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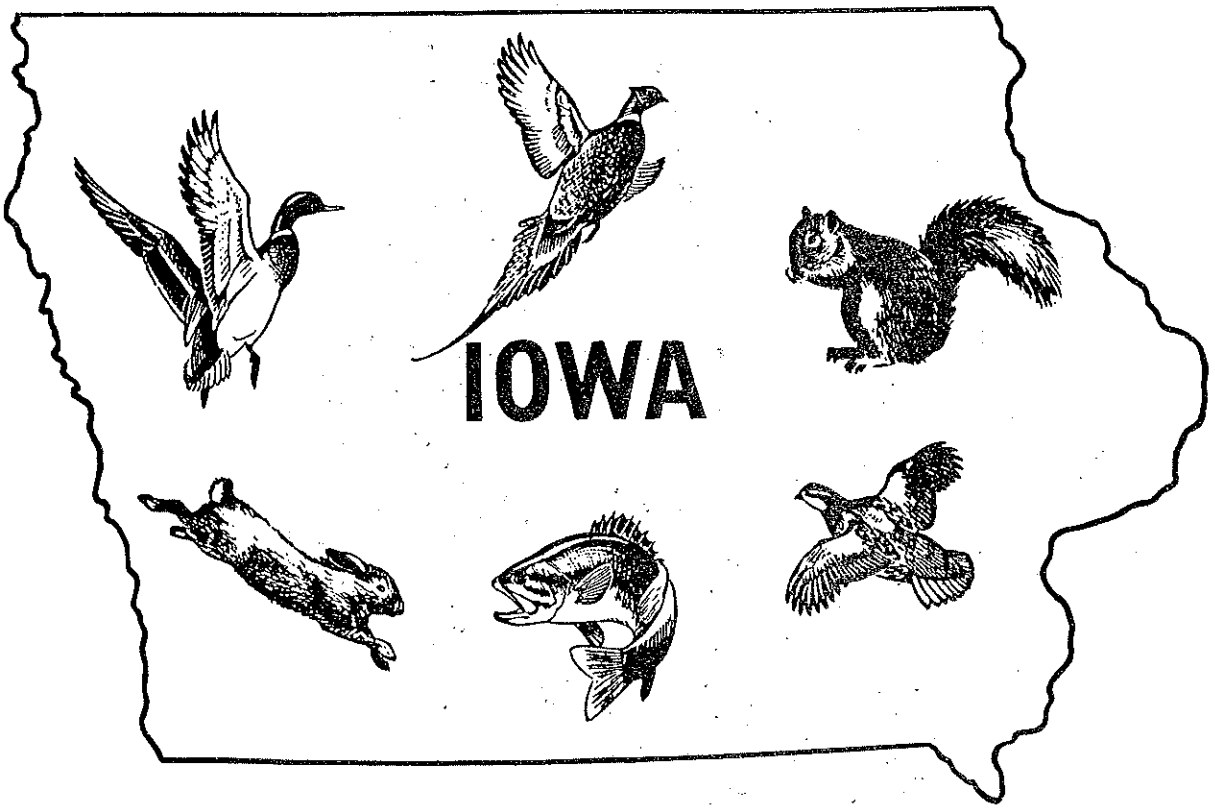
# QUARTERLY BIOLOGY REPORTS




FISH AND GAME DIVISION — BIOLOGY SECTION

STATE CONSERVATION COMMISSION

# QUARTERLY BIOLOGY REPORTS

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FISHERIES



GAME

# RESULTS OF REMOVAL ON THE GROWTH RATE OF CHANNEL CATFISH FROM THE WAPSIPINICON RIVER

Robert Schacht
Fisheries Biologist

During routine fishery surveys in northeast Iowa streams, stunted channel catfish were found in the Wapsipinicon River below Anamosa. Attempting to stimulate the growth of remaining catfish, 5,200 were removed in the fall of 1959. Further reduction followed when 7,949 were removed in 1963, 2,798 in 1964, 400 in 1965, and 8,286 in 1966.

## METHODS

Catfish were removed by Fisheries Section personnel by using 1/2 and 3/4 inch mesh hoop nets baited with cheese. In September of 1966 a sample of pectoral spines was taken for age and growth determinations to evaluate the removal program. Total lengths of the fish were recorded to the nearest 1/4 inch. In the laboratory the spines were sectioned and mounted between microscope slides. The sections were aged by microprojection of the spine image and each annulus recorded on paper strips. Later interpretation on a straight-line nomograph yielded the length at the end of each year of life.

## RESULTS

Examination of the age and growth data shows the catfish population is well behind the average growth attained in Iowa streams as described by Carlander (1959). Anamosa catfish attained total lengths of 5.4, 8.0, 8.8, 10.6, 11.8, 14.0, 19.0, and 20.3 at the second through ninth year of life respectively (Table 1). Catfish from other waters attain the lengths of 5.5, 9.5, 11.7, 13.3, 15.6, 17.8, 210 and 22.0 at comparable age groups. There was no increase in growth the first summer following the largest removal. As shown in Figure 1 the 1964 year class averaged the lowest growth following removal of 7,949 catfish in 1963. In its second growing season the 1964 year class showed the best growth of all fish sampled. Harrison (1953) found a similar growth pattern on a stunted catfish population on the Des Moines River in Humboldt County. A removal of 18,000 catfish caused an increase in growth but they still remained below average.

## DISCUSSION

No vast improvement has resulted in the growth. This would seem to indicate that population reduction was insufficient. It also bears out that removal of catfish alone is not the entire answer. It may also suggest that total removal of rough fish could be of benefit since a large rough fish population competes for food and space needed by the catfish during its first few years of life.

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Table 1. Calculated total length and increment for each year of life for channel catfish, Wapsipinicon River below Anamosa

Growth

| Year Class | Age Group | Number | Mean total length at Annulus | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1965 | I | 8 | 2.6 | | | | | | | | |
| 1964 | II | 9 | 1.8 | 6.0 | | | | | | | |
| 1963 | III | 8 | 2.0 | 3.3 | 5.9 | | | | | | |
| 1962 | IV | 4 | 2.0 | 4.1 | 6.5 | 8.9 | | | | | |
| 1961 | V | 8 | 2.0 | 3.5 | 5.9 | 7.8 | 10.0 | | | | |
| 1960 | VI | 6 | 2.0 | 4.4 | 7.4 | 9.3 | 11.0 | 12.9 | | | |
| 1959 | VII | 1 | 3.0 | 5.2 | 8.5 | 11.2 | 12.8 | 13.8 | 16.8 | | |
| 1958 | VIII | 2 | 2.2 | 4.3 | 6.4 | 10.1 | 13.5 | 15.3 | 17.3 | 18.9 | |
| Grand avg. length | | | 2.2 | 4.4 | 6.8 | 9.5 | 11.8 | 14.0 | 17.1 | 18.9 | |
| Mean T.L. at capture | | | - | 5.5 | 8.0 | 7.3 | 10.4 | 11.8 | 14.5 | 19.0 | |

Increments

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1965 | I | 8 | 2.6 | | | | | | | | |
| 1964 | II | 9 | 1.8 | 4.2 | | | | | | | |
| 1963 | III | 8 | 2.0 | 1.3 | 2.6 | | | | | | |
| 1962 | IV | 4 | 2.0 | 2.1 | 2.4 | 2.4 | | | | | |
| 1961 | V | 8 | 2.0 | 1.5 | 2.4 | 1.9 | 2.2 | | | | |
| 1960 | VI | 6 | 2.0 | 2.4 | 3.0 | 1.9 | 1.7 | 1.9 | | | |
| 1959 | VII | 1 | 3.0 | 2.2 | 2.7 | 2.7 | 1.6 | 1.0 | 3.0 | | |
| 1958 | VIII | 2 | 2.2 | 2.1 | 2.1 | 3.7 | 3.4 | 1.8 | 2.0 | 1.6 | |
| Grand Avg. Increment | | | 2.2 | 2.3 | 2.5 | 2.3 | 2.2 | 1.6 | 2.5 | 1.6 | |
| Observed Increment | | | 2.2 | 3.3 | 3.5 | - | 3.1 | 1.4 | 2.7 | 4.5 | |
| Number in sample | | | 46 | 38 | 29 | 21 | 17 | 9 | 3 | 2 | |

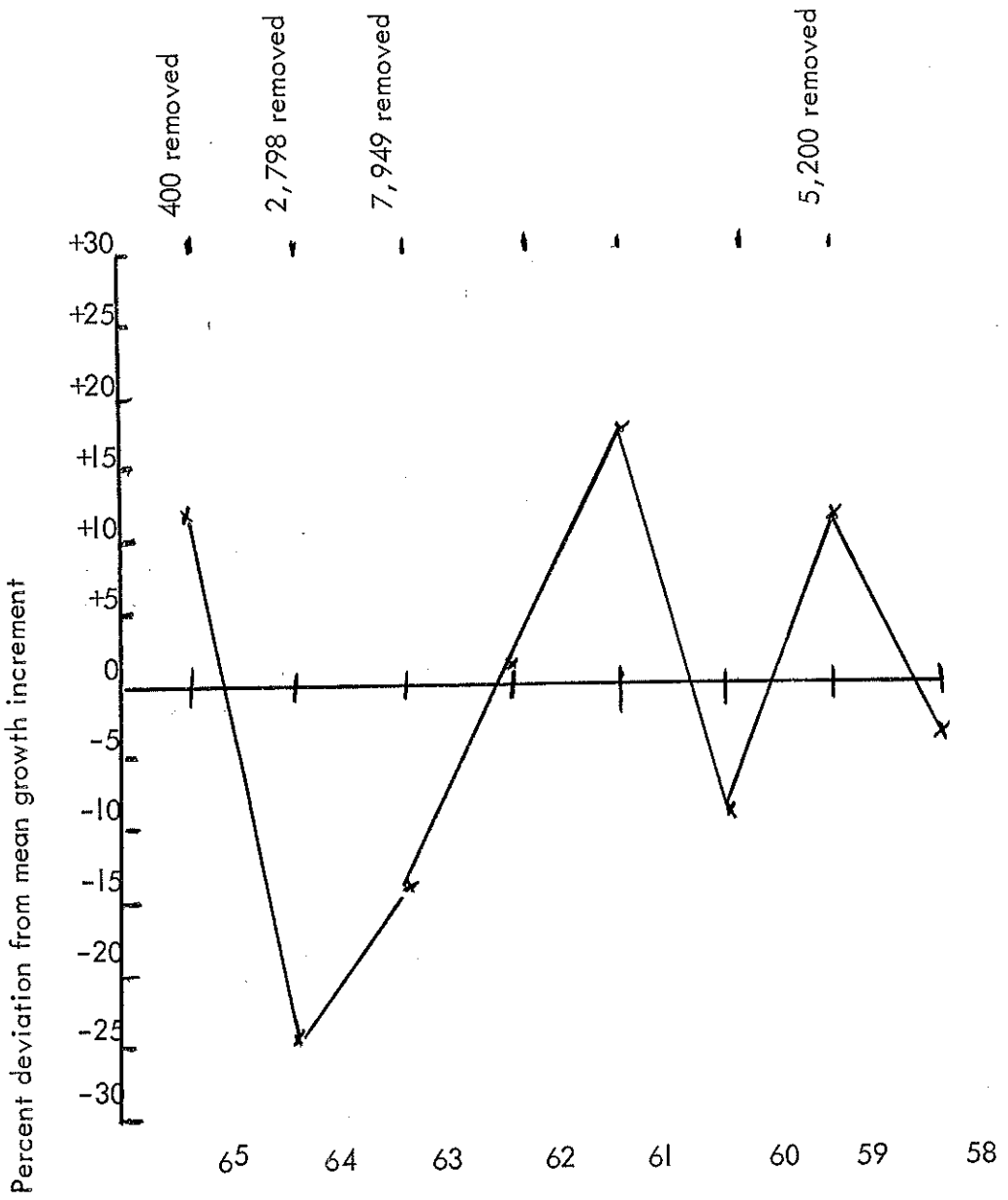


Figure 1. Per cent deviation of growth from mean for catfish - Wapsi River

# AGE AND GROWTH OF FLATHEAD CATFISH IN THE DES MOINES RIVER

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Asst. Supt. of Biology

Flathead catfish, Pilodictis olivaris (Rafinesque), are found in varying abundance in Iowa streams. Harlan and Speaker (1956:112) list this species as quite common in the Mississippi and Missouri Rivers and in large inland streams in areas with highly oxygenated waters. Cleary (1956:309) found it distributed in the Des Moines, Cedar, Iowa, Chariton and Grand River systems. It was also recorded in several lakes and reservoirs.

Information concerning the life history of flathead catfish is limited. This is probably due to difficulty obtaining adequate fish samples. Ackerman (1966) reported flathead catfish comprised 0.9 per cent of the catch by weight and 0.7 per cent by number during intensive netting surveys in the Des Moines River. Welker (1963) also reported less than one per cent occurrence in Missouri River fisheries inventories. In the Mississippi and Missouri River they occupy less than two per cent of the commercial catfish catch (Schoumacher, 1964; Robinson, 1960).

Angler exploitation of flathead catfish populations is also quite low. Annual creel census reports by Harrison from 1953 through 1960 (Quarterly Biology Reports, Iowa Conservation Commission) indicated the catch of flathead catfish was insignificant to the overall sport fishery in the upper Des Moines River. Creel census information from other Iowa streams also indicates identical low angler exploitation and catch success (Welker, 1964).

The major recreational importance of this species is realized in the fact that it represents the only game-fish of extremely large size in inland Iowa streams. There is a sizable group of anglers that expend considerable time and effort to catch one or two large flathead catfish annually. Most of these anglers prefer the low productivity of flathead catfish angling, because of the large size when successful, to the high productivity of other catfish species. Hence, the fishery assumes certain aesthetic values.

Intensive bait netting in the Des Moines River, Marion County, in 1966 produced a sample of 307 flathead catfish. Information for age and growth studies was obtained from 184 of these fish. This study was an integral segment of commercial fish species investigation with the U. S. Bureau of Commercial Fisheries financially participating.

## METHOD OF STUDY

Pectoral spine samples were obtained from flathead catfish throughout the entire summer. Removal was easily accomplished by simultaneously twisting and depressing the spine toward the body of the fish at the articulating process. Most spines were removed without mechanical aid of pliers or forceps. Some difficulty was encountered in removing spines from extremely large fish without injury to the fish or breakage.

Measurements of total length to the nearest 0.1 inch and weight to the nearest 0.01 pound were recorded for each specimen. The spine samples were cleaned and stored in small coin envelopes. No effort was made to determine the sex of fish.

Spine samples were processed for aging identical to the method used for channel catfish by Sneed (1951), Marzloff (1955), and Harrison (1957). Large spines were difficult to cross-section properly because the thin saw blade warped with friction heat, resulting in unevenly cut sections. This caused distortion in microprojected spine images making accurate location of annuli impossible. These were discarded.

## VALIDITY OF ANNULI AS YEAR MARKS

Annuli appear as light bands on a dark background in the projected spine image. In general appearence flathead catfish were identical to channel catfish described by Sneed (op. cit.). Each fish was aged and the location of each annulus marked on a paper tagboard strip. These marks were considered true annuli because: (1) larger fish possessed more year marks than smaller, younger fish; (2) there was general agreement between modes in total length frequency distribution and modal lengths assigned to year classes; and (3) calculated total length did not differ significantly from empirical lengths of age groups. Chi-square was used to test the difference between the expected (E) length and observed (O) lengths (Snedecor, 1953:190). This hypothesis was accepted and did not differ significantly at the 0.05 level of probability ( $X^2 = 0.25$, $P.05 = 2.16$, 7 d.f.).

## LENGTH-WEIGHT RELATIONSHIP

Total length-weight information was obtained from 138 fish. The sample was separated into 1/2- inch size groups and mean length and weight determined for each group. Resulting values were graphically plotted in Figure 1. The length-weight relationship for flathead catfish is best described by the least squares equation

$$\text{Log } W = -2.4088 + 3.047 \text{ Log } L$$

where $L$ = total length in inches

and $W$ = weight in hundredths pounds.

The difference between calculated and observed weights in Table 1 is not significant ( $t = 0.524$, $P_{0.05} - 2.064$, 24 d.f.). Maximum deviation was 0.6 pounds in one fish of extremely large size (T. L. = 29.7 inches). Large deviation occurred only in samples of fewer than 2 fish.

Coefficient of condition, C, was determined for each size group by using the reciprocal of total length. Mean C for the entire sample was 45 with a range of 37 to 51. There was no change in condition factor with change in relative size.

## BODY-SPINE RELATIONSHIP

Establishment of a mathematical relationship between body length and spine diameter was necessary for calculation of absolute growth. Magnified spine cross-sections (X 32) were measured to the nearest 0.1 inch from the center of the lumen along a straight line in the right lobe of the postero-lateral field. These data were grouped by 2-inch length intervals and resulting means values graphically plotted in Figure 2.

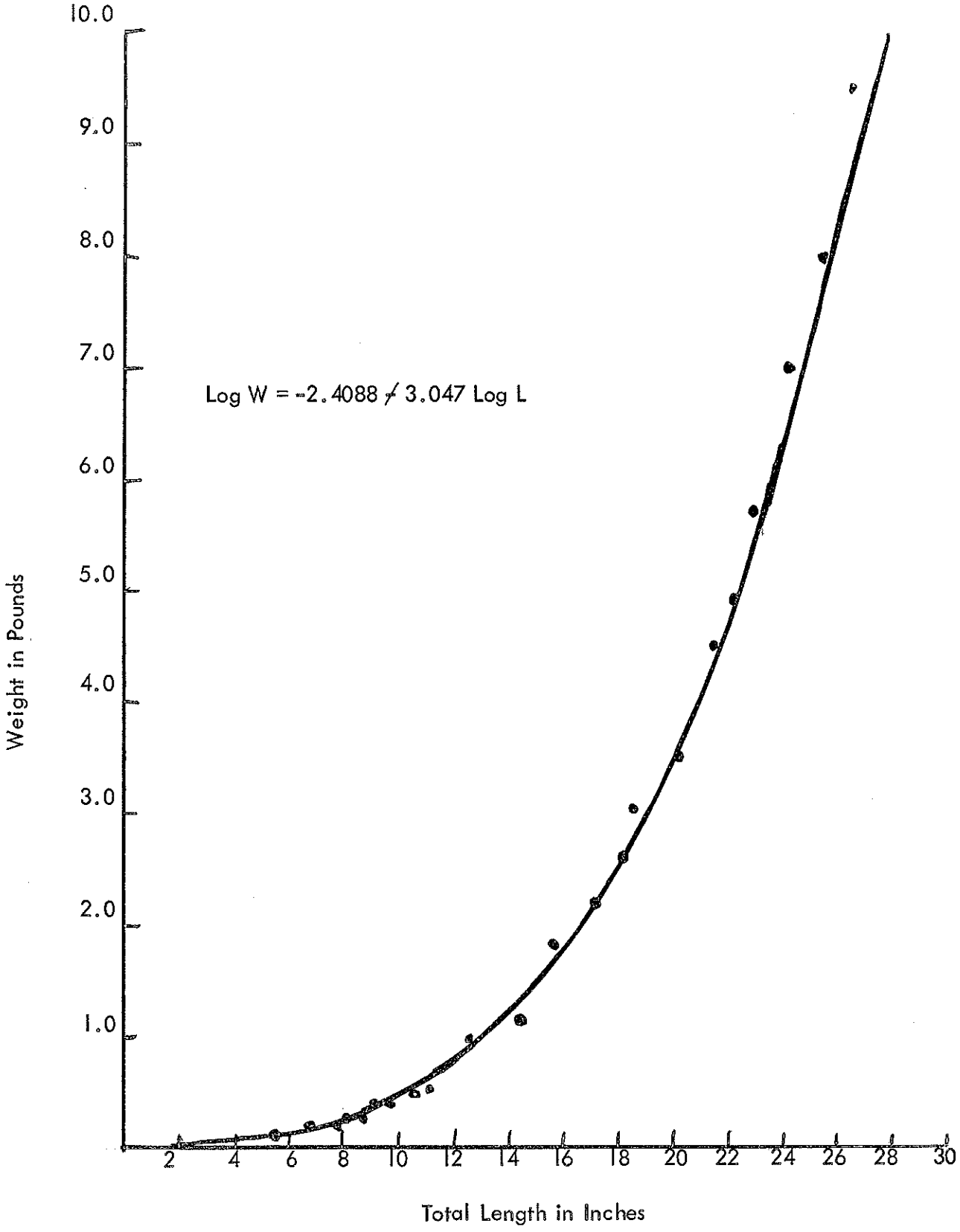


Figure 1. Length-weight relationship of flathead catfish, Des Moines River.

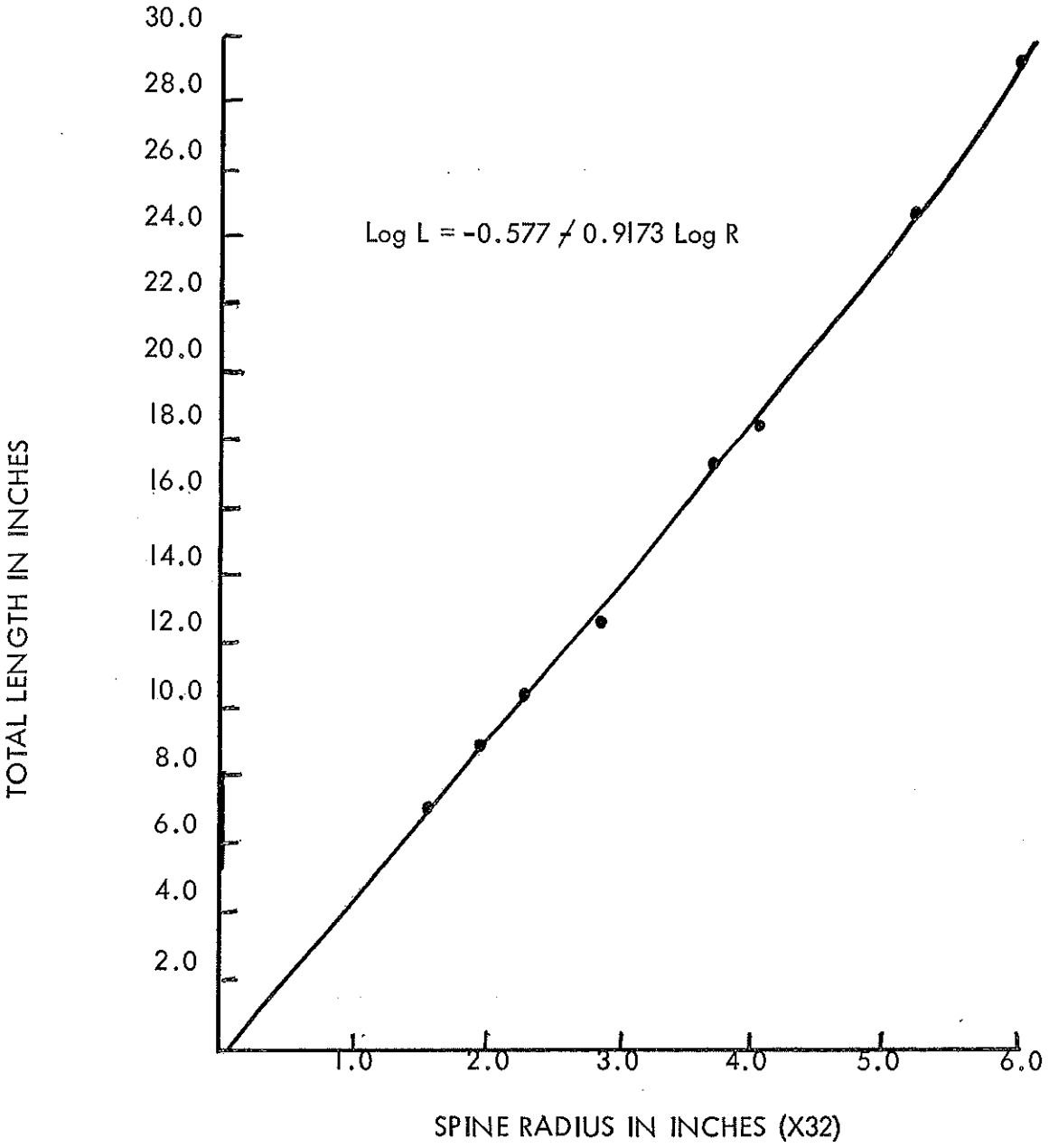


Figure 2. Body-spine relationship of flathead catfish, Des Moines River.

Table 1. Observed and calculated weight of flathead catfish in the Des Moines River.

| Size Group | Mean T. L. | Mean Weight | | Deviation C/O | Condition Factor | No. in Group |
|---|---|---|---|---|---|---|
| | | Observed | Calculated | | | |
| 6.0-6.4 | 6.2 | .11 | .11 | - | 46 | 6 |
| 6.5-6.9 | 6.8 | .16 | .13 | -0.03 | 51 | 14 |
| 7.0-7.4 | 7.1 | .17 | .15 | -0.02 | 47 | 4 |
| 7 5-7.9 | 7.8 | .22 | .20 | -0.02 | 46 | 12 |
| 8.0-8.4 | 8.2 | .21 | .24 | +0.03 | 38 | 14 |
| 8.5-8.9 | 8.7 | .24 | .28 | +0.04 | 37 | 21 |
| 9.0-9.4 | 9.2 | .36 | .34 | -0.02 | 46 | 7 |
| 9.5-9.9 | 9.7 | .37 | .40 | +0.03 | 40 | 13 |
| 10.0-10.4 | 10.1 | .44 | .45 | +0.01 | 43 | 10 |
| 10.5-10.9 | 10.8 | .49 | .55 | +0.06 | 39 | 4 |
| 11.0-11.4 | 11.2 | .55 | .61 | +0.06 | 39 | 2 |
| 12.5-12.9 | 12.7 | .90 | .90 | - | 44 | 3 |
| 14.0-14.4 | 14.4 | 1.15 | 1.32 | +0.17 | 39 | 2 |
| 15.5-15.9 | 15.6 | 1.85 | 1.68 | -0.17 | 48 | 2 |
| 17.0-17.9 | 17.3 | 2.20 | 2.31 | +0.11 | 42 | 2 |
| 18.0-18.4 | 18.3 | 2.60 | 2.74 | +0.14 | 42 | 5 |
| 18.5-18.9 | 18.5 | 3.05 | 2.84 | -0.21 | 48 | 1 |
| 20.0-20.4 | 20.3 | 3.50 | 3.75 | +0.25 | 42 | 1 |
| 21.5-21.9 | 21.7 | 4.50 | 4.60 | +0.10 | 44 | 3 |
| 23.0-23.4 | 23.1 | 5.75 | 5.57 | -0.18 | 47 | 2 |
| 24.0-24.4 | 24.2 | 7.00 | 6.42 | -0.58 | 49 | 1 |
| 25.5-25.9 | 25.5 | 8.00 | 7.53 | -0.47 | 49 | 2 |
| 26.5-26.9 | 26.5 | 9.50 | 9.47 | -0.03 | 51 | 2 |
| 29.0-29.4 | 29.1 | 11.80 | 11.40 | -0.40 | 48 | 2 |
| 29.5-29.9 | 29.7 | 12.50 | 11.90 | -0.60 | 48 | 1 |

By visual inspection it appeared the body-spine relationship was curvilinear. Smith and Appleget (1951) also found this evident for channel catfish in the Mississippi River, although their method used radial measurement of the fifth vertebrate and second degree polynomial regression. The body-spine relationship for 115 flathead catfish was calculated by the logarithmic method suggested by Rounsefell and Everhart (1953:324). This curvilinear regression is best described by the equation

$$\text{Log } L = -0.577 + 0.9173 \text{ Log } R$$

where L = total length in inches

and R = spine radius (X 32).

Total length at the end of each year of life was computed by construction of a logarithmic nomograph in which the log-log transformation of total length values were identical to the curvilinearity of the calculated body-spine relationship. The correlation coefficient of this regression is highly significant ($r = 0.992$, $P_{.05} = 0.666$, 7 d.f.). Sneed (op. cit.) found similar correlation coefficients for catfish in Oklahoma.

## RATE OF GROWTH

The rate of growth for fish less than 8 years old was easily calculated with the nomograph. Several flathead catfish from age groups IX through XII were captured but inaccurate spine sample processing resulted in unreliable data and these were not included in the growth analysis.

After flathead catfish reach 6 years of age, there is also a tendency for the first annulus to erode into the lumen. In this study this occurred partly at age group V and always at age group VI. At age group VIII the second annulus had also disappeared. Back calculation of total length for these age groups was also deleted from the growth study.

Grand average calculated total length for age groups I through VIII was 5.5, 10.3, 15.5, 18.5, 21.7, 23.6, 26.5 and 28.1 inches respectively. Mean observed weight for corresponding year classes was 0.07, 0.24, 1.54, 2.46, 4.0, 6.37, 8.0 and 10.66 pounds (Table 2).

Grand average growth increment was 5.5, 4.9, 5.1, 2.9, 3.3, 2.0, 3.0 and 1.5 inches for the eight age groups. Mean weight increment was 0.07, 0.17, 1.3, 0.92, 1.54, 2.37, 1.63, and 2.66 pounds.

Age and growth studies of flathead catfish from other regions are almost unavailable for comparison. Schoumacher (1964) reported mean observed total lengths of 13.1, 15.4, 17.2, 20.0, 22.3, 26.4 and 25.0 inches for age groups II through VIII in Mississippi River commercial catfish catches. These values are slightly less than those found in the Des Moines River.

Table 2. Calculated total length and length increments for each year of life for flathead catfish in the Des Moines River

| Year Class | No. in Sample | Age Group | Mean total length at annulus | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1965 | 92 | I | 6.5 | | | | | | | |
| 1964 | 16 | II | 5.6 | 10.0 | | | | | | |
| 1963 | 10 | III | 4.6 | 11.3 | 15.0 | | | | | |
| 1962 | 4 | IV | 5.6 | 9.6 | 16.9 | 18.9 | | | | |
| 1961 | 4 | V | 5.7 | 12.2 | 14.8 | 18.5 | 21.6 | | | |
| 1960 | 2 | VI | * | 9.6 | 14.8 | 18.7 | 22.1 | 23.9 | | |
| 1959 | 6 | VII | * | * | 15.7 | 18.2 | 21.6 | 23.6 | 26.4 | |
| 1958 | 4 | VIII | * | | 15.6 | 18.0 | 21.3 | 23.4 | 26.6 | 28.1 |
| Mean calculated length | | | 5.5 | 10.3 | 15.5 | 18.5 | 21.7 | 23.6 | 26.5 | 28.1 |
| Mean length at capture | | | 5.5** | 8.2 | 13.8 | 17.6 | 21.0 | 23.7 | 25.5 | 28.4 |
| Mean weight | | | .07 | .24 | 1.54 | 2.46 | 4.0 | 6.37 | 8.0 | 10.66 |

| | | | INCREMENT | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1965 | 92 | I | 6.5 | | | | | | | |
| 1964 | 16 | II | 5.6 | 4.4 | | | | | | |
| 1963 | 10 | III | 4.6 | 6.7 | 3.7 | | | | | |
| 1962 | 4 | IV | 5.6 | 4.0 | 7.3 | 2.0 | | | | |
| 1961 | 4 | V | 5.7 | 6.5 | 2.6 | 3.7 | 2.9 | | | |
| 1960 | 2 | VI | * | 4.9 | 5.2 | 3.9 | 3.4 | 1.8 | | |
| 1959 | 6 | VII | * | 4.8 | 4.8 | 2.5 | 3.4 | 2.0 | 2.8 | |
| 1958 | 4 | VIII | * | * | 7.0 | 2.4 | 3.3 | 2.1 | 3.2 | 1.5 |
| Mean calculated increments | | | 5.5 | 4.9 | 5.1 | 2.9 | 3.3 | 2.0 | 3.0 | 1.5 |
| Mean observed increments | | | 5.5 | 2.7 | 2.6 | 6.8 | 3.4 | 3.7 | 1.8 | 1.6 |
| Mean weight increments | | | .07 | .17 | 1.3 | .92 | 1.54 | 2.37 | 1.63 | 2.66 |
| Number in group | | | 138 | 46 | 30 | 20 | 16 | 12 | 10 | 4 |

## SUMMARY

Age and growth investigations were conducted on 138 flathead catfish from the Des Moines River. The length-weight relationship is best described as Log W = -2.4088 + 3.047 Log L. The body-spine relationship is curvilinear and calculated as Log L = 0.577 + 0.9173 Log R. Grand average total length for the eight year classes was 5.5, 10.3, 15.5, 18.5, 21.7, 23.6, 26.5 and 28.1 inches respectively. Mean weight for corresponding age groups was 0.07, 0.24, 1.54, 2.46, 4.0, 6.37, 8.0 and 10.66 pounds.

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# FISHING BOAT AND PLEASURE BOAT NUMBERS ON SEVERAL NORTHWEST IOWA LAKES

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Fisheries Biologist

Boat fishing and pleasure boating are major water-use activities on most bodies of water. These boaters are in direct conflict with one another. The boat fisherman is at distinct disadvantage when competing for space with those boating for pleasure. Usually the boat and motor used by an angler are smaller than the counterpart of a pleasure boater. When fishing the angler is either anchored or moving very slowly; whereas, the thrill of pleasure boating is speeding across the surface of water.

As participation in these recreations increases a solution to this problem will become more urgent Before a solution can be accomplished, knowledge of actual boating activity levels on various bodies of water must be known. The following data are presented to increase our basic knowledge of these levels on some northwest Iowa lakes during prime pleasure boating months.

## METHODS AND PROCEDURES

Creel census clerks have been counting fishing boats since 1956. Beginning in 1961 they were also required to count pleasure craft. Details for expanding these data to estimates of total boating trips have been explained in a previous quarterly report (Rose, 1956). Briefly, the day is divided into two eight hour periods. These periods are set into a prearranged schedule to allow adequate coverage throughout the month with extra effort expended on week ends. Boat counts were made on a bi-hourly basis beginning at 7 A.M. and continuing until 9 P.M.. The duration of each pleasure boat trip was assumed to be 1.5 hours. By averaging total boat counts for week days and week-end days, total trips can be estimated for each period. Boat hours were determined by multiplying the average time per trip into estimated trips. The results were calculated as the total trips and hours, both fishing and pleasure, for an average week day and week-end day. With the exception of no pleasure boat counts during July, 1966 on Spirit Lake, these were then totaled monthly for June, July, and August of 1964, 1965, and 1966 on Spirit, East Okoboji, and West Okoboji Lakes. Similar totals were obtained for Black Hawk during June, July, and August of 1964. July and August, 1965 were also censused.

By using individual counts it is possible to obtain maximum densities for pleasure, fishing, and combined boats at any one count on each lake. For comparison purposes these data are presented in acres per boat.

## LAKE CENSUSED

All four lakes mentioned above are of glacial origin, eutrophic, and support excellent fish populations. All are subject to considerable fishing and pleasure boat activity. An abundance of summer cottages and permanent homes are evident around each lake. Surface area of these lakes is quite varied and will be listed separately below. The results obtained from these counts will be discussed separately by lake.

## RESULTS

Spirit Lake (5,660 surface acres): Fishing boat trips consistently outnumbered those of pleasure vessels during the three-year period (Table 1). At no time on an average week day, during this period were pleasure boat trips more numerous than fishing craft. On week days fishing boat hours ranged from 2 to 15 times greater than pleasure boat hours. Each week end produced a decided increase in boating activity. Only during these periods did pleasure vessels offer much competition to fishing craft. Pleasure trips outnumbered fishing trips only once in the past three years (July, 1965).

Maximum combined boat density occurred during June, 1964. At this time 129 fishing craft were counted or about one per 44 acres (Table 5). At no count during this period were there less than 135 acres per pleasure boat.

East Okoboji (1,875 surface acres): East Okoboji is not conducive to water skiing and "speed" boating as some of other lakes because of severe blue-green algal blooms. Even though, pleasure boating was the dominant activity during the three years (Table 2). Only on week days during the month of June each year were the differences between fishing and pleasure crafts small. During this time, hours spent angling from boats was higher during 2 of the 3 years than the hours spent boating for pleasure. Week ends brought a decided increase of boating activity primarily of the "speeding " variety.

The maximum density recorded for pleasure vessels during this period occurred during July, 1964 when 101 were observed, or one per 19 acres (Table 5). When combined with the fishing boat count of the same period a maximum density of one craft per 18 acres is recorded. This density was also reached during July, 1965 when 91 pleasure and 13 fishing boats were counted.

West Okoboji (3,788 surface acres): West Okoboji has a reputation as being a pleasure boating lake. These data tend to substantiate this reputation. Pleasure boats were substantially higher than fishing craft during all counts (Table 3). Pleasure trips ranged from 4 to 10 times greater than fishing trips during the three years. As on the other two lakes, an increase of pleasure boating activity was observed during week ends.

Maximum pleasure craft densities ranged between 24 and 57 acres per boat (Table 5). Two-thirds of the observed maximum pleasure boat counts found them more dense than one per 41 acres. A maximum combined density of one per 23 acres was recorded. Fishing boats were never more abundant than one to 158 acres.

Black Hawk (923 surface acres): Pleasure boating was the dominant boating activity on this lake during the summers of 1964 and 1965 (Table 4). During an average summer week day pleasure boats outnumbered fishing boats by not less than 5 to 1 nor more than 15 to 1. During an average summer week-end day fishing crafts were outnumbered by as much as 35 to 1. Even though the number of boats utilizing this lake was not as large as recorded on the other lakes, the small size of this lake contributed to the high maximum densities observed (Table 5). Maximum pleasure craft densities ranged between one per 8 and 31 acres. Maximum combined densities ranged between 7 and 30 acres per boat.

## DISCUSSION

These data indicate that "speed" boating is the dominant summer boating activity on all of the lakes except Spirit. These findings are similar to those reported by Moen for 1961, 1962, and 1963. Week ends and holidays brought an increase in boating activity. The ratio of increase during these periods was in favor of pleasure boats on all lakes.

"Estimates of safe limits of boating have ranged from one boat per acre for fishermen to one boat to 40 for water skiers" (Moen, 1964). Assuming that 40 acres per pleasure boat is required for safety it can be concluded that Black Hawk Lake, during periods of increased activity, is being used excessively for boating. During peak activity West Okoboji is also approaching minimum requirements for safe boating.

Seemingly, during high pleasure boat activity the number of fishing boats would decrease. A number of comparisons between these two recreational forms have been made but no correlation can be demonstrated.

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Table 1. Numbers of fishing boats, pleasure boats and boat hours for each during 1964, 1965, and 1966 on Spirit Lake

| Month | Year | Type | Ave. Week Day Number | Ave. Week Day Hours | Ave. Week-End Day Number | Ave. Week-End Day Hours | Monthly Total Number | Monthly Total Hours |
|---|---|---|---|---|---|---|---|---|
| June | 1964 | P* | 9 | 14 | 59 | 89 | 675 | 1,015 |
| | | F** | 63 | 217 | 178 | 630 | 2,842 | 9,820 |
| | 1965 | P | 15 | 23 | 20 | 30 | 501 | 792 |
| | | F | 65 | 216 | 64 | 242 | 1,951 | 6,692 |
| | 1966 | P | 13 | 20 | 30 | 45 | 525 | 800 |
| | | F | 66 | 214 | 117 | 418 | 2,385 | 8,052 |
| July | 1964 | P | 29 | 43 | 117 | 176 | 1,603 | 2,405 |
| | | F | 46 | 137 | 70 | 222 | 1,631 | 4,938 |
| | 1965 | P | 43 | 64 | 124 | 184 | 2,051 | 3,071 |
| | | F | 54 | 166 | 70 | 293 | 1,821 | 6,287 |
| August | 1964 | P | 31 | 46 | 47 | 70 | 1,116 | 1,678 |
| | | F | 57 | 158 | 58 | 171 | 1,776 | 5,002 |
| | 1965 | P | 33 | 49 | 69 | 103 | 1,336 | 1,997 |
| | | F | 44 | 136 | 77 | 230 | 1,660 | 5,147 |
| | 1966 | P | 35 | 53 | 56 | 84 | 1,260 | 1,891 |
| | | F | 62 | 204 | 96 | 312 | 2,284 | 7,188 |

*P - Pleasure Boat Trips
**F - Fishing Boat Trips

Table 2. Numbers of fishing boats, pleasure boats and boat hours for each during 1964, 1965, and 1966 on East Okoboji Lake

| Month | Year | Type | Ave. Week Day Number | Ave. Week Day Hours | Ave. Week-End Day Number | Ave. Week-End Day Hours | Monthly Total Number | Monthly Total Hours |
|---|---|---|---|---|---|---|---|---|
| June | 1964 | P* | 26 | 39 | 50 | 200 | 1,638 | 2,458 |
| | | F** | 16 | 48 | 41 | 124 | 684 | 2,048 |
| | 1965 | P | 57 | 86 | 58 | 87 | 1,714 | 2,588 |
| | | F | 29 | 104 | 29 | 101 | 868 | 3,096 |
| | 1966 | P | 27 | 41 | 48 | 72 | 978 | 1,478 |
| | | F | 11 | 33 | 11 | 36 | 336 | 1,014 |
| July | 1964 | P | 229 | 343 | 139 | 208 | 6,372 | 9,553 |
| | | F | 10 | 30 | 11 | 32 | 314 | 946 |
| | 1965 | P | 28 | 124 | 288 | 430 | 4,393 | 6,598 |
| | | F | 15 | 59 | 47 | 178 | 755 | 2,810 |
| | 1966 | P | 60 | 90 | 137 | 206 | 2,710 | 4,066 |
| | | F | 14 | 40 | 15 | 50 | 441 | 1,350 |
| August | 1964 | P | 80 | 120 | 138 | 207 | 3,062 | 4,590 |
| | | F | 11 | 34 | 14 | 43 | 383 | 1,144 |
| | 1965 | P | 86 | 130 | 92 | 403 | 4,303 | 6,487 |
| | | F | 29 | 70 | 48 | 134 | 834 | 2,746 |
| | 1966 | P | 50 | 76 | 69 | 104 | 1,720 | 2,580 |
| | | F | 23 | 78 | 25 | 85 | 731 | 2,474 |

*P - Pleasure Boat Trips
**F - Fishing Boat Trips

Table 3. Numbers of fishing boats, pleasure boats and boat hours for each during 1964, 1965, and 1966 on West Okoboji Lake

| Month | Year | Type | Ave. Week Day Number | Ave. Week Day Hours | Ave. Week-End Day Number | Ave. Week-End Day Hours | Monthly Total Number | Monthly Total Hours |
|---|---|---|---|---|---|---|---|---|
| June | 1964 | P* | 74 | 111 | 326 | 484 | 4,198 | 6,314 |
| | | F** | 28 | 84 | 57 | 172 | 1,078 | 3,224 |
| | 1965 | P | 174 | 262 | 253 | 380 | 5,849 | 8,804 |
| | | F | 38 | 122 | 41 | 95 | 1,168 | 3,444 |
| | 1966 | P | 101 | 151 | 297 | 446 | 4,592 | 6,890 |
| | | F | 31 | 60 | 22 | 75 | 871 | 2,025 |
| July | 1964 | P | 250 | 375 | 227 | 340 | 7,569 | 11,345 |
| | | F | 26 | 76 | 36 | 109 | 876 | 2,620 |
| | 1965 | P | 367 | 551 | 526 | 789 | 12,808 | 19,223 |
| | | F | 41 | 132 | 51 | 158 | 1,365 | 4,326 |
| | 1966 | P | 134 | 215 | 500 | 749 | 8,367 | 12,539 |
| | | F | 31 | 60 | 22 | 75 | 871 | 2,025 |
| August | 1964 | P | 217 | 325 | 301 | 451 | 7,561 | 9,225 |
| | | F | 59 | 178 | 37 | 110 | 1,602 | 4,838 |
| | 1965 | P | 325 | 503 | 231 | 411 | 10,003 | 14,765 |
| | | F | 50 | 147 | 38 | 119 | 1,228 | 4,305 |
| | 1966 | P | 170 | 252 | 400 | 600 | 8,110 | 10,665 |
| | | F | 40 | 117 | 40 | 116 | 1,249 | 3,619 |

*P - Pleasure Boat Trips
**F - Fishing Boat Trips

Table 4. Numbers of fishing boats, pleasure boats and boat hours for each during 1964, and 1965 on Black Hawk Lake

| Month | Year | Type | Ave. Week Day Number | Ave. Week Day Hours | Ave. Week-End Day Number | Ave. Week-End Day Hours | Monthly Total Number | Monthly Total Hours |
|---|---|---|---|---|---|---|---|---|
| June | 1965 | P* | 34 | 51 | 184 | 275 | 2,217 | 3,322 |
| | | F** | 7 | 27 | 11 | 41 | 245 | 922 |
| July | 1964 | P | 47 | 71 | 318 | 478 | 3,634 | 5,457 |
| | | F | 5 | 16 | 9 | 38 | 182 | 672 |
| | 1965 | P | 71 | 107 | 107 | 161 | 2,525 | 3,642 |
| | | F | 7 | 29 | 5 | 17 | 178 | 635 |
| August | 1964 | P | 42 | 64 | 117 | 176 | 2,065 | 3,104 |
| | | F | 5 | 20 | 6 | 24 | 171 | 670 |
| | 1965 | P | 61 | 91 | 75 | 150 | 2,141 | 3,202 |
| | | F | 4 | 17 | 7 | 28 | 153 | 626 |

*P - Pleasure Boat Trips
**F - Fishing Boat Trips

Table 5. Maximum single count densities of fishing, pleasure and combined boats, presented as acres per boat for Spirit, East Okoboji, West Okoboji, and Black Hawk Lakes

| Lake | Year | Month | Fishing Boats | Pleasure Boats | Combined |
|---|---|---|---|---|---|
| Spirit Lake (5,660 Acres) | 1965 | June | 44 | 283 | 44 |
| | | July | 177 | 135 | 84 |
| | | August | 153 | 236 | 132 |
| | 1965 | June | 109 | 435 | 102 |
| | | July | 83 | 138 | 58 |
| | | August | 123 | 174 | 102 |
| | 1966 | June | 90 | 515 | 84 |
| | | August | 138 | 270 | 109 |
| East Okoboji (1,875 Acres) | 1964 | June | 134 | 62 | 49 |
| | | July | 312 | 19 | 18 |
| | | August | 110 | 69 | 37 |
| | 1965 | June | 94 | 89 | 67 |
| | | July | 75 | 20 | 18 |
| | | August | 104 | 43 | 37 |
| | 1966 | June | 234 | 89 | 67 |
| | | July | 187 | 57 | 47 |
| | | August | 110 | 111 | 109 |
| West Okoboji (3,788 Acres) | 1964 | June | 189 | 47 | 43 |
| | | July | 199 | 24 | 23 |
| | | August | 158 | 44 | 39 |
| | 1965 | June | 223 | 40 | 38 |
| | | July | 223 | 37 | 36 |
| | | August | 158 | 38 | 36 |
| | 1966 | June | 270 | 53 | 43 |
| | | July | 253 | 27 | 26 |
| | | August | 253 | 39 | 36 |
| Black Hawk (923 Acres) | 1964 | June | 184 | 12 | 11 |
| | | July | 92 | 8 | 7 |
| | | August | 230 | 25 | 24 |
| | 1965 | July | 184 | 12 | 11 |
| | | August | 231 | 31 | 30 |

# AGE AND RATE OF GROWTH OF THE CHANNEL CATFISH IN CORALVILLE RESERVOIR

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Intensive fishing for channel catfish during the early summer and fall of 1966 was conducted on Coralville Reservoir as part of a study to determine if this species can be commercially exploited. Preliminary investigations were made to determine growth history.

Finanacial aid for this study has been given by the Bureau of Commercial Fisheries, U. S. Fish and Wildlife Service.

## METHODS

Spine samples were collected at 11 bi-weekly periods commencing on June 18. The reservoir was arbitrarily divided into headwaters and pool areas because of the marked difference in physical characteristics. Four hundred and eighty-one were obtained from the pool and 95 from the headwaters area.

## RESULTS

### Body-Spine Relationship

There was no difference in the body-spine relationship between the headwaters and the pool fish so the data was combined. The spines were sectioned as described by (Helms 1965), magnified 32 times and measured to the nearest 1/8 inch on the maximum radius. The relationship when viewed emperically was curvilinear and constants a and b were solved by the least squares method $\text{Log } Y = a + bX$. The equation:

$$\text{Log } Y = 0.3477 + 0.1931X$$

was obtained, where Y equals the standard body length in inches and X equals the spine radius in inches times 32. This relationship was used to construct an arithmetic nomograph from which body lengths were back calculated for various years of life.

### Description of Growth

Calculated lengths were identical among the bi-weekly periods for each area and were combined by weighted averages (Tables 1 and 2).

Table 1. Grand average calculated lengths of channel catfish in the pool area of Coralville Reservoir

| Year Class | Age Group | year of life | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1965 | I | 2.8 | | | | | | | | | |
| 1964 | II | 2.7 | 6.6 | | | | | | | | |
| 1963 | III | 2.8 | 5.5 | 10.2 | | | | | | | |
| 1962 | IV | 3.0 | 5.8 | 8.0 | 13.3 | | | | | | |
| 1961 | V | 2.7 | 4.6 | 6.8 | 8.8 | 14.0 | | | | | |
| 1960 | VI | 2.8 | 5.7 | 8.1 | 10.1 | 12.2 | 16.6 | | | | |
| 1959 | VII | 3.2 | 5.4 | 7.3 | 9.6 | 11.1 | 12.8 | 18.4 | | | |
| 1958 | VIII | 3.8 | 6.8 | 8.3 | 9.7 | 10.9 | 12.2 | 13.6 | 19.0 | | |
| 1957 | IX | 3.0 | 5.2 | 7.3 | 8.9 | 11.0 | 12.5 | 13.7 | 14.7 | 17.9 | |
| 1956 | X | 3.7 | 7.3 | 10.0 | 14.9 | 17.3 | 18.0 | 19.5 | 20.8 | 22.4 | 25.0 |
| average | | 3.0 | 5.9 | 8.2 | 10.8 | 12.7 | 14.4 | 16.3 | 18.1 | 20.2 | 25.0 |

Table 2. Grand average calculated lengths of channel catfish in the headwaters of Coralville Reservoir.

| Year Class | Age Group | year of life | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1965 | I | 2.6 | | | | | | |
| 1964 | II | 2.7 | 6.3 | | | | | |
| 1963 | III | 2.5 | 4.7 | 9.0 | | | | |
| 1962 | IV | 2.4 | 4.8 | 7.0 | 12.0 | | | |
| 1961 | V | 2.0 | 3.5 | 5.3 | 6.9 | 12.6 | | |
| 1960 | VI | | | | | | | |
| 1959 | VII | 4.2 | 7.2 | 9.0 | 11.1 | 15.2 | 16.7 | 18.3 |
| average | | 2.7 | 5.3 | 7.6 | 10.0 | 13.9 | 16.7 | 18.3 |

The grand average calculated lengths for the pool were: 3.0, 5.9, 8.2, 10.8, 12.7, 14.4, 16.3, 18.1, 20.2, and 25.0 inches. For the headwaters area they were: 2.7, 5.3, 7.6, 10.0, 13.9, and 18.3 inches. During the first four years of life growth rate of the headwaters fish is slower than that of the pool fish (Figure 1). Helms (op. cit.) found that headwaters and pool fish had similar growth rates. The pool fish of the present study agree very closely, but the headwaters fish have a slower growth rate found by the previous study.

Increment values were derived from the average calculated lengths (Tables 3 and 4). There is a divergence from the cumulative grand average calculated lengths at age five. This divergence is probably due to the small sample size after age five.

Table 3. Grand average calculated increments of the channel catfish in the pool area of the Coralville Reservoir

| Year Class | Age Group | year of life | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1965 | I | 2.8 | | | | | | | | | |
| 1964 | II | 2.7 | 3.9 | | | | | | | | |
| 1963 | III | 2.8 | 2.7 | 4.6 | | | | | | | |
| 1962 | IV | 3.0 | 2.9 | 2.2 | 5.3 | | | | | | |
| 1961 | V | 2.7 | 1.9 | 2.2 | 2.0 | 5.2 | | | | | |
| 1960 | VI | 2.8 | 2.9 | 2.4 | 2.0 | 2.1 | 4.4 | | | | |
| 1959 | VII | 3.2 | 2.2 | 1.9 | 2.3 | 1.5 | 1.7 | 5.6 | | | |
| 1958 | VIII | 3.8 | 3.0 | 1.5 | 1.4 | 1.2 | 1.3 | 1.4 | 5.4 | | |
| 1957 | IX | 3.0 | 2.2 | 2.2 | 1.6 | 2.1 | 1.4 | 1.3 | 1.0 | 3.1 | |
| 1956 | X | 3.7 | 3.7 | 2.6 | 4.9 | 2.4 | 0.7 | 1.4 | 1.4 | 1.5 | 2.7 |
| average | | 3.0 | 2.8 | 2.5 | 2.8 | 2.4 | 1.9 | 2.4 | 2.6 | 2.3 | 2.7 |
| cumulative | | 3.0 | 5.8 | 8.3 | 11.1 | 13.5 | 15.4 | 17.8 | 20.4 | 22.7 | 25.4 |

Table 4. Grand average calculated increments of the channel catfish in the headwaters of Coralville Reservoir

| Year Class | Age Group | year of life | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1965 | I | 2.6 | | | | | | |
| 1964 | II | 2.7 | 3.6 | | | | | |
| 1963 | III | 2.5 | 2.1 | 4.4 | | | | |
| 1962 | IV | 2.4 | 2.3 | 2.3 | 5.0 | | | |
| 1961 | V | 2.0 | 1.5 | 1.8 | 1.6 | 6.0 | | |
| 1960 | VI | | | | | | | |
| 1959 | VII | 4.2 | 3.0 | 1.8 | 2.1 | 4.1 | 1.5 | 1.7 |
| average | | 2.7 | 2.5 | 2.6 | 2.9 | 5.1 | 1.5 | 1.7 |
| cumulative | | 2.7 | 5.2 | 7.8 | 10.7 | 15.8 | 17.3 | 19.0 |

Variation of growth in different calendar years was determined by converting increments of each year of life to a percentage of the mean increment for that year of life. These percentages were then averaged by calendar year including all age groups for the year. One hundred was then subtracted from each of these values to obtain a + or - per cent deviation from the mean.

There is close agreement of growth deviation between the headwaters and pool areas. (Tables 5 and 6). It is evident that the 1965 year of growth was excellent for both the pool (+ 71.3%) and headwaters (+ 30.8%) (Figure 2). It is possible that a fish kill in 1965 and a subsequent biological void enhanced growth in this year.

Table 5. Percent deviation from mean annual increments for various calendar years for the pool of Coralville Reservoir

| Year | Percent deviation |
|---|---|
| 1956 | + 03.5 |
| 1957 | + 15.8 |
| 1958 | + 4.6 |
| 1959 | + 20.7 |
| 1960 | - 21.4 |
| 1961 | - 24.3 |
| 1962 | - 22.2 |
| 1963 | - 24.6 |
| 1964 | - 23.0 |
| 1965 | + 71.3 |

Table 6. Percent deviation from mean annual increments for various calendar years for the headwaters of Coralville Reservoir

| Year | Percent deviation |
|---|---|
| 1959 | + 46.7 |
| 1960 | + 17.0 |
| 1961 | - 30.8 |
| 1962 | - 28.1 |
| 1963 | - 18.8 |
| 1964 | - 16.9 |
| 1965 | + 30.8 |

Growth within the season for the pool including age groups I, II, III, IV and VII was determined by subtracting average length at last annulus formation from the average length at time of capture for each age group and each bi-weekly period. The emperical growth for each group terminated by September 24, therefore, the increment of growth for the 8th bi-weekly period was used as a base to determine the percentage growth completed for previous periods. The age groups were averaged and by interpolation 15 per cent of the annual growth was completed by June 24, 25 per cent by June 28, 50 per cent by July 9, 75 per cent by August 9 (Figure 3). Data was insufficient to calculate growth for the headwaters or age groups V, VI, VIII, IX and X in the pool.

Length-Weight Relationship

By visual inspection of the data the length-weight relationship for the channel catfish was considered to be identical for headwaters and pool. The average weight for each one inch length interval was calculated and the constants a and b were solved for the formula: Log Y = a + b Log X. The resulting equation

$$\text{Log } W = 3.444 + 2.932 \text{ Log } L$$

where W equals weight in pounds and L equals total length in inches best describe the length weight relationship.

Growth in Weight

Cumulative grand average calculated lengths were calculated in terms of the length-weight relationship; 0.01, 0.06, 0.18, 0.42, 0.74, 1.09, 1.70, 2.51, 3.39, and 4.78 pounds were the weight values for the fish of the pool area for annuli I through X respectively. The values for the headwaters fish were: 0.01, 0.06, 0.15, 0.38, 1.15, 1.51 and 1.99 pounds for annuli I through VII respectively (Figure 4).

## CONCLUSIONS

1. Grand average calculated lengths were 3.0, 5.9, 8.2, 10.8, 12.7, 14.4, 16.3, 18.1, 20.2, and 25.0 inches for the pool and 2.7, 5.3, 7.6, 10.0, 13.9, 16.7 and 18.3 inches for the headwaters area for annuli I through X and I through VII respectively.

2. There was a large variation of growth for various calendar years. An increase in growth of 94.3 per cent from 1964 to 1965 occurred in the pool and 47.7 percent in the headwaters area.

3. Twenty-five percent of the 1966 growth in the pool had occurred by June 28th, 50 per cent by July 9th, 75 per cent by August 9th, growth was completed by September 16th.

4. Growth in weight was 0.001, 0.002, 0.18, 0.42, 0.74, 1.09, 1.70, 2.51, 3.39 and 4.78 pounds for the pool and 0.001, 0.002, 0.15, 0.38, 1.15, 1.51, and 1.99 for the headwaters area for annuli I through X and I through VII respectively.

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# CLEAR LAKE WALLEYE POPULATION ESTIMATE

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Clear Lake is a eutrophic lake of 3,643 acres with a maximum depth of about 20 feet. Only 15 per cent of the lake exceeds 15 feet in depth (Bailey and Harrison, 1945). It is Iowa's third largest natural lake and is the only large lake in north central Iowa. As such, it receives heavy fishing pressure.

Clear Lake contains at least 43 species of fish. One of the most popular game fish is the walleye. It has been studied extensively at Clear Lake. Walleye population estimates were made by Whitney (1958) in 1953 and by McCann (1960) in 1958. Creel census described by Rose (1956) has been used on the lake since 1958. It shows a decline in the walleye catch since McCann made his estimate (Moen, 1961, 1962, Jennings, 1965, Hollingsworth, 1966). In March, 1966, a marking study was initiated to determine if the population had declined with the catch. Exploitation was also investigated.

## MARKING

In March and April, 1966, 1,400 walleye in excess of 12 inches total length were marked with monel metal jaw tags - placed over the pre-maxillary and maxillary. Another 822 fish were marked by excising the left pectoral fin. These 2,222 walleyes were obtained from routine operations of the Clear Lake Fish Hatchery and from electro-fishing. The fin clipped sample was to be used to determine if tagged and untagged fish bite at different rates. It also provided a second population estimate and increased the total number of marked fish. Marking procedures were reported on earlier (Hollingsworth, 1966)

## RECOVERIES

A creel census clerk was employed at Clear Lake from May 1 through September 30, 1966. During routine creel checks, he recorded the marks and total walleye he observed. He also took scale samples during the first week of every month. These were used to calculate recruitment.

In its continuing investigation of Clear Lake, the Iowa Cooperative Fisheries Research Unit employs gill nets, short drag seines, and an electric shocker from June through August. The Research Unit made its record of walleye recaptures available for this study.

The Biology Section surveys crew also devoted special attention to Clear Lake in 1966. Recovery work with a shocker and a 500 foot bag seine was done periodically from June through October. Three routine fishery inventories with emphasis on recovering tagged walleyes were also conducted during this time.

Peterson estimates were based on the creel census and combined data of the Research Unit and Survey Crew. Tags and fin-clips were treated separately.

## TAGGED SAMPLE

The census clerk observed an adjusted sample of 291 walleyes from May 1 through September 30. Of these, 28 had were recaptures. The resulting estimate of 14,550 has a 95 per cent confidence interval of 9,392 - 19,778 (Table 1A). This does not differ greatly from the estimate of 10,793 derived from recovery work by the Research Unit and Survey Crew. They took an adjusted sample of 424 walleyes with 55 tags. The 95 per cent confidence interval for this estimate is 7,977 - 13,507 (Table 1B). The recovery work estimate is probably more accurate because of its larger sample size. Also, hook and line fishing is selective when jaw tags are used for marks. Since tagged fish do not grow as fast as untagged fish in the same population, it is likely that they do not feed as much or as efficiently. Tagged fish probably have a lower exploitation rate and estimates based on hook and line sampling tend to be larger than true populations. This may explain why the creel census estimate is higher than that for the recovery work. Table 1 A shows in July only one tag was recovered in a sample of 21 walleyes. This ratio is different from all others and inflates the final estimate.

It is possible to oversample the larger fish in a population when their favored habitat is limited as it is in Clear Lake. Large walleye are concentrated in a few dense stands of bull-rush. These areas are difficult to fish and few fishermen work them. The big fish they harbor are highly vulnerable to shocking, but not to hook and line. A recovery work sample of 424 fish contained 139 walleyes over 20 inches long. It is unlikely that nearly one-third of the walleyes in the lake exceed 20 inches as suggested by this ratio. Therefore, the recovery work estimate of 10,793 is probably low.

The Clear Lake walleye population lies between the creel census estimate (14,550) and the recovery work estimate (10,793), however, the latter is probably more accurate.

## FIN-CLIPS

Most of the fin-clipped sample (822 fish) was captured in 2 and 2 1/2 inch (bar measure) gill nets. An effort was made to obtain smaller walleye for clipping by electro-fishing, but time did not permit marking many. Although the fin-clipped walleyes were not measured, they certainly had a larger average length than the tagged fish. The smallest fin-clip recaptured was 14.5 inches long.

The creel census clerk observed 13 fin-clips in an adjusted sample of 291 walleye. This gives a population estimate of 18,400 with a 95 per cent confidence interval of 8,730 - 28,070 (Table 2A). This estimate is significantly different from all others, probably because of the selectivity of hook and line fishing and the large average size of the fish.

The recovery work estimate is much different (Table 2B). The sample of 424 walleyes contained 40 fin-clips. The resulting estimate of 8,713 has a 95 per cent confidence interval of 6,091 - 11,335. Again, the difference between these estimates may be explained by the large average size of the clipped fish. This would tend to make the creel census estimate high and the recovery work estimate low. The latter figure compares favorably with the recovery work estimate from the tagged sample. The larger size of the fin-clips would tend to make that estimate lower, but each estimate, 8,713 (fin-clips) and 10,793 (tags) within the 95 per cent confidence interval of the other.

## DISCUSSION

The best estimate of the Clear Lake walleye population from this study is 10,793 based on tag returns from recovery work. It is lower than Whitney's estimate of the 1953 population. He found 30,820 fish over 12 inches long or 8.5 walleyes per acre. The present estimate represents only 2.1 per acre. Moen (1965) felt that 7 adult walleyes per acre was a relatively high population. He estimated Spirit Lake to have 4.9, 8.5, and 14.1 walleyes per acre in 1961, 1962, and 1963, respectively. From this it is apparent the present population is low.

The 1958 Clear Lake walleye population was estimated by McCann to be 12,300 with a 95 per cent confidence interval of 9,500 - 15,000. This is fairly close to the current estimate of 10,793.

The number of walleyes in Clear Lake is low, but is not significantly different than it was in 1958. The catch has declined since then, but the population has probably not changed significantly. This supports the contention that factors other than the number of fish present influence fishing success.

## EXPLOITATION

Fishermen returned 121 tags between May 1 and September 30 for a minimum exploitation rate of 8.6 per cent. Angler returns are far from complete. A better approximation of exploitation can be calculated from the 1966 Clear Lake creel census. The census clerk observed 563 walleyes of which 291, or 51.7 per cent, were 12 inches long or longer when tagging was done. Applied to the estimated 7,991 walleyes caught, this ratio gives 4,131 fis over 12 inches long in the creel. Since the walleye population probably lies between the two tag estimates (Table 1), minimum and maximum exploitation rates should be considered. Based on the recovery work estimate, 10,793, maximum exploitation for the 5 month period is 38.3 per cent. Minimum exploitation based on the hook and line estimate, 14,550, is 38.5 per cent. These rates seem realistic. Moen (1965) estimated exploitation of Spirit Lake walleyes for a 9 1/2 month period at 50 per cent in 1961 and 33 per cent in 1962 and 1963.

It was intended to compare exploitation of tagged and untagged (fin-clipped) fish. The disproportionate number of large walleyes in the clipped sample prohibits a valid comparison.

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Table 1. Population estimates based on tag recaptures

A. Creel census

| Month | Adjusted Sample | Marked No. | Population Estimate | 95% Confidence Interval |
|---|---|---|---|---|
| May | 98 | 11 | 12,473 | |
| June | 137 | 13 | 14,754 | |
| July | 21 | 1 | 29,400 | |
| August | 27 | 3 | 12,600 | |
| Sept. | 8 | 0 | | |
| Totals | 291 | 28 | 14,550 | 9,392 - 19,778 |

B. Recovery work

| Month | Adusted Sample | Marked No. | Population Estimate | 95% Confidence Interval |
|---|---|---|---|---|
| May | 0 | | | |
| June | 82 | 12 | 9,567 | |
| July | 66 | 6 | 15,400 | |
| August | 266 | 36 | 10,344 | |
| Sept. | 0 | | | |
| October | 10 | 1 | 14,000 | |
| Totals | 424 | 55 | 10,793 | 7,977 - 13,507 |

Table 2. Population estimates based on fin-clip recaptures

A. Creel census

| Month | Adjusted Sample | Marked No. | Population Estimate | 95% Confidence Interval |
|---|---|---|---|---|
| May | 98 | 7 | 11,508 | |
| June | 137 | 4 | 28,154 | |
| July | 21 | 2 | 8,631 | |
| August | 27 | 0 | | |
| Sept. | 8 | 0 | | |
| Totals | 291 | 13 | 18,400 | 8,730 - 28,070 |

B. Recovery work

| Month | Adjusted Sample | Marked No. | Population Estimate | 95% Confidence Interval |
|---|---|---|---|---|
| May | 0 | | | |
| June | 82 | 6 | 11,234 | |
| July | 66 | 7 | 7,750 | |
| August | 266 | 26 | 8,410 | |
| Sept. | 0 | | | |
| October | 10 | 1 | 8,220 | |
| Totals | 424 | 40 | 8,713 | 6,091 - 11,335 |

# 1966 - OFFICER CONTACT CREEL CENSUS FOR THE MISSISSIPPI RIVER

Don R. Helms
Fisheries Biologist

Beginning in 1960 Conservation Officers were instructed to obtain basic information on catch statistics from Iowa anglers during routine patrol. As officers interviewed anglers, information was gathered on the number of anglers in the party, total hours fished, and number and species of fish caught. These data are returned to the Biology Section for analysis and are reproted in the Quarterly Biology Reports.

The following is a presentation of data collected in 1966 on the Mississippi River as it borders Iowa.

A total of 1,629 contacts were made. This represents a sample of 2,903 man hours of fishing. Table I shows the contribution by each species in each county. In interpreting these data, one must keep in mind that at best, there are many variables and bias involved in creel census. Thus, the limited number of contacts and lack of uniformity in seasonal distribution of these contacts in individual counties resulted in unquestionable error. However, the author feels that the average of all counties combined represents a reasonably close estimate of the catch rates.

Catch rate varied from a high of 2.16 fish per hour in Allamakee County to 0.81 fish per hour in Des Moines County. The average was 1.23 fish per hour. Bluegill, crappie, walleye and sauger were the major species contributing over 70 percent of the catch. Other species reported in order of their numerical contribution were largemouth bass, bullhead, drum, channel catfish and carp.

Table 1. Angler success and harvest by county on the Mississippi River in 1966

| County | Total Contacts | Total Hours | Fish Per Hour | Percent of Catch by Species by County | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Blue-gill | Crappie | Walleye Sauger | Bass | Bull-head | Drum | Cat-fish | Carp | W&Y Bass | Misc. |
| Allamakee | 151 | 455 | 2.16 | 52.4 | 34.1 | 3.6 | 5.2 | -- | --- | 0.8 | 0.9 | --- | 2.9 |
| Clayton | 81 | 145 | 1.80 | 57.0 | 13.8 | 1.9 | 17.2 | 2.3 | --- | 1.1 | 6.5 | --- | --- |
| Dubuque | 409 | 693 | .88 | 23.6 | 20.2 | 12.5 | 10.7 | 4.4 | 15.2 | 6.2 | --- | 2.0 | 5.2 |
| Jackson | 89 | 274 | 1.80 | 1.6 | 10.7 | 79.1 | -- | 8.1 | 0.2 | --- | --- | 0.2 | --- |
| Clinton | 240 | 456 | .84 | 35.4 | 25.6 | -- | 6.0 | 18.2 | 4.9 | 1.3 | 1.3 | 6.8 | 0.5 |
| Scott | 436 | 496 | .98 | 18.6 | 33.4 | 12.4 | 7.0 | 10.7 | 7.4 | 4.5 | 3.5 | --- | 2.5 |
| Muscatine | No Contacts Reported | | | | | -- | | | | | | | |
| Louisa | 21 | 53 | 1.23 | 6.2 | 1.5 | -- | 23.1 | 41.5 | 1.5 | --- | 1.5 | 23.1 | 1.5 |
| Des Moines | 132 | 248 | .81 | 29.4 | 10.9 | -- | 10.9 | 9.6 | --- | 13.9 | 7.5 | --- | 17.9 |
| Lee | 70 | 83 | .88 | 32.9 | 1.4 | 6.8 | 15.1 | 12.3 | --- | 11.0 | 15.1 | --- | 5.5 |
| All Counties Combined | 1,629 | 2,903 | 1.23 | 31.8 | 23.4 | 16.1 | 7.5 | 7.0 | 4.2 | 3.1 | 2.1 | 1.5 | 3.3 |

# AGE OF QUAIL TAKEN BY IOWA QUAIL HUNTERS
## 1966 SEASON

M. E. Stempel
Game Biologist

## INTRODUCTION

The Iowa quail wing study began in 1946. It is based on information obtained from wings of quail shot by hunters. Hatching dates of quail under 150 days old are determined during this work; further, it is a means of learning how various weather patterns affected hatching. From it has been learned which age groups are most often taken by hunters and eventually it should show whether long hunting seasons take excessive numbers of quail that would otherwise live until another production period. These data can be compared to summer whistling quail counts since both studies indicate progress of hatching. The current report is based on results of the 1966 wing survey, with supplemental data from roadside and field surveys. Comparisons are made with similar data for 1965.

## METHODS

A number of cooperators are contacted each year before the hunting season. These are both Conservation Commission personnel and licensed quail shooters who live in southern Iowa where they can collect large numbers of wings. Procedures are further discussed in the Quarterly Biology Reports for October - December 1965.

## RESULTS

A total of 1,436 wings was collected in October and early November of 1966. These were from 21 counties and the number was more than enough to establish production periods of the young (Haugen 1958). Eighty-six percent were from young birds; the comparable figure was 85 percent in 1965. There were 95 hens per 100 cocks in the sample. Other information is given in Tables 1 and 2.

The 1966 wing collection was carried out primarily in October, whereas the open season dates were October 22 to January 31, 1967. In 1965, the corresponding collection of wings was made November 6 to 18.

While hunters took the most birds from the more numerous young segment, the true proportion in the field may not be represented. The quail wing sample which is obtained from hunters must be regarded as a sample of the most available birds which are large enough to be acceptable to hunters since some do not shoot the "squealers" or very young quail. Opportunity to kill quail is influenced by many factors. As an example, any quail, adult or young, which have fully developed flight plumage, and are thus capable of strong flight, are less liable to be shot than mature-appearing quail with short or immature flight feathers. Hence it is possible that the kill of the strong flying quail would be less than that of the weaker flyers, even though the better developed birds (either young or old) might be more numerous than is shown in the kill.

## Quail Hatching Distribution in 1966

Seventy-four percent of the wings of quail taken early in the season were from quail under 150 days old, and the approximate age of these could be determined by growth stage of primaries. For this segment the hatch began in June, peaked in July, remained high into August, then tapered off and ended in October (Figure 1). The graph represents mostly birds shot in October, since as the season progressed a higher percentage exceeded 150 days in age.

## Adults

About 14 percent of the total take was adult quail (over 1 year old). They moult all 10 of the wing primaries while the young usually shed only the inner 8 flight feathers. None of the adults had moulted completely; i.e., the primaries were not all replaced with new feathers.

## Supplementary Data from Broods Sighted in the Summer

No exact hatching date can be assigned to young quail over 150 days old because flight feather growth is completed and all primaries are full length. However, we have information on the age of 42 broods seen during summer. I observed some of these, while others were reported by officers, biologists, farmers, and dog trainers. These began to hatch in early May. Most of the broods seen were hatched in May (18), June (8) and August (9).

# DISCUSSION

About 75 percent of the birds under 150 days old were nearing maturity when taken by gunners. The number of other quail (over 150 days old) represent a good early hatch. Many adults were still in early moult when shot, and this indicated that there was good late production as well as early production, since moult follows nesting activity. Supplemental information indicates that pairing was comparatively early and calling was extensive; these indicate much nesting activity. Altogether, after an early start, a high rate of hatch was soon reached and good success was maintained, with a resulting high fall population.

The 1966 production pattern was estimated from the collection of 1,436 wings from 21 counties in southern Iowa quail range. Seventy-four percent were young (under 150 days old) that could be aged. Their hatching dates were established. Twelve percent were young (over 150 days old) with fully matured flight feathers. None of the adults collected in October bore fully matured wing plumage. Additional information was gleaned from observation of 42 broods in the summer.

In 1965, good production was indicated by comparable data from 1,364 wings. Twenty-one counties were again represented. Fifty-nine percent of the young (under 150 days old) could be aged and their hatching dates established. Forty-one percent were young (over 150 days old) with fully matured flight feathers. Three percent of the adults bore fully matured flight feathers, but these were taken after November 1. Additional information came from 55 coveys seen in the summer of 1965.

The 1966 quail shooting season began October 22; the 1965 season began November 6. The earlier season was of considerable help in getting better production information from a sample of birds harvested.

## LITERATURE CITED

Haugen, Arnold O., and Daniel W. Speake.
1958. Progress report on Alabama bobwhite quail wing study. Proc. Twelfth Ann. Conf. S. W. Assoc. of Game and Fish Commissioners.

Table 1. A tabular compilation of data from Iowa quail wings collected in 1966 and 1965

| | 1966 | 1965 |
|---|---|---|
| 1. No. of wings | 1,436 | 1,364 |
| 2. No. of wings accompanied by useable information | 1,436 | 1,364 |
| 3. No. of counties represented | 21 | 21 |
| 4. Percent of young in sample | 86 | 85 |
| 5. Percent of young that were mature or nearly so (90 days old or older) | 67* | 81 ** |

* Birds taken October 22 to November 12 (In 1964, this figure was 77 percent.)

** Birds taken November 6 to 18.

Table 2. The percent young in quail bagged in Iowa, 1966-67

| Year | % young in quail bagged | No. of wings in sample * |
|---|---|---|
| 1956 | 87 | 352 |
| 1957 | 87 | 613 |
| 1958 | 80 | 1,253 |
| 1959 | 85 | 939 |
| 1960 | 90 | 656 |
| 1961 | 89 | 560 |
| 1962 | 88 | 576 |
| 1963 | 89 | 1,380 |
| 1964 | 86 | 1,639 |
| 1965 | 85 | 1,364 |
| 1966 | 86 | 1,436 |

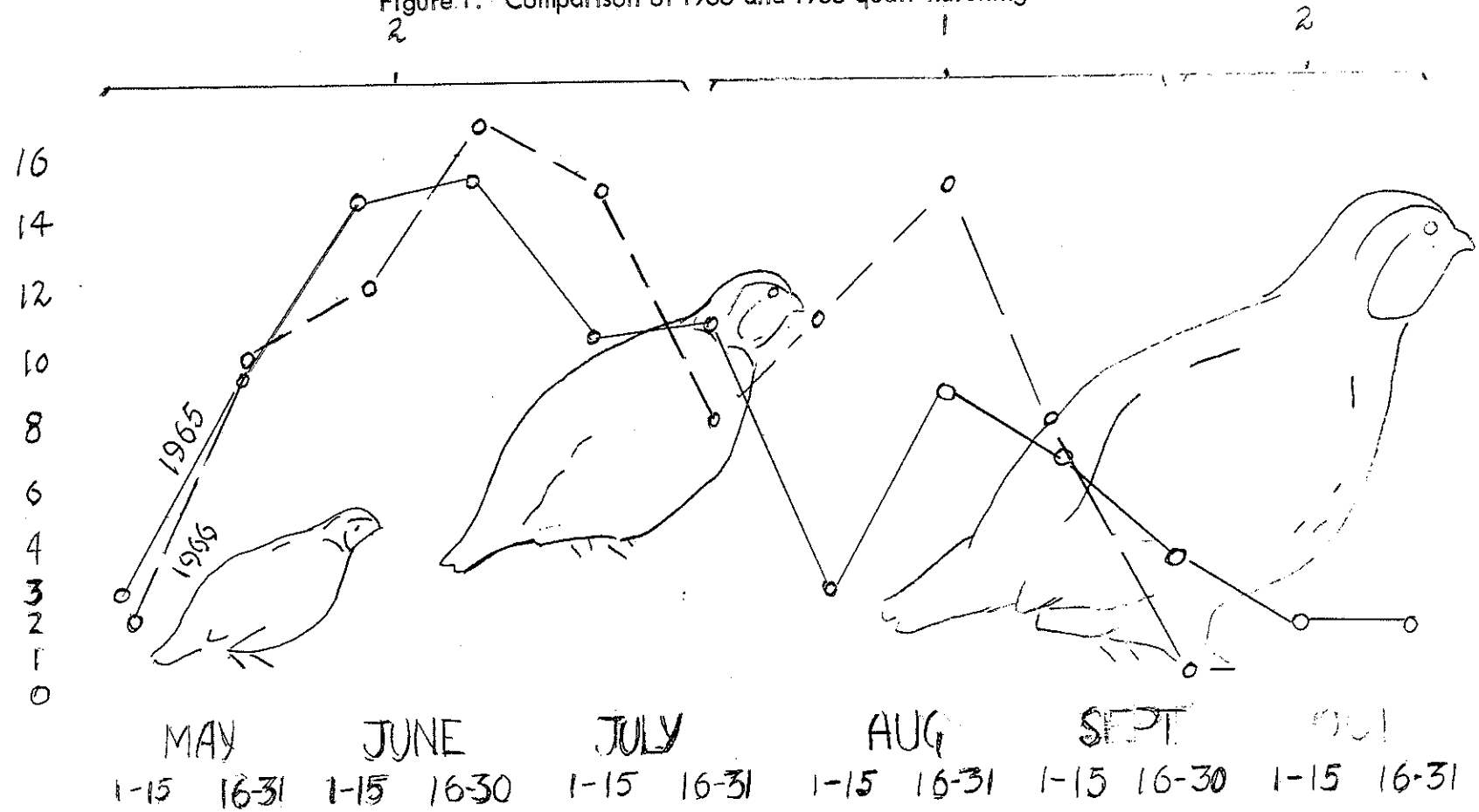
* Some wings are not included as they were not accompanied by data on place and date of kill; some wings decayed because they were sealed in plastic bags or other air tight containers.

# AGE OF QUAIL TAKEN BY IOWA QUAIL HUNTERS, 1966 SEASON

M. E. Stempel
Game Biologist

Wings from more than 1,436 quail shot by Iowa hunters during the 1966-67 season were collected from 21 counties in late October and early November. Eighty-six percent were juveniles. The hatch, as determined from wings and from coveys seen in the summer, began in May, peaked in June, and remained high into August. Altogether, after an early start a high rate of hatch was soon reached and except for a low in July and early August, it was maintained over a long period-with a resulting higher population than in 1965.

Figure 1. Comparison of 1966 and 1965 quail hatching date distribution.




*1. Data from ageable wings taken through early November.

2. Based on wing samples, brood seen and aged, research area call counts and other calling quail counts; few wings can be aged from birds hatched prior to July when the season opens in November. In 1966, the season opened in late October and wings could be aged back to June 1966.

# BOW HUNTERS DEER KILL REPORTS - 1966
(including comparison with 1965)

Keith D. Larson
Game Biologist

## INTRODUCTION

The 1966 bow season was significantly different due to a change in regulations. Because an experimental shotgun season was set for mid-November, a split - season was necessary to continue to provide the opportunity permitted in previous years. The season was 51 days long as in recent years. It began on October 15th and first closing was November 13th. It reopened November 26th and closed December 16th. The only other change was the removal of a restriction to a bow of 30# minimum pull.

## RESULTS

### Card Returns

The hunter report card was returned by 4,021 of the 4,576 permit holders. Of the total permitees 218 reported they did not hunt. For the purpose of computing hunters success, those that did not report were assumed to have hunted. (See Table 1).

### Total Kill and Success Ratio

Bow hunters killed 579 deer; a decline from 1965. The success ratio also declined to 13.3%. This compares with the previous 5-year average of 17.5%. (See Table 2).

### Time Spent Hunting

Collectively, bow hunters spent 175,750 hours hunting deer in 1966, or an average of 43.7 hours per hunter. This means number of total hours spent per kill was 304 hours which is 11% greater than in 1965, an average year. The successful hunter averaged 44.8 hours which compares to 52.8 for 1965 and 60.3 hours for 1964.

### Deer Observed

Although approximately one hundred fewer hunters reported on deer observed, more than 10,000 fewer deer were seen. When related to hours of hunting, 0.38 deer were seen per hour in 1966 while 0.35 deer were seen per hour in 1965. On this basis, a higher population may have been present.

Sex and Age Ratio of Harvested Deer

Archers reported harvesting 344 males and 233 females for a sex ratio of 148 males: 100 females. This compares to 170: 100 for 1965. The age ratio was 27 fawns per 100 adults in 1966 which compares with 17 per 100 in 1965.

Time of day and part of season Deer were taken

Afternoon hunting continues to be slightly more productive. Fifty six percent of the successful hunters bagged their deer in the afternoon.

The split season divided into 30 and 21 day periods. Hunters bagged 68.7% of the harvest during the first 30 day period which was 59% of the total season.

Deer Wounded but not Retrieved

Approximately 8% of the hunters said they hit but failed to retrieve one or more deer in 1966. Only 310 hunters of 4,021 indicated they had wounded 369 deer. Nearly 10 percent reported wounding deer in 1965 when 405 hunters of 4,159 reporting, wounded 463 deer.

## DISCUSSION

The relative success of a late season in terms of success rate, period killed and total hours per kill are not clearly revealed by these data. The success rate was below average by 20% and as such reveals poorer hunting. Although the best period of the "rut" was denied the hunters, his success early in the season suggests that weather may also be an important factor. The increase in mean hours per kill by all the hunters is too complex to interpret in light of much reduced, success would improve, as this period is the best hunting time.

Of significance, however, is the reduced rate of crippling in terms of numbers of hunters crippling one or more deer. This rate is two-thirds of the average for the three previous seasons. Also, hunters observed slightly more deer per hour during this season. This suggests that the expected extra-wariness of deer following the shotgun season may not be a serious factor, as it does improve the quality of hunting.

These data suggest that no biological basis exists for denying late season hunting opportunity with bow as long as early hunting opportunity is also provided. Therefore, October through December seasons are appropriate for hunting with bow.

Table 1. Summary of misc. statistics from 1966 data taken from bow hunter reports for the 1966 bow season, with comparison to 1965 data.

| | 1965 | 1966 |
|---|---|---|
| Resident permit Holders Reporting - Bow | 4,159 | 4,021 |
| Bow Permit Kill | 710 | 579 |
| Short Zone | 154 | 156 |
| Long Zone | 556 | 420 |
| Est. Fall Populations | 43,500 | 48,793 |
| Hunter Success | 16.4% | 13.3% |
| Wounded Deer Ratio | 65/100 | 64/100 |
| Hours Hunted | | |
| Season | 195,100 | 175,750 |
| Per Kill | 274 | 304 |
| By Successful Hunter | 52.8 | 44.8 |
| Deer Per Hunter (in Pop) | 10 | 12 |
| Hunter Distribution | | |
| Counties Hunted | 1.41 | 1.40 |
| No. Hunters Hunting | 4,159 | 4,021 |
| Home County Only | 2,212 | 2,168 |
| Home Co. & Others | 1,195 | 1,105 |
| Other than Home Co. | 695 | 748 |
| Both Zones | 172 | 304 |
| Period Killed (by %)* | | |
| 1st | 26.5% | 39.8% |
| 2nd | 30.1% | 18.0% |
| 3rd | 43.4% | ---- |
| Deer Observed | 55,701 | 45,547 |

* By 17 day periods in 1965 (1/3 of 51 day season) and in 1966 for the period before and after the shotgun season.

Table 2. Summary of Bow Hunters Deer Kill and Success Ratio, 1953 to 1966

| Year | Length of Season in Days | No. of Bow Hunters | No. Deer Taken by Bow | Hunter Success Ratio (%) |
|---|---|---|---|---|
| 1953 | 5 | 10 | 1 | 10.0 |
| 1954* | 12 | 92 | 10 | 10.9 |
| 1955 | 23 | 414 | 58 | 14.0 |
| 1956** | 31 | 1,280 | 117 | 9.1 |
| 1957 | 31 | 1,228 | 138 | 11.4 |
| 1958 | 30 | 1,380 | 162 | 12.4 |
| 1959 | 31 | 1,627 | 255 | 16.2 |
| 1960 | 44 | 1,772 | 277 | 16.0 |
| 1961 | 48 | 2,191 | 367 | 17.1 |
| 1962 | 51 | 2,404 | 404 | 16.9 |
| 1963 | 51 | 2,858 | 538 | 18.8 |
| 1964 | 51 | 3,678 | 670 | 18.8 |
| 1965 | 51 | 4,159 | 710 | 16.4 |
| 1966 | 51 | 4,021 | 579 | 13.3 |

* First extended bow season for deer.
** First year a special permit was required to hunt deer with a bow.

# POSTAL CARD SURVEYS OF RABBIT AND CROW HUNTERS FOR THE 1966-67 SEASON

M. E. Stempel
Game Biologist

## INTRODUCTION

This paper contains the results of the 1966-67 Hunter Postcard Survey for cottontail rabbits with a lesser amount of information on results of jackrabbits and crow hunting. Details of the method are explained in the 1965 April-June Biology Quarterly Reports, which also has additional information on relationship of snow to rabbit hunting.

## RESULTS

Response. In 1966, 281,000 hunting and combination resident licenses were sold and about 2 percent of these were contacted in this survey. Of the 9,200 non-resident license purchasers about 2 percent were contacted. Resident hunters returned 1,772 cards, about 35 percent; non-residents returned 76, or about 37 percent.

Cottontails. For both residents and non-residents, of those reporting, 53 percent hunted cottontails. Tabulation of information on the cottontails is contained in Table 1. When information from the cards is expanded for cottontails, all licensed hunters expended 2,969,222 hours taking 2,180,523 cottontails during 1,020,670 trips at a rate of 0.73 per gun hour, compared to a success rate of 0.58 in 1965-66.

In 1965-66, 1,602,060 were bagged; the greater take of rabbits in 1966-67 is attributed to the longer favorable period of hunting weather which included some snowy days, with only a few severe winter days. There were only a few days with 1 inch or more of new snow, but in portions of Iowa, there was a total deposit of up to 14 inches of snow sometime during the 164 day rabbit season. Furthermore, there were many days when some snow did fall.

Jackrabbits and Crows. (Table 2) Jackrabbit hunters made up 7 percent of licensed resident hunters (9% in 1965-66) with 91,481 jackrabbits being harvested during 89,888 trips involving 237,703 hours. The bag per gun hour averaged 0.34 as compared to 0.37 in 1965-66. Data on non-residents are few as only three cards were returned with information on non-resident hunting of jackrabbits.

Crows were shot by 8 percent of resident licensed hunters. Non-residents did not report any crow hunting. A total kill of 198,378 was shown, with 211,604 hunting hours being spent in pursuit of crows; the bag rate was 0.90 per gun hour.

Table 1. Statewide results of 1966-67 postal card survey of cottontail hunting success

| Item | Resident | Non-resident | Total |
|---|---|---|---|
| Statewide bag - cottontails | 2,148,741 | 31,782 | 2,180,523 |
| Total hunting hours | 2,910,706 | 58,516 | 2,969,222 |
| Total hunting trips | 1,005,794 | 14,876 | 1,020,670 |
| No. hunting this species | 152,393 | 2,254 | 154,647 |
| Percent hunting this species | 54% | 28% | 53% |
| Avg. no. trips per hunter | 6.6 | 4.3 | 6.6 |
| Avg. no. gun hours per hunter | 19.1 | 23.1 | 19.2 |
| Avg. no. hours per trip | 2.9 | 5.4 | 3.5 |
| Avg. no. bagged per hunter per season | 14.1 | 12.7 | 14.1 |
| Avg. no. bagged per trip | 2.1 | 3.2 | 2.6 |
| Avg. no. bagged per gun hr. | 0.74 | 0.55 | 0.73 |
| Avg. no. hrs. per animal bagged | 1.4 | 1.8 | 1.4 |

Table 2. Statewide results of 1966-67 postal card survey of jackrabbit hunting success

| Item | Resident | Non-resident* | Total |
|---|---|---|---|
| Statewide bag, jackrabbit | 91,481 | 197 | 91,688 |
| Total hunting hrs. | 237,703 | 4,545 | 242,248 |
| Total hunting trips | 89,888 | 1,719 | 91,607 |
| No. hunting this species | 19,975 | 382 | 20,357 |
| Percent hunting this species | 7% | 5% | 7% |
| Av. no. trips per hunter | 4.5 | 4.5 | 4.5 |
| Av. no. gun hrs. per hunter | 11.9 | 11.9 | 11.9 |
| Av. no. hrs per trip | 2.6 | 6.0 | 2.6 |
| Av. no. bagged per hunter per season | 4.6 | 0.5 | 4.5 |
| Av. no. bagged per trip | 1.0 | 0.1 | 1.0 |
| Avg. no. bagged per gun hr. | 0.38 | 0.04 | 0.38 |
| Avg. no. hrs per animal bagged | 2.6 | 23.1 | 2.6 |

Table 3. Statewide results of 1966-67 postal card survey of crow hunting success

| Item | Total* |
|---|---|
| Statewide bag, crow | 198,378 |
| Total hunting hrs. | 211,604 |
| Total hunting trips | 112,414 |
| No. hunting this species | 22,042 |
| Percent hunting this species | 8% |
| Avg. no. trips per hunter | 5.1 |
| Avg. no. gun hrs per hunter | 9.6 |
| Avg. no. hrs. per trip | 2.0 |
| Avg. no. bagged per hunter per season | 9.0 |
| Avg. no. bagged per trip | 1.6 |
| Avg. no. bagged per gun hr. | 0.90 |
| Avg. no. hrs. per animal bagged | 1.1 |

* No non-residents, reported hunting crows, so this represents all resident hunters.

# THE 1966 DEER SEASON REPORT

Keith D. Larson
Game Biologist

## INTRODUCTION

The season was set for November for the first time since hunting was authorized in 1953. The weather was warmer than the average for the dates and provided pleasant fall hunting conditions.

There were 20,841 permits issued for the statewide "any deer" season, with landowners, tenants, and their children allowed to hunt without a deer permit on property under their control.

The state was divided into two zones bounded by highways; these zones were identical to those of 1965. Two days were authorized for the north central zone and the remainder of the state had four days.

Data used in this report was taken from compulsory hunter card returns and various Conservation Officers reports.

Hunter report cards were received from 19,212 shotgun hunters of the 20,841 for a 92% return.

## RESULTS AND DISCUSSION

The data discussed in this report are presented in Table 1, and Table 2.

### DEER KILL

The kill by shotgun permit hunters was 8,581. Projected kill, including an estimate for those hunters failing to return report cards, was 9,070. This represents the highest kill ever achieved.

The total gun kill was 10,742. This was composed of the above plus 1,672 taken by farmers, of which 911 were tagged by Conservation Officers for processing.

A summary of the kill by county, which includes deer killed by hunters and those killed by other causes, is given in Table 1. Totals are given for both short and long zone. Total reported mortality for the short zone was down 4.5% although the number of hunters was decreased to 2,170 from 3,830 in 1965 by more restrictive regulations. (See Table 2).

## HUNTER SUCCESS RATES

The statewide hunter success rate recovered from the low of 39% in 1965 to 45% for 1966. The short zone success increased by 64% from 22% in 1965 to 36% in 1966. The control of hunting pressure in this zone provided better hunting apparently with a corresponding decrease in expected expansion of breeding stock.

## DEER PER HUNTER IN EACH ZONE

The control of permits in the short zone provided for a more equitable distribution of hunting pressure on the respective deer herds of each zone. From a 1965 short zone pressure of approximately 1 hunter per deer, based on officers estimates, the pressure equalized to approximately 2.6 deer per hunter in both zones for 1966. This was the objective of permit regulation by zone.

## LICENSED FARMERS

After an annual increase in number of licensed farmers of 27% in 1964 and 43% in 1965, there was a reduction in licensed farmers from 6,146 in 1965 to 5,750 in 1966. The reasons for this reduction are not apparent. In the past the increased farmer applications represented the biggest portion of the increased authorization. There was significantly increased kill by unlicensed farmers which may explain the reduction in licensed farmers.

## HUNTER DISTRIBUTION

The success of the zoning regulation in controlling the kill in the north central area of the state is demonstrated in the results. Success rates in the east central area (including both short and long zone areas) are very low in comparison to the average county success rate. There is some indication that this area is being overharvested. Twenty two counties have success below 25%.

| COUNTY - % FOREST<br>* = Short Zone<br>** = Long Zone<br>*** = Both Zones | RESIDENT PERMIT HOLDERS REPORTING SHOTGUN | TOTAL SHOTGUN HUNTERS | PERMIT KILL BOW SH ZONE | PERMIT KILL BOW LG ZONE | PERMIT KILL GUN SH ZONE | PERMIT KILL GUN LG ZONE | FARM KILL TAGGED | FARM KILL UNTAGGED | MISC MORTALITY | TOTAL MORTALITY | % change | Est FALL 66 Pop | % FALL Pop Killed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Adair ** 3% | 183 | 244 | | 1 | | 104 | 16 | | 5 | 126 | +19 | 680 | 19 |
| 2. Adams ** 6% | 110 | 214 | | 5 | | 95 | 11 | | 4 | 115 | +37 | 408 | 28 |
| 3. Allamakee ** 32% | 365 | 1297 | | 5 | | 431 | 19 | 15 | 14 | 484 | +36 | 2550 | 19 |
| 4. Appanoose ** 17% | 122 | 191 | | 1 | | 62 | 7 | 5 | 16 | 91 | +40 | 258 | 35 |
| 5. Audubon ** 1% | 54 | 109 | | 2 | | 56 | 16 | 4 | - | 78 | + 3 | 267 | 29 |
| 6. Benton *** 4% | 220 | 249 | | 4 | 3 | 43 | 3 | | 2 | 55 | +22 | 70 | 79 |
| 7. Black Hawk *** 5% | 562 | 176 | 5 | 8 | 14 | 23 | 1 | 4 | 10 | 65 | +18 | 323 | 20 |
| 8. Boone * 8% | 123 | 141 | 11 | | | 49 | 17 | | 11 | 88 | +16 | 476 | 18 |
| 9. Bremer *** 5% | 171 | 190 | | 4 | | 46 | 1 | | 2 | 53 | -15 | 230 | 23 |
| 10. Buchanan ** 5% | 191 | 150 | | 4 | | 32 | 1 | 5 | 4 | 46 | +35 | 153 | 30 |
| 11. Buena Vista * 1% | 145 | 46 | 6 | | 15 | | 3 | 3 | 3 | 30 | +25 | 92 | 33 |
| 12. Butler * 4% | 109 | 106 | 2 | | 35 | | 3 | 4 | 10 | 54 | + 8 | 272 | 20 |
| 13. Calhoun * 1% | 92 | 18 | | 0 | 5 | | | 1 | 1 | 7 | -30 | 41 | 17 |
| 14. Carroll *** 1% | 171 | 23 | | 1 | 4 | 2 | 1 | | 5 | 13 | -32 | 119 | 11 |
| 15. Cass ** 3% | 229 | 251 | | 2 | | 99 | 17 | 6 | 22 | 146 | + 2 | 634 | 23 |
| 16. Cedar ** | 76 | 147 | | 0 | | 27 | | 15 | 6 | 48 | - 6 | 230 | 21 |
| 17. Cerro Gordo * 1% | 175 | 30 | 2 | | 12 | | | | 4 | 18 | +100 | 34 | 53 |
| 18. Cherokee *** 3% | 115 | 169 | 5 | 3 | 19 | 29 | 8 | 7 | 10 | 81 | -13 | 311 | 26 |
| 19. Chickasaw ** 5% | 135 | 205 | 1 | 1 | | 52 | 2 | | 11 | 67 | +60 | 221 | 30 |
| 20. Clark ** 14% | 111 | 251 | | 7 | | 102 | 15 | 20 | 7 | 151 | +72 | 850 | 18 |
| 21. Clay * 2% | 117 | 129 | 6 | | 50 | | 9 | 2 | 6 | 73 | -14 | 257 | 28 |
| 22. Clayton ** 24% | 433 | 1073 | | 9 | | 358 | 13 | 17 | 7 | 404 | +36 | 1700 | 24 |
| 23. Clinton ** 7% | 271 | 338 | | 2 | | 74 | 10 | 35 | 10 | 131 | + 7 | 265 | 49 |
| 24. Crawford ** 3% | 146 | 319 | | 3 | | 157 | 19 | 10 | 13 | 202 | +19 | 1360 | 15 |
| 25. Dallas *** 9% | 310 | 458 | | 7 | 7 | 160 | 12 | 5 | 17 | 208 | +17 | 595 | 35 |
| 26. Davis ** 16% | 85 | 167 | | 3 | | 73 | 1 | 15 | 13 | 105 | +57 | 416 | 25 |
| 27. Decatur ** 17% | 144 | 393 | | 2 | | 216 | 27 | 20 | 7 | 272 | +57 | 1105 | 25 |
| 28. Delaware ** 7% | 130 | 276 | | 8 | | 85 | 6 | 7 | 6 | 112 | +47 | 306 | 37 |
| 29. Des Moines ** 15% | 455 | 616 | | 37 | | 341 | 7 | 5 | 17 | 407 | +14 | 1785 | 23 |
| 30. Dickinson * 2% | 92 | 52 | 6 | | 30 | | 5 | 2 | 17 | 60 | +28 | 51 | 118 |
| 31. Dubuque ** 14% | 657 | 283 | | 1 | | 51 | 2 | 6 | 14 | 74 | - 6 | 221 | 33 |

# 1966 DEER KILL REPORT

| COUNTY - % FOREST<br>* = Short Zone<br>** = Long Zone<br>*** = Both Zones | RESIDENT PERMIT HOLDERS REPORTING SHOTGUN | TOTAL SHOTGUN HUNTERS | PERMIT KILL BOW ZONE SH | BOW ZONE LG | GUN ZONE SH | GUN ZONE LG | FARM KILL TAGGED | FARM KILL UNTAGGED | MISC MORTALITY | TOTAL MORTALITY | % change | Est FALL 66 Pop. | % FALL Pop Killed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32. Emmett*2% | 104 | 89 | 6 | | 36 | | 7 | 3 | 7 | 59 | +28 | 160 | 37 |
| 33. Fayette ** 8% | 306 | 469 | | 5 | | 171 | 5 | 0 | 10 | 191 | +52 | 416 | 46 |
| 34. Floyd *** 3% | 160 | 136 | 4 | 3 | 18 | 20 | 6 | 4 | 6 | 61 | +22 | 308 | 20 |
| 35. Franklin * 1% | 65 | 37 | 1 | | 13 | | | | 4 | 18 | +38 | 85 | 21 |
| 36. Fremont ** 9% | 20 | 78 | | 11 | | 43 | 23 | 2 | 28 | 107 | +81 | 223 | 48 |
| 37. Greene * 3% | 126 | 80 | 9 | | 30 | | 11 | 1 | 10 | 61 | - 6 | 270 | 23 |
| 38. Grundy * 2% | 81 | 2 | 0 | | | | | | | | | 9 | 0 |
| 39. Guthrie ** 10% | 231 | 801 | 1 | 10 | 1 | 407 | 52 | 51 | 35 | 557 | +51 | 1826 | 31 |
| 40. Hamilton *2% | 135 | 68 | 6 | | 19 | | 5 | 0 | 11 | 41 | + 2 | 221 | 19 |
| 41. Hancock * 1% | 67 | 47 | 0 | | 14 | | 3 | 0 | 1 | 18 | -22 | 179 | 10 |
| 42. Hardin * 4% | 142 | 113 | 4 | | 26 | | | | 8 | 38 | -41 | 213 | 18 |
| 43. Harrison ** 10% | 232 | 456 | | 7 | | 233 | 32 | 175 | 27 | 474 | +28 | 1700 | 28 |
| 44. Henry ** 13% | 157 | 196 | | 1 | | 55 | 13 | 10 | 8 | 87 | +10 | 315 | 28 |
| 45. Howard ** 4% | 132 | 155 | | 7 | | 47 | 5 | 5 | 2 | 66 | +128 | 255 | 26 |
| 46. Humboldt *2% | 56 | 46 | 1 | | 20 | | 4 | 1 | 7 | 33 | +94 | 145 | 23 |
| 47. Ida *** 1% | 58 | 25 | 1 | 3 | 4 | 7 | 0 | 0 | 7 | 22 | +29 | 36 | 61 |
| 48. Iowa *** 8% | 162 | 151 | 2 | | 23 | 10 | 6 | 1 | 16 | 58 | +16 | 221 | 26 |
| 49. Jackson ** 20% | 246 | 522 | | 6 | | 149 | 14 | 54 | 12 | 235 | - 3 | 961 | 24 |
| 50. Jasper *** 7% | 276 | 116 | 3 | 5 | 4 | 16 | 3 | 0 | 6 | 37 | -46 | 340 | 11 |
| 51. Jefferson ** 13% | 67 | 121 | 0 | | | 40 | 11 | 3 | 15 | 69 | +47 | 221 | 31 |
| 52. Johnson *** 10% | 340 | 291 | 4 | 1 | 13 | 29 | 2 | 5 | 21 | 75 | -24 | 221 | 34 |
| 53. Jones ** 11% | 191 | 348 | | 3 | | 71 | 6 | 30 | 10 | 120 | +11 | 374 | 32 |
| 54. Keokuk ** 9% | 174 | 243 | | 0 | | 71 | 11 | 8 | 9 | 99 | +115 | 442 | 22 |
| 55. Kossuth * 1% | 111 | 88 | 13 | | 35 | | 1 | 1 | 1 | 51 | +42 | 221 | 23 |
| 56. Lee ** 24% | 298 | 412 | | 15 | | 155 | 24 | 2 | 54 | 250 | +31 | 1124 | 22 |
| 57. Linn ** 10% | 975 | 428 | | 8 | | 78 | 2 | 4 | 10 | 102 | +2 | 408 | 25 |
| 58. Louisa ** 16% | 99 | 162 | | 2 | | 56 | 6 | 6 | 7 | 77 | +17 | 245 | 31 |
| 59. Lucas ** 18% | 245 | 738 | | 11 | | 289 | 40 | 18 | 16 | 374 | +30 | 1853 | 20 |
| 60. Lyon *** 1% | 125 | 354 | 2 | 7 | | 156 | 8 | 3 | 10 | 186 | +63 | 434 | 43 |
| 61. Madison ** 14% | 118 | 525 | | 12 | | 205 | 37 | 15 | 23 | 292 | +28 | 799 | 37 |
| 62. Mahaska **8% | 165 | 244 | | 0 | | 104 | 10 | 14 | 1 | 129 | +60 | 617 | 21 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 63. Marion ** 14% | 273 | 457 | | 6 | | 156 | 10 | 6 | 10 | 188 | +40 | 638 | 29 |
| 64. Marshall * 4% | 134 | 54 | 5 | | 12 | | 1 | 6 | 2 | 26 | -26 | 128 | 20 |
| 65. Mills ** 9% | 136 | 146 | | 9 | | 88 | 15 | 0 | 19 | 131 | +20 | 867 | 15 |
| 66. Mitchell *** 3% | 84 | 93 | | 1 | 10 | 11 | 6 | 4 | 10 | 42 | -21 | 250 | 17 |
| 67. Monona ** 11% | 173 | 394 | | 8 | | 206 | 33 | 10 | 19 | 276 | +31 | 1700 | 16 |
| 68. Monroe ** 26% | 96 | 702 | | 5 | | 266 | 17 | 12 | 21 | 321 | +35 | 1182 | 27 |
| 69. Montgomery ** 4% | 104 | 141 | | 7 | | 70 | 6 | 0 | 8 | 91 | +30 | 522 | 17 |
| 70. Muscatine ** 11% | 156 | 158 | | 6 | | 22 | 2 | 0 | 13 | 43 | -19 | 204 | 21 |
| 71. O'Brien * 1% | 163 | 83 | 1 | | | 35 | 5 | 1 | 5 | 47 | - 6 | 146 | 32 |
| 72. Osceola * 8% | 65 | 21 | 0 | | | 18 | | | 3 | 21 | +31 | 53 | 40 |
| 73. Page ** 4% | 112 | 101 | | 1 | | 47 | 5 | 3 | 16 | 72 | +33 | 473 | 15 |
| 74. Palo Alto * 2% | 96 | 76 | 3 | | 46 | | 7 | 1 | 4 | 61 | +97 | 54 | 113 |
| 75. Plymouth *** 2% | 147 | 158 | | 11 | | 54 | 7 | 0 | 26 | 98 | +16 | 374 | 26 |
| 76. Pocahonata * 2% | 70 | 16 | 0 | | 5 | | | 1 | | 6 | -33 | 95 | 6 |
| 77. Polk *** 8% | 1202 | 171 | 4 | 10 | 3 | 40 | 4 | 15 | 51 | 127 | - 11 | 289 | 44 |
| 78. Pottawattamie ** 4% | 330 | 434 | | 33 | | 199 | 21 | 24 | 97 | 374 | +24 | 2052 | 18 |
| 79. Poweshiek *** 5% | 163 | 57 | 1 | 4 | 3 | 8 | | 1 | 7 | 24 | +33 | 187 | 13 |
| 80. Ringgold ** 8% | 122 | 198 | | 0 | | 81 | 11 | 3 | 2 | 97 | + 1 | 451 | 22 |
| 81. Sac *** 2% | 128 | 37 | 4 | 0 | 12 | 3 | 0 | 0 | 7 | 26 | -13 | 58 | 45 |
| 82. Scott ** 5% | 499 | 216 | | 6 | | 35 | 3 | | 5 | 49 | +32 | 112 | 44 |
| 83. Shelby ** 1% | 68 | 235 | | 4 | | 133 | 22 | 40 | 15 | 214 | +20 | 850 | 25 |
| 84. Sioux *** 1% | 173 | 237 | 0 | 8 | 0 | 83 | 12 | 0 | 15 | 118 | + 4 | 296 | 40 |
| 85. Story * 4% | 207 | 36 | 4 | | 5 | | 1 | | 5 | 15 | -46 | 58 | 26 |
| 86. Tama * 6% | 144 | 88 | 6 | | 21 | | 4 | | 3 | 34 | -36 | 87 | 39 |
| 87. Taylor ** 7% | 68 | 116 | | 1 | | 45 | 14 | 1 | 10 | 71 | +37 | 400 | 18 |
| 88. Union ** | 198 | 288 | | 8 | | 125 | 8 | 3 | 4 | 148 | - 3 | 486 | 30 |
| 89. Van Buren ** 21% | 148 | 237 | | 2 | | 132 | 13 | | 7 | 154 | +34 | 595 | 26 |
| 90. Wapello ** 18% | 235 | 270 | | 5 | | 89 | 12 | 10 | 28 | 144 | +45 | 1105 | 13 |
| 91. Warren ** 12% | 284 | 546 | | 19 | | 184 | 9 | 6 | 32 | 250 | +16 | 279 | 90 |
| 92. Washington ** 10% | 242 | 267 | | 6 | | 57 | 6 | 5 | 21 | 95 | + 9 | 434 | 22 |
| 93. Wayne ** 8% | 124 | 176 | | 1 | | 74 | 7 | 5 | 6 | 93 | +90 | 638 | 15 |
| 94. Webster *6% | 188 | 100 | 4 | | 32 | | 7 | 1 | 12 | 56 | + 6 | 272 | 21 |
| 95. Winnebago * 1% | 63 | 100 | 14 | | 38 | | 5 | 3 | 11 | 71 | +34 | 162 | 44 |

# 1966 DEER KILL REPORT

| COUNTY - % FOREST<br>* = Short Zone<br>** = Long Zone<br>*** = Both Zones | RESIDENT PERMIT HOLDERS REPORTING SHOTGUN | TOTAL SHOTGUN HUNTERS | PERMIT KILL BOW SH | PERMIT KILL BOW LG ZONE | PERMIT KILL GUN SH | PERMIT KILL GUN LG ZONE | FARM KILL TAGGED | FARM KILL UNTAGGED | MISC MORTALITY | TOTAL MORTALITY | % change | Est FALL 66 Pop | % FALL Pop Killed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 96. Winneshiek ** 13% | 325 | 696 | | 7 | | 263 | 14 | | 10 | 294 | +10 | 986 | 30 |
| 97. Woodbury ** 4% | 361 | 509 | | 15 | | 193 | 20 | 0 | 25 | 253 | + 3 | 716 | 35 |
| 98. Worth * 2% | 56 | 92 | 9 | | 33 | | 1 | | 12 | 55 | +22 | 168 | 33 |
| 99. Wright * 2% | 85 | 40 | 3 | | 15 | | 4 | 0 | 5 | 27 | -13 | 313 | 9 |

# SUMMARY OF 1966 DEER KILL DATA AND COMPARISONS WITH 1965 DATA

| | 1965 | 1966 |
|---|---|---|
| Resident Permit Holders Reporting - Gun | 16,761 | 19,212 |
| Total Hunters (Hunter Counties) - Gun | 21,701 | 23,598 |
| Bow Permit Kill | 710 | 579 |
| Short Zone | 154 | 156 |
| Long Zone | 556 | 420 |
| Gun Permit Kill | 6,588 | 9,070* |
| Short Zone | 835 | 789 |
| Long Zone | 5,753 | 7,792 |
| Farm Kill | | |
| Tagged | 692 | 911 |
| Untagged | 630 | 761 |
| Misc. Mortality | 1,224 | 1,250 |
| Total Mortality | 9,884 | 12,571 |
| % change, Long Zone - Gun | -8.8% | 35.4% |
| % change, Short Zone - Gun | -13.6% | -5.5% |
| % change, Statewide - Gun | -9.4% | 27.7% |
| Est. Fall Populations | 43,500 | 48,793 |
| Per cent Fall Population Killed (T.M.) | 23% | 26% |
| Short Zone - Total Mortality (B&G) | 989 | 945 |
| - % change | -14% | -10% |
| Long Zone - Total Mortality (B&G) | 6,309 | 8,701 |
| - % change | -24% | 38% |
| Hunter Success | | |
| Statewide | 39% | 45% |
| Short Zone | 22% | 36% |
| Long Zone | 41% | 46% |
| Total Hunters | | |
| Short Zone | 3,830 | 2,170 |
| Long Zone | 14,032 | 17,018 |
| Hunting Home County Only | 7,652 | 8,489 |
| Number Licensed Farmers | 6,146 | 5,750 |
| Deer Per Hunter | | |
| Short Zone | 0.98 | 2.6 |
| Long Zone | 2.8 | 2.5 |

* Corrected for Non Returns

# RESULTS OF THE 1966 PHEASANT HUNTER SURVEY

Richard C. Nomsen
Game Biologist

A random sample consisting of 5,000 names was drawn from the duplicate files of license sales following the 1966 season. Names were selected from each county according to the number of hunting and combination hunting-fishing licenses sold. This total also includes 150 names drawn from the duplicate files of non-resident hunting license sales. A record card and letter of instructions were mailed to each person selected requesting information about the previous hunting season.

The 52-day season opened on November 12 and closed January 2, 1967, with shooting permitted from 8:00 a.m. to 4:30 p.m.. The daily bag limit was 3 cocks and the possession limit was 6 roosters.

A total of 2,175 cards was received from resident hunters, which was 45 per cent of the sample mailed. There were 92 returns from non-resident hunters. Total resident license sales for 1966 consisted of 165,000 hunting and 116,000 combination, which was slightly higher than in 1965. Non-resident license sales increased from 6,500 in 1965 to 9,200 in 1966. Total license sales increased 3 per cent from the previous year.

Results of the survey indicated a very favorable season for Iowa pheasant hunters. Complete statewide statistics are given in Table 1 for both resident and non-resident hunters. These figures include only licensed hunters - no figures are available for persons hunting on their own land without a license, or those under 16 hunting with a licensed adult. This is believed that their omission would tend to balance any bias in the data obtained due to non-response and the possibility that hunting results were poorer for those that did not respond.

The total kill of cocks during the 1966 season was 1,449,400 which was 30 per cent higher than in 1965. The 1966 August roadside count had indicated a 16 per cent increase in the fall population. In addition to the higher population of ringnecks, hunting conditions were more favorable for the hunter. Corn harvest was 75-80 per cent complete on opening weekend.

The survey showed that there were 15,000 more hunters this year and each hunter averaged 10 per cent more trips afield in 1966 (Table 2). Less time was needed to bag each rooster and hunters averaged 1.1 cocks per trip.

Hunting pressure decreased in the northwest and north central regions again in 1966 as all regions showed increases (Table 3). Central Iowa supported 21.2 per cent of the hunting pressure which was high for the state. The estimated harvest of ringnecks in the central region was 282,700 cocks - also high when compared to the other regions. The total kill for each of the other primary regions were quite similar - from 239,300 birds in the northwest region to 257,200 cocks harvested in southwest Iowa. All regions showed good increases except the northwest region which remained about the same.

The selectees were also asked if and where thay hunted opening weekend, and how many birds were bagged. Eighty-one per cent of the hunters indicated that they hunted during the first 2 days and each killed an average of 2.2 roosters. The average opening weekend kill in 1965 was 1.6 birds. It was estimated that 188,000 resident hunters bagged 410,000 ringnecks during the first two days. Total kill on opening weekend represented 30 per cent of the season kill. Regions of central and eastern Iowa appeared to support the greatest hunting pressure on opening weekend(Table 4). Lower hunting pressure was noted in northwest and north central Iowa.

Counties with the highest reported number of opening weekend hunters included Adair, Cerro Gordo, Poweshiek, Fayette, Black Hawk and Benton.

HUNS

Huns were reported taken in 19 northwest Iowa Counties. Success appeared to be quite similar to that of 1965. A total of 91 huns were reported killed by 35 hunters. Estimates from these limited samples indicated that 12,000 hungarian partridge were harvested compared to 11,500 in 1965. The open season area for huns includes approximately 11,200 sections in north central and northwest Iowa.

Table 1. Statewide Pheasant Hunting Statistics from the 1966 Postal Card Survey

| | Resident | Non-Resident | Total |
|---|---|---|---|
| Statewide Bag - Pheasants | 1,370,000 | 79,400 | 1,449,400 |
| Total Hunting Hours | 4,882,000 | 246,500 | 5,128,500 |
| Total Hunting Trips | 1,268,000 | 47,100 | 1,315,100 |
| Number Hunting Pheasants | 231,800 | 8,600 | 240,400 |
| Per Cent Hunting Pheasants | 82.5% | 93.4% | 83.0% |
| Avg. No. Trips per Hunter | 5.47 | 5.48 | 5.47 |
| Avg. No. Gun Hours per Hunter | 21.06 | 28.66 | 21.33 |
| Avg. No. Bagged per Hunter per Season | 5.91 | 9.23 | 6.03 |
| Avg. No. Bagged per Trip | 1.08 | 1.74 | 1.10 |
| Avg. No. Bagged per Gun Hour | 0.28 | 0.33 | 0.28 |
| Avg. No. Hours per Bird | 3.56 | 3.01 | 3.54 |
| Avg. No. Hours per Trip | 3.85 | 5.23 | 3.90 |

Table 2. Summary of Statewide Hunting Success, Iowa, 1965 and 1966

| | 1965 | 1966 |
|---|---|---|
| Resident Hunters | | |
| Per Cent of Licensees Hunting Pheasants | 80.1% | 82.5% |
| Avg. No. of Hunting Trips | 5.0 | 5.5 |
| Avg. Season Kill Per Hunter | 4.9 | 5.9 |
| Hours per Pheasant Killed | 3.8 | 3.6 |
| Estimated Total No. of Pheasant Hunters | 220,275 | 231,800 |
| Estimated Total No. of Hunting Trips | 1,105,800 | 1,268,000 |
| Estimated Total No. of Pheasants Killed | 1,075,000 | 1,370,000 |
| Non-Resident Hunters | | |
| Per Cent of Licensees Hunting Pheasants | 91.0% | 93.4% |
| Avg. No. of Hunting Trips | 4.9 | 5.5 |
| Avg. Season Kill per Hunter | 7.8 | 9.2 |
| Hours per Pheasant Killed | 3.3 | 3.0 |
| Estimated Total No. of Pheasant Hunters | 5,460 | 8,600 |
| Estimated Total No. of Hunting Trips | 26,500 | 47,100 |
| Estimated Total No. of Pheasants Killed | 42,450 | 79,400 |

Table 3. Distribution of Hunting Pressure and Pheasant Kill by Regions, Iowa, 1965 and 1966

| Region | Percentage of Trips | | Birds Killed | |
|---|---|---|---|---|
| | 1965 | 1966 | 1965 | 1966 |
| 1. Northwest | 22.2% | 20.3% | 240,800 | 239,300 |
| 2. North Central | 20.1 | 16.6 | 196,700 | 246,400 |
| 3. Southwest | 15.0 | 16.0 | 195,700 | 257,200 |
| 4. Central | 18.9 | 21.2 | 183,800 | 282,700 |
| 5. East | 18.6 | 19.0 | 189,200 | 255,900 |
| 6. South | 5.2 | 6.9 | 68,800 | 88,500 |

Table 4. Distribution of Hunting Pressure - Opening Weekend, 1965 and 1966

| Region | Per cent of Hunting Pressure on Opening Weekend | |
|---|---|---|
| | 1965 | 1966 |
| 1. Northwest | 18.8% | 15.9% |
| 2. North Central | 19.3 | 18.8 |
| 3. Southwest | 15.9 | 16.7 |
| 4. Central | 21.0 | 21.9 |
| 5. East | 19.0 | 20.1 |
| 6. South | 6.0 | 6.6 |

# RESULTS OF THE POSTAL CARD SURVEY OF SQUIRREL, FOX, RACCOON, AND WOODCHUCK HUNTERS FOR THE 1966-67 SEASON

Robert L. Phillips
Game Biologist

## INTRODUCTION AND METHODS

This paper constitutes a report on one phase of a postal card survey of licensed Iowa hunters for the 1966-67 season. The methods used in this survey were essentially the same as described by Kline (1965).

## RESULTS AND DISCUSSION

### Response

Sales of resident and non-resident hunting and combination licenses totaled approximately 290,000 in 1966. Of the 5,000 cards sent out for the squirrel, pheasant and waterfowl survey, 45 percent responded. On the quail, rabbit, fox, coyote and raccoon survey, there was a 34 percent response. Complete tabulation of the data on the four species assigned to me appears in Table 1.

### Squirrels

Of those hunters reporting, 45 percent hunted squirrels. The expanded data indicates that 130,500 hunters spent 2,210,000 hours harvesting 1,370,250 squirrels in 1966. The hunting effort figures (Table 1) agree closely with the 1965-66 postal card survey data.

### Foxes and Coyotes

Iowa fox and coyote hunters comprised 15 percent of the licensed resident hunters. This compares with 14.6 percent in 1965-66 and 19.5 percent in 1964-65. The drop in the number of fox and coyote hunters in the last two years may possibly be due to the lack of snow during the winter months. Despite poor hunting conditions, the expanded data indicates a harvest of 113,100 foxes and coyotes in 1,013,550 hours of hunting. Again this year, the fox and coyote harvest figure appears to be exaggerated because of hunter response biases. I believe the estimated harvest figures for these species should serve primarily as an index for determining changes in annual populations and harvest.

### Raccoon

Raccoon hunters are represented by 8 percent of the licensed hunters. The expanded data reveals 779,500 hours were expended in bagging 301,600 raccoons. Again, the total harvest for this species appears to be somewhat exaggerated when comparing this estimate with fur buyer records. However, the later may not be particularly accurate either.

Woodchuck

Woodchuck hunting continues to be a relatively minor sport as compared to other species. The number of Iowa hunters participating in this activity was approximately the same as in the 1965-66 season. Because of the small number of returned cards that contained woodchuck hunting data on them, the confidence limits on the figures presented in Table I would be rather wide; however, it is the only harvest information available.

## LITERATURE CITED

Kline, Paul D.
1965. Postal card surveys of squirrel, rabbit, fox, and coyote hunters for the 1964-65 season. Iowa Conservation Commission, Quarterly Biology Reports 14(2):44-49.

Table 1. Results of postcard survey for squirrel , fox, coyote, raccoon, and woodchuck, 1966-67 season

| Species | Percent of all Hunters Hunting Species | Statewide Bag | No. Hunting This Species | Total Hours Hunted | Total Hunting Trips Made |
|---|---|---|---|---|---|
| Squirrel | 45 | 1,370,250 | 130,500 | 2,210,000 | 717,750 |
| Fox & Coyote | 15 | 113,100 | 43,500 | 1,013,550 | 278,400 |
| Raccoon | 8 | 301,600 | 23,200 | 779,500 | 183,280 |
| Woodchuck | 1 | 15,370 | 2,900 | 20,010 | 26,280 |

| Species | Avg. Trips /Hunter / Season | Avg. Hours/ Hunter Season | Avg. Hours/ Hunter/ Day | Avg. Bagged /Hunter/ Season | Avg. Bagged /Hunter/Day | Avg. Bag'd /Hunter/Hr. | Avg. Hrs. to bag one animal |
|---|---|---|---|---|---|---|---|
| Squirrel | 5.5 | 17.0 | 3.1 | 10.5 | 1.9 | 0.62 | 1.6 |
| Fox & Coyote | 6.4 | 23.3 | 3.6 | 2.6 | 0.4 | 0.10 | 9.0 |
| Raccoon | 7.9 | 33.6 | 4.6 | 13.0 | 1.3 | 0.39 | 2.6 |
| Woodchuck | 9.2 | 6.9 | 0.7 | 5.3 | 0.6 | 0.77 | 1.3 |

# POSTAL CARD SURVEYS OF IOWA QUAIL HUNTERS FOR THE 1966-67 SEASON

M. E. Stempel
Game Biologist

## INTRODUCTION

This report of quail hunting success for the past season is based on a hunter postcard survey. About 5,000 hunters were contacted and data are here expanded to represent the 1966-67 quail hunting success of all Iowa quail shooters.

Also included is information from a research area and data from a survey of a group of experienced southern Iowa shooters. Since 1960, the 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 1966-67 quail hunting season extended from October 22, 1966 to January 31, 1967; shooting hours, 8:00 a.m. to 4:30 p.m. daily, bag limit 8; possession limit, 16. For 1965-66 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 quail shooting.

The methods of survey are outlined in the 1965 April-June Quarterly Biology Reports, 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 1,772 cards of which 389 contained information on quail shooting. Twenty-two per cent had thus shot quail. Resident hunters bagged 1,024,287 quail (Table 1). The 62,078 hunters made 378,676 trips involving 1,384,339 hours.

The average Iowa resident hunter who shot quail made 6.1 quail hunting trips during the 1966-67 season. The average outing for the individual was 3.9 hours, with 2.7 quail per trip, and a success rate of 1.5 hours per quail bagged.

The material for the 1966-67 season is presented here on a state-wide 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 year, 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, 70 non-residents returned hunting reports, and 13 of these (19 per cent) shot quail. Non-residents bagged 27,344 quail last year (Table 1), with 1,709 such hunters making 8,200 quail hunting trips involving 34,379 hours.

Non-resident quail shooters recorded an average (per man) hunting trip of 5.6 hours with 3.2 birds per trip at a rate of 1.7 hours per quail (.58 bird per hour).

January Quail Hunting

Because the month of January was added to the season last year 1965-66 season a special question was added regarding hunting during this month It was found in the 1966-67 season that 59 per cent of reporting hunters went hunting in January. Eighty-four per cent of those who hunted during the month had bagged quail, with 37 per cent of the total season's trips being made during January. Thirty-three per cent of the total take was in January (366,828 quail). One per cent of the non-residents hunted quail in January. In comparison, in January 1966, 42 per cent of the 1965-66 hunters were out for quail and 76 per cent of these bagged quail; with 34 per cent of the total season's trips being made during the month. Twenty-nine per cent of the total 1965-66 take occurred in January. Thirty per cent of the reporting non-residents shot some quail in January. The comparatively small sample of non-resident quail hunters probably influence the results.

January 1967 was more favorable to quail hunting than was January 1966. "Iowa Climatological Data" reported January 1967 temperatures as mostly in the 20's and 30's with only a few zero readings on thermometers. Deep snow occurred only in the east.

## DISCUSSION AND COMPARISON WITH RELATED SURVEYS

The 1966-67 postcard survey provided a statewide sample of the type of productive quail hunting which will last a long as weather favors survival and production. The postcard survey indicated fairly good success, and the same was indicated in a survey of selected hunters in good quail range in southern Iowa.

A comparison of success of average shooters, as represented by those contacted in the postcard survey, with more experienced quail gunners indicates the following: average shooters took birds at a rate of 1.5 hours per quail; experienced shooters took quail at a rate of .81 hours per quail.

This survey indicated that 22 per cent of all licensed resident hunters do shoot some quail. Of those residing in the primary quail range, about 50 per cent hunt quail. The latter figure is taken from another survey.

Further information was obtained from interviews with farmers living on a 7,000-acre research site in quail range. This indicated that during the 10 days the season was open in October, 19 per cent of the seasons quail hunting occurred; while in November, December and January about 27 per cent took place each month.

Table 1. Results of 1966-67 Iowa quail hunting season (from hunter postcard questionnaire)*

| | Resident | non-Resident | Total |
|---|---|---|---|
| Statewide quail bag | 1,024,287 | 27,344 | 1,051,631 |
| Total hunting hours | 1,384,339 | 34,379 | 1,418,708 |
| Total hunting trips | 378,676 | 8,200 | 386,876 |
| No. hunting this species | 62,078 | 1,709 | 63,787 |
| Per cent hunting this species | 22 | 19 | 22% |
| Avg. no. of trips per hunter | 6.1 | 5.2 | 6.1 |
| Avg. no. of gun hours per hunter | 22.3 | 21.8 | 22.2 |
| Avg. no. hours per trip | 3.9 | 5.6 | 3.9 |
| Avg. no. bagged per hunter per season | 16.5 | 16.0 | 16.5 |
| Avg. no. bagged per trip | 2.7 | 3.2 | 2.7 |
| Avg. no. bagged per gun hour | 0.67 | 0.58 | 0.67 |
| Avg. no. hours per bird bagged | 1.5 | 1.7 | 1.5 |

* Based on 281,000 resident hunting and combination hunting and fishing licenses and 9,200 non-resident licenses.

## SUMMARY

1. A sample of 2 per cent of resident hunters and 2 per cent of non-resident Iowa hunters was contacted in early 1967 by mail.

2. Cards were filled out, and returned by 1,772 resident licensees and 70 non-resident licensees.

3. Twenty-two per cent of residents and 19 per cent of non-residents hunted quail.

4. Residents took 1,024,287 quail at 1.5 hours per quail; the non-resident rate was 1.7 on a bag of 27,344 birds.

5. Thirty-three per cent of the total quail bagged during the 1966-67 season, were taken in January.

6. About 19 percent of the total season hunting effort took place in October (first 10 days of season), while the remaining effort was evenly divided between the months of November, December and January (about 27 per cent each month).

# POPULATION DYNAMICS OF WHITETAILS

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This report includes a comprehensive review of population numbers, natality and mortality factors, and their cumulative effect on the present deer population beginning in 1953.

There is a dearth of published material concerning interpretation of population statistics for whitetails living under conditions similar to the Iowa herd. The history of these herds reveals difficulties in their management, i.e. it has been difficult to balance natality and mortality with "any-deer" seasons and high legal and illegal hunting pressure.

## NATALITY FACTORS

Three surveys are available from which natality can be computed for whitetails in Iowa. Some of the basic data are presented in Tables 2 and 3. Prior to this time, a crude reproduction rate was derived by determining a fawn to adult ratio from a sample of the harvest. This has varied from 1.38 in 1953 to 1.87 in 1966. Basic data are presented as part of Table 2. The multiplication factor used to compute the fall population from the officers February estimate is based on this crude reproductive rate and is represented by R in a number of tables. The first published computation of a fall population was in 1960 and a factor (R) of 1.63 was used; this represented the average for preceding years. Since that time 1.70 has been used as it represents an average of more recent years data at the time of selection.

Now that results are available from two additional surveys initiated in 1965 to 1966, some evaluation is possible. The road-killed doe survey has provided usable information on 95 females. These data indicate that 36% of these females are fawns. No bias is indicated although it may be present. Embryo counts yielded 1.03 embryos per fawn doe and 1.87 embryos per adult doe (Table 1). A basic reproductive rate of 1.57 fawns per doe at this age ratio is indicated. This can be translated to a basic rate of increase of 78.5%. These data are in very close agreement with Nebraska data. Menzel (1967) reports 1.85 embryos per adult doe and 0.7 for fawn does.

The fall survey of observed deer reveals 36% fawns in both the 1965 and 1966 survey. This agrees exactly with the spring data from road-kills. It is believed to be a minimum rate of occurrence notwithstanding this agreement.

Basic data in Table 2 reveals a mean crude reproductive rate of 1.72 for the years 1954-1966. Since in recent years excessive herd mortality has altered the age ratios, the mean for the years 1954-1959 has been selected as the best usable crude reproductive rate. It is believed that throughout most of the years since 1953 the true rate of increase has not changed appreciably; i.e., it is relatively constant and is not variable for purposes of computation. For this reason 1.67 is used throughout this report for purposes of population analysis. This would correspond to an age ratio of 40% fawns.

## POPULATION ESTIMATES

Considerable variation has existed from year to year in the Officers February estimates. (Table 2). Given a stable rate of reproduction as has been previously suggested, a lack of starvation losses, and the minimum loss to disease that has been experienced over the years, there exists a tremendous capacity for herd expansion. Legal harvest rates over most of the years involved have been very conservative to moderate in degree. Yet herd expansion over the years of 1953 to 1967 has averaged only 7% per year. The potential for increase is 67% a year. What is or are the limiting factors? All evidence indicates no lack of capacity so the factor must be one of mortality rate as opposed to natality rate. The question then arises: It is natural mortality, legal hunting, or illegal hunting? Data concerning these factors are presented in sequence in this report in which various techniques of population analysis are employed to illustrate what is happening to this very dynamic herd.

### Statistically Derived Population Estimates

Eberhardt (1960) has developed a life equation for deer under Michigan conditions which has been used here to calculate the fall population for each year from 1953-1967. These results are presented in Table 3. I do not believe that these estimates are very precise, or perhaps even usable as population figures, but the procedure demonstrates very graphically the degree of natural mortality (including illegal hunting), its relationship to the legal kill, and the whitetail's tremendous capacity to reproduce itself and expand the population. The formula used was:

$$P_{n+1} = R(P_n - K_n)\,a$$

where $P_n$ = Previous years per-season population

$R$ = Rate of Recruitment

$P_{n+1}$ = pre-season population

$K_n$ = previous years legal kill plus misc. kill

$a$ = Survival rate from end of season to beginning of next.

It is essential to start with a good reliable estimate. Eberhardt used trial and error to determine this. Our best estimate was determined to be the 1953 winter population when used as a pre-season estimate for 1953 instead of the 20,000 or so which would have been the calculated fall population (since no hunting season take involved). Recruitment rate is considered to be a constant at 1.67. Unknown mortality as expressed in the survival rate (a) is considered a variable in the formula. In making a number of test runs with various rates of (a) it was decided that (a) would decrease as the population of deer became greater. Traditionally illegal hunting increases with the population and apparently is disproportionate to the rate of population expansion; that is, it takes an increasing proportion

as numbers increase. This was considered a valid interpretation because otherwise Iowa's herd would have multiplied to the hundreds of thousands by now under existing legal kill rates, with the populations at the levels estimated.

The following interpretations are made from these data when the above assumptions are considered valid.

1. Populations have increased (statewide) each year since 1954.

2. The mortality from natural causes, which includes illegal hunting take and unknown legal farm kill, has equalled or exceeded by as much as 75% the legal permit take over most of the years.

3. Legal kill-rates have been moderate to low over most of the years.

4. Illegal kill rates have been high.

5. Officers estimates as presently taken do not have the necessary precision on a regional or statewide basis for intensive management; better census techniques are needed.

6. In the last three years legal hunters have been getting a somewhat higher share of the harvestable surplus.

Officers February Deer Estimates

The 1967 estimate totals 25,350 and projects to a fall population of 43,095. Previous estimates are recorded in Table 4 in projected form as well as in Table 2 as a winter population. Table 5 compares 1966 and 1967 estimates:

The 1967 estimate may well be true, indicating a reduction in breeding stock of 3,132 deer (Table 2). However, if there is a true relationship between the 1966 and 1967 estimate, then in consideration of the 1966 kill, the 1967 estimate cannot be accurate. Table 4 indicates 31.1% of the population would have to be removed between seasons to result in this change. This rate of mortality corresponds with mortality indicated for the first years of open seasons when estimates also indicated a decline. As Table 3 and 4 indicate, quite probably there has been no decline. These estimates cannot be relied on to indicate precise changes in population, on a year-to-year statewide basis. This does not mean to say that a qualified observer working in an area the size of a county cannot detect there has been a change in population levels, particularly over longer periods. I believe that this can provide valuable long-term data. The system currently in use cannot do this on a yearly basis, however. Other criteria have far more validity for use in intensive management.

The ratio of natural mortality to legal kill in the last column of Table 4 reveals the same story as in Table 3. The mean is 1.7. For every 100 deer taken legally, 170 are lost in other ways.

The rate of natural mortality required to result in next years population is the reciprocal of the rate of survival between seasons. It is expected that these rates would change only moderately from year to year. The fact that they fluctuate to extremes reflects the inaccuracies of the population estimates, in part.

Aerial Counts

In the absence of precise criteria for determining status of the deer populations, aerial counts are extremely valuable in determining regional trends. However, there has been only one year in the last four in which sufficient snowcover was present to make significant counts.

Although conditions were not the best, some flights were made with a Cessna 185 and with helicopters. The results in terms of data are meager but due to the opportunity to make comparative flights with the two types of craft much was learned of significance to management.

Primarily, the assumption has been in the past that we flew too high and too fast for good sighting conditions. This is true. In some instances the main reason why more deer were not seen from the air is simply that they were not there; i.e., populations were lower than believed.

Three counties in eastern Iowa were surveyed in 1967 under avarage conditions. The data from the helicopter counts are rather alarming in one aspect, at least. Some of the very best habitat was surveyed and found to be largely vacant of deer. Survey of thousands of acres of such habitat would reveal only an occasional single, pair, or trio. The data of necessity, must have more precise analysis using a planimeter on composite aerial photos of counties involved to determine rates. These data will be presented in future reports.

## STATUS OF THE VARIOUS POPULATIONS

The effect of mortality of all types is cumulative. The age composition data (Table 6) and success rates (Figures 2, 3 and 4) are the result of all mortality factors affecting the population and not just legal hunting harvests. Specific data concerning success, legal kill, misc. kill, and hunter pressure for each county has been compiled for the years back to 1960.

These data have been critically examined and the status of the population categorized as stable, increasing, or decreasing (Figure 1). These interpretations are considered valid with but one reservation. Many counties indicated as stable are in fact stabilized at the present time but have fewer deer than in years past and have unsatisfactory success rates in comparison with long-term averages. These herds attained lower levels in many cases after the '61 and '63 seasons, which had extensive snow cover. The frequency of this occurrence suggests that snow cover increases vulnerability and perhaps has precipitated declines.

Percentage Age Composition

The basic data on age structure of the herd are presented in Table 6 and are the basis for all computations of life tables and survivorship curves which have been prepared. Table 7 presents the age structure of several types of samples from the 1966 data. It reveals the effect of different levels of exploitation as well as the cumulative effect over the years.

The high percentages of fawns and yearlings and the extremely low percentages of deer over 3 1/2 are believed to indicate sustained heavy mortality which is approaching or may be exceeding recruitment particularly in the population indicated as declining.

## Mortality between Age Classes

Wagner (1963) has presented information concerning mortality between age-classes as criteria for determining rate of harvest. The mean of the mortality between classes should not exceed recruitment which in Iowa would be about 40%. He submits that 37% is a good average for whitetails. Data presented in Table 8 indicates that mortality has exceeded this rate every year back to 1959 as shown. Since less than 1% of the deer living in 1959 are alive today, the criteria again do not precisely fit Iowa conditions. This is possibly because of the higher reproductive rate. However, a reasonable assumption would be that mortality in Iowa is very close or might exceed recruitment at the present time.

The fate of cohorts beginning life together in the years indicated in Table 9 is parallel with the data in Table 8. It demonstrates increasing rate of mortality, particularly in the first three age classes which are paramount in importance and the most valid for comparisons.

## Life Tables and Survivorship

Life tables and survivorship curves have been prepared to aid in interpretation of the data in terms of the status of the population.

Like much of the earlier evidence the criteria for interpretation are not precise as concerns mortality and survivorship. It is clear, however, that mortality must again approach or exceed recruitment.

One very clear comparison exists in the life tables. This lies in the declining mean expectation of life which is the direct result of increasing exploitation. Three of these tables are presented in this report to illustrate this point. Compare this parameter in fawns for a lightly, illegally hunted herd (Table 10, 2.45), the 1966 short zone (Table 11, 1.33) and the long zone (Table 12, 1.57).

## Distribution of Legal Hunting Pressure

The kill data have been assembled on a regional basis to compare hunting pressure and kill in order to locate the problem areas. Figure 6 illustrates the regions used and the data are graphed in Figures 7, 8, 9, 10, 11, and 12. There is a graphic difference in the forms of these curves in Regions 4 and 6 when compared to the other regions.

These data and past experiences indicate that simple zonations are not adequate to build back depleted herds. More intensive management is indicated. These regions have been located to be suitable for management regions.

## CAPSULE SUMMATION

There is insufficent supportable evidence to conclude that on a statewide basis there will be significantly fewer deer in 1967 than in 1966. There is considerable evidence that mortality is approaching or exceeding recruitment slightly and is primarily from illegal hunting and unknown farm mortality. The legal hunters are sharing approximately 40% of the harvestable surplus.

On a regional basis some herds are stable, some are stable at lower levels than previously existed, and some are increasing rapidly. On a county basis, there are some herds which are decreasing significantly. These situations can be controlled by more intensive management.

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Table 1. Preliminary results of embryo counts of road-killed does, March-June, 1966 and 1967.

| Origin of Data | AGE OF DEER | EMBRYOS PRESENT 0 | 1 | 2 | 3 | TOTAL DOES | TOTAL EMBRYOS | RATIO EMB/DOES |
|---|---|---|---|---|---|---|---|---|
| '66 Road Kill | Fawns * | 7 | 9 | 4 | 0 | 20 | 17 | 0.85 |
| | Adults * | 2 | 6 | 17 | 4 | 29 | 52 | 1.79 |
| '67 Road Kill | Fawns * | 1 | 6 | 1 | 1 | 9 | 11 | 1.22 |
| | Adults * | 0 | 4 | 9 | 0 | 13 | 22 | 1.69 |
| '67 Road Kill | Fawns ** | 0 | 3 | 2 | 0 | 5 | 7 | 1.40 |
| | Adults ** | 0 | 0 | 17 | 2 | 19 | 40 | 2.11 |
| Combined | All | 10 | 28 | 50 | 7 | 95 | 149 | 1.57 |
| Combined | Fawns | 8 | 18 | 7 | 1 | 34 | 35 | 1.03 |
| Combined | Adults | 2 | 10 | 43 | 6 | 61 | 114 | 1.87 |

* Age verified from jawbones provided by Officers making count.
** Age not verified but report made.

Table 2. Basic data concerning known mortality, age ratios, and population estimates (Officers)

| YEAR | KNOWN MORTALITY GUN & BOW | MISC | TOTAL | % FAWNS IN KILL | POPULATION WINTER | ESTIMATES PRE-SEASON |
|---|---|---|---|---|---|---|
| 1952 | | | | | 10,721 | |
| 1953 | 4008 | 393 | 4401 | 27.4 | 12,982 | 21,530 |
| 1954 | 2992 | 310 | 3302 | 41.7 | 11,892 | 19,860 |
| 1955 | 3062 | 306 | 3368 | 34.7 | 10,674 | 17,826 |
| 1956 | 2678 | 419 | 3097 | 36.3 | 10,811 | 18,054 |
| 1957 | 2805 | 345 | 3150 | 40.8 | 10,384 | 17,174 |
| 1958 | 2891 | 438 | 3329 | 45.9 | 10,643 | 17,774 |
| 1959 | 2731 | 508 | 3239 | 38.6 | 11,705 | 19,547 |
| 1960 | 4269 | 753 | 5022 | 42.5 | 13,101 | 21,368 |
| 1961 | 5364 | 839 | 6203 | 44.3 | 14,155 | 24,063 |
| 1962 | 5703 | 939 | 6642 | 41.9 | 15,938 | 27,097 |
| 1963 | 7151 | 1129 | 8280 | 43.7 | 19,565 | 33,219 |
| 1964 | 9694 | 1170 | 10864 | 46.1 | 21,580 | 36,694 |
| 1965 | 8600 | 1224 | 9844 | 43.1 | 25,573 | 43,474 |
| 1966 | 11321 | 1250 | 12571 | 46.6 | 28,482 | 48,793 |
| 1967 | | | | | 25,350 | 43,095 |
| Means | | | | | | |
| All Years | | | | 42.0 | (R=1.72) | |
| '54-'59 | | | | 40.0 | (R=1.67) | |
| '60-'66 | | | | 44.0 | (R=1.79) | |

Table 3. Reconciliation of Natural Mortality, known kill, and populations, 1953 - 1967

| YEAR | RECRUITMENT RATE | KNOWN KILL | SURVIVAL RATE*** | RATIO UM/LK* | CALCULATED FALL POP. ESTIMATE |
|---|---|---|---|---|---|
| 1953 | | | | | (12,982)** |
| 1954 | 1.67 | 4401 | 0.875 | 0.5 | 12,538 |
| 1955 | 1.67 | 3302 | 0.875 | 0.75 | 13,496 |
| 1956 | 1.67 | 3368 | 0.875 | 0.8 | 14,788 |
| 1957 | 1.67 | 3097 | 0.875 | 1.2 | 17,097 |
| 1958 | 1.67 | 3257 | 0.875 | 1.2 | 20,379 |
| '54-'58 | | | | 0.89 | |
| 1959 | 1.67 | 3329 | 0.85 | 1.6 | 24,202 |
| 1960 | 1.67 | 3239 | 0.85 | 2.1 | 29,756 |
| 1961 | 1.67 | 5022 | 0.85 | 1.6 | 35,109 |
| '59-'61 | | | | 1.75 | |
| 1962 | 1.67 | 6203 | 0.825 | 1.7 | 39,825 |
| 1963 | 1.67 | 6642 | 0.825 | 1.8 | 45,717 |
| 1964 | 1.67 | 8240 | 0.825 | 1.7 | 51,633 |
| '62-'64 | | | | 1.75 | |
| 1965 | 1.67 | 10864 | 0.80 | 1.5 | 54,467 |
| 1966 | 1.67 | 9844 | 0.80 | 1.9 | 59,616 |
| 1967 | 1.67 | 12571 | 0.80 | 1.5 | 62,852 |
| '65-'67 | | | | 1.61 | |
| 1968 | 1.67 | (16,000) | 0.80 | (1.0) | (62,593) |

* Ratio of Unknown Mortality to legal hunting kill.

** Winter '53 Population Estimate used as starting point for calculations based on Eberhardt, 1960.

*** Estimated.

Table 4. Rate of Natural Mortality related to population estimates with the indicated ratio to kill levels of years '53 to '66 (R=1.67)

| YEAR | PRE-SEASON POPULATION (Est. x1. 70)* | LEGAL KILL | KILL AS % OF FALL POP. | RATE OF NAT. MORT. REQUIR. TO RESULT IN NEXT YRS. POP. | RATE OF SURVIVAL BETWEEN SEASONS | RATIO NAT. MORT./ KILL |
|---|---|---|---|---|---|---|
| 1953 | 21,530 | 4,008 | 18.6% | 32.1% (9,402) | 67.9% | 2.34 |
| 1954 | 19,860 | 2,992 | 15.1% | 36.7% (10,344) | 63.3% | 3.46 |
| 1955 | 17,826 | 3,062 | 17.2% | 26.8% (6,602) | 73.2% | 2.16 |
| 1956 | 18,054 | 2,678 | 14.8% | 33.1% (8,504) | 66.9% | 3.17 |
| 1957 | 17,174 | 2,805 | 16.3% | 25.9% (6,222) | 74.1% | 2.21 |
| 1958 | 17,774 | 2,891 | 16.3% | 21.4% (5,308) | 78.6% | 1.84 |
| 1959 | 19,547 | 2,731 | 14.0% | 23.9% (6,715) | 76.1% | 2.46 |
| 1960 | 21,368 | 4,269 | 20.0% | 15.7% (4,492) | 84.3% | 1.05 |
| 1961 | 24,063 | 5,364 | 22.3% | 13.2% (4,130) | 86.8% | 0.77 |
| 1962 | 27,097 | 5,703 | 21.0% | 7.0% (2,509) | 93.0% | 0.43 |
| 1963 | 33,219 | 7,151 | 21.5% | 15.8% (6,840) | 84.2% | 0.95 |
| 1964 | 36,694 | 9,694 | 26.4% | 3.2% (1,616) | 96.4% | 0.17 |
| 1965 | 43,474 | 8,600 | 19.8% | 16.2% (9,447) | 83.8% | 1.10 |
| 1966 | 48,793 | 11,321 | 23.2% | 31.1% (19,473) | 68.9% | 1.72 |
| 1967 | 43,095 | | | | | x=1.7 |

* 1.70 used from '61 to '67, times the officers estimate
1.63 used for '60
1.67 used for '53 to '59.

Table 5. Iowa deer population county estimates (Cons. Officers), 1967.

| | 1966 | 1967 | % Change |
|---|---|---|---|
| 1. Adair | 400 | 370 | - 8 |
| 2. Adams | 240 | 170 | - 29 |
| 3. Allamakee | 1500 | 1500 | 0 |
| 4. Appanoose | 152 | 175 | 15 |
| 5. Audubon | 157 | 130 | - 17 |
| 6. Benton | 41 | 63 | 54 |
| 7. Black Hawk | 190 | 91 | - 52 |
| 8. Boone | 280 | 130 | - 54 |
| 9 Bremer | 135 | 35 | - 74 |
| 10 Buchanan | 90 | 80 | - 11 |
| 11. Buena Vista | 54 | 54 | 0 |
| 12 Butler | 160 | 73 | - 54 |
| 13. Calhoun | 24 | 24 | 0 |
| 14 Carroll | 70 | 62 | - 11 |
| 15. Cass | 373 | 248 | - 34 |
| 16. Cedar | 135 | 75 | - 44 |
| 17. Cerro Gordo | 20 | 33 | 65 |
| 18. Cherokee | 183 | 161 | - 12 |
| 19 Chickasaw | 130 | 50 | - 62 |
| 20. Clark | 500 | 520 | 4 |
| 21 Clay | 151 | 160 | 6 |
| 22. Clayton | 1000 | 670 | - 33 |
| 23 Clinton | 156 | 218 | 39 |
| 24 Crawford | 800 | 800 | 0 |
| 25. Dallas | 350 | 400 | 14 |
| 26. Davis | 245 | 300 | 23 |
| 27. Decatur | 650 | 720 | 11 |
| 28. Delaware | 180 | 170 | - 6 |
| 29. Des Moines | 1050 | 695 | - 31 |
| 30. Dickinson | 30 | 39 | + 30 |
| 31 Dubuque | 130 | 115 | - 12 |
| 32. Emmett | 94 | 112 | 19 |
| 33 Fayette | 245 | 155 | - 37 |

| | 1966 | 1967 | % Change |
|---|---|---|---|
| 34. Floyd | 181 | 144 | - 20 |
| 35. Franklin | 50 | 56 | 12 |
| 36. Fremont | 131 | 185 | 41 |
| 37. Greene | 159 | 149 | -6 |
| 38. Grundy | 5 | 6 | 20 |
| 39. Guthrie | 1074 | 1020 | - 5 |
| 40. Hamilton | 130 | 130 | 0 |
| 41. Hancock | 105 | 61 | - 42 |
| 42. Hardin | 125 | 127 | 2 |
| 43. Harrison | 1000 | 700 | - 30 |
| 44. Henry | 185 | 170 | - 8 |
| 45. Howard | 150 | 120 | - 20 |
| 46. Humboldt | 85 | 120 | 41 |
| 47. Ida | 21 | 31 | 48 |
| 48. Iowa | 130 | 135 | 4 |
| 49. Jackson | 565 | 565 | 0 |
| 50. Jasper | 200 | 103 | - 49 |
| 51. Jefferson | 130 | 75 | - 42 |
| 52. Johnson | 130 | 130 | 0 |
| 53. Jones | 220 | 150 | - 32 |
| 54. Keokuk | 260 | 153 | - 41 |
| 55. Kossuth | 130 | 130 | 0 |
| 56. Lee | 661 | 725 | 10 |
| 57. Linn | 240 | 207 | - 9 |
| 58. Louisa | 144 | 168 | 17 |
| 59. Lucas | 1090 | 740 | - 32 |
| 60. Lyon | 255 | 250 | - 2 |
| 61. Madison | 470 | 540 | 15 |
| 62. Mahaska | 363 | 398 | 10 |
| 63. Marion | 375 | 122 | - 67 |
| 64. Marshall | 75 | 64 | - 15 |
| 65. Mills | 510 | 493 | - 3 |
| 66. Mitchell | 147 | 160 | 8 |
| 67. Monona | 1000 | 1025 | 3 |

| | 1966 | 1967 | % Change |
|---|---|---|---|
| 68. Monroe | 695 | 690 | - 1 |
| 69. Montgomery | 307 | 333 | 8 |
| 70. Muscatine | 120 | 75 | - 37 |
| 71. O'Brien | 86 | 94 | 9 |
| 72. Osceola | 31 | 33 | 6 |
| 73. Page | 278 | 232 | - 17 |
| 74. Palo Alto | 32 | 105 | 228 |
| 75. Plymouth | 220 | 152 | - 31 |
| 76. Pocahontas | 56 | 41 | - 27 |
| 77. Polk | 170 | 155 | - 9 |
| 78. Pottawattamie | 1207 | 1120 | - 7 |
| 79. Poweshiek | 110 | 55 | - 50 |
| 80. Ringgold | 265 | 300 | 13 |
| 81. Sac | 34 | 70 | 105 |
| 82. Scott | 66 | 74 | + 12 |
| 83. Shelby | 500 | 500 | 0 |
| 84. Sioux | 174 | 93 | - 47 |
| 85. Story | 34 | 54 | 59 |
| 86. Tama | 51 | 95 | 86 |
| 87. Taylor | 235 | 110 | - 53 |
| 88. Union | 286 | 275 | - 4 |
| 89. Van Buren | 350 | 550 | 57 |
| 90. Wapello | 650 | 325 | - 50 |
| 91. Warren | 164 | 178 | 9 |
| 92. Washington | 255 | 125 | - 51 |
| 93. Wayne | 375 | 218 | - 42 |
| 94. Webster | 160 | 140 | - 12 |
| 95. Winnebago | 95 | 100 | 5 |
| 96. Winneshiek | 580 | 540 | - 7 |
| 97. Woodbury | 421 | 421 | 0 |
| 98. Worth | 99 | 97 | - 2 |
| 99. Wright | 68 | 35 | - 49 |
| | 28,482 | 25,350 | - 11 |

Table 6. Basic data taken from samples of the Iowa deer kill, 1959 - 1966.

| | Age class | 1959 # | 1959 per 1000 | 1960 # | 1960 per 1000 | 1961 # | 1961 per 1000 | 1962 # | 1962 per 1000 | 1963 # | 1963 per 1000 | 1964 # | 1964 per 1000 | 1965 # | 1965 per 1000 | 1966 # | 1966 per 1000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fawns | 1 | 197 | 386 | 312 | 425 | 321 | 443 | 383 | 419 | 588 | 437 | 801 | 461 | 195 | 431 | 422 | 466 |
| 1 1/2 | 2 | 150 | 295 | 203 | 276 | 182 | 251 | 236 | 258 | 383 | 284 | 448 | 253 | 136 | 300 | 256 | 282 |
| 2 1/2 | 3 | 92 | 181 | 123 | 167 | 130 | 179 | 183 | 200 | 229 | 170 | 328 | 189 | 74 | 163 | 116 | 128 |
| 3 1/2 | 4 | 41 | 81 | 61 | 83 | 55 | 76 | 76 | 83 | 90 | 72 | 99 | 57 | 28 | 62 | 61 | 67 |
| 4 1/2 | 5 | 19 | 39 | 25 | 34 | 23 | 32 | 23 | 25 | 33 | 25 | 44 | 25 | 12 | 26 | 30 | 33 |
| 5 1/2 | 6 | 5 | 10 | 4 | 6 | 6 | 8 | 7 | 8 | (24) | (12) | 11 | 6 | 6 | 13 | 12 | 13 |
| 6 1/2 | 7 | 3 | 6 | 5 | 7 | 3 | 4 | 3 | 3 | | | 6 | 3 | 1 | 2 | 5 | 6 |
| 7 1/2 | 8 | | | 1 | 1 | 3 | 4 | 2 | 2 | | | 1 | 1 | 1 | 2 | 1 | 1 |
| 8 1/2 | 9 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | 1 | 1 |
| 9 1/2 | 10 | 1 | 1 | | | 1 | 1 | 1 | 1 | | | | | | | | |
| 10 1/2 | 11 | | | | | | | | | | | | | | | 2 | 2 |
| | | 509 | 1000 | 735 | 1000 | 725 | 1000 | 915 | 1000 | 1347 | 1000 | 1738 | 1000 | 453 | 1000 | 906 | 1000 |

Table 7. Percentage age composition - 1966

| | Short Zone % | Long Zone % | State Wide % | Inc. Pop. % | Dec. Pop. % | Stable Pop. % | Mo. Pop. % |
|---|---|---|---|---|---|---|---|
| Fawns | 52.0 | 44.3 | 46.6 | 44.3 | 46.9 | 50.0 | 41.8 |
| 1 1/2's | 26.9 | 28.1 | 28.2 | 27.4 | 34.7 | 28.8 | 38.1 |
| 2 1/2's | 11.4 | 14,3 | 12.8 | 14.8 | 8.2 | 13.5 | 13.7 |
| 3 1/2's | 5.9 | 7.0 | 6.8 | 7.9 | 6.1 | 3.2 | 5.1 |
| Over 3 1/2's | 3.65 | 6.3 | 5.6 | 5.6 | 4.1 | 4.5 | 1.4 |
| Totals | 100.3 | 100.0 | | 100.0 | 100.0 | 100.0 | |
| Sample size | 219 | 512 | | 445 | 49 | 156 | 1272 |

Table 8. Mortality between age classes, 1959 - 1966

| | Fawn to 1 1/2 | 1 1/2 to 2 1/2 | 2 1/2 to 3 1/2 | 3 1/2 to 4 1/2 | Mean Mort. |
|---|---|---|---|---|---|
| 1959 | 24 | 39 | 55 | 54 | 43 |
| 1960 | 35 | 39 | 50 | 59 | 46 |
| 1961 | 43 | 29 | 58 | 58 | 47 |
| 1962 | 38 | 22 | 68 | 70 | 50 |
| 1963 | 35 | 40 | 61 | 63 | 50 |
| 1964 | 44 | 27 | 70 | 56 | 49 |
| 1965 | 30 | 46 | 62 | 57 | 49 |
| 1966 | 39 | 55 | 47 | 51 | 48 |
| Mean | 36 | 37 | 59 | 59 | 48 |

Table 9. Mortality between age classes of cohorts

| | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 |
|---|---|---|---|---|---|---|---|---|
| F - 1 1/2 | 28 | 41 | 42 | 32 | 42 | 35 | 35 | |
| 1 1/2 - 2 1/2 | 35 | 20 | 34 | 33 | 36 | 57 | | |
| 2 1/2 - 3 1/2 | 54 | 64 | 66 | 67 | 59 | | | |
| 3 1/2 - 4 1/2 | 70 | 65 | 54 | 46 | | | | |
| 4 1/2 - 5 1/2 | 76 | 48 | 50 | | | | | |
| 5 1/2 - 6 1/2 | 67 | 54 | | | | | | |
| 6 1/2 - 7 1/2 | 50 | | | | | | | |

Table 10. Time specific life table, 1965 Gifford Area (Nebraska)

| | Age Class (X) | Deaths (d'X) | Deaths/1000 (dX) | Surv. (lX) | Death Rate (q X) | Avg. Living (LX) | Mean Life Exp. (ex) |
|---|---|---|---|---|---|---|---|
| Fawns | 1 | 31 | 235 | 1000 | 235 | 882 | 2.45 |
| 1 1/2 | 2 | 29 | 220 | 765 | 288 | 655 | 2.00 |
| 2 1/2 | 3 | 26 | 197 | 545 | 361 | 447 | 1.67 |
| 3 1/2 | 4 | 24 | 181 | 348 | 520 | 257 | 1.34 |
| 4 1/2 | 5 | 13 | 98 | 167 | 587 | 118 | 1.25 |
| 5 1/2 | 6 | 5 | 38 | 69 | 551 | 50 | 1.30 |
| 6 1/2 | 7 | 2 | 15 | 31 | 484 | 24 | 1.29 |
| 7 1/2 | 8 | 1 | 8 | 16 | 500 | 12 | 1.00 |
| 8 1/2 | 9 | 1 | 8 | 8 | 1000 | 4 | 0.50 |
| 9 1/2 | 10 | | | | | | |
| 10 1/2 | 11 | | | | | | |
| Totals | | 132 | | | | | |

Table II. Time specific life table, 1966 Short Zone

| | Age Class (x) | Deaths (d'x) | Deaths/1000 (dx) | Surv. (lx) | Death Rate (qx) | Avg. Living (Lx) | Mean Life Exp. (ex) |
|---|---|---|---|---|---|---|---|
| Fawns | 1 | 114 | 521 | 1000 | 521 | 739 | 1.33 |
| 1 1/2 | 2 | 59 | 270 | 479 | 564 | 344 | 1.24 |
| 2 1/2 | 3 | 25 | 114 | 209 | 545 | 152 | 1.20 |
| 3 1/2 | 4 | 13 | 59 | 95 | 621 | 65 | 1.04 |
| 4 1/2 | 5 | 5 | 23 | 36 | 638 | 24 | 0.94 |
| 5 1/2 | 6 | 2 | 9 | 13 | 692 | 8 | 0.76 |
| 6 1/2 | 7 | | | | | | |
| 7 1/2 | 8 | | | | | | |
| 8 1/2 | 9 | 1 | 4 | 4 | 1000 | 2 | 0.50 |
| 9 1/2 | 10 | | | | | | |
| 10 1/2 | 11 | | | | | | |
| Mean Total | | 219 | 1000 | | | | |

Table 12. Time specific life table, 1966 Long Zone

| | Age Class x | Deaths d'x | Deaths/1000 dx | Surv. lx | Death Rate qx | Avg. Living Lx | Mean Life Exp. ex |
|---|---|---|---|---|---|---|---|
| Fawns | 1 | 227 | 443 | 1000 | 443 | 778 | 1.57 |
| 1 1/2 | 2 | 144 | 281 | 557 | 504 | 416 | 1.43 |
| 2 1/2 | 3 | 73 | 143 | 276 | 518 | 204 | 1.38 |
| 3 1/2 | 4 | 36 | 70 | 133 | 526 | 98 | 1.34 |
| 4 1/2 | 5 | 19 | 37 | 63 | 587 | 44 | 1.28 |
| 5 1/2 | 6 | 6 | 12 | 26 | 461 | 20 | 1.42 |
| 6 1/2 | 7 | 4 | 8 | 14 | 571 | 10 | 1.21 |
| 7 1/2 | 8 | | | | | | |
| 8 1/2 | 9 | 1 | 2 | 6 | 333 | 5 | 1.16 |
| 9 1/2 | 10 | | | | | | |
| 10 1/2 | 11 | 2 | 4 | 4 | 1000 | 2 | 0.50 |
| Total | | 512 | 1000 | | | | |

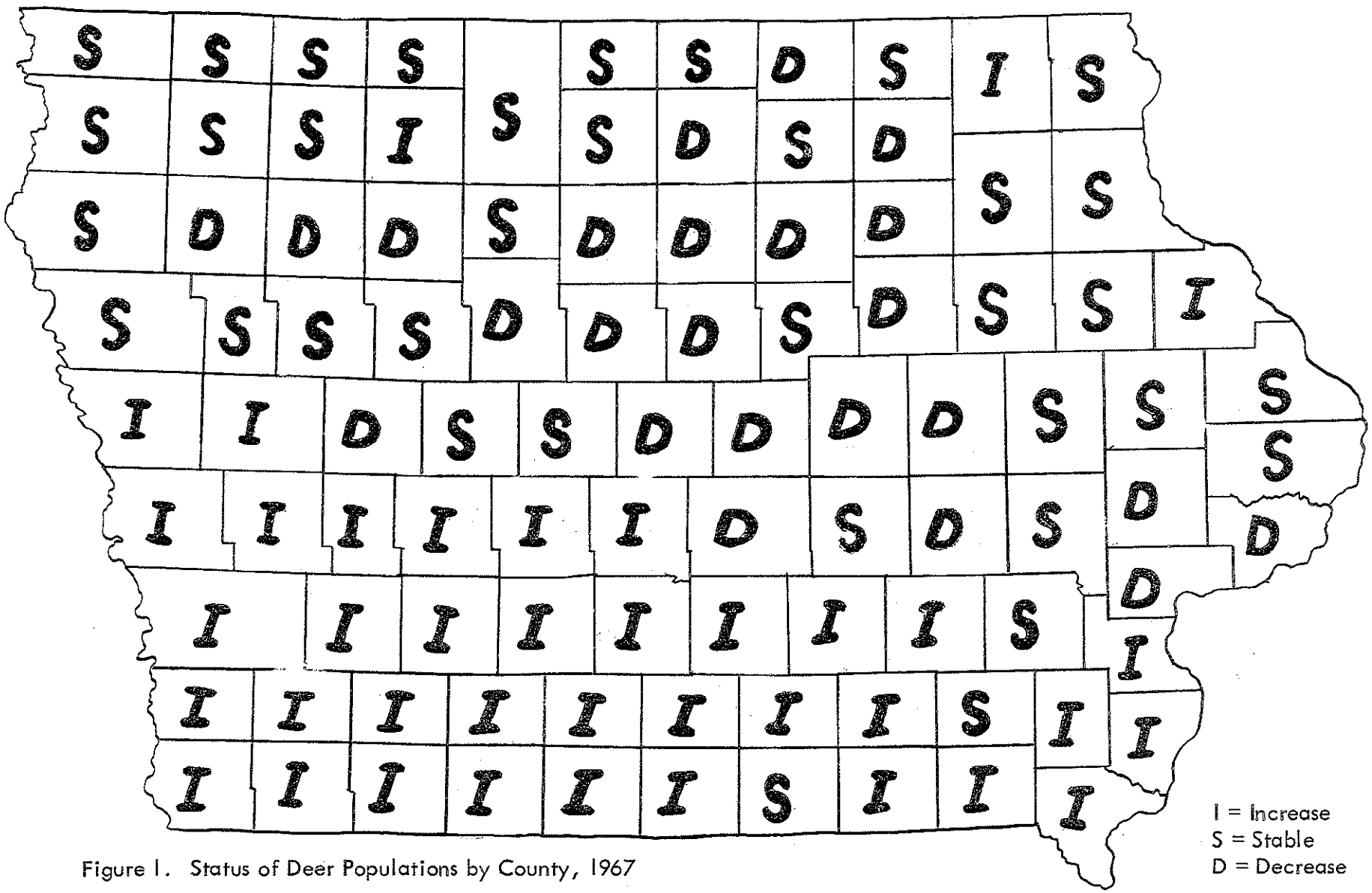



Figure 1. Status of Deer Populations by County, 1967

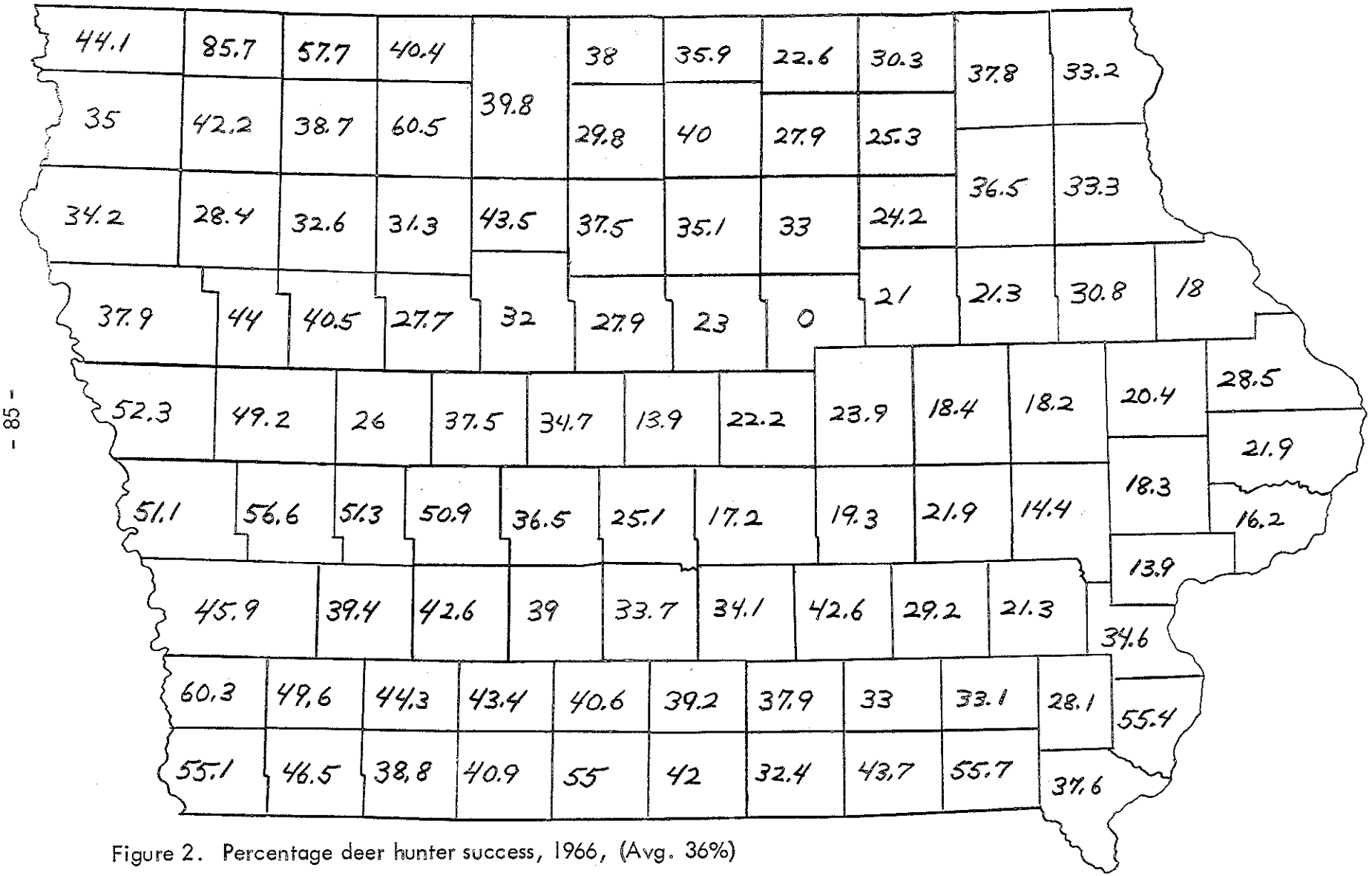



Figure 2. Percentage deer hunter success, 1966, (Avg. 36%)

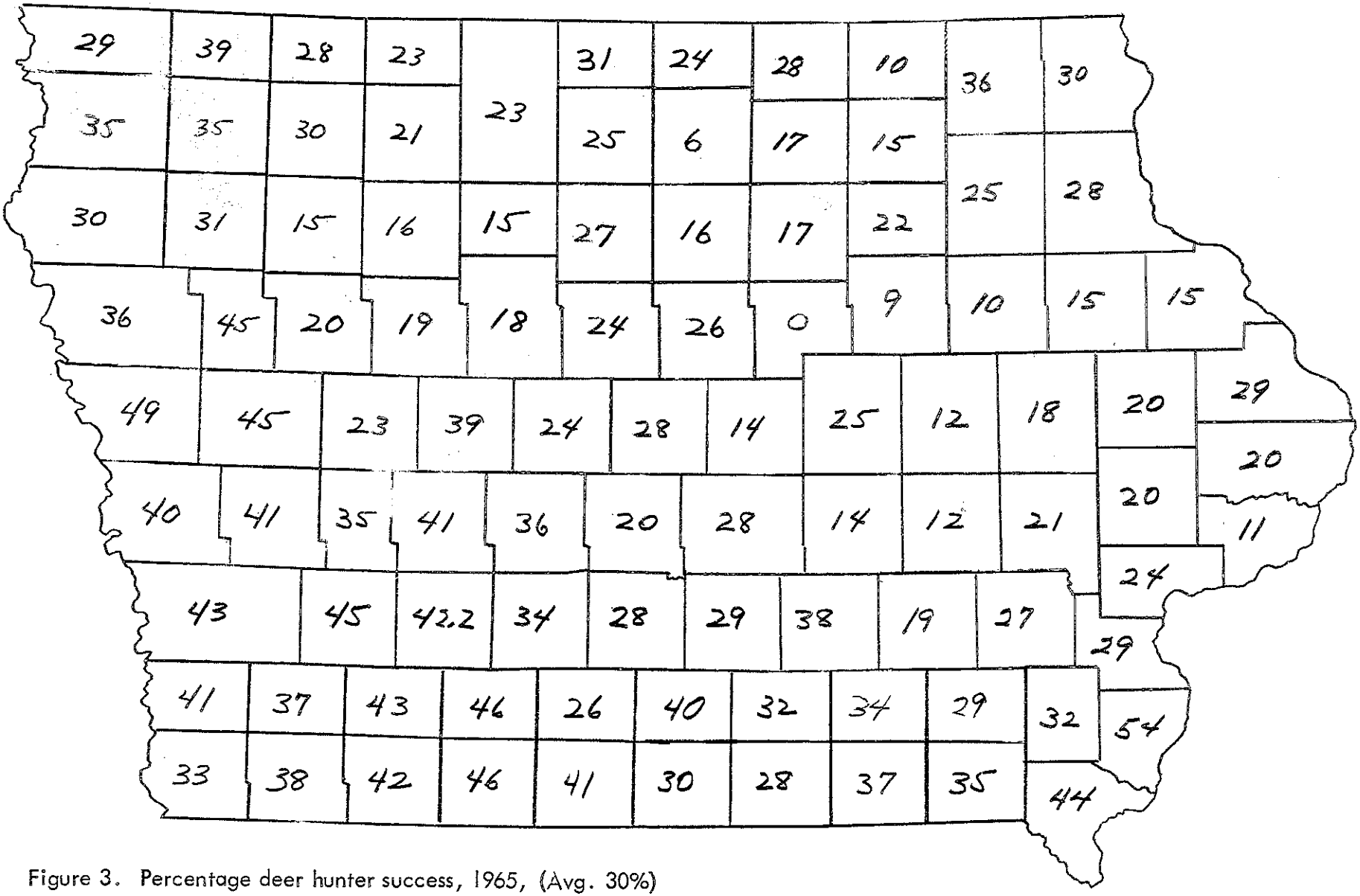



Figure 3. Percentage deer hunter success, 1965, (Avg. 30%)

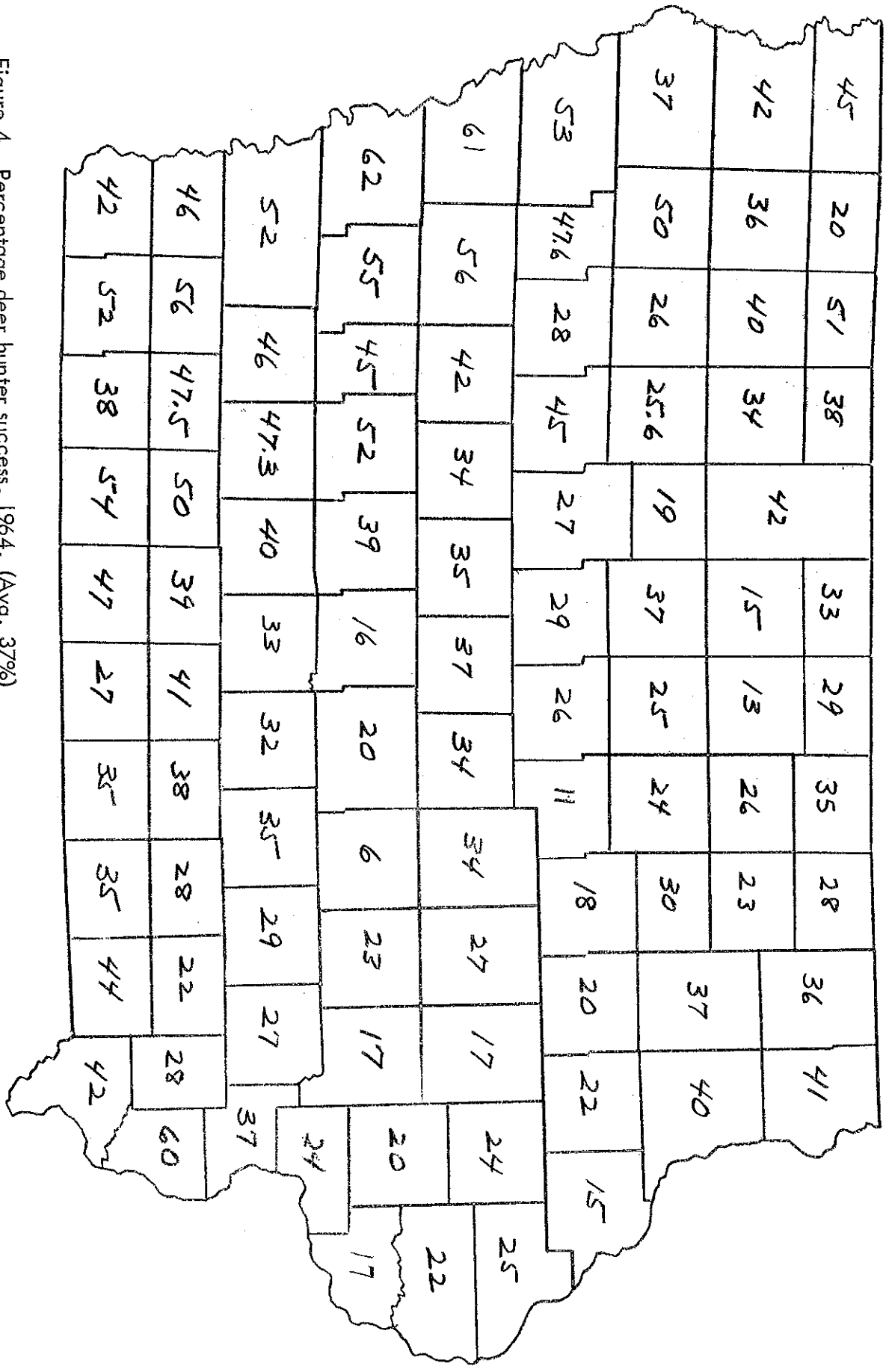



Figure 4. Percentage deer hunter success, 1964, (Avg. 37%)

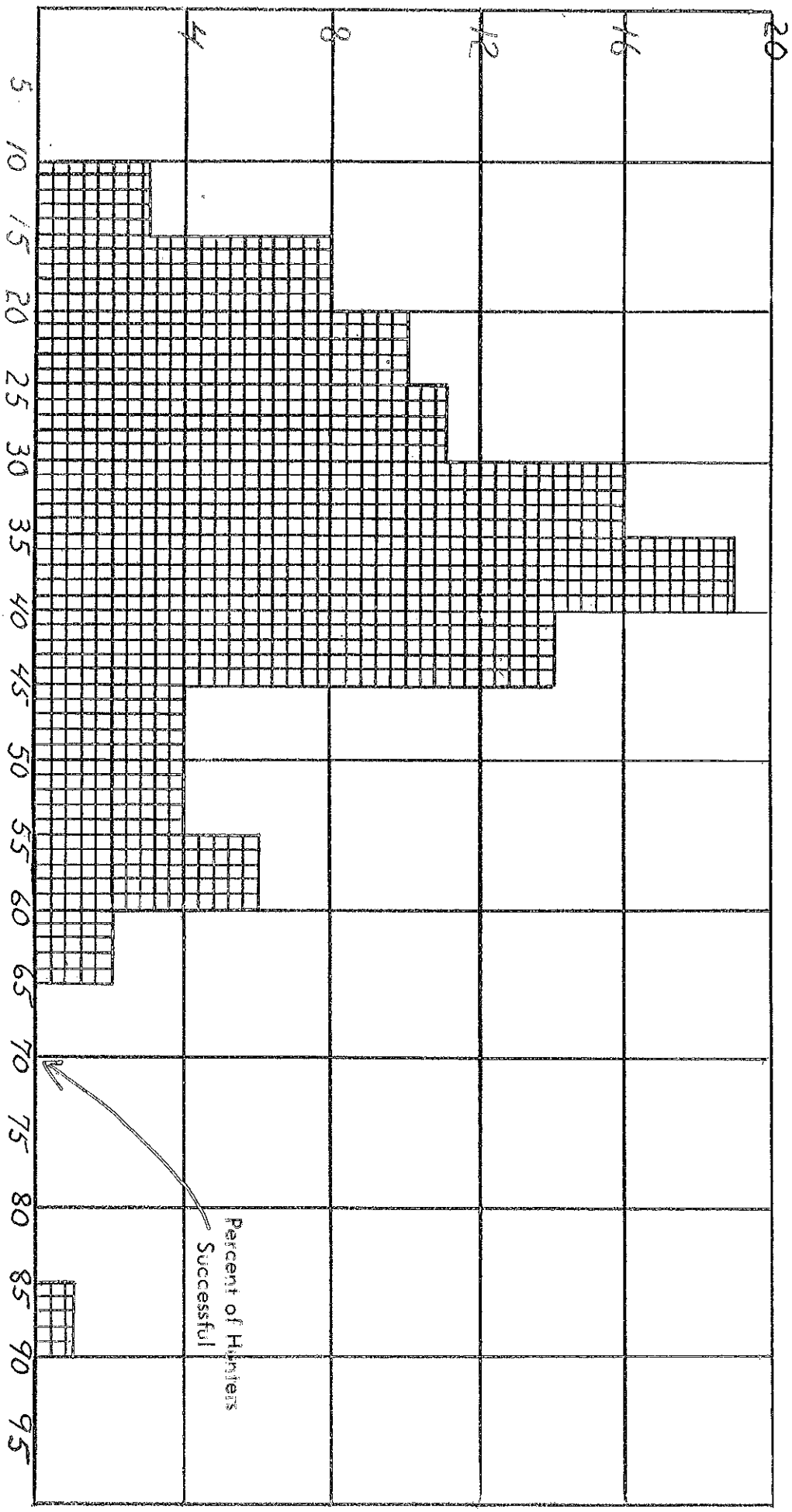



Figure 5. Frequency distribution of Deer Hunter success rates, 1966, by county.

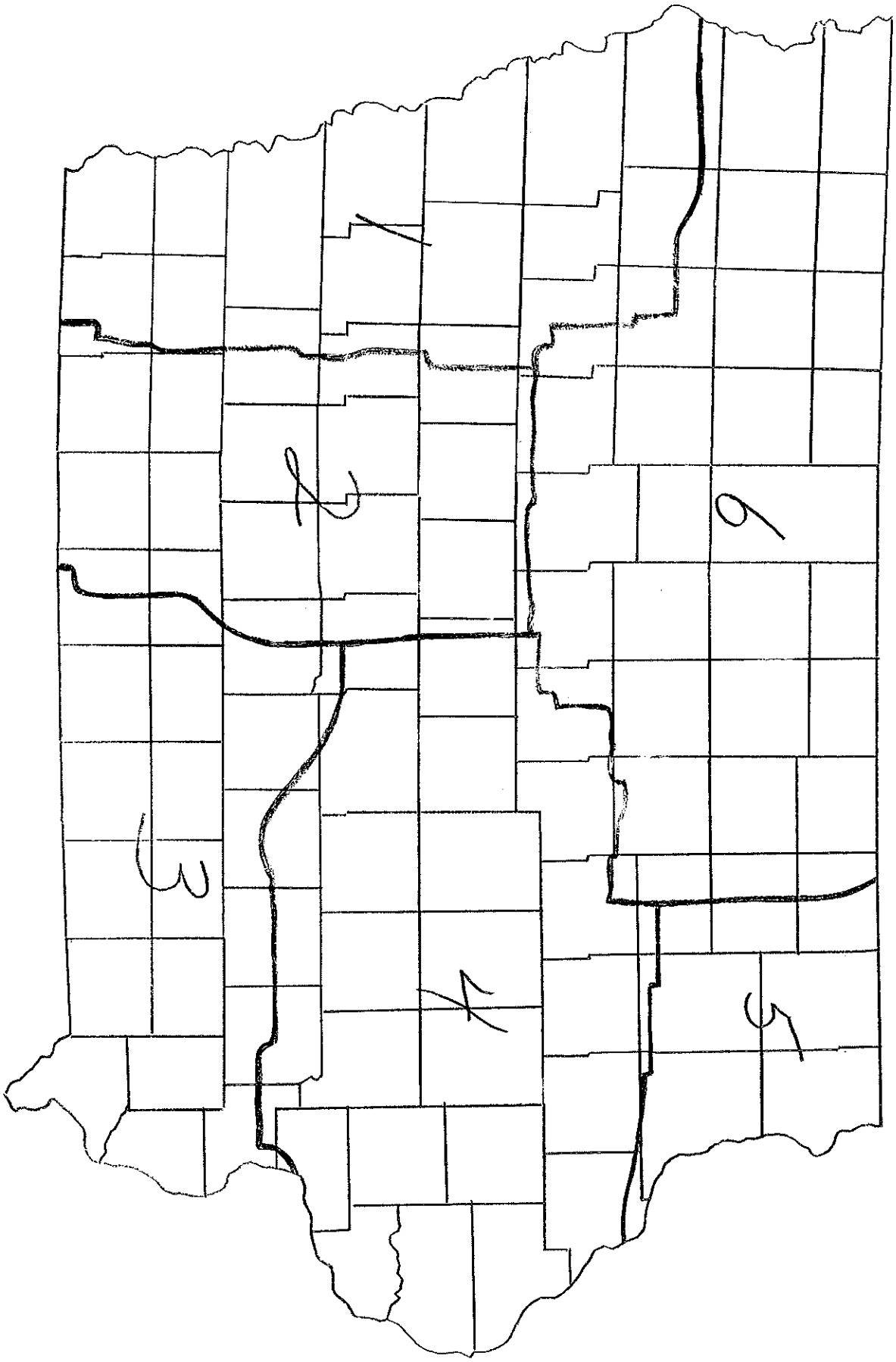
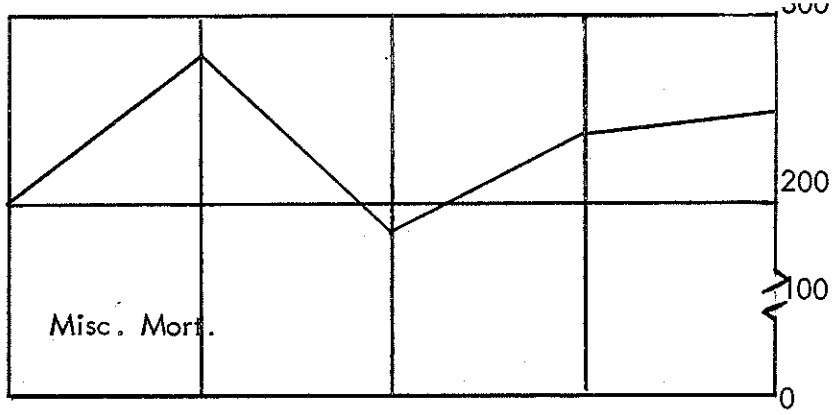



Figure 6. Iowa deer management regions, 1967.

Figure 7. Data from deer management Region I, 1960-66



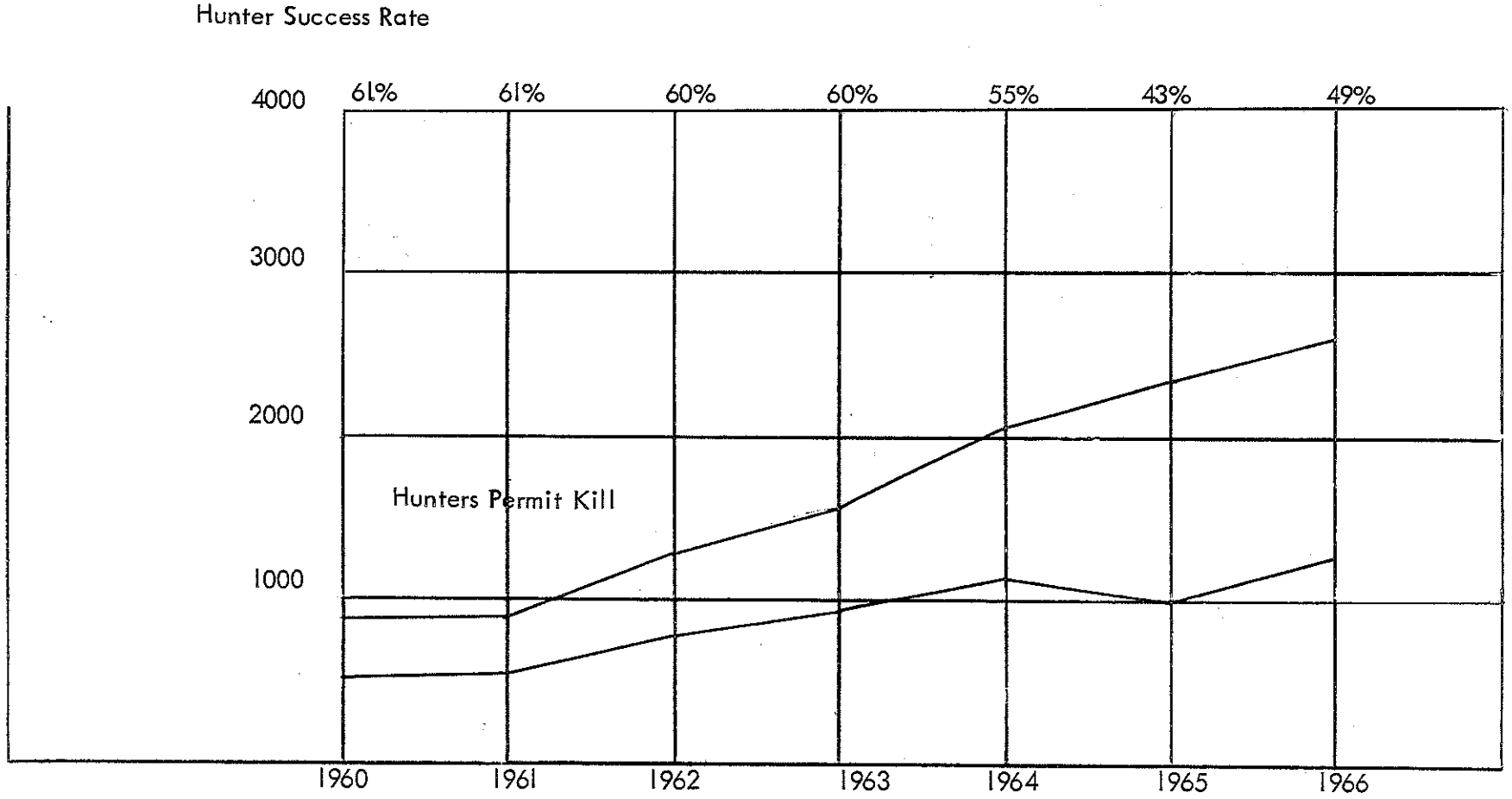
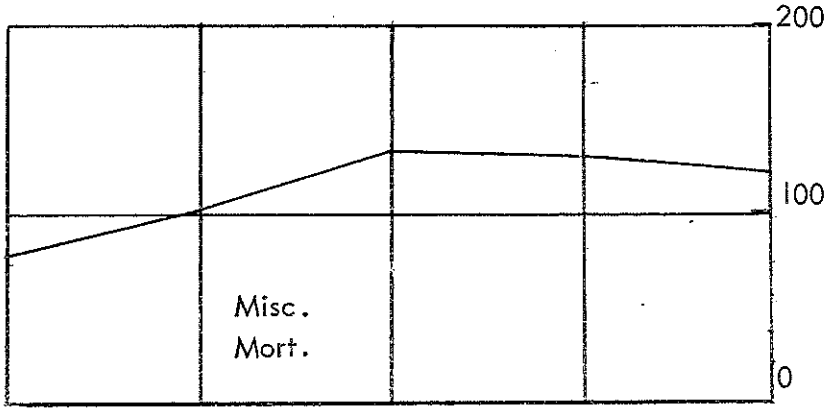



Figure 8. Data from deer management Region 2, 1960-66



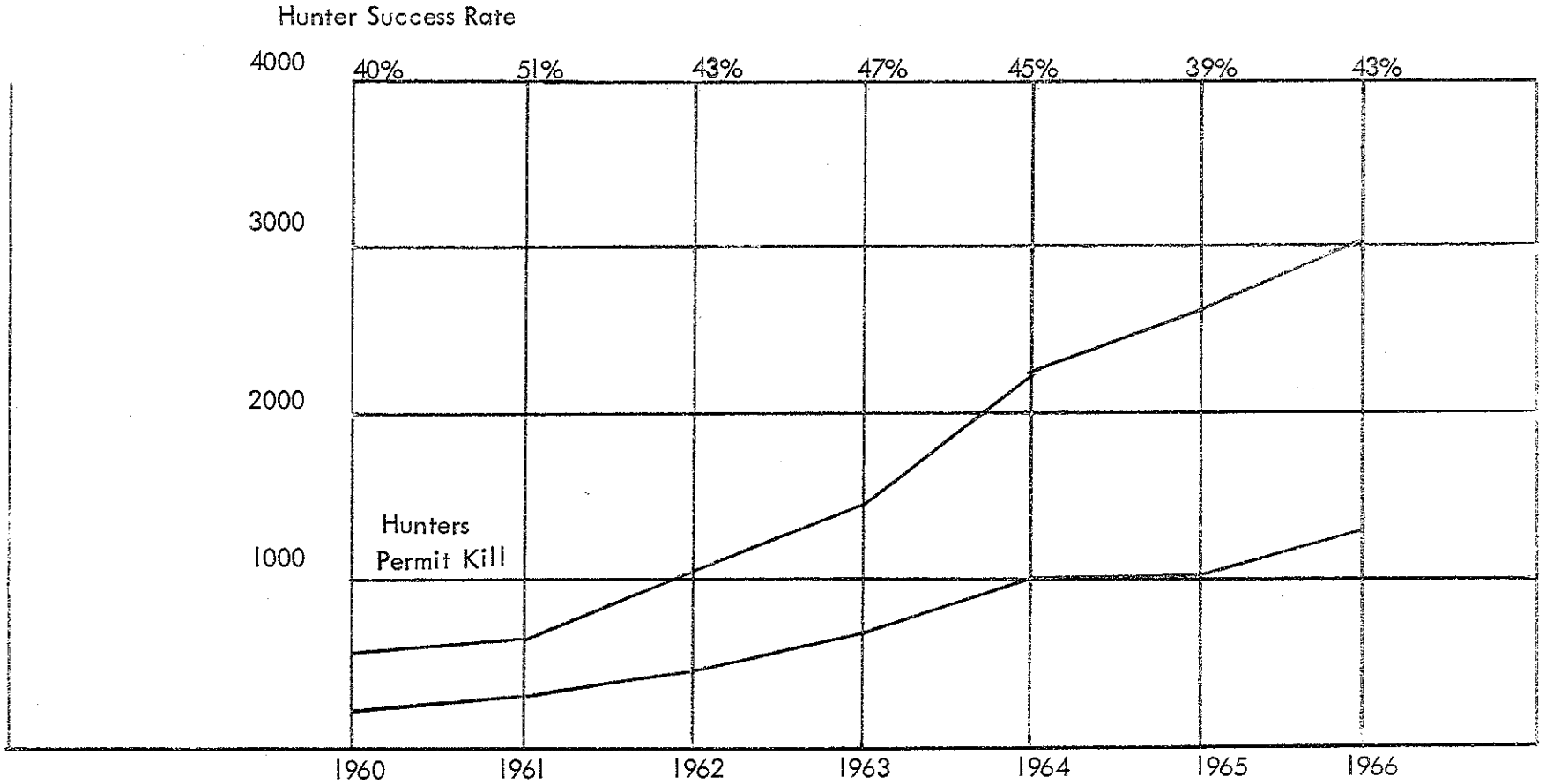



Figure 9. Data from deer management Region 3, 1960-66

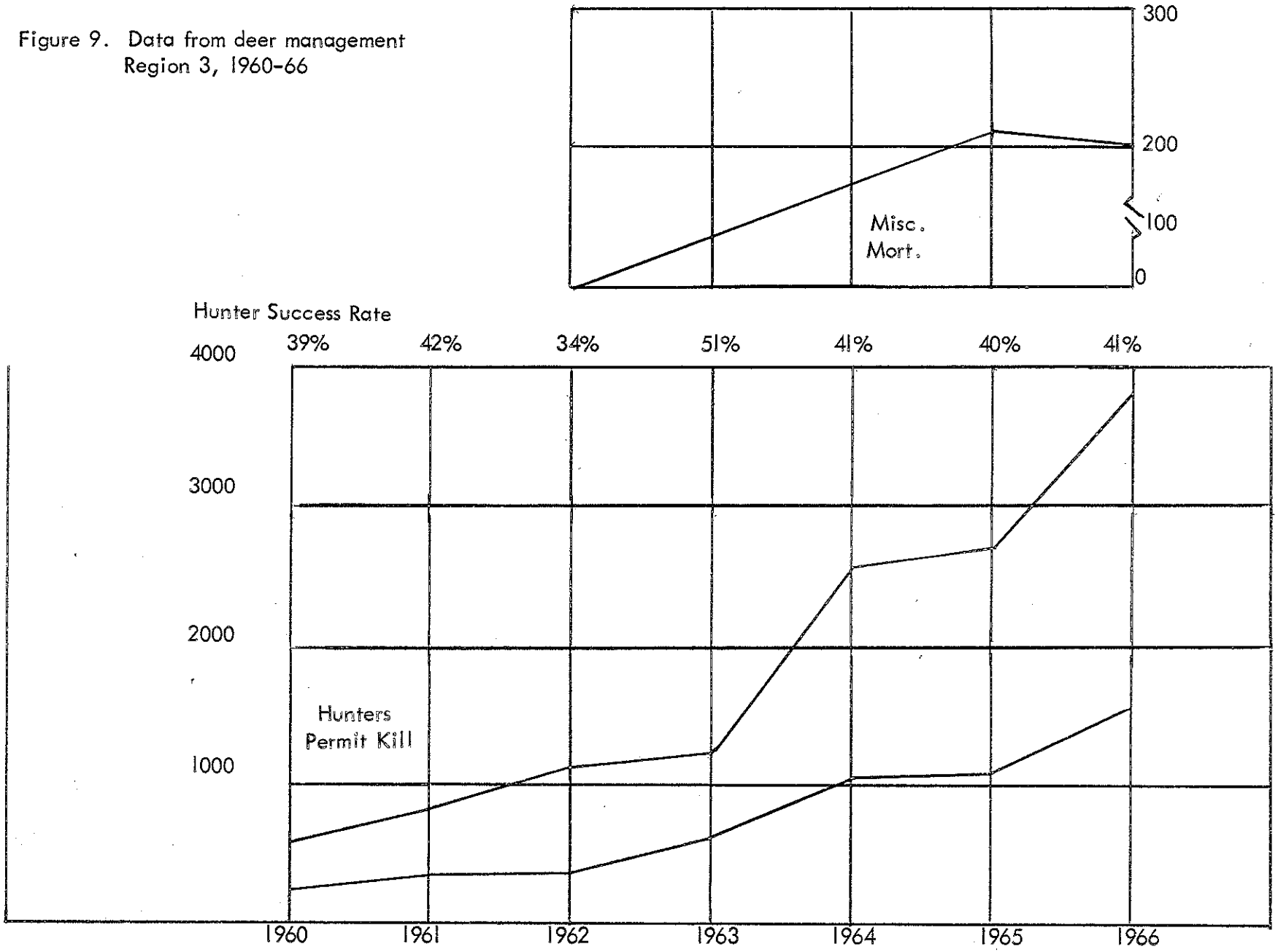


Figure 10. Data from Deer Management Region 4, 1960-66

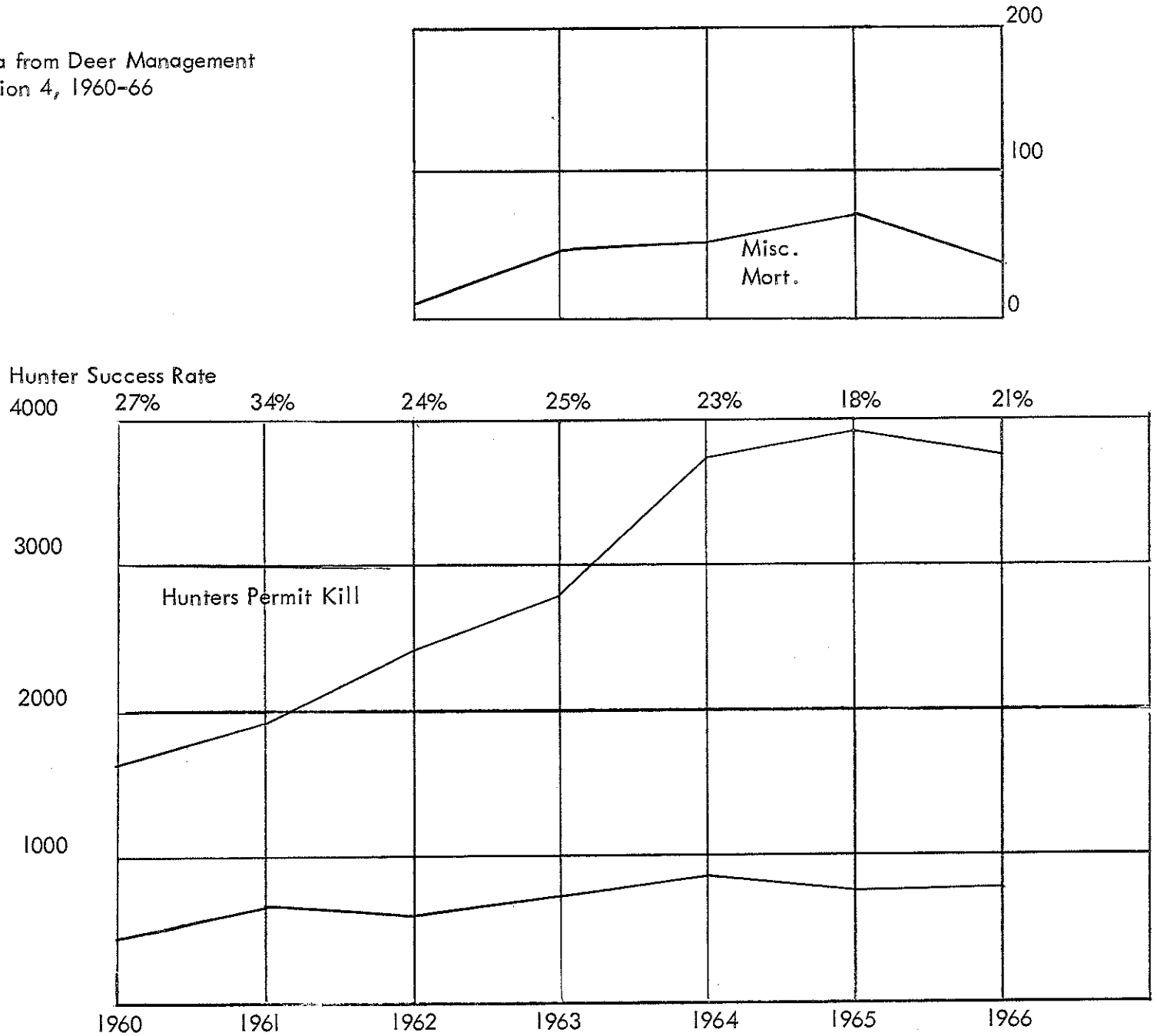


Figure 11. Data from Deer Management Region 5 1960-66

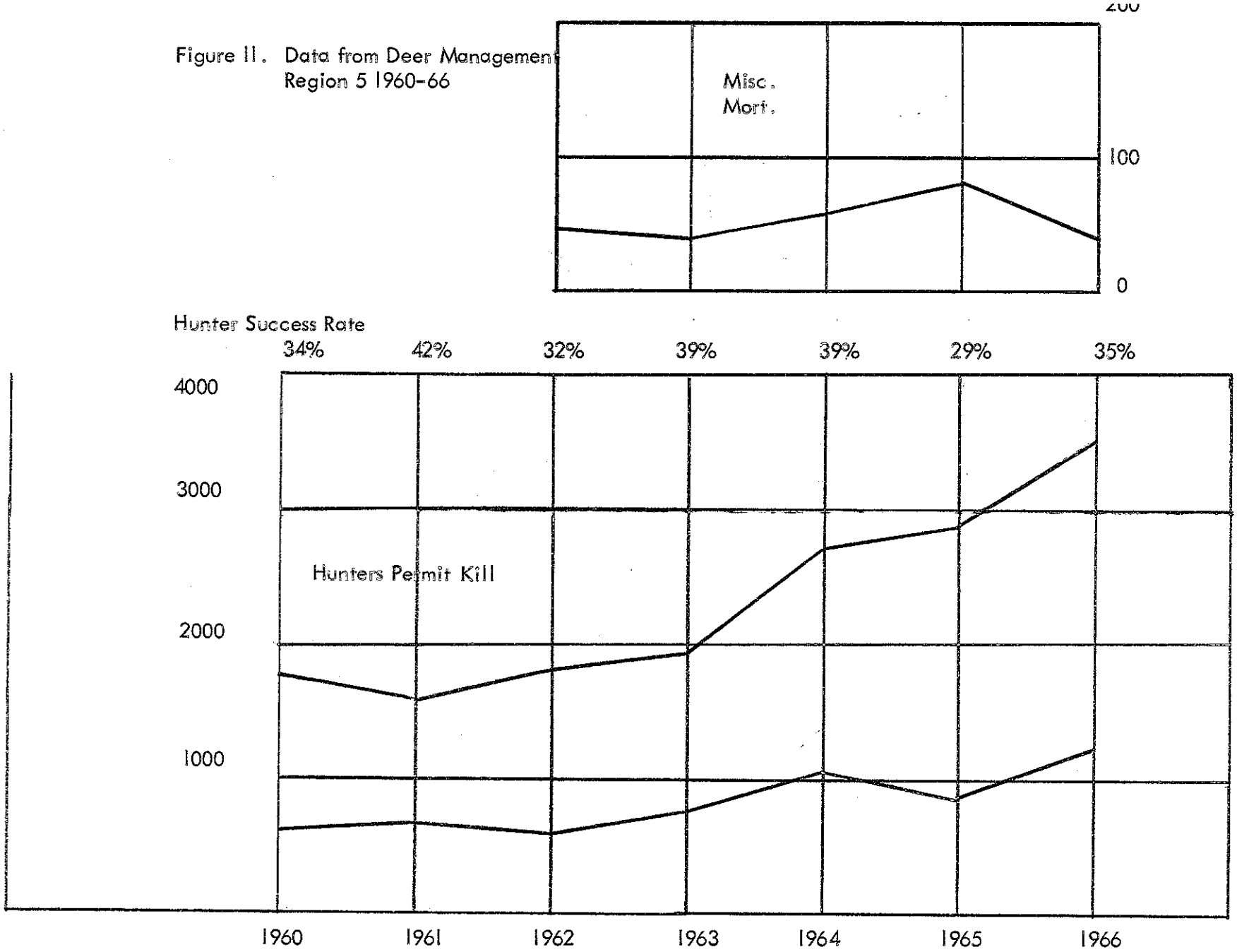
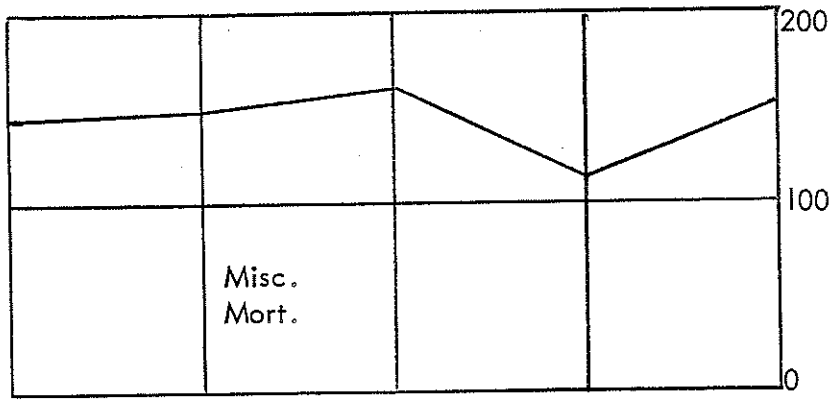
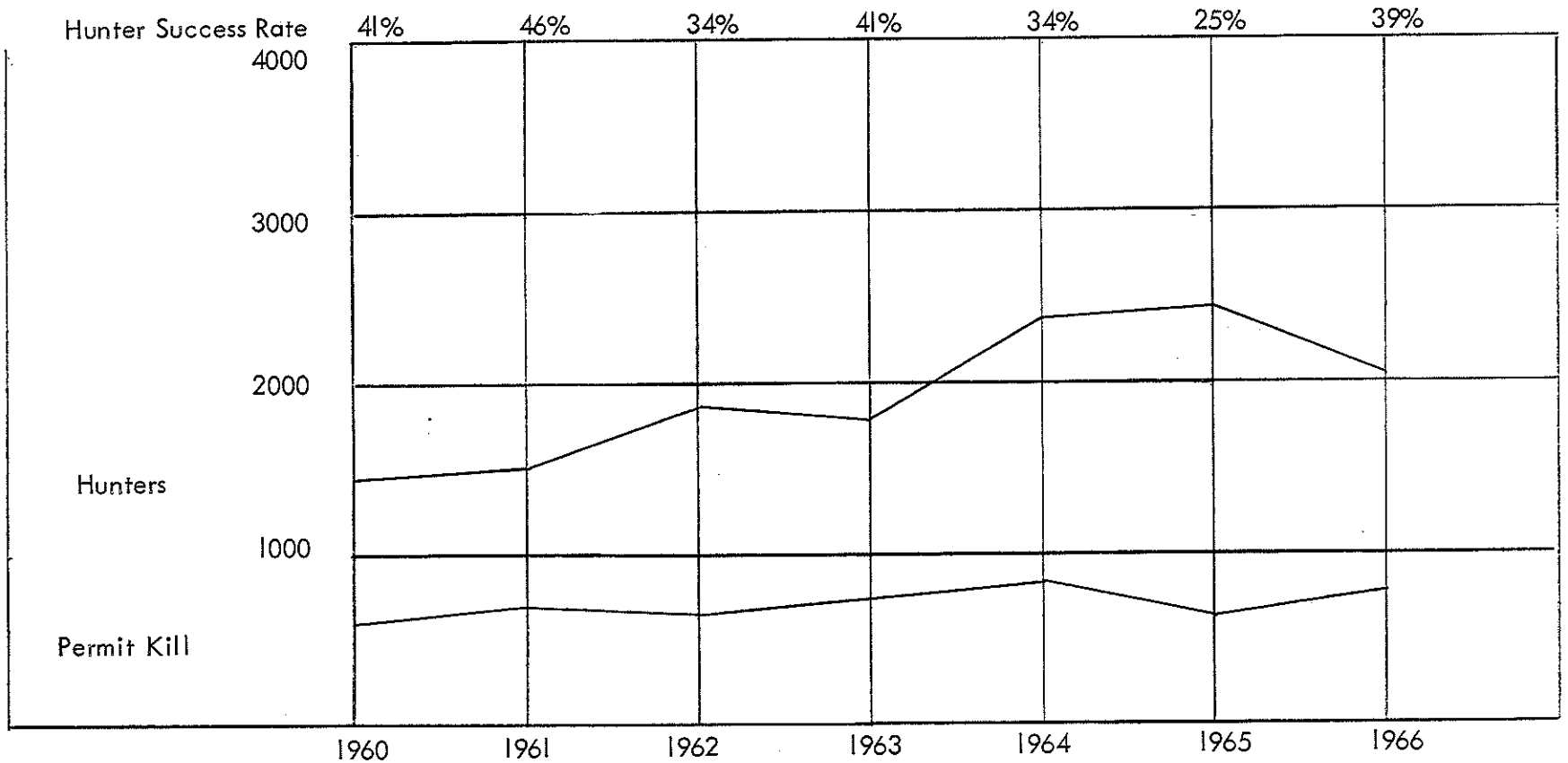


Figure 12. Data from Deer Management Region 6 1960-66



# IOWA'S 1966 EXPERIMENTAL TEAL SEASON

Richard Bishop
Game Biologist

## INTRODUCTION

An experimental season on teal was held for the second year in Iowa, during September, 1966. The 9-day season ran from September 17 through September 25. Shooting hours were from sunrise to sunset with a four bird bag limit.

A special teal permit was again required this year; the application deadline was July 31. All those applying by this time were issued permits. A total of 16,408 permits were issued, 610 less than were issued in 1965. This represents about 41 per cent of the total waterfowl hunters in Iowa. The per cent of permit holders that hunted at least once decreased from 68 per cent in 1965 to 67 per cent in 1966.

All states in the Central Flyway chose to have the season and all states except Wisconsin, Minnesota, Alabama, and Tennessee in the Mississippi Flyway held a season. Not unlike the season in 1965, each state that held the season had to complete spy-blind reports on hunters to gain information on crippling loss, hunter behavior, and illegal kill.

## RESULTS

Early fall of 1966 was one of the driest on record. By middle September most marshes in central and northern Iowa had very low water levels to the point of being critical. Teal began building up on northern Iowa marshes in late August, and by September 10th teal populations were considered high with many marshes having rather constant populations of about 1,000 birds. Population fluctuations continued until the opening of the season; some marshes gained more teal, but others lost considerable numbers by the opening day. Unlike September of 1965, very little water was available other than in permanent ponds and marshes. Teal were more concentrated than in 1965.

Wood ducks were very plentiful on northern Iowa marshes by the opening as well as on the inland streams and the Mississippi River. Mallards were generally present in good numbers along with a few widgeon, shoveler, and pintail. Good local production of mallards and wood ducks was responsible for the higher numbers of those present.

The season held a week later in 1966 to see if more teal would be present in central and southern Iowa. This did not seem to be the case. Very poor hunting was reported in southern Iowa as was true in 1965. It appears that when the teal leave the northern Iowa marshes, they do not stop long on the limited water areas in central and southern Iowa.

Opening day hunting was very good in northern Iowa with most parties filling their limits. The second day of the season was a somewhat different story. Hunting was generally good, but fewer teal were killed than on opening day. The illegal kill of wood ducks, mallards, widgeon, and a few other species appeared to be considerable from reports of certain hunters and state

personnel; however, this illegal kill is probably greatly over-emphasized.

Data obtained from a Fish and Wildlife Service questionnaire, sent to 7 per cent of those hunters receiving teal permits in Iowa, revealed an estimated total kill (bagged birds plus crippling loss) in Iowa of 39,530 blue-winged teal and 9,510 green-winged teal. This compares with 40,040 blue-wings and 5,200 green-wings killed in 1965. The total kill of teal includes a crippling loss of 23 per cent. The total teal kill in the Mississippi Flyway was 192,470 blue-winged teal and 33,790 green-winged teal. Iowa had the second highest kill of teal in the Mississippi Flyway. Louisiana was first. Minnesota which was second last year, did not participate this year. Iowa hunters spent 29,090 days afield and on the average each active hunter killed 3.7 teal. Hunting success was slightly lower than in 1965. Approximately 65 per cent of the teal kill occurred opening weekend, 42 per cent on Saturday and 23 per cent on Sunday. About 20 per cent were killed the last weekend. The remaining 5 per cent were taken on the intervening week days.

Age ratios of teal killed during the teal season averaged 2.27 immatures per adult in the flyway. Iowa showed 4.6 immatures per adult compared to 2.5 in 1965. Similar ratios were found in the Central Flyway, indicating somewhat better production in 1966. Sex ratios show Iowa killed 1.1 males per female, with an overall flyway ratio of 1.03 males per female.

Fish and Wildlife Service data show an illegal kill in Iowa of 5,640 ducks of which 1,795 were mallards and 2,820 were wood ducks. A total kill of 12,642 illegal ducks was projected for the Mississippi Flyway. The estimated illegal kill of mallards was only 1 per cent of the 1965 regular season kill in the Central and Mississippi Flyways. The illegal kill of wood ducks was between 1 and 2 per cent of the 1965 hunting season kill.

## DISCUSSION

One of the first questions asked when considering extending the teal season for another year is: What is the kill doing to the teal population? An estimated total kill of teal during the special season in both flyways was 355,480 birds. This is considered only 3 per cent of the fall population. An estimated kill for both seasons or total U. S. kill, was 705,480, only 6 per cent of the fall population. Fish and Wildlife Service data show that a 6 per cent rate of kill during 1966 is no greater than the rate of kill during the regular seasons from 1955-59. Blue-winged teal have a high annual mortality, somewhere between 60 and 70 per cent. It would appear from these data that the special teal season did not greatly affect the teal population.

The next, and probably the biggest, problem in the sportsman's mind, as well as many of our personnel, is the illegal kill of other species. Data from 92 spy-blind observations made in Iowa indicated that 46 per cent of the hunters violated the law and 23 illegal ducks were observed killed (Table 1). Expanding this data, the Fish and Wildlife Service produced a figure of 5,640 illegal ducks killed during the Iowa season. This seems like a very large figure; but compared with the flyway population of these species, it is very minimal. Data indicates that the illegal kill of mallards is only 1 per cent of the regular season kill in the two flyways and the illegal wood duck kill is between 1 and 2 per cent of the regular harvest. The overall effect appears very small.

Hunters shot on 41 per cent of the opportunities they had at illegal ducks. There is some bias in this figure because it is likely that many illegal ducks that were not shot at were considered out of range by the observers. All, or nearly all, birds, even those out of range, were recorded if hunters shot at them. Probably many of the illegal ducks considered out of range by observers were considered in range by the hunters but passed up. This brings up the factor of vulnerability of illegal species. Illegal species tended to fly higher and present harder targets. Hunters found that teal were twice as vulnerable as illegal ducks. Much of the illegal shooting observed was not considered consequential as far as waterfowl populations go. There is one other thing that should be considered here and that is the number of birds that were hit and later died due to this high shooting. Unfortunately no measure of this loss can be made.

These data indicate that the special teal season afforded hunters with a substantial recreational opportunity without hurting the population of any waterfowl species.

I have listened to some of our own personnel and many hunters commenting upon the number of illegal ducks killed and the unsportsmanlike conduct of hunters. I talked with a good many hunters and they wll observed this situation; however, all of them said they personally did not contribute to this. From this I can only conclude that it must be just a few bad hunters! I do feel the teal season has left a bad taste in the mouths of many sportsmen. There are many though that believe the teal season is a very good deal. I feel that the teal season is right in theory and it is a good sign to duck hunters that waterfowl biologists and managers are willing to go out of their way to provide extra recreation where the resource can support it. Too many times we are criticized for being too restrictive on waterfowl. This is a good example of species management, and if hunters cannot take on this responsibility, they have no basis for complaining about restrictive seasons.

I do not like the waste of anything, especially of waterfowl; and in this one respect, I do not approve of the teal season. I feel that the kill of illegal ducks is much higher on a flyway basis than what is suggested due to some states not reporting any illegal shooting and by crippled birds not being noticed by observers. Taking these all into consideration, the facts still point one way in favor of the season. I do not believe that personal sentiment should rule over sound factual reasoning. In many things you must take a little bad with the good.

As yet the teal season is still experimental and there is much to be learned about hunter psychology, species management, and hunting mortality. A two-year situation is not long enough to get enough data to be conclusive. It is hoped that three years of data will provide partial answers. I believe we should continue the teal season for the third year to benefit from this experience.

## REFERENCES

1966 Experimental September Hunting Season on Teal. U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, Migratory Bird Population Station Administrative Report No. 127. 36p.

Table 1. Iowa teal season spy-blind observation data, 1965 & 1966

| | 1965 | 1966 |
|---|---|---|
| No. hunters | 208 | 186 |
| No. parties observed | 97 | 92 |
| Ave. No. hunters per party | 2.1 | 2.0 |
| Length of observations | 228 hrs. | 221 hrs |
| Man hours of observations | 503 | 378 |
| Teal shot down directly | 229 | 164 |
| Teal that sailed down | 47 | 26 |
| Birds bagged per cripple | 2.8 (bag check data) | |
| No. parties that did not violate | 64 | 50 |
| No. parties that violated | 33 | 42 |
| Per cent that violated | 34% | 46% |
| Illegal ducks killed | 23 | 23 * |
| Shots fired at illegal ducks | 151 | 163 |
| Shots fired at teal | 1,076 | 570 |
| No. times hunters passed up illegal ducks | 178 | 187 |
| No. times hunters shot at illegal ducks | 84 | 129 |
| Per cent of opportunities that hunters shot at illegal ducks | 32% | 41% |
| Illegal duck kill per man hours | 1 duck/21.7 man hours | 1 duck/16..8 man hours |

39% violated opening day
47% violated second day
48% violated during the rest of the season

* Wood duck and mallard