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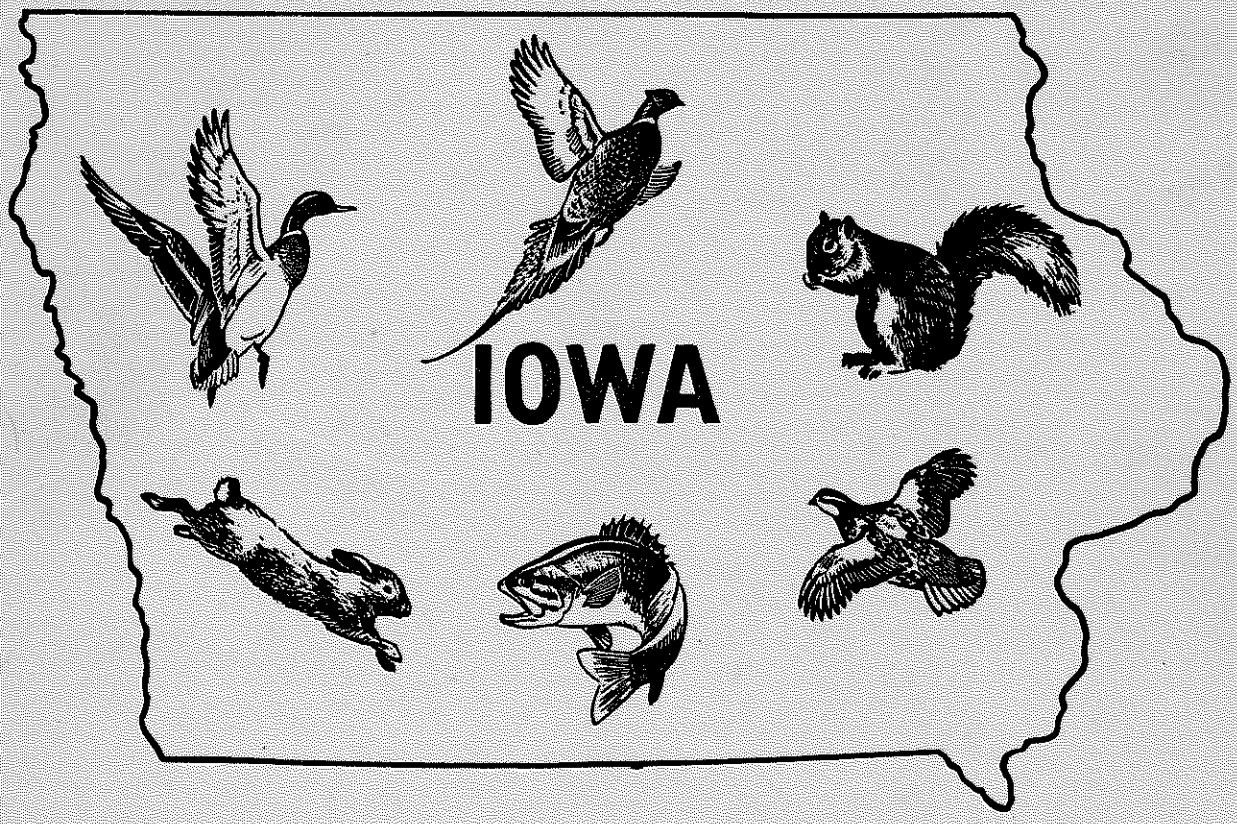
QUARTERLY BIOLOGY REPORTS



FISH AND GAME DIVISION — BIOLOGY SECTION

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Biology Section
Everett B. Speaker, Supt.

State Conservation Commission
Bruce F. Stiles, Director

Fish and Game Division
Ray W. Beckman, Chief

East 7th and Court Streets
Des Moines, Iowa

TABLE OF CONTENTS

FISHERIES SECTION — PAGE NO.

GAME SECTION

Population Studies

The Fish Population of a Southern Iowa Artificial Lake

James Mayhew
Fisheries Biologist

Lake McBride, a 138 acre state-owned artificial lake in Johnson County was drained in the fall of 1956 to permit reconstruction of the dam. With the near completion of construction on the Coralville Flood-Control Dam project the present crest elevation of Lake McBride would be flooded with approximately 27 feet of water. Rather than destroy the facilities offered by this established recreational area, the various agencies involved decided to raise the height of the McBride dam 29 feet. Surface area would be expanded to about 940 acres at the new spillway elevation.

The lake bed is situated in a deep- valley with two protruding arms from the main body of the lake. Maximum depth at the time of original construction was reported at 30 feet, but heavy siltation had reduced this to approximately 20 feet at drainage. As in most artificial lakes the shoreline is highly irregular, and bottom contours extremely steep. Water samples taken during the annual fisheries survey indicate thermal and chemical stratification is limited to certain favorable periods during the summer months. Vegetation growth is restricted to the shoal areas of the lake.

Complete drainage projects of this nature are exceptionally well fitted to studying the existing fish populations. Since little information is available on population estimates in Iowa artificial lakes it seemed expedient to obtain basic population data from a typical impoundment. Speaker (1948) made a similar study at Beed's Lake in Franklin County.

The final project at drainage was designed to, (1) study the population dynamics and balance, (2) determine the age and species composition of the fish population, (3) determine the accuracy of various types of sampling gear, and (4) study the effects of past management practices. Population estimates and balance, age and species composition, and past management practices are considered in this study. A study of the use of various types of sampling gear will be included in a future report.

Drainage and Method of Population Estimate

The gate in the dam was opened on October 17, 1956, to a discharge volume of about four square feet. On October 27, only a small pool remained immediately in front of the dam. Prior to opening the gate, the outlet stream bed was cleared of all debris, shrubs, and small trees. Two sections of one inch bar measure seine were placed in the channel of the outlet stream. These seines were weighted with steel chain along the lead line to prevent it from pulling off the bottom in the turbulent current.

After several days of draining very few fish were observed in the trap below the dam. When the water level had receded enough to permit investigation, the steel grate covering the outlet structure was removed, and fish began to move in quantity out of the lake. During several periods of the operation, several seine hauls were made in suitable areas in the main body of the lake. Most of the de-

weight of 42 adults was 3.2 pounds; whereas, 71 sub-adults averaged 0.3 pounds.

Bluegill

In number, the bluegill was the second most abundant species of fish in the lake. By weight; however, this fish represented only 4.8 per cent of the total population. Average weight of 112 bluegills was .21 pound. Mean growth for the first three years of life was 3.4, 4.7, and 6.0, inches total length. Annual survey records reveal relatively stable reproduction and survival. There was no significant difference in year class strength for the first three years.

Crappie

The crappie population was comprised of approximately 85 per cent white and 15 per cent black crappies. It is interesting to note that during the early years of angling history this ratio was reversed. As late as 1947 inventory records indicate the black crappie was the dominant group.

The crappie population was undoubtedly overcrowded, since growth was below normal and the fish in poor physical condition. Growth rates are nearly normal for the first two years of life, but diminish rapidly thereafter. Mean growth for the first three years was calculated at 3.9, 6.5, and 7.1 inches. Part of this is believed due to the exceptionally strong 1953 year class. Of 531 crappies randomly sampled, 93 per cent was in this age group.

The periodic development of large year classes seem to be characteristic of this type of artificial lake. Correspondingly, the years between abundant age groups result in sub-normal reproduction.

Average weight was 0.2 pounds for the white crappie, and slightly heavier for black crappies.

Bullheads

Since bullheads seldom reproduce in Iowa artificial lakes, populations are maintained by "put-and-take" stocking. Man's control over the abundance of these populations usually result in optimum growth. No attempt was made to analyze the age composition of the bullheads in Lake McBride, but mean total length was 9.3 inches and average weight 0.41 pound. By weight, bullheads comprised 12.2 per cent of the total population.

Channel Catfish

Recently the channel catfish has been stocked as a companion and supplemental species to the bullhead in many impoundments. Reproduction is usually limited in similar manner as in the bullhead, and populations perpetuated through annual fingerling stocking. Average weight was 1.06 pounds for a sample of 15 adult catfish. Growth was calculated at a mean of 9.0, 13.0, and 15.1 inches total length for the third, fourth and fifth years of life respectively.

Carp

The carp, by all criteria, was the dominant species of fish in Lake McBride. By weight, 38.8 per cent of the total population was represented by this species. Growth rates were exceptionally rapid, attaining a mean of 8.4, 14.0, 19.2, and

25.3 inches total length in the first four years of life. Carp in age group III were the most abundant. Average weight of 122 specimens was 3.0 pounds.

Bigmouth Buffalo

This species was second to the carp in total poundage. The buffalo comprised 26.4 per cent of the population by weight. Most of these fish were large individuals, averaging about 5.0 pounds. Several specimens in excess of 20 lbs. were recovered during the drainage operation. Scale samples were taken from a representative sample of buffalo, but age analysis was not relibable because of the size and poor transparency of the scales.

Discussion

Game-fish populations in Lake McBride were obviously in a state of imbalance. Two exotic species existed in quantity enough to dominate the entire fish population. Survey records do not reveal the initial date that carp and buffalo appeared in the lake, but it was apparently sometime before 1945.

Throughout the history of the impoundment there were definite changes in the habitat and environmental conditions. A considerable portion of this change undoubtedly occurred with increasing siltation. The original effect of silting and turbidity in changing the habitat might well have been a primary factor in changing the species composition. Each species has a different tolerance to habitat and live more favorably in different optimum conditions. Siltation has a definite influence in alteration of environment which would favor the carp and buffalo. After domination of the fisheries biomass by the species most adjusted to the changing conditions, this species (carp in this case) also affected changes in environmental condition to further suit basic requirments by normal feeding and social activities. Other evidence to indicate habitat changes are observed in the reverse of the ratio of black and white crappies. Black crappie were most numberous until 1948, after which the white crappie became the most abundant. As the habitat was further changed to fit the optimum conditions of the white crappie the ratio was considerably different. This criterion is considered very good evidence of the slow evolution of environmental conditions.

Evidence of overcrowded conditions were very apparent in the crappie population. Growth was considerably below normal for this type of impoundment. The predator population had been reduced by low reproduction and/or survival to the extent that prey fish were much more adapted to controlling the predator than the predators were of controlling the prey. This situation can not be present because of interspecific competition for food, but rather for space and similar common needs. Bennett (1952) states this to be evident in bass-bluegill populations in small ponds, in that dominant bluegill populations are much more adapted to controlling bass than bass are to controlling bluegills.

In recent years management problems have occurred frequently with rough fish and stunted pan-fish populations. Rough fish control is virtually ineffective because of stumps, debris, and fish shelters in all areas of the lake. Recently attempts have been made to remove portions of the excessive crappie populations in order to increase growth. It is thought that an increase in the average size of these fish would make them more desirable to the angler, and thus increase harvesting of the surplus standing crop. During the past two years approximately 25,000 crappies were removed by seining, but little change in the size or growth was noted. Apparently by creating a void within the crappie population, by ap-

proximately 3,500 pounds, recruitment of weight into the fishery biomass was made by the dominant species rather than by the species removed.

Summary

Lake McBride was drained in October, 1956 to facilitate dam reconstruction. The stream outlet was blocked off by two sections of seine in a manner to rescue desirable fish from the lake, and also prevent rough fish migration downstream to the Iowa River. The total standing crop in the lake was estimated by counting and weighing representative samples. Total standing crop was estimated at 123,836 pounds.

Carp and bigmouth buffalo were the most numerous fish by weight; whereas, crappie and bullhead were the most abundant game-fish.

Growth rates were good for carp, buffalo, and largemouth bass, but relatively slow for crappie and bluegill.

Predator-prey relationships, interspecific competition, past management practices, changes in habitat are discussed.

Appendix

Table 2. Average growth at each year of life of fish from Lake McBride.

Species	Number of Sample	Average Total Length at Each Year of Life						
		1	2	3	4	5	6	7
Lm. Bass	113	4.9	6.9	-	13.0	17.0	18.0	19.8
Bluegill	112	-	3.4	4.7	6.0	-		
W. Crappie	531	3.9	6.5	7.5	-	-		
B. Crappie	13	-	6.5	7.5	-	11.2		
Ch. Catfish	15	-	-	9.0	13.0	15.1		
Carp	22	8.4	14.6	19.2	25.3			

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Results of Fish Management at Blackhawk Lake

Earl T. Rose
Fisheries Biologist

Introduction

The Iowa Conservation Commission has conducted an intensive fish management program at Blackhawk Lake during the past several years to improve angling. A huge population of gizzard shad developed in the lake in 1946 and since have created an annual over-supply of forage which have contributed to a greatly reduced sport fishery. A few days of fair crappie angling usually was enjoyed each spring prior to the development of shad young-of-the-year and after this period practically no fish were caught. The management program designed to correct this situation included heavy stocking of predatory species, such as the walleye and northern pike, plus intensive seining to reduce shad and carp populations.

No measurable success attended the efforts either in the degree of shad reduction or in increaseing the catch of game fish by anglers until 1956. Data from the rough fish removal operations in 1956 and 1957, plus lake survey information indicates that a change of considerable magnitude has occurred and that imbalances in the population are temporarily at least, partially corrected, either by the interaction of natural forces or management efforts or both.

The Shad and Carp Problem

The first gizzard shad observed from this lake was obtained by routined lake survey work in 1945. This record was a nine inch specimen. Since that time the annual surveys characteristically have revealed large numbers of young-of-the-year, yearlings and few adults. From 1946 to 1951 the average catch per haul of the survey seine (500 foot-$\frac{1}{4}$ inch bar mesh) has exceeded 18,000 young-of-the-year shad (range 4,000 to 30,000).

Carp have been a relatively minor part of the fish population structure in this lake until recent years. A large hatch occurred in 1953 when an average of 346 young-of-the-year were obtained in survey seine hauls. These fish now average about one-half poung and dominate the lake's population structure.

In order to be as brief as possible in tables and discussion, this report includes data from 1951 to 1957 only. This period was arbitrarily selected from many years of accumulated information as typifying the problem and includes the years in which evidence of change is manifest in seine catches by rough fish removal and biology survey test hauls.

Routh fish removal crews keep an accurate record of the pounds of each species of rough fish removed from each lake whether or not the fish are sold. In addition, counts of game fish are recorded from each haul. As often as possible, technicians from the Biology Section are present to record the numbers of game fishes caught and released. At Blackhawk Lake seine size has varied somewhat; however, a 2500 foot seine with $1\frac{1}{2}$ inch bar mesh wings and 3/4 inch bar mesh bag has been used for most of the hauls by cres of the Fish Management Section and reported in this record. In order to present the data on the basis of catch per unit effort, each year's catch was totaled and the average number of pounds of rough fish per haul was computed. The percentage of each species was then determined together with the total poundage removed and the pounds per acre.

These data are included in Table 1.

Obviously, gizzard shad dominated the catches from 1951 to 1956; however, the 1951 effort, with thirty two hauls, reduced the shad density considerably. In 1956 the most singificant change appeared when only 25 percent of the catches were of shad, and in 1957 this had declined to less than three percent. Concurrently with this gradula decline in shad, a corresponding increase in carp occurred. In 1951, only 1.8 percent of the catches were of carp and 98.1 were shad; whereas in 1957 the situation was practically reversed, with 96.3 percent carp and only 2.8 percent shad. This indicates that these species occupy about the same ecological niches and that the vacanies produced by the shad removal were rapidly assumed by the large successful hatch of carp in 1953.

Similar data were obtained in the lake surveys by the Biology Section. Counts of young-of-the-year shad from 1949 to 1951 were 24,547; 30,115 and 22,244 respectively per haul with the small-meshed 500 foot seine. In 1955 the average catch per haul was 7,717 young-of-the-year and in 1956 only 842. Adult carp increased from an average of 29 per haul in 1951, to 707 in 1956.

A profound change in game fish populations occurred during this period of years. As mentioned previously, accurate counts of game fish are recorded from each haul. The game fish taken in the rough fish removal operations, are included, in Table 2. The data are treated similarly, with the average number of adult game fish per haul recorded together with the percentage species composition. Obviously, game fish were relatively scarce in 1951 and increased tremendously by 1953. At this time crappies constitued nearly 97 percent of the populatioh structure. By 1955 an increase of bullheads and walleyes was apparent, along with a corresponding decrease in crappies. Hauls made under ice and open water of the spring of 1957 show a continuation of the condition since crappie declined to 45.5 percent, bullheads and walleyes increased to 11 percent along with a sudden vast increase of channel catfish. The latter ranged from a trace in 1951 to 1954 to nearly 31 percent in 1957. This increase in channel catfish may be the result of heavy sub-adult stocking in 1953, or from abundant natural reproduction in the same year, as revealed by survey hauls, or from both sources.

The record of fish stocking in Blackhawk during the period from 1951 to 1956 is included in Table 3. It is apparent that the walleyes have become well established in the lake due to stocking efforts. Previous to 1951, only an occasional walleye was observed in rough fish and lake survey hauls. Reproduction has occurred annually since 1953 as determined by lake surveys. In addition, creel census records from 1947 to 1952 show only fourteen walleyes caught by anglers in the entire period. The average catch per census season (May 15 to July 1) from 1952 to 1956 has been around 600. Unfortunately, in 1956 the best catches were made after the close of the census period, when large numbers were commonly taken by anglers.

Northern pike have apparently failed to become established even though a considerable amount of stocking has been done and this is equally true of a largemouth bass, indicating that competition for food and space, or other factors, inhibited development of these species. The heavy stocking of adult bullheads throughout the period is definitely reflected in the rough fish haul data especially from 1955 to 1957 (Table 2). Game fish taken in lake surveys in 1955 and 1956, had 27 percent and 43 percent bullheads respectively. Creel census records of the past two seasons have bullheads dominating the catch being

61 and 42 percent of the total respectively; whereas, all other years of census, crappies were the dominant species.

Conclusions

It is difficult to conclude definitely from these data exactly what has occurred in this lake and ascribe certain cause and effect relationships. The following items appear significant:

1. A vast decrease in gizzard shad abundance has occurred. Failure of the 1956 year-class development occurred either through adverse reproduction conditions or predation on spawn or fry, or a combination of factors.

2. A vast increase in carp has occurred coincident with the decrease in shad. These are primarily from a large year-class developed in 1953. Conceivably, carp may have been a factor in depressing the shad population by egg predation although no data is available to support this contention.

3. Walleyes and channel catfish have become well established by stocking. The high- walleye population has certainly contributed to the decline in shad abundance since the latter is an ideal prey species.

4. Northern pike and largemouth bass failed to become significantly established.

5. An over-all improvement has occurred in game fish populations; however, no evidence of trends or stability is apparent indicating continued intensive management and study.

Table 1. Annual average poundage of rough fish removed per haul,* pounds per acre and total pounds removed from Blackhawk Lake.

YEAR	NO. HAULS	AV. NO. POUNDS PER HAUL	POUNDAGE PERCENTAGE: SHAD	CARP	BUFFALO	NUMBER POUNDS PER ACRE	TOTAL POUNDAGE
1951	32	6,944	98.1	1.8	T	232	222,197
1952	13	1,980	88.8	10.8	0.4	27	25,745
1953	21	3,966	82.1	17.6	0.3	87	83,284
1954	18	2,100	87.2	12.8	T	40	37,829
1955	24	8,291	88.8	10.8	0.4	208	198,999
1956	10	4,451	24.5	73.9	1.6	45	44,511
1957	9	7,829	2.8	96.3	0.9	84	70,961

* Seine varied somewhat in length and mesh size from year to year--mostly 2,500 feet long with 1½ inch mesh wings and 3/4 inch mesh bag (bar measure).

Table 2. Annual average number of adult game fish per haul and species composition percentage from Blackhawk Lake rough fish removal operations.

Year	Av. Number Game Fish/Haul	Species Composition Percentage								
		Crappie	B'head	Walleye	Cat.	L.M.Bass	B'gill	Perch	N.P.	W.Bass
1951	771	90.2	0.4	1.4	T	1.4	2.2	3.0	0.2	1.5
1952	1,436	87.2	0.2	4.0	T	0.8	0.2	5.0	0.5	0.9
1953	67,515	96.8	0.6	0.3	T	0.1	0.2	0.2	T	T
1954	1,137	83.5	3.1	2.7	0.6	2.6	1.1	4.1	0.5	1.4
1955	1,879	71.3	13.7	7.6	2.3	1.1	1.0	0.6	0.4	2.4
1956	1,725	73.2	14.7	7.4	0.8	0.2	1.9	0.1	0.1	0.2*
1957	4,114	45.5	10.7	11.0	30.8	0.5	0.3	0.0	T	0.5**

* 0.5 percent yellow bass

** 0.6 percent yellow bass

Table 3. Fish stocking record from 1951 to 1956, Blackhawk Lake.*

SPECIES and SIZE	1951	1952	1953	1954	1955	1956
Walleye fry						2,000,000
Walleye Fing.	10,000	12,000	5,190	9,721		
Walleye Adult**		825	333		6,169	
N. Pike Fry		100,000	300,000		325,000	
N. Pike Fing.		1,300		837		676
N. Pike Adult	120		1			
L. M. Bass (Fingerling)	420		5,075	50	5,195	
L. M. Bass (Adult)			12	3,630	435	
Bullhead Adult	12,600	35,800	14,295	84,770	52,500	
Catfish Fing.	2,050			60		
Catfish Adult			11,209	15		
Perch Adult	1,208	50				

* Major Species, some minnow stocking not included.
** Included Yearling

Growth of the Channel Catfish *Ameiurus Punctatus* (Rafinesque) in Some Iowa Waters

Harry M. Harrison
Fisheries Biologist

This paper will appear in its entirety in the forthcoming Proceedings of the Iowa Academy of Science. For the purpose of the present Quarterly Biology Report, the more significant findings of the paper follow by numbered paragraphs.

1. Growth of channel catfish in Iowa waters is slow. This, despite the fact that our waters are rich in the nutrients required for fish growth.

2. Average observed total lengths of the channel catfish are approximately 3.5 inches at one year; 6.5 inches at two years; 8 inches at three years; and 10 to 11 inches at four years of age.

3. A large portion of the annual growth (about 60%) occurred in a 30-35 day interval of June and early July.

4. Average annual water stage did not show any consistent effect upon the rate of growth of channel catfish.

5. In the two instances observed, a substantial reduction of the standing population of all fish resulting from fish kills was followed by an accelerated growth rate of channel catfish.

CHANNEL CATFISH SURVEYS

NORTHEAST IOWA RIVERS

R. E. Cleary
Fisheries Biologist

The year 1956 marked the highest bait net catch of catfish in northeast Iowa since the inception of this inventorying project in 1952. Attending this phenomenon, the per-hour catch also reached a record high (Table 1).

Table 1. Five-year summary of Bait Netting on Rivers of Northeast Iowa

	1952	1953	1954	1955	1956
Number Catfish Taken	2198	9861	7057	6938	11,191
Weight of Catfish Taken	889	2084	1662	1172	1700
Number of Hours Fished	4230	4854	6460	5162	5130
Number/Net Hours	.54	2.03	1.09	1.34	2.18
Weight/Net Hours	.21	.42	.26	.23	.33
Average Wt./Fish	.40	.21	.24	.17	.15

Just what caused this increased net catch is difficult to determine. The increase was also manifest in the anglers' creel success as it was during the 1953 net-evident population eruption. In 1952, 0.61 catfish were creeled in an hour's fishing; in 1953 this figure increased to 0.67 catfish per hour. In 1954 it took eastern Iowa anglers 1.31 hours to catch a channel catfish, while in 1956 this effort was reduced to 1.09 hours. The average weight of the netted fish has been on a steady decline since 1954, indicating either that the younger segment of the population was increasing in magnitude; that our sampling methods were biased in favor of the "fiddler" portion of the population; or that our river population of channel catfish has surpassed the carrying capacity of its habitat and is exhititing - a trend toward slow growth and stunting.

In 1955, 2,537 channel catfish were measured from a total of 6,892 fish. In 1956, 2,621 cat were measured from a catch of 11,191 fish. Table 2 indicates quite clearly that the 1956 catch is made up of consistently smaller fish.

Table 2. Total Length Frequency Groupings of Samples of Channel Catfish Taken in Rivers of Northeast Iowa, 1955 and 1956.

River	Total Catch	Number Measured	% less than 10"	% between 10" & 12"	% greater than 12"
Iowa					
1955	3592	935	72	18	10
1956	2724	734	87	7	6
Cedar					
1955	1514	779	70	15	15
1956	986	566	85	9	6
Wapsie					
1955	1774	811	86	7	7
1956	7463	1303	89	5	6
Maquoketa					
1955	12	12	74	13	13
1956	18	18	28	17	55
Yearly Totals					
1955	6,892	2,537	75	14	11
1956	11,191	2,621	88	6	6

This catch of smaller fish is manifest in most rivers and most stations. If the 1956 net-evident population is a true picture of the structure of the catfish population, then the discriminating fishermen, or one who keeps only fish over 12 inches total length, found his fishing potential reduced 45 percent as compared with 1955. Even the "meat" fisherman who kept any catfish over 10 inches had his fishing potential cut 52 percent. Subsequently the catfisherman who reported taking more fish in less time in 1956 than in 1955 was either satisfied with "fiddlers" or increased competition from the fiddler portion of the population caused the larger catfish to bite more freely.

Table 2 also indicates that there was a 15 percent increase in the "less than 10-inch" group, giving the population structure the appearance of a base-heavy triangle. In an effort to determine just how abnormal this population structure was, the literature on catfish length-frequency work was examined and the results of the more similar studies are included in Table 3. Many of the length-frequency studies in literature were done on commercial catches or when combined into a length-weight, study, the smaller fish were culled to increase accuracy of weights. This concentration on larger fish or fish over the commercial length limit, tended to bias the data in favor of the larger fish. Therefore, several of these studies could not be used in the comparison.

Table 3. Comparison of Reported Length-frequence Groupings in Populations of Channel Catfish.

Location	Method of Capture	Number Measured	% less than 10"	% between 10" & 12"	% greater than 12"
Miss. River - 1944 (1.)	Miscel. Nets	320	17	22	61
Miss. River - 1946 (1.)	Miscel. Nets	1,136	68	16	16
Des Moines River, Ia. (2.)	Bait Nets	814	45	41	14
Grand Lake, Oklahoma (3.)	Rotenone	177	84	10	6
Northeast Iowa Rivers - 1956	Bait Nets	2,621	88	6	6

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While it is apparent that the 1956 Iowa study had the greatest segment under 10 inches, the Grand Lake population was not far behind. However, compared with the other three river populations, the 1956 data are extremely base-heavy. (The vagaries of netting probably account for the complete switch in length dominance in the 1944 and 1946 catches on the Mississippi River rather than a complete population shift).

Table 4 is a tabular presentation of the 1956 survey data. A significant feature of these data is the markedly superior numerical catch in the Wapsie River when compared with other rivers. It is assumed that this is a manifestation of stage rises in this river brought on by late July and August rains, the first rains of the summer. All other stations were visited prior to August.

Table 4. Bait-net Catches of Channel Catfish in Northeast Iowa Rivers - 1956.

River	Netting Station	Dates Surveyed	Total No. Fish	Total Wt.Fish	No./Hr.	Wt./Hr.	Av. Wt. Per Fish
Iowa	Belle Plaine	May 21-25	73	9.0	.13	.02	.15
Cedar	Vinton	June 5-9	539	88.2	.94	.15	.16
Cedar	Cedar Falls	June 11-15	447	115.8	.81	.21	.26
Maquoketa	Bailey's Ford	June 25-28	18	8.1	.08	.04	.45
Iowa	Marshalltown	July 9-13	1707	221.5	3.28	.42	.13
Iowa	Le Grand	July 9-13	944	91.7	1.64	.16	.10
Wapsie	Central City	July 3-Aug. 3	2077	263.9	3.72	.47	.13
Wapsie	Otterville	Aug. 6-10	2985	535.3	5.65	1.01	.18
Wapsie	Littleton	Aug. 6-10	2104	321.7	4.15	.64	.15
Wapsie	Tripoli	Aug. 13-17	297	45.4	.54	.08	.15
Iowa	Belle Plaine	Aug. 20-24	361	80.5	.63	.14	.22

By way of proving this conjecture, the Belle Plaine station was revisted in August. At this time there was 10 to 14 inches more water in the survey area than was there in late May. Reference to Table 4 shows that there was a substantial increase in numbers caught in August as compared with the May catch. This figure does not include the 2,477 young-of-the-year catfish also taken in the operation. Hence, recruitment can be ruled out. We assume that the increas e in the average weight of the fish was brought on by a summer's growth and not indicative of sampling a different population. To substantiate this assumption, we found that the number of catfish in the group less than 10 inches had dropped from 89 percent of the population in May to 80 percent in August. The increase was picked up by the 10" - 12" group with the over - 12" group remaining constant. This is the expected phenomenon, for the greater growth is usually made by the younger age classes in a given population.

It is possible that the inordinately large segment of small fish found in eastern Iowa is similar to the population structure Harrison (Op. Cit.) found in the Des Moines River and upon which he commented: "suspicion of slow or stunted growth is usually associated with a large population of small Fish". And the fact that he went on to show that this population was actually comprised of many slow-growing species, leads us to suspect that the net-evident population of catfish in most northeast Iowa streams is also of the slow-growing variety. Perhaps this is inherent in the species inhabiting small inland rivers which lose a major portion of their volume during the summer and fall, and cause

post-spawning crowding. A sequence of ecological conditions favoring reproduction and survival with the attending growth inhibiting,post-spawning crowding could well lead to a base-heavy population structre.

SUMMARY

The 1956 bait net catch of catfish in northeast Iowa rivers was the largest since the start of the project. However, the average size of the fish was the smallest. In fact, 88 percent of the netted fish were between 4 and 10 inches in length. This may be a danger signal that the catfish in eastern Iowa tending toward over-crowding and stunting. Slow growth may be a genetical factor or simply a case of favorable spawning conditions followed by poor growing conditions due to radically reduced water volume in late summer and fall.

Preliminary Notes on the Crappies of

Backbone Lake

Tom Moen and Robert Cleary
Fisheries Biologists

Backbone Lake is a 125 acre artificial lake created by impounding a portion of the upper reaches of the Maquoketa River in the extreme northwest corner of Delaware County. This lake is an important part of the recreational facilities of Backbone State Park.

The fish populations in this lake have not been studies to any extent, except for a routine lake survey completed in October 1954. Creel data are not available but fisherman reports indicated that the lake contained a large population of small crappies. This was supported by the lake survey findings but no stunting was noted in the limited scale examinations. It was apparent, however, that a number of these crappies should be removed in order to prevent stunting. During this removal further study of the population was possible.

On May 8, 1956, the fisheries management section began a reduction of the crappie population in Backbone Lake. Through the cooperation of the management crew under Don Edlen we were able to sample portions of the netted fish for a length-frequency study and secure a stratified sample for age and growth determinations.

The removal operations made use of various size trap nets and two seine hauls. During two weeks of operation nine species totaling 12,182 individual fish were netted (Table 1). Only the crappies, suckers, and carp were removed.

Crappie samples were taken from live cribs on May 10 and on May 15. Each fish was measured to the nearest 0.5 inch in order to obtain data for length-frequency and then weighed in the aggregate. A total of 491 crappies were measured and weighed in the first day of sampling. A stratified sample of

Table 1. Total number of each species of fish taken during netting operation at Backbone Lake, May, 1956. (Data from Edlen)

SPECIES	NUMBER	PERCENT OF TOTAL
Crappies (Black and White)	10,556	86.6
Suckers	727	6.0
Bluegills	605	5.0
Bullheads	143	1.2
Trout	108	0.9
Carp	20	0.1
Largemouth Bass	12	0.1
Yellow Perch	6	T
Northern Pike	5	T

30 were processed for age and growth. Sixty-one per cent of the measured group were black crappies. On May 15, 535 crappies were measured and 22 were taken in detail for age and growth. A reversal of the species composition occurred in this sample with 65 percent white crappies. The combined sample of

1,026 fish resulted in nearly equal numbers of white (52 percent) and black (48 percent) crappies. This is a sharp contrast to the fact that the survey results indicated nearly 99 percent white crappies.

Length frequency figures for the combined samples show a high percentage of fish (79.5) between 7 and 8 inches in total length (Table 2(. The relatively small size of the average fish is also shown by the fact that 97.2 percent of the fish were less than nine inches long. Selective gear prevented sampling fish less than six inches long, but the survey record, which included hauls made with quarter inch seine, revealed very few smaller fish. Observations indicated that on an average the black crappies ran 0.5 inch less than the white in any given length class.

Table 2. Length-frequency data on a sample of crappies from Backbone Lake in May, 1956.

Length Class (Total length in inches)	No. of fish	Percent of Total
6.0 - 6.4	33	3.2
6.5 - 6.0	41	4.0
7.0 - 7.4	4440	42.6
7.5 - 7.9	379	36.9
8.0 - 8.4	87	8.5
8.5 - 8.9	17	1.7
9.0 - 9.4	14	1.4
9.5 - 9.9	6	0.6
10.0 -10.4	3	0.3
10.5 -10.9	2	0.2
11.0 -11.4	1	0.1
11.5 -11.9	2	0.2
12.0 -12.5	1	0.1

Based on aggregate weights the average weight was 0.16 pounds per fish and thus the total weight of all crappies removed came to 1,617 pounds. This represents a reduction of approximately 13 pounds per acre.

A total of 52 fish were aged; of this sample 35 were white and 17 were black crappies. The 1956 annulus had not formed at the time these fish were captured. Backbone Lake is largely spring fed and the annulus formation naturally would be retarded. For this reason the total length at the time of capture was used as the length at the last annulus. The dominance of the 1952 year class is quite apparent in both species (Table 3). These fish do not show a tendency toward stunting, in fact they compare favorably with reported growths for this latitude (Garlander 1950). Although they range quite widely in length at a given age this is seemingly normal in most pan fish populations.

Table 3. Brief age and growth data on a sample of 52 crappies from Backbone Lake, May, 1956.

SPECIES	AGE CLASS	YEAR CLASS	NUMBER	RANGE	TOTAL LENGTH MEAN	MODE
B. Crappie	III	1953	1		6.5	
	IV	1952	15	6.5-10.0	7.7	7.5
	V	1951	1		9.8	
W. Crappie	III	1953				
	IV	1952	33	7.0-10.2	7.4	7.5
	V	1951	2	8.2-10.2	9.2	

Another criterion often used in comparing fish populations is the coefficient of condition or relative plumpness of a fish. The mean "K" for black crappies was 3.05 and the mean "K" for white crappies 3.13 and compares favorably with "K" factors for crappies examined in other studies.

Table 4. Comparison of coefficient of conition "K" of crappies from Backbone Lake and crappies from several other localities.

LOCATION	BLACK CRAPPIE	WHITE CRAPPIE
Clear Lake, Iowa	3.39	2.08
Red Haw Lake, Iowa	2.94	2.54
East Lake, Iowa	3.09	2.52
Decature Lake, Illinois	----	2.80
Minnesota	3.08	----
Senachwine Lake, Illinois	----	2.84
Crab Orchar Lake, Illinois	----	3.88
Backbone Lake, Iowa	3.05	3.13

It appears that the two species of crappies are doing quite well, both in growth and condition, in Backbone Lake. However, the tremendous 1952 year class needs room for growth before the fishing quality improves. The anglers have not complained of the catchability of these crappies, just the size.

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EFFECTS OF THE 1956 SEASON

UPON IOWA'S DEER HERD

Paul D. Kline
Game Biologist

and

Everett B. Speaker
Supt. of Biology Section

Introduction

Iowa has permitted deer hunting for a short time every autumn starting in 1953. The season originally was opened to reduce and scatter herds in certain areas where the deer had become a nuisance to farmers. The original troublesome herds were effectively decimated and scattered. Continuing seasons have prevented conflict with agricultural interests and, at the same time, maintained the herd in numbers sufficient to perpetuate the species in most areas in Iowa. In general, the principal change has been a trend toward scattered small herds throughout Iowa, and particularly, a trend toward balance of deer numbers with available habitat in all sections of the state.

Data gathered at field checking stations during previous seasons indicate our herd reproduces at a rate of 50-60 percent every year. Natural mortality seems to account for about $\frac{1}{2}$ of this reproduction. All this means that left along the deer herd would increase by 25-30 percent every year. Experience of the past three years indicate the present herd size is quite compatible with agriculture. Hence, it is desirable to maintain the present herd size. The easiest means to nullify the trend toward herd increase is to harvest a number of deer every year.

In February of 1956 the herd was estimated by conservation officers as numbering 10,811 individuals. Allowing for natural mortality probably 10,000 deer reproduced 5,700 fawns by July 4. Hence, again allowing for natural mortality, about 14,500 deer were present in Iowa when the season began December 8. A harvest of 3,000 to 3,500 deer would have tended to reduce the herd to about the same level as during 1955. However, one unknown factor complicated the picture. A severe outbreak of disease, believed to be the hemmorhagic epizootic, reduced deer numbers in some areas, particularly the western two-thirds of Iowa. The deer season was set with the foregoing factors in mind.

Deer hunting regulations for 1956 varied from those of 1955 principally in that two instead of three days were opened for gun hunters and in that 31 instead of 23 days were opened for bow hunters. The expected results were a reduction in kill by gun hunters and an increase in numbers of deer taken by bow-and-arrows.

Opening day of gun season, December 8, was a cold blustery day during which many nimrods hunted only sporadically. As a result, fewer deer were taken than was expected, for the first day. However, December 9, presented much warmer weather with a fresh tracking snow over much of northern and central Iowa. As a result more deer were killed on the second day when most hunters were afield than on the first when many hunters hugged the warmth of their autos.

Hunting Results

All licensed deer hunters in 1957 were requested to fill out and return a card which would indicate their hunting success. Of a 5,440 licensed gun hunters, 5,099 returned their cards for a return of 93.7 percent. A total of 1,236 of 1,284 licensed bow-and-arrow hunters returned their cards for a return of 96.2 percent. However, only 1,169 or 91.0 percent of the bow-and-arrow cards contained usable information. Much of the data presented in this report results from compilation of the above card returns. The remainder are compilations of conservation officer estimates and reports of deer killed on farms (untagged and tagged for transportation) and of deer numbers in their respective counties during February, 1957.

Table 1. Deer kill for 1956 season as compared to conservation officers' February, 1957, deer estimates by agricultural areas.

Agricultural Area	Deer Taken By Bow Hunters*	Deer Taken by Unlicensed Farmers, Tagged	Deer Taken by Unlicensed, Farmers, Untagged	Deer Taken by Licensed Gun Hunters**	Total Deer Kill for 1956 Season	Number of Deer by February Officers' 1957 Estimate
Northwest	18	41	35	275	369	662
North Central	13	23	27	174	237	862
Northeast	19	20	97	570	706	2,631
West Central	15	35	27	314	391	1,405***
Central	14	22	24	164	224	740
East Central	8	14	26	156	204	993
Southwest	19	15	81	152	267	1,051
South Central	3	16	22	111	152	1,195
Southeast	6	9	27	74	116	745
Totals	115	195	366	1,990	2,666	10,284

Numbers of deer taken by the various groups of hunters in each agricultural area can be seen in Table 1. A total of 2,666 deer were believed killed during the 31 days of bow-and-arrow hunting and two days of gun hunting. Of these, 117 fell to bow-and-arrow hunters for a hunting success of 9.9 percent. Two thousand of 5,099 reporting licensed gun hunters killed deer for a hunting success of 39.2 percent.

* Two additional were taken from an unknown location.

** Ten additional were taken from an unknown location.

*** Monona and Crawford County estimates are based on calculations by biologist of proportion of 1956 total kill by licensed hunters.

An additional 195 deer were tagged by conservation officers for transportation from farms, and 366 were estimated killed by unlicensed farmers who hunted on their own land and did not transport the deer.

Northeast Iowa produced 706 deer, more than any other area. Second and third were the west central and northwest areas where the kill was 391 and 369 respectively. Fewest deer were bagged in southeast and south central Iowa.

Licensed hunters reportedly bagged 1,206 bucks and 911 does. Gun hunters observed a total of 33,570 deer during 60,836 hours of hunting. The average gun hunter saw 6.1 deer while hunting 11.2 hours or 0.55 deer per hour of effort. Bow-and-arrow hunters reportedly saw 6,196 deer while hunting 50,393 hours. Average bow-and-arrow hunters saw 5.3 deer while hunting 4311 hours for an average of 0.12 deer per hour. Apparently gun hunters saw more deer because more hunters were afield during shotgun season and kept the deer on the move. Of course, 33,570 deer seen by gun hunters represents individual observations and not numbers of deer in Iowa. In other words a single deer may have been observed and reported by a number of different hunters.

Licensed gun hunters bagged only 850 of 1,995 deer (42.5 percent) on opening day. This is in contrast to 1955 when over half the deer were bagged on opening day of a three day season. Undoubtedly weather conditions account for the apparent descrepancy. More deer were taken on the morning of the first day (478) than during the afternoon (372). The situation was reversed on December 9th when 480 deer were bagged during the morning and 662 during the afternoon.

Farmers comprised the largest single occupation group of gun hunters (Table 2). They harvested more deer than any other group (42.7 percent) and were more successful than other groups (43.5 percent bagged a deer).

Table 2. Success of gun-hunters based upon occupation groups.

* Success of 10 reporting hunters was not indicated on cards.

Occupation Group	Number of Hunters Reporting	Percent of Total Hunters	Number of Successful Hunters*	Percent of Group Who Bag- a Deer.	Percent of Total Harvest
Farmer	1,960	38.4	853	43.5	42.7
Laborer	1,539	30.2	562	36.5	28.0
Professional	281	5.2	106	37.7	5.3
Technical	133	2.6	48	36.1	2.4
Retired	62	1.2	25	40.3	1.3
Merchant	420	8.2	162	38.6	8.1
Housewife	15	0.03	4	26.7	0.2
Miscellaneous	689	13.5	230	29.4	11.5
Totals	5,099	99.33	2,000	----	99.5

Among the bow-and-arrow hunters, laborers made up the largest single group of hunters (32.8 percent of all hunters). Also, they bagged 32.5 percent of the deer taken with bow-and-arrow (Table 3). In all, 1,445 (54.2 percent) of all deer taken during the 1956 season were bagged by farmers.

Conservation officers estimated the deer herd during February, 1957, as numbering 10,284 animals (Table 1). This represents a small decline from 1955 and 1956 figures when the herd was estimated respectively at 10,674 and 10,811 deer.

Deer numbers apparently increased in the northeast, southwest, and southeast agricultural areas (Table 4) and remained about the same in the north central, central, and south central agricultural areas. Decreases were noted in the northwest which declined from 794 deer in 1956 to 662 in 1957; in the west central which declined from 1,829 in 1956 to 1,405 in 1957; and in the east central which declined from 1,351 in 1956 to 993 in 1957.

Table 3. Success of bow-and-arrow hunters based upon occupation groups.

Occupation Group	Number of Hunters Reporting	Percent of Total Hunters	Number of Successful Hunters	Percent of Group Who Bagged a Deer	Percent of Total Harvest
Farmer	183	15.6	21	11.5	17.9
Laborer	384	32.8	38	9.9	32.5
Professional	89	7.6	7	7.8	6.0
Technical	95	8.1	7	7.3	6.0
Retired	7	0.6	0	0.0	0.0
Merchant	113	9.7	13	11.5	11.1
Housewife	14	1.2	3	21.4	2.6
Miscellaneous	284	24.3	28	9.8	23.9
Totals	1,169	99.9	117	Av.9.9	100.0

Table 4 shows the percentage of total deer in each agricultural area for 1956 and 1957, and the percentage of total kill for the 1956 season and the percentage of available habitat in each area. Examination of Table 4 shows the northwest, north central, west central, southwest areas all have proportionally more deer than deer habitat. The east central, south central, and southeast have fewer deer than they could support under our management system. The northeast and central areas essentially appear balanced.

The southeast presents the greatest descrepancy (Table 4) with 16.7 percent of the state's available deer habitat and only 7.2 percent of the deer herd.

However, despite hunting pressure the deer are increasing in the southeast and may in time fill the population vacumn.

Table 4. Comparison by percentage of 1956 and 1957 officers' deer estimates, 1956 harvest, and available deer habitat.

Agricultural Area	Percent of Total Officers' Estimates for February, 1956	Percent of Total Kill for 1956 Season*	Percent of Total Officers' Estimates for February, 1957	Percent of Total Available Habitat**
Northwest	7.4	13.8	6.4	2.5
North Central	7.9	8.9	8.4	3.5
Northeast	23.2	26.4	25.6	21.5
West Central	16.9	14.7	13.6	8.7
Central	6.9	8.4	7.2	8.5
East Central	12.6	7.6	9.6	14.3
Southwest	8.1	10.0	10.3	7.4
South Central	10.8	5.7	11.6	15.4
Southeast	6.2	4.4	7.2	16.7

* Includes bow-and-arrow kills, licensed hunters kills, and tagged and untagged farm kills.

** Baed upon acres of ungrazed woodland from 1950 census.

The northwest presents a special problem with a small amount of habitat, comparatively large deer herd and at the present time little complaint from farmers concerning deer damage to agriculture. The northwest herd appears to be experiencing a decline as a result of continued hunting pressure.

Under the present management system of statewide seasons we should expect the deer herd to decrease in areas having comparatively little cover-particularly the northwest and north central areas. On the other hand those areas which have comparatively few deer and large amounts of habitat should experience a population climb.

Summary

1. Deer harvest during Iowa's two day season of 1956 was calculated at 2,666 animals. Of these, 117 were taken by bow-and-arrow hunters.

2. Of the licensed gun hunters, 39.2 percent bagged deer. Nine and nine-tenths percent of the licensed bow-and-arrow hunters bagged deer.

3. Farmers bagged 54.2 percent of all deer harvested.

4. Conservation officers estimated the herd as numbering 10,284 deer during February, 1957. This represents a decline of from 10,811 deer in 1956 and 10,674 in 1955.

5. Under the present system of statewide management the deer herd is increasing in the southwest and decreasing in the northwest.

SPECIAL REPORT ON DEER KILLED BY MEANS OTHER THAN BY HUNTERS

Paul Leaverton
Supt. of Game Section.

At the request of the Supt. of Biology Section, this special report has been prepared to show the distribution of Iowa deer killed by methods other than hunting.

A record of deer killed by dogs, automobiles, trains, illegal hunting and unknown causes has been kept for the past six years. This information is reported to the Game Section by Conservation Officers at regular monthly intervals. Separate report cards indicate the date killed; time of day; county; township; age; sex and weight of the deer; cause of death and estimate of damage if killed by automobile.

From the table below there appears to be a correlation between the number of deer killed by cars and other causes to the size of the deer population. In addition to population levels, topography, condition and character of highways and other factors that influence speed and visibility of drivers etc. must be considered.

It was also observed that the highest loss by cars was in the rutting season (November). There has been a tendency over the past several years toward higher kills with high deer populations and deminishing kills with lower populations. This has held true without exception except for the past season.

Last year there was a considerable increase, in the number of miscellaneous deer killed other than by hunters. We are not sure what caused this situation. It may have been a series of factors. The hunting season was reduced to two days and this, coupled with a cold, disagreeable opening gun season day, reduced the total harvest about 21% under the previous year. This, together with other factors, may have had some influence on the increased automobile kill.

Table 1. Population, Gun Season and Deer Kill 1951 - 1956.

YEAR	WINTER DEER POPULATION	MISCELLANEOUS KILLS	HUNTER KILL	SEASON
1951	6,897	192	none	closed
1952	10,721	256	none	closed
1953	12,982	393	3,508	3 days in 45 Co.
1954	11,892	310	2,700	3 days in 65 Co.
1955	10,674	306	3,400	3 days Statewide
1956	10,811	419	2,666	2 days Statewide

The following table lists the deer killed in various ways (except by bow and gun hunters) by agricultural districts:

1956

AGRICULTURAL DISTRICT	DOGS	AUTOS	ILLEGAL	MISCELLANEOUS UNKNOWN	TOTAL
Northwest	none	46	11	29	86
North Central	none	34	6	7	47
North East	none	37	6	3	44
West Central	1	22	none	9	32
Central	none	26	1	12	39
East Central	none	29	4	7	40
South West	none	22	2	15	39
South Central	none	38	3	12	53
South East	none	30	5	4	39
TOTALS	1	284	36	98	419

Two additional tables are included in this report, namely a summary of deer killed (except by hunters) by counties, and a tabulation of those kills by months. An estimated tabulation of damage sustained to automobiles appears in the right hand columne of the later report.

SUMMARY OF DEER KILL IN IOWA
FOR THE YEAR 1956

MONTH	DOG	AUTO	ILLEGAL	MISCELLANEOUS	TOTAL	*ESTIMATED CAR DAMAGE
JANUARY		15	2	4	21	$ 1,290.00 (11)
FEBRUARY		8	1	1	10	45.00 (2)
MARCH	1	13		2	16	900.00 (6)
APRIL		15		3	18	1,090.00 (6)
MAY		20		8	28	740.00 (8)
JUNE		24		3	27	3,625.00 (15)
JULY		14			14	680.75 (4)
AUGUST		10		4	14	255.00 (3)
SEPTEMBER		29	4	5	38	1,520.00 (8)
OCTOBER		39	8	40	87	1,870.00 (20)
NOVEMBER		72	17	25	114	7,095.00 (46)
DECEMBER		25	4	3	32	1,984.00 (12)
TOTALS	1	284	36	98	419	$ 21,094.75 (141)

* The number in (0) is the number of cars reporting damages.
There is an average damage of $156.70 per car.

Auto totals include deer killed by train.
Misc. totals include deer killed by agricultural operations. (mowers & combines)

SUMMARY OF DEER KILL IN IOWA
FOR THE YEAR 1956

COUNTY	DOG	AUTO	ILLEGAL	MISC	TOTAL
APPANOOSE		4	1		5
BENTON		3	2	1	6
BLACKHAWK		2	1	2	5
BOONE		2		1	3
BREMER		1			1
BUCHANAN		1	1		2
BUENA VISTA		3			3
BUTLER		3			3
CARROLL				1	1
CASS		2			2
CEDAR			1		1
CERRO GORDO		3	1	1	5
CHEROKEE		5		4	9
CHICKASAW		5			5
CLARKE		5		1	6
CLAY		8	2	3	13
CLAYTON		3			3
DALLAS		6	1	4	11
DAVIS		1	1		2
DECATUR		3		4	7
DELAWARE		1	1		2
DES MOINES		1			1
DICKINSON		2			2
EMMET		10	1	3	14
FAYETTE		10	1	1	12
FLOYD		8	2	1	11
FRANKLIN		1			1
FREMONT		1			1
GUTHRIE	1	1			2
HAMILTON				1	1
HARDIN		4			4
HENRY		1			1
HOWARD		6			6
IDA		2		1	3
IOWA		6		4	10
JACKSON		8			8
JASPER		4			4
JEFFERSON		3			3
JOHNSON		3		1	4
JONES		1			1
KEOKUK		3		1	4
KOSSUTH		8			8
LEE		3			3
LINN		3			3
LOUISA		3	2		5
LUCAS		4		4	8
LYON		2	2	1	5
MADISON		9			9
MAHASKA		5	1	3	9
MARION		4	1		5
MILLS		6	2	6	14
MITCHELL		6	1	2	9
MONROE		3			3
MONTGOMERY		5		5	10
MUSCATINE		4		1	5
O'BRIEN		6		2	8
OSCEOLA		1		1	2
PALO ALTO		1			1
PLYMOUTH		6	6	8	20
POLK		5			5
POTTAWATTAMIE		8		4	12
POWESHIEK				1	1
SAC		6		4	10
SCOTT		1	1		2
SIOUX		2		7	9
STORY		4			4
UNION		1			1
VAN BUREN		4			4
WAPELLO		4			4
WARREN		5	1	3	9
WASHINGTON		2	1		3
WEBSTER		1		5	6
WINNEBAGO		2			2
WINNESHIEK		8			8
WOODBURY		13		3	16
WORTH		2	2	1	5
WRIGHT		1		2	3
TOTALS	1	284	36	98	419

Age of Quail Shot by Hunters

M. E. Stempel
Game Biologist

Following each recent hunting season, a study has been made of quail wings collected by sportsmen. Data indicated that changes had occurred within the population. First, the young to adult ratio was determined; second, the immature were classified by days of age. The study thus yielded figures that demonstrated the hatching cycle during the previous summer.

Research by Stoddard (1931) and Leopold (1939) indicated that usually the immature can be distinguished from adults since the outer primary flight feathers of young had pointed tips while adults had rounded tips. Light colored ends of covert feathers also identify birds of the current year.

Petrides and Nestler (1943) published tables that enabled field personnel to establish the age of young by measuring growing flight feathers. Subsequent work led to the conclusion that delayed moult in adults followed a late hatching season.

Several states made use of the wing moult for determining hatching periods, and the ratio of young to old. This was regarded as a supplement to other information.

METHOD

Wings were obtained from quail shot by hunters. Some of the wings were sent directly to the biologist in charge. Hunters also gave wings to conservation officers who forwarded them by mail, or made delivery in person if this could be conveniently done.

For our purpose wings first were classified as to county of origin. Next, they were classified as adult or young. Information on the date and place of kill was included with some wings. Quail under 150 days of age were identified as to date of hatch, while older birds hatched in 1956 were placed in a single category.

Wings from adults were examined, and the number which had mature primary flight feathers recorded. Sex was noted if that information was with the wings. Young were listed as belonging to one of three groups. These were: immature, those nearly mature, and the fully developed. An additional list was made of dominant age groups found during each of three periods.

RESULTS

A total of 1,558 wings was received from cooperators where the county was known. Additional information on the date of kill was recorded for 352. Identification for 119 wings was lost and these were listed as "unknown". Table 1 sets forth the percent of young found each year since 1946 in hunters' bags.

Table 1. The percent of young quail in the hunter's bag 1946 - 1956.

YEAR	PER CENT OF YOUNG QUAIL
1946	85.7
1947	82.7
1948	87.2
1949	88.2
1950	83.1
1951	85.6
1952	87.0
1953	83.4
1954	90.0
1955	89.0
1956	87.0

Data on place and date was received from cooperators in Clarke, Decatur, Davis, Lucas, Mills, Montgomery, Ringgold, Tama, Wapello, Van Buren, and Wayne counties. This sample indicated that hatching began in June, continued at a peak through July and remained fairly high through August and into Sept.

In order to understand the significance of time of hatching, several climatological factors must be considered. These are: April 1956 was cold and dry; May, hot and dry; June, hot and dry. Rainfall was restricted to scattered areas. July was cool while August was warm, and rainfall spotty.

In the take for the entire season, quail over 150 days old comprised 48 percent of the dated wing group in 1956. The peak of hatching occurred in July and continued at a high level into September.

The 1955 weather was warm with spotty rainfall. April 1955 was mild and wet; May, sunny and warm; June, cool and dry; July, very warm; August, hot. Consequently it was considered one of the driest on record. In 1955 the 150 day old and older group of young comprised 62 percent of the total. Hatching reached the highest point in July, but diminished from that time.

In Table 2 the ages of quail shot in November is demonstrated. The percentages differ from those taken throughout the season.

Table 2. Age variations in young quail bagged during November, expressed as percent of year class.

Hatching Year	1-120 days old	121-149 days old	150 days old or older
1950	39	24	37
1951	59	27	12
1952	40	11	48
1953	37	24	37
1954	32	11	57
1955	22	22	51
1956	37	23	41

In 1953 hatching was the poorest in several years. The brooding season was characterized by an abrupt hatching peak. Very dry weather followed June. In this year no one group showed great predominance.

Conversely, in 1954, one of the best recent seasons for production, and later hunting success, the production period stayed up for some time after the peak. The variation between age groups was sizeable in that there was significant difference in the number in each age groups.

It is assumed that since there are few summers when ideal hatching weather is continuous, most production would be characterized by high success during comparitively short periods. However, a significant level of production may appear at other times than at the peak. One item not revealed in Table 3 is the fact that the number of young hatched in August 1954 was ten times that of August 1953. Table 3 lists the age of quail taken during various parts of the season.

Table 3. Percent of matured-size young quail in the hunters' bag by hunting periods during the 1953-56 seasons.

Hunting Period	1953	1954	1955	1956
Nov. 1-15	35	33	34	36
Nov. 16-30	53	61	67	54
Dec. 1-15	90	84	79	70

Since 1955 the season opened on November 5 instead of November 1.

Thompson and Kabat (1950) suggested that the stage of moult in the adult should correspond to the moult in young. Early moulting and early maturity of primary feathers in both young and adults should follow an early brooding season. The percentage of adult wings with full-grown plumage in December 1954 was three percent; 1955, 44 percent; and in 1956 it was 16 percent.

During the past few years several experienced hunters collected data on the sex ratio of quail bagged. This ratio was as follows: 1951, 92 hens per 100 cocks; 1952 and 1953, 104 hens per 100 cocks; in 1954, 90 hens per 100 cocks; 1956, there were 75 hens per 100 cocks. No exact reason is known for the wide variation. Undoubtedly, the small sample influenced the figures. However, there were two possible explanations for the variations: First, it has been observed that an entire bag of quail may be made up of those of one sex: Second; late hatching was thought to cause delay in growing new primaries. Certainly it seems logical that late brooding hens would grow new primaries slower than the males. Without the critical outer flight feathers they could not escape as swiftly as cocks, and they could be found more readily after the shorter initial flight. Due to late moult and resulting immaturity of feathers used in flight they would tire more easily because more energy was used to go the same distance with less flight surface. In a few cases it has been observed that the above flight characteristics were those of matured hens who had not fully recovered from moulting.

DISCUSSION

There are indications that shooting success is influenced by factors other than the number of quail. Nevertheless, it is believed that a pronounced change

in any one factor reveals a trend in the huntable crop.

In 1954 the long hatching season extended into August and was accompanied by a long period of favorable weather. This appears to favor quail production as a successful hunting season followed.

In 1954, 1955 and 1956 age composition varied considerable though the amount of favorable hatching weather needed for good production remained about the same. Six or more weeks of weather favored hatching. In 1953 a shorter period of suitable weather prevailed and poor hunting followed.

Immature young mixed with coveys of older birds will hold better for dogs than coveys composed entirely of fully developed young. During the 1954 season which hunters described as unusually good, a large number of immature young were taken by hunters while in 1953, a poor season, the very young were scarce.

While there was an indication that moderate weather favored production of quail, there was also a case when rainstorms accompanied by high winds were apparently destructive to small birds.

The fact that the number of young in various age groups changed from year to year may indicate a possibility that this resource could be more fully utilized.

SUMMARY

1. From quail wings, data were obtained that indicated the hatching periods.

2. The young to old ratio in quail varied from year to year.

3. Six or more weeks of moderate summer weather was apparently needed for successful quail hatching.

4. Further exploration of the composition of quail coveys may reveal that the maximum use is not being made of this resource.

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Conservation Officers' Winter Count of Quail

M. E. Stempel
Game Biologist

Our continuing inventory required a check of quail that survived the shooting season and the winter. This will be used as a basis to estimate brood stock. Other data will be obtained from counts made last fall, and from spring and summer work.

In late winter, 1947 a letter was sent to each conservation officer in quail territory, provided the area supported hunting or indicated promise of doing so. To obtain data for comparisons, the biologist made several field trips alone, or with other personnel to count birds under conditions similar to those recommended.

Work was to be done in snow if possible. This procedure would simplify work since the object was to ascertain the number of birds and this could be learned from quail tracks.

Careful observation of the procedure had previously been stressed. This year, emphasis was placed on the importance of keeping an accurate record of time spent. Previous to 1956 no limit was set on time. Not only was this changed, but in order to make instructions more uniformly understood minor changes were made in preparing the instructions which were otherwise unchanged from the previous year.

Results: Statewide, 1955-57.

A total of 111 ranges were inspected in 1957 during the census period; 581 quail were seen. In 1956 there were 117 ranges covered and 605 birds seen. Table 1 below sets forth the percentage of occupancy.

Table 1. Percentage of Quail Ranges Occupied, 1954 to 1957.

YEAR	PERCENTAGE OF RANGES OCCUPIED	BIRDS PER OCCUPIED COVEY RANGE
1954	67	12.3
1955	74	13.0
1956	48	10.8
1957	49	11.1

The high count indicated by the figure 74 in 1955 is partially due to a mistake in the method of making counts.

It is believed that the figures for 1956 and 1957 are most accurate because definite limits on time and area have to some extent standardized procedures. It was recommended that forty minutes be spent on each area. Though this unit was not adhered to, the time spent was listed and used to calculate hours per bird.

During 1957, 56 areas were visited on morning trials; 28 were found occupied; in afternoons 49 were checked and 24 found occupied. This is a higher rate of occupancy than were reported in 1956 when 24 ranges contained birds during morning counts when a total of 54 areas were visited. In afternoon counts 29 of 63 areas were found in use.

Highest degree of success in locating birds was reported for the morning hours, eight and ten. The most productive afternoon hours of 12, one and three. The areas of high population yielded nine quail per hour afield.

Counts by Agricultural Districts

Indications were that the population of quail fluctuated locally as well as statewide. Records are therefore kept on the state, district, and county levels. The 1957 work indicated the south-central had the most birds per area.

The probable accuracy of the counts was tested on check areas. On these areas of limited extent, the number of birds was rechecked, using several methods. Then the standard procedure was used. This revealed that slight upward or downward trends in number of quail were reflected in small year to year variations in census results. A change of less than 20 percent would probably not have been evident without the detailed comparisons. This may result from individual differences in the method of working and observing. Weather conditions may also effect results of observations. Table 2 indicates changes found within agricultural districts.

Table 2. Quail Populations by Agricultural Districts 1956 - 1957.

Agricultural District	Average No. of Quail per Occupied Range		Av. No. of Quail on all Ranges Checked	
	1956	1957	1956	1957
East Central	12.6	12.7	7.0	6.8
South Central	12.1	12.0	8.1	8.8
Southeast	15.0	10.6	6.5	5.8
Border Counties	8.2	9.0	3.5	4.0

A slight downward trend was indicated in the mail quail territory. Lack of snow could have caused the censusing effort to be less productive. Sample checks in the good quail range were made by the biologist and indicated a plentiful supply of quail survived. Border counties reported a slight increase in magnitude.

The Count by Counties

Highest counts occurred in the main quail range in Davis county where 39 birds were flushed in the three covey areas; these were found in one hour and 30 minutes. One hour and 40 minutes field work in Wayne County produced 39 quail.

Jackson County, in the secondary range, produced 55 birds in one hour and 25 minutes. In Cass county 42 birds were flushed during three hours, 40 minutes afield. Whereas, in Marshall county 27 birds flushed during two hours and 50 minutes of work.

No quail were found in Adams, Buchanan, Chickasaw, Harrison, Jasper and Linn and Story Counties. Reports were requested on 39 counties and to date all but two have reported.

In most cases some high counts can be expected. Also, some low counts will occur. No condition was reported or observed which would indicate that any part of the state had a condition that warranted more than the usual amount of attention.

SUMMARY

1. A total of 111 winter quail ranges were checked in 1957 and 581 birds were flushed. In 1956 on 117 ranges 605 quail were seen.

2. Most of the quail were seen between eight A.M. and four P.M.

3. Good wintering quail populations were found in Davis and Wayne Counties.

4. In the secondary quail range, high counts of quail were reported from Jackson and Cass Counties.

Notes on Coturnix Quail

M. E. Stempel
Game Biologist

A wide interest in the coturnix quail has prompted some investigation of this bird, and has suggested that some inquiry into its possible future is in order. This bird has several possibilities. Chief of these are its potential as a wild game bird in the United States, its desirability for training dogs, and its use as a game bird on control-led shooting areas.

This quail has a similar appearance to that of the bobwhite except its beak is thinner than that of most upland game birds.

Hatchery reared coturnix weigh three or four ounces while bobwhite weigh four to six ounces.

These birds have several common names, including; king quail, Japanese quail, etc. The bird's commonest call is described as being of three syllables, and is a rattling kind of call. The middle note can be heard up to one-half mile. The bird also has a cricket-like visiting call for conversation with his companions. He is not as sociable as the native quail of Iowa, and is apt to be found as singles or pairs.

Food needs are similar to those of the bobwhites. It may be that an aversion to dried winter foods prompts migration.

There are indications that the bird prefers grassy areas for nesting. Migration to nesting areas occurs in April. The female mates with a victorious male, after he contested for her attention. Brooding takes place from May through July.

In the hatchery, fertility is high and females may lay up to 250 eggs per year. The mottled eggs are slightly larger than those of the bobwhite. They hatch in 16 days.

They mature at 51 days which is twice as rapid growth as that of our native Iowa quail.

In Missouri experimental releases revealed that this bird quickly migrated as much as 125 miles. Quail were collected in Texas, Mississippi, Kansas, and on the Illinois border.

Wild populations vary greatly over a period of years. Best hunting probably would be on a migration route, and the birds would be fine targets since although they may be travelling as a flock, the birds have a tendency to flush as individuals. Coturnix lay well for dogs.

Wild birds are reported in one instance as having the habit of fleeing into brushy cover when pursued; other workers tell us that coturnix fly into grassy cover if hunted and flushed. Coturnix are said to be excellent eating.

Coturnix have been experimentally raised by the game departments of the following states which have released these quail to the wild; Alabama, Illinois, Indiana, Missouri, Tennessee and Virginia.

Other states that raised the quail but did not report making releases are; Georgia, Nevada, Oklahoma.

No comprehensive reports are known to be available on the success of releases, since it is only now time for the birds to begin returning to nesting sites.

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STATUS OF IOWA COTTONTAILS

Paul D. Kline
Game Biologist

Results of the recent Crossley Survey of fishing and hunting in Iowa portrays quite conclusively that cottontails remain second only to pheasants in importance to Iowa hunters. The survey indicated 47.9 percent of all hunters in Iowa pursued rabbits, and that 13.4 percent preferred rabbits over all other species. However, the figure for percent of hunting trips (21.3 as compared to 28.3 percent for pheasants) was most convincing.

Cottontails provide hunting during mid-winter when seasons for all upland game birds and squirrels are closed. No doubt the recreation furnished by rabbits at this season is worth many thousands of dollars to Iowans. Also, the flesh from rabbits in the bag, added to the fare of many farm and sportsman families, is of no little consequence.

Rabbit hunters, like most nimrods, most often judge the success of their hunting ventures upon how much time they require to bag rabbits. In other words, good hunting depends upon, among other things, numerous rabbits. If hunting is poor then the average hunter will explain, "rabbits are scarce". Biologists of the State Conservation Commission have developed a number of rabbit inventory methods geared to sample rabbit numbers in various portions of Iowa at various seasons. Most important of these inventories are the: July roadside counts, July age-ratio counts, rabbit-hunter cooperator reports, rural mial carrier counts, and February roadside counts. A presentation of results of these recent inventories is the purpose of this paper.

The July roadside counts were down from 5.7 rabbits seen per 10 miles of route in 1955 to 4.0 in 1956. However, two agricultural areas, the southeast and west central, yielded higher counts in 1956. Most significant was the 6.9 rabbits (Table 1) seen per 10 miles of route in the southeast during 1956 as compared to 5.8 seen in 1955. More young per adult rabbits were seen during the July age-ratio counts for 1956 (2.7 young per adult) than for any previous year except 1955 (3.0 young per adult). Ratios for years 1950 through 1955 averaged 2.5 young per adult. Although the ratios were down from 1955, again, the two exceptions were the southeast and west central areas where the counts of young per adult increased over 1955. Highest age ratios were obtained in the southeast and south central areas of the state (Table 1).

Rural mail carrier counts for July 30 - August 4 did not quite agree with the aforementioned indices (Table 1). Statewide figures indicated an increase in rabbits seen in 1956 (1.2 rabbits per 100 miles) over 1955 (1.0 rabbits per 100 miles). Greatest gains appeared in the south central areas were the index increased from 1.6 rabbits per 100 miles in 1955 to 3.9 in 1956. Perhaps the extreme hot weather during summer of 1955 depressed the counts of rural mail carriers for that season.

The rural mail carriers saw more rabbits per 100 miles of route again October 1-6, 1956 in the south central agricultural area than elsewhere in Iowa. Hence, on the basis of all - summer and early fall rabbits surveys a good hunting season was anticipated in the general southeastern portion of Iowa. Observations by the writer subsequently bore out this expectation.

Hunting success as reported by rabbit hunter cooperators improved slightly during 1956-57 season as compared to 1955-56. In 1956-57, 225 rabbits were bagged in 233.7 man hours of hunting. Hence, about one rabbit was bagged per hour of hunting as compared to 0.9 rabbits per hour in 1955-56 (Table 2). Hunters also reported having seen more rabbits (2.2 per hour) in 1956-57 than in 1955-56 (1.9 per hour). These data indicate a gradual increase in rabbit hunting success since 1954-55 when 0.8 rabbits were bagged per hour of hunting. The reports revealed that for every 100 rabbits bagged, four were crippled and lost.

Table 1. Averages for nine agricultural areas of four rabbit surveys conducted during 1956.

Agricultural Area	"July Roadside Counts	* July Age Ratios	# Rural Mail Carrier Counts	
			July 30-August 4	October 1 - 6
Northwest	3.54	1:1.64	0.59	0.25
North Central	2.50	1:2.52	0.63	0.66
Northeast	3.01	1:2.54	1.26	0.41
West Central	3.58	1:2.78	0.97	0.23
Central	2.77	1:2.24	0.46	0.15
East Central	4.91	1:2.68	1.31	0.46
Southwest	3.21	1:2.59	1.11	0.20
South Central	4.81	1:3.76	3.91	0.99
Southeast	6.85	1:3.36	2.09	0.48
Statewide	4.02	1:2.67	1.19	0.39

" Designates rabbits seen per 10 miles of route.
* Designates adult rabbits over juveniles.
# Designates rabbits seen per 100 miles of travel.

Eight of 13 hunters in 1956-57 thought rabbit hunting more profitable for that season than for the previous season. In 1955-56, seven of nine thought that season better than 1954-55. These data are not numerous enough to attach any particular significance, except perhaps that for both seasons the majority of rabbit hunters were satisfied with results of their efforts. In 1956-57 the hunters were again asked to compare the 1955-56season with 1954-55. Only six of 12 thought the 1955-56 season best. These data appear to be inconclusive.

Table 2. Hunting success as reported by hunter cooperators for 1955-56 and 1956-57 seasons.

	Before November 15		November 15-January 31		Entire Season			Before November 15		November 15-January 31		Entire Season		
	*	#	*	#	*	#	"	*	#	*	#	*	#	"
Hunting Trips	3	4	28	5	33	9	42	3	2	44	5	47	7	54
Total Hunters	4	5	44	9	48	14	62	8	4	89	8	97	12	109
Man Hours Hunted	14.5	14.1	114.5	27	129	41.1	170.1	7	4.7	201	21	208	25.7	233.7
Rabbits Seen	19	12	223	23	242	35	277	13	2	454	39	467	41	508
Rabbits Killed	10	7	122	14	132	21	153	5	2	205	13	210	15	225
Rabbits Crippled	0	2	5	0	5	2	7	0	0	10	0	10	0	10
Rabbits Seen/Hour	1.3	0.9	1.9	0.9	1.9	0.9	1.6	1.9	0.4	2.3	1.0	2.3	1.6	2.2
Rabbits in Bag/Hour	0.7	0.5	1.1	0.7	1.0	0.5	0.9	0.7	0.4	1.0	0.6	1.0	0.6	1.0
Rabbits Crippled/ Kill	0.0	0.3	0.04	0.0	0.04	0.1	0.05	0.0	0.0	0.05	0.0	0.05	0.0	0.04

* Designates those hunters who hunted primarily for rabbits.
\# Designates those hunters who hunted primarily for other game.
" Designates both groups of hunters who hunted rabbits and other game.

Only seven of 54 hunting trips reported by rabbit hunters were conducted prior to November 15 for the 1956-57 season. This means that rabbits are virtually neglected furing the first two months of the season. Also, early season hunters killed only 0.7 rabbits per hour as compared to 1.0 rabbits per hour bagged from November 15 to January 31.

Rabbit hunters were divided into two groups on the basis of reports: Those who hunted primarily for rabbits, and those who hunted primarily for other species. The objectives of the hunting parties seemd to make considerable difference in their ultimate success. Those hunters who tried primarily for rabbits saw an average of 2.3 rabbits per hour and bagged 1.0 per hour as compared to those hunters who hunted primarily for other game and saw only 1.6 rabbits per hour while bagging 0.6.

Seventy-four rabbits were aged by presence or absence of epiphyseal cartilage at the proximal ends of humeri. Of the total, 55 or 74.3 percent were juveniles in a ratio of 2.9 juveniles per adult. These data can be compared

with totals from six previous years, 1950-56, when 72.2 percent of 457 rabbits were juveniles in a ratio of 2.6 juveniles per adult. The visual age ratio counts for July and leg bone studies gave comparable results.

The February roadside rabbit surveys indicated rabbits were down from 1.8 seen per 10 miles of route in 1956 to 1.3 in 1957 (Table 3). However, only 13 of 75 routes were run when snow was upon the ground. In addition, only five routes had complete snow coverage as compared to 17 in 1956. It is believed lack of snow may depress credulence when rabbits seen on routes having no snow cover are compared. In 1956, 1.2 rabbits were seen per 10 miles of route having no snow. If compared to 1957 when 1.4 rabbits were seen per 10 miles of snow-lacking route, it appears there may be an actual increase in our rabbit breeding population for 1957. The effect of snow upon rabbits seen on survey routes need more study.

Table 3. Results by agricultural areas of February 1957 roadside rabbit counts and comparisons with 1956.

Agricultural Area	Rabbits Seen	Total Miles	Number Routes	*1957 Index	*1956 Index
Northwest	23	338.0	9	0.67	3.21
North Central	29	291.3	8	0.99	2.96
Northeast	21	356.4	10	0.59	1.42
West Central	31	191.0	5	1.62	1.17
Central	38	259.5	8	1.46	1.61
East Central	53	340.0	10	1.56	1.22
Southwest	9	208.7	6	0.43	0.79
South Central	66	319.1	9	2.07	1.92
Southeast	75	347.2	10	2.16	2.00
Statewide	345	2,651.2	75	1.30	1.82

* Represents number of rabbits seen per 10 miles of route.

The February counts indicate rabbits are most numerous in the southeast and south central agricultural areas where 2.2 and 2.1 rabbits were seen per 10 miles of route. For both these areas the counts indicate population increases from 1957 to 1957.

SUMMARY

All of the aforementioned surveys indicate a good population of rabbits has developed in the southeast and south central agricultural areas. This appears to be the most important development among cottontail rabbits during the past year. The number of rabbits in the wouthwest seems to have suffered a decline, however. To what this can be attributed is not known. Probably it is not talaremia as no infected rabbits have come to the attention of the writer during 1956-57. Only four human cases were reported to the State Department of Health in 1956 as compared to nine in 1955.

ECONOMIC IMPORTANCE OF IOWA JACK RABBITS

Paul D. Kline
Game Biologist

Jack rabbits are considered by most Iowans as a mammal novelty; seen only occasionally, and providing hunting sport or target practice for a few hunters who happen to jump one while pursuing other species. However, during recent years jacks have assumed a new significance of which many of us are unaware. A presentation of this new importance is the purpose of the present paper.

Distribution The white-tailed jack rabbit (Lepus Townsendi), the only species native to Iowa, is distributed throughout most of the state. It varies from very rare in the southeast to abundant in the northwest. Originally, the species invaded Iowa from the northwest in the late 19th century (Scott, 1937), and spread in a southeasterly direction.

Commercial Use The mechanical age has created a market for jeckrabbits in a rather consequent disuse of horses has resulted in an obvious, comparative scarity of horses throughout the country. Fur farmers have long depended upon worn-out horses as a staple flesh to feed their penned animals. Nowadays horses are hard to find and the fur ranchers are forced to turn to other sources of meat. Jack rabbits have proven the logical source.

An interesting account of the use of jacks has been provided by Jack G. Perrin (1957, Personal Communication), a mink rancher from Cherokee, Iowa. As Mr. Perrin describes: The jacks are first skinned; the anterior portion of the heads, including teeth, and feet are chopped off; stomachs and intestines are removed; and the remainder - flesh (with bones), lungs, livers, hearts, and kidneys - are soaked overnight in water containing a mild solution of aureomycin. Carcasses are then sharp-frozen before storage. They are ground while frozen whole and mixed about 35 parts to 65 parts fish; beef liver, lips, and tripe; and commercial cereal. This mixture is then food for ranch mink.

The pelts of white-tailed jacks had a market value of about $1.25 per pound during the past season. Slightly more than three pelts, were required on the average to make one pound. The pelts were stretched, dried, and baled. Most of them were shipped east for use in the hatters' trade. Some of them are used as trimming on cheap fur coats.

Markets and Value Data concerning numbers of jack rabbits taken in northwest Iowa was obtained by contacting 13 conservation officers whose territories fell within the area where it was believed a market for the rabbits had developed. Letters were mailed to eleven officers. Two were contacted verbally. Each was asked to designate location of markets, prices paid, numbers of rabbits purchased, abundance of jacks in his territory, and any other pertinent information. All officers cooperated fully and the information furnished by them is greatly appreciated.

Eight known markets (Table 1) purchased at least 859 jack rabbits from Iowa hunters at an average price of $0.60 and a total value to hunters of $7,133.15 during 1956-57 season. Small dealers paid less as a rule, while

larger buyers paid the highest prices. The established price was generally about 65 cents. Doubtlessly some markets were overlooked in the survey. Many rabbits were known to have been taken to Minnesota markets of which we have no record.

The writer believed at least 20,000 jack rabbits were sold by Iowans at a total value of $12,000. At 1955-56 season fur prices this exceeds the total value of all furs sold in Iowa except mink, raccoon, muskrat, and beaver. Prices were down for all furs during 1956-57; hence, jack rabbits should easily outclass all fur mammals in value except the above-named ones.

Table 1. Buyers of Iowa jack rabbits, number purchased, price per animal, and total value.

KNOWN BUYERS	CITY	COUNTY	STATE	NO. PURCHASED (ESTIMATE)	PRICE PAID	TOTAL VALUE
Bolls & Rogers	Sioux Falls	--------	So. Dak.	2,000	$0.65	$ 1,300.00
M. Stein & Co.	Sioux Falls	--------	So. Dak.	4,000	$.65-70	2,700.00
LeRoy Hetlet	Larchwood	Lyon	Iowa	1,000	$0.65	650.00
Shuver Fur House	Britt	Hancock	Iowa	-----	$0.60	--------
Fred Sahr	Forest City	Winnebago	Iowa	-----	------	--------
----------	Kiester	--------	Minn.	-----	$0.75	--------
Nylen Produce Co.	Granville	Sioux	Iowa	1,000	$0.35	350.00
Darrell Weaver	Spirit Lake	Dickinson	"	-----	$0.65	--------
Mayberry Produce	Pocahontas	Pocahontas	"	73	$0.25	17.25
Strange Bros.	Sioux City	Woodbury	Iowa	300	$0.50	150.00
Johnson Produce	Swea City	Kossuth	Iowa	2,286	$0.65	1,485.90
Perrin & Sons	Cherokee	Cherokee	"	1,200	$0.40	480.00
Totals				11,859		$ 7,133.15

Population Density Jacks vary quite erratically in abundance from one location to another. Conservation officer Frank Starr reported as many as 20 jacks killed in one section by circle hunters. Jack Perrin stated 25 rabbits were taken from good sections in Cherokee County, while poor sections yielded only five or six. Conservation officer Gene Newell stated that one group of circle

hunters killed 1,200 jack rabbits.

Although all officers were asked whether or not jacks were more abundant than in past years, not all had an opinion. Two in the extreme northwest counties reported a decrease in numbers. Further east and south three officers reported increases and one believed the number of jack rabbits remained about the same.

SUMMARY

1. Jack rabbits have recently assumed a new importance to hunters in northwest Iowa, as they have market value for their fur and flesh.

2. A total of 11,859 jacks were known sold by Iowans at an average price of $0.60 and a total value of $7,133.15.

3. It is believed at least 20,000 jacks reached some market from Iowa at a price of $12,000.00.

4. Jack rabbits are fifth in importance to Iowans when compared to other furbearers. Only mink, beaver, muskrat, and raccoon exceed them in value.

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WATERFOWL AND WILDLIFE RECORDS - WHY?

James G. Sieh
Game Biologist

Iowa has a vested interest in the waterfowl which migrate into and over the Hawkeye State each spring and fall. The general pattern of movement is well known, but inadequately documented to provide records of permanent value. All wildlife workers have a responsibility to record and document each pertinent observation concerning fish or game. A written record of a valuable observation is the only valid receipt of a wildlife transaction. In this day and age, illiteracy, or neglect of this repsonsibility is no more defensible than ignorance of law in court. The documentation procedure is simple, a brief written record of the observation with a count or estimate of the species and numbers involved. The transaction is not complete, however, until the information has been delivered to a source for permanent record.

Here we must pause for a moment and ask ourselves an important question. What specific information do we need, and what do we need it for? Very briefly, we require written information in the form of documented records to adequately clarify and support our own observations or contentions. An orderly and systemmatic analysis of material pertaining to wildlife is the equivalent of a cost accounting analysis in business.

The Grand Passage of Waterfowl Into and Across Iowa in 1956

Mass fall migrations of waterfowl are the phenomenon which govern distribution and the harvest of mallards and bluebills (scaup and ring necked duck) in Iowa, and in much of the Mississippi Flyway. Let me attempt to prove this statement by illustrating and documenting the "grand passage" of waterfowl through Iowa in 1956. The general subject of mass migration has been discussed in detail by Hockbaum in his recent book entitled "Travels and Traditions of Waterfowl". A brief discussion of factors known to influence mass fall migrations of waterfowl in Iowa are on record (Sieh, 1956).

Observations were begun in Dickinson County, Iowa at daybreak on November 7, 1956. The sky was almost clear and a light wind from the northwest held little promise of waterfowl migration. At approximately 8:00 A.M. many resident flocks of Franklin's Gulls (Larus franklini Richardson) were leaving the larger lakes in V-shaped wedges or flocks which at first were thought to be waterfowl. Upon closer inspection, these flocks of gulls lacked their characteristic undulating flight pattern so typical of Franklin's Gulls. Their flight direction was southerly. This gull flight turned out to be the exodus of this species from the Iowa lakes region in 1956, and a fore-runner of the grand passage of waterfowl.

A few flocks of mallards appeared from the north flying south southeasterly course about 9:00 A.M. From 9:00 to 9:30 A.M. the number of flocks of migrating ducks increased until flocks could be seen at anytime somewhere between horizon and horizon. Often, many flocks totaling several hundred waterfowl were in view at the same time. Seldom was there a lull of more than a very few minutes between pushes or groups of migrating mallards. Apparently few if any of these birds were alighting on the lakes at this time of day.

This was the beginning of the "grand passage", a tremendous mass fall migration of waterfowl. To measure the intensity and number of passing waterfowl several simultaneous counts were made. Mr. Seth Shepard, Biologist's Aid, recorded the number and size of passing flocks observed eastward out of the Biology Station window at Spirit Lake (Table 1). This count indicated a passage of 3,038 ducks per hour; however, ducks flying directly over the building could not be counted because they were obscured from fision by the roof of the building. This factor would reduce the duck-per-hour figure somewhat.

Table 1. The number and size of each flock of ducks observed during mass fall migration from the Biology Station window at Spirit Lake, Dickinson Count, Iowa on November 7, 1956 from 10:30 AM until 11:30 AM.

The number of ducks estimated in each flock observed.	2	4	5	10	13	15	20	25	35	50	75	100	150	200	250	375
The number of flocks of each size observed.	1	2	1	2	1	4	1	9	1	8	3	4	4	2	1	1
The total number of ducks observed.	2	8	5	20	13	60	20	225	35	400	225	400	600	400	250	375

Grand Totals. 3,038 ducks per hour in 45 flocks averaging 67 ducks per flock. (3,038 ducks per hour).

Mr. Thomas Moen, Biologist, and Mr. Shepard made another count at the southwest corner of Pleasant Lake, Dickinson County, Iowa (Table 2). This count included all waterfowl crossing an imaginary vertical plane while facing eastward, from the horizon to a point directly overhead. This count indicated a passage of 8,311 ducks at a rate of 4,155 ducks-per-hour. Simultaneously, Mr. Bill Basler, Conservation Officer, made a count at Trumbull Lake in Clay County, Iowa. He counted 86 flocks crossing a similar imaginary plane totaling 5,160 ducks in one hour. These figures provide a comparative measure of the rate of passage of waterfowl during this migratory flight.

Table 2. The number and size of each flock of ducks observed during mass fall migration at the southwest corner of Pleasant Lake, Dickinson County, Iowa on November 7, 1956 from 1:30 PM until 3:30 PM.

The number of ducks estimated in each flock observed.	2	4	10	15	20	25	30	50	75	100	150	200	250	300	450	500	600
The number of flocks of each size observed.	1	1	3	1	4	13	1	29	5	12	8	6	1	2	1	1	1
The total number of ducks observed.	2	4	30	15	80	325	30	1450	375	1200	1200	1200	250	600	450	500	600

Grand Totals 8,311 ducks in 2 hours in 90 flocks averaging 92 birds per flock. (4,155 ducks per hour)

Mass fall migrations, and especially the grand passage, extend east and west across large parts of the flyway and perhaps beyound. To prove this, another simultaneous count was made while driving eastward on highway # 9 from Spirit Lake and recording all visible waterfowl crossing the highway from the horizon ahead to a point directly above the automobile. Ducks were counted from start to finish totaling 10,967 ducks in a 112 mile route averaging 5,483 ducks per hour (Table 3). There was no indication of any change in the rate of passage at any point along the entire distance traveled.

Rough calculations indicated several million mallards crossed this 100 mile front into and through Iowa on this date. This number represents a very large proportion of the entire flyway population. The flight was observed throughout Iowa from the Missouri to the Mississippi, and there is every indication it extended beyond in both directions east and west. It is desirable to establish the geographical dimensions of these mass migrations as closely as possible.

The ground speed of these migrants approximated 75-90 miles per hour depending upon wind velocity. In the afternoon their speed was checked by speedometer readings while traveling beneath and parallel to several flocks. This grand passage began about 9:30 A.M. in the Spirit Lake area and continued until 4:30 P.M. Only a very small percentage of these ducks stopped enroute in Iowa. It is probable that most of these migrants traveled en masse several hundred miles or miltiples thereof with ease. Total flight distances and duration are most desirable information.

Frank Bellrose of the Illinois Natural History Survey intercepted this migration along the Illinois-Iowa boundary while flying in an aircraft with this specific purpose in mind. He reported a continuation of the flight south southeastward, and likewise indicated that the migrants were distributed over a broad front. George Saunders of the U. S. Fish and Wildlife Service indicated that at least a part of this same flight continued into the southern U. S. and divers showed up on the Gulf Coast areas. From this information it is probable that a large proportion of the mallard, scaup, and ring-necked duck population in the Mississippi Flyway crossed Iowa and several other states in a matter of hours. Of course, with a migration of this size in progress, some waterfowl always alight to reat or feed along the way. Others may remain in local areas for a few days or weeks, but the majority continued over Iowa almost non-stop.

Evidence is available indicating that during mass migrations in recent years many divers have crossed Iowa unseen during the hours of darkness, some alighting on the larger open waters of the state during the hours of darkness, resting during the day, resuming their mass migration during the late afternoon of the following day (Sieh, 1955). There are always some variations in the flight pattern governed by wind, weather and circumstances.

Iowa's waterfowl harvest is directly proportional to the length of time waterfowl remain within the state. Evidence in recent years indicate the harvest of diving species has been negligible, and the total mallard harvest insignificant inland and beyond the border rivers. Regulations permitting additional shooting hours in the afternoon would legitimately increase the harvest opportunity and perhaps the harvest. Rapid mass migration through Iowa is one major cause of reduced harvest.

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Sieh, James G.
1955 A Glimpse of Mass Migration at Spirit Lake, Iowa in 1955. Iowa Bird Life, 26 (2): 35-37.

1956 A Brief Discussion of Factors Known to Influence Mass Fall Migrations of Waterfowl in Iowa.
Iowa State Conservation Commission. Quarterly Biology Reports, 8 (3): 28-29.

Table 3. The number and size of each flock of ducks observed during mass fall migration from Spirit Lake, Iowa while traveling eastward 112 miles at 55 m.p.h. on State Highway #9 to the Shellrock River crossing from 12:55 AM until 3:05 PM on November 7, 1956.

The No. of Ducks estimated in each flock observed.	1	2	5	7	8	9	10	11	12	15	17	20	25	30	35	40	45	50	60	70	75	80	90	100	110	120	125	135	150
																						(cont'd)			175	180	200	250	300
The number of flocks of each size observed.	2	2	1	1	1	1	11	1	2	7	1	12	12	13	8	14	6	7	7	3	19	6	3	9	5	4	8	1	5
																						(cont'd)			1	1	2	3	3
The total number of ducks observed.	2	4	5	7	8	9	110	11	24	105	17	240	300	390	280	560	270	350	420	210	1425	480	270	900	550	480	1000	135	750
																						(cont'd)			175	180	400	750	900

Grand Totals 10,967 ducks in 182 flocks averaging 60 ducks per flock in 2 hours. (5,483 ducks per hour)

OBSERVED SEX RATIOS AS SHOWN BY

WINTER PHEASANT COUNTS

Richard C. Nomsen
Game Biologist

The regular winter pheasant surveys were conducted during January and February by conservation officers and rural mail carriers. The purpose of these counts is to determine the post-season sex ratio of Iowa's pheasant population. Observed sex ratios were used to calculate the 1956 harvest of cocks and are necessary for completion of the spring population survey.

Conservation Officers Winter Count

All conservation officers were contacted late in December and were supplied with the necessary forms and instructions. Reports were requested every two weeks during January and February. However, counts were to be made only with a complete snow cover in order to eliminate certain variables.

Weather and cover conditions were generally unfavorable for the sex ratio count. Adequate snow cover was present for only short periods during the winter. In many cases, officers made special counts during more favorable periods in order to obtain the necessary information.

Officers recorded a total of 20,404 pheasants during the census, with a ratio of 3.3 hens per cock. the observed ratio of hens per cock for 1956 was also 3.3 females.

The kill percentage was calculated from the difference between the pre-season and post-season sex ratio. From these results, it was determined that hunters shot 63 per cent of the available roosters during the 1956 season. The harvest was very similar to the 1955 results when the shooters took 62 per cent of the cocks.

The kill percentage during the past three years has been more favorable than for all other previous years. It seems apparent that with our present hunting pressure, we can expect the licensees to harvest about two-thirds of the cocks.

The total number of birds reported from each district should not be used for population comparisons - district totals are listed merely to show the sample size (Table 1). Samples from each area depend a great deal on checking conditions as well as the bird population. The sample from southern Iowa was again quite small but was included as a reference.

Table 1. Observed Sex Ratios and Pheasants Reported by Agricultural Districts - 1957.

DISTRICTS	HENS	COCKS	SEX RATIO
1. Northwest	2388	694	3.4
2. North Central	4442	1756	2.5
3. Northeast	3851	927	4.1
4. West Central	1097	281	3.9
5. Central	2086	445	4.7
6. East Central	1358	372	3.7
7. Southwest	166	53	3.1
8. South Central	320	168	1.9
Total for State	15,708	4,696	3.3

Of the eight districts listed, four indicated fewer hens per cock and four reported an increase in the proportion of hens to cocks (Table 2). However, only slight changes occurred in most areas. It is quite possible that this variation was in part caused by the smaller sample this year. The ratio in northwest Iowa indicated a higher percentage kill than in 1955 and was partly due to the lower population last fall. Harvest in north central Iowa was much below the state average. Results from other districts showed very little change from the 1955 records. The central district again recorded the highest percentage kill followed closely by the area in northeast Iowa.

Table 2. Comparison of Observed Sex Ratios by Agricultural Districts 1955-1957.

	OBSERVED SEX RATIOS		
DISTRICT	1955	1956	1957
1. Northwest	2.9	2.8	3.4
2. North Central	2.7	3.3	2.5
3. Northeast	4.4	3.8	4.1
4. West Central	4.1	4.0	3.9
5. Central	4.8	4.6	4.7
6. East Central	4.5	3.8	3.7
7. Southwest	4.9	3.0	3.1
8. South Central	3.3	2.4	1.9
State Average	3.6	3.3	3.3

The results of this survey will be used to complete the spring population count. The spring hen index is determined from results of the crowing count and the winter sex ratio study.

Rural Mail Carriers Winter Count

The rural mail carriers were contacted in January and furnished cards and instructions for the winter survey. They were asked to count game along their routes during the week of January 21-26.

Mild weather conditions caused a considerable decrease in the total number of birds checked this year. They reported a total of 17,411 birds for the six days with a ratio of 2.2 hens per cock. This figure was much lower than the 3.1 hens per cock reported in 1956.

Table 3. Birds Reported and Observed Sex Ratios by Agricultural Districts Mail Carriers - 1957.

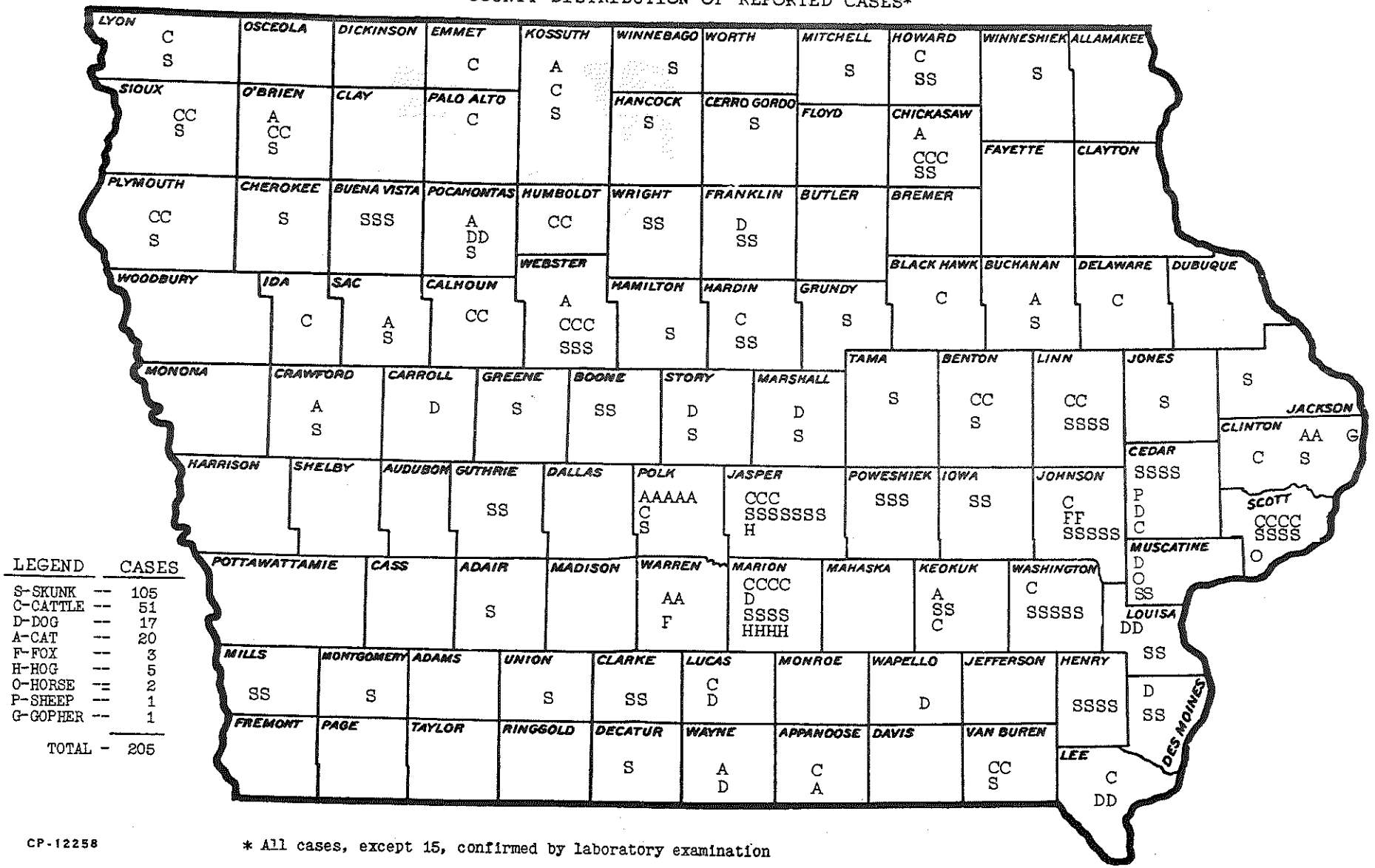
DISTRICT	HENS	COCKS	SEX RATIO
1. Northwest	1,153	556	2.1
2. North Central	4,180	2,124	2.0
3. Northeast	2,625	1,120	2.3
4. West Central	1,165	410	2.8
5. Central	1,490	762	2.0
6. East Central	996	391	2.5
7. Southwest	215	54	3.9
8. South Central	60	38	1.6
9. Southeast	51	21	2.4

The rural carriers consistently report a higher percentage of cocks in the winter population than the officers. This variation is much more pronounced during a mild winter such as we had this year, which was the reason for the low sex ratio the past winter.

Iowa State Department of Health
Edmund G. Zimmerer, M.D., Commissioner
and Collaborating Epidemiologist

RABIES IN ANIMALS IN IOWA 1956

COUNTY DISTRIBUTION OF REPORTED CASES*



LEGEND	CASES
S-SKUNK	105
C-CATTLE	51
D-DOG	17
A-CAT	20
F-FOX	3
H-HOG	5
O-HORSE	2
P-SHEEP	1
G-GOPHER	1
TOTAL -	205

CP-12258

* All cases, except 15, confirmed by laboratory examination