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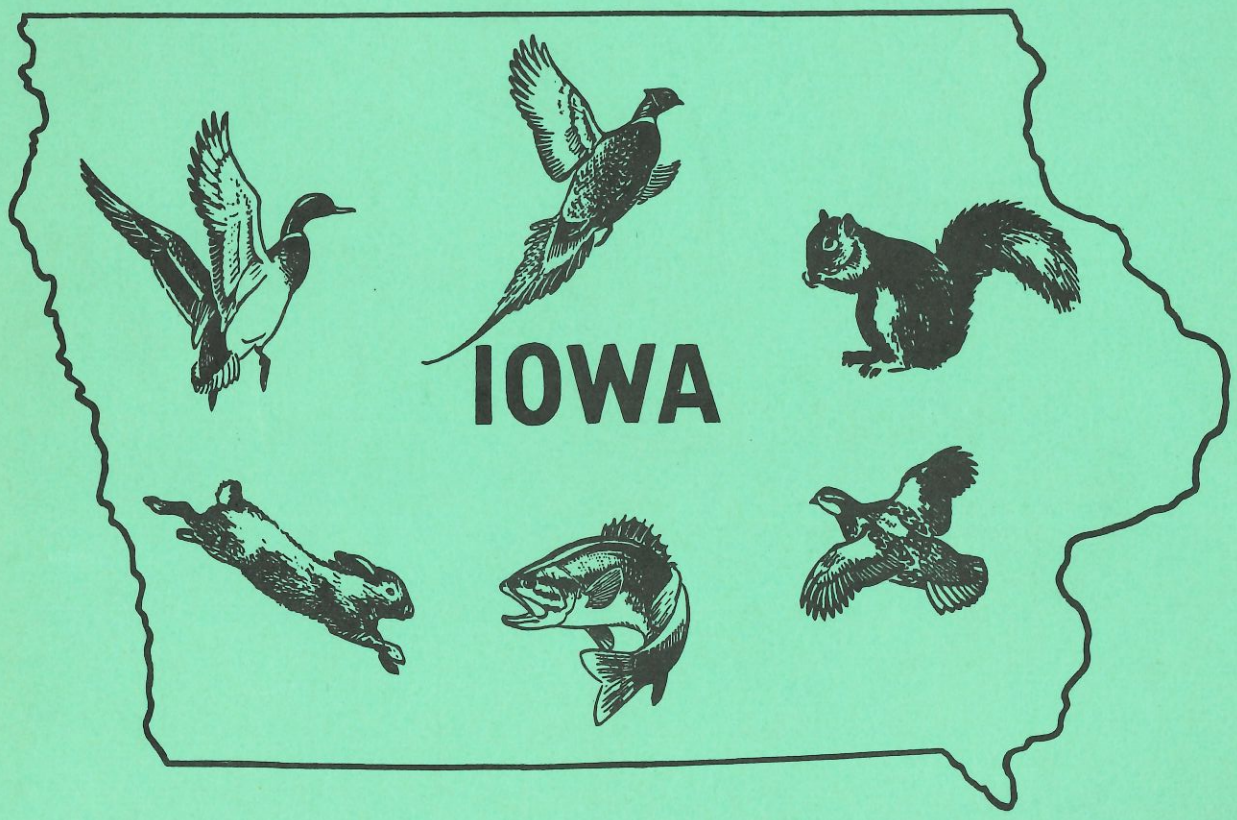
# QUARTERLY BIOLOGY REPORTS




FISH AND GAME DIVISION — BIOLOGY SECTION

STATE CONSERVATION COMMISSION

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## 1969 OFFICER DEER ESTIMATES

Paul D. Kline
Game Biologist

Estimates by Conservation Officers indicate 23,327 deer were present in Iowa early in 1969. This is a 2.0 percent increase over 1968 estimates. Since 1963 populations as reported by officers have increased in western and southern Iowa, decreased in east-central and northeast Iowa, and remained stable in the north-central area. The estimated fall hunting population will be ≠32,650. The 1969 regulations are designed to permit a modes increase in the deer herd.

## WOODCOCK SINGING-GROUND SURVEY, 1969

Gene Hlavka
Game Biologist

For the ninth consecutive year Iowa has cooperated with the U.S. Fish and Wildlife Service in the annual woodcock singing-ground survey. This survey is conducted to determine changes in the resident breeding population. The 1969 index of 0.19 woodcock heard per stop is slightly below the 9-year average. Iowa has a closed season on woodcock while neighboring states permit liberal seasons. A woodcock season concurrent with a grouse season could promote quality hunting with an opportunity for a mixed bag.

## THE 1968-69 IOWA QUAIL HUNTING SEASON

M. E. Stempel
Game Biologist

Gene Hlavka
Game Biologist

The 98 day 1968-69 Iowa quail hunting season extended from October 26, 1968 through January 31, 1969. The post-season hunter survey showed the season results were similar to those of the previous 3 years, i.e., very good. A total of 62,484 hunters, or 23 per cent of all licensed hunters, bagged 777,687 quail. The rate of kill of 1.8 hours of hunting per bird bagged was slightly better than last year. A special survey of experienced shooters in prime quail country showed they took birds at the rate of 0.89 hours per bird, also slightly better than the previous year. The amount of quail hunting that took place in January this year was less than the previous 3 years, no doubt because the weather was much rougher and less conducive to hunting.

## IOWA'S SPRING PHEASANT POPULATION - 1969

Richard C. Nomsen
Game Biologist

Iowa's 1969 statewide spring pheasant population was down 10-15 per cent, with the greatest decrease occurring in Northwest Iowa. The spring population in the southeast third of the pheasant range was the same or slightly higher than in 1968. Extremely poor censusing conditions during the survey caused an undetermined portion of the recorded decrease. The harsh winter in northern and northwestern counties caused above normal winter loss in this area of Iowa's pheasant range.

## FOX MOVEMENT STUDIES IN IOWA 1966-1969

Ron Andrews
Game Biologist

To provide information needed to properly manage the red fox as a game animal and predator in Iowa, a fox tagging project was initiated in 1966 to determine dispersal, population status, and mortality of this species. Hunting, trapping and road kills are the major factors causing mortality. A total of 85 foxes were tagged in 1966, with a 46 per cent tag return; 259 foxes were tagged in 1967, with nearly a 20 per cent return; 388 foxes were tagged in 1968, with approximately a 40 per cent return rate on these. In 1969, 260 foxes were tagged. Preliminary analysis of the data indicates that male foxes disperse an average of 22 miles prior to and during their first breeding season while females move an average of 71/2 miles. Extremes of these movements has varied from less than one mile to over 100 miles. The heavy snows during the winter of 1968-69 and the high prices paid for fox pelts encouraged considerable interest in fox hunting by the Iowa sportsmen. We hope this increased interest and the publicity from our tagging project will promote a more specific hunting season for Iowa foxes. This would help reduce the indiscriminate killing of fox pups that often takes place under the continuous open season now in effect.

## PRELIMINARY RESULTS OF ARTIFICIAL NEST BASKET STUDY

Richard Bishop
Game Biologist

A project was designed in 1964 to try and increase mallard production on state owned marshes. An artificial nesting structure that was relatively predator proof was designed, and 222 of these nests were erected on 11 state areas in the spring of 1964. Data obtained from 1964 through 1966 indicated that 209 baskets (38 per cent) were used out of 555 baskets that were checked. Of the 209 nests used, 203 were used by mallards, 5 by redheads and 1 by a blue-winged teal. A total of 179 nests hatched (86 per cent ) out of the 209 nests and 76 per cent of the eggs laid were hatched. The project indicated that local production could be

increased because of decreased rate of nest destruction found with the baskets. Nesting populations can be increased to some extent, but reliable data to determine to what extent they can be increased is lacking.

## RUFFED GROUSE STUDIES, 1969 (PROGRESS REPORT)

Lee Gladfelter
Game Biologist

A project to learn more about the status of ruffed grouse in Iowa was initiated by the Conservation Commission in 1961. The objectives of this study are (1) to determine the present population density of the species in Iowa, (2) to determine the possibility of re-establishment of the species in some of its former range in the state, and (3) to evaluate the hunting potential of ruffed grouse in Iowa. Roadside drumming counts were again made on nine major routes in northeastern Iowa in the spring of 1969. A mean of 1.37 drums per stop was heard and represents a six per cent decline in the population since the 1968 count. A full time trapping program will be initiated in the fall of 1970 with a goal of transplanting 50 grouse to each of the Shimek and Stephes State Forests. The first hunting season in 45 years was conducted in Iowa in the fall of 1968. An estimated 720 ruffed grouse were harvested by 1150 Iowa hunters which represented a six per cent rate of harvest of the fall grouse population.

## PROJECTED CHANGES IN AQUATIC HABITATS OF THE MISSISSIPPI RIVER ASSOCIATED WITH POOL LEVEL RAISES

Don R. Helms
Fisheries Biologist

The proposed 12-foot navigation channel for the upper Mississippi River has created a need for a method of projecting changes resulting from different pool level raises. This paper proposes a method for determining aquatic habitat changes. Alterations in habitat are calculated by this method for pools 9 through 19 for one, two and three foot pool level raises.

## CREEL CENSUS RESULTS FROM THREE IOWA LAKES - 1968-69

Terry Jennings
Fisheries Biologist

Data are presented on the results of a comprehensive creel census made on Spirit Lake, West Okoboji, and East Okoboji. During the 1968-69 census period 18.7 pounds of fish-per-acre were caught from Spirit Lake. West Okoboji yielded 21.1 pounds-per-acre. Fishermen harvested 24.7 pounds-per-acre from East Okoboji.

## ANGLER UTILIZATION AND SURVIVAL OF WALLEYE IN LAKE MACBRIDE

Larry R. Mitzner
Fisheries Biologist

Angler utilization of walleye in Lake MacBride was determined by creel census and angler returns of marked fish. Both methods yielded minimum estimates, but revealed both harvest and angling pressure have increased over 9 fold since 1963. A minimum harvest rate of approximately 10% was found in 1968. Total annual mortality rate was 0.29.

## AN EVALUATION OF THE 1968 FISH KILL IN THE DES MOINES RIVER BELOW DES MOINES

Jim Mayhew
Assistant Superintendent of Biology

and

Gaige Wunder
Fisheries Biologist

An evaluation of the pollution caused fish kill in the Des Moines River below Des Moines in 1968 is presented. Bypassing of large quantities of raw domestic and industrial sewage at the Des Moines Sewage Treatment Plant created large BOD upon the river and resulted in depletion of DO for a considerable length of time. Fish loss occurred for a distance of 70 miles downstream. Drastic changes occurred in species composition of the catch in a study area 40 miles downstream the following summer. Catch success was also reduced by as much as 75% in comparison to other years. Approximately 54% of the channel catfish population was killed in the study area. Many carp and river carpsucker were also lost as a result of this catastrophe.

# PROGRESS REPORT OF SPIRIT LAKE WALLEYE STUDIES

## 1968 POPULATION ESTIMATE

Terry Jennings
Fisheries Biologist

A mark and recapture study of the walleye population in Spirit Lake was completed in 1968. A total of 1,672 walleye > 12 inches total length were marked with monel metal jaw tags. A population estimate of 27,280 resulted from data collected by a creel census. This estimate is considered the best estimate of the population. This is indicative of a low walleye population density in Spirit Lake. These data were separated into 2-inch length groups and an estimate was made for each length group.

Anglers voluntarily returned 232 tags or a minimum exploitation rate of 14%. A higher rate of exploitation (24%) can be calculated using the estimated total harvest of walleye by anglers and the population estimate. This rate is probably nearer the true percentage which is considerably below the 40% obtained in 1967 and the 33% for all previous studies.

# 1969 OFFICERS DEER ESTIMATES

Paul D. Kline
Game Biologist

## INTRODUCTION

Conservation Officers have been making winter estimates of deer since 1947. This has been an annual survey; only during one year, 1949, was it not conducted.

In accepting the results of this survey it is fully realized that precise counts of deer are impossible to make, even by men who are unquestionably familiar with the people and wildlife of their territories as are the majority of Conservation Officers. However, I believe, over any large portion of Iowa and during a period of three years or more, that these surveys do show population trends, whether up, down, or stable. The numbers may not be precise but the trends will appear.

## METHODS

The method used in this survey has not altered through the years. In winter, following the deer season, officers are sent county maps of their respective territories and requested to mark on these maps locations of deer herds and numbers of deer in each herd. The maps are then returned to the Biology Section where the results are tabulated.

In compiling the results of the 1969 survey, Zones from the 1969 gun season are used. This was done so the data might be related more readily to other deer research work - hunter success statistics for example. Also, because 1963 was the first year during which hunting Zones were used, comparisons are drawn with data from 1963 and 1968.

## RESULTS

A list of counties with estimates for years 1963, 1968, and 1969 appears in Table 1. Fifty three counties show population increases since 1968, 41 show declines. All Zones showed increased populations except Zone 3. Since 1963 increasing populations appear in Zones 1, 2, and 5; declining populations in Zones 3 and 4 (Table 2).

The statewide estimated population of 23,327 was up 2.0 percent from 1968 and 19.2 percent from 1963 (Table 3). Population declines had been reported both in 1967 and 1968.

The fall population (multiplying 23,327 x 1.7) will be less than 39,656 deer. Probably a more realistic fall population estimate would be achieved by multiplying the spring population estimate by 1.4. This is the factor which showed actual annual increase in deer populations from 1947 to 1953 prior to hunting seasons. It is more realistic in that it accounts for mortality other than legal hunting. Using the 1.4 factor gives us an expected fall population of $\pm$ 32,659.

## DISCUSSION

Deer license quotas and season length for 1969 have been altered to reduce hunting pressure some and permit a modest increase in the deer herd. It is planned to continue this policy of slowly increasing the herd over a period of years in an effort to substantially increase hunting recreation in the future. I feel that the 2.6 million acres of forest land and other deer habitat in Iowa can support two to four times as many deer as we currently have. The limiting factor in the long run will not be habitat; it will be public tolerance. When and if deer become so numerous in any locale as to be regarded a nuisance by farmers or the public then it will be a relatively simple task to relax hunting restrictions and harvest surplus deer.

Table 1. Conservation officer deer estimates by counties for 1963, 1968, and 1969

| County | Estimates* | | |
|---|---|---|---|
| | 1963 | 1968 | 1969 |
| Adair | 189 | 295 | 245 |
| Adams | 70 | 83 | 90 |
| Allamakee | 750 | 1,500 | 1,200 |
| Appanoose | 84 | 161 | 145 |
| Audubon | 87 | 105 | 130 |
| Benton | 39 | 65 | 73 |
| Black Hawk | 139 | 81 | 91 |
| Boone | 106 | 121 | 173 |
| Bremer | 117 | 60 | 62 |
| Buchanan | 138 | 70 | 50 |
| Buena Vista | 51 | 53 | 53 |
| Butler | 220 | 60 | 78 |
| Calhoun | 30 | 25 | 35 |
| Carroll | 35 | 56 | 68 |
| Cass | 220 | 160 | 240 |
| Cedar | 77 | 155 | 75 |
| Cerro Gordo | 25 | 40 | 39 |
| Cherokee | 111 | 126 | 185 |
| Chickasaw | 120 | 45 | 50 |

Table 1. Continued

| County | Estimates* | | |
|---|---|---|---|
| | 1963 | 1968 | 1969 |
| Clarke | 450 | 550 | 600 |
| Clay | 112 | 122 | 104 |
| Clayton | 1,150 | 765 | 950 |
| Clinton | 160 | 217 | 112 |
| Crawford | 375 | 550 | 500 |
| Dallas | 242 | 400 | 420 |
| Davis | 89 | 237 | 275 |
| Decatur | 590 | 750 | 750 |
| Delaware | 283 | 140 | 120 |
| Des Moines | 410 | 686 | 585 |
| Dickinson | 75 | 65 | 80 |
| Dubuque | 200 | 90 | 115 |
| Emmet | 80 | 88 | 116 |
| Fayette | 80 | 87 | 160 |
| Floyd | 155 | 143 | 140 |
| Franklin | 135 | 47 | 69 |
| Greene | 88 | 117 | 107 |
| Grundy | 5 | 9 | 9 |
| Guthrie | 527 | 773 | 725 |
| Hamilton | 111 | 99 | 90 |

Table 1. Continued

| County | Estimates | | |
|---|---|---|---|
| | 1963 | 1968 | 1969 |
| Hancock | 33 | 32 | 44 |
| Hardin | 115 | 113 | 110 |
| Harrison | 260 | 550 | 707 |
| Henry | 153 | 250 | 287 |
| Howard | 165 | 100 | 80 |
| Humboldt | 80 | 104 | 91 |
| Ida | 57 | 26 | 49 |
| Iowa | 127 | 130 | 130 |
| Jackson | 595 | 280 | 220 |
| Jasper | 106 | 145 | 195 |
| Jefferson | 192 | 112 | 114 |
| Johnson | 130 | 140 | 145 |
| Jones | 160 | 370 | 285 |
| Keokuk | 146 | 122 | 233 |
| Kossuth | 73 | 185 | 155 |
| Lee | 237 | 525 | 386 |
| Linn | 220 | 170 | 182 |
| Louisa | 85 | 136 | 104 |
| Lucas | 530 | 515 | 610 |

Table 1. Continued

| County | Estimates* | | |
|---|---|---|---|
| | 1963 | 1968 | 1969 |
| Lyon | 155 | 140 | 135 |
| Madison | 300 | 600 | 660 |
| Mahaska | 139 | 150 | 215 |
| Marion | 129 | 131 | 141 |
| Marshall | 133 | 76 | 72 |
| Mills | 264 | 386 | 393 |
| Mitchell | 135 | 129 | 137 |
| Monona | 775 | 705 | 640 |
| Monroe | 285 | 620 | 540 |
| Montgomery | 194 | 313 | 303 |
| Muscatine | 80 | 72 | 115 |
| O'Brien | 35 | 74 | 35 |
| Osceola | 21 | 25 | 23 |
| Page | 188 | 219 | 141 |
| Palo Alto | 44 | 130 | 129 |
| Plymouth | 315 | 220 | 340 |
| Pocohontas | 45 | 40 | 49 |
| Polk | 120 | 135 | 160 |
| Pottawattami | 1,385 | 1,109 | 1,321 |

Table 1. Continued

| County | Estimates* | | |
|---|---|---|---|
| | 1963 | 1968 | 1969 |
| Poweshiek | 65 | 55 | 55 |
| Ringgold | 85 | 196 | 300 |
| Sac | 87 | 55 | 88 |
| Scott | 58 | 77 | 60 |
| Shelby | 215 | 375 | 308 |
| Sioux | 205 | 114 | 128 |
| Story | 72 | 66 | 74 |
| Tama | 63 | 114 | 115 |
| Taylor | 38 | 113 | 75 |
| Union | 85 | 215 | 275 |
| Van Buren | 109 | 650 | 600 |
| Wapello | 162 | 310 | 285 |
| Warren | 144 | 166 | 165 |
| Washington | 240 | 168 | 247 |
| Wayne | 120 | 199 | 260 |
| Webster | 160 | 140 | 160 |
| Winnebago | 60 | 85 | 110 |
| Winneshiek | 775 | 350 | 500 |
| Woodbury | 370 | 440 | 385 |

Table 1. Continued

| County | Estimates* | | |
|---|---|---|---|
| | 1963 | 1968 | 1969 |
| Worth | 70 | 83 | 70 |
| Wright | 72 | 50 | 61 |

* In some instances officers gave maximum and minimum estimates for individual counties. Means of these estimates are used in this report.

Table 2. Officers deer estimates: A comparison by zones (1969) of 1963, 1968, and 1969

| Zone | 1963 | 1968 | 1969 | Percent Change 1968-69 | Percent Change 1963-69 |
|---|---|---|---|---|---|
| 1 | 5,018 | 5,395 | 5,735 | + 6.3 | + 14.3 |
| 2 | 6,217 | 9,753 | 9,885 | + 1.4 | + 59.0 |
| 3 | 3,141 | 2,829 | 2,643 | - 6.6 | - 15.9 |
| 4 | 3,072 | 2,802 | 2,922 | + 4.3 | - 4.9 |
| 5 | 2,117 | 2,091 | 2,142 | + 2.4 | + 1.2 |
| Statewide | 19,565 | 22,870 | 23,327 | + 2.0 | + 19.2 |

Table 3. Deer population estimates 1958-69

| Year | Number Deer Reported | Percent Change from Previous Year |
|---|---|---|
| 1958 | 10,643 | ------ |
| 1959 | 11,705 | + 10.0 |
| 1960 | 13,101 | + 11.9 |
| 1961 | 14,155 | + 8.0 |
| 1962 | 15,938 | + 12.6 |
| 1963 | 19,565 | + 22.8 |
| 1964 | 21,580 | + 10.3 |
| 1965 | 25,573 | + 18.5 |
| 1966 | 28,482 | + 11.4 |
| 1967 | 25,450 | - 10.6 |
| 1968 | 22,870 | - 10.1 |
| 1969 | 23,327 | + 2.0 |

# WOODCOCK SINGING-GROUND SURVEY, 1969

Gene Hlavka
Game Biologist

Singing-ground counts have been conducted annually throughout much of North America's primary woodcock nesting range since 1953 (Goudy 1966). These surveys are conducted to determine changes in the spring breeding population. The Iowa survey, in cooperation with the U. S. Fish and Wildlife Service, has been conducted each spring since 1961. Iowa has a closed season on woodcock while neighboring states permit liberal seasons.

The male woodcock performance consists of "peenting" on the ground and "twittering and chirping" in the air. The males begin their performances from 10 to 30 minutes after sunset, depending on the amount of cloud cover. The number of different woodcock heard "peenting" in a 2-minute listening period forms the basis for the singing-ground survey.

Male singing-ground activities begin prior to and during migration each spring and continue beyond the nesting period. The singing-ground surveys are timed to start after migrants have left an area and are done to obtain an index to the size of the resident population. Survey dates specified were April 15 to May 5 for the southern two thirds of Iowa; April 20 to May 10, for the northern third. Established routes along roads were used. Selected stops on the routes are at least 0.4 miles apart. The counts are limited to 35 minutes and are conducted by experienced Game and Biology Section personnel.

Nine counts were made in the eastern half of Iowa. Woodcock were heard on 6 routes. Two routes were discontinued. Two counts could not be made because of flooding. One exploratory route was run. A mean of 0.19 birds per stop was computed from 12 woodcock heard at 63 stops (Table 1). The 1969 index of 0.19 woodcock heard per stop is slightly below the 9-year average (Table 2).

One woodcock brood of 4 chicks was observed by Parks Section personnel on April 18, 1969 at Red Haw State Park. Photos of the hen and brood were taken by Jim Smith, Chariton newspaper photographer. Previous brood sightings and the annual singing-ground surveys point out that woodcock, although certainly not abundant, are widely distributed in Iowa.

## DISCUSSION

During the 9 years of the singing-ground surveys in Iowa, the resident breeding population has been relatively stable. Of the 14 Mississippi Flyway States, Iowa was the only state that did not allow an opportunity to participate in the sport of woodcock hunting. Our neighboring states of Minnesota, Wisconsin, Illinois and Missouri each permitted a woodcock season of 65 days in 1968. The daily bag was 5; the possession limit, 10.

An Iowa woodcock season concurrent with the ruffed grouse season could provide for a mixed bag --- and possibly some satisfied hunters. The woodcock habit of allowing a close approach should permit some good dog work. Brushy cover and whistling wings would cause

Table 1. Results of spring, 1969, woodcock singing-ground counts in Iowa

| Route | County | No. of Countable Stops | No. of Woodcock Heard | Woodcock heard per Stop |
|---|---|---|---|---|
| Paint Creek | Allamakee | 9 | 3 | 0.33 |
| Luster Heights | Allamakee | 7 | 1 | 0.14 |
| Wapsie Bottoms | Bremer | 5 | 1 | 0.20 |
| Buck Creek | Clayton | 9 | 2 | 0.22 |
| Sny Magill | Clayton | 8 | 3 | 0.38 |
| Rock Creek | Jasper | Discontinued because of camper activity | | |
| Sugar Creek | Lee | Discontinued because no woodcock have been heard | | |
| Klum Lake | Louisa | Not run because of flooding | | |
| City Lakes | Lucas | 5 | 0 | 0.00 |
| Colyn Area | Lucas | 3 | 0 | 0.00 |
| Otter Creek | Tama | Not run because of flooded road | | |
| Blakesburg | Wapello | 8 | 0 | 0.00 |
| Canoe Creek | Winneshiek | 9 | 2 | 0.22 |
| Lower Big Paint* | Allamakee | (7) | (2) | (0.29) |
| Totals (9 routes) | | 63 | 12 | 0.19 |

* Exploratory route : road poor, frog choruses at each stop. Data not used.

Table 2. Indexes to the size of the woodcock breeding population in the eastern half of Iowa, 1961-69

| Year | No. of Stops | No. of Woodcock Heard | No. of Woodcock Heard per Stop | No. of Routes |
|---|---|---|---|---|
| 1961 | 46 | 10 | 0.22 | 4 |
| 1962 | 42 | 9 | 0.21 | 5 |
| 1963 | 92 | 32 | 0.35 | 10 |
| 1964 | 108 | 17 | 0.16 | 12 |
| 1965 | 84 | 14 | 0.17 | 10 |
| 1966 | 113 | 26 | 0.23 | 13 |
| 1967 | 99 | 22 | 0.22 | 13 |
| 1968 | 93 | 20 | 0.22 | 12 |
| 1969 | 63 | 12 | 0.19 | 9 |
| 9-yr. Avg. | 82 | 18 | 0.22 | 10 |

many primers to be dented before the daily bag of 5 birds was filled.

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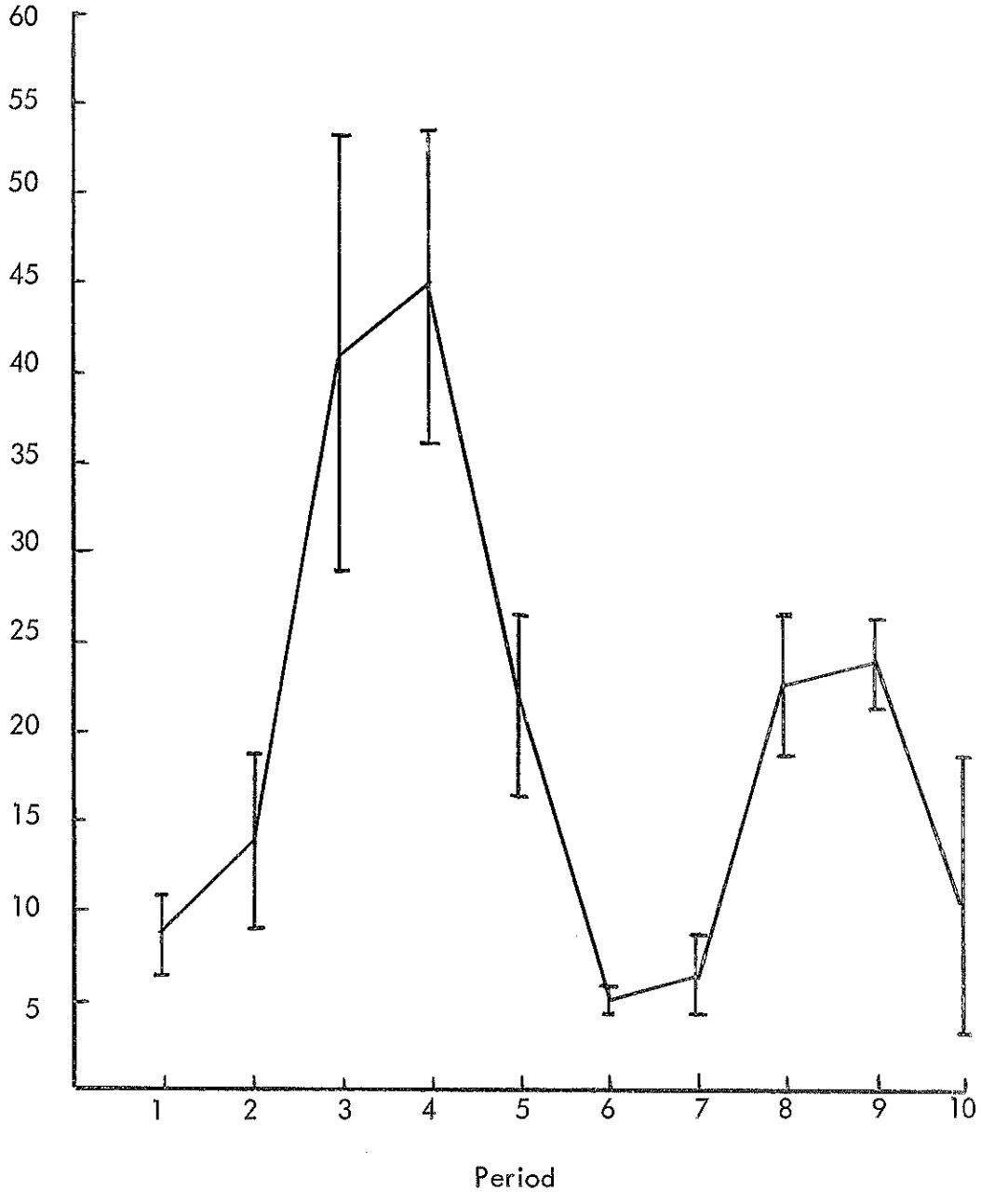


Figure 1. Catch success of channel catfish at bi-weekly intervals in 1967. Brackets represent standard deviation of the mean

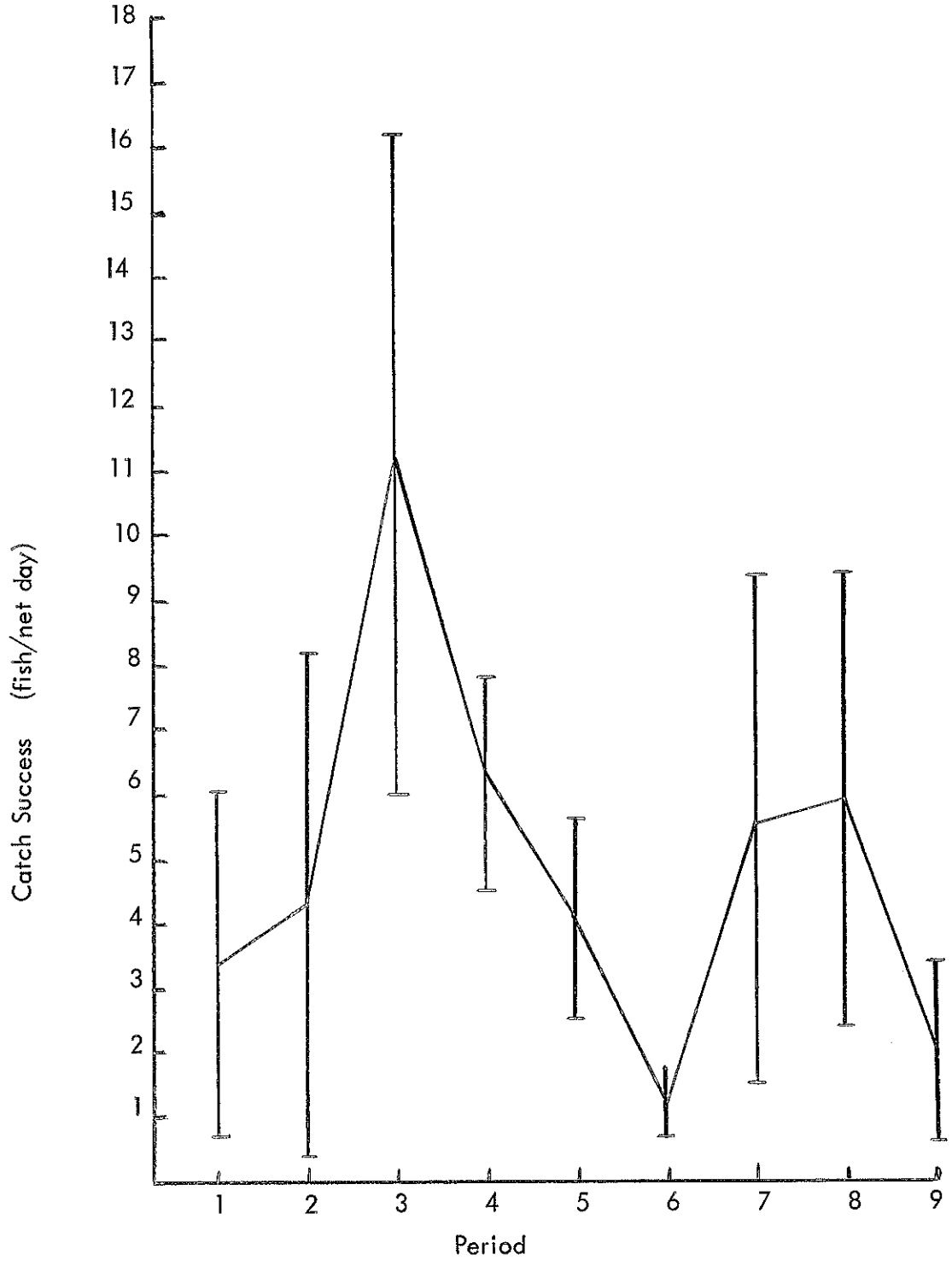


Figure 2. Catch success of channel catfish at be-weekly intervals in 1968. Brackets represent standard deviation of the mean.

# THE 1968-69 IOWA QUAIL HUNTING SEASON

M. E. Stempel, Game Biologist
Gene Hlavka, Game Biologist

## INTRODUCTION

This report of quail hunting success for the past season is based primarily on a hunter post-card survey. About 5,000 hunters were contacted and data received from them are here expanded to represent the 1968-69 quail hunting success of all Iowa quail shooters. Also included is information from a special research area and data from a survey of a group of experienced southern Iowa quail shooters.

Since 1960, Iowa winters and most other seasons have favored survival and production of bobwhites. Hence, Iowa could offer increasingly longer hunting seasons due to the comparatively high quail populations. The 1968-69 quail hunting season extended from October 26, 1969 to January 31, 1969; shooting hours, 8:00 a.m., to 4:30 p.m. daily; bag limit 8, possession limit 16. For 1967-68 the season was October 21, 1967 to January 28, 1968. For 1966-67 the season was October 22, 1966 to January 31, 1967; for all above seasons, shooting hours and bag-possession limits were the same. For the 1965-66 period the season was November 6, 1965 to January 31, 1966, shooting hours 8:30 a. m. to 4:00 p.m.. For 1964-65 the season was October 31, 1964 to January 3, 1965, with shooting hours from 8:30 a.m. to 5:00 p.m. Bag and possession remained the same and the entire state was open for shooting.

The methods of postcard survey are outlined in the 1965 April-June Quarterly Biology Report, with about 2 per cent of resident hunters and 2 per cent of non-resident hunters being contacted.

## RESULTS

### Resident Licensees, Statewide

From the entire state, residents returned 1,561 cards of which 353 contained information on quail shooting. Twenty-three per cent had thus hunted quail. Resident hunters bagged 694,533 quail (Table 1). The 66,146 hunters made 357,188 trips involving 1,230,316 hours.

The average Iowa resident hunter who shot quail made 5.4 quail hunting trips during the 1968-69 season. The average outing for the individual was 3.4 hours, with 1.9 quail per trip, and a success rate of 1.8 hours of hunting per quail bagged.

The material for the 1968-69 season is presented here on a statewide basis. In a similar 1966 quail hunting report, success was discussed for various portions of Iowa. Since there were few significant regional weather variations the past 3 years, the trends in the different areas of the state were similar. For this reason the various parts of Iowa will not be discussed here. A survey of comparative success in various parts of the state is also set forth in the 1965 April-June Quarterly Biology Reports.

Non-Resident Hunters

In addition to licensed resident quail shooters, 73 non-residents returned hunting reports, and 24 of these (33 per cent) shot quail. Non-residents bagged 83,154 quail last year (Table 1) with 4,221 such hunters making 23,216 quail hunting trips involving 126,630 hours. Non-resident quail shooters recorded an average (per-man) hunting trip of 5.4 hours with 3.6 birds per trip at a rate of 1.5 hours per quail (0.66 bird per hour).

Since there were so few of these cards, the figures may not represent very precisely the true results of hunting by the non-residents.

January Quail Hunting

Because the month of January was added to the season in 1965-66 a special question was added regarding hunting during this month. It was found in the 1968-69 season that 50 per cent of reporting hunters went quail hunting in January with 22 per cent of the total season's trips being made during January. Forty-seven percent of the residents and 12 percent of non-residents who hunted during the month had bagged quail, with 23 per cent of the total take occurring in January (178,868 quail). Because of cold, rain, snow and ice, the winter weather was generally unfavorable for quail shooting.

The January hunting for 1966 through 1969 is shown in Table 2. The four-year January averages include about one-third of the statewide bag and one-third of the statewide trips, with 50 per cent of all quail hunters participating. The above figures are both resident and non-resident shooters. Only a few non-residents reported, hence their records are not entered separately.

## DISCUSSION AND COMPARISON WITH RELATED SURVEYS

The 1968-69 postcard survey showed a statewide quail hunting season which was similar to recent seasons. This amounted to nearly the same success in birds per hunter, with slightly less time per bird bagged as compared to 1967-68. This was due to a succession of favorable production years. The postcard survey indicated that the statewide bag was down 30 per cent from the all-time high of 1966-67. The concensus was that hunting was nevertheless satisfactory. In this respect, the 1968-69 success in hours per quail bagged was 1.8 compared to 1.9 in 1967-68. Experienced shooters contacted during the season took birds at a rate of 0.89 hour per bird in 1968-69, whereas it was 0.96 in 1967-68.

This survey indicated that 23 per cent of all licensed resident hunters do hunt quail. Of these residing in the primary quail country, about 50 per cent hunt quail. The latter figure was taken from an earlier survey.

Further information on quail hunting was obtained from interviews with farmers living on a 7,000 acre research area in quail range. This indicated that during the 6 days the season was open in October 30 per cent of the season's quail hunting occurred; in November the figure was 40, in December 16 and January 14. These results differ somewhat from the post-card survey figures. However, the farmers do not know of all hunting that takes place on their farms, so their impressions have considerable room for error.

## SUMMARY

1. A sample of 2 per cent of resident hunters and 2 per cent of non-resident Iowa hunters was contacted in early 1969 by mail.

2. Cards were filled out, and returned by 1,562 resident licensees and 73 non-resident licensees.

3. Twenty-three per cent of residents and 33 per cent of non-residents hunted quail.

4. Residents took 694,533 quail at 1.8 hours per quail; the non-resident rate was 1.1 on a bag of 83,154 birds.

5. Twenty-three per cent of the total quail bagged during the 1967-68 season, were taken in January.

6. According to farmer interviews, about 30 per cent of the total season hunting effort took place in October (first 6 days of the season) while the remaining effort was for November, December and January as follows: 40, 16, and 14.

Table 1. Results of 1968-69 Iowa Quail hunting season (from hunter postcard questionnaire)*

| | Resident | Non-resident | Total |
|---|---|---|---|
| Statewide quail bag | 694,533 | 83,154 | 777,687 |
| Total hunting hours | 1,230,316 | 126,630 | 1,356,946 |
| Total hunting trips | 357,188 | 23,216 | 380,404 |
| No. hunting this species | 66,146 | 4,332 | 70,367 |
| Per cent hunting this species | 23 | 33 | 23 |
| Avg. no. of trips per hunter | 5.4 | 5.2 | 5.4 |
| Avg. no. of gun hours per hunter | 18.6 | 30.0 | 19.3 |
| Avg. no. of hours per trip | 3.4 | 5.4 | 3.6 |
| Avg. no. bagged per hunter per season | 10.5 | 19.7 | 11.1 |
| Avg. no. bagged per trip | 1.9 | 5.6 | 2.0 |
| Avg. no. bagged per gun hour | 0.56 | 0.66 | 0.57 |
| Avg. no. hours per bird bagged | 1.8 | 1.5 | 1.8 |

* Based on 66,146 resident hunting and combination hunting and fishing licenses and 4,221 non-resident licenses

Table 2. Iowa January quail hunting

| Year | % of Statewide bag | % of Total Trips | % of all Quail Hunter Active |
|---|---|---|---|
| 1966 | 29 | 34 | 42 |
| 1967 | 33 | 37 | 59 |
| 1968 | 33 | 27 | 53 |
| 1969 | 23 | 22 | 44 |
| 4-year avg. | 30 | 30 | 50 |

# IOWA'S SPRING PHEASANT POPULATION - 1969

R. C. Nomsen
Game Biologist

The crowing cock count, which includes a 10-mile roadside survey, is the primary method for obtaining information on the spring pheasant population in Iowa. There were 172 routes checked this year by Conservation Officers, Unit Game Managers and Biologists.

The winter of 1968 - 1969 was cold, snowy, cloudy, icy, windy and long. Heavy snow in the northern counties and icing in southern areas were common during January and February. Schools were closed more days during January than they were open. Drifting snow in the northwest quarter of the state soon filled marginal winter cover and severely tested the quality of the remaining good winter cover. The adverse winter weather conditions caused above normal mortality in the northern pheasant range to near normal in the southern parts of Iowa.

## METHODS

The technique for conducting the spring crowing and roadside counts remained the same as in previous years. Results are given for the six major regions as well as statewide.

The winter pheasant count was conducted from January 1 to March 15, 1969, to determine the sex ratio of Iowa's post-season pheasant population. These results are presented and are used to complete the crowing cock count interpretation.

## RESULTS AND DISCUSSION

### Sex Ratio Count

Conservation Officers, Unit Game Managers and Biologists reported a total of 34,417 pheasants during the winter survey (Table 1). This total was the highest in recent years. The prolonged periods of heavy snow cover kept the birds concentrated near winter cover which made it easier to check a large sample.

The observed statewide sex ratio of 3.5 hens per cock indicted that hunters harvested 66 per cent of the cocks last fall. Observed sex ratios indicted that the rate of harvest was best in southwest and east regions - and was lowest in northwest regions.

Censusing conditions were generally poor in 1969 which would tend to lower the count. Cloudy, cool, and wet weather delayed counts in all regions (Table 3). The average completion date this year was May 14 - eight days later than in 1968.

The statewide hen index indicted that the 1969 population of hens was down 10 per cent compared to the average of the previous 5 years. It is difficult to compare these results directly with results obtained in 1968. As reported last year, the reliability of sex ratios obtained during the open winter of 1967 - 1968 should be used with caution. The hen index was determined by multiplying the average number of calls per stop by the observed sex ratio from winter observations.

## SPRING ROADSIDE COUNT

Results of the 1969 spring roadside count indicated a large decrease in Iowa's brood stock of pheasants but checking conditions were extremely unfavorable for this survey. Many fields of corn stubble remained undisturbed during the period of the count, making it difficult to see birds. Normally, these fields would have been worked and seeded down during April, but wet fields delayed planting of government ground until late May. There were only 2,281 birds sighted on 172 routes this year - an average of 1.33 birds per mile.

Thus, when all counts are considered, Iowa's 1969 statewide spring pheasant population was down 10-15 per cent with the greatest decrease in northwest Iowa. The spring population in the southeast third of the pheasant range was the same or slightly higher than in 1968. Extremely poor checking conditions during the survey caused an undetermined portion of the recorded decrease. The harsh winter in northern counties caused above normal winter loss in this area of Iowa's pheasant range. The results of our August survey should help answer some of these questions.

Table 1. Observed sex ratios, by regions, during the winter survey, 1968-69

| Region | Number of Hens | Number of Cocks | Sex Ratio 1969 | Sex Ratio 1968 |
|---|---|---|---|---|
| North west | 7,844 | 3,092 | 2.5 | 2.5 |
| North central | 4,798 | 1,315 | 3.6 | 2.9 |
| South west | 2,830 | 587 | 4.8 | 4.1 |
| Central | 6,127 | 1,630 | 3.8 | 5.1 |
| East | 4,159 | 866 | 4.8 | 5.0 |
| South | 951 | 218 | 4.4 | 4.9 |
| Statewide | 26,709 | 7,708 | 3.5 | 4.1 |

Table 2. Results of the 1969 spring crowing cock counts made by conservation officers, unit game managers, and biologists, and comparison with 1968 results

| Region of State | 1969 No. of Counts | 1969 Mean calls per stop | 1968 No. of Counts | 1968 Mean Calls per Stop | Change from 1968 |
|---|---|---|---|---|---|
| North west | 28 | 9.5 | 28 | 12.8 | -26% |
| North central | 27 | 11.1 | 26 | 13.8 | -20% |
| South west | 22 | 14.2 | 23 | 16.9 | -16% |
| Central | 28 | 12.4 | 27 | 14.8 | -16% |
| East | 30 | 8.7 | 34 | 9.0 | -3% |
| South | 37 | 8.8 | 38 | 8.0 | +10% |
| Statewide | 172 | 10.6 | 176 | 11.8 | -10% |

Table 3. Comparison of dates on which spring pheasant counts were taken and mean wind velocity during counts 1969 vs. 1968.

| Region of state | Mean Date of Counts 1969 | 1968 | Mean Wind (mph) 1969 | 1968 |
|---|---|---|---|---|
| North west | May 18 | May 11 | 3.1 | 2.7 |
| North central | May 20 | May 16 | 2.2 | 2.3 |
| South west | May 10 | April 30 | 2.7 | 1.0 |
| Central | May 12 | May 5 | 2.1 | 2.1 |
| East | May 13 | May 4 | 1.9 | 2.4 |
| South | May 12 | April 30 | 3.0 | 2.2 |
| Statewide | May 14 | May 6 | 2.5 | 2.1 |

Table 4. Results of spring population counts, 1964 - 1969

| Year | Calls Per Stop | Hen Index | Cocks per mile | Hens per mile | Birds per mile |
|---|---|---|---|---|---|
| 1964 | 11.9 | 42.8 | 0.80 | 1.96 | 2.76 |
| 1965 | 9.4 | 32.9 | 0.61 | 1.36 | 1.97 |
| 1966 | 13.1 | 41.9 | 0.80 | 1.77 | 2.57 |
| 1967 | 12.7 | 40.6 | 0.85 | 1.81 | 2.66 |
| 1968 | 11.8 | 48.1 | 0.81 | 1.92 | 2.73 |
| 1969 | 10.6 | 37.1 | 0.53 | 0.80 | 1.33 |

Table 5. Results of the 1969 spring roadside counts

| Region of State | Number of Miles | Number of Cocks | Number of Hens | Total Birds | Cocks per Mile | Hens per Mile | Total Birds per Mile | Observed Sex Ratio |
|---|---|---|---|---|---|---|---|---|
| North west | 280 | 91 | 85 | 176 | 0.30 | 0.63 | 0.93 | 0.9 |
| North central | 270 | 166 | 204 | 370 | 0.62 | 0.76 | 1.38 | 1.2 |
| South west | 220 | 148 | 270 | 418 | 0.67 | 1.23 | 1.90 | 1.8 |
| Central | 280 | 154 | 244 | 398 | 0.55 | 0.87 | 1.42 | 1.6 |
| East | 300 | 171 | 228 | 399 | 0.57 | 0.76 | 1.33 | 1.3 |
| South | 370 | 179 | 341 | 520 | 0.48 | 0.92 | 1.40 | 1.9 |
| Statewide | 1,720 | 909 | 1,372 | 2,281 | 0.53 | 0.80 | 1.33 | 1.5 |

# FOX MOVEMENT STUDIES IN IOWA
1966 - 1969

Ron Andrews
Game Biologist

## INTRODUCTION

In order to properly manage and assess the red fox (Vulpes Fulva) as a game animal and predator in Iowa it is necessary that we have a current knowledge of its population status, productivity, movements, mortality, and food habits. This paper deals with the preliminary results of a movement and mortality study initiated in 1966 by Robert Phillips, former Fur Bearer Biologist with Iowa. The year 1969 marked the fourth year of the five year study. When the study is completed an attempt will be made to describe the nature of the dispersal of the red fox as well as mortality factors significant to red fox populations and the ramifications therein. Approximately 1,000 red fox have been ear-tagged in Iowa during the past 4 years.

The project has been expanded cooperatively with three agencies involved - The Iowa Conservation Commission, The University of Minnesota's Department of Ecology and Behavioral Biology, and the U. S. Fish and Wildlife Service. The final analysis will be made by all three agencies and will incorporate ear tagging data from Iowa and Illinois and radio tracking data from the University of Minnesota.

## METHODS AND MATERIALS

A mechanical wire ferret was used to remove fox pups from their dens. The ferrets are made from spring steel wire varying in length from 20-60 feet. A spring 8 inches long is turned on one end of the ferret while a handle is bent at the other end. A wooden plug placed in the spring of the ferret creates a thumping noise as the ferret is twisted into each den. The noise either scares the young foxes from the den or their fur becomes entangled in the wire and the fox pups can be pulled out. A couple of men stand ready with dip nets to catch any foxes that the ferret scares out. Tagging operations take place from mid April to mid June.

Near the end of the tagging period, when pups are a third to half grown, padded traps are set to catch adults as well as pups at dens where the ferret does not work successfully.

Button-type ear tags are placed in each ear and each tag has an identifying number on one side and the words "Notify Iowa Conservation Commission, Boone, Iowa" on the other. Metal band type tags were used in 1966 but these proved to be less effective because they were less noticeable to persons taking a tagged fox.

The fox tagging area is located roughly across the north central, northeast one-fourth of Iowa (see figure 1). A small area in west central Iowa and another area in south central Iowa are also involved. The tagging areas are considered to have the higher densities of red fox compared with the rest of the state and therefore the effectiveness and efficiency

in locating dens is considerably better.

The majority of fox den locations are found by contacting State Conservation Officers, Game Biologists, Unit Managers and interested fox hunters and trappers. An airplane was also used to spot active fox dens in 1967, 1968 and 1969. Locating dens from the air worked well in 1967 and 1968 but was very inefficient in 1969.

## RESULTS AND DISCUSSION

In 1966 a total of 85 foxes was tagged and released at the den site. During 1967, 249 foxes were tagged. In 1968 and 1969 the tagging operations were supervised by myself and Richard Bishop, game biologist at Clear Lake. George Good, farmer and fox trapper from Randall, was in charge of all field operations. A total of 388 fox was tagged in 1968 and 260 in 1969. Table 1 shows the county breakdown of foxes captured during the 1969 tagging period.

At some dens farmers requested that we take all foxes caught from their property. In 1966 and 1967 most of these pups were taken to the Wildlife Research Station at Boone and raised until late summer when they were tagged and released in various parts of the state. Their return rate was very high and their longevity was short.

In 1968 we transplanted 61 unwanted foxes to other active fox dens. Of these 61 transplants, 22 tag returns were reported to us for a return rate of 36.1 per cent. This compares quite closely to the 37.3 per cent return of the foxes captured, tagged and released at their natal den site. This could be an indication that the majority of these foxes are adopted readily into the new litter, and we feel this is a much better way of handling these unwanted foxes. In 1969 very few fox were transplanted. This was due partly to the fact that the population was down somewhat and possibly to the fact that people are becoming more interested in and tolerant of the red fox.

Tag returns from 8 dispersing transplanted male fox pups indicated an average movement of 22.7 miles by males, while 6 transplanted females averaged 30.7 miles. Transplanted male movement compares quite close to normal fox movement, while the transplanted females moved 4 times farther than the normal female moved. The sample size is quite small in each case and until we have more data no conclusion can be made regarding the movement of these transplanted foxes.

### MOVEMENT

Table 2 shows us the average distances traveled during the first year of 189 red fox pups. October is the first month that we receive any significant number of tag returns and this is a likely indication that this is the month when the early dispersal of foxes begins. From the October to March period average first year movement by males was 22.1 miles while dispersing females averaged only 7.4 miles. Extremes of these movements have ranged from less than 1 mile to nearly 115 miles.

Physical barriers, food availability, population density, weather and topography are some of the factors that affect the dispersal patterns in mammals. Fox tag returns from the north central Iowa prairie indicate that dispersal likely occurs in a random fashion. However, in northeast Iowa the same pattern does not occur because the Mississippi River acts as a barrier. To date we have not received any returns on fox moving across the river. The river is not generally frozen during the period of peak fox dispersal. Actually our tagged sample of red fox in the northeast Iowa river boundary counties has been quite small and at the present there is no reason to believe that the red fox would not move across the river if it were frozen over.

First year returns from 1968 indicated that nearly two thirds of the fox moved northward. This might be indicative of a possible directional preference northward but until the project is complete no conclusions will be made regarding this. The 1966 and 1967 dispersal patterns show a more random movement in all directions.

In 1968 movement and mortality information was received on 37 fox tagged in 1967. This would involve two period of dispersing activity. Of the 24 returns on males the movement averaged 32 miles while the females averaged 15.7 miles. This compares to 22.1 miles and 7.4 miles respectively during the first year of dispersement.

MORTALITY

Table 3 gives a breakdown of the significant mortality factors on the Iowa red fox population during the first year. The hunter, the trapper, and the automobile are the main causes of mortality on the Iowa red fox. Also during the first year some pups are killed indiscriminately near their natal areas.

In 1966 a 45.9% return rate was noted. I personally feel this is not a true figure as far as the mortality on the total red fox population is concerned. The sample size is significantly smaller than the 1967, 68 and 69 sample and this might not show a true comparison with these 3 years.

Nearly a 20% return on tagged foxes was tabulated in 1967. Poor fox hunting conditions that winter probably accounts for the much reduced return rate. The year 1967 probably marked one of the mildest dryest winters that north Iowa has encountered for several years. The reduced hunting pressure on the red fox during 1967-68 season apparently left a high breeding population in the spring of 1968. Increased ease and efficiency in finding fox dens and tagging fox pups occurred that spring and 388 foxes were tagged. Reports from Commission personnel, farmers, fox hunters, and trappers indicated a high population of fox in northern Iowa.

The winter of 1968-69 was a complete reversal of the previous winter. Heavy snows and cold weather prevailed from mid-December through mid-March and this created considerably better hunting conditions than in 1967-68. Hunter postcard surveys this past winter indicated that the number of fox hunters increased nearly 33% over the 1967 figures and the take per hunter season doubled the 1967 take. The total kill was $2\frac{1}{2}$ times greater in 1968 than 1967. Field reports also indicated increased hunting pressure on the Iowa red fox. Good pelt prices

were an added incentive. (Andrews, 1969)

The tag return rate in 1968 was approximately 40 per cent on pups plus another 18½ per cent on 2-year-olds. These figures also indicate a considerable increase in hunting pressure during the winter of 1968-69.

When the final analysis is made, vulnerability quotients comparing the mortality rates of young to adult foxes and males to females will be determined. Also we hope to be able to construct a life table on the red fox to determine the longevity of this species and the different year classes.

Future plans for the project involve some blood sampling of foxes from different areas to determine possible genetic differences, the protein levels and also to see what diseases occur in the species. Some castration has and will take place. To date no significant differences in movement of these castrated male fox can be determined. An effort will be made to collect reproductive tracts from females in different parts of the state to see if there is any statewide variability in the reproductive potential of the red fox. Some food habits work is also being done.

Other ramifications of the project are to educate the public that the red fox is not the culprit we once believed it to be - that it is not an important factor as far as reduced pheasant populations are concerned nor do they cause the poultrymen the problems they may have once did.

The red fox is becoming an important game and pelt animal and we hope to have a season on them in the near future to reduce the indiscriminate killing of fox pups that is taking place. At the present their economic and recreational importance far exceeds the harm they might do.

Plans are also being made by Commission personnel to publish a semi-popular bulletin once the project is completed.

Andrews, Ron, 1969. Results of postal card survey of squirrels, fox, coyote, and woodchuck hunters for the 1968-69 season. Iowa Conservation Commission Quarterly Reports 21 (1).

Table 1. Foxes captured and ear-tagged in Iowa, by county, 1969

| County | Males | Females | Total |
|---|---|---|---|
| Allamakee | 1 | | 1 |
| Boone | 7 | 9 + 1 AF | 17 |
| Bremer | 9 | 10 | 19 |
| Cerro Gordo | 22 | 16 + 1 AF | 39 |
| Chickasaw | 5 | 4 + 1 AF | 10 |
| Clayton | 15 | 8 | 23 |
| Delaware | 5 | 3 | 8 |
| Fayette | 9 | 4 + 1 AF | 14 |
| Floyd | 13 | 6 | 19 |
| Hamilton | 1 | | 1 |
| Hancock | 4 | 2 | 6 |
| Howard | 8 | 7 | 15 |
| Jasper | | 1 | 1 |
| Kossuth | 5 | 5 | 10 |
| Mitchell | 7 | 5 | 12 |
| Poweshiek | 13 + 1 AM | 8 | 22 |
| Tama | 1 | 3 | 4 |
| Winnebago | 5 | 4 | 9 |
| Winneshiek | 3 | 3 | 6 |
| Worth | 13 + 1 AM | 8 + 1 AF | 23 |
| Wright | 1 | | 1 |

Table 2. Average distances traveled during the first year by juvenile red foxes tagged in Iowa during the April to June period 1966 - 1968

| Month | Males | | Females | |
|---|---|---|---|---|
| | No. of Animals | Avg. Distance Traveled | No. of Animals | Avg. Distance Traveled |
| April | -- | -- | 1 | 2.5 |
| May | 5 | .5 | 3 | .5 |
| June | 7 | .7 | 6 | 1.2 |
| July | 5 | .7 | 1 | 2.5 |
| August | 1 | 2.0 | 3 | .8 |
| Sept. | -- | -- | 1 | 1.5 |
| Oct. | 6 | 18.1 | 1 | .5 |
| Nov. | 16 | 25.4 | 14 | 7.7 |
| Dec. | 27 | 18.4 | 18 | 5.6 |
| Jan. | 36 | 24.4 | 18 | 10.2 |
| Feb. | 7 | 16.8 | 10 | 6.6 |
| March | 1 | 48 | 1 | 3.0 |

Avg. Distance Traveled by 93 Dispersing Males Oct. - March
22.1 miles

Avg. Distance Traveled by 62 Dispersing Females Oct. - March
7.4 miles

Table 3. Return rate and mortality factors during the first year of Iowa red fox 1966-68

| Year | # Tagged | * of Returns | | | Method of Take | | | |
|---|---|---|---|---|---|---|---|---|
| | | Males | Females | Total | Hunter | Trapper | Rdkill | Misc.* |
| 1966 | 85 | 20 | 19 | 39 (45.9%) | 24 (28.2%) | 6 (7.1%) | 4 (3.5%) | 5 (5.9%) |
| 1967 | 249 | 32 | 17 | 49 (19.7%) | 21 (8.4%) | 12 (4.8%) | 9 (3.6%) | 7 (2.8%) |
| 1968 | 388 | 82 | 62 | 144 (37.6%) | 95 (24.2%) | 20 (5.2%) | 16 (4.1%) | 13 (3.6%) |

* Miscellaneous mortality includes pups at den, found dead. bow and arrow, killed by dog, and other unknown mortality.

# PRELIMINARY RESULTS OF ARTIFICIAL NEST BASKET STUDY

Richard Bishop
Game Biologist

A project to increase production of mallard ducks on Iowa marshes was initiated by Bob Barratt, Supt. of Game, in 1964. The idea was to provide artificial nesting structures that were predator prooof and thus would reduce nest destruction. A 2 ft. square cone shaped structure covered with $\frac{1}{4}$-inch mesh hardware cloth and placed on a 5/8-inch diameter pipe was designed.

A total of 222 nests was placed on 11 state owned marshes in 1964. The nests were placed at various locations generally described as on shore, over water in vegetation, and in open water.

Several marshes in north central and northwest Iowa were selected and baskets were checked periodically from late April to mid July. Data were recorded on use and success by area. The number of baskets checked varied from one year to another due to loss of baskets from weather and ice, additional baskets added, and baskets being erected on new areas.

## RESULTS

Data from the first year observations indicated that mallards would readily use these structures and that success was very high. Additional observations showed that baskets on shore were not acceptable and those in dense vegetation were rarely used. Baskets placed in open water or close to emergent stands of vegetation were the preferred sites. The bottom of the baskets should be placed between 2 and 4 feet above the water. Those higher than 3 ft. were often used as perching spots by hawks and owls and those placed lower than 2 ft. were subject to invasion by predators.

Results from data gathered on the selected areas from 1964 through 1968 are presented in Table 1. First year data indicated 22 baskets were used out of 80 available on 3 areas, for a 27.5 per cent rate of use. Nest success was 77 per cent, with a 71 per cent rate of hatchability of the eggs laid. Data from 1964 through 1968 showed that 209 baskets were used out of 55 for 38 per cent average use rate. Of the 209 nests, 203 were by mallards, 5 by redheads and 1 by blue-winged teal.

Success averaged 86 per cent for the 209 nests, with 11 per cent abandoned, 1.4 per cent destroyed, and 1.6 per cent with an unknown fate. Those nests of unknown fate were known to have been used but no remains of eggs were present upon the next check.

Data from 184 nests yielded an average clutch size of 9.7 eggs with an average hatchability rate of 76 per cent. Of the 1,363 eggs hatched from 184 nests, 2.5 per cent of the ducklings were found dead in the nest.

Data on individual areas are presented in Tables 2, 3 and 4.

# DISCUSSION

## BASKET USE

The baskets were used predominantly by mallards but six were used by other species (five redheads and one blue-winged teal). Nest selection was slanted toward baskets in open water or open water next to emergent stands of vegetation. Different sites on each marsh were preferred and used each year while others were totally avoided. Baskets that were most commonly used were those in open pools of water and from 2 to 4 ft. above the water level. Baskets lower than two feet above the water invited predation and were not used to the extent of higher baskets. The higher baskets were readily used; however, some of these were favorite perching posts for owls and to a lesser extent, hawks. No predation was attributed to owls but apparently they discouraged duck use. Site selection increased the use to a limited degree; however, additional baskets over a certain level did not increase the use.

## SUCCESS

Success has been extremely high on established nests and averaged 86 per cent over the five years. The biggest limiting factor on success has been abandonment of nests, which is probably in part caused by the investigators. Destroyed nests have been unbelieveably low (1.4 per cent). The predator was not identified in any of the three instances where predation was believed to occur. Ground predators are eliminated by placing the nests on pipe over the water but aerial predators were expected to take their toll. Crows are common dwellers around north Iowa marshes and are very efficient nest predators except in this case. It was believed that once crows caught on to them they would create havoc with basket nests, but such did not happen. A possible explanation of this is that yellow-headed blackbirds and black terns literally mob crows and hawks that fly over the marsh. Owls commonly use these baskets for perching and eating their prey in twilight hours without this severe harrassment, but they have not created problems of nest destruction.

Nest success is no doubt much greater for birds nesting in these structures than normal wild nesting mallards. Other studies have indicated only about 30-40 per cent success in the uplands. The one drawback experienced with this type of nests was that many unhatched ducklings were left in the nest. Apparently early hatched young would jump out of the nest and consequently would be unable to get back in. The peeping of the frightened young would cause the hen to leave the nest with those that were hatched and thus leave some partially hatched eggs in the nest. Data on 184 nests indicate that the average size of broods leaving the nest was 7.2 young, which is probably not too much lower than normal broods by the time they reach the marsh.

## POPULATIONS AND NEST BASKETS

It is not known to what extent this project increased the mallard breeding population on a given area; however, on a couple of small marshes it concentrated the birds to a greater extent than would occur normally. It undoubtedly increased the use on the two small areas and on most areas it should have increased production due to higher nest success. Possibly, if mortality rates attributed to hunting were reduced, mallard populations on these areas would

build and use of baskets would increase. It is hard to evaluate changes in use of nests because we do not know to what extent homing takes place or what effect changes in hunting regulations or changes in the physical features of the marshes have on this use.

It was found that by saturating a marsh with nest baskets that nesting populations were not greatly increased nor was the number of nests greatly increased. There appears to be a point beyond which the number of nests erected does not increase the number used but this point varies with each area.

## RECOMMENDATIONS

The use of artificial nest baskets for increasing mallard duck production is a documented success. However, large projects would have to be justified on a cost basis before they would be advisable. In order for this type of project to be a success, yearly maintenance of the baskets is a necessity. Without yearly maintenance the baskets would quickly deteriorate and the work would yield short term benefits. Small projects on private areas by sportsmen groups or land owners would be beneficial on a local basis if maintenance was kept up from year to year.

Table 1. Use and success of nest baskets from 1965 - 1968

| Year | No. Areas | No. Baskets | No. Baskets Used | % Use | Mallard | Redhead | Others | No. Nest Succ. | No. Dest. | No. Aban. | Fate Unk. | % Suc. | No. Eggs Laid | No. Eggs Hatched | Eggs Lost | % Hatched | No. Ducks Left In Nest |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1964 | 3 | 80 | 22 | 27.5 | 21 | 1 | - | 17 | 1 | 3 | 1 | 77% | 215 | 152 | 63 | 71% | 2 |
| 1965 | 4 | 79 | 33 | 43% | 29 | 4 | - | 27 | 1 | 4 | 1 | 82% | 329 | 250 | 79 | 76% | 13 |
| 1966 | 5 | 86 | 40 | 48% | 40 | - | - | 36 | 0 | 4 | - | 90% | *1 308 | 245 | 63 | 79% | 1 |
| 1967 | 7 | 131 | 62 | 47% | 62 | - | - | 50 | 1 | 9 | 2 | 81% | *1 490 | 328 | 162 | 67% | 9 |
| 1968 | 7 | 179 | 52 | 30% | 51 | - | 1-Bwt | 49 | - | 3 | - | 96% | *3 447 | 388 | 59 | 87% | 7 |
| Totals | | 555 | 209 | 38% | 203 | 5 | 1-Bwt | 179 | 3 | 23 | 4 | 86% | *4 1789 | 1363 | 426 | 76% | 32 |

*1 Data on 33 nests
*2 Data on 51 nests - Cold spring many eggs were frozen in late freeze.
*3 Data on 45 nests
*4 Data on 184 nests

Table 2. Use data on nest baskets on Ventura Marsh

| Year | No. Baskets | No. Baskets Used | % Used | Mallard | Other Species | No. Nests Suc. | No. Dest. | No. Aban. | Fate Unknown | % Succ. | No. Eggs Laid | No. Eggs Hatched | Eggs Lost | Ducks Left In nest |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **VENTURA MARSH** | | | | | | | | | | | | | | |
| 1964 | 50 | 10 | 28% | 10 | | 7 | 1 | 2 | | 70% | 98 | 69 | 29 | 2 |
| 1965 | 29 | 10 | 35% | 9 | *1 1 Redhead | 9 | | 1 | | 90% | 106 | 85 | 21 | 3 |
| 1966 | 18 | 7 | 40% | 7 | | 7 | | | | 100% | Unk | Unk. | 5 | 6 |
| 1967 | 18 | 11 | 61% | 11 | | 10 | | *2 1 | | 90% | Unk. | Unk. | 8 | 3 |
| 1968 | 50 | 14 | 30% | *3 16 | | 15 | | 1 | | 100% | 152 | 137 | 15 | 7 |
| **MYRE SLOUGH** | | | | | | | | | | | | | | |
| 1968 | 25 | 6 | | 5 | 1 Bwt | 6 | 0 | 0 | | | 64 | 61 | 3 | 0 |

*1 Dump nest
*2 Eggs froze - nest abandoned
*3 2 nest baskets used twice

Table 3. Use data on nest baskets on Iowa Lake Marsh and Jemmerson Slough

IOWA LAKE MARSH

| Year | No. Baskets | No. Baskets Used | % Used | Mallard | Other Species | No. Nests Suc. | No. Dest. | No. Aban. | Fate Unknown | % Succ. | No. Eggs Laid | No. Eggs Hatched | Eggs Lost | Ducks Left In Nest |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1964 | 20 | 4 | 20% | 4 | | 4 | 0 | 0 | - | 100% | 41 | 39 | 2 | - |
| 1965 | 20 | 9 | 45% | 8 | 1 Redhead | 8 | 1 Redhead | - | - | 89% | 99 | 79 | 20 | 8 |
| 1966 | 20 | 13 | 65% | 13 | - | 12 | - | 1 | - | 92% | 137 | 119 | 18 | 0 |
| 1967 | 30 | 8 | 27% | 8 | - | 6 | 1 | 1 | - | 75% | 94 | 65 | 29 | 9 |
| 1968 | 30 | 5 | 17% | 5 | - | 5 | - | - | - | 100% | 55 | 48 | 7 | 0 |

JEMMERSON SLOUGH

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1964 | 10 | 8 | 80% | 7 | 1 Redhead | 6 | - | 1 | 1 | 75% | 76 | 44 | 32 | 0 |
| 1965 | 10 | 8 | 88% | 6 | 2 Redhead | 5 | - | 2 | 1 | 62% | 73 | 40 | 33 | 2 |
| 1966 | 10 | 6 | 60% | 6 | - | 4 | - | 2 | - | 67% | 47 | 32 | 15 | 0 |
| 1967 | 10 | 8 | 80% | 8 | - | 6 | - | 2 | - | 75% | 78 | 50 | 28 | 0 |
| 1968 | 10 | 0 | 0% | area dry | | | | | | | | | | |

Table 4. Use data on nest baskets on Four Mile Lake and Ingham Lake

FOUR MILE LAKE

| Year | No. Baskets | No. Baskets Used | % Used | Mallard | Other Species | No. Nests Suc. | No. Dest. | No. Aban. | Fate Unknown | % Succ. | No. Eggs Laid | No. Eggs Hatched | Eggs Lost | Ducks Left In Nest |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1966 | 18 | 4 | 22% | 4 | - | 4 | 0 | 0 | - | 100% | 38 | 34 | 4 | 0 |
| 1967 | 18 | 8 | 44% | 8 | - | 7 | - | 1 | - | 87% | 73 | 64 | 9 | 0 |
| 1968 | 19 | 7 | 37% | 7 | - | 6 | - | 1 | - | 86% | - | Unk. | 15 | 0 |

INGHAM LAKE - EAST SLOUGH

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1965 | 20 | 6 | 30% | 6 | - | 5 | - | 1 | - | 83% | 51 | 46 | 5 | 0 |
| 1966 | 20 | 10 | 50% | 10 | - | 9 | - | 1 | - | 90% | 86 | 60 | 26 | 1 |
| 1967 | 20 | 12 | 60% | 12 | - | 8 | 1 | 2 | 1 | 66% | 116 | 62 | 54 | 0 |
| 1968 | 20 | 11 | 55% | 11 | - | 10 | - | 1 | - | 90% | 109 | 91 | 18 | 0 |

# RUFFED GROUSE STUDIES, 1969 (PROGRESS REPORT)

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## INTRODUCTION

A project to learn more about the status of ruffed grouse in Iowa was initiated by the Conservation Commission in 1961. The objectives of this study are to determine the present population density of the species in Iowa; determine the possibility of re-establishment of the species in some of its former range in the state; and to evaluate the hunting potential of ruffed grouse in northeastern Iowa.

## POPULATION DENSITY

To determine the population density of grouse in Iowa the spring roadside drumming count technique was selected as the most suitable census method for our purposes. Background information on the procedures for the drumming counts can be obtained from the April - June, 1961 issue of the Quarterly Biology Reports. In 1956 and 1960, a few exploratory drumming counts were made in northeastern Iowa, the only area in the state where ruffed grouse are found at present. More intensive surveys were initiated in 1961 and have been continued since that time. After several years of setting up and conducting many different routes, nine routes were established for the purpose of maintaining annual comparisons of ruffed grouse population trends.

In 1969 there were 14 counts completed on 10 routes by Biologists and Conservation Officers. Data from nine of these routes were suitable for comparison with counts from previous years. There were 184 drums heard on 134 stops for a mean of 1.37 drums per stop. Detailed information on the 1969 counts is presented in Table 1.

When the 1969 mean drumming count of 1.37 drums per stop is compared to previous years (Table 2) there is some indication of a slight decline in the population which has apparently been taking place since 1966. Several insignificant adjustments have been made in some of the annual mean drums per stop (Table 2) as published in earlier Quarterly Biology Reports in order to have all results on as comparable a basis as possible for comparison with current data and to correct a couple of small errors in the original records.

To further evaluate the results of the annual roadside counts, data has been compiled for the nine major routes used in estimating the population trend and is presented in Table 3. To give a more meaningful indication of population trends the mean drums per stop was computed for each route by using only those years that were comparable for weather conditions, date of count, standarization of stops along route, and individuals conducting drumming count. This mean was then compared with the 1969 results and the percentage of change computed.

Of the nine major routes, four actually indicated an increase in drums per stop with the other five indicating decreases. The majority of routes indicating an increase in drums per

stop are located in marginal areas or in areas where roads do not come close enough to the best grouse habitat to evaluate the true grouse population.

It should be pointed out that there are a large number of variables that may bias results of roadside drumming counts. Several steps will be taken in the future to standardize the major routes as much as possible. This fall the exact location of each of the 15 stops along each route will be clearly marked by spray painting trees, rocks, or other large objects at the stop. In the past, these locations were marked on a map which presented a possible source of error. Also, in an attempt to eliminate the errors caused by variation of the abilities of the observers, the same individual will be assigned the same route each year.

## TRAPPING AND TRANSPLANTING

The second phase of this ruffed grouse study involves the possible re-establishment of the species in some of its former range in the state. At the present time there appear to be a least two areas in the state with considerable potential for re-establishment of grouse. These are the Shimek State Forest in Lee and Van Buren Counties in southeastern Iowa and the Stephens State Forest in Lucas and Monroe Counties in south central Iowa. Both contain large tracts of forest under state control and are surrounded by considerable forested areas on private land.

In the past, trapping and transplanting efforts have been rather limited. The first attempt at trapping birds was made in the Yellow River Forest in the fall of 1962 with another trapping program initiated in the fall of 1965. A total of 19 birds have been transplanted to Shimek Forest as a result of these two trapping efforts. Roadside drumming routes conducted through the forest have produced negative results but some individuals have reported seeing or hearing grouse in the forest until 1967.

It is intended that a full-time trapping program will be initiated in the fall of 1970, and it is hoped that at least 50 grouse can be stocked in each of the two forests.

## HUNTING POTENTIAL

The third aspect of the project is concerned with evaluating the hunting potential of ruffed grouse in northeastern Iowa. The drumming counts in previous years indicated a population density that compared favorable with many other states where hunting is allowed. Thus a hunting season to remove some of the annual surplus of birds was set by the Conservation Commission in 1968 (the first in 45 years). The 16 day season extended from November 2 through November 17 with a daily bag limit of two birds and a possession limit, after the first day, of four birds. Legal shooting hours were from 8:00 a.m. to 4:30 p.m. and hunting was permitted only in the northeastern part of the state.

Details on Iowa's first ruffed grouse hunting season will be published in the Proceedings of the Iowa Academy of Science (E. D. Klonglan and G. Hlavka, Volume 76, in press). The statistics included in Table 4 were obtained from the annual hunter postcard survey which samples two per cent of the licensed hunters in Iowa. This sample size is considered insufficient for estimates of hunting success for small and isolated game populations such as ruffed grouse.

The sample size will be increased to five per cent next year.

During the 1968 season an estimated 720 ruffed grouse were harvested by 1150 Iowa hunters. This total represents a six per cent rate of harvest of the estimated fall population of 12,000 birds in northeastern Iowa. The spring estimated population of 4,000 birds (E. D. Klonglan and G. Hlavka, Proceedings of the Iowa Academy of Science, Volume 76, in press) indicates that we could enjoy a much higher rate of harvest without reducing the spring breeding population. Only further evaluation of subsequent hunting seasons will give us a better understanding of the effects of hunting on the Iowa grouse population.

## SUMMARY

1. A mean of 1.37 drums per stop was obtained on 134 stops on 9 major routes during the 1969 spring ruffed grouse roadside drumming survey in northeastern Iowa.

2. A slight decline in the population is indicated by the roadside drumming counts.

3. Further trapping of grouse in Yellow River Forest is programmed for fall 1970 with birds being transplanted to Shimek and Stephens State Forest.

4. A six per cent rate of harvest was realized from the 1968 ruffed grouse hunting season in Iowa.

5. Evaluation of the hunting potential of grouse in Iowa is continuing.

Table 1. Results of spring 1969 ruffed grouse drumming counts in northeast Iowa

| ROUTE | COUNTY | NO. STOPS | DRUMS HEARD | DRUMS PER STOP |
|---|---|---|---|---|
| Yellow River State Forest | Allamakee (SE) | 15 | 32 | 2.13 |
| Village Creek | Allamakee (C) | 15 | 25 | 1.67 |
| Harpers Ferry - Wexford | Allamakee (E) | 15 | 18 | 1.20 |
| Upper Iowa River | Allamakee (N) | 15 | 27 | 1.80 |
| Highlandville - North Bear | Winneshiek (NE) | 15 | 34 | 2.27 |
| Sny Magill - Bierbaum | Clayton (NE) | 15 | 11 | .73 |
| Bloody Run | Clayton (NE) | 15 | 9 | .60 |
| Lower Yellow River | Allamakee (SE) | 15 | 16 | 1.07 |
| Frankville - Yellow River | Winneshiek (SE) | 14 | 12 | .86 |
| | | 134 | 184 | 1.37 |
| Other counts made but not used for long term comparisons because of poor weather conditions, lower counts, or counts taken after drumming peak. | | | | |
| Highlandville - North Bear | Winneshiek (NE) | 15 | 26 | 1.73 |
| Frankville - Yellow River | Winneshiek (SE) | 15 | 0 | ---- |
| Upper Iowa River | Allamakee (N) | 15 | 7 | .47 |
| Village Creek | Allamakee (C) | 15 | 4 | .27 |
| Garnavillo - Buck Creek | Clayton (EC) | 12 | 7 | .58 |

Table 2. Indices to ruffed grouse population density in northeast Iowa. 1961-1969, as measured by the spring roadside drumming count (comparable routes only).

| YEAR | NO. OF ROUTES | NO. OF STOPS | TOTAL DRUMS | DRUMS PER STOP | CHANGE FROM PREVIOUS YEAR |
|---|---|---|---|---|---|
| 1961 | 6 | 89 | 135 | 1.52 | ----- |
| 1962 | 8 | 111 | 188 | 1.69 | + 10% |
| 1963 | 9 | 130 | 217 | 1.67 | - 1% |
| 1964 | 9 | 133 | 203 | 1.53 | - 8% |
| 1965 | 9 | 135 | 227 | 1.68 | + 10% |
| 1966* | (2) | (30) | (54) | (1.80) | (Insuff. Data ) |
| 1967 | 7 | 103 | 154 | 1.50 | - 11% |
| 1968 | 9 | 130 | 190 | 1.46 | - 3% |
| 1969 | 9 | 134 | 184 | 1.37 | - 6% |
| 8 years | 66 | 965 | 1498 | 1.55 | Little |

Unfavorable weather throughout peak drumming period made it impossible to obtain satisfactory counts on most routes.

Table 3. Comparison of ruffed grouse drums per stop on the major spring roadside drumming count routes from 1961 - 1969

| ROUTE | COUNTY | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | Mean drums per stop on comparable routes 1961-1968 | 1969 change from the mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Yellow River State Forest | Allamakee | 2.27 | 3.47 | 2.53 | 2.93 | 2.47* | --- | 2.07* | 1.60* | 2.13 | 2.11 | + 1% |
| Village Creek | Allamakee | (0.46) | 2.31* | 2.00* | 1.92* | 2.73* | --- | 1.38* | 2.08* | 1.67 | 2.09 | - 20% |
| Harpers Ferry - Wexford | Allamakee | 1.73* | 2.00* | 1.60* | 1.80 | 1.60* | (1.73) | 1.00* | 1.87* | 1.20 | 1.63 | - 26% |
| Upper Iowa River | Allamakee | 1.60* | 2.00* | 1.73* | 1.07* | 2.27* | ---- | 1.40* | 3.07* | 1.80 | 1.88 | - 4% |
| Highlandville-N. Bear | Winneshiek | 2.86* | 1.78* | 3.00* | 1.67* | 3.07* | (1.87) | 3.40* | 2.13* | 2.27 | 2.56 | - 11% |
| Sny Magill - Bierbaum | Clayton | 0.33* | 0.60* | 0.73* | 0.73* | 0.33* | ----- | 0.60* | 0.60* | 0.73 | 0.56 | + 23% |
| Bloody Run | Clayton | ----- | 1.00 | 1.00 | 1.20 | 1.00* | ----- | 0.60* | 0.46* | 0.60 | 0.70 | - 14% |
| Lower Yellow River | Allamakee | ----- | ----- | 1.87 | 1.73 | 1.00* | ----- | (0.40) | 0.87* | 1.07 | 0.93 | + 13% |
| Frankville-Yellow River | Winneshiek | 0.40* | 0.14* | 0.60* | 0.73* | 0.67* | ----- | ----- | 0.36* | 0.86 | 0.49 | + 43% |
| | | | | | | | AVERAGE | | | 1.37 | 1.49 | - 8% |

* - Years used to compute averages
( ) Counts conducted but not used because of poor weather conditions or other factors

Table 4. Ruffed grouse hunting season results, Iowa, 1968, as determined by post-season hunter survey

| ITEM | STATISTIC |
|---|---|
| Number of ruffed grouse bagged | 720 |
| Number of hunters pursuing grouse | 1150 |
| Per cent of all Iowa hunters after grouse | 0.4% |
| Total hunting trips (days) for grouse | 2070 |
| Total hours hunting fro grouse | 8510 |
| Average number of grouse bagged per hunter during season | 0.6 |
| Average number of grouse bagged per hunter per trip (day) | 0.3 |
| Average number of grouse bagged per hunter per hour | 0.08 |
| Average number of hours needed to bag one grouse | 11.8 |
| Average number of trips (days) per hunter during season | 1.8 |
| Average number of hours per hunter during season | 7.4 |
| Average number of hours per hunter per trip (day) | 4.1 |

# PROJECTED CHANGES IN AQUATIC HABITATS OF THE MISSISSIPPI RIVER ASSOCIATED WITH POOL LEVEL RAISES

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The upper Mississippi River is presently being studied to determine the feasibility of a 12-foot navigation channel. Should this stabilized channel become a reality, the 3-foot depth increase over the present 9-foot channel would be obtained by one of the following methods.

1. Dredge the entire three feet.

2. Dredge two feet and raise the pool one foot.

3. Dredge one foot and raise the pool two feet.

4. Raise the pool level the entire three feet.

In deciding which of these methods would be most beneficial to conservation interests, changes induced by each must be anticipated and evaluated. The following is offered as a method for projecting changes in aquatic habitats resulting from raises in pool level. Effects of dredging and spoil disposal are not considered in this study.

Projected habitat changes in this study are based on the theory habitat identification is largely dependant upon water depth. A longitudinal cross-section of a pool model would show sloping bottom and a relatively flat surface, giving the pool a typical wedge shaped appearance. Water depth is greatest at the downstream end. Habitat here is classified lake. Moving upstream, depth is progressivel reduced, and islands appear. As these islands become larger and more numerous, lake graduates to slough and side channel habitats. Main channel and main channel border also become more clearly defined. Slough and side channel surface areas diminish further upstream until the next dam is reached. The main channel and main channel border habitats remain approximately the same width.

If the surface of this model pool is raised, more islands would flood and lake environment would extend further upstream. Similarly, partial flooding of land areas would increase slough and side channel surface areas. The overall effect would shift all types of habitat upstream. Because the upper limit of the pool remains stationary, total surface area of habitats are reduced in an amount equivalent to the amount they would have projected beyond the upper dam with their apparent shifting upstream.

With an estimated gradient of one foot per mile a raise in pool level of three feet would extend lake habitat upstream an additional three miles. For the purpose of this study the additional lake area is considered equal to total surface area in the lower three miles of pool prior to the raise. Since all other habitats shift upstream in a similar manner, there would be a net loss in these habitats equal to the surface area of each habitat within three miles of the upper dam. Tailwater is excluded from this calculation because it is defined as the first one-

half mile below the upstream dam. Consequently, its surface area would not be changed greatly by increasing pool level.

Habitat changes in pools 9 through 19 were projected for one, two and three-foot flat pool raises in this manner. The results are presented in Tables 1 through 11.

Simplified means of projecting changes are admittedly error prone. However, the author concludes the resulting data provides a general idea of the magnitude and direction of changes and could be used as a guide for further investigation until better information is provided.

Table 1. Anticipated changes in acreages and percent of aquatic habitats associated with one, two and three foot raises in flat pool level for Pool 9 of the Mississippi River

| Water Level | | Habitat Type | | | | | | | Pool Total |
|---|---|---|---|---|---|---|---|---|---|
| | | Tailwaters | Main channel | Main Channel Border | Side Channel | Slough | Lake | Pond | |
| Present Pool (620 msl) | A | 104 | 2,206 | 1,633 | 1,332 | 9,847 | 12,773 | --- | 27,895 |
| | % | 0.3 | 7.9 | 5.9 | 4.8 | 35.3 | 45.8 | 0.0 | |
| 1 - Foot | A | 104 | 1,862 | 1,375 | 1,176 | 8,110 | 16,675 | --- | 29,302 |
| | % | 0.4 | 6.4 | 4.7 | 4.0 | 27.7 | 56.9 | 0.0 | |
| 2 - Foot | A | 104 | 1,634 | 1,276 | 808 | 7,500 | 17,876 | --- | 29,198 |
| | % | 0.4 | 5.6 | 4.4 | 2.8 | 25.7 | 61.2 | 0.0 | |
| 3 - Foot | A | 104 | 1,373 | 1,067 | 627 | 5,466 | 18,282 | --- | 26,919 |
| | % | 0.4 | 5.1 | 4.0 | 2.3 | 20.3 | 67.9 | 0.0 | |

Table 2. Anticipated changes in acreages and percent of aquatic habitats associated with one, two and three foot raises in flat pool for Pool 10 of the Mississippi River

| Water Level | | Habitat Type | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Tailwaters | Main Channel | Main Channel Border | Side Channel | Slough | Lake | Pond | Pool total |
| Present Pool (611 msl) | A | 28 | 3,482 | 2,972 | 1,579 | 5,568 | 2,309 | 65 | 16,002 |
| | % | 0.2 | 21.8 | 18.6 | 9.9 | 34.8 | 14.4 | 0.4 | |
| 1 - Foot | A | 28 | 3,185 | 2,806 | 964 | 4,809 | 5,024 | 24 | 16,840 |
| | % | 0.2 | 18.9 | 16.7 | 5.7 | 28.6 | 29.8 | 0.1 | |
| 2 - Foot | A | 28 | 2,860 | 2,589 | 640 | 4,215 | 7,102 | 24 | 17,458 |
| | % | 0.2 | 16.4 | 14.8 | 3.7 | 24.1 | 40.7 | 0.1 | |
| 3 - Foot | A | 28 | 2,312 | 2,347 | 569 | 3,201 | 8,698 | 24 | 17,179 |
| | % | 0.2 | 13.5 | 13.7 | 3.3 | 18.6 | 50.6 | 0.1 | |

Table 3. Anticipated changes in acreages and percent of aquatic habitats associated with one, two and three foot raises in flat pool for Pool 11 of the Mississippi River

| Water level | | Habitat Type | | | | | | | Pool total |
|---|---|---|---|---|---|---|---|---|---|
| | | Tailwaters | Main channel | Main channel border | Side channel | Slough | Lake | Pond | |
| Present pool (603 msl) | A | 51 | 2,334 | 1,750 | 1,504 | 1,953 | 11,896 | 113 | 19,601 |
| | % | 0.3 | 11.9 | 8.9 | 7.7 | 10.0 | 60.7 | 0.6 | |
| 1 - Foot | A | 51 | 2,011 | 1,528 | 1,069 | 1,461 | 14,182 | 84 | 20,386 |
| | % | 0.3 | 9.9 | 7.5 | 5.2 | 7.2 | 69.6 | 0.4 | |
| 2 - Foot | A | 51 | 1,767 | 1,321 | 784 | 1,243 | 16,980 | 84 | 22,230 |
| | % | 0.2 | 7.9 | 5.9 | 3.5 | 5.6 | 76.4 | 0.4 | |
| 3- Foot | A | 51 | 1.662 | 1,275 | 727 | 1,161 | 19.832 | 84 | 24,788 |
| | % | 0.2 | 6.7 | 5.1 | 2.9 | 4.7 | 80.0 | 0.3 | |

Table 4. Anticipated changes in acreages and percent of aquatic habitats associated with one, two and three foot raises in flat pool for Pool 12 of the Mississippi River

| Water Level | | Habitat Type | | | | | | | Pool total |
|---|---|---|---|---|---|---|---|---|---|
| | | Tailwaters | Main channel | Main channel border | Side channel | Slough | Lake | Pond | |
| Present Pool (592 msl.) | A | 117 | 2,846 | 2,726 | 1,900 | 2,031 | 1,765 | 86 | 11,470 |
| | % | 1.0 | 24.8 | 23.8 | 16.6 | 17.7 | 15.4 | 0.7 | |
| 1 - Foot | | 117 | 2,577 | 2,385 | 1,765 | 1,930 | 3,257 | --- | 12,030 |
| | | 1.0 | 21.4 | 19.8 | 14.7 | 16.0 | 27.1 | 0.0 | |
| 2 - Foot | | 117 | 2,228 | 2,181 | 1,765 | 1,729 | 5,330 | --- | 13,250 |
| | | 0.9 | 16.7 | 16.3 | 13.2 | 13.0 | 39.9 | 0.0 | |
| 3 - Foot | | 117 | 1,912 | 1,953 | 1,535 | 1,654 | 6,799 | --- | 13,970 |
| | | 0.8 | 13.7 | 14.0 | 11.0 | 11.8 | 48.7 | 0.0 | |

Table 5. Anticipated changes in acreages and percent of aquatic habitats associated with one, two and three foot raises in flat pool for Pool 13 of the Mississippi River

| Water level | | Habitat Type: Tailwaters | Main channel | Main channel border | Side channel | Slough | Lake | Pond | Pool total |
|---|---|---|---|---|---|---|---|---|---|
| Present Pool (583 msl.) | A | 86 | 2,723 | 2,732 | 1,310 | 2,643 | 17,403 | 71 | 26,968 |
| | % | 0.3 | 10.1 | 10.1 | 4.9 | 9.8 | 64.5 | 0.3 | |
| 1 - Foot | A | 86 | 2,525 | 2,547 | 1,230 | 2,357 | 23,455 | 71 | 32,272 |
| | % | 0.3 | 7.8 | 7.9 | 3.8 | 7.3 | 72.7 | 0.2 | |
| 2 - Foot | A | 86 | 2,227 | 2,307 | 1,095 | 1,829 | 28,103 | 40 | 35,687 |
| | % | 0.2 | 6.2 | 6.5 | 3.1 | 5.1 | 78.7 | 0.1 | |
| 3 - Foot | A | 86 | 1,908 | 1,939 | 946 | 1,603 | 30,668 | 40 | 37,190 |
| | % | 0.2 | 5.1 | 5.2 | 2.5 | 4.3 | 82.5 | 0.1 | |

Table 6. Anticipated changes in acreages and percent of aquatic habitats associated with one, two and three foot raises in flat pool for Pool 14 of the Mississippi River

| Water level | | Habitat Type: Tailwaters | Main channel | Main channel border | Side channel | Slough | Lake | Pond | Pool total |
|---|---|---|---|---|---|---|---|---|---|
| Present Pool (572 msl.) | A | 72 | 2,470 | 2,315 | 1,286 | 1,941 | 2,326 | --- | 10,410 |
| | % | 0.7 | 23.7 | 22.2 | 12.4 | 18.7 | 22.4 | 0.0 | |
| 1 - Foot | A | 72 | 2,237 | 2,135 | 1,063 | 1,795 | 3,136 | --- | 10,438 |
| | % | 0.7 | 21.4 | 20.5 | 10.2 | 17.2 | 30.0 | 0.0 | |
| 2 - Foot | A | 72 | 1,941 | 1,880 | 892 | 1,723 | 4,013 | --- | 10,521 |
| | % | 0.7 | 18.4 | 17.8 | 8.5 | 16.4 | 38.1 | 0.0 | |
| 3- Foot | A | 72 | 1,586 | 1,653 | 780 | 1,309 | 4,948 | --- | 10,348 |
| | % | 0.7 | 15.3 | 16.0 | 7.5 | 12.6 | 47.8 | 0.0 | |

Table 7. Anticipated changes in acreages and percent of aquatic habitats associated with one, two and three foot raises in flat pool for Pool 15 of the Mississippi River

| Water level | | Habitat Type | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Tailwaters | Main channel | Main channel border | Side channel | Slough | Lake | Pond | Pool total |
| Present Pool (561 msl.) | A | 94 | 754 | 478 | 462 | 11 | 1,863 | --- | 3,662 |
| | % | 2.6 | 20.6 | 13.1 | 12.6 | 0.3 | 50.9 | 0.0 | |
| 1 - Foot | A | 94 | 278 | 285 | 443 | 11 | 2,334 | --- | 3,445 |
| | % | 2.7 | 8.1 | 8.3 | 12.9 | 0.3 | 67.8 | 0.0 | |
| 2 - Foot | A | 94 | --- | --- | 302 | --- | 2,819 | --- | 3,215 |
| | % | 2.9 | 0.0 | 0.0 | 9.4 | 0.0 | 87.7 | 0.0 | |
| 3 - Foot | A | 94 | --- | --- | 302 | --- | 2,827 | --- | 3,225 |
| | % | 2.9 | 0.0 | 0.0 | 9.4 | 0.0 | 87.8 | 0.0 | |

Table 8. Anticipated changes in acreages and percent of aquatic habitats associated with one, two and three foot raises in flat pool for Pool 16 of the Mississippi River

| Water level | | Habitat Type: Tailwaters | Main channel | Main channel border | Side channel | Slough | Lake | Pond | Pool Total |
|---|---|---|---|---|---|---|---|---|---|
| Present Pool (545 msl.) | A | 97 | 3,025 | 2,753 | 2,692 | 1,719 | 1,345 | --- | 11,632 |
| | % | 0.8 | 26.0 | 23.6 | 23.1 | 14.8 | 11.6 | 0.0 | |
| 1 - Foot | A | 97 | 2,566 | 2,525 | 2,606 | 1,686 | 3,272 | --- | 12,752 |
| | % | 0.8 | 20.1 | 19.8 | 20.4 | 13.2 | 25.7 | 0.0 | |
| 2 - Foot | A | 97 | 2,162 | 2,138 | 2,588 | 1,524 | 5,000 | --- | 13,510 |
| | % | 0.7 | 16.0 | 15.8 | 19.2 | 11.3 | 37.0 | 0.0 | |
| 3 - Foot | A | 97 | 1,872 | 1,703 | 2,219 | 1,433 | 6,641 | --- | 13,965 |
| | % | 0.7 | 13.4 | 12.2 | 15.9 | 10.3 | 47.6 | 0.0 | |

Table 9. Anticipated changes in acreages and percent of aquatic habitats associated with one, two and three foot raises in flat pool for Pool 17 of the Mississippi River

| Water level | | Habitat Type: Tailwaters | Main channel | Main channel border | Side channel | Slough | Lake | Pond | Pool total |
|---|---|---|---|---|---|---|---|---|---|
| Present Pool (536 msl.) | A | 109 | 2,264 | 1,763 | 1,749 | 1,034 | 31 | --- | 6,950 |
| | % | 1.6 | 32.6 | 25.4 | 25.2 | 14.9 | 0.4 | 0.0 | |
| 1 - Foot | A | 109 | 1,922 | 1,286 | 1,678 | 970 | 1,035 | --- | 7,000 |
| | % | 1.6 | 27.5 | 18.4 | 24.0 | 13.9 | 14.8 | 0.0 | |
| 2 - Foot | A | 109 | 1,601 | 967 | 1,457 | 964 | 2,087 | --- | 7,185 |
| | % | 1.5 | 22.3 | 13.5 | 20.3 | 13.4 | 29.0 | 0.0 | |
| 3 - Foot | A | 109 | 1,254 | 781 | 1,140 | 889 | 3,546 | --- | 7,719 |
| | % | 1.4 | 16.2 | 10.1 | 14.8 | 11.5 | 45.9 | 0.0 | |

Table 10. Anticipated changes in acreages and percentages of aquatic habitats associated with one, two and three foot raises in flat pool for Pool 18 of the Mississippi River

| Water level | | Habitat Type: Tailwater | Main channel | Main channel border | Side | Slough | Lake | Pond | Pool total |
|---|---|---|---|---|---|---|---|---|---|
| Present Pool (528 msl.) | A | 90 | 2,790 | 2,578 | 1,870 | 1,129 | 4,000 | 196 | 12,653 |
| | % | 0.7 | 22.1 | 20.4 | 14.8 | 9.0 | 31.6 | 1.5 | |
| 1 - Foot | A | 90 | 2,443 | 2,403 | 1,658 | 1,129 | 5,757 | 196 | 13,676 |
| | % | 0.7 | 17.9 | 17.6 | 12.1 | 8.3 | 42.1 | 1.4 | |
| 2 - Foot | A | 90 | 2,032 | 2,173 | 1,566 | 1,129 | 7,431 | 196 | 14,617 |
| | % | 0.6 | 13.9 | 14.9 | 10.7 | 7.7 | 50.8 | 1.3 | |
| 3- Foot | A | 90 | 1,582 | 1,892 | 1,389 | 1,094 | 8,499 | 196 | 14,742 |
| | % | 0.6 | 10.7 | 12.8 | 9.4 | 7.4 | 57.7 | 1.3 | |

Table 11. Anticipated changes in acreages and percentages of aquatic habitats associated with one, two and three foot raises in flat pool for Pool 19 of the Mississippi River

| Water level | | Habitat Type | | | | | | | Pool Total |
|---|---|---|---|---|---|---|---|---|---|
| | | Tailwater | Main channel | Main channel border | Side channel | Slough | Lake | Pond | |
| Present Pool (518 msl.) | A | 93 | 4,270 | 2,556 | 3,292 | 2,343 | 17,711 | --- | 30,264 |
| | % | 0.3 | 14.1 | 8.4 | 10.9 | 7.7 | 58.5 | 0.0 | |
| 1 - Foot | A | 93 | 4,257 | 2,551 | 3,270 | 2,321 | 18,062 | --- | 30,554 |
| | % | 0.3 | 13.9 | 8.3 | 10.7 | 7.6 | 59.1 | 0.0 | |
| 2 - Foot | A | 93 | 4,113 | 2,470 | 3,179 | 2,317 | 18,760 | --- | 30,932 |
| | % | 0.3 | 13.3 | 9.0 | 10.3 | 7.5 | 60.6 | 0.0 | |
| 3 - Foot | A | 93 | 4,005 | 2,409 | 2,967 | 2,312 | 19,437 | --- | 31,223 |
| | % | 0.3 | 12.8 | 7.7 | 9.5 | 7.4 | 62.3 | 0.0 | |

# CREEL CENSUS RESULTS FROM THREE IOWA LAKES - 1968-69

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During the 1968-69 fishing season a creel census was made on Spirit Lake, Lake West Okoboji and Lake East Okoboji. The census was a comprehensive type whereby estimates are made of fish harvest, angler trips, and hours spent fishing. Rose (1956) thoroughly explained the methods used for collection and expansion of these data.

May through February were censused on Spirit Lake and West Okoboji. These data are separated into open water fishing (May through November) and winter fishing (December through February). East Okoboji was censused from May through September.

## SPIRIT LAKE

Open Water Fishing. An estimated 151,145 fish were caught during this period (Table 1). This estimate is about 80,000 fish below the corresponding harvest of 1967 and approximately 50,000 fish below the average estimated harvest of the last 10 years. Seventy-five per cent of the 1968 catch were bullhead, 14% yellow perch, 5% walleye and 4% crappie. Bluegill, white bass, northern pike, largemouth bass, smallmouth bass, and sheepshead were also taken. Even though walleye were third in creel abundance, the 7,509 estimated to have been harvested is 52% below the previous low estimate for this species.

During this period 44,588 fishing trips were made to the lake, 10,000 trips less than 1967 and 11,000 trips less than the ten-year average. Thirty-three percent of the 1968 trips were made during June. An average trip lasted 2 hours and 37 minutes and yielded 3.4 fish.

The computed harvest rate of 1.30 fish-per-hour is nearly 0.30 less than 1967 but equal to the ten-year average. Fish were caught most rapidly during June, with a catch rate of 1.49 fish-per-hour. Slowest fishing occurred in October and November, with catch rates of 0.39 fish-per-hour.

Winter Fishing. Approximately 3,942 fish were caught during this period (Table 2). Yellow perch and walleye comprised 86% and 13% of these fish. White bass and smallmouth bass were also taken.

An estimated 1,295 fishing trips were made to Spirit Lake during this period. This estimate is about 86% below the corresponding 1967 estimate. This reduction is probably the result of much cold, snowy weather during the 1968-69 winter.

Fish were caught at an average rate of 1.11 fish-per-hour. This rate of harvest is well above the ten-year average of 0.75 fish-per-hour.

Based on the average catch rate, fishing in Spirit Lake during 1968 was about equal to the average season of the last 10 years. But total fish harvested and fishing pressure were considerably less than the ten-year average.

Table 1. Estimated harvest of fish from Spirit Lake, May through November, 1968

| | May | June | July | August | Sept. | Oct. | Nov. | Total | % of Total | Avg. (lb.) |
|---|---|---|---|---|---|---|---|---|---|---|
| Bluegill | --- | 1,238 | 622 | 254 | 62 | -- | --- | 2,176 | 1 | 0.47 |
| Crappie | 3,510 | 748 | 505 | 512 | 301 | -- | --- | 5,576 | 4 | 0.45 |
| Walleye | 1,736 | 4,079 | 944 | 240 | 332 | 178 | --- | 7,509 | 5 | 1.05 |
| W. Bass | --- | 34 | --- | --- | --- | --- | --- | 34 | < 1 | 1.71 |
| N. Pike | 37 | 157 | 51 | 55 | 8 | 6 | --- | 319 | < 1 | 2.65 |
| Bullhead | 16,651 | 52,264 | 18,393 | 20,076 | 5,890 | 277 | --- | 113,551 | 75 | 0.68 |
| L.M. Bass | -- | 8 | 7 | 16 | --- | 29 | --- | 60 | < 1 | 2.33 |
| S.M. Bass | 20 | 30 | 14 | 14 | 16 | 14 | --- | 108 | < 1 | 1.63 |
| Sheepshead | --- | 89 | 284 | 259 | 50 | 23 | --- | 705 | < 1 | 1.46 |
| Perch | 10 | 1,212 | 2,151 | 7,608 | 8,133 | 1,589 | 404 | 21,107 | 14 | 0.58 |
| Total | 21,964 | 59,859 | 22,976 | 29,034 | 14,792 | 2,116 | 404 | 151,145 | 99 | 0.68 |
| Angler Trips | 7,965 | 14,799 | 7,735 | 7,728 | 4,324 | 1,596 | 441 | 44,588 | | |
| Total Hours | 19,189 | 40,172 | 17,795 | 20,911 | 11,857 | 5,359 | 1,038 | 116,321 | | |
| Fish-per-trip | 2.76 | 4.22 | 2.94 | 3.76 | 3.42 | 1.33 | 0.92 | 3.39 | | |
| Fish-per-hour | 1.15 | 1.49 | 1.29 | 1.39 | 1.25 | 0.39 | 0.39 | 1.30 | | |

Table 2. Estimated harvest of fish from Spirit Lake, December through February, 1968-69

| Species | December | January | February | Total | % of Total | Avg. (lbs) |
|---|---|---|---|---|---|---|
| Walleye | 403 | 92 | 17 | 512 | 13 | 1.28 |
| W. Bass | 6 | --- | --- | 6 | < 1 | 2.33 |
| S. M. Bass | --- | 14 | --- | 14 | < 1 | 4.21 |
| Perch | 2,888 | 296 | 226 | 3,410 | 86 | 0.59 |
| Total | 3,297 | 402 | 243 | 3,942 | 99 | 0.69 |
| Angler Trips | 712 | 441 | 112 | 1,265 | | |
| Total Hours | 2,050 | 1,045 | 465 | 3,560 | | |
| Fish-per-trip | 4.63 | 0.91 | 2.17 | 3.12 | | |
| Fish-per-hour | 1.61 | 0.38 | 0.52 | 1.11 | | |

## LAKE WEST OKOBOJI

Open Water Fishing. During this period an estimated 113,889 fish were creeled from West Okoboji (Table 3). This estimate is 51% less than a corresponding estimate in 1967 and 49% less than the ten-year average. In 1968 yellow perch, bullhead, and bluegill comprised 71% 16%, and 7% of the fish taken. Crappie, walleye, white bass, northern pike, largemouth bass, smallmouth bass, sheepshead, and buffalo were also caught.

An estimated 28,017 fishing trips were made to West Okoboji. Each trip lasted 2 hours and 36 minutes and yielded about 4 fish.

May was the poorest fishing month when only 0.21 fish-per-hour were caught. The rate of catch increased to 2.77 fish-per-hour by November. An average harvest rate of 1.56 fish-per-hour was calculated for this period. The average catch rate for the past 10 years is 1.87 fish-per-hour was calculated for this period. The average catch rate for the past 10 years is 1.87 fish-per-hour.

Winter Fishing. As shown in Table 4 yellow perch comprised 92% of the 55,623 fish estimated to have been harvested. Bluegill and walleye made up 4% and 2% of the harvest. Northern pike, crappie, smallmouth bass, largemouth bass and white bass were also caught.

During this period, an estimated 9,833 fish-per-hour, slightly above the ten-year average.

Fishing for all species in 1968 was poorer than the previous year. Catch rate, fish harvest, and angling pressure were all less than the ten-year average.

## LAKE EAST OKOBOJI

During the census period fishermen caught an estimated 87,094 fish from East Okoboji, a decrease of 61% from 1967. Sixty-nine per cent were bullhead, 18% were yellow perch, and 9% were bluegill. Walleye, crappie, white bass, northern pike, largemouth bass, catfish, and sheepshead were also caught.

An estimated 27,076 trips were made to fish East Okoboji. Each trip lasted an average of 2 hours and 42 minutes. Each yielded 3.22 fish. These fish were caught at an average rate of 1.20 fish-per-hour.

Catch rate, fish harvest, and fishing pressure were all less than corresponding totals for 1967.

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Table 3. Estimated harvest of fish from Lake West Okoboji, May through November, 1968

| Species | May | June | July | August | Sept. | Oct. | Nov. | Total | % of Total | Avg. (lbs.) |
|---|---|---|---|---|---|---|---|---|---|---|
| Bluegill | --- | 1,826 | 2,292 | 1,106 | 2,329 | 509 | --- | 8,062 | 7 | 0.38 |
| Crappie | 8 | 1,246 | 471 | 114 | 295 | 619 | 11 | 2,764 | 3 | 0.47 |
| Walleye | 14 | 78 | 223 | 197 | 565 | 123 | 292 | 1,492 | 1 | 2.41 |
| W. Bass | --- | --- | --- | 313 | 24 | 148 | 10 | 495 | 1 | 0.95 |
| N. Pike | 17 | 136 | 36 | 78 | 291 | 54 | 55 | 667 | 1 | 4.16 |
| Bullhead | 516 | 10,333 | 5,193 | 358 | 823 | 284 | 118 | 17,625 | 16 | 0.52 |
| L. M. Bass | 94 | 381 | 47 | 22 | 25 | --- | --- | 569 | 1 | 2.26 |
| S.M. Bass | --- | 64 | 239 | 20 | 16 | 10 | 11 | 360 | 1 | 1.32 |
| Perch | --- | 3,088 | 4,012 | 6,023 | 34,129 | 23,542 | 10,505 | 81,299 | 71 | 0.38 |
| Catfish | --- | --- | --- | --- | 225 | --- | --- | 225 | 1 | 4.56 |
| Sheepshead | --- | --- | --- | 55 | 155 | 99 | --- | 309 | 1 | 1.23 |
| Buffalo | 22 | --- | --- | --- | --- | --- | --- | 22 | 1 | 24.00 |
| Total | 671 | 17,152 | 12,513 | 8,286 | 38,877 | 25,388 | 11,002 | 113,889 | 98 | 0.48 |
| Angler trips | 1,860 | 4.524 | 5,477 | 4.639 | 6,069 | 3,869 | 1,579 | 28,017 | | |
| Total hours | 3,261 | 11,128 | 14,746 | 11,008 | 17,301 | 11,493 | 3,965 | 72,902 | | |
| Fish-per-trip | 0.36 | 3.79 | 2.28 | 1.79 | 6.41 | 6.56 | 6.97 | 4.06 | | |
| Fish-per-hour | 0.21 | 1.54 | 0.85 | 0.75 | 2.25 | 2.21 | 2.77 | 1.56 | | |

Table 4. Harvest of fish from Lake West Okoboji, December through February, 1968-69

| Species | December | January | February | Total | % of Total | Avg. (lbs.) |
|---|---|---|---|---|---|---|
| Bluegill | 18 | 1,242 | 666 | 1,926 | 4 | 0.35 |
| Crappie | 94 | 87 | 133 | 314 | 1 | 0.38 |
| Walleye | 268 | 122 | 439 | 829 | 2 | 3.92 |
| W. Bass | 18 | --- | --- | 23 | 1 | 1.28 |
| N. Pike | 303 | 58 | 227 | 588 | 1 | 6.30 |
| L. M. Bass | 37 | 98 | --- | 135 | 1 | 3.80 |
| S. M. Bass | 16 | 29 | 113 | 158 | 1 | 1.41 |
| Perch | 13,241 | 26,476 | 11,938 | 51,655 | 92 | 0.33 |
| Totals | 13,995 | 28,112 | 13,516 | 55,623 | 100 | 0.46 |
| Angler Trips | 2,269 | 4,628 | 2,936 | 9,833 | | |
| Total Hours | 5,790 | 13,429 | 10,086 | 29,305 | | |
| Fish-per-trip | 6.17 | 6.07 | 4.60 | 5.65 | | |
| Fish-per-hour | 2.42 | 2.09 | 1.34 | 1.89 | | |

Table 5. Estimated harvest of fish from Lake East Okoboji, May through September, 1968

| Species | May | June | July | August | Sept. | Total | % of Total | Avg. (lbs.) |
|---|---|---|---|---|---|---|---|---|
| Bluegill | --- | 6,509 | 164 | 712 | 532 | 7,917 | 9 | 0.49 |
| Crappie | 383 | 214 | --- | 7 | 23 | 627 | 1 | 0.39 |
| Walleye | 608 | 858 | 264 | 94 | 124 | 1,948 | 2 | 1.33 |
| W. Bass | --- | --- | --- | 86 | 39 | 125 | 1 | 0.79 |
| N. Pike | --- | --- | 27 | --- | 23 | 50 | 1 | 2.48 |
| Bullhead | 14,009 | 31,585 | 6,874 | 4,024 | 3,534 | 60,026 | 69 | 0.53 |
| L. M. Bass | --- | 34 | --- | 17 | --- | 51 | 1 | 2.51 |
| Catfish | 8 | 48 | 156 | --- | 37 | 249 | 1 | 3.24 |
| Perch | 29 | 338 | 2,418 | 4,724 | 7,853 | 15,362 | 18 | 0.38 |
| Sheepshead | --- | --- | --- | 580 | 159 | 739 | 1 | 1.20 |
| Totals | 15,037 | 39,586 | 9,903 | 10,244 | 12,324 | 87,094 | 98 | 0.53 |
| Angler trips | 5,114 | 9,164 | 5,014 | 4,595 | 3,183 | 27,076 | | |
| Total hours | 16,171 | 24,145 | 12,583 | 11,233 | 8,736 | 72,868 | | |
| Fish-per-trip | 2.94 | 4.32 | 1.98 | 2.23 | 3.86 | 3.22 | | |
| Fish-per-hour | 0.93 | 1.64 | 0.79 | 0.91 | 1.41 | 1.20 | | |

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# AN EVALUATION OF THE 1968 FISH KILL IN THE DES MOINES RIVER BELOW DES MOINES

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In January 1968 a large fish kill occurred in the Des Moines River commercial fisheries study area as a result of pollution from the city of Des Moines. Since this kill would have a gross effect upon the results of population dynamics studies underway on commercial fish species it was necessary that a complete investigation of the magnitude of this catastrophe be determined before experimental exploitation was continued. Most of these studies involved changes in growth, changes in species composition, changes in catch success, and the decline in expected numbers of tagged catfish caught in the study area.

## FIELD OBSERVATIONS

Investigation of the fish kill was undertaken by the Biology Section shortly after it was reported on 17 January, 1968. Most of the data were collected from the study area near Knoxville. Comparison of the characteristics of the fish populations before and after the fish kill was possible only in this area because of the intensive investigations on fish population dynamics since 1964. Only inconclusive information was available for other sections of the river. After review of the data it was apparent evaluation of the channel catfish populations was most desirable because more information was available for this species. There is no evidence fish population characteristics at any location between Des Moines and Ottumwa are different from the study area. Therefore, any changes in fish populations that occurred inside the boundaries of the study area were also considered typical of the entire stream below Des Moines to Ottumwa.

Dead fish were first observed and reported to the Biology Section on 17 January. Aerial overflights of the river between Des Moines and Ottumwa the following day revealed large quantities of organic material were being bypassed into the river at the Des Moines Sewage Treatment Plant. However, no dead fish were observed because of heavy ice and snow cover on almost the entire river.

Ground observations at the STP after temination of the flight confirmed large masses of organic material and a thick, heavy oil were coming from the bypass outfall. Dissolved oxygen samples obtained the following day showed critically low levels were present in the river ($\leq$2.0 mg/l) downstream to Eddyville, where DO was 4.0 mg/l. Additional samples were also collected above the STP on this date and revealed +10.0 mg/l present.

On 29 January distressed fish were reported below the Ottumwa Power Dam by employees of the plant. Samples of DO collected in the power surge of the dam were 1.0 mg/l. Inter-

# PROGRESS REPORT OF SPIRIT LAKE WALLEYE STUDIES 1968 POPULATION ESTIMATE

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## INTRODUCTION

Spirit Lake ranks as one of Iowa's finest walleye waters. Although subject to noteable fluctuations, the population and harvest of walleye continues good when compared to other lakes in this state. Because the walleye is highly esteemed by Spirit Lake anglers, special efforts to keep abreast of their populations were initiated in 1949 and have been carried forward at frequent but irregular intervals since that time (Rose 1949 and 1955, Moen 1962, 1963 and 1964, Jennings 1965 and 1967. Walleye population and exploitation studies were ran again in 1968. This report gives the results of that endeavor.

## METHODS

During April, 1968, 1,672 walleye $\geq$12 inches in total length were marked by clamping serially numbered monel metal tags around the left maxillary and premaxillary. Two sizes of tags were used. Number 3 tags were placed on all walleye $<$20 inches in total length and number 4 tags were placed on all walleye $\geq$20 inches.

Electro-fishing equipment, operated between dusk and dawn, provided 1,312 (78%) of the total fish marked. Walleye taken by this method were measured, tagged, and released near the place of capture. Most of those taken by electro-shocker were males (1,291). It is evident from Figure 1 that most of the male walleye captured by electro-fishing ranged between 12 and 17 inches. A distribution of this sample is bimodal one at 9.5 and one at 14.5.

Gill nets were used to capture 360 walleye, or 22% of the fish marked. Fish taken by this method were transported to the Spirit Lake Fish Hatchery and stripped of eggs or sperm before being measured and tagged. These fish were marked at the hatchery, transported back to the lake and released. Male walleye accounted for 199 (55%) of the gill netted fish and females totaled 161 (45%). Gill netted male walleye ranged in total length between 12 and 28 inches (Figure 2). However, 68% of them were 19 inches. The greatest mode occurred at the 20.5 inch class mark. Female walleye taken by gill nets ranged between 17 and 30 inches total length. Two modes are evident at the 19.5 and 22.5 inch class mark (Figure 2).

Mortality of marked walleye to injuries sustained during capture, crowding, or handling was not a serious problem. Tags were returned from about 1% of the total number marked. Assuming 50% of these tags were withheld and not returned, tagging mortality would still be 2%. Two of the dead fish tags returned had been placed on fish captured by electro-fishing and 13 had been placed on gill netted walleye.

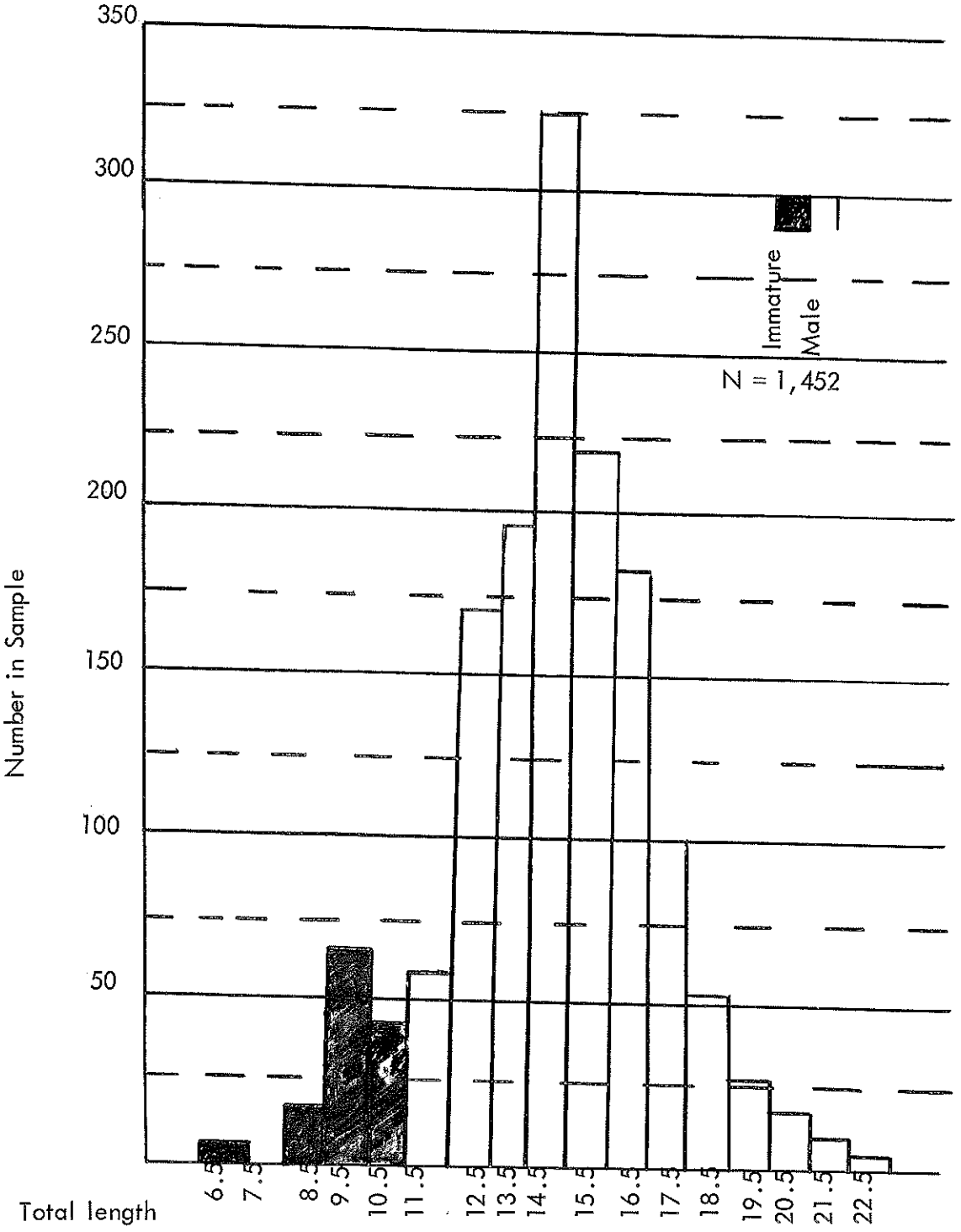


Figure 1. Length frequency of male and immature walleye captured from Spirit Lake by electro-shocker during April, 1968.

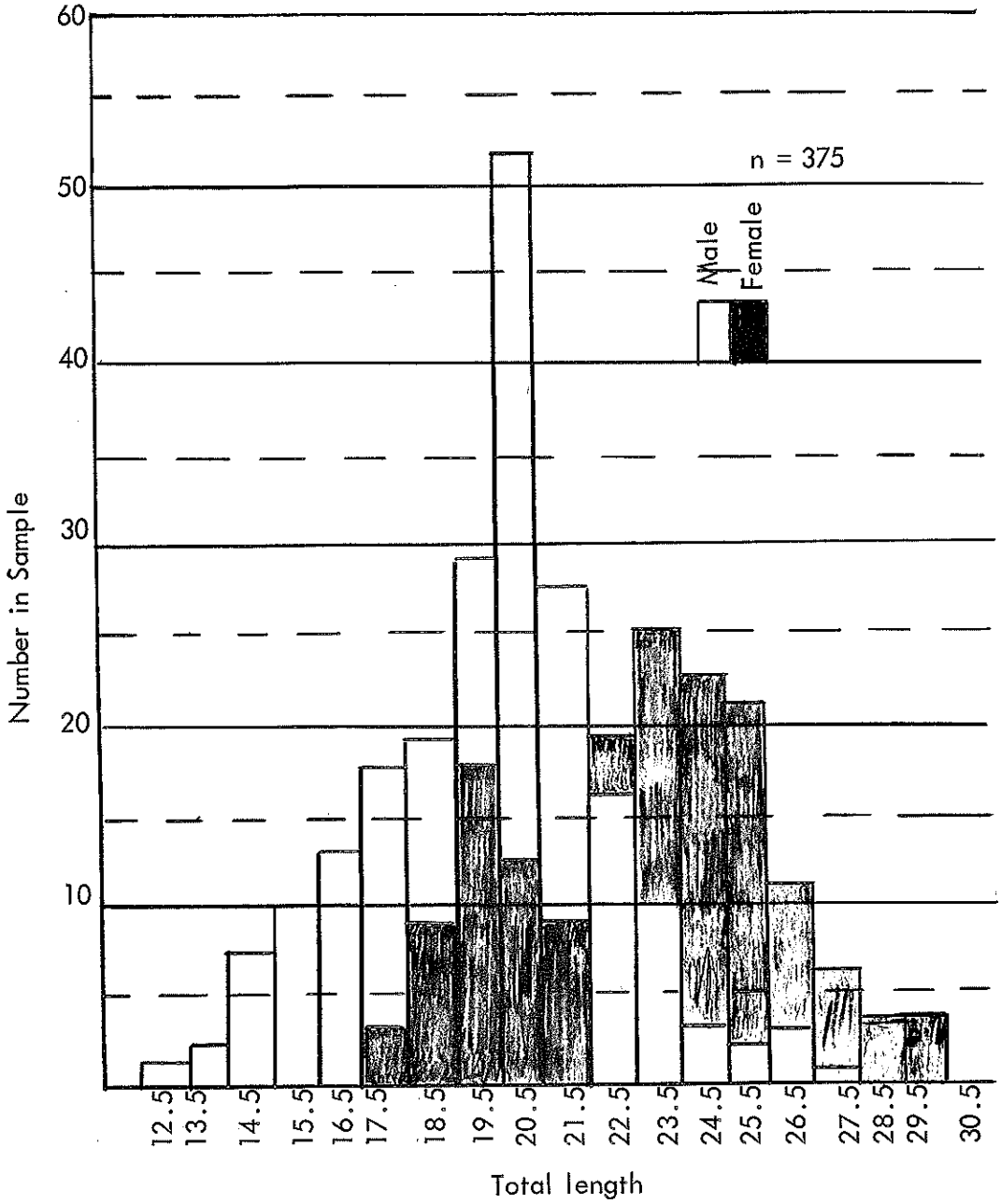


Figure 2. Length frequency of male and female walleye captured by $2\frac{1}{2}$-inch bar measure from Spirit Lake during April, 1968

## POPULATION ESTIMATE

Recaptures, from which estimates of the walleye population were made, were obtained through a creel census study and seining. A census clerk measured and checked all walleye he observed for tags. During a 3 or 4 day period near the middle of each month the clerk took scale samples from all walleye he observed. Recruitment was adjusted from the scale samples and length-frequency distribution.

During the period between 1 May, 1968 and 15 February, 1969, the clerk observed 770 walleye (Table 1). After adjustments were made for recruitment and for fish 12 inches long. The total sample was 620 fish, of which 38 were recaptures. Using the Petersen formula, a population estimate of 27,280 is obtained. This estimate pertains to walleye present in Spirit Lake as of the opening of the walleye fishing season (April 27, 1968) and includes that portion of the population 12 inches total length. 95% confidence intervals were 18,706 to 35,854 walleye. Population estimates were made on data collected during May and June and the combined July through February data. These estimates were independently derived. Confidence interval for these estimates overlapped each other indicating a valid estimate.

On June 5, 1968 a seine haul was made at the northeast corner of Spirit Lake. A total of 106 walleye, including 5 tagged fish, were captured. A population estimate of 35,446 resulted from these data. This estimate is also within the confidence limits based on creel data.

In order to obtain information on the abundance of the various sizes of walleye present, the data were separated into 2-inch length groups. A population estimate was computed for each length group (Table 2). It is evident that relatively small numbers of fish are present in each length group and especially noticeable in the two smaller length groups. Indications are recruitment by the 1964 and 1965 year classes into these two size groups was limited.

## VOLUNTARY TAG RETURNS AND EXPLOITATION RATE

During the 1968-69 fishing season 232 tags were voluntarly received from anglers. This represents an exploitation rate of about 14%.

Creel census data, after adjustments were made, indicated 6.1% of the creeled walleye were marked and that 6,449 of them were caught. On this basis, tags removed from the lake by fishermen should have totaled 393. Based on this estimate, anglers harvested about 24% of the adult walleye population that was present at the beginning of the fishing season.

Fishermen voluntarily returned 59% of the tags estimated to have been removed from the population.

## DISCUSSION

The best population estimate of walleye was 12 inches total length in Spirit Lake at the beginning of the 1968 walleye fishing season is 27,280. In comparison to previous