool with 75 per cent of the fish ranging between 5.5 and 8.4 inches.
4. Catfish are also small in the Steamboat Rock pool with 94 per cent between 5.0 and 7.4 inches.
5. Greater numbers of large channel catfish are believed present at Iowa Fall and Steamboat Rock. Larger catfish are usually taken by netting in the spring and early summer.

6. Creel census results show a small number of smallmouth bass, northern pike, bluegill, largemouth bass, and walleye being taken in Hardin county. Bullhead were most numerous in the creel. Channel catfish, suckers, and carp follows in importance.
7. Temporary benefits that resulted from chemical renovation of fish populations did not materially affect the fishery in the treated area for an extended period of time.

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CLEAR LAKE WALLEYE STUDY - PROGRESS REPORT

Robert Hollingsworth
Fisheries Biologist

Introduction

Clear Lake is a highly eutrophic lake located in Cerro Gordo county. It's 3,643 acres make it Iowa's third largest natural lake. As such, it receives heavy fishing pressure. One of the most sought after game fish is the walleye, (Stizostedion vitreum vitreum). A comprehensive creel census described by Rose (1956) has been used during the summer months on Clear Lake since 1958. This census indicated fishing success for walleyes, while fluctuating, has declined in recent years (Jennings, 1965). The primary purpose of this study is to estimate the number of walleyes over 12 inches total length in Clear Lake. Data are being collected on age and growth, exploitation, movement, and mortality. A comparison of the exploitation rates of tagged and fin-clipped fish will also be made.

Marking

During the spawning run in March and April, 1966, 2,222 walleyes were marked. Number three and four monel metal jaw tags were placed over the premaxillary and maxillary of 1,400 fish. The remaining 822 were marked by removing the left pectoral fin. Fish were obtained for marking from the brood fish gill netting operations conducted by the Clear Lake Fish hatchery. About one half of these walleyes were stripped in the field at one of two gill net camps. Fish handled in this manner were fin-clipped and released at the camp-site. No data other than tag numbers were recorded. The remaining walleyes were taken to the hatchery for stripping. They were all tagged, measured, and released at the hatchery. About 400 of these fish were weighed. Night electro-fishing was done to obtain additional fish. These were tagged until 1,400 were marked. Those captured later were fin-clipped.

Recoveries

Recoveries for the primary population estimate are being affected through a full time census clerk. During routine creel checks, the clerk records all tag numbers and all fin-clips that he observes. He also records the lengths and weights of all walleye creeled. A Petersen estimate based on the number of marked to unmarked fish in this sample will be made at the end of the census period (after October 31). This will be done for each two inch length group beginning at 12 inches. An attempt will be made to determine any difference in exploitation between large and small fish. Estimates will be made based on total marks (2,222), on tags only (1,400), and on fin-clips only (822). Any major difference in exploitation rates for the two differently marked groups of fish should be apparent. Scale samples from all sizes of walleye are being taken monthly to determine recruitment and to obtain age growth data.

Results to Date

The census clerk obtained a sample of 298 walleyes over 12 inches total length by August 31. This included 41 marked fish, of which 28 were tagged and 13 were fin-clipped. Estimates based on total marks, tags only, and fin-clips only, are 16,106, 14,900, and 18,688, respectively. No adjustment for recruitment has been made. When adjusted, these estimates should agree closely with those for May when recruitment was probably not yet significant. The May sample of 98 walleyes included 18 marks, 11 tags and 7 fin-clips. This gives an estimated 12,092 walleyes based on total marks, 12,473 based on tags, and 11,508 based on fin-clips.

Secondary Estimate

Another sample of the walleye population is being collected by electro-fishing. Personnel of Iowa State University's Cooperative Fisheries Research Unit have assisted in this. It was originally intended that this sample provide a secondary estimate for comparison. A scarcity of fish under 16 inches total length taken by shocking gear made this impossible. The electro-fishing sample will be used to estimate the number of walleyes over 16 inches long in the lake. This will also be done by two inch length groups.

Voluntary Returns

Throughout the season, voluntary tag returns have been coming into the Clear Lake Fish Hatchery and to the Clear Lake Chamber of Commerce which annually sponsors a "big fish" contest. These returns will be used to determine a minimum exploitation rate for the walleye population. To date, about 10 per cent of the 1,400 tags have been returned voluntarily. Fishermen overlook fin-clip marks and none have been reported.

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CREEL CENSUS RESULTS FROM CLEAR AND BLACK HAWK LAKES, 1965

Robert Hollingsworth
Fisheries Biologist

Clear Lake

Clear Lake, Iowa's third largest natural lake (3,643 acres), is shallow and eutrophic. Maximum depth is approximately 20 feet with only 15 per cent of the lake exceeding 15 feet in depth (Bailey and Harrison, 1945). The roughly saucer-shaped bottom is composed of silt with occasional sand and gravel bars. Clear Lake has a varied fish population of at least 43 species (op. cit.). The 11 species most important to the fisherman are considered in this paper.

A comprehensive creel census has been used on Clear Lake since 1958. Though the censusing period has varied, the five month period of May through September has been censused since 1963 (Jennings, 1965). Fishing during the remainder of the year is too light to warrant a full scale census.

1965 Creel Census Results

Since 1958 Clear Lake fishermen have creeled more yellow bass than any other species. The estimated 98,516 yellow bass caught in 1965 represented 44.9 per cent of the total harvest (Table I). Excellent yellow bass fishing occurred in September when nearly 42,000 were creeled. This raised the catch rate for that month to 3.29 fish per hour.

Bullheads were the second most abundant fish in the creel with an estimated 59,872 represented. Records indicate that the bullhead population has been increasing since 1960. They comprised 27.9 per cent of the estimated total harvest.

Crappies ranked third in abundance in the creel and comprised 20.4 per cent of the total catch. This represents a decrease of 36 per cent from the nearly 69,000 crappies harvested in 1964. Table I shows that crappie fishing peaked in June and dwindled during the hot weather months.

Walleye are the most popular game fish in Clear Lake. They ranked fourth in the creel in 1965 and comprised 2.4 per cent of the total harvest. The 5,244 walleye creeled represents an increase of some 1,800 fish over the previous year's catch.

Northern pike accounted for less than one per cent of the catch in 1965. The estimated 1,990 northern pike creeled is significantly fewer than the record 12,846 harvested in 1964. Heavy run-off and mild weather in the spring of 1964 made excellent northern pike fishing. Over 10,000 northern pike were creeled in May when they were concentrated about inlet water courses. These conditions did not recur in 1965.

Table No. 1. Total harvest of fish, as determined by comprehensive creel census methods, from Clear Lake during the open water fishing period of May through September, 1965.

| Species | May | June | July | August | September | Total | Avg. Wt. | |
|--------------------|--------|--------|--------|--------|-----------|---------|----------|------------|
| | | | | | | | Per Fish | Total Fish |
| Bluegill | 54 | 442 | 994 | 170 | 56 | 1,716 | .27 | .8 |
| Crappie | 7,742 | 26,678 | 5,942 | 1,164 | 2,340 | 43,866 | .29 | 20.4 |
| Walleye | 1,102 | 2,106 | 1,304 | 284 | 448 | 5,244 | 1.68 | 2.4 |
| Cattfish | 158 | 82 | 260 | 1,326 | 42 | 1,868 | 1.91 | .86 |
| White Bass | 10 | | 42 | | 10 | 62 | 1.61 | T |
| Yellow Bass | 14,772 | 16,348 | 9,984 | 15,656 | 41,758 | 98,518 | .21 | 44.9 |
| N. Pike | 1,242 | 502 | 98 | | 148 | 1,990 | 2.63 | .92 |
| Bullhead | 14,646 | 11,790 | 22,588 | 6,502 | 4,346 | 59,872 | .24 | 27.9 |
| L.M. Bass | 34 | | 12 | 40 | | 86 | 2.53 | T |
| Yellow Perch | 70 | 256 | 706 | | 268 | 1,300 | .36 | T |
| Carp | | | | | 22 | 22 | 2.72 | T |
| Totals | 39,830 | 58,204 | 41,930 | 25,142 | 49,438 | 214,544 | .31 | 98.1 |
| Total Angler Trips | 10,566 | 10,842 | 8,950 | 5,412 | 5,212 | 40,982 | | |
| Total Hours | 36,568 | 34,778 | 27,012 | 16,906 | 15,020 | 130,284 | | |
| Fish per Man | 3.77 | 5.37 | 4.68 | 4.65 | 9.49 | 5.42 | | |
| Fish per Hour | 1.09 | 1.67 | 1.55 | 1.49 | 3.29 | 1.64 | | |

Although the 1,868 channel catfish creel comprised only 0.86 per cent of the catch, the catch is significant. A fingerling stocking program has been in effect for several years in an attempt to establish a fishable population of catfish in Clear Lake. This population, while increasing slowly, is contributing more to the creel each year.

The remaining species taken by fishermen comprised 2.6 per cent of the creel. They were largemouth bass, white bass, bluegills, yellow perch, and carp. None of these species has figured prominently in the creel in recent years.

When based on total weight, relative abundance of each species in the creel remains unchanged for yellow bass, bullheads, crappies, and walleyes. They contributed 33, 21, 17, and 15 per cent, respectively, to the estimated 66,699 pounds of fish harvested. Northern pike, channel catfish, and yellow perch comprised 6.4, and 3 per cent of the total. The remaining species made up 1 per cent of the total weight.

Clear Lake anglers averaged 1.65 fish per hour in 1965. September was the best fishing month when 3.29 fish per hour were creeled. Fishermen averaged 5.42 fish per trip.

There were 6 fishing trips totaling 10.1 angling hours per surface acre of Clear Lake in 1965. This effort yielded an estimated 58.8 fish weighing 18.2 pounds per acre.

Black Hawk Lake

Black Hawk Lake is a 923 acre lake in Sac county. With the exception of a small dredged bay the lake has a maximum depth of 10 feet. Maximum depth of the dredged area is about 14 feet. The lake is long and narrow with a meandered shoreline.

The present comprehensive creel census began on Black Hawk in 1957 and has been conducted annually since then except in 1961. The 1965 census was conducted from May through October. Fishing pressure during the rest of the year is insignificant.

1965 Creel Census Results

For the second consecutive year, crappies were the most abundant fish caught by anglers. (Table 2). They provided excellent fishing, especially in May and October. They comprised 42 per cent of the estimated harvest. Black Hawk Lake has been justly popular for its excellent crappie fishing in recent years.

Bullheads were the second most frequently caught fish during 1965. They comprised 40 per cent of the estimated total catch. The record indicates that bullhead have become more abundant during the last 4 years.

Black Hawk is one of the best channel catfish lakes in Iowa. The 1965 catfish harvest was estimated at 8,771 fish or 9 per cent of the total catch. This is the third consecutive year that the catfish harvest has declined. The 1965 total is down over 50 per cent from the 19,156 catfish taken in 1953 (Jennings, 1965).

Table No. 2 Total harvest of fish, as determined by comprehensive creel census methods from Black Hawk Lake during the open water fishing period of May through October, 1965.

| Species | May | June | July | August | September | October | Total | Per cent | |
|--------------------|--------|--------|--------|--------|-----------|---------|--------|------------|------------|
| | | | | | | | | Total Fish | Total Fish |
| Bluegill | 79 | 44 | 127 | 88 | 5 | 28 | 367 | T | |
| Crappie | 11,860 | 3,425 | 1,671 | 2,955 | 6,867 | 12,898 | 39,676 | 42 | |
| Walleye | 120 | 218 | | 7 | 48 | 60 | 453 | T | |
| Catfish | 699 | 2,313 | 2,199 | 1,924 | 1,060 | 576 | 8,771 | 9 | |
| White Bass | | 14 | | | | | 14 | T | |
| Yellow Bass | | | 1,761 | 990 | 336 | | 3,087 | 4 | |
| N. Pike | | | | | 5 | | 5 | T | |
| Bullhead | 7,668 | 4,036 | 7,428 | 7,339 | 5,452 | 6,287 | 38,210 | 40 | |
| L. M. Bass | 52 | | 5 | | 5 | | 62 | T | |
| Carp | 199 | 349 | 46 | 606 | 501 | 1,126 | 2,827 | 3 | |
| Totals | 20,677 | 10,399 | 13,237 | 13,909 | 14,279 | 20,971 | 93,472 | 98 | |
| Total Angler Trips | 3,953 | 3,430 | 3,276 | 3,235 | 2,322 | 3,161 | 19,377 | | |
| Total Hours | 11,093 | 10,012 | 8,450 | 8,809 | 6,452 | 7,843 | 52,659 | | |
| Fish Per Man | 5.23 | 3.03 | 4.04 | 4.31 | 6.15 | 6.63 | 4.82 | | |
| Fish Per Hour | 1.86 | 1.04 | 1.57 | 1.58 | 2.21 | 2.67 | 1.77 | | |

About 4 per cent of the total harvest was composed of yellow bass. The hot weather months of July and August provided the best fishing for this species.

Carp comprised 3 per cent of the catch from Black Hawk Lake. Fishermen kept over 2,800 of these rough fish.

The five species mentioned composed 98 per cent of the total harvest. The remaining 2 per cent included northern pike, largemouth bass, walleye, white bass, and bluegill. Walleye and bluegill were the most abundant.

When based on total weight, the order of species abundance in the creel changes little. Crappies, bullheads, and channel catfish contributed 30, 26, and 25 per cent by weight, respectively. Carp accounted for 13 per cent and yellow bass 1 per cent. Walleye averaged 3.43 pounds and comprised 3 per cent of the harvest. The remaining 2 per cent of the harvest was composed of largemouth bass, bluegill, white bass, and northern pike.

Fishing of Black Hawk Lake was generally good throughout 1965. The fish per hour rate of 1.77 varied from 1.04 in June to 2.67 in October. Fishermen averaged 4.82 fish per fishing trip. Excellent fall crappie fishing yielded 6.63 fish per trip in October.

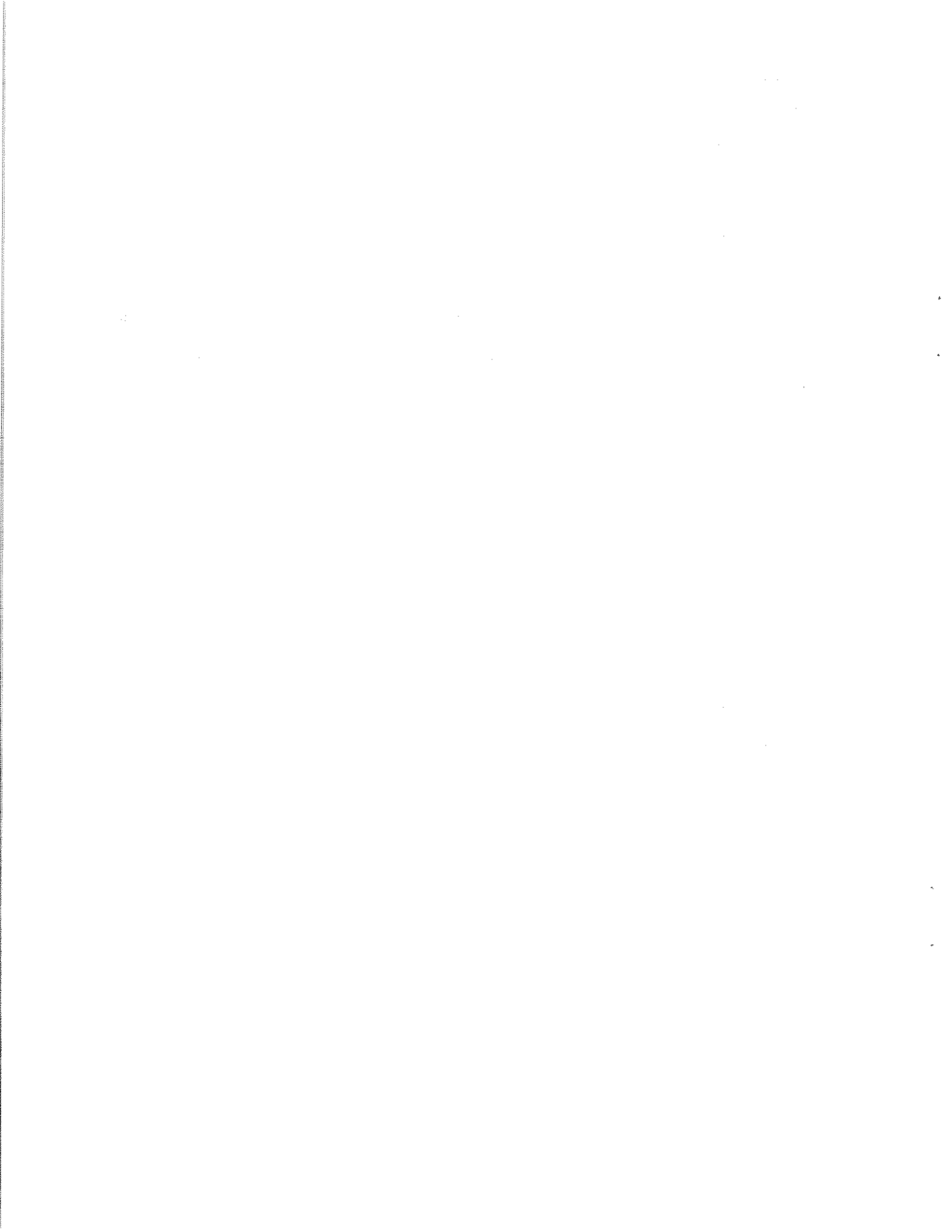
During the 1965 census period, the average acre of water in Black Hawk Lake yielded 101 fish weighing 65.7 pounds. An estimated 20.9 angling trips and 57 hours of fishing per acre was required to harvest these fish.

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1965 COMMERCIAL FISHING STATISTICS
FOR THE
MISSISSIPPI RIVER BORDERING IOWA

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INTRODUCTION

There were 384 licensed owners of commercial fishing gear on the Mississippi River in 1965. Each of these fishermen was furnished forms and instructions for recording their catch by weight, species, pools fished and gear used. Failure or refusal to return the completed forms is -- "cause for the Commission to refuse issuance of license renewal until such report is made." (Section 109.116, Code of Iowa) This report is a summary of these data reported by the 222 commercial fishermen who completed and returned the required forms.

RESULTS AND DISCUSSION

Carp, buffalo, catfish, and drum were the major commercial species. Together, they comprised 97 percent of the reported catch by weight (Table I).

Nearly a million pounds of carp were reported. Half of these were caught in pools 9 and 18. The production of carp has remained constant for the past 3 years and is somewhat higher than reported in 1961 and 1962.

Buffalo were taken in good numbers in all pools with a reported catch of over a half million pounds. Production has remained steady since 1962 but is down from 1961.

The reported catch of catfish of slightly more than 400,000 pounds was considerably less than the peak of 700,000 pounds reported in 1964. It is however, equal to or greater than production during the three previous years.

Drum production was reduced from the figures obtained in 1961, 1963, and 1964, but closely matched the 1962 harvest.

Remaining species are generally in less demand and are primarily taken incidental to efforts exerted toward the capture of the above species. Exceptions to this statement are sturgeon and paddlefish. Their habits are sufficiently different to require special effort to obtain them in quantity. Only a small number of fishermen have desired to do so. Hence, 80 percent of the total catch of sturgeon was reported from three pools (11, 16 and 17), and was largely due to the efforts of a few fishermen.

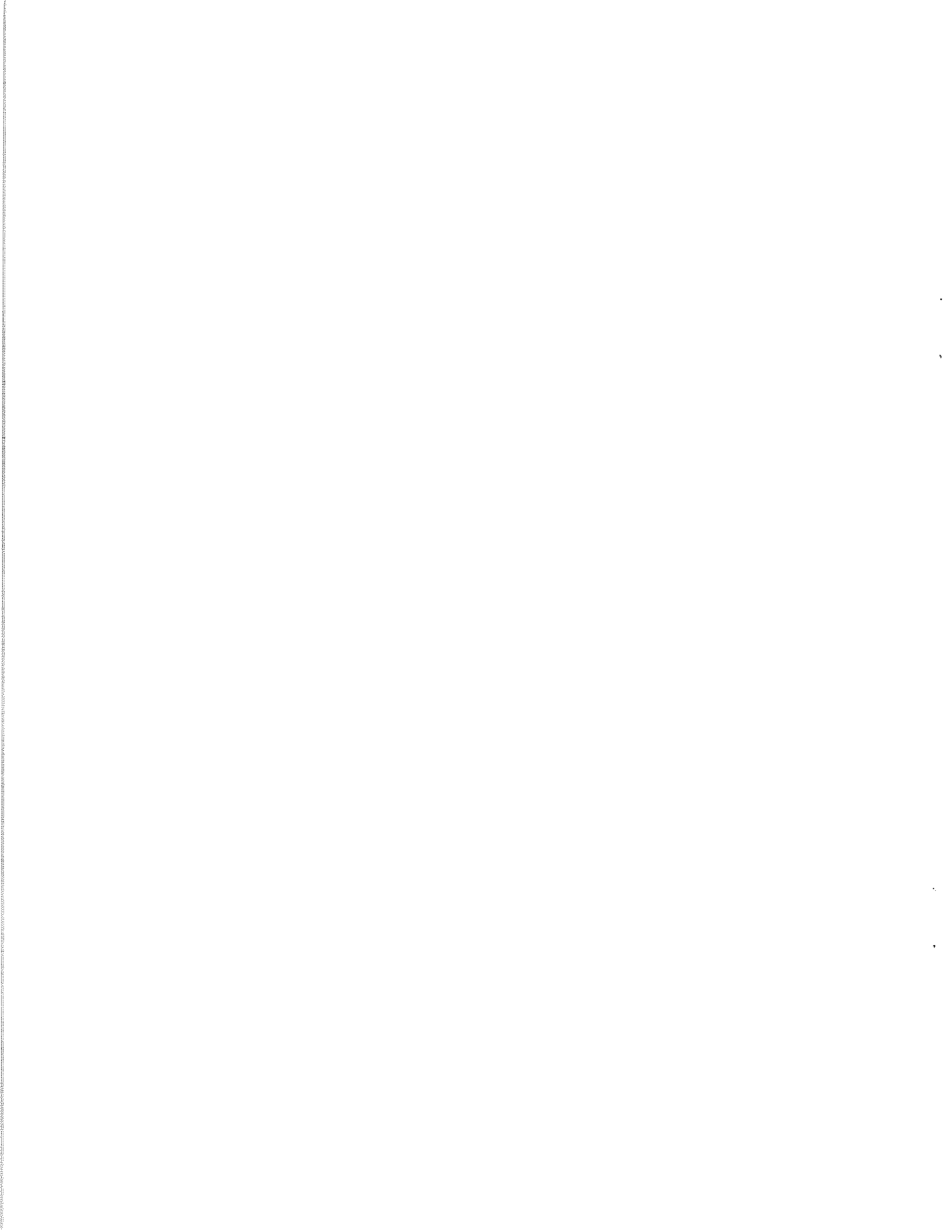
Similarly, a single individual fishing in pools 17 and 18 reported over one half of the total catch of paddlefish.

TABLE 1. Commercial fish catch reported on the Mississippi River bordering Iowa in 1965

| SPECIES | POOL NUMBERS | | | | | | |
|----------------------|--------------|---------|---------|--------|---------|---------|--------|
| | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| Carp | 358,189 | 61,184 | 31,314 | 46,046 | 88,275 | 41,852 | 22,319 |
| Buffalo | 127,372 | 60,394 | 74,335 | 29,918 | 98,558 | 89,674 | 22,062 |
| Drum | 126,826 | 13,362 | 30,339 | 3,159 | 36,143 | 7,190 | 9,004 |
| Cattfish | 80,988 | 29,440 | 80,619 | 8,643 | 53,607 | 40,944 | 4,313 |
| Bullhead | 29,424 | 1,006 | 644 | | 142 | 343 | 171 |
| Redhorse-Sucker | 18,666 | 3,979 | 39 | 1,233 | 2,443 | 298 | |
| Sturgeon | 186 | 178 | 3,332 | 250 | 567 | 128 | 129 |
| Paddlefish | 627 | 100 | 78 | | 265 | 850 | 43 |
| Gar | 54 | | 4 | | 1,087 | | |
| Bowfin | 2,362 | 111 | | | | | |
| A. Eel | 4 | | | | | | |
| Other | | | | | | | |
| TOTAL (All kinds) | 744,698 | 169,754 | 220,704 | 89,249 | 281,087 | 181,279 | 58,041 |

TABLE I. (continued)

| SPECIES | POOL NUMBERS | | | | | TOTAL - ALL POOLS |
|----------------------|--------------|---------|---------|---------|-------|----------------------|
| | 16 | 17 | 18 | 19 | 20 | |
| Carp | 26,930 | 46,311 | 134,219 | 75,308 | 2,886 | 934,833 |
| Buffalo | 29,029 | 46,429 | 49,895 | 61,941 | | 689,607 |
| Drum | 1,851 | 11,279 | 28,748 | 16,511 | | 284,412 |
| Catfish | 8,289 | 9,047 | 65,108 | 24,820 | | 405,818 |
| Bullhead | 25 | 53 | 678 | 95 | | 32,581 |
| Redhorse-Sucker | 90 | 25 | 6,000 | 24 | | 32,797 |
| Sturgeon | 1,062 | 3,288 | 316 | 354 | | 9,790 |
| Paddlefish | 172 | 1,149 | 2,020 | 326 | | 5,630 |
| Gar | | 6 | | | | 1,151 |
| Bowfin | | | | | | 2,473 |
| A. Eel | | | | | | 4 |
| Other | 250 | | | | | 250 |
| TOTAL (all kinds) | 67,698 | 117,587 | 286,984 | 179,379 | 2,886 | 2,399,346 |



SUCCESSFUL RENOVATION OF A SMALL, NATURAL, IOWA LAKE

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Introduction

Center Lake, having a surface area of 264 acres, is located in northwestern Iowa. This eutrophic lake of glacial origin has a maximum depth of about 14 feet. During periods of normal water levels, the shoal area is steeply sloping to about the 5 foot contour and is composed mainly of scattered boulders and sand. The remainder of the lake is composed of mud and silt. Because the shoreline is largely wooded and undeveloped, the littoral area contains excellent habitat for fish in the form of dead limbs and fallen trees. Two sloughs connecting with the lake during periods of normal water levels make excellent spawning habitat for most species present in the lake.

Moen (1962) aptly stated the management problems in Center Lake when he said "Late in the summer of 1958 stunted bullheads (3 years old, averaging 3.7 inches in length) were present at a population of about 580 pounds per acre. Carp were the next most abundant species, comprising 213 pounds per acre. Other species, including walleye, northern pike, largemouth bass, black crappie, bluegill, and common sucker, accounted for less than an estimated 5 pounds per acre." Based on these observations and very poor fishing, the decision was made to eliminate existing fish. It was also decided the lake would be restocked for maximum production of largemouth bass and bluegill.

On October 1, 1958 the lake was treated with liquid toxaphene at a rate of 0.05 ppm. As could be determined a complete kill was obtained. Toxicity of the lake remained high throughout the winter. By May, 1959 minnows in a live car lived for 2 weeks, thus it was assumed the lake had detoxified.

Restocking

Restocking of the lake began during June, 1959 with the addition of 60,000 largemouth bass advanced fry (Table I). Because this lake is eutrophic it is subject to very heavy "blooms" of bluegreen algae. One such algal "bloom" occurred during the last week of July, 1959. The dying algae precipitated a severe oxygen depletion which killed an estimated 95 per cent of the zooplankton (Moen, op. cit.). Natural disintegration and copper sulfate treatments brought the situation under control. Since this time copper sulfate has been applied as needed in an effort to avoid a recurrence of the severe biological oxygen demands. Following the 1959 summer-kill no dead largemouth bass were observed. It was assumed that even though the water was not toxic to minnows it was toxic to the small stocked bass. Another bass stocking was made in September when fingerling fish were stocked. Trawl hauls made during October indicated good survival. With the establishment of a predator population, adult bluegills were stocked during March, 1960.

The largemouth bass-bluegill stocking list was amended accidentally during the initial stocking of adult bluegills when, apparently, the load also contained crappies. The list

was intentionally amended in 1960 when yellow bullheads were introduced, in 1963 with the introduction of northern pike and in 1965 when several muskie-northern pike hybrids were also stocked.

Table 1. Species, numbers and size of fish stocked into Center Lake, 1959-66

| Year | Date | Species | Number | Size |
|------|-----------|----------------------------|--------|--------------|
| 1959 | June | Largemouth bass | 60,000 | Advanced Fry |
| | September | Largemouth bass | 22,000 | Fingerlings |
| 1960 | March | Bluegills | 9,000 | Adults |
| | July | Yellow Bullheads | 200 | Adults |
| | August | Yellow Bullheads | 10,000 | Fingerlings |
| | August | Largemouth Bass | 35,000 | Fingerlings |
| 1962 | June | Largemouth Bass | 30,000 | Advanced Fry |
| 1963 | August | Northern Pike | 53 | Adults |
| | September | Largemouth Bass | 8,300 | Fingerlings |
| | October | Northern Pike | 45 | Adults |
| | November | Northern Pike | 24 | Adults |
| | November | Northern Pike | 32 | Fingerlings |
| 1964 | January | Northern Pike | 34 | Adults |
| | April | Northern Pike | 259 | Adults |
| | August | Yellow Bullheads | 6,000 | Fingerlings |
| | September | Largemouth Bass | 10,000 | Fingerlings |
| | October | Largemouth Bass | 4,000 | Fingerlings |
| 1965 | August | Northern-Muskie Hybrids | 18 | Fingerlings |
| | September | Largemouth Bass | 10,000 | Fingerlings |

Population Sizes and Growth Rates

Bluegill: Seine hauls late in the summer of 1960 using 500 feet of 1/4-inch web indicated a large number of young bluegills. Since this is a special study lake, it was thought desirable to have a more definite knowledge of this year class size. During September, 1962 a simple Peterson type estimate of the bluegill population was made. Bluegills were captured for marking with an otter trawl. The captured fish were marked by excising one of the pectoral fins and returned to the lake. One week later the ratio of marked to unmarked fish captured through trawling operations indicated a population of 562,000 bluegills. Seining during this same period captured marked to unmarked bluegills at a ratio which indicated a population of 1,157,000 present or about 500 pounds per acre. The population estimate obtained by seining was considered large whereas trawling seemed to have produced a more realistic figure. Consequently, the size of this year class was estimated to be between 500,000 and 600,000 (Moen, op. cit.). It has recently become apparent that the number of bluegills present at the time of these estimates was approaching the figure obtained from the seining operations.

Growth rates for the 1960 year class of Center Lake bluegills were obtained by using the standard scale examination method. Scale samples were taken from representative bluegills during May, 1964, October, 1965 and February, 1966. Scales were mounted between glass slides, soaked in water, then with the aid of microprojection all annuli were located. The position of each annulus was marked on a strip of tag board. A direct proportion nomograph as described by Carlander and Smith (1944) aided in determining the total length in inches at each annulus (Table 2).

Table 2. Average total length in inches at each annulus for the 1960 year class of bluegills in Center Lake as determined by examination of scale samples.

| Sample Size | I | II | III | IV | V | VI |
|-------------|-----|-----|-----|-----|-----|-----|
| 108 | 2.1 | 4.5 | 5.3 | 6.2 | 6.8 | 7.1 |

Overall, the growth rate is slightly below that reported by Mayhew (1956) for bluegills in West Okoboji Lake. The 8.1 inch average total length he found for 6 year old fish is quite comparable with similar aged fish from other parts of the United States. Even though there was a high population of bluegills present in Center Lake, their growth was only slightly below average. Over 100,000 bluegills were removed by seining (50,000 during 1960 and 60,000 during 1962) with no noticeable increase in growth rates.

Test netting failed to indicate the presence of young bluegills during 1961, 1962, and 1963. However, during 1964 a large hatch occurred. An abundance of young bluegill could be seen in vegetated areas of the lake. One seine haul made in an area considered to be very poor habitat for young bluegills captured nearly 5,500. Based on these observations, it was apparent young bluegill would present a management problem in the near future.

Consequently, it was decided to try and selectively lower the population of young bluegill by applying light dosages of rotenone. Beginning early in September, 1964 and contin-

uing for 9 days, 22.5 gallons of liquid rotenone were applied along the shoreline at a rate of 1 gallon per 1,000 feet of shore or a calculated rate of about 0.5 ppm. Because of the many problems involved in making an estimate of the number of young bluegills destroyed the range of the estimated number killed was quite wide between 500,000 and 1,000,000. During these applications less than 100 adult fish -- including largemouth bass, northern pike, bluegills and crappies -- were killed. Based on the number of dead adults and the actual dosage level was probably closer to 0.1 ppm than 0.5 ppm. The effectiveness of this technique was apparent during 1965 when seining operations captured only fair numbers of yearling bluegill. Small hatches of bluegill have been observed during 1965 and 1966.

Black Crappies: During 1960 the seine hauls which demonstrated the presence of young bluegills, also captured about 1 young crappie for each 4 or 5 young bluegill. This ratio of about 20 per cent was found in subsequent samplings done during 1961 and 1962 (Moen, op. cit.). By assuming the bluegill population in 1962 to be approximately 1,000,000, then the crappie population should have been nearly 250,000 or about 140 pounds per acre.

Because of insufficient collection of scale samples, the average total length each year (Table 3) was compiled from data collected during test netting near the end of each growing season.

Table 3. Average total length in inches each year for the 1960 and 1964 year classes of black crappie from Center Lake.

| 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 |
|------|------|------|------|------|------|------|
| 3.4 | 6.4 | 7.3 | 8.2 | 8.4 | 9.3 | 9.4 |
| | | | | 2.6 | 6.6 | 8.1 |

The overall growth of these fish is about average for this species in other lakes of the region.

Seine hauls using 500 feet of 1/4-inch web failed to capture significant numbers of young crappie until 1964. Since young crappies were inhabiting the deeper portion of the lake at the time chemical work was done to reduce the young bluegills, crappies were not measurably affected by the chemical treatment. There has been good survival of this year class and they are now clearly the most abundant year class of crappie in the lake. Reproduction for this species during 1965 and 1966 has been limited.

Largemouth Bass: Even though largemouth bass have been stocked into Center Lake each year--with the exception of 1961--since 1959, electro-fishing has demonstrated good survival of only the 1959, 1962, and 1964 stockings. During 1966 it was estimated that these 3 year classes totaled about 13 fish per acre, with the 1964 year class being the the most abundant. The bass used in making this estimate were captured by electro-fishing, marked by excising a pectoral fin and returned to the lake. The recoveries for making a Peterson type estimate were obtained primarily by electro-fishing and angling.

Electro-fishing and test netting failed to demonstrate the presence of successful natural bass reproduction until 1966. No bass stocking will be done during 1966 because the natural reproduction is contributing substantial numbers of young bass to the lake.

Miscellaneous Species: Several attempts to establish the fast growing yellow bullhead in Center Lake have been unsuccessful. Only one yellow bullhead has been reported during routine checks of the lake's fish populations.

Northern pike were first introduced into the lake as part of the management plan during 1963. However, one northern had been captured during routine test netting prior to this time. During 1965 and 1966 relatively large numbers of young northerns have been observed.

The recent years black bullheads have become well established in the lake even though none were known to have been stocked. During 1965 moderate numbers of young bullheads were observed. The survival of these young fish was apparently low because few have been captured since. Based on results of July seine hauls, the 1966 bullhead hatch was the largest of any year since the lake was renovated. However, seine hauls made during late August revealed a substantial decrease in their numbers.

Several other species have been captured in this lake including yellow perch, walleye, and carp. During the 1966 spring electro-fishing for largemouth bass, one adult carp was captured. This is significant because it was the first carp to have been captured here since the 1958 renovation. Since, one additional adult carp and one young carp have been captured.

Angler Harvests and Utilization

Following chemical treatment Center Lake was out of production, as far as angling was concerned, for over 3 years. During the latter part of 1962 bluegill and crappies attained a size acceptable to anglers. Since angler utilization of the lake was expected to increase, it seemed desirable to have an estimate of the total number of each species caught and of total fishing pressure. Consequently, a comprehensive type census, similar to that described by Rose in 1956 was used. This census was first used on this lake in 1963 and has been employed each year since. The census period during 1963, 1964, and 1965 extended from May through October. Because of personnel problems during 1966 the census period encompassed only the months from May through September. Fishing pressure is too light the remainder of the year to justify a full scale census.

As expected, bluegill was most abundant species creel comprising 76, 69, 74, and 73 per cent of the total estimated catch during annual census periods. (Table 4). Anglers harvested nearly 750,000 bluegill, mainly from the 1960 year class, during this four-year period.

Black crappies were second in creel abundance comprising 22, 30, 21, and 19 per cent. Prior to 1966 nearly all of the crappies were from the 1960 year class. During 1966 the bulk of the catch was composed of 1964 year class fish. Fishing for the other species in the lake was quite poor. Probably the low totals of largemouth bass caught can be explained by the

Table No. 4. Comprehensive Creel Census Data for Center Lake.

| SPECIES | 1963* | | 1964* | | 1965* | | 1966* | |
|-----------------|----------------|---------------|----------------|----------------|----------------|---------------|----------------|---------------|
| | Fish | Weight | Fish | Weight | Fish | Weight | Fish | Weight |
| Bluegill | 167,824 | 29,100 | 309,542 | 71,444 | 173,918 | 44,372 | 101,042 | 33,612 |
| Black Crappie | 51,652 | 10,360 | 135,550 | 49,232 | 51,208 | 20,690 | 25,500 | 10,868 |
| Bullhead | 2,530 | 2,428 | 2,628 | 3,126 | 9,016 | 3,452 | 9,927 | 4,549 |
| Largemouth Bass | 1,758 | 2,504 | 798 | 1,734 | 448 | 860 | 622 | 1,074 |
| Yellow Perch | 204 | 28 | 34 | 14 | 136 | 194 | 43 | 13 |
| Northern Pike | 0 | 0 | 186 | 564 | 0 | 0 | 287 | 1,087 |
| TOTAL | 233,968 | 45,420 | 448,738 | 126,114 | 234,726 | 68,568 | 137,421 | 51,203 |
| Angler Trips | 22,766 | | 45,406 | | 30,290 | | 25,804 | |
| Angler Hours | 49,118 | | 108,914 | | 90,744 | | 62,795 | |
| Fish/Man | 10.27 | | 9.87 | | 7.74 | | 5.33 | |
| Fish/Hour | 4.68 | | 4.12 | | 2.58 | | 2.19 | |

* Census period May through October.

** Census period May through September.

failure of anglers to fish for this species. Most of the bass recorded were caught accidentally by bluegill or crappie fishermen.

One of the most enlightening aspects of this project is the total amount of fish creeled when expressed in pounds per acre. During 1963, 1964, 1965, and 1966 anglers harvested approximately 170, 480, 260, and 190 pounds per acre. It is not uncommon to see families creel 200 bluegills during an afternoon of fishing. The most striking figure here is not the high harvest of 1964 but rather the consistency with which high yields occurred. During an average year 275 pounds per acre of fish were creeled from this lake.

Angling pressure was quite heavy during the census periods totaling nearly 124,200 angler trips. Yearly fishing pressure ranged between an estimated 22,766 and 45,406 fishing trips and averaged about 31,000 trips. Nearly 311,500 hours were spent fishing in the lake. The yearly range was between 49,118 and 108,914 and averaged about 77,800 hours. An average year found 117 angling trips totaling 295 hours being made per surface acre in Center Lake.

One of the best means of determining fishing success is by examining the number of fish caught per fishing hour. Fishing success has been far above average during the census periods in each of the four years with fish per hour rates of 4.6, 4.12, 2.58, and 2.19 being recorded during 1963, 1964, 1965, and 1966 respectively.

Due to an error in computer programing, the figures reported in this paper are two times greater than those reported in previous Quarterly Biology Reports.

It is apparent the cost of the Center Lake renovation project has been amply justified by the many hours of fishing recreation spent on the lake during the last four years and by the amount of fish creeled during this time. Without this project angler utilization of this lake would have been insignificant during the past 6 years.

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SIX YEARS OF OFFICER CREEL CONTACTS ON NATURAL LAKES, 1960-1965

Larry Dunham
Biologist Aid

Since 1960, Conservation Officers have been supplied with field contact books and asked to check angling success during their routine work. Angling success is determined by contacting fishermen and recording the following information: party size, hours fished, and number and species of fish caught. This furnishes additional information on a state wide basis where information was not previously obtained by other creel census methods, especially on natural lakes, of minor importance. (Speaker 1962)

This report concerns natural lakes of Iowa located mainly in the northwest part of the state. Only lakes that were sampled frequently during the six-year period were analyzed. As a result, 20 lakes made up mostly of lakes where no comprehensive type of creel census has been used is considered. Clear Lake and Black Hawk Lake are included for comparison purposes between the two census methods.

As a result of leaving the number, time of day and time of year for making contacts up to each individual Officer, there is a bias entering into the data. For this reason, the Officer contact data is analyzed simply by year with emphasis on the rate of catch and species composition of the catch in all lakes. Tables are included for those interested in individual lakes.

RESULTS

Officer Contacts for 1960

During 1960 Iowa Conservation Officers contacted 2,612 fishermen. These people caught 12,065 fish after fishing 5,872 hours for an average catch rate of 2.05 fish per hour (Table 1). Success rate varied from 0.23 at Crystal Lake to 3.90 at Ingham Lake. Each fisherman averaged 4.62 fish per trip. Bullhead was the predominant species in the creel making up 93 percent of the catch. Other game fish species including walleye, crappie, bluegill, channel catfish, yellow bass, largemouth bass, northern pike, yellow perch and white bass contributed per cent. Rough fish, including carp and suckers, made up 1 per cent of the total catch.

Officer Contacts for 1961

Conservation Officers contacted 3,071 anglers who fished 7,289 hours and caught 9,661 fish. This is an average rate of 1.33 fish per hour (Table 2). Each angler averaged 3.15 fish per trip. Success rate varied from 0.36 at Swan Lake to 6.70 at Trumbull Lake. Species composition for 1961 in order of importance was: bullheads (80 per cent); crappie (10 per cent); bluegill (3.3 per cent); walleye (2.4 per cent); perch (1.8 per cent); catfish (1.1 per cent); carp (0.6 per cent); yellow bass (0.3 per cent); largemouth bass (0.2 per cent); northern pike (0.1 per cent); sheepshead (0.1 per cent); and suckers, white bass and sunfish (0.1 per cent).

Officer Contacts for 1962

A total of three thousand eight hundred and eighty-one fishermen were contacted in 1962. They caught 15,626 fish during 6,844 hours of fishing for an average catch rate of 2.28 fish per hour (Table 3). Success rate varied from 0.35 at Clear Lake to 7.94 at Storm Lake. Each fisherman averaged 4.03 fish per trip. Bullhead was the predominant species making up 88.4 per cent of the creel. Other species in order of predominance were: crappie (4.2%); walleye (3.2%); largemouth bass (1.1%); catfish (0.9%); carp (0.9%); yellow bass (0.7%); northern pike (0.2%); perch (0.1%); bluegill (0.1%); white bass (0.1%) and sheepshead (trace).

Officer Contacts for 1963

Iowa Conservation Officers contacted 3,416 fishermen who fished 6,186 hours and caught 10,189 fish at an average rate of 1.65 fish per hour. (Table 4). Each angler averaged 2.69 fish per trip. Success rate varied from 0.23 at North Twin to 2.43 at Five Island Lake. Species composition in order of importance were: bullhead (84.4%); largemouth bass (4.2%); walleye (3.7%); catfish (1.7%); crappie (1.3); yellow bass (1.2%); carp (1.0%) northern pike (1.0%); bluegill (0.7%); sunfish (0.7%); and sucker, perch and white bass (trace).

Officer Contacts for 1964

During 1964 Conservation Officers contacted 2,263 fishermen. These anglers caught 4,575 fish during 7,853 hours for an average catch rate of 1.71 fish per hour (Table 5). Success rate varied from 0.09 at North Twin Lake to 5.12 at Five Island Lake. The average angler trip resulted in 3.47 fish creeded. Bullhead was the predominant species comprising 82.1% of the creel. Other species in order of importance were: catfish (5.2%); crappie (3.9%); carp (1.9%); walleye (1.8%); largemouth bass (1.6%); sunfish (1.1%); northern pike (0.9%); white bass (0.9%); bluegill (0.3%); perch (0.2%); yellow bass, sucker and sheepshead less than 0.1 per cent.

Officer Contacts for 1965

In 1965 only 9 of the 20 lakes analyzed over the six-year period were sampled. However, Conservation Officers contacted 1,704 fishermen who fished 2,998 hours and caught 6,142 fish at an average rate of 2.05 fish per hour (Table 6). Each angler averaged 3.6 fish per trip. Success rate varied from 0.19 at Ventural Marsh to 3.78 at Lost Island Lake. Species composition of the creel in order of importance was: bullhead (82.5%); carp (4.2%); crappie (3.2%); white bass (2.7%); catfish (2.5%); northern pike (1.2%); yellow bass (0.9%); bluegill (0.9%); sunfish (0.9%); largemouth bass (0.5%); walleye (0.4%); and perch (0.1%).

DISCUSSION

In order to make the Officer contact type of creel census on natural lakes of value ideally the individual Officer would strive for equal sampling of lakes in their county with sufficient number of contacts. When sampling a lake, the Officers should make an attempt to make contacts over the whole year and at various times during the day to get a more true picture of fisherman success.

Until these two factors (equal sampling and sufficient number of contacts) are achieved the census will be inaccurate. However, if one assumes these biases are constant from year to year in evaluating the Officer contact data the information becomes more valuable.

When comparing angler success by using both comprehensive and Officer contact types of creel censuses for Clear and Black Hawk Lakes a wide discrepancy was found. The catch rate in 1965 for Clear Lake by comprehensive methods and Officer contact methods were 1.64 and 1.04 respectively (Table 8). Variance was also noted in catch composition between the two types of creel census with yellow bass, bullhead, and crappie showing the greatest differences.

Black Hawk Lake showed even greater discrepancies between the two methods. The catch rate for Black Hawk Lake in 1964 by comprehensive and Officer contacts were 1.66 and 0.50 respectively, and for 1963, 1.87 and 0.74 respectively (Table 8). Variances in predominance of species in the creel was also noted for the 2 years with crappie, bullhead, catfish and yellow bass showing the largest differences.

TABLE 8. Comparison between Comprehensive and Officer Contact Types of Creel Census Methods

| Lake | Year | | F/Hr. | Species Composition by Per Cent | | | |
|------------|------|-----------------|-------|---------------------------------|----------|-------------|---------|
| | | | | crappie | bullhead | yellow bass | catfish |
| Clear | 1965 | Comprehensive | 1.64 | 20.4 | 27.9 | 45.0 | |
| | | Officer contact | 1.04 | 3.0 | 70.7 | 12.0 | |
| Black Hawk | 1964 | Comprehensive | 1.66 | 39.0 | 34.0 | | 12.0 |
| | | Officer contact | 0.50 | 19.6 | 40.0 | | 18.5 |
| Black Hawk | 1963 | Comprehensive | 1.87 | 17.0 | 21.0 | 17.0 | 27.0 |
| | | Officer contact | 0.74 | 8.0 | 61.9 | 13.1 | 11.8 |

The major importance of the Officer contact type creel census is it is the only practical means presently employed of checking angler success on a statewide basis. Where no other type of creel census is used, assuming one Officer's data comparable from year to year, the Officer contact type of creel census is of value in measuring contribution of individual year classes of species to the fisherman's creel. An example of this was a 1964 year class of white bass in Storm Lake which showed up in the 1965 Officer contacts. This species increased in its predominance in the Officer contact creel census of Storm Lake from 68 fish in 1964 to 165 fish in 1965 indicating over a two-fold increase. Also, stocking success and measuring the extent of fish kills may be seen by noticeable increase or reduction in angler harvest.

SUMMARY

1. Over the six-year period fishermen averaged 1.82 fish per hour and 3.63 fish per angler trip.
2. Bullhead was the most predominant fish caught from the 20 natural lakes during the six year period. Crappie was second followed by walleye and channel catfish.
3. In 1965 there was a great reduction in the number of lakes sampled (9 out of the original 20 analyzed).
4. Channel catfish made great increases in 1964 and remained rather high in 1965.
5. Angling success was higher in 1962 than any other year. Fishermen caught 2.28 fish per hour and averaged 4.03 fish per angler trip.
6. Comparison between comprehensive and Officer contact types of creel census show variance in angling success and catch composition.

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TABLE I. The 1960 officer contacts on Iowa natural lakes

| Lake | County | Total Contacts | Hours Fished | Total Fish | F/M | F/Hr | B'head | Species composition | | | | |
|-------------------------|-------------|----------------|--------------|------------|-------|-------|--------|---------------------|--------|------|--------|----------|
| | | | | | | | | Croppie | Bigill | Carp | C. Cat | Others** |
| Storm | Buena Vista | 263 | 857 | 2336 | 8.88 | 2.72 | 2317 | | 19 | | | |
| North Twin | Calhoun | 124 | 240 | 171 | 1.38 | 0.71 | 147 | | 24 | | | |
| Swan | Carroll | 225 | 320 | 244 | 1.09 | 0.76 | 226 | 6 | 4 | 7 | 1 | |
| Clear | Cerro Gordo | 308 | 765 | 1610 | 5.23 | 2.11 | 1368 | 164 | 5 | 4 | | 69 |
| Trumbull | Clay | 138 | 236 | 242 | 1.75 | 1.02 | 242 | | | | | |
| Ingham | Emmet | 5 | 10 | 39 | 7.80 | 3.90 | 39 | | | | | |
| Iowa | " | 118 | 520 | 1780 | 15.09 | 3.42 | 1775 | | 4 | | | 1 |
| Tuttle | " | 51 | 124 | 130 | 2.55 | 1.04 | 129 | | | | | 1 |
| Dunbar Slough | Greene | 3 | 10 | 16 | 5.33 | 1.60 | 16 | | | | | |
| Little Wall | Hamilton | 12 | 24 | 77 | 6.41 | 3.21 | 77 | | | | | |
| Crystal | Hancock | 47 | 69 | 16 | 0.34 | 0.23 | 16 | | | | | |
| Five Island | Palo Alto | 1 | 2 | 1 | 1.00 | 0.50 | 1 | | | | | |
| Lost Island | " | 411 | 795 | 2740 | 6.66 | 3.44 | 2719 | | 17 | | | 4 |
| Black Hawk | Sac | 668 | 1453 | 1993 | 2.98 | 1.37 | 1585 | 294 | 23 | 27 | 39 | 25 |
| Rice | Winebago | 139 | 270 | 342 | 2.46 | 1.26 | 339 | | 3 | | | |
| Cornelia | Wright | 68 | 105 | 286 | 4.20 | 2.72 | 180 | 17 | 50 | 4 | | 35 |
| Morse | Wright | 31 | 72 | 42 | 1.35 | 0.58 | 42 | | | | | |
| Grand Total | | 2612 | 5872 | 12065 | 4.62* | 2.05* | 11218 | 481 | 82 | 109 | 40 | 135 |
| Total Catch by per cent | | | | | | | 93.0 | 4.0 | 0.7 | 0.9 | 0.3 | 1.1 |

* Figure represents mean.

** Others includes the following species: walleye (0.3); yellow bass (0.3); perch (0.3); white bass (0.1); largemouth bass (T); northern pike (T); sucker (T); and sheephead (T) where (T) stands for less than 0.1%.

TABLE 2. The 1961 officer contacts on Iowa natural lakes

| Lake | County | Total Contacts | Hours Fished | Total Fish | F/M | F/H ^a | B/head | Species composition | | | | | | |
|-------------------------|-------------|----------------|--------------|------------|-------|------------------|--------|---------------------|--------|------|--------|----------|-----|-----|
| | | | | | | | | Croppie | Bigill | Carp | C. Cat | Others** | | |
| Storm | Buena Vista | 449 | 1060 | 2304 | 5.13 | 2.17 | 2275 | 6 | | | | 18 | | 5 |
| North Twin | Calhoun | 85 | 151 | 181 | 2.13 | 1.20 | 179 | | | | | | 2 | |
| Swan | Carroll | 151 | 369 | 133 | .89 | .36 | 129 | 3 | | | | | | 1 |
| Clear | Cerro Gordo | 289 | 626 | 464 | 1.53 | .74 | 271 | 130 | 1 | | | 1 | 3 | 58 |
| Trumbull | Cloy | 7 | 23 | 154 | 22.0 | 6.7 | 154 | | | | | | | |
| Ingham | Emmet | 119 | 337 | 614 | 5.16 | 1.82 | 610 | | | | | 1 | 2 | 1 |
| Iowa | Emmet | 128 | 445 | 691 | 5.39 | 1.55 | 668 | | | | | 10 | | 11 |
| Tuttle | Emmet | 52 | 142 | 589 | 11.33 | 4.15 | 589 | | | | | | | |
| Dunbar Slough | Greene | | | | | | | | | | | | | |
| Little Wall | Hamilton | 19 | 27 | 10 | .52 | .37 | 10 | | | | | | | |
| Crystal | Hancock | 40 | 84 | 55 | 1.38 | .65 | 50 | | | | | | 5 | |
| Five Island | Palo Alto | 35 | 59 | 124 | 3.54 | 2.10 | 119 | 5 | | | | | | |
| Lost Island | Palo Alto | 391 | 1099 | 1374 | 3.51 | 1.16 | 1282 | 7 | | | | 3 | 1 | 81 |
| Silver (Ayrshire) | Palo Alto | 103 | 316 | 154 | 1.50 | .50 | 51 | | | | | | | 103 |
| Black Hawk | Sac | 652 | 1422 | 1362 | 2.08 | .95 | 350 | 818 | 23 | | | 16 | 104 | 51 |
| Rice | Winnebago | 292 | 652 | 671 | 2.30 | 1.03 | 671 | | | | | | | |
| Lake Cornelia | Wright | 252 | 457 | 775 | 3.07 | 1.69 | 315 | 1 | 294 | | | 1 | | 164 |
| Morse | Wright | 8 | 20 | 6 | .75 | .30 | 6 | | | | | | | |
| Grand Total | | 3071 | 7289 | 9661 | 3.15* | 1.33* | 7729 | 970 | 318 | 57 | 110 | 475 | | |
| Total Catch by per cent | | | | | | | 80.0 | 10.0 | 3.3 | 0.6 | 1.1 | 5.0 | | |

* Figure represents mean.

** Others includes the following species: Walleye (2.4); perch (1.8); yellow bass (0.3); largemouth bass (0.2); northern pike (0.1); sheepshead (0.1); white bass (T); sucker (T); and sunfish (T) where (T) stands for less than 0.1%.

TABLE 3. The 1962 officer contacts on Iowa natural lakes

| Lake | County | Total Contacts | Hours Fished | Total Fish | F/M | F/Hr | B ¹ head | Species composition | | | | |
|-------------------------|-------------|----------------|--------------|------------|-------|-------|---------------------|---------------------|---------|--------|---------|----------|
| | | | | | | | | W ¹ eye | Crappie | C. Cat | Lm Bass | Others** |
| Pickeral | Buena Vista | 13 | 24 | 65 | 5.00 | 2.60 | 65 | | | | | |
| Storm | Buena Vista | 1193 | 1262 | 10030 | 8.40 | 7.94 | 9753 | 218 | 3 | 9 | 11 | 36 |
| North Twin | Calhoun | 85 | 151 | 181 | 2.13 | 1.20 | 179 | | | | | 2 |
| Swan | Carroll | 222 | 437 | 293 | 1.32 | .67 | 293 | | | | | |
| Clear | Cerro Gordo | 288 | 777 | 275 | .95 | .35 | 101 | 52 | 23 | 2 | | 97 |
| Ingham | Emmet | 25 | 60 | 55 | 2.20 | .91 | 55 | | | | | |
| Iowa | Emmet | 55 | 89 | 209 | 3.80 | 2.35 | 209 | | | | | |
| Tuttle | Emmet | 98 | 231 | 512 | 5.22 | 2.21 | 509 | | | | 164 | 3 |
| Little Wall | Hamilton | 151 | 273 | 248 | 1.64 | .90 | 84 | | | | | |
| Crystal | Hancock | 71 | 158 | 185 | 2.60 | 1.17 | 185 | | | | | |
| Lost Island | Palo Alto | 95 | 323 | 477 | 5.01 | 1.44 | 391 | 14 | 58 | 1 | | 13 |
| Silver | Palo Alto | 110 | 241 | 385 | 3.50 | 1.60 | 185 | 200 | | | | |
| Black Hawk | Sac | 954 | 1797 | 1379 | 1.44 | .82 | 499 | 16 | 572 | 126 | | 166 |
| Rice | Winnebago | 277 | 605 | 1046 | 3.77 | 1.71 | 1046 | | | | | |
| Cornelia | Wright | 244 | 416 | 286 | 1.17 | .97 | 268 | | | | | 18 |
| Grand Total | | 3881 | 6844 | 15626 | 4.03* | 2.28* | 13822 | 500 | 656 | 138 | 175 | 335 |
| Total Catch by per cent | | | | | | | 88.4 | 3.2 | 4.2 | 0.9 | 1.1 | 2.2 |

* Figure represents mean.

** Others includes the following species: Carp (0.9); yellow bass (0.7); northern pike (0.2); white bass (0.1); bluegill (0.1); perch (0.1); and sheepshead (T) where (T) stands for less than 0.1%.

TABLE 4. The 1963 officer contacts on Iowa natural lakes

| Lake | County | Total Contacts | Hours Fished | Total Fish | F/M | F/Hr | Species composition | | | | | | | | | | | | |
|-------------------------|-------------|----------------|--------------|------------|------|------|---------------------|--------|---------|--------|--------|----------|--|--|--|--|--|--|--|
| | | | | | | | Bluehead | W. Eye | Croppie | C. Cat | LmBoss | Others** | | | | | | | |
| Pickeral | Buena Vista | | | | | | | | | | | | | | | | | | |
| Storm | Buena Vista | 1124 | 2324 | 5652 | 5.02 | 2.43 | 5283 | 145 | 39 | 65 | 23 | 97 | | | | | | | |
| North Twin | Calhoun | 145 | 194 | 46 | .31 | .23 | 32 | 10 | | | | 4 | | | | | | | |
| Trumbull | Clay | 152 | 161 | 677 | 4.45 | 4.20 | 677 | | | | | | | | | | | | |
| Ingham | Emmet | 60 | 79 | 69 | 1.15 | .87 | 61 | 8 | | | | | | | | | | | |
| Iowa | Emmet | | | | | | | | | | | | | | | | | | |
| Tuttle | Emmet | 90 | 174 | 308 | 3.42 | 1.77 | 299 | 1 | | | | 8 | | | | | | | |
| Little Wall | Hamilton | 240 | 503 | 377 | 1.56 | .74 | 186 | | 15 | | 175 | 1 | | | | | | | |
| Crystal | Hancock | 88 | 190 | 110 | .59 | 1.25 | 110 | | | | | | | | | | | | |
| Five Island | Palo Alto | 177 | 150 | 780 | 4.40 | 5.20 | 449 | | 4 | | 204 | 123 | | | | | | | |
| Lost Island | Palo Alto | 123 | 150 | 340 | 2.76 | 2.22 | 329 | 7 | 2 | 1 | | 1 | | | | | | | |
| Silver (Ayrshire) | Palo Alto | 253 | 218 | 311 | 1.23 | 1.42 | 133 | 176 | | | | 2 | | | | | | | |
| Black Hawk | Sac | 548 | 1222 | 906 | 1.65 | .74 | 561 | 17 | 72 | 107 | 1 | 148 | | | | | | | |
| Rice | Winebago | 202 | 389 | 383 | 1.80 | .98 | 383 | | | | | | | | | | | | |
| Cornelia | Wright | 214 | 432 | 230 | 1.07 | .53 | 104 | 9 | 1 | | 21 | 96 | | | | | | | |
| Morse | Wright | | | | | | | | | | | | | | | | | | |
| Grand Total | | 3416 | 6186 | 10189 | 2.69 | 1.65 | 8607 | 373 | 133 | 172 | 424 | 480 | | | | | | | |
| Total Catch by per cent | | | | | | | 84.4 | 3.7 | 1.3 | 1.7 | 4.2 | 4.7 | | | | | | | |

** Figure represents mean

** Others includes the following species: Yellow bass (1.2); northern pike (1.0); carp (1.0); bluegill (0.7); sunfish (0.7); white bass (1); perch (1); and sucker (1) where (1) stands for less than 0.1%.

TABLE 5. The 1964 officer contacts on Iowa natural lakes

| Lake | County | Total Contacts | Hours Fished | Total Fish | F/M | F/Hr | B/head | Species composition | | | | |
|-------------------------|-------------|----------------|--------------|------------|-------|-------|--------|---------------------|------|--------|---------|----------|
| | | | | | | | | Crappie | Carp | C. Cat | W. Bass | Others** |
| Storm | Buena Vista | 901 | 2318 | 5277 | 5.85 | 2.27 | 4601 | 91 | 115 | 341 | 68 | 61 |
| North Twin | Calhoun | 62 | 124 | 12 | .19 | .09 | 8 | | 1 | | | 3 |
| Trumbull | Clay | 76 | 73 | 130 | 1.71 | 1.75 | 119 | | | | | 11 |
| Ingham | Emmet | 38 | 58 | 69 | 1.81 | 1.19 | 60 | 1 | | | | 8 |
| Iowa | Emmet | 11 | 46 | 30 | 2.72 | .65 | 28 | | 1 | | | 2 |
| Tuttle | Emmet | 15 | 49 | 30 | 2.00 | .61 | 27 | | | | | 2 |
| Dunbar Slough | Greene | 39 | 42 | 52 | 1.34 | 1.24 | 46 | | 2 | | | 4 |
| Little Wall | Hamilton | 86 | 161 | 141 | 1.64 | .87 | 124 | 1 | | | | 16 |
| Crystal | Hancock | 33 | 90 | 85 | 2.60 | .94 | 85 | | | | | 138 |
| Five Island | Palo Alto | 140 | 113 | 579 | 4.13 | 5.12 | 346 | 95 | | | | 13 |
| Lost Island | Palo Alto | 65 | 60 | 134 | 2.00 | 2.23 | 121 | | | | | 42 |
| Silver (Aryshire) | Palo Alto | 208 | 241 | 542 | 2.60 | 2.24 | 500 | | | | | 49 |
| Black Hawk | Sac | 382 | 717 | 362 | .95 | .50 | 145 | 71 | 30 | 67 | | |
| Rice | Winneshago | 12 | 17 | 18 | 1.50 | 1.06 | 18 | | | | | 121 |
| Cornelia | Wright | 151 | 385 | 286 | 1.90 | .74 | 114 | 51 | | | | |
| Morse | Wright | 44 | 81 | 106 | 2.41 | 1.31 | 106 | | | | | |
| Grand Total | | 2263 | 4575 | 7853 | 3.47* | 1.71* | 6448 | 310 | 149 | 408 | 68 | 470 |
| Total Catch by per cent | | | | | | | 82.1 | 3.9 | 1.9 | 5.2 | 0.9 | 6.0 |

* Figure represents mean

** Others includes the following species: walleye (1.8); largemouth bass (1.6); sunfish (1.1); northern pike (0.9); bluegill (0.3); perch (0.2); yellow bass (T); sucker (T); and sheephead (T) where (T) stands for less than 0.1%.

TABLE 6. The 1965 officer contacts on Iowa natural lakes

| Lake | County | Total Contacts | Hours Fished | Total Fish | F/M | F/Hr | Species composition | | | | | | | | |
|-------------------------|-------------|----------------|--------------|------------|-------|-------|---------------------|---------|------|--------|---------|----------|-----|--|--|
| | | | | | | | Bhead | Crappie | Carp | C. Cat | W. Bass | Others** | | | |
| Pickereel | Buena Vista | 8 | 26 | 65 | 8.12 | 2.50 | 65 | | | | | | | | |
| Storm | Buena Vista | 443 | 1053 | 2915 | 6.58 | 2.77 | 2218 | | 166 | 187 | 152 | 165 | 27 | | |
| North Twin | Calhoun | 127 | 148 | 440 | 3.46 | 3.00 | 422 | | | 18 | | | | | |
| Swan | Carroll | 682 | 814 | 918 | 1.34 | 1.11 | 749 | | | 52 | 1 | | 116 | | |
| Clear | Cerro Gordo | 219 | 461 | 481 | 2.20 | 1.04 | 340 | | 14 | | 2 | 1 | 124 | | |
| Ventura Marsh | Cerro Gordo | 20 | 42 | 8 | .40 | .19 | 2 | | | | | | 8 | | |
| Trumbull | Clay | 56 | 174 | 276 | 4.92 | 1.58 | 259 | | | | | | 17 | | |
| Dunbar Slough | Greene | 16 | 27 | 83 | 5.18 | 3.07 | 82 | | | 1 | | | | | |
| Lost Island | Palo Alto | 133 | 253 | 956 | 7.18 | 3.78 | 932 | | 15 | | | | 9 | | |
| Grand Total | | 1704 | 2998 | 6142 | 3.60* | 2.05* | 5069 | | 195 | 258 | 155 | 166 | 299 | | |
| Total Catch by per cent | | | | | | | 82.5 | | 3.2 | 4.2 | 2.5 | 2.7 | 4.9 | | |

* Figure represents average rather than total.

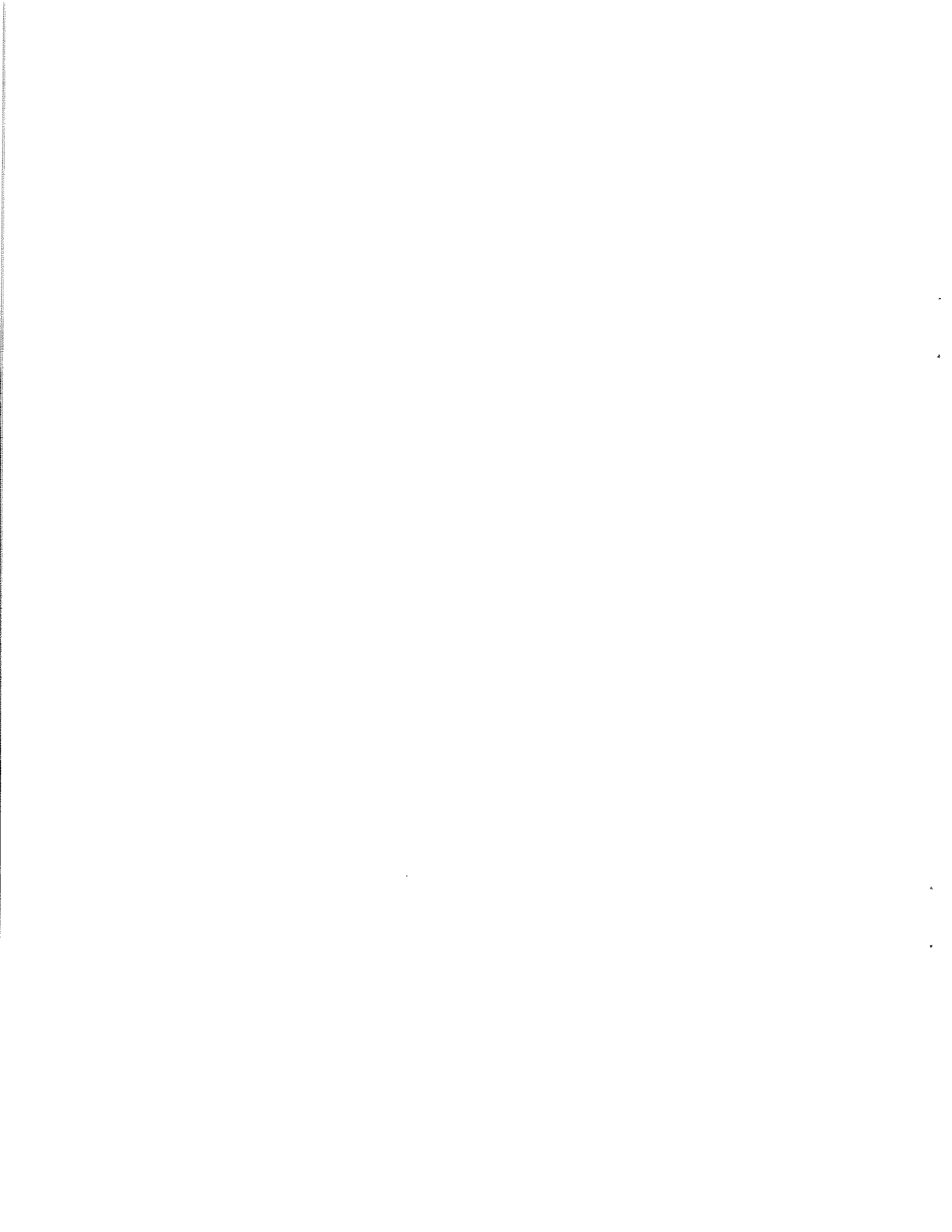
** Others includes the following species: northern pike (1.2); bluegill (0.9); yellow bass (0.9); sunfish (0.9); largemouth bass (0.5); walleye (0.4); and perch (0.1).

TABLE 7. Officer contacts for the 6-year period 1960-65 at Iowa natural lakes

| Year | Total Contacts | Hours Fished | Total Fish | Species composition by per cent | | | | | | | | | | | | | |
|-------|----------------|--------------|------------|---------------------------------|------|---------------------|--------------------|---------|---------------------|------|--------|--------|-------|-------|-------|----------|--|
| | | | | F/M | F/Hr | B ¹ head | W ¹ eye | Crappie | B ¹ gill | Carp | C. Cat | Lmbass | WBass | YBass | NPike | Others** | |
| 1960 | 2612 | 5872 | 12065 | 4.62 | 2.05 | 93.0 | 0.3 | 4.0 | 0.7 | 0.9 | 0.3 | T* | 0.1 | 0.3 | T* | 0.3 | |
| 1961 | 3071 | 7289 | 9661 | 3.15 | 1.33 | 80.0 | 2.4 | 10.0 | 3.3 | 0.6 | 1.1 | 0.2 | T* | 0.3 | 0.1 | 1.9 | |
| 1962 | 3881 | 6844 | 15626 | 4.03 | 2.28 | 88.4 | 3.2 | 4.2 | 0.1 | 0.9 | 0.9 | 1.1 | 0.1 | 0.7 | 0.2 | 0.1 | |
| 1963 | 3416 | 6186 | 10189 | 2.69 | 1.65 | 84.4 | 3.7 | 1.3 | 0.7 | 1.0 | 1.7 | 4.2 | T* | 1.2 | 1.0 | 0.7 | |
| 1964 | 2263 | 4575 | 7853 | 3.47 | 1.71 | 82.1 | 1.8 | 3.9 | 0.3 | 1.9 | 5.2 | 1.6 | 0.9 | T*0.9 | 1.3 | 1.3 | |
| 1965 | 1704 | 2998 | 6142 | 3.60 | 2.05 | 82.5 | 0.4 | 3.2 | 0.9 | 4.2 | 2.5 | 0.5 | 2.7 | 0.9 | 1.2 | 1.0 | |
| Total | 16947 | 33764 | 61536 | 3.63 | 1.82 | 85.1 | 2.0 | 4.4 | 1.0 | 1.6 | 2.0 | 1.3 | 0.6 | 0.6 | 0.6 | 0.8 | |

* -less than 0.1 per cent

** Others includes the following species: perch, sunfish, sucker and sheepshead. Their six year average percent of the creel composition are 0.4, 0.4, T, and T where T stands for less than 0.1 per cent.



FACTORS INFLUENCING PRODUCTION IN FOX SQUIRRELS

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Robert Phillips, Game Biologist

INTRODUCTION

On February 7 a project was initiated to determine chronology of production of spring and fall litters of fox squirrels and relative importance of each as contributors to fall population. The project was also designed to relate the chronology of production and success of production to climate and mast abundance.

A 285-acre refuge adjacent to the Wildlife Research Station, Boone, was chosen as the original study area. Low trapping success, calculated by dividing trap-days by number of squirrels captured, of 1.26 percent, mortality apparently caused by coccidiosis and limited ability to observe marked animals resulted in changing study areas. On July 16, traps were moved to a 40-acre, grazed, oak-hickory woodlot (study area II) adjacent to Ledges State Park.

RESULTS

Trapping success was not increased (0.7 percent) on the new location, but squirrels could be observed more readily. Forty squirrels were captured on the two study areas, and 26 were back-and-ear-tagged and released. The remaining squirrels suffered mortality and submitted to the Diagnostic Laboratory, Iowa State University, Ames, and/or preserved for examination of internal reproductive organs. Carcasses of 39 additional squirrels were handled during the quarter.

Of 79 squirrels examined, 47 were adult and 33 juvenile; 45 were female, 34 male (Table I). Adult females constituted 30% of total sample while juvenile males contributed only 14%.

Of a total of 59 adult females examined in 1963, 1965 and 1966, 17 were lactating and 3 were pregnant. Lactating squirrels were noted in March and from June through September, while pregnant females were recorded in June, July and August. Placental scars on the uteri of 15 adult females averaged 3.33.

Twelve juvenile squirrels were aged by Uhlig's (1956) technique, and it was estimated that they were born on February 22, 27, April 1, 2, 4, 8, 13, 19, May 6, 14 and June 3, 5, respectively. Calculations made by utilizing a gestation period of 45 days (Trippensee 1948), showed that reproduction was in progress as early as January 8 in Iowa.

Weights of adult fox squirrels during March through September ranged from 434 to 916 grams. Adult females averaged slightly heavier than adult males and the combined mean

weight of males and females was greatest in September (Table 2). Weights of juveniles ranged from 118 to 654 grams during the same period. Two weight classes of juveniles appeared to be present in September indicating the presence of second litters.

Nests and Dens

Nests and dens on area II were examined for litters from mid-July until August 31. Only 19 of 26 nests were accessible to examination, and 11 of the 19 were considered to be in use at time of examination. No litters were found in the 11 nests or 9 dens examined.

The majority of leaf nests were located in white oaks (Table 3), and average height above ground of all nests was approximately 31 feet. Average height of dens was 24 feet from the ground (Table 4).

Mast Count

Mast counts were conducted on study area II during August and early September. A random sample of mast crop was obtained by a slight modification of Petrides' (1953) method. Rather than cutting 25 twigs from each tree, 25 randomly selected terminal portions representing new growth of branches of the white oak and hickory group and the terminal 12 inches of the red oak group were removed from each mast producing tree. New growth generally consisted of 1 to 3 twigs. Thus, the total number of twigs counted is slightly higher than 25 per tree. Results of mast counts are presented in Tables 5 and 6. Data are available for the initial year only, and thus no comparison is possible.

SUMMARY

1. A reproductive study on fox squirrels was initiated to determine chronology of production of spring and fall litters of fox squirrels and relative importance of each as contributors to fall population; the project was also designed to relate the chronology of production and success of production to climate and mast abundance.
2. Trap success was 1.26 percent on study area I (Wildlife Research Station) and 0.7 percent on area II (private area near Station).
3. Of 79 squirrels handled 40 were trapped on study areas and 26 of these were back-and-ear-tagged and released.
4. Of 59 adult females examined in 1963, 1965 and 1966, 17 were lactating and 3 pregnant.
5. Placental scars on the uteri of 15 adult females averaged 3.33.
6. Back dating of juvenile squirrels showed conception as early as January 8 in Iowa.
7. During March through September adult squirrels' weight ranged from 434 to 916 grams and juveniles from 118 to 654 grams.

Table 1. Sex and age of fox squirrels handled in relation to month of capture, Boone, Iowa 1966.

| Month | Male | | Female | |
|-----------|-------|----------|--------|----------|
| | adult | juvenile | adult | juvenile |
| March | 2 | 0 | 2 | 0 |
| April | 3 | 1 | 6 | 0 |
| May | 2 | 0 | 0 | 1 |
| June | 2 | 2 | 3 | 6 |
| July | 3 | 1 | 5 | 1 |
| August | 4 | 3 | 4 | 6 |
| September | 7 | 4 | 4 | 7 |
| Total | 23 | 11 | 24 | 21 |

Table 2. Average weights of adult fox squirrels handled in relation to month of handling, Iowa, 1966.

| Month | Number | | Average weight | |
|-----------|--------|--------|----------------|--------|
| | male | female | male | female |
| March | 2 | 2 | 589 | 756 |
| April | 3 | 6 | 637 | 644 |
| May | 2 | 0 | 663 | - |
| June | 2 | 2 | 581 | 748 |
| July | 3 | 5 | 643 | 713 |
| August | 4 | 5 | 573 | 645 |
| September | 7 | 4 | 689 | 820 |

8. Nineteen nests and 9 dens were examined. The majority of leaf nests were in white oaks and average height of all nests was 31 feet.
9. Mast count on 108 white oak resulted in 0.63 acorns per twig. Thirty-four hickories yielded 0.54 nuts per twig.

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Table 3. Leaf nests examined on area II, Boone, Iowa, 1966.

| Tree species | Height (feet) | Width (inches) | Entrance diameter (inches) | Cavity (inches) | Status of use |
|--------------|------------------|-------------------|-------------------------------|--------------------|---------------|
| Hickory | 23 | 11 | 3 | 8 | A* |
| Hickory | 34 | 16 | 2 | 5 | A |
| Sugar maple | 34 | 28 | 3 | 10 | A |
| White oak | 35 | 17 | 3 | 5 | A |
| White oak | 28 | -- | - | - | IA** |
| White oak | 44 | 18 | 3 | 7 | A |
| White oak | 26 | 12 | 4 | 8 | A |
| White oak | 32 | 13 | 5 | 9 | IA |
| White oak | 30 | 9 | 3 | 5 | IA |
| White oak | 34 | 18 | 5 | 12 | A |
| White oak | 29 | 24 | 3 | 5 | A |
| White oak | 33 | 19 | 2 | 9 | A |
| White oak | 31 | 12 | 3 | 9 | IA |
| White oak | 23 | 24 | 2 | 5 | A |
| White oak | 23 | 21 | 3 | 3 | A |
| Mean | 30.6 | 17.3 | 3.1 | 7.1 | |

* A - Active

** IA - Inactive

Table 4. Squirrel dens examined in area II, Boone, Iowa, 1966

| Tree species | Height of den (inches) | Diameter of opening (inches) | Cavity (inches) | Status of use |
|--------------|---------------------------|---------------------------------|--------------------|---------------|
| Elm | 42 | 3 | 24 | A* |
| Elm | 25 | 4 | 37 | A |
| Elm | 30 | 4 | 16 | A |
| Elm | 7 | 6 | 18 | IA** |
| Elm | 34 | 6 | 18 | A |
| White oak | 20 | 4 | 30 | A |
| White oak | 36 | 7 | 13 | A |
| White oak | 11 | 3 | 36 | A |
| White oak | 8 | 4 | 30 | A |
| Mean | 23.7 | 4.6 | 24.7 | |

* A - Active

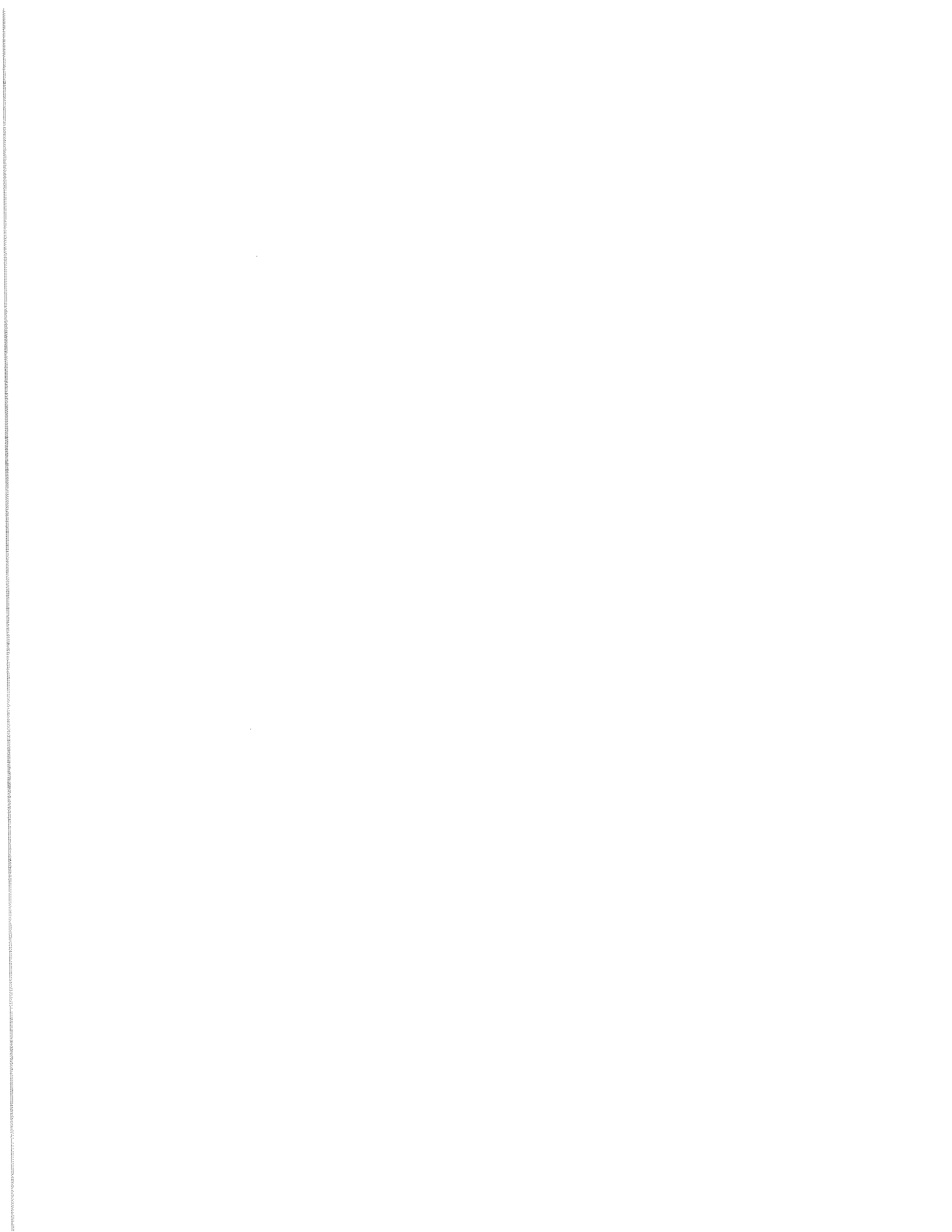
** IA - Inactive

Table 5. Result of mast counts on terminal twigs of oaks in area II, Boone, Iowa, 1966.

| Species | Number of trees | Average DBH (inches) | Number of twigs | Number of acorns | Acorn/twig |
|--------------------|-----------------|----------------------|-----------------|------------------|------------|
| Northern white oak | 108 | 24 | 4892 | 317 | 0.63 |
| Burr oak | 16 | 25 | 398 | 111 | 0.28 |
| Red oak | 3 | 24 | 77 | 148 | 2.05 |

Table 6. Result of mast counts on terminal twigs of hickories in area II, Boone, Iowa, 1966

| Number of trees | Average DBH (inches) | Number of twigs | Number of nuts | Nuts/twig |
|-----------------|----------------------|-----------------|----------------|-----------|
| 34 | 16 | 850 | 462 | 0.54 |



IOWA QUAIL POPULATIONS, 1966

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INTRODUCTION

The July count of whistling cock quail is the primary means of determining breeding quail populations. A resume of this procedure is given in the 1963 July-September Quarterly Biology Reports. The method as used in Iowa is based on 94 ten-stop routes distributed throughout the state.

Additional information used in calculating the prospective fall population is obtained each year from other game surveys on which quail are recorded. These censuses are taken from April through August. In late July, rural mail carriers also count quail, together with other small game species, during a single week. Information from all these counts gives a fairly complete picture of post-winter survival, summer adult populations, and of the production up to late summer.

Favorable weather preceeding pairing and nesting is necessary so that breeding quail will be in prime condition. In this respect, in the primary quail territory the 1965-66 winter had no excessive snowfall, though January was one of the coldest in recent years. Spring quail populations were higher than the previous year. February and March were mild in southern Iowa; April was cool and dry. May was cool with light precipitation; June was wet; late summer was mostly dry but with sufficient moisture for good production. (The above weather and crop information for dates concerned is from Iowa Climatological Data and Iowa Weekly Weather and Crop Reports.)

The censusing system was essentially the same as described in the Quarterly Biology Reports for July-September 1964, and as mentioned there, the changeover to uniform ten-stop routes was completed in 1965.

RESULTS

Whistling Quail Census: Statewide

This July count measures annual variations in the Iowa breeding quail numbers (Table I). The 1966 count was made on 94 ten-stop routes. On the total of 940 stops, 1,331 cocks were heard calling. This amounted to a mean of 1.42 per stop compared to 1.23 in 1965, which is a 15 per cent increase.

The increase in numbers of quail in prime range (south-central and southeast) was 19 per cent. In the areas which border the prime range (central, east and south-west) the change ranged from 101 per cent loss to 8 per cent gain; however these areas have relatively few quail, and a slight change amounts to a high percentage. In northern Iowa there was an increase, but since the number of quail is so small a precise measure of the population change is difficult to obtain.

Wapello and Decatur-Wayne and Story County Research Areas

Sunrise whistling activity in quail begins in late March or in April. It ends in September. The activity is checked about once each two weeks when the number of calling males is recorded along a 10-stop route at sunrise when the sky is clear and wind is moderate. This is the same procedure used on the statewide routes.

In 1966 on the first two aforementioned routes, sunup calling began in April, it peaked in June and July, then in late July the calling declined. It continued fairly high to mid-August then slowed thereafter, and regular sunup calling ceased by September.

On a similar route in Story County, a low quail population area, the summer checks showed a late June peak. Here calling also persisted through much of the summer.

Rural Mail Carrier Counts

Second in importance to the whistling quail counts, because of the large numbers of quail reported (Table 2), is the rural mail carriers' count. The quail seen during one week of late July is reported. In 1966 the returned postcards showed 3,087 quail in 36,512 miles. This averages 8.45 per 100 miles compared to 5.06 in 1965. This is a 67 per cent increase. The north-west and north-central have the fewest quail and here the numbers were 1.23 per 100 miles in 1966 compared to 0.97 in 1965. Within the fair to good quail range, the gain was 5.56 quail sighted per 100 miles in 1966 against 2.81 in 1965.

Quail Sight Records in Conjunction with other Counts

On Spring Pheasant Counts A measure of quail survival is obtained from the numbers of quail sighted on the April-May spring pheasant surveys. In 1965 this covered 1,730 miles of 10-mile routes with 50 quail being seen, which was an average of 2.89 per 100 miles. In 1966 along 1,910 miles of these routes 41 quail were seen, which was an average of 2.15 per 100 miles. This is a gain of 34 per cent since 1965. The corresponding figure for 1964 was 3.01 and it was 2.83 for 1963. In 1962 it was 1.20.

On Rabbit Counts Quail are also counted on the regular July rabbit counts. These are made along roads that were selected because they are in rabbit territory, which in southern Iowa is also quail range. The procedure is described in the 1963 July-September Biology Reports in the rabbit report. In 1966 this count was made on 2,790 miles of routes throughout the state. Altogether, 192 quail were reported seen for an average of 6.88 per 100 miles (Table 3). In 1965 and 1964 results were similar to each other at 3.85. The numbers of coveys seen should be an indicator of the stage of production; in this respect in 1966, 3 coveys were seen, against 2 for 1965 and 3 in 1964 (if coveys were not recorded as such, any report of 9 or more quail at one place was considered as a covey).

On August Roadside Pheasant Count A late summer roadside pheasant count is made in August, with quail sighted also being counted. Along 5,880 miles of route, 521 quail were seen. This was an average of 8.86 per 100 miles, which is an increase of about 33 per cent over 1965 (Table 4). Of the six districts, there was a significant increase in the central

region and decrease in the eastern district. No significant changes were noted in the other four regions.

On Calling Quail Surveys Records are also kept of quail seen on whistling quail routes. In 1966, 92 quail were seen along routes comprising 940 miles or 9.74 quail per 100 miles (or more correctly per 100 listening stops since some stops are more than one mile apart). (Table 5). In 1965 forty-two quail were seen along routes having 1,047 stops, or 4.01 per 100 stops.

DISCUSSION

In late April and in May, the first count is made of the adult quail which eventually produce the new coveys. This is done in conjunction with the spring pheasant survey, and this year it indicated that more quail survived the 1965-66 winter than had survived the 1964-65 winter. Next to be taken is the whistling cock quail count in early July, and this count also indicated an increase. On this same census, 75 cooperators said they thought there were as many or more quail as in 1965, while only two thought there were fewer. The latter two were in marginal quail range. The June, July and August calling quail counts were made this year on the Wapello, and Decatur-Wayne Research sites; another count was made in Story County. Those in other counties were discontinued. On the Research sites we now have 2 year's data and the 1966 record shows more calling cocks than in 1965; furthermore there was more calling over a comparatively long period (May through August) and this indicates extensive production. Early July quail counts along rabbit survey routes indicates good production. About the same number of young quail coveys was seen in 1966, 1965 and 1964.

Because of the relatively small number of quail sighted on the quail, rabbit and pheasant surveys made during the summer by Commission personnel, it is likely a better idea of the overall quail picture could be obtained by combining the data from these three counts. When this was done, it was found that 8.38 quail were seen per 100 miles in 1966 as compared to 5.68 in 1965 (a 48 per cent increase) and 4.84 in 1964 (Table 6). A 67 per cent increase was shown by rural mail carriers July Survey. It must be remembered that those counts made in July are actually not sampling the entire year's production, since the hatching season is not yet over at the time. Many of the birds counted are adults, and thus still must be classed as brood stock.

The August pheasant surveys show a higher proportion of young, and it is possible the 33 per cent gain shown by this count may be the best estimate of the actual pre-hunting season population trend. However, a few more year's data on these recently revised quail census methods will be necessary before their relative worth can be fully evaluated.

SUMMARY

1. Winter and spring 1966 quail counts indicated more brood stock than a year ago.
2. July counts of calling quail also indicated more breeding quail than in 1965.
3. Combined results from the July rabbit, July calling quail and August pheasant counts showed more quail than in 1965.
4. A count by rural mail carriers in late July also indicated an increase in quail compared to their 1965 counts.
5. It is thus concluded that there is a sizeable increase in the numbers of quail as compared to last year and other recent years, and this should be a good quail hunting year.

Table 1. July whistling quail counts, Iowa, 1966

| Region of state | No. of routes | No. of stops | No. of whistling cocks | Mean no. whistling cocks per stop | 1965 mean stop | Per cent change from 1965 |
|-----------------|---------------|--------------|------------------------|-----------------------------------|----------------|---------------------------|
| N.W. | 14 | 140 | 11 | 0.08 | 0.02 | +33 |
| N. C. | 13 | 130 | 15 | 0.12 | 0.08 | +50 |
| C. | 17 | 170 | 233 | 1.37 | 1.14 | +20 |
| E. | 20 | 200 | 249 | 1.25 | 1.15 | + 8 |
| S. W. | 11 | 110 | 148 | 1.35 | .67 | +101 |
| S. E. & S. C. | 19 | 190 | 675 | 3.55 | 2.98 | +19 |
| STATEWIDE | 94 | 940 | 1,331 | 1.42 | 1.23 | +15 |

Table 3. Quail observed on the July rabbit count, Iowa 1966

| Region of state | No. Rtes. | No. Miles | No. quail seen | Quail seen per 100 miles | 1965 No. per 100 miles | Per cent change from 1965 |
|-----------------|-----------|-----------|----------------|--------------------------|------------------------|---------------------------|
| N.W. | 14 | 420 | 0 | 0.00 | 0.00 | 0 |
| N.C. | 13 | 390 | 0 | 0.00 | 0.25 | -100 |
| C. | 14 | 420 | 5 | 1.19 | 1.02 | +17 |
| E. | 20 | 600 | 49 | 8.17 | 5.18 | +58 |
| S.W. | 12 | 360 | 13 | 3.61 | 2.78 | +29 |
| S.C. & S.E. | 20 | 600 | 125 | 20.83 | 10.07 | +107 |
| STATEWIDE | 93 | 2,790 | 192 | 6.88 | 3.85 | +78 |

Table 2. Quail counted by rural mail carriers, late July, Iowa, 1966

| Region of state | No. of routes | No. of miles driven | No. quail seen | No. of quail seen/100 miles | 1965 no. of quail seen/100 miles | Per cent change from 1965 |
|-----------------|---------------|---------------------|----------------|-----------------------------|----------------------------------|---------------------------|
| N.W. | 110 | 7,663 | 145 | 1.89 | 1.88 | 0 |
| N.C. | 59 | 4,259 | 24 | 0.56 | 0.06 | +833 |
| C. | 101 | 6,849 | 138 | 2.01 | 1.02 | +97 |
| E. | 100 | 6,259 | 431 | 6.89 | 4.37 | +58 |
| S.W. | 78 | 5,171 | 403 | 7.79 | 3.03 | +157 |
| S.C. & S.E. | 98 | 6,311 | 1,946 | 30.84 | 23.49 | +31 |
| STATEWIDE | 546 | 36,512 | 3,087 | 8.45 | 5.06 | +67 |

Table 4. Quail sighted on the August pheasant count, Iowa, 1966

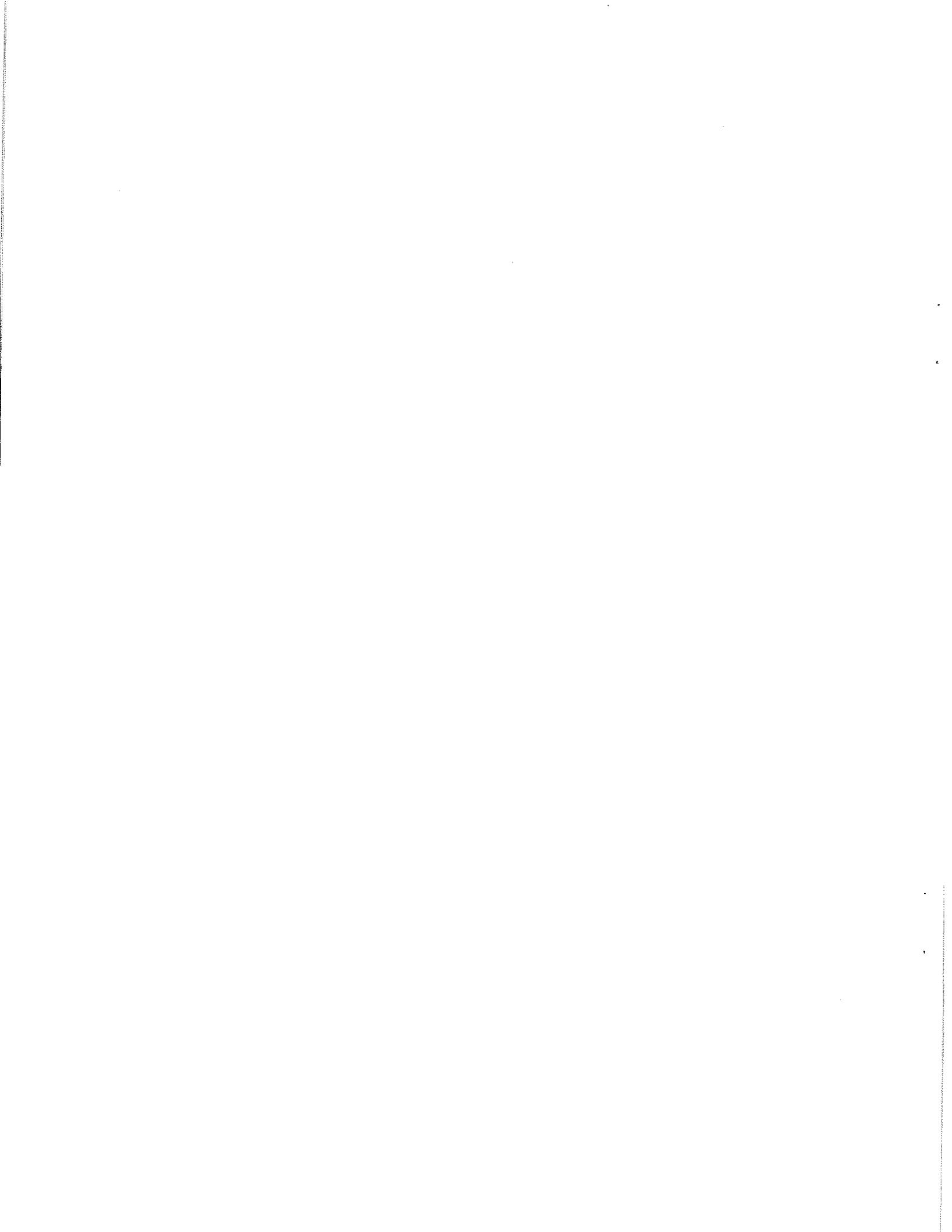
| Region of state | No. Routes | No. Miles Driven | No. quail seen | No. quail seen/100 miles | 1965 No. quail seen /100 miles | Per cent change from 1965 |
|-----------------|------------|------------------|----------------|--------------------------|--------------------------------|---------------------------|
| N.W. | 26 | 780 | 5 | 0.67 | 0.00 | + |
| N.C. | 30 | 900 | 0 | 0.00 | 0.13 | - |
| C. | 32 | 960 | 88 | 9.17 | 0.54 | +1598 |
| E. | 33 | 990 | 14 | 1.41 | 5.10 | -72 |
| S.W. | 25 | 750 | 33 | 4.40 | 4.49 | -2 |
| S.C. & S.E. | 50 | 1500 | 381 | 25.40 | 25.12 | +1 |
| STATEWIDE | 196 | 5,880 | 521 | 8.86 | 6.65 | +33 |

Table 5. Quail sighted on whistling quail counts, Iowa, 1966

| Region of state | No. routes | No. miles driven | No. quail seen | No. of quail seen/100 miles | 1965 No. quail seen /100 miles | Per cent change from 1965 |
|-----------------|------------|------------------|----------------|-----------------------------|--------------------------------|---------------------------|
| N.W. | 14 | 140 | 0 | 0.00 | 0.00 | + |
| N.C. | 13 | 130 | 1 | 0.77 | 2.50 | -225 |
| C. | 17 | 170 | 15 | 8.82 | 2.62 | +237 |
| E. | 20 | 200 | 16 | 8.00 | 1.13 | +608 |
| S.W. | 11 | 110 | 21 | 19.09 | 4.03 | +374 |
| S.C. & S.E. | 19 | 190 | 39 | 20.52 | 11.54 | +78 |
| STATEWIDE | 94 | 940 | 92 | 9.79 | 4.01 | +144 |

Table 6. A summary of combined results of quail sighted on calling quail census, rabbit count and pheasant survey, July and August, Iowa 1966 and 1965

| Region | 1966 | | | | 1965 | | | | Per cent change 1965-66 |
|-----------|-----------|-----------|----------------|-----------------|-----------|-----------|----------------|-----------------|-------------------------|
| | No. rtes. | No. miles | No. quail seen | quail/100 miles | No. rtes. | No. miles | No. quail seen | quail/100 miles | |
| NW | 54 | 1340 | 5 | 0.38 | 51 | 1438 | 0 | 0.00 | + |
| NC | 56 | 1420 | 1 | 0.07 | 47 | 1308 | 5 | 0.38 | -123 |
| C | 63 | 1550 | 108 | 6.97 | 68 | 1887 | 17 | 0.90 | +674 |
| E | 73 | 1790 | 79 | 4.41 | 70 | 1881 | 87 | 4.63 | -5 |
| SW | 48 | 1220 | 67 | 5.49 | 47 | 1318 | 50 | 3.79 | +45 |
| SC & SE | 89 | 2290 | 545 | 23.80 | 85 | 2218 | 412 | 18.57 | +28 |
| STATEWIDE | 383 | 9610 | 805 | 8.38 | 368 | 10051 | 571 | 5.68 | +48 |



IOWA'S LATE SUMMER PHEASANT POPULATION - 1966

Richard C. Nomsen
Game Biologist

INTRODUCTION

The roadside pheasant count made in August is the primary source of information on the status of the pre-hunting season pheasant population. There were 184 routes checked by Conservation Officers, Unit Game Managers, and Biologists.

Additional information is obtained from counts made by rural mail carriers during a one-week period in late July. Pheasant broods are also counted along rabbit and quail routes during July. Preliminary indications of reproductive success are obtained from these July counts.

The winter of 1965-1966 was noted for its lack of snowfall. One cold spell was recorded during the last half of January. The most severe storm occurred during late March following a period of very mild temperatures.

The spring of 1966 was generally cool with below normal rainfall. Temperatures averaged 3.8 degrees below normal in April and 3.5 degrees below in May.

METHODS

The techniques used this year were the same as in 1965. The number of routes remained at 184 - records were kept by regions in order to make comparison with previous years.

RESULTS AND DISCUSSION

Birds per Mile

There were 10,610 pheasants sighted on the 184 routes (5,520 miles) censused, for an average of 1.92 birds per mile (Table I). This count represents a 16 per cent increase over the 1.66 birds per mile reported in 1965. Counts for the past 12 years have ranged from 1.28 to 2.72 birds per mile with an average of 1.97 (Figure 1). Thus, the 1966 statewide pheasant population is about equal to the 12-year average.

Results of this survey indicate substantial increases in all areas of the primary pheasant range except the Northwest region, where no significant change was recorded. The greatest pheasant population this fall will again be found in Southwest and West Central Iowa. The greatest increase over 1965 occurred in the central region where the count was equal to the state average. Higher populations were again reported in Eastern Iowa - and the count remained about the same in the Southern region.

Broods per 30-Mile Count

There were 1,338 broods sighted on the 184 routes compared to 1,143 broods on an equal number of routes in 1965 (Table 2). The average of 7.3 broods per 30-mile count represents an 18 per cent increase - very similar to the birds-per-mile figure as would be expected. Changes in the regional figures were all similar to birds-per-mile figures.

Per Cent of Hens With Brood

There were 1,737 hens sighted and 1,141 (65.7%) were with broods (Table 3). This is slightly higher than in 1965 but still somewhat below normal. Hens appeared to have the best success in the northwest half of the state. The per cent of hens with brood was below the state average in the southwest portion of the range.

Average Brood Size

The statewide average brood size for 1966 was 5.8 chicks per brood (Table 3). This was slightly below the 5.9 chicks per brood last year. An average of 5.4 chicks per brood was reported in the northwest region and 5.6 chicks in Eastern Iowa. All other regions reported an average brood size of 5.9 or 6.0 chicks per brood.

Young Per Hen

The statewide young per hen index for 1966 was 4.5 (Table 3). This again represented a lower rate of reproductive success this year - it was 4.7 young per hen in 1965. However, it must be remembered that our brood stock was about 30 per cent higher this year. Therefore, even though the production rate was lower, the population increased as a result of the substantial increase in the brood stock.

Production appeared to be best in the southwest region. All other areas were average or below with the lowest success in the southern region. Results appeared to be quite variable in some area due to the cool temperatures last spring and extreme local variations of weather conditions.

Hatching Date Distribution

A greater percentage of the birds were hatched in June this year (80 per cent) than in 1965 (72 per cent). The peak hatching period occurred during mid-June followed very closely by the first period - June 1 - 10. Only 13 per cent were hatched in July compared to 20 per cent in 1965.

Rural Mail Carrier Counts

Iowa rural mail carriers made their annual count during the week of July 25-30. According to this survey, the rate of pheasant reproduction was slightly lower in 1966. Trends were quite similar to the regular August count - the per cent of hens with broods remained at 45 per cent, but the average brood size decreased to 5.7 chicks.

Table 1. Results of the 1966 August roadside pheasant counts, and comparison with 1965 results.

| Region of State | No. of Counts | No. Miles Driven | Total No. Birds Sighted | Birds per Mile | 1965 Birds Per Mile | % Changes From 1965 |
|-----------------|---------------|------------------|-------------------------|----------------|---------------------|---------------------|
| Northwest | 28 | 840 | 1,222 | 1.46 | 1.51 | -3% |
| North Central | 27 | 810 | 2,088 | 2.58 | 2.19 | +18% |
| Southwest | 23 | 690 | 2,506 | 3.63 | 3.05 | +19% |
| Central | 31 | 930 | 1,818 | 1.96 | 1.30 | +51% |
| East | 35 | 1050 | 1,630 | 1.55 | 1.32 | +17% |
| South | 40 | 1200 | 1,346 | 1.12 | 1.17 | -4% |
| STATEWIDE | <u>184</u> | <u>5520</u> | <u>10,610</u> | <u>1.92</u> | <u>1.66</u> | <u>+16%</u> |

Table 2. Comparison of number of broods sighted on August roadside pheasant counts in 1966 and 1965.

| Region of State | No. Broods Sighted | Broods Per 30 Mile Count | No. Broods Sighted 1965 | 1965 Broods Per Count | % Change In Broods |
|-----------------|--------------------|--------------------------|-------------------------|-----------------------|--------------------|
| Northwest | 155 | 5.5 | 165 | 5.9 | -7% |
| North Central | 255 | 9.4 | 204 | 7.8 | +21% |
| Southwest | 327 | 14.2 | 285 | 11.9 | +19% |
| Central | 229 | 7.4 | 157 | 4.9 | +51% |
| East | 208 | 5.9 | 157 | 4.5 | +33% |
| South | 164 | 4.1 | 175 | 4.5 | -9% |
| STATEWIDE | <u>1,338</u> | <u>7.3</u> | <u>1,143</u> | <u>6.2</u> | <u>+18%</u> |

Table 3. Data from 1966 August roadside pheasant count.

| Region of State | No. of Cocks | No. of Hens | Sex Ratio Index M:F | Hens | | % Hens With Brood | No. of Young Chicks | No. of Young Per Hen | No. of Young Per Brood |
|-----------------|--------------|--------------|---------------------|---------------|--------------|-------------------|---------------------|----------------------|------------------------|
| | | | | Without Brood | With Brood | | | | |
| Northwest | 173 | 198 | 1:1.1 | 63 | 135 | 68.2 | 829 | 4.2 | 5.4 |
| North Central | 259 | 339 | 1:1.3 | 99 | 240 | 70.8 | 1,498 | 4.4 | 5.9 |
| Southwest | 161 | 394 | 1:2.4 | 125 | 269 | 68.2 | 1,954 | 5.0 | 6.0 |
| Central | 158 | 297 | 1:1.9 | 110 | 187 | 63.0 | 1,350 | 4.5 | 5.9 |
| East | 163 | 306 | 1:1.9 | 114 | 192 | 62.7 | 1,163 | 3.8 | 5.6 |
| South | 132 | 203 | 1:1.5 | 85 | 118 | 58.1 | 978 | 4.8 | 6.0 |
| STATEWIDE | <u>1,046</u> | <u>1,737</u> | <u>1:1.7</u> | <u>596</u> | <u>1,141</u> | <u>65.7</u> | <u>7,772</u> | <u>4.5</u> | <u>5.8</u> |

Table 4. Distribution of the 1966 Iowa pheasant hatch by regions and statewide for 1965-1966
(figures given are percentages by 10-day periods)

| Date of Hatch | 1966 | | | | | 1965 | | |
|----------------------|-----------|---------|-----------|---------|------|-------|-----------|-----------|
| | Northwest | Central | Southwest | Central | East | South | Statewide | Statewide |
| May 1-10 | - | - | - | - | - | - | - | - |
| 11-20 | - | 0.8 | 0.6 | - | 1.0 | 1.3 | 0.6 | 0.7 |
| 21-31 | - | 3.3 | 7.9 | 6.5 | 9.7 | 6.3 | 5.9 | 7.6 |
| June 1-10 | 23.6 | 23.0 | 30.7 | 27.8 | 42.6 | 28.7 | 29.5 | 26.7 |
| 11-20 | 33.8 | 27.6 | 31.0 | 38.7 | 24.6 | 37.1 | 31.9 | 22.4 |
| 21-30 | 31.1 | 23.4 | 18.4 | 12.6 | 13.8 | 14.7 | 18.7 | 23.2 |
| July 1-10 | 10.1 | 16.3 | 6.4 | 8.3 | 4.1 | 7.7 | 8.8 | 13.5 |
| 11-20 | 0.7 | 4.2 | 3.2 | 3.2 | 3.6 | 2.8 | 3.2 | 5.0 |
| 21-31 | 0.7 | 1.4 | 1.2 | 2.9 | 0.4 | 0.7 | 1.2 | 0.9 |
| Aug. 1-10 | - | - | 0.6 | - | - | 0.7 | 0.2 | - |
| 11-20 | - | - | - | - | - | - | - | - |
| No. Broods In Sample | 148 | 239 | 342 | 230 | 195 | 143 | 1297 | 1197 |

Table 5. Statewide results of rural mail carriers July pheasant counts, 1962-1966

| Year | Young Per Hen | Average Brood Size | % of Hens With Broods |
|------|---------------|--------------------|--------------------------|
| 1962 | 2.1 | 5.3 | 39% |
| 1963 | 2.6 | 5.7 | 45% |
| 1964 | 2.7 | 5.8 | 47% |
| 1965 | 2.6 | 5.9 | 45% |
| 1966 | 2.5 | 5.7 | 45% |

Pheasant Broods Sighted on Rabbit and Quail Counts

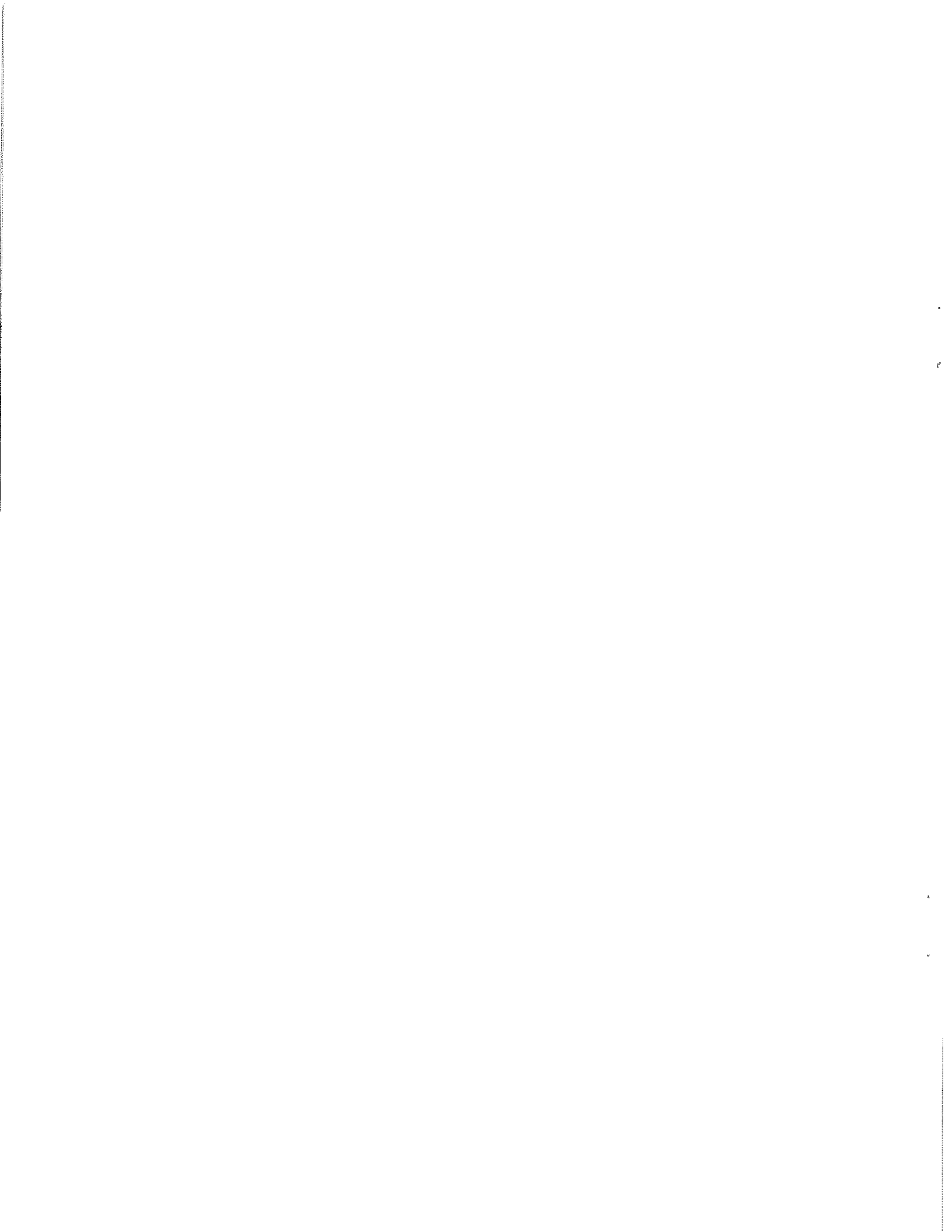
Pheasant broods sighted along rabbit and quail survey routes were recorded and the results used as early indicators of hatching success (Table 6). Statewide, there were 5.9 broods recorded per 100 miles compared with 5.4 broods in 1965. Very little change was noted in most regions with the exception of central Iowa where a substantial increase was recorded.

SUMMARY

1. The August roadside pheasant count is the primary source of information on the status of the pre-hunting season pheasant population. It is supplemented by the rural mail carrier survey and information recorded on the rabbit roadside and quail surveys.
2. The winter of 1965-1966 was quite mild with below normal snowfall. The spring of 1966 was cool.
3. A total of 184 routes was checked in 1966 - same as in 1965. Observers recorded 10,610 pheasants or 1.92 birds per mile. This count represents a 16 per cent increase over the 1.66 birds per mile reported in 1965.
4. Increases were recorded in all areas of the primary pheasant range except Northwest Iowa where no significant change was recorded. Highest populations were recorded in the Southwest and West Central regions.
5. Results of the various production indices showed a lower rate of production in 1966. However, the fall population was higher as a result of the substantial increase in the brood stock.
6. Rural mail carrier counts indicated a lower rate of production than in 1965.
7. More pheasant broods were sighted on the mid-July rabbit and quail routes.

Table 6. Pheasant broods observed on 1966 mid-July rabbit roadside survey and quail whistling counts.

| Region of State | Rabbit Survey | | | Quail Survey | | | Combined | | | | |
|-----------------|---------------|------------|----------------------|--------------|------------|----------------------|--------------|------------|----------------------|------------|------------|
| | No. Miles | No. Broods | Broods per 100 Miles | No. Miles | No. Broods | Broods per 100 Miles | No. Miles | No. Broods | Broods per 100 Miles | 1966 | 1965 |
| Northwest | 450 | 24 | 5.3 | 157 | 3 | 1.9 | 607 | 27 | 4.4 | 4.4 | 4.6 |
| North Central | 420 | 41 | 9.8 | 149 | 9 | 6.0 | 569 | 50 | 8.8 | 8.8 | 8.9 |
| Southwest | 390 | 30 | 7.7 | 122 | 11 | 5.0 | 512 | 41 | 8.0 | 8.0 | 8.3 |
| Central | 450 | 47 | 10.4 | 193 | 11 | 5.7 | 643 | 58 | 9.0 | 9.0 | 6.3 |
| East | 600 | 29 | 4.8 | 231 | 9 | 3.9 | 831 | 38 | 4.6 | 4.6 | 3.2 |
| South | 600 | 17 | 2.8 | 209 | 4 | 1.9 | 809 | 21 | 2.6 | 2.6 | 3.9 |
| STATEWIDE | <u>2,910</u> | <u>188</u> | <u>6.5</u> | <u>1,061</u> | <u>47</u> | <u>4.4</u> | <u>3,971</u> | <u>235</u> | <u>5.9</u> | <u>5.9</u> | <u>5.4</u> |



RESULTS OF 1966 RABBIT SURVEYS

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Game Biologist

INTRODUCTION

The annual July rabbit roadside counts were continued in 1966. This survey has been conducted with slight modifications every summer beginning in 1950. It is made from July 10 to 20 by Conservation Officer, Biology and Game Section personnel. In 1966 they drove predetermined routes on gravelled roads; these were 30-mile routes which previously had been 30 to 40 miles long. The standardized routes makes compiling of the data easier. Participants drive 20 to 25 miles per hour, starting at sunrise, and record all rabbits sighted along the routes. The July counts were developed for use in surveying cottontail populations. However, starting in 1958, jackrabbits were counted as well.

The age of rabbits was recorded as adult or juvenile to obtain age ratios and for computation of the fall population index. Numbers of quail, Hungarian partridge, and pheasant broods seen during each survey were also recorded. These data are given to Biologist responsible for these species for evaluation. Similar data on cottontails and jackrabbits taken in conjunction with quail and pheasant surveys are reported in this paper.

RESULTS

Ninety-eight routes totaling 2,940 miles were surveyed. This is a slight decrease in miles due to a change to a standardized length of 30 miles per route. In all, 1,785 cottontails were seen for an index of 6.07 per 10 miles (Table 1). Cottontails were most abundant in the Southern Loess area, where they have traditionally been most abundant (Table 2). Populations of cottontails in the other three areas ranked, in ascending order, as follows: Eastern, Northern Glaciated, Western Loess. The order of relative abundance was similar to the 16-year average for the four areas (Table 2).

The statewide index indicates populations may have increased very slightly from 1965 though the difference between 6.07 and 6.05 rabbits per 10 miles would not be statistically significant. The highest populations within the past 16 years were in 1958 (6.86) with the low in 1953 (3.31); the indices have been above 6.0 only five times - including the last 3 years. Average index for the 16 years, including 1966, is 4.97 cottontails per 10 miles of route. There were increases over 1965 in the west and in the north with some decrease in the east and in the south. In all regions the 1966 figures were higher than was the 16-year average.

Twenty-seven jackrabbits were counted during the surveys. The index of jackrabbits seen per 10 miles was 0.09 in 1966, 0.11 in 1965, 0.15 in 1964, 0.17 in 1963 and 0.11 in 1962. These indices indicate a general decline in jacks seen; the high for recent years was 0.44 in 1959. Whether this is a true decline is not known since the census is designed for cottontails and not for jackrabbits. Most jackrabbits were seen in northern and western Iowa.

Table 1. Results of July rabbit surveys for 1966

| Area | No. of Routes | Total miles | Cottontails observed | Jackrabbits observed | Cottontails per 10 miles | Jackrabbits per 10 miles |
|-----------------------|---------------|-------------|----------------------|----------------------|--------------------------|--------------------------|
| northern glaciated | 43 | 1,290 | 527 | 23 | 4.09 | 0.18 |
| Western Loess | 12 | 360 | 249 | 3 | 6.92 | 0.08 |
| Southern Loess | 27 | 810 | 820 | 1 | 10.12 | 0.01 |
| Eastern | 16 | 480 | 189 | 0 | 3.94 | 0.00 |
| STATEWIDE | 98 | 2,940 | 1,785 | 27 | 6.07 | 0.09 |

Table 2. Comparison of July roadside rabbit surveys for years 1952 through 1966. Cottontails observed per 10 miles

| Year | Western Loess | Northern Glaciated | Southern Loess | Eastern | STATEWIDE |
|-------------|------------------|-----------------------|-------------------|---------|-----------|
| 1951 | 6.69 | 3.37 | 5.68 | 2.13 | 3.92 |
| 1952 | 6.74 | 3.70 | 6.14 | 1.78 | 4.18 |
| 1953 | 4.26 | 2.70 | 4.23 | 3.33 | 3.31 |
| 1954 | 3.90 | 2.97 | 4.55 | 2.36 | 3.35 |
| 1955 | 3.55 | 4.60 | 6.03 | 5.31 | 4.96 |
| 1956 | 3.51 | 3.06 | 5.99 | 4.44 | 4.07 |
| 1957 | 4.72 | 3.32 | 7.59 | 4.79 | 4.87 |
| 1958 | 8.76 | 4.68 | 12.95 | 4.65 | 6.86 |
| 1959 | 7.92 | 4.36 | 10.46 | 4.66 | 6.33 |
| 1960 | 5.07 | 4.62 | 5.41 | 1.80 | 4.56 |
| 1961 | 6.12 | 4.25 | 6.58 | 2.19 | 4.79 |
| 1962 | 3.53 | 2.94 | 6.67 | 1.80 | 3.88 |
| 1963 | 5.27 | 4.19 | 10.17 | 3.87 | 5.61 |
| 1964 | 6.95 | 4.79 | 11.27 | 4.18 | 6.69 |
| 1965 | 5.11 | 3.95 | 11.59 | 4.31 | 6.05 |
| 1966 | 6.92 | 4.09 | 10.12 | 3.94 | 6.07 |
| 16 yr. avg. | 5.56 | 3.85 | 7.84 | 3.47 | 4.97 |

Of 1,785 cottontails aged, 1,171 were juveniles for a 1966 ratio of 1.91 juveniles per adult (Table 3). This ratio may be compared to 1965 (2.37) and 1964 (2.41). It is below the 1950 to 1966 average of 2.30. Best production appears to be in the southern Loess area where the index was 2.25 young per adult (Table 3).

The fall population index, which is obtained by dividing the number of juvenile cottontails seen along the survey routes (1,171) by the number of miles (2,940) and multiplying by ten, was 4.00 compared to 4.26 in 1965; further comparisons appear in the July-September 1965 Biology Reports. This indicates the rate of production was down from a year ago. However, a higher brood stock carryover enabled the total population to remain high.

Numbers of cottontails seen per 10 miles during the spring pheasant surveys averaged 2.49 compared with 1.89 in 1965, indicating a higher breeding population (Table 4). Cottontail populations as indicated by whistling quail survey data on rabbits, taken about the same time as the regular rabbit counts, showed higher than for 1965 (6.36 vs. 5.87); the highest counts were again in the south (10.67). Both the index from this count and from the rabbit census thus show an increase.

The index of cottontails sighted during the 1965 August roadside pheasant surveys was 4.24. This is a considerable increase from the 2.72 of 1965, and highest for the 4 years rabbits have been counted on this survey. Highest counts were again in the south with 9.10, while the west was at 4.17 and the north and east, respectively, at 1.63 and 1.52 (Table 6).

DISCUSSION

Weather conditions were not unduly severe during the past winter, but May was very cool. There was thus a good carry-over of cottontails through the winter. It is assumed that early production was retarded, although it is not definitely known that a cold or unpleasant spring weather cycle will always depress nesting success. In southern Iowa there was a definite benefit to cottontail survival in 1966 when there were no destructive floods during the production period. There were such floods in 1965. From the data presented here, it appears that there are more cottontails this year than in late summer 1965.

TABLE 3. Age ratios of cottontails observed during July 1966 surveys

| Area | Number of adults | Number of juveniles | Juvenile/adult |
|--------------------|------------------|---------------------|----------------|
| Northern glaciated | 179 | 348 | 1.94 |
| Western Loess | 119 | 130 | 1.09 |
| Southern Loess | 252 | 568 | 2.25 |
| Eastern | 64 | 125 | 1.95 |
| STATEWIDE | 614 | 1,171 | 1.91 |

TABLE 4. Rabbits seen during 1966 spring pheasant surveys

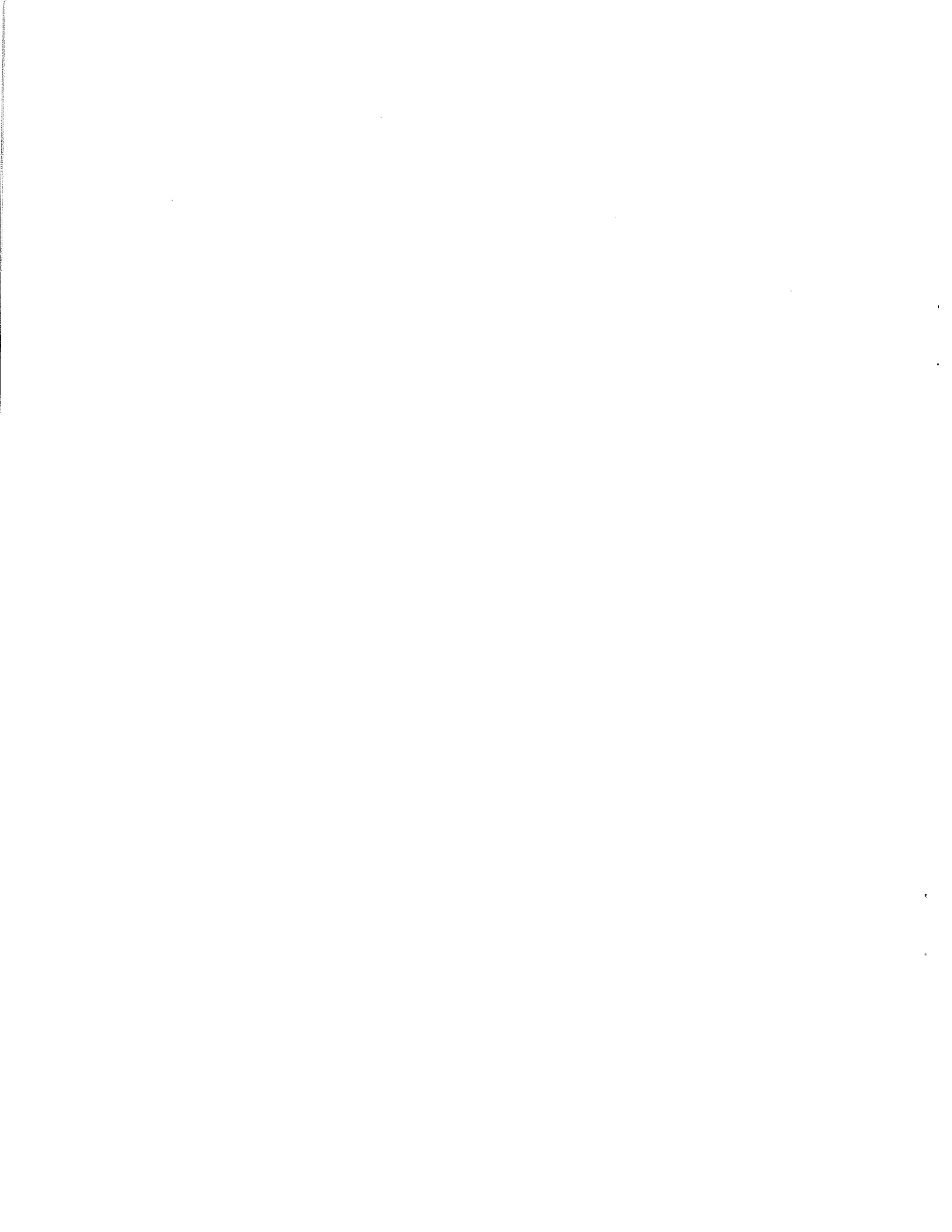
| Area | Number Miles | Cottontails observed | Jacks seen | Cottontails per 10 miles | 1965 index | Jacks per 10 miles |
|--------------------|--------------|----------------------|------------|--------------------------|------------|--------------------|
| Northern glaciated | 1,833 | 308 | 55 | 1.68 | 1.44 | 0.30 |
| Western Loess | 683 | 174 | 6 | 2.55 | 2.40 | 0.09 |
| Southern Loess | 1,195 | 509 | 0 | 4.26 | 2.40 | 0.00 |
| Eastern | 571 | 75 | 0 | 1.31 | 1.56 | 0.00 |
| STATEWIDE | 4,282 | 1,066 | 61 | 2.49 | 1.89 | 0.14 |

TABLE 5. Rabbits seen on quail whistling surveys, July 1966

| Area | Number miles | Cottontails observed | Jacks seen | Cottontails / 10 miles | 1965 index | Jacks / 10 miles |
|--------------------|--------------|----------------------|------------|------------------------|------------|------------------|
| Northern glaciated | 473 | 212 | 5 | 4.48 | 3.02 | 0.11 |
| Western Loess | 136 | 110 | 0 | 8.09 | 6.19 | 0.00 |
| Southern Loess | 252 | 269 | 0 | 10.67 | 12.16 | 0.00 |
| Eastern | 183 | 73 | 0 | 3.99 | 3.57 | 0.00 |
| STATEWIDE | 1,044 | 664 | 5 | 6.36 | 5.87 | 0.05 |

TABLE 6. Rabbits seen during 1966 August roadside pheasant surveys

| Area | Number miles | Cottontails seen | Jacks seen | Cottontails / 10 miles | 1965 index | Jacks / 10 miles |
|--------------------|--------------|------------------|------------|------------------------|------------|------------------|
| Northern glaciated | 2,670 | 436 | 59 | 1.63 | 1.15 | 0.22 |
| Western Loess | 780 | 325 | 6 | 4.17 | 3.16 | 0.08 |
| Southern Loess | 1,800 | 1,638 | 1 | 9.10 | 5.83 | 0.006 |
| Eastern | 630 | 96 | 0 | 1.52 | 1.58 | 0.00 |
| STATEWIDE | 5,880 | 2,495 | 66 | 4.24 | 2.72 | 0.11 |



REEVES PHEASANT STOCKINGS AND OBSERVATIONS, 1966

Gene Hlavka
Game Biologist

INTRODUCTION

The Reeves pheasant was first introduced into Iowa in 1963 adjacent to the Cedar Creek Unit of the Stephens State Forest in Lucas County. The Reeves in its native habitat of China is primarily a bird of the forest, and not of grasslands like the ringneck pheasant. The forested river valleys, timbered pastures, brushy waterways and hilly woodlands of south central Iowa resemble in several respects the wooded hills of central and northern China. In Europe, the Reeves pheasant has become established in England, France, Austria, Hungary, Czechoslovakia and Yugoslavia.

The Reeves cock can be easily recognized by the black "Lone Ranger" mask that encircles the white head and neck. In full-plumaged cocks the tail feathers may reach 3 or 4 feet. The Reeves hen is plain but has a dark crown and a dark patch behind the eye. Reeves outweigh ringnecks, but this difference is not very apparent in the field.

The primary objective of our experimental stocking was to establish breeding populations of a pheasant species on land where the ringneck pheasant is absent or at a low population level. If the objective could be reached, more hunting opportunity would accrue and the aesthetic value of the wildlife fauna be increased.

STOCKINGS

By September 15, 1966, 4,611 Reeves pheasants (2,347 cocks and 2,264 hens) had been stocked in Lucas and Monroe Counties (Table I). From 1963-1965 over 2,400 Reeves were stocked in the 5 units of the Stephens State Forest. During 1966, over 2,100 Reeves were released on State and private lands, mostly northeast of Chariton. The releases in mid-September liberated the last of the "Ohio" brood stock. Also in September, another wilder strain of Reeves (7 cocks, 20 hens) from Tennessee was obtained.

METHODS OF COLLECTING DATA

During the summer of 1966 (May 20 to August 31) the State Conservation Commission employed graduate student Vernon Wright primarily to collect field data on the Reeves pheasant. The investigator spent many hours walking and sitting near the various release sites. Farmers were contacted frequently. Efforts were made to visit with most of the residents near the three eastern forest units. A Brittany spaniel was used on occasion. Driving the roads through and adjacent to the forest units during the mornings and evenings proved to be the most successful way of finding Reeves pheasants.

TABLE 1. Summarization of Reeves pheasant stockings in Lucas and Monroe Counties, 1963-66

| Date | Stocking Site | Number Stocked | | | | | | GRAND TOTAL | |
|----------------------|--|----------------|------|-------|------|------|-------|-------------|--|
| | | Cocks | | | Hens | | | | |
| | | Ads. | Juv. | Total | Ads. | Juv. | Total | | |
| 1963-65 | Five Units of Stephens State Forest, Lucas County | 144 | 1240 | 1384 | 323 | 729 | 1052 | 2436 | |
| <u>1966</u> | 1000 ac. Unit, Lucas co. (Turkey release site) | | | | | | | | |
| May 27 | | | | | | | | | |
| June 2 | 1000-ac. Unit, Lucas co. | 17 | - | 17 | 94 | - | 94 | 111 | |
| Aug. 24 | Cedar Creek Unit, Lucas co. | - | 100 | 100 | - | 100 | 100 | 200 | |
| Aug. 24 | Chariton Unit, Lucas co. (cattle guard) | | 100 | 100 | - | 100 | 100 | 200 | |
| Aug. 24 | 1000-ac. Unit, Lucas co. (turkey release site) | - | 100 | 100 | - | 100 | 100 | 200 | |
| Aug. 25 | NW 1/4 sect. 4, T-72 N, R-20W, Lucas co. | - | 100 | 100 | - | 100 | 100 | 200 | |
| Aug. 25 | Chariton Unit, Lucas Co. (End of fire lane in SW 1/4 sect. 26, T-73 N, R-20 W) | - | 100 | 100 | - | 100 | 100 | 200 | |
| Aug. 25 | NW 1/4 sect. 17, T-73 N, R-19W, Monroe co. | - | 100 | 100 | - | 100 | 100 | 200 | |
| Aug. 26 | SE 1/4 sect. 1, T-73 N, R-20 W, Lucas co. | - | 100 | 100 | - | - | - | 100 | |
| Aug. 26 | Center sect. 21, T-73 N, R-20W, Lucas co. | - | 70 | 70 | - | 70 | 70 | 140 | |
| Aug. 26 | NE 1/4 sect. 21, T-72N, R-20 W, Lucas co. | - | 60 | 60 | - | 60 | 60 | 120 | |
| Sept. 15 | NW 1/4 sect. 15, T-72 N, R-20W, Lucas co. | - | 50 | 50 | - | 50 | 50 | 100 | |
| Sept. 15 | Center sect. 3, T-73 N, R-20 W, Lucas co. | - | 40 | 40 | - | 80 | 80 | 120 | |
| Sept. 15 | SE 1/4 sect. 1, T-73 N, R-20 W, Lucas co. | - | 1 | 1 | - | 100 | 100 | 101 | |
| TOTAL for 1966 | | ----- | | | | | | 2175 | |
| GRAND TOTAL, 1963-66 | | ----- | | | | | | 4611 | |

SURVIVAL AND SIGHTINGS

The winter of 1965-66 was characterized by lack of snow in southern Iowa. Although direct counts were not possible, Reeves pheasants did survive the winter in or near the three eastern forestry units. Those Reeves stocked in the vicinity of the Lucas and Whitebreast Units were difficult to locate and seemed to dwindle or move away. Reports indicated that two Reeves were sighted near the northwest corner of the Whitebreast Unit as late as June 20.

From 1963-65 about 98% of the released Reeves were sighted within 5 miles of the release site; almost 90% within the first mile (Hlavka, G. 1965, Reeves Pheasant Sightings and Stockings, 1963-65. Qrtly. Biol. Reports, Iowa Conservation Comm. (17) 3: 3-7). This apparent sedentary behavior of the majority of the Reeves is further illustrated by the field notes (Appendix A). One worthy migrant was a hen sighted about 2 1/2 miles east of Millerton in Wayne County.

BROOD REPORTS

During the summer of 1965, 5 broods with a minimum of 53 chicks were reported to us. In 1966, 5 broods were again reported, but the minimum number of chicks was computed as 40. However, with a stocking of 624 juvenile hens in October 1965 and with a winter distinguished by lack of snow in southern Iowa, brood production was expected to be better than that of 1965. Since few hens were observed after mid-May 1966, the investigator and farmers believed the hens to be nesting. Several hens were sighted after August 1. None of the hens observed had broods, and only four of those reported were believed to have broods. Reports indicated that broods contained 6 or 8 chicks. The latest sighting of a Reeves brood was reported by a local sportsman on October 4. This brood was observed on October 3 on the road about 1 mile west of the original release site near the Cedar Creek Unit. The chicks were reported to be larger than quail (Oct. 4, Appendix A). It is possible that hens with broods are more secretive than unsuccessful nesters. If many unbanded Reeves are counted in the 1966-67 winter survey, the preceding possibility will need to be considered. Because of the lack of field experience with Reeves and the scarcity of information in the literature, it is difficult to know just what to expect in the way of behavior of this bird. The tendency is to interpret observation in light of what is known about ringnecked pheasants, but this may be misleading and result in erroneous conclusions. Only time will tell.

DIET

Published reports indicate that the diet of the Reeves pheasant in the wild apparently consists primarily of acorns and other mast, seeds, berries and insects. In Lucas County during the fall and winter of 1965-66, 3 Reeves cocks per month were collected with a rifle in four different months to determine in general what foods were being utilized. The crop and gizzard contents were inspected and compared with a limited seed collection. It was found that during winter and early spring corn, soybeans and weed seeds were the primary foods utilized by all birds in the sample (Table 2). The October specimens contained mainly weed seeds and green herbaceous matter. Part of an acorn was found in one digestive tract. Unverified reports from bow and arrow deer hunters indicated that Reeves were taking acorns.

Table 2. Crop and gizzard contents of 12 male Reeves pheasants collected in Lucas county during fall and winter, 1965-66

| <u>Collection date</u> | <u>Habitat</u> | <u>Collection Site</u> | <u>Crop and Gizzard Contents</u> |
|-----------------------------|---|----------------------------------|--|
| Oct. 20, 1965 (3 cocks) | State forest area and pastured timber. Cultivated crops about 1/4 mile distant. | Entrance to Lucas Unit. | Grass seed and seed heads, misc. weed seeds (ragweed, smartweed and knotweed), green herbaceous matter, piece of acron insect (ant). |
| Jan. 5, 1966 (3 cocks) | Edge of mature timber and corn field. | Release site at Chariton Unit. | Corn, beans, weed seeds (smartweed, ragweed, cherry-?-pits), green herbaceous matter. |
| Jan. 31, 1966 (3 cocks) | Edge of mature timber and corn field. | Release site at Chariton Unit. | Corn, weed seeds (ragweed, knotweed), grass leaves. |
| March 21, 1966 (3 cocks) | Small woodland floodplain interspersed with soybean fields | Sect. 4, T-72N, R-20W, Lucas Co. | Soybeans, weed seeds (smartweed, cherry-?-pits), green herbaceous matter. |

DISCUSSION

"The birds are too tame." "I could almost catch the bird with my hands." Or "I almost had to stop the car to keep from running over the new pheasants." Such are the comments the writer hears in the field. After 3 years of stocking a bird of unknown genealogy obtained from Ohio, it became quite evident that something wilder was needed. It was hoped that enough Reeves broods would be reared in the wild from released birds to allow some to be trapped and used as brood stock, but that hope has not materialized to date. Instead, arrangements were made to secure a "wild strain" Reeves pheasant from Tennessee. In September 1966, 27 Reeves (7 cocks, 20 hens) arrived. These "French" Reeves are much thinner or "streamlined" in appearance and certainly wilder. Hopefully we are now on a better track in the attempt to establish this species in the state.

APPENDIX A

Selected Field Notes of Reeves Sightings and Behavior, 1966

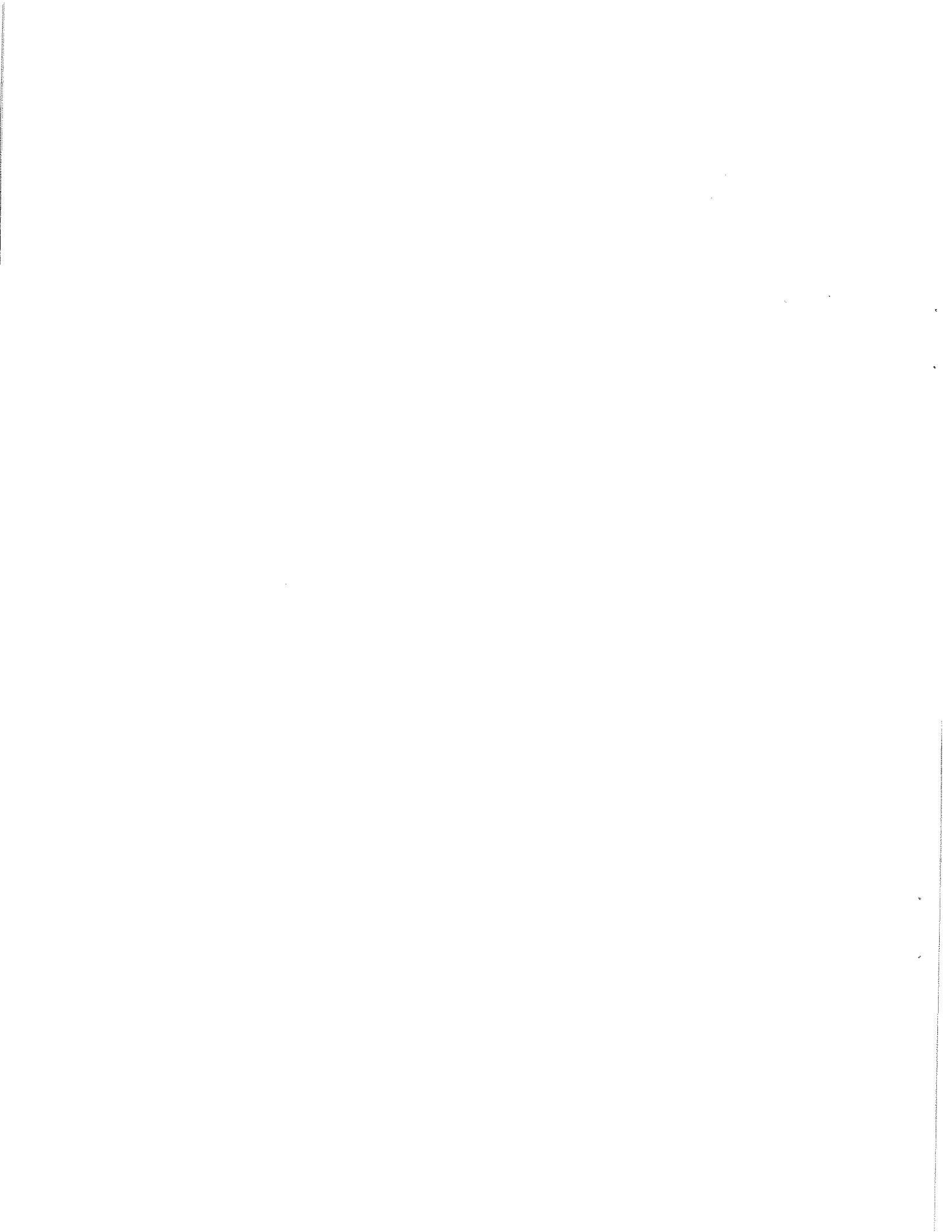
- Jan. 5 Sighted 8 cocks feeding in corn field near bridge in Chariton Unit. The 8 increased to 13. Soon birds were all around me. Approached to about 10 feet of 6 cocks. Leg bands visible. Few birds perched on large limbs of brush piles. Some birds crossed road and faded into corn field. One cock suddenly dashed back across road toward timber. Buteo made pass at another cock -- and missed. Alarm calls sounded. More birds ran for timber. Buteo made 3 more passes in timber. No luck! Later about 30 Reeves flushed from corn field.
- Jan. 31 Spotted about 5 Reeves cocks feeding in a field at edge of timber south of 1000-Ac. Unit. Scratchings in field certainly evident from the air --- large circular areas. Long tails stood out --- no mistaking them for ringnecks. Birds ran into brushy fencerow as plane passed over.
- Feb. 10 Received 6 Reeves bands from Mrs. C. Cook. Carcasses found in vicinity of farm house. Two were known road kills.
- Mar. 7 Talked with Conservation Officer Uhlenhake who received a letter about boys catching Reeves with a chicken hook on Feb. 27 in the Chariton Unit.
- Mar. 21 "Scratched" 3 Reeves from the Cedar Creek flock for food habits study. Three cocks approached the auto minutes after I parked. The cocks were only 10 feet away. When collecting, the thrashing of a fatally hit cock would often attract other cocks.
- Received the following 5 notes from Mrs. C. Spencer, sect. 32, Jackson Twp., Lucas Co.:
- Apr. 11 1. Saw 2 Reeves pheasants along fence west of house.
- Apr. 27 2. Two pheasants in road near mail box. One with long tail.

- May 1 3. Two pheasants in driveway.
- May 15 4. Two pheasants out on ash pile, came up to about 3 or 4 feet of me.
- June 20 5. Two pheasants over by Mrs. G's place.
- May 4. Sighted 5 Reeves cocks near cattle guard in Chariton Unit. Four birds came up to 10 feet of me. Bands visible.
- May 13 Received report of sighting of 1 Reeves cock near Stone King cemetery from the Forestry men.
- May 28 Found 5 cocks feeding near 1000 acre release site. Three cocks had long tail feathers.
- June 3 Spotted 2 Reeves hens in 1000 acre Unit east of pines near post piles.
- June 26 Found Reeves hen in mulberry tree along corn field near the Cedar Creek Unit.
- ? Grabbed tail feathers of cock. When cock broke away, feathers remained in my hand.
- July 11 Observed 6 cocks feeding in vicinity of picnic table in the bottom of Chariton Unit. Birds very tame. Two were molting long tail feathers. One bird had no band.
- July 13 Stopped near the release site in the Chariton Unit. Six cocks ran up to the car. Could read the band on one bird. It was U-497.
- July 25 Sighted 3 Reeves cocks in hay field behind Cook's place near the Cedar Creek Unit. Birds are quite tame.
- Aug. 5 Observed 2 Reeves hens at edge of road just west of M. White's place. They disappeared easily in the dead grass and weeds.
- Aug. 14 Sighted 4 Reeves cocks as we rounded road bend at picnic area in Chariton Unit. The 4 cocks ran up to the auto. Observed bands on 3 cocks. One cock would not run off when I kicked at him nor when I tossed a clod. As we proceeded along the road, one cock kept running alongside the auto for about 100 yards. Auto was traveling at speed of about 20 miles per hour.
- Sept. 7 Sighted adult Reeves cock and 2 juvenile hens on dirt road that passes through the north part of Cedar Creek Unit. Cock very bold, defiant. Hens quite tame. When hens rambled off into brush, cock followed.
- Sept. 14 Sighted 5 juvenile Reeves (3 cocks, 2 hens) while walking down Cedar Creek in the Cedar Creek Unit. Birds leisurely rambled off into the brush. Deer tracks numerous.

- Sept. 22 Talked with E. Blakey who reported a Reeves pheasant (possibly a hen) in sect. 22, T-70N, R-21W, Wayne County. Sighting occurred about 2 1/2 miles east of Millerton. Grandson approached to about 10 feet to "see" the bird.
- Sept. 24 Talked with Mrs. Colver who observed 5 Reeves on the road at their place. Said birds were too tame.
- Oct. 2 Received report from Mrs. D. Gass that a Reeves pheasant (possibly a hen) struck a window in Melcher. Bird was to be delivered to Stufflebeam. Stufflebeam says this bird was a ringneck!
- Oct. 4 Talked with P. Parsons who reported sighting a Reeves brood of 8+ chicks yesterday. Chicks were just larger than quail. Hen not observed. Brood was on road at northwest corner of sect. 6, T-72N, R-20W, Lucas County, about 4:30 p.m. (CDT). Chicks hopped over fence and ran off.

SUMMARY

1. Winter and spring 1966 quail counts indicated more brood stock than a year ago.
2. July counts of calling quail also indicated more breeding quail than in 1965.
3. Combined results from the July rabbit, July calling quail and August pheasant counts showed more quail than in 1965.
4. A count by rural mail carriers in late July also indicated an increase in quail compared to their 1965 counts.
5. It is thus concluded that there is a sizeable increase in the numbers of quail as compared to last year and other recent years, and this should be a good quail hunting year.



1966 IOWA WATERFOWL BREEDING PAIR SURVEY

Richard Bishop
Game Biologist

INTRODUCTION

A brood production survey was flown in July, 1965. The objective of the survey was to gain information on duck production. The situations that were involved with this survey made it less than satisfactory. Marshes with good vegetation, which consequently produce the most ducks, were the marshes with fewest observations recorded due to the dense brood cover. The marshes that were more open, and thus only produced a few broods, indicated higher production because of lack of cover to conceal broods. An inverse situation thus developed, because on areas of little or no vegetative cover broods were easily sighted from the plane compared to areas of dense cover where few broods were observed. It was thus concluded that the picture was not accurate and possibly very misleading.

METHODS AND RESULTS

The survey was changed in 1966 to a breeding pair survey in middle May. This should give us an idea of the population of birds we have breeding on our marshes. General brood observations later will give us the needed information on production.

The survey was made flying east and west at 100 feet at 90-100 mph. at 5-mile intervals. Two observers counted breeding pairs for 1/8 mile on each side of the airplane. This total coverage of 1/4 mile out of every 5 gave us a sample of 1/20 of the total area. The Fish and Wildlife Service uses 1/40 of the total area and indicate this is statistically sound. On this survey, as in the 1965 aerial flight, potholes were counted to determine breeding area available. The flights were made on May 16, May 25, and May 26. Normally breeding pair flights should be run the first week or two in May, but due to the lateness of the season, it had to be postponed.

Table I shows the results of the ten transects which covered an area from the Minnesota border south for 50 miles and from highway 65 on the east to highway 59 on the west. The transects were roughly 130 miles long. Roughly 6500 square miles were included in this survey. The expanded data indicates 2900 wet potholes and small marshes in the 6500-square mile area. State marshes are not included in these data. Breeding pair data indicate 1240 pair of mallards and 960 pair of blue-winged teal nesting in the 6500 square miles.

DISCUSSION

A very high breeding population of mallards was found using potholes, marshes, small creeks, and dredge ditches. Most of the mallards were observed on the creeks and dredge ditches. I doubt if the high use of creeks and ditches by mallards was known prior to this. This greatly increases our breeding areas for mallards. Because of the lateness of our survey, many hens were on the nest; therefore single loafing male mallards were counted as pairs. The large breeding population of mallards is very encouraging.

TABLE I. Iowa's aerial breeding pair survey, May 1966

| | |
|---|-------------------------|
| <u>Transect 1</u> | <u>Transect 6</u> |
| 20 potholes | 17 potholes |
| 10 pair mallards | 6 pair mallards |
| 6 pair bluewinged teal | 13 pair bluewinged teal |
| 10 unidentified | 5 male bluewinged teal |
| | 1 unidentified |
| <u>Transect 2</u> | <u>Transect 7</u> |
| 21 potholes | 19 potholes |
| 6 pair mallards | 7 pair mallards |
| 4 pair bluewinged teal | 7 pair bluewinged teal |
| 1 male bluewinged teal | |
| 2 unidentified | |
| <u>Transect 3</u> | <u>Transect 8</u> |
| 10 potholes | 5 potholes |
| 12 pair mallards | 1 pair mallards |
| 1 pair bluewinged teal - 2 single bluewinged teal | 1 pair bluewinged teal |
| 1 pair ruddy | |
| 1 male ruddy | <u>Transect 9</u> |
| <u>Transect 4</u> | 5 potholes |
| 23 potholes | 3 pair mallards |
| 10 pair mallards | 1 pair bluewinged teal |
| 7 pair bluewinged teal | |
| 8 male bluewinged teal | <u>Transect 10</u> |
| 3 unidentified | 8 potholes |
| | 2 pair mallards |
| <u>Transect 5</u> | |
| 17 potholes | |
| 5 pair mallards | |
| 8 pair bluewinged teal | |
| 2 single bluewinged teal | |
| 1 pair gadwall | |
| 1 male gadwall | |
| 1 pair pintail | |

The fact that mallards out-ranked the number of breeding teal in this survey indicate a bias of the survey. Mallards were very easily spotted and most often were loafing in the open, whereas blue-winged teal were occupying the heavier vegetated areas and were very hard to see. The blue-winged teal is the number one nesting duck in Iowa, so I feel the survey is not accurate enough to indicate the relative breeding teal population. Very few good marshes were included in the transect as compared to the numerous creeks and dredge ditches used by mallards. This probably throws bias into the data favoring the mallard. A large number of the teal produced in Iowa are on state marshes and very few of these were crossed during the flight. I believe the survey is a very good indicator of mallard numbers but not so reliable for teal, though it may well indicate trends for the latter.

We can gain information on breeding blue-winged teal by first obtaining an idea of available breeding areas and then by correlation with observations on the ground estimate the numbers of nesting teal.

The survey used for obtaining trend information is probably valid and is superior to a later survey when vegetative growth is more developed. The flight will be flown again next year so a trend in breeding pairs can be established.

ADDITIONAL INFORMATION FROM RESEARCH PROJECTS

A comparison of air and ground pair counts was made during mid-May of 1966. Two marshes were completely flown and later complete pair counts were taken from the ground. This information gives us an idea of the percent of birds observed from the air. Myre Slough and Harmon Lake in Winnebago county were the areas counted. Myre Slough is a heavily vegetated marsh (90%) compared to Harmon Lake which is a wide open marsh (10% vegetation). On May 16, these areas were counted from the air and on May 18, and May 20, Harmon Lake and Myre Slough, respectively, were counted from the ground (Table 2). This information indicates a large portion of the birds present are not observed from the air.

Data dealing with mallard use on potholes like those viewed from the air are generally lacking. Thus a small scale study was begun this spring to determine duck use on small private potholes. Six small potholes on private land were checked. All of these potholes attracted from one to four pairs of breeding mallards. All six potholes checked later in August produced at least one brood. One pothole was not much more than a wet meadow, but did produce a brood of mallards.

CONCLUSION

The May aerial survey indicated a good breeding population of mallards and later observations during the spring gave additional support. Brood observations indicated very good production by mallard and wood ducks and fairly good production by blue-winged teal and redheads.

TABLE 2. Ground and air breeding pair count comparison, 1966

| Area | | Air Count (May 16) | | Ground Count (May 18) | | |
|-------------|---------------------|-----------------------|---------|--------------------------|-------|---------|
| Harmon Lake | Species | Pairs | Singles | Species | Pairs | Singles |
| | Mallard | 2 | | Mallard | 18 | 4 |
| | Blue-winged Teal | 2 | 14 | Bluewinged teal | 54 | 13 |
| | Gadwall | 0 | 10 | Gadwall | 5 | |
| | Shoveler | 1 | | Shoveler | 2 | 2 |
| | Scaup | 1 | | Widgeon | 2 | |
| | Ruddy Duck | 2 | 1 M. | Redhead | 1 | 3 |
| | | | | Scaup | 21 | 14 |
| | | | | Ring-neck | 1 | |
| | | | | Wood Duck | 2 | 1 |
| | | | | Pintail | 1 | |
| | | | | Bufflehead | 1 | |
| | | | | Green-wing teal | | 1 |
| Myre Slough | Species (May 16) | Pairs | Singles | Species (May 20) | Pairs | Singles |
| | Mallard | 5 | | Mallard | 14 | 3 |
| | Blue-winged teal | 4 | 1 M. | Bluewinged teal | 96 | 30 |
| | Gadwall | 2 | 2 M. | Gadwall | 4 | 2 |
| | Shoveler | 2 | 2 M. | Redhead | 4 | 3 |
| | Redhead | 1 | | Widgeon | 1 | |
| | Scaup | 3 | | Ruddy Duck | | 2 |
| | Ruddy Duck | | 1 M. | Pintail | 1 | |
| | | | | Scaup | 4 | 2 |
| | | | | Wood Duck | 1 | |
| | | | | Ring-neck | 3 | |
| | | | | Green-wing teal | | 1 |

The breeding pair count aerial survey is superior to a brood aerial survey for determining waterfowl production trends in Iowa. It is better for determining a trend in the breeding populations of mallards than it is for teal. A more reliable picture can be achieved by obtaining good ground observations throughout the reproductive season and comparing these to the aerial survey.

1

RUFFED GROUSE INVESTIGATIONS IN NORTHEAST IOWA

Wayne Porath, Graduate Assistant,

Iowa State University

Keith D. Larson, Game Biologist

INTRODUCTION

The primary objectives of this study are to determine the density of the ruffed grouse population on a study area representative of grouse habitat in northeast Iowa, and to determine the relationship of ruffed grouse to habitat types during the summer and early fall.

The study area is located on the upper portion of Paint Creek Unit, Yellow River State Forest. The area comprises 360 acres, divided almost equally into two parts by Little Paint Creek. The bottomland is composed mainly of ungrazed bluegrass meadow. The flat upland areas have been cleared for farming where possible, leaving the inaccessible edges of hills and the slopes as existing grouse coverts. Mixed mature hardwoods, bottomland hardwoods, second growth hardwoods, early successional hardwoods, and conifer-hardwoods dominate the habitat groupings.

METHODS OF STUDY

Searching. The study area was searched on foot by the investigator and two persons from the Luster Heights Correction Camp, beginning on June 6, 1966, and extending to August 31, 1966. A Labrador dog was added on July 1 to aid in finding birds. The entire study area was canvassed at least once each week. Field maps were completed daily to record area covered, drumming and drumming log locations, male flushings, and brood sightings. Forms devised by Fisher (1939) were adapted to record pertinent information regarding brood sightings and drumming logs.

Trapping. Mirror and lily-pad traps were used to capture drumming males and broods respectively. The mirror traps were similar to those described by Dorney and Mattison (1956). Attempts were made to identify only "active" drumming logs (logs having fresh droppings on them). Each mirror trap was positioned on the drumming log about 3 feet from the drumming spot and camouflaged with leafy twigs.

The basic plan of the lily-pad traps used is described by Dorney and Mattison (1956), although the traps were modified by adding 30 feet to each lead (providing for 60 foot leads) and by placing a lily-pad enclosure at the distal end of each lead.

Trap site locations for lily-pad traps were chosen according to the following criteria:

1. Brood flushing sites.

2. Sites of probable grouse traffic
3. Feeding areas
4. Arbitrarily

Four traps were set during June, and an additional 13 were operated as trapping success improved in July. No bait was used in the traps. Tops of the enclosures were camouflaged with leafy branches. The traps were checked each morning between 8 and 12.

Marking. Adults and large chicks were marked with an aluminum leg band and a colored backtag as described by Labisky and Mann (1962). Chicks too small to backtag were marked with red or blue chick dye.

Sexing and aging live-trapped birds. Techniques outlined by Palmer (1957) were used to sex juvenile birds. Pigmented eye-patch, little or no peeping, well-developed feathers, and presence of a ruff were characteristic of the males, while females tended to show opposite characteristics. Adult males typically were stouter, showed a greater degree of eye-patch pigmentation, and had sharper plumage patterns.

Adults are easily differentiated from juveniles during the summer by the presence of a dark tail band. Development of wing primary feathers (Bump, et al. 1947) was the main technique utilized for determining the age of juveniles.

RESULTS

Population densities. At least eight males were identified as having territories on the study area. A minimum of 11 broods was sighted during the summer. Brood size ranged from 2 to 10 chicks per brood, with an average size of 5.1, compared with 7.67 average size reported by Polderboer (1940). Brood movements were minimal during early summer; therefore a reasonably stable population of 48 grouse was recorded July 15, which was one grouse to 7.5 acres of suitable grouse habitat. As the summer progressed, brood movements increased, and no accurate density estimate was possible. Broods were constantly moving on and off the study area later in the summer.

Habitat utilization. A study of grouse made during 1938-1940 by Polderboer near Lansing, Iowa, (12 miles north of the present study area) provided the only comparable information. Polderboer classified the cover according to vegetation types (Table 1) that are also applicable to the Paint Creek area.

Brood flushes in the various cover types during June (Table 2), July (Table 3) and August (Table 4) were tabulated. A consistent association of number of flushes and the Quercus - Carya associates with a Cornus - Corylus layer 20-35 years old (type G) occurred. An index of utilization comparing number of broods flushed to acres of cover type indicated greatest utilization of the 20-35 year old Quercus rubra - Tilia - Acer - Betula faciation with cover type G second in importance (Table 5). More cover types were used in August than in

Table I. Key to vegetative cover formations (taken from Polderboer 1940).

| Type of cover | | Acres on study area | Type code |
|---------------|---|---------------------|-----------|
| Mature | (<u>Quercus</u> - <u>Carya</u> association over 80 years old - | 126 | A |
| | (<u>Acer</u> - <u>Tilia</u> association over 80 years old - | 0 | B |
| | (<u>Fraxinus</u> - <u>Ulmus</u> association over 80 years old - | 0 | C |
| Advanced | (<u>Quercus</u> - <u>Carya</u> association 35 to 80 years old - | 20 | D |
| | (<u>Acer</u> - <u>Tilia</u> association 35 to 80 years old - | 4 | E |
| | (<u>Fraxinus</u> - <u>Ulmus</u> association 35 to 80 years old - | 6 | F |
| Second Growth | (<u>Quercus</u> - <u>Carya</u> associates and a <u>Cornus</u> - (<u>Corylus</u> layer 20 to 35 years old - | 170 | G |
| | (<u>Quercus</u> - <u>Carya</u> associates and a <u>Cornus</u> - (<u>Corylus</u> layer 10 to 20 years old - | 2 | H |
| | (<u>Quercus rubra</u> - <u>Tilia</u> - <u>Acer</u> - <u>Betula</u> (faciation 20 to 35 years old - | 16 | I |
| | (<u>Quercus rubra</u> - <u>Tilia</u> - <u>Acer</u> - <u>Betula</u> (faciation 10 to 20 years old - | 1 | J |
| | (<u>Populus</u> consociation | 9 | K |
| | (Saplings, stump sprouts, and briars (5 to 10 years old - | 4 | L |
| | (Early herb and briar stage 1 to 5 years old - | 2 | M |

Table 2. Brood flushes recorded from various cover types during June, 1966,
Little Paint Creek Area.

| Cover type | A | G | H | K | M |
|--------------------------------|------|------|------|------|------|
| Brood flushes in cover type | 2 | 4 | 1 | 1 | 1 |
| Percentage of cover use | 22.2 | 44.4 | 11.1 | 11.1 | 11.1 |

Table 3. Brood flushes recorded from various cover types during July, 1966,
Little Paint Creek Area.

| Cover type | F | G | H | I | J |
|--------------------------------|------|------|------|-----|-----|
| Brood Flushes in cover type | 3 | 10 | 4 | 2 | 2 |
| Percentage of cover use | 14.3 | 47.5 | 19.0 | 9.5 | 9.5 |

June or July and may reflect the greater brood movement. Certain types, such as H, appear to be used occasionally, but consistently, by broods. Polderboer (1940) observed a preference for type D and L in June, H, K, and L in July, and B, E, K, and L during August.

Distribution of brood flushes was, in general, related to changing food availability. For example, during June, red and black raspberry patches were favored cover types; while in August, choke cherry, black cherry, and blackberry were favored. Most flushes were near an open field or openings larger than 20 feet in diameter. The majority of flushes was made on upper ridges, although four sightings were recorded on lower slopes. There appeared to be no pattern of specific cover being used at different times of the day; however, most of the searching effort was made during late morning and early to middle afternoon.

Drumming logs. Eighteen drumming logs were located and described. Most logs were used infrequently or not at all during the summer. Drumming was heard on three separate occasions during early June, and again on August 30. A general description of the logs would include (1) being located in dense understory with medium to dense canopy, (2) within 100 feet or closer to an opening 20 feet or more in diameter and (3) beginning to decay and at least partially moss covered. Usually a main log with 20-30 droppings on it could be distinguished from at least one accessory log nearby with only 5-20 droppings.

Trapping.

Mirror traps: Traps were placed on seven logs during the summer and males were trapped on four of the seven. Logs with fresh droppings were selected as trap sites. Trapping results and presence of droppings indicate at least intermittent use of drumming logs during the summer months (Table 6). Logs were checked regularly following capture of a male. No sign was present to indicate the bird returned to the sight of capture.

Lily-pad traps: A total of 41 birds was captured during 609 trap nights for a success of 6.7 percent. Trapping success increased to a peak of 19 percent during the last week in August (Fig. 1).

Relationship of cover type and trapping success (Table 7) shows greater success in second growth hardwoods (type G). A number of the traps were placed in cover because of the presence of broods and thus constitute a bias toward brood cover.

Predation on birds captured in lily-pad traps was 19.5 percent (8 birds). Seven of the birds were killed by red fox (*Vulpes fulva*), and one was killed by an unknown avian predator. Four of the birds killed by fox were in one trap. This trap was removed because of repeated predation. Running of the traps in the afternoon (Gullion 1966) may partially reduce loss to predators.

Marking. A total of 45 grouse was captured in mirror and lily-pad traps. Four were recaptures of marked birds. After adjustment for known mortality, a total of 21 birds was believed to have been wearing backtags on the study area as of August 31.

Table 4. Brood flushes recorded from various cover types during August, 1966,
Little Paint Creek Area.

| Cover type | A | D | E | F | G | H | I | J | L | M |
|--------------------------------|------|-----|-----|-----|------|-----|-----|-----|-----|-----|
| Brood flushes in cover type | 3 | 2 | 1 | 2 | 6 | 1 | 2 | 1 | 2 | 1 |
| Percentage of cover use | 14.3 | 9.5 | 4.8 | 9.5 | 28.6 | 4.5 | 9.5 | 4.8 | 9.5 | 4.8 |

Table 5. Index of brood flushes recorded from various cover types during summer 1966,
Little Paint Creek Area, divided by acreage of individual cover types on the
study area.

| Cover type | A | D | G | I |
|--------------------------------|------|------|------|------|
| Brood flushes in cover type | 5 | 2 | 20 | 4 |
| Acres of cover type | 126 | 20 | 170 | 16 |
| Index of utilization | 0.04 | 0.10 | 0.12 | 0.25 |

Table 6. Male ruffed grouse captured in mirror traps, Little Paint Creek study area, summer 1966.

| Date captured | Trap nights prior to capture |
|---------------|------------------------------|
| June 17 | 2 |
| June 30 | 8 |
| July 16 | 26 |
| July 31 | 2 |

Table 7. Relationship of trapping success and cover type, Little Paint Creek study area, summer 1966.

| Cover type | A | F | G | I | L | M |
|-----------------------------------|------|-----|------|------|-----|------|
| Captures in cover type | 5 | 4 | 21 | 6 | 1 | 4 |
| Percent of effort in cover type | 9.2 | 4.3 | 47.0 | 2.8 | 3.3 | 14.6 |
| Percent of captures in cover type | 12.2 | 9.8 | 51.0 | 14.6 | 2.5 | 9.8 |

Juvenile sex ratio. Of a live-trapped sample of 29 juvenile ruffed grouse, 8 were females, 14 were males, and 7 were either too young to sex or had been eaten by predators before being observed.

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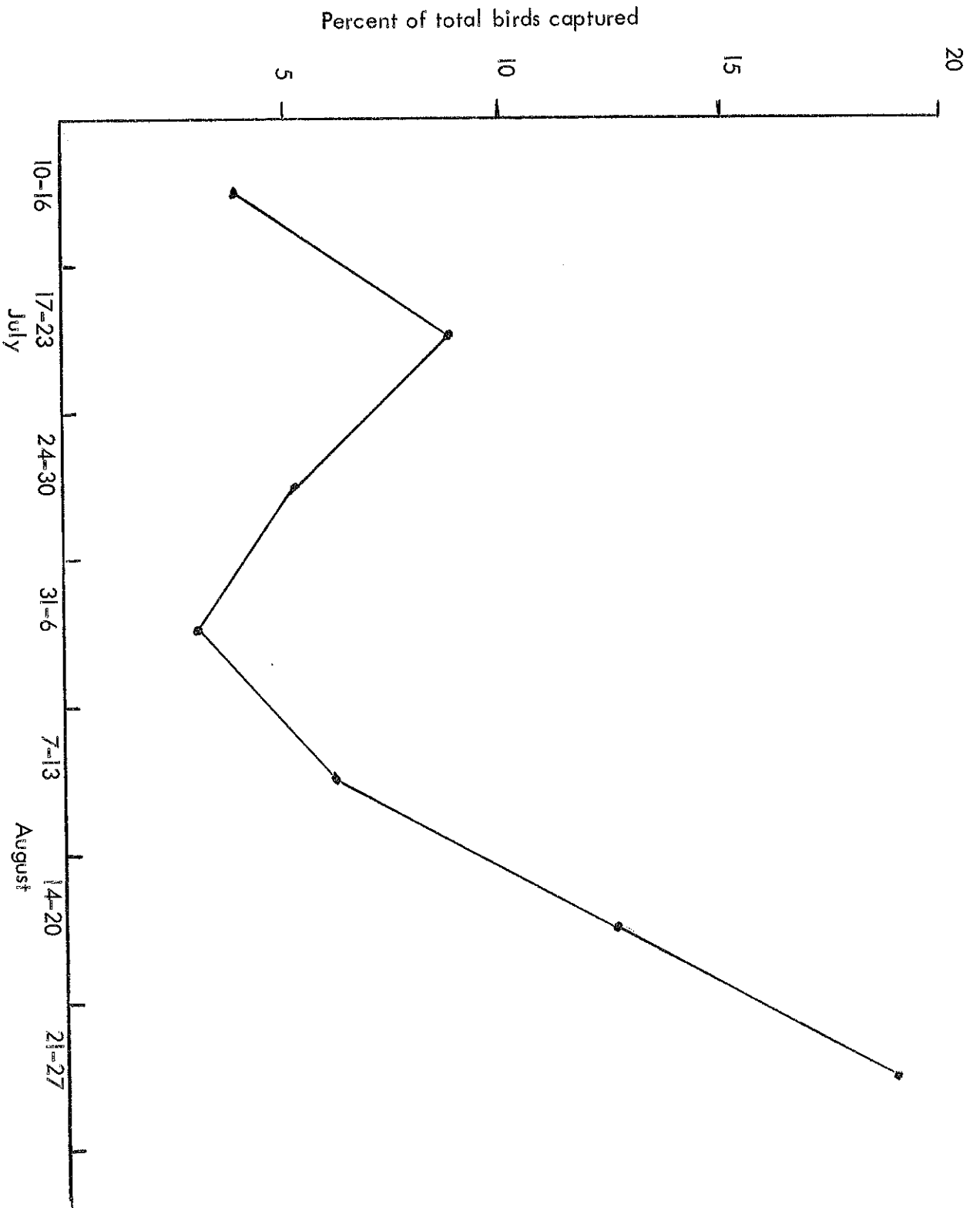


Fig. 1. Trapping success of ruffed grouse, Little Paint study area, summer 1966.

