July - Aug - Sept - 1963

1963 Desoto Creek Census

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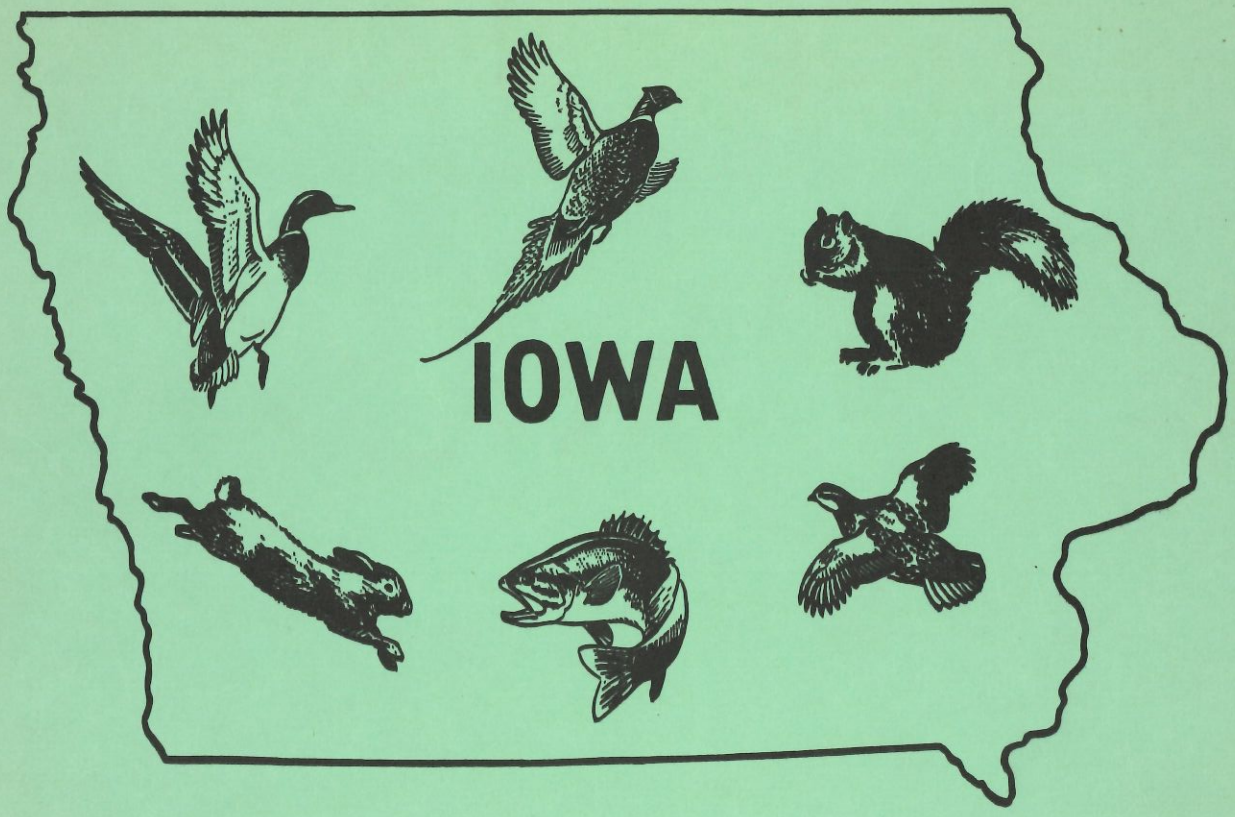

FISH AND GAME DIVISION — BIOLOGY SECTION

STATE CONSERVATION COMMISSION

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ABSTRACTS OF QUARTERLY BIOLOGY REPORTS

PRE-IMPOUNDMENT CREEL CENSUS AND FISHERY SURVEY OF RED ROCK DAM AND RESERVOIR AREA, MARION COUNTY, IOWA

1962-1963

Harry M. Harrison
Fisheries Biologist

Creel census and fishery surveys were conducted in 1962 and 1963 on the area to be impounded by the Red Rock Dam an the Des Moines River in Marion County, Iowa.

The creel census was patterned after other censuses carried on in Iowa streams. It involved a study of fishing pressure together with the kind and number of fish caught, the rate of catch, the species being fished for and preferred. The census revealed that the channel catfish is the most important species caught. It is followed by carp, carpsuckers, and sheepshead in that order.

Fish populations were studied by electro-fishing techniques and by hoop nets. Carpsuckers dominated making up 48 per cent of the population by weight. Carp followed with 39 per cent. Channel catfish ranked third and constituted 6 per cent of the fishes in the area. Nine other species were present, but occurred in insignificant numbers.

CREEL CENSUS OF THREE NATURAL LAKES, 1962-63

Tom Moen
Fisheries Biologist

Data are presented on the results of a comprehensive type creel census conducted on three natural lakes in Dickinson County, Iowa. The three lakes have a combined surface area of 11,000 acres. An estimated 97,697 angler trips were recorded, involving 250,568 hours of fishing. Angling success was rather high with an estimated total of 445,577 fish weighing 303,966 pounds taken from the three lakes at an average rate of 1.7 fish per hour. Eleven species were noted in the creel. Bullheads and yellow perch were of about equal importance in the catch; they comprising 42 and 38 per cent of the total fish, respectively.

Tables are presented covering the essential data, along with a discussion of the data recorded for each lake.

RESULTS OF A WALLEYE AND SAUGER TAGGING STUDY IN THE IOWA WATERS OF THE MISSISSIPPI RIVER

Roger Schoumacher
Fisheries Biologist

In 1957, 1958, and 1959, 1,149 walleye and 1,836 sauger were tagged with serially numbered metal jaw tags below Lock and Dam #10 on the Mississippi River. Sex ratios were about 1 male to 2 females for walleye and 1 male to 3 females for sauger. One hundred seventy-six walleye and 289 sauger were recaptured by anglers for known exploitation rates of 15 and 16 per cent respectively. Fifty-three per cent of the recaptured walleye and 63 per cent of the sauger were taken within 5 miles of the tagging site, and 84 per cent of both species were taken less than 50 miles away. Of the recaptured fish, 59 per cent of the walleye and 65 per cent of the sauger were taken in the home pool, and 68 per cent of the walleye and 89 per cent of the sauger were taken in the vicinity of lock and dams. Fifty-nine per cent of both walleye and sauger recaptures were taken within 6 months after tagging. Forty-eight per cent of the walleye recaptures and 53 per cent of the sauger were taken during April and May.

FURTHER STUDIES OF THE EFFECTS OF THERMAL STRATIFICATION ON THE GROWTH OF BLUEGILL

Jim Mayhew
Fisheries Biologist

The effects of severe stratification on the growth of bluegill in Red Haw Lake is being studied. Scale samples were obtained from bluegill at 15 to 30-day intervals. All scale samples were taken from 2-year-old fish.

Annulus formation and initial growth begins prior to May 1. The fish grow rapidly until early June, when, at the approximate time of hypolimnion stagnation, further growth is greatly retarded. In most cases the scales had accessory year marks.

DESOTO BEND CREEL CENSUS, 1963

Bill Welker
Fisheries Biologist

Between May 1 and September 15, 1963, a creel census was conducted on a 700-acre Missouri River ox-bow lake by the biologists from the Iowa Conservation Commission and the Nebraska Game, Forestation and Parks Commission. Since the area has only two access roads, a "visitor contact upon leaving" type of census was considered best. An estimated total number of 22,849 fishermen visited the area during the census period. Approximately 24,409 fish were caught in the lake during the 138 days of the census. An average of about 20 pounds of fish per surface acre of lake was removed by the fishermen. Crappie were the most numerous fish in the creel during 16 of the first 19 weeks of the census. Channel catfish or carp were most important in the creel during the remaining 3 weeks. The highest catch per hour (.43 fish) was recorded during the first 2 weeks of the census. Other values during

subsequent 2-week periods, excluding the last 12 days of the census, ranged between .18 and .34 fish per hour.

QUAIL WHISTLING COCK CENSUS IN IOWA, 1963

M. E. Stempel
Game Biologist

The quail whistling cock census has been used in Iowa since 1947. Revisions of this census system have been made over the years, culminating in 1963 with fewer and shorter routes for Conservation Officers, and with added routes to be checked by Game and Biology Section Personnel. The best 1963 quail populations are in southern Iowa as usual, and the best of this range is in southeastern Iowa. On comparable routes in southern Iowa there was an average of 2.1 whistling cocks per mile, compared to 1.4 in 1962 - a 50 per cent increase. The statewide census indicates that from the good southern Iowa quail areas a smaller population of quail extends northward along the Mississippi, Missouri and Des Moines Rivers.

WOODCOCK SINGING GROUND COUNTS IN IOWA, 1961-62-63

Eugene D. Klonglan
Game Biologist

Woodcock singing ground counts were made in Iowa for the first time in the spring of 1961, and were repeated in 1962 and 1963. Iowa is one of 24 states and Canadian provinces cooperating in this program, coordinated by the U. S. Fish and Wildlife Service, which is aimed at obtaining an index to woodcock breeding population density trends. The survey is an audio count of "displaying" woodcock males during their evening courting period in the spring, with the total number of different males heard on a specified number of routes and stops being recorded. Over the 3-year period, 51 woodcock were heard on 187 stops on 19 counts, an average of 0.27 per stop. The routes were all located in the eastern half of the state, most being in northeastern Iowa. Inquiries made as part of the survey revealed that three woodcock broods had been sighted (in southeast, south central and western Iowa) during the past breeding season. This species is apparently more widely distributed and more common in the state than generally believed.

IOWA'S LATE SUMMER PHEASANT POPULATION - 1963

Eugene D. Klonglan
and
Richard C. Nomsen
Game Biologists

The August roadside pheasant count is the primary source of information on the status of the pre-hunting season pheasant population. It is supplemented by rural mail carrier surveys, Conservation Officer sight records and information recorded on the rabbit roadside and quail whistling surveys. Following a very favorable winter and spring, an increase of 42 per cent in the number of pheasants sighted on the August roadside counts was recorded over 1962 (2.72 vs. 1.92 birds per mile). This is the highest in the 10 years these counts have been taken in August, and 8 per cent above the previous high of 2.51 recorded in 1958. The best pheasant

populations are in northwest, north-central and southwest Iowa. The highest population on a localized basis is to be found in Adair County and vicinity in southwest Iowa. Various indices to reproductive success indicate production was better in 1963 than 1962, which was also a fairly good production year, and well above average. The hatching peak was 1 to 2 weeks earlier than usual. Rural mail carrier counts and Conservation Officers sight records both showed that 1963 was the best "pheasant year" for some time.

RESULTS OF THE JULY, 1963, ROADSIDE RABBIT SURVEYS

Paul D. Kline
Game Biologist

July roadside surveys for 1963 revealed a sharp increase in cottontail populations over much of Iowa. The statewide index climbed from 3.88 in 1962 to 5.61 in 1963. All areas showed increased populations. The indices, higher than the 14-year average in all areas except the western loess where it was very nearly the same, indicate that higher than normal populations of cottontails occur in most portions of Iowa. Lowest populations appeared, as usual, in the northeast counties. Production for 1963, as indicated by age ratios, was considerably higher than 1962, though lower than the 14-year mean. It is possible that early breeding during the warm dry spring resulted in many near-adult sized juveniles during July and distorted the age ratios, thereby indicating production was lower than really occurred. The fall population index of 3.94, as compared to 2.33 for 1962, indicates hunting of cottontails will be somewhat improved during the 1963-64 season. The index of jackrabbits (0.17 per 10 miles) was higher than in 1962 (0.11 per 10 miles) but below the indices obtained for years 1958 through 1961. Numbers of rabbits sighted during the spring and summer pheasant surveys and quail whistling counts are recorded here for the first time. These data corroborate rather strongly the data from the regular rabbit surveys.

PRE-IMPOUNDMENT CREEL CENSUS AND FISHERY SURVEY OF RED ROCK DAM AND RESERVOIR AREA, MARION COUNTY, IOWA

1962-1963

Harry M. Harrison
Fisheries Biologist

INTRODUCTION

In June, 1960, the U. S. Corps of Army Engineers initiated construction of the Red Rock Dam and Reservoir in Marion County, Iowa. When completed, it will be the second of several flood control projects planned for this state.

Of considerable interest to fishery workers, recreationists and anglers are the changes occurring to fishery resources resulting from impoundment works. To gather information for comparison with post-impoundment studies, creel census and fisheries surveys of the existing waters were begun in 1962 and will continue until the reservoir is closed.

The creel census has been designed to appraise pre-impoundment angling in the area to come under the influence of the dam. Two censuses are used. One obtains angling information from Conservation Officer Contact Records from the Des Moines River in the reach extending from the city of Des Moines to its mouth. The second census, conducted by the Biology Section, is run on a special study area located in Marion County. Information sought by the creel census includes: angling pressure, rate of catch, composition of the harvest, species preference, amount of travel per fishing trip and the occupations of the fishermen.

Fishery surveys are being conducted in the same pattern as the creel census, i.e., comprehensive and continuing studies are in progress on the special study area in Marion County. This work is being supplemented by routine checks of fish populations at other sampling stations scattered along the river between Des Moines and its mouth. Information relating to the kinds of fish present, species composition, population fluctuations and age and growth of the abundant species will be determined by the surveys.

The present paper reports the results of two seasons of creel census and fish population studies in the Marion County area.

Description of the Area

The Marion County study area is a 12-mile length of river beginning at the bridge on Highway 14 north of Knoxville and extending downstream to county road "P" southwest of Pella. It was selected for study because this will be the region permanently flooded at the completion of the project. Additionally, it is typical of the Des Moines River for as much as 75 miles above or below.

The area is a series of long sweeping bends characterized by sharply cut banks alternating with extensive sand bars. Much of the bottom is fine sand with coarser gravel flooring the main channel. Limestone outcroppings occur as a bottom type in three areas, but are considered of minimum importance because of their limited extent.

Fish cover consists largely of piles of driftwood and trees felled into the water by undercutting on the high bank side. Some fish cover is provided by limestone deposits.

Stream flows are characterized by wide fluctuations and have ranged from a mimimum of 40 to a maximum of 155,000 c.f.s.. The average discharge determined by 40 years of record is 4,137 c.f.s.. Depending upon stream stage, channel depths vary between 5 and 30 feet. During low flows much of the stream consists of water less than 1 foot deep.

The valley is largely devoted to row crop farming with typical bottom land timber bordering the stream. This timber occurs as a narrow band along much of the cut banks. On the bar side, timber areas become more extensive.

Creel Census

Sixteen creel censuses were completed on the Marion County area during 1962 and 1963. They were run by boat so all fishermen could be contacted during each census. Anglers were interviewed with respect to the length of time they had been fishing, the kind and number of fish caught, the bait being used, the species of fish preferred, his occupation and where he was from. The census clerk also noted whether the contact was a man, women, boy or girl and if they were fishing from shore, boat or wading. At the completion of the census, the clerk recorded the date and time of day the census was run. Additionally, he noted the number of boats on the area and made general observations concerning angling conditions.

There were 142 fishermen - 110 men, 27 women and 5 boys - contacted during the 16 censuses. They had fished 279 hours and caught 120 fish at a rate of .43 fish per hour. Channel catfish (80) were the principle fish taken. They were followed by carp (33), flathead catfish (4), carpsuckers (2) and sheepshead (1).

With regard to species preference, 109 fishermen wanted to catch channel catfish, 22 were after carp and 11 didn't care what they caught.

Thirty fishermen were fishing from boats and 112 from shore.

Commercial catfish bait was being used by 68 anglers, worms by 30, doughballs by 30, and shrimp by 16. A variety of other baits including spleen, crayfish, clams and grasshoppers were also employed but to a much lesser extent.

More than half of the anglers contacted lived within 10 miles driving distance, with addresses at Knoxville, Pella, Monroe and Otley. Thirty-five anglers come from Newton, a distance of approximately 20 miles. A Marshalltown resident travelled the greatest distance to fish this area.

With respect to employment, the greatest number of contacts (55) were retired; 27 were housewives, 24 laborers, 15 farmers, 8 businessmen, and 4 professional people.

Creel censuses similar to the one reported upon have been run in central Iowa streams since the early 1950's. By drawing upon knowledge derived from that work and applying the information at hand from the study area, some general conclusions pertaining to the fishery resource are possible even though this particular census is in its beginning stages. Furthermore, those things already learned about the catch of fish from the study area will apply to the entire reach of the Des Moines between the cities of Des Moines and Ottumwa.

Briefly, some of these general conclusions follow:

1. Rate of catch can be expected to continue at approximately 0.5 fish per hour.

2. Channel catfish will dominate the creel, followed by carp. Other species will be of minor importance.

3. Channel catfish will persist as the most preferred species.

4. Utilization will be by anglers living relatively close (within 10 miles) to the river, and their travel will be more or less perpendicular to the stream. This results from the fact that many fishermen will be retired and not inclined toward long distance travel. Additionally, such things as access, fish cover, species distribution and other characteristics of the stream are relatively homogeneous, making lenghwise travel along the stream unnecessary.

5. Due the large size of the stream in this area, most utilization by anglers will be in the late summer and fall when stream flows are at a minimum.

Fish Surveys

Fish populations in the area are being studied by electro-fishing and by hoopnetting. During 1962 and 1963, the Marion County area was surveyed 11 times by electrical shocker, and hoop nets were fished for 1,090 hours. Table 1 lists the species composition by weight and numbers for 3,084 fish taken in these surveys.

Two species of carpsuckers, Carpiodes carpio and Carpiodes cyprinus, are the most numerous fish inhabitating the area. The river carpsucker dominates, making up approximately 95 per cent of the group. Neither species is of economic value, and because of their large numbers are considered detrimental to the fishery of the area.

By weight, carp are the second most abundant species. They are well adapted to the area, and field observations indicate that carp prosper in the lower Des Moines. All specimens observed in the Marion County area have appeared to be in good condition. Yearlings usually exceed 10 inches total length. A second size group, 13 to 17 inches long and weighing 1 to 2.5 pounds, are very numerous. These are believed to be 2-year old fish. Larger carp, 4 to 10 pounds, are plentiful, but laboratory studies will have to be completed before information pertaining to their growth can be determined.

Numberwise, channel catfish rank second, but because of their smaller size they constitute a comparatively insignificant part of the total poundage (Table 1). They are, however, the ranking species from the standpoint of the angler, and for this reason must be regarded as the most important fish in the area.

On the basis of preliminary studies, channel catfish growth is slow, but is quite normal for Iowa's inland streams. Yearling are 8 inches long; two-year olds 9.25 inches; three-year olds 10.25 inches. All three groups are numerous. Larger catfish are plentiful but age determinations have not yet been made for these larger individuals.

Flathead catfish made up 1 per cent of the population by both numbers and weight. Whether

TABLE 1. Species composition by weight and by number of 3,084 fish taken from the Marion County study area - 1962 and 1963*

Species	Number	Frequency Occurrence By Number	Weight Pounds	Frequency Occurrence By Weight
Carpsuckers	2,101	68	855	.48
Carp	310	10	706	.39
Channel Catfish	350	11	114	6
White Crappie	11	tr.	4	tr.
Bigmouth Buffalo	24	1	48	3
Flathead Catfish	18	1	17	1
Goldeye	12	tr.	6	tr.
Gizzard Shad	237	7	16	1
Redhorse	7	tr.	5	tr.
Common Sucker	2	tr.	2	tr.
Green Sunfish	8	tr.	1	tr.
Sheepshead	4	tr.	1	tr.
	3,084		1,775	

*. Only fish exceeding 4 inches total length were weighed and measured.

or not these figures are indicative of their relative abundance is questionable. Flatheads are not readily vulnerable to survey techniques, and only a few are caught by anglers. As a consequence, little is known of the species in Iowa's inland waters. Shockers and hoop nets take a few flathead catfish in most areas offering proper habitat. In light of the abundance of adequate flathead cover in the study area, the species might well be more numerous than our surveys have indicated.

Other species, including bigmouth buffalo, white crappie, goldeye, gizzard shad, redhorse, common suckers, sheepshead and green sunfish, are presently insignificant species, and should remain so under unimpounded conditions.

CREEL CENSUS OF THREE NATURAL LAKES, 1962-63

Tom Moen
Fisheries Biologist

EAST OKOBOJI LAKE

East Okoboji Lake is the smallest of the three lakes censused with a surface area of approximately 1,400 acres. This lake supports fair populations of several species that are normally important in the winter fishery of the other lakes but during the past twelve years of legal winter fishing the winter fishery has failed to develop to a point where a winter census would provide significant data. Thus the census period covered in this paper extends through the six month period of May through October of 1962 (Table 1).

During the six months of censusing, ten species were recorded in the creel. Bullheads accounted for 73 per cent of the fish caught and 64 per cent of the weight, and equalled 49 pounds per acre. Bullhead fishermen have had three successive years of excellent fishing for this species, averaging 83 pounds per acre for the three-year period 1960-62. Yellow perch were next in importance in the catch making up 17 per cent of the fish caught and 17 per cent of the weight. Although a few perch were caught during the early summer months, over 90 per cent of the 33,913 perch recorded were taken in September and October.

A decided increase in the number of bluegill and crappie was noted. Each of these species increased from about 1,000 individuals in the 1961 catch to 6,000 in 1962. Walleye were the sixth most abundant fish with the sheepshead or freshwater drum the fifth. The two species were about equal in total weight.

Fishing reached a peak in June with 34 per cent of the total fish and 35 per cent of the weight taken during this month. In spite of a success rate of 3.5 fish per hour, June was only the fourth best in this category. Good crappie and bullhead fishing in May and perch fishing in October brought about phenomenally high success rate of 5.7 fish per hour for these months.

During the six month period an average acre of water in East Okoboji provided 36 hours of fishing and 77 pounds of fish at the average rate of 3.6 fish per hour. In spite of excellent fishing success only half as many fishing trips were recorded in 1962 as compared with 1961. The 1962 total hours and total fishing trips were the lowest recorded figures in this category in the past six years on East Okoboji Lake.

WEST OKOBOJI LAKE

West Okoboji Lake is (maximum depth 130 feet), highly eutrophic and provides excellent fishing for several species. Comprehensive creel census data was gathered on this 3,939 acre lake over a 10 month period from May through February, 1962-63. A limited amount of fishing occurred in March and April but insufficient to warrant a full scale census. In order to provide comparisons the results are presented and discussed as open water fishing and winter fishing.

Open water fishing: For the second consecutive season the yellow perch provided the best fishing among the eleven species reported (Table 2). Perch comprised over 50 per cent of the

TABLE 1. Total harvest of fish, as determined by comprehensive creel census from East Okoboji Lake during the open water fish period of May through October inclusive, 1962

Species	May	June	July	August	September	October	Totals or Average	Average Weight Per Fish
Bluegill		2,892	1,070	1,105	982		6,049	.41
Crappie	2,748	1,527	156	379	1,127		5,937	.45
Walleye	395	746	475	98	246	80	2,040	1.83
White Bass	424	57		38	46		565	1.52
Northern Pike		127	87	25			239	3.23
Bullheads	32,694	56,958	27,951	12,789	6,789		137,650	.50
Largemouth Bass		554	313	33	179		1,079	3.00
Perch	108	356	290	355	10,996	21,808	33,913	.56
Sheepshead		2,207	232	75	142	72	2,728	1.94
Carp		39	90				129	4.60
TOTALS	36,369	65,463	30,664	14,766	20,507	21,960	189,729	.51
Total Anglers	2,356	7,669	4,048	3,209	2,386	1,706	21,374	
Total Hours	6,495	18,681	9,060	7,555	5,718	3,846	51,355	
Fish Per Man	15.71	8.54	7.58	4.60	8.50	12.87	8.8	
Fish Per Hour	5.70	3.50	3.38	1.95	3.59	5.71	3.6	

TABLE 2. Total harvest of fish, as determined by comprehensive creel census methods, from West Okoboji Lake during the open water fishing period of May through November of 1962

Species	May	June	July	August	September	October	November	Totals or Average	Average Weight Per Fish
Bluegill		2,243	4,983	1,636	228	150		9,150	.42
Crappie	8	873	4,525	184	300	379		6,282	.43
Walleye	307	618	841	629	603	87	69	3,154	1.45
White Bass	195				229	34		458	1.29
Northern Pike	65	124	133	117	177	83		699	4.40
Bullhead	7,411	2,939	9,892	2,824	1,827			24,895	.53
Largemouth Bass	830	1,302	152	83	114	385		2,866	2.70
Smallmouth Bass		69	335	342	38			784	2.17
Perch	1,181	9,984	3,941	5,016	16,712	5,308	13,442	55,584	.51
Sheepshead	957	1,222	797	258	69	32		3,335	1.93
Carp		112	144		73			329	5.21
TOTALS	10,967	19,486	25,653	11,089	18,543	6,458	13,511	107,534	.70
Total Anglers	1,742	3,075	3,861	2,792	2,014	1,342	1,990	16,816	
Total Hours	4,162	8,118	8,138	6,724	4,992	3,368	4,350	39,852	
Fish Per Man	6.58	6.34	6.64	3.97	9.21	4.81	6.79	6.4	
Fish Per Hour	2.76	2.40	3.15	1.65	3.71	1.92	3.11	2.8	

catch of 107,534 fish estimated for the seven months of open water fishing. Bullheads were second in importance making up 23 per cent. Bluegills, crappie, sheepshead and walleye were next in that order of importance, each comprising less than 10 per cent of the fish taken.

July provided the best fishing from the standpoint that four species were important in the catch and fishermen were catching 3.1 fish per hour. Perch fishing in September provided 3.7 fish per hour but not as many fish were caught as in July.

As was the case in the East Okoboji the number of fishing trips was about one-half the number recorded for the same period in 1961. Nineteen pounds of fish per acre were caught in 1962 as compared to 31 pounds in 1961, in spite of the excellent fishing success of 2.8 fish per hour for the season. Two things appear to have influenced the apparent shift in fishing. One concerned the weather during 1962 that kept many fishermen from making their normal number of trips to the lake. A violent wind and 10 inch rain on successive week-ends lead the list of adverse weather conditions. The second item involves the ability of the creel census clerk to secure adequate fisherman counts. The latter item is believed to be of lesser importance but will be checked out in 1963 through special aerial counts of fishermen.

Winter fishing: West Okoboji has consistently attracted winter fishermen since it was legalized in 1950. Perch continued to lead in the number of fish taken, and comprised about 90 per cent of the catch of over 42,000 fish (Table 3). Bluegills were second in importance making up slightly less than 10 per cent of the catch. Walleye fishing was the poorest in recent years; less than 300 fish were recorded for the entire winter season.

Some observers believed that the winter weather of 1962-63 kept many fishermen off the ice. A prolonged severe cold period prevailed during the month of January. Fishing shanties numbered 174 as compared to nearly 500 in the early 1950's. This indicated that more fishermen are fishing in the open or from an automobile and therefore they have a tendency to wait for warm weather periods to fish. Whatever the reason, the total fishing trips and hours spent fishing was considerably less than the previous season.

Combining both open water fishing and winter fishing we find that West Okoboji provided six fishing trips and 15 hours of fishing per acre of water, 60 per cent occurring during the open water period. Thirty-eight fish weighing 27 pounds per acre were taken in 1963.

SPIRIT LAKE

This is the 18th consecutive year in which some type of creel census data has been collected on the largest natural lake in Iowa (5,684 acres). The comprehensive creel census data presented for this lake covers a 10 month period from May through February 1962-63. A limited amount of fishing occurred during March and April but insufficient to carry on a full scale census. Data collected for the month of November was included in the winter fishing period.

Open water fishing: For the first time in several years yellow perch outnumbered bullheads, but by only a narrow margin, with walleyes a close third. The three species made up 33, 32 and 19 per cent of the total catch respectively. Walleye and perch were almost of equal importance by weight, each comprising 22 per cent of the weight, while the bullheads lead at 33 per cent. White bass were fourth in importance by both numbers and weight. Only half as many white bass were taken during the 1962 season as in 1961, but the total weight of those taken in 1962 was greater. The average size of white bass increased from slightly over 0.7 pounds to 1.4 pounds.

TABLE 3. Total harvest of fish, as determined by comprehensive creel census methods, from West Okoboji Lake during the winter fishing period of December, January and February, 1962-63

Species	December Number	January Number	February Number	Totals Number	Average Weight Per Fish
Bluegill	12	3,041	965	4,018	.40
Crappie		234	106	340	.40
Walleye	74	138	83	295	1.78
Northern Pike	20	96	78	194	4.78
Largemouth Bass		14	3	17	3.70
Perch	14,199	15,956	7,474	37,629	.35
TOTALS	16,132	19,479	8,709	42,493	
Total Anglers	2,596	3,026	1,258	6,880	
Total Hours	6,945	9,308	4,583	20,836	
Fish Per Man	6.21	6.44	6.92	6.2	
Fish Per Hour	2.32	2.09	1.90	2.04	

Freshwater drum were the most important among the six other species recorded. These six species accounted for less than 10 per cent of the catch. The twenty-four inch length limit on northern pike has curtailed the harvest of this species. Thus the average size of these on the stringer was considerably above the average that fishermen would normally take.

Excellent perch fishing during the month of October provided the highest success rate but the month of May provided the greatest number of fish. Over half the walleyes and two-thirds of the bullheads were taken during the months of May and June. (Table 4).

Data collected during the summer by the creel census clerk in relation to a population estimate and growth rate of the walleye indicated that the 1960 year class became increasingly important in the catch as the summer progressed. This year class made up only three per cent of the fish observed during May, increased to 18 per cent during June and reached a peak of 59 per cent in October. Fishermen creeled fewer walleyes under 12 inches in 1962 than during 1961. The walleye fishery during both seasons was quite dependent on fish in their third year of life. This dependency on fish in their third year is even more important when examined in the light of the 1961 exploitation rate calculated at nearly 50 per cent of the walleyes over 12 inches long at the start of the season. A serious failure in reproduction in any one year shifts the fishing pressure to the older fish that have already experienced a possible 50 per cent mortality.

Fishing pressure measured by angler trips and hours of fishing remained about the same as for 1961; there were a few more fishermen but they spent less time fishing. Fewer fish were caught in 1962 largely due to a 150 per cent reduction in the number of bullheads caught.

Winter fishing: Winter fishing during the ice covered period of 1962-63 improved considerably over the same period of 1961-62. Increases were recorded in both the walleye and perch catch, especially the perch. The number of walleyes in the creel increased from slightly over 3,000 in 1961-62 to well over 6,000 the past season; the total perch catch jumped from slightly less than 3,000 fish to over 17,000 fish. (Table 5)

Not as many large walleye were recorded in the winter fishery as compared to former years. This is reflected in the average weight of only 1.6 pounds as compared to a two or three pound average in the past several winters. About 50 per cent of the walleyes on the stringer were fish that were less than 12 inches long at the start of the season in May. The average size of perch caught during the winter fishery remained about the same as those of 1961-62. A few crappies, white bass and northern pike completed the species list for the winter fishing. These three accounted for less than two per cent of the total catch for the winter season.

The winter fishery accounted for 22 per cent of all the fish taken during the ten month season, 30 per cent of the total walleye and 37 per cent of the perch. The winter catch represents about one walleye and 3 perch per surface acre.

During the ten month census period, Spirit Lake provided an estimated nine trips and 23 hours of fishing per acre and a harvest of 18 fish weighing 17 pounds.

TABLE 4. Total harvest of fish, as determined by comprehensive creel census methods, from Spirit Lake during the seven months of open water fishing from May through November of 1962

Species	May	June	July	August	September	October	Totals or Average	Average Weight Per Fish
Bluegill		97	442	218	284	7	1,048	.34
Crappie	69	62	20	12	30	146	339	.67
Walleye	6,255	6,550	1,667	158	522	526	15,678	1.13
White Bass	2,305	999	1,220	1,330	359	162	6,375	1.41
Northern Pike	118	159	89	10	67	48	491	4.25
Bullhead	15,573	4,057	6,203	472	327	11	26,643	1.00
Largemouth Bass		207	78	23	19		327	1.86
Smallmouth Bass	15	13		21	55	25	129	1.39
Perch	410	4,698	2,820	630	8,241	10,990	27,789	.64
Sheepshead	427	502	1,250	565	220	32	2,996	1.55
TOTALS	25,172	17,344	13,789	3,439	10,124	11,947	81,815	.97
Total Anglers	10,506	10,724	8,901	4,464	4,996	3,866	43,457	
Total Hours	28,487	28,420	20,623	9,552	13,712	11,033	111,827	
Fish Per Man	2.40	1.62	1.56	.77	2.03	3.09	1.87	
Fish Per Hour	.88	.61	.67	.36	.74	1.08	.73	

TABLE 5. Total harvest of fish, as determined by comprehensive creel census methods, from Spirit Lake during the four months of winter fishing from November through February, 1962-63

Species	November Number	December Number	January Number	February Number	Totals Number	Average Weight Per Fish
Crappie		13	24	17	54	.66
Walleye	23	4,099	1,730	612	6,464	1.60
White Bass		71			71	1.95
Northern Pike		97	46	93	236	6.10
Perch	1,985	10,193	3,852	1,151	17,181	.74
TOTALS	2,008	14,473	5,652	1,873	24,006	1.02
Total Anglers	732	5,280	2,311	847	9,170	
Total Hours	2,000	15,013	7,083	2,502	26,598	
Fish Per Man	2.74	2.74	2.45	2.21	2.61	
Fish Per Hour	1.00	.96	.80	.75	.82	

RESULTS OF A WALLEYE AND SAUGER TAGGING STUDY IN THE IOWA WATERS OF THE MISSISSIPPI RIVER

Roger Schoumacher
Fisheries Biologist

INTRODUCTION

Walleye and sauger are two of the most important game fish in the upper Mississippi River. In 1957, tagging studies were begun to determine their movement and utilization by anglers. A portion of the population was tagged and fishermen were relied upon to report the recapture of tagged fish. The location chosen for the study is immediately below Lock and Dam #10 at Guttenburg, Iowa, an area known to have good walleye and sauger populations. Tagging began in 1957 and continued through 1959.

METHODS

The fish were collected with electro-fishing gear between 5:30 and 10:30 P.M. along the shorelines within one mile below Lock and Dam #10. In addition to the "shocker" boat, one or more "pick-up" boats were used. These followed the shocker and picked up fish which, because of the strong currents, often surfaced as much as several hundred feet behind the electrodes. Periodically the fish were taken to a two of three man crew for processing.

Each fish 11 inches or longer (total length) was measured to the nearest 1/10 inch, weighed to the nearest 1/100 pound, sexed, tagged, and released, Number 3 monel metal self-piercing jaw or strap tags were applied to the left maxilla. The tags were serially numbered and identified as belonging to the Iowa Conservation Commission.

Fishermen were advised of the tagging operations and alerted to watch for, and report, the capture of a tagged fish.

RESULTS AND DISCUSSION

Number of fish tagged: During the three years, 1,149 walleye and 1,836 sauger were tagged (Table 1).

Length frequency of the catch: Eighty-one per cent of the male walleye were 12 to 17 inches long, with few longer (Table 2). The length frequency of the females peaked between 13 and 16 inches and again between 20 and 23 inches. There were few immature walleye over 14 inches.

Eighty-two per cent of the male sauger were 12 to 16 inches long, whereas the majority of the females (83%) were between 13 and 18 inches. Few immature sauger were over 14 inches.

The length frequency of the walleye catch varied from year to year (Table 3), probably reflecting year class strength. Preliminary age and growth studies indicate the 1954 year class was especially strong, and 1952 and 1956 were also good years. Weaker year classes were

TABLE 1. Number of walleye and sauger tagged in various years

Year	Walleye		Sauger		Total	
	No.	%	No.	%	No.	%
1957	393	34	749	66	1,142	100
1958	331	43	436	57	767	100
1959	425	39	651	61	1,076	100
Total	1,149	38	1,836	62	2,985	100

TABLE 2. Numbers of walleye and sauger tagged in 1957 - 1959 in one inch length groups. Percentages in each group are in parenthesis.

Species	Sex	Length (inches) 11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Total
Walleye	Male	10	34	54	42	54	47	22	10	6	2		1	1	3				1			287
		(3)	(12)	(19)	(15)	(19)	(16)	(8)	(3)	(2)	(1)		(Tr.)	(Tr.)	(1)				(Tr.)			(100)
	Female	4	40	64	62	61	38	41	25	34	64	72	46	23	18	2	9	5	3	1	1	613
		(1)	(6)	(10)	(10)	(10)	(6)	(6)	(4)	(6)	(10)	(12)	(8)	(4)	(3)	(Tr.)	(1)	(1)	(Tr.)	(Tr.)	(Tr.)	(100)
	Immature	73	77	46	11		1															208
		(35)	(37)	(22)	(5)		(1)															(100)
	Not sexed		10	15	8	2	1				1	2	1	1								41
			(25)	(37)	(20)	(5)	(2)				(2)	(5)	(2)	(2)								(100)
	Totals	87	161	179	123	117	87	63	35	40	67	74	48	25	21	2	9	5	4	1	1	1149
		(8)	(14)	(16)	(11)	(10)	(8)	(5)	(3)	(3)	(6)	(6)	(4)	(2)	(2)	(Tr.)	(1)	(Trace .....)				(100)
Sauger	Male	35	113	86	63	45	23	9	5	1												380
		(9)	(30)	(23)	(17)	(12)	(6)	(2)	(1)	(Tr.)												(100)
	Female	4	78	179	219	233	196	143	76	28	8	1	1	2								1168
		(Tr.)	(7)	(15)	(19)	(20)	(17)	(12)	(7)	(2)	(1)	(Trace ...)										(100)
	Immature	39	91	39	13	5	1	2	1													191
		(20)	(48)	(20)	(7)	(3)	(Tr.)	(1)	(Tr.)													(100)
	Not sexed		11	19	26	12	12	10	5	1			1									97
			(11)	(20)	(27)	(12)	(12)	(10)	(5)	(1)			(1)									(100)
	Totals	78	293	323	321	295	232	164	87	30	8	1	2	2								1839
		(4)	(16)	(18)	(17)	(16)	(13)	(9)	(5)	(2)	(Trace .....)											(100)

TABLE 3. Per cent of walleye and sauger in one inch length groups taken below Lock and Dam #10 in 1957, 1958, and 1959

Year and Species	Length Group (inches) 11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Total
Walleye																					
1957	7	21	28	14	4	4	3	2	2	4	4	2	2	1		1	Tr.	Tr.			
1958	17	13	9	5	13	11	9	4	2	3	2	5	3	2	Tr.	1	1				
1959	Tr.	8	9	12	13	8	6	4	6	10	12	6	2	2		Tr.		Tr.	Tr.	Tr.	
Sauger																					
1957	7	14	15	17	14	15	11	6	1	Tr.	Tr.	Tr.	Tr.								
1958	5	16	22	19	15	9	8	4	2	Tr.											
1959	1	18	18	17	19	13	7	4	2	1			Tr.								

produced in 1953 and 1955.

The length frequency of the sauger populations did not show large annual variations.

Sex Ratio: The sex ratio of walleye was about equal in 1957 and 1958, but fell to a ratio of about 1 male to 7 females in 1959 (Table 4). The sex ratio of sauger varied considerably from year to year, and averaged 1 male to 3 females over the three year period.

These fish were caught during a pre-spawning aggregation. Many of the females were still green, and ripening could be detected as the tagging progressed during each year. Eschmeyer (1950) cites several studies, all of which found a preponderance of males in walleye populations during the spawning period on the spawning grounds. This is probably due to two facts (Niemuth, Churchill, and Wirth, 1959):

1. Males arrive on the spawning grounds before females and stay longer.

2. Males often mature one year earlier than females.

Since the area from which fish were collected in this study is not believed to be a spawning area, many of the males were probably already on the spawning grounds.

Number of tags returned: Tags were returned by fishermen from 176 walleye and 289 sauger. Returns were about the same for both species - 15 per cent for walleye and 16 per cent for sauger (Table 5). Males of both species were taken at a lower rate than females, and immatures were taken at a higher rate than adults.

However, immature walleye were returned at a lower rate than adults the first year after tagging (Table 6). After that the rate was higher than for adults. This is due to two reasons:

1. Failure of anglers to keep small fish.

2. Longer life expectancy after tagging of younger (immature) fish.

Immature sauger were taken at a higher rate than adults during the first 6 months after tagging, and none were taken more than 2 years after tagging.

Hubley (1963), using the same type of tags on walleye and sauger in pool 7 of the Mississippi River had a recapture percentage of 7.9 for walleye and 5.0 for sauger. He found that dart tags gave a higher return for both species (13.2 and 12.6 per cent respectively).

Length frequency of recaptured fish: The length frequency of the recaptured fish corresponded very closely with the length frequency of the tagged fish (Table 7).

Distance travelled by recaptured fish: Fifty-three per cent of the walleye and 63 per cent of the sauger were recaptured within 5 miles of the tagging site (Table 8). Eighty-four per cent of both walleye and sauger were retaken less than 50 miles away, and only 3 per cent of the walleye (all females) and 4 per cent of the sauger were recaptured at distances greater than 100 miles.

Hubley (op. cit.) found that 78 per cent of the walleye and 80 per cent of the sauger

TABLE 4. Sex ratios of tagged walleye and sauger

Walleye

Year	Male		Female	
	No.	%	No.	%
1957	133	48	144	52
1958	103	47	114	53
1959	51	13	355	87
Totals	287	32	613	68

Sauger

Year	Male		Female	
	No.	%	No.	%
1957	213	38	356	62
1958	79	21	297	79
1959	88	15	515	85
Totals	380	25	1,168	75

TABLE 5. Number of tagged walleye and sauger recaptured. Percentages in each group are in parenthesis

Species	Year Tagged	Male	Female	Adult	Immature	Not Sexed	Total
Walleye	1957	16 (12)	25 (17)	41 (69)	13 (17)	5 (12)	59 (15)
	1958	8 (8)	35 (31)	43 (64)	24 (21)		67 (20)
	1959	5 (10)	42 (12)	47 (94)	3 (16)		50 (12)
	Totals	29 (10)	102 (17)	131 (74)	40 (19)	5 (12)	176 (15)
Sauger	1957	30 (14)	88 (25)	118 (81)	11 (13)	16 (16)	145 (19)
	1958	5 (6)	60 (20)	65 (84)	12 (20)		77 (18)
	1959	7 (8)	53 (10)	60 (89)	7 (15)		67 (10)
	Totals	42 (11)	201 (17)	243 (84)	30 (16)	16 (16)	289 (16)

TABLE 6. Percentages of walleye and sauger taken at various time intervals after tagging

Sex and Species		Time Interval				
		Less than 6 mths.	6 mths. - 1 yr.	1 yr. - 2 yrs.	2 yrs. - 3 yrs.	Over 3 yrs.
Walleye	Male	66	14	14	6	0
	Female	60	9	18	9	4
	Adults (male plus female)	61	10	17	9	3
	Immature	50	7	28	10	5
Sauger	Male	57	29	12	0	2
	Female	55	31	10	2	2
	Adults (male plus female)	56	30	10	2	2
	Immature	73	10	17		

TABLE 7. Numbers of tagged walleye and sauger recaptured expressed as total length of fish at time of tagging. Percentages in each group are in parenthesis.

Sex	Walleye Total Length (inches) 11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Totals
Male	1 (3)	6 (21)	6 (21)	3 (11)	3 (11)	6 (21)	1 (3)		1 (3)			1 (3)		1 (3)							29 (100)
Female	3 (3)	2 (2)	15 (14)	8 (8)	15 (14)	5 (5)	9 (9)	4 (4)	5 (5)	10 (10)	7 (7)	8 (8)	2 (2)	8 (8)				1 (1)			102 (100)
Immature	13 (32)	18 (45)	6 (15)	3 (8)																	40 (100)
Not sexed		1 (20)	2 (40)	2 (40)																	5 (100)
Totals	17 (10)	27 (16)	29 (17)	16 (9)	18 (10)	11 (6)	10 (6)	4 (2)	6 (3)	10 (6)	7 (4)	9 (5)	2 (1)	9 (5)				1 (Tr.)			176 (100)
	Sauger																				
Male	2 (5)	8 (19)	10 (24)	12 (28)	8 (19)	2 (5)															42 (100)
Female	1 (Tr.)	22 (11)	33 (17)	42 (21)	43 (22)	20 (10)	25 (12)	9 (4)	5 (2)				1 (Tr.)								201 (100)
Immature	7 (24)	14 (46)	6 (20)	2 (7)	1 (3)																30 (100)
Not sexed		1 (6)	5 (31)	3 (19)	1 (6)	2 (13)	3 (19)	1 (6)													16 (100)
Totals	10 (3)	45 (16)	54 (19)	59 (20)	53 (18)	24 (8)	28 (10)	10 (3)	5 (2)				1 (Tr.)								289 (100)

TABLE 8. Numbers of walleye and sauger recaptured at various distances from the tagging site. Percentages in each group are in parenthesis.

Species	Sex	Minimum distance travelled (miles) 0-5	6-24	25-49	50-74	75-99	100-124	Totals
Walleye	Male	18 (62)	3 (10)	5 (18)	2 (7)	1 (3)		29 (100)
	Female	51 (50)	14 (15)	19 (19)	7 (6)	6 (6)	5 (5)	102 (100)
	Immature	21 (53)	2 (5)	12 (30)	4 (10)	1 (2)		40 (100)
	Totals	90 (53)	19 (11)	36 (20)	13 (8)	8 (5)	5 (3)	171 (100)
Sauger	Male	29 (69)	1 (2)	8 (19)	2 (5)		2 (5)	42 (100)
	Female	119 (59)	7 (3)	39 (20)	18 (9)	10 (5)	8 (4)	201 (100)
	Immature	23 (78)		4 (13)	1 (3)	1 (3)	1 (3)	30 (100)
	Totals	171 (63)	8 (3)	51 (18)	21 (8)	11 (4)	11 (4)	273 (100)

recaptured in his study were taken within 2 miles of the tagging site. None travelled over 39 miles.

Direction of movement of recaptured fish: Thirty-five per cent of the walleye were recaptured upstream from the tagging site and 19 per cent downstream (Table 9). Twenty-two per cent of the sauger were recaptured upstream and 16 per cent down.

Recaptures in home pool: Fifty-nine per cent of the walleye and 65 per cent of the sauger were recaptured in the pool in which they were tagged. Hubley (op. cit.) found movement out of the home pool to be insignificant.

Recaptures at lock and dams and in tributaries: Of the recaptured fish, 68 per cent of the walleye and 89 per cent of the sauger were taken in the vicinity of lock and dams. Six per cent of the walleye were taken in tributary streams - nine in the Wisconsin River and one in the Kickapoo River (Wisconsin). Four per cent of the sauger were taken in the tributaries - ten in the Wisconsin River and one each in the Turkey and Upper Iowa River (Iowa).

Time interval between tagging and recapture: Of walleye recaptures, 59 per cent were retaken within 6 months after tagging, and 86 per cent within 18 months (Table 10). Fifty-nine per cent of the sauger recaptures were taken within 6 months, and 95 per cent within 18 months. "Resident" fish - those caught at the tagging site - averaged 147 days out before recapture, whereas "travellers" averaged 271 days out.

Month of recapture: Forty-eight per cent of the walleye and 53 per cent of the sauger recaptures were made during April and May (Table 11). July and June were the next most important months, in that order, for walleye, and June and October for sauger. Hubley (op. cit.) found May and June to be the most important months. April, however, was closed to walleye and sauger fishing in the area he studied.

LITERATURE CITED

Eschmeyer, Paul H.

1950. The life history of the walleye, Stizostedion vitreum vitreum (Mitchell), in Michigan. Bulletin #3. Institute of Fisheries Research, Michigan Conservation Department.

Hubley, Raymond C., Jr.

1963. The second year of walleye and sauger tagging on the upper Mississippi River. West Central Area Investigational Memorandum #6, March, 1963, Wisconsin Conservation Department.

Niemuth, Wallace, Warren Churchill, and Thomas Wirth

1959. The walleye: Its life history, ecology, and management. Publication #227, Wisconsin Conservation Department.

TABLE 9. Numbers of walleye and sauger recaptured at locations up and down stream from the tagging site. Percentages in each group are in parenthesis.

Sex	Upstream Recaptures	Downstream Recaptures	Total Recaptures
	Walleye		
Male	7 (24)	6 (21)	29 (100)
Female	34 (33)	24 (24)	102 (100)
Immature	18 (45)	2 (5)	40 (100)
Totals	59 (35)	32 (19)	171 (100)
	Sauger		
Male	10 (24)	4 (10)	42 (100)
Female	44 (22)	39 (19)	201 (100)
Immature	6 (20)	1 (3)	30 (100)
Totals	60 (22)	44 (16)	273 (100)

TABLE 10. Numbers of walleye and sauger recaptured at various time intervals after tagging. Percentages in each group are in parenthesis.

Sex	Time Interval (days) 0-7	8-29	30-89	90-179	180-359	360-539	540-719	720-1079	1080-1439	1440-1779	Total
					Walleye						
Male	3 (10)	4 (14)	9 (31)	4 (14)	3 (10)	4 (14)		2 (7)			29 (100)
Female	9 (9)	11 (11)	23 (22)	18 (17)	9 (9)	16 (16)	2 (2)	9 (9)	2 (2)	3 (3)	102 (100)
Immature	1 (2)	9 (23)	6 (15)	4 (10)	3 (7)	11 (28)		4 (10)	2 (5)		40 (100)
Totals	13 (8)	24 (14)	38 (22)	26 (15)	15 (9)	31 (18)	2 (1)	15 (9)	4 (2)	3 (2)	171 (100)
					Sauger						
Male	2 (5)	9 (21)	9 (21)	4 (10)	12 (29)	3 (7)	2 (5)		1 (2)		42 (100)
Female	22 (11)	38 (19)	35 (17)	16 (8)	57 (29)	21 (11)	4 (2)	5 (2)	2 (1)	1 (Tr.)	201 (100)
Immature	2 (7)	11 (37)	7 (23)	3 (10)	3 (10)	4 (13)					30 (100)
Totals	26 (10)	58 (21)	51 (20)	23 (8)	72 (26)	28 (10)	6 (2)	5 (2)	3 (1)	1 (Tr.)	273 (100)

TABLE 11. Numbers of walleye and sauger recaptured in various months of the year. Percentages in each group are in parenthesis.

Sex	Month Recaptured J	F	M	A	M	J	J	A	S	O	N	D	Totals
							Walleye						
Male			1 (3)	7 (25)	9 (32)	3 (10)	2 (7)		5 (17)	1 (3)	1 (3)		29 (100)
Female	4 (4)		2 (2)	24 (23)	20 (19)	15 (15)	17 (17)	8 (8)	5 (5)	3 (3)	4 (4)		102 (100)
Immature			1 (3)	8 (20)	14 (34)	7 (17)	3 (8)		5 (12)	1 (3)		1 (3)	40 (100)
Totals	4 (2)		4 (2)	39 (23)	43 (25)	25 (15)	22 (13)	8 (5)	15 (9)	5 (3)	5 (3)	1 (Tr.)	171 (100)
							Sauger						
Male	2 (5)	1 (2)	3 (7)	12 (29)	10 (24)	3 (7)	3 (7)		1 (2)	1 (2)	4 (10)	2 (5)	42 (100)
Female	8 (4)	4 (2)	11 (5)	57 (29)	48 (24)	19 (10)	4 (2)	4 (2)	8 (4)	20 (10)	11 (5)	7 (3)	201 (100)
Immature			2 (7)	9 (30)	12 (40)	2 (7)	1 (3)	1 (3)		2 (7)	1 (3)		30 (100)
Totals	10 (4)	5 (2)	16 (6)	78 (28)	70 (25)	24 (9)	8 (3)	5 (2)	9 (3)	23 (9)	16 (6)	9 (3)	273 (100)

FURTHER STUDIES OF THE EFFECTS OF THERMAL STRATIFICATION ON THE GROWTH OF BLUEGILL

Jim Mayhew
Fisheries Biologist

Each year, beginning in the latter part of May, the vertical movements of fish are greatly restricted in most Iowa artificial lakes (Jim Mayhew, 1962. Thermal stratification and its effects on fish and fishing in Red Haw Lake, Iowa. Special Scientific Publication. Biology Section, State Conservation Commission. 23 pp.) In Red Haw Lake, this stratum comprises less than 30 per cent of the total lake volume. An abrupt change in environmental conditions such as this restricts the total fish population or population potential in direct proportion to the capacity of the epilimnion. Confinement of the total fish population into a region considerably less than the total volume available should result in either a severe reduction of the population or retarded fish growth.

A sudden interruption of normal growth can usually be identified in the scales of fishes as a false or accessory year mark. The creation of supernumery annuli is a rather common occurrence in fish subjected to changes in the normal pattern of life. Some known causes of false annuli are changes in food supply, unsatisfactory chemical and/or physical conditions - such as extreme periodic turbidity, or a change from one type of food or another. One worker detected the forming of an accessory year mark with the commencing of bottom dredging in another portion of the lake.

METHODS OF GROWTH ANALYSIS

In order to test the impact of severe thermal stratification on the growth of bluegill in Red Haw Lake, scale samples were obtained from 20 bluegill at predetermined time intervals ranging from 15 to 30 days over a 2-year period. All bluegill were 2 years old with a maximum standard length range of 0.5 inches during individual sampling periods. The scales were inspected by microprojection in corresponding sampling groups (each sampling date as one sampling group) for discrepancies in age and other scale marks foreign to this age group. Each annulus was located and marked on a paper tagboard strip. As a cross check of the location of annuli, the scales were read and tabbed twice. The standard length at each annulus and the growth attained between the formation of the last annulus and the edge of the scale were calculated with a straight proportion nomograph. The scales from the first year's sampling were both read and tabbed by fellow fisheries biologist, Tom Moen, to prevent inherent bias by the author due to interest in the study. Mr. Moen read the scales without prior knowledge of what project the scale samples were from, or why he was requested to do the scale analysis. Further scale analysis, without tabbing the annuli locations, were made by the author to verify the information. During the second year the author made all scale and growth analysis.

FORMATION OF THE ANNULUS AND SUMMER GROWTH PATTERN

Annulus formation and initial annual growth begins prior to May 1 in Red Haw Lake. In the samples taken on this date, mean calculated growth was approximately 7 millimeters (Figure 1). By May 15, the average calculated growth had increased to 46 millimeters. Fifteen days later growth was exactly the same. During the next 3 sampling periods the pattern of growth

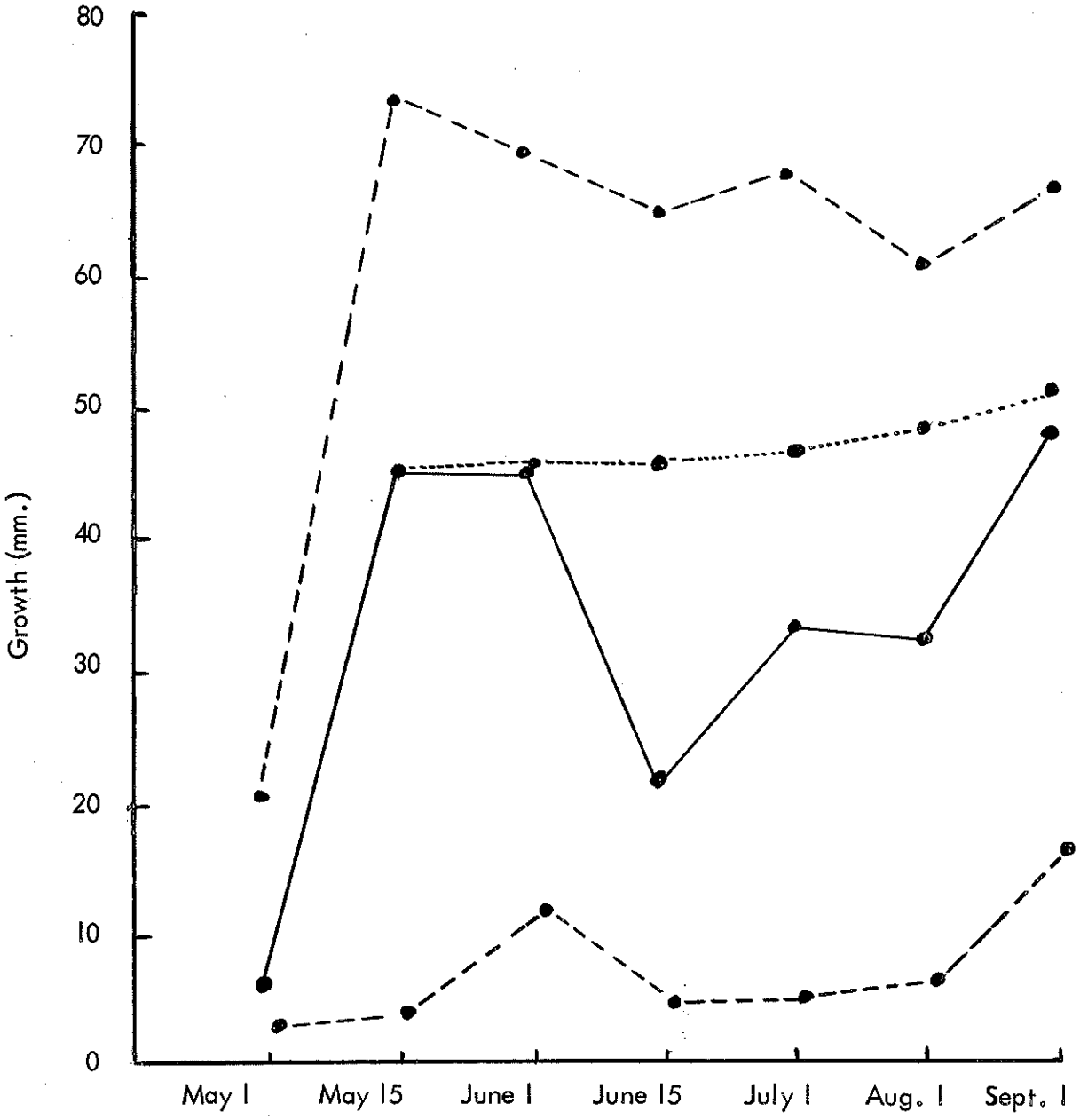

Figure 1. Mean calculated growth of bluegill in millimeters from the formation of the annulus to September. Solid line represents mean calculated growth. Dotted line represents projected mean gowth when only scales without false annuli are used in calculation. Broken lines represent maximum-minimum calculated growth.

and calculated growth from annulus formation changed abruptly. On June 15, the mean calculated growth decreased from the previous sampling period to 23 millimeters, but was significantly lower than the calculated growth prior to June 1. Finally on the last sampling period, September 1, the mean annual increment increased abruptly to 49 millimeters.

Closer inspection of the data and scale tabs revealed that although the fish varied only 0.5 inches in standard length, many of the fish were called 3 and 4 year old, when actually they were all age group II. This indicated that the aging error was the direct results of the formation of accessory year marks.

Distinct regions of retarded growth were commonly found between the first and second annuli (Table I). The per cent of occurrence ranged from 60 to 85 per cent in the scale samples. Circuli formation after the second annulus also indicated interference of normal growth pattern immediately after the lake became stratified. These accessory marks varied considerably in occurrence. In the first sampling period they were totally absent. Per cent of occurrence in individual sampling periods increased until June 15, when 50 per cent of the scale samples had accessory year marks.

TABLE I. The occurrence of false annuli in the second and third years of growth in bluegill from Red Haw Lake

Date of Sample	No. Fish in Sample	Per Cent Occurrence Age I	Mean St. L. Annulus Occurred	Per Cent Occurrence Age II	Mean St. L. Annulus Occurred
May 1	39	78	54	0	--
May 15	40	75	55	16	128
June 1	39	65	56	20	121
June 15	40	80	59	50	133
July 1	38	60	64	50	124
August 1	39	75	50	30	130
September 1	40	85	59	25	122

Abrupt interruption in growth and the formation of a false annulus in the third year of life would account for the radical change and decline in calculated growth after June 1. As shown in Figure 1, calculated growth increased until this date, and then decreased until September 1. Prior to the formation of the false annulus, growth calculations were made from the true year mark, or that annulus formed during the previous winter. After the accessory mark was formed, measurements were apparently made from this mark instead of the true scale mark. This would clearly cause the calculated growth to decrease immediately after the false annulus was formed. Consequently, all calculations would be made from the accessory mark on scales upon which it was found. The maximum effect of this false annulus would not be attained unless it appeared in all scale samples. In the third year of growth it appeared in approximately 50 per cent of the samples. Mean calculated growth would therefore be reduced only to this degree.

Further calculations of mean growth were made using only the scale samples that did not possess false annuli in the third year of life. When these data were plotted on the same curve as those with false annuli, the trend of decreased growth after June 1 was not present. After this date growth continued to increase slowly throughout the sampling periods (Figure 1). This further explains the apparent decrease in calculated growth after the lake becomes stratified and

scales with false annuli are included in the samples.

DISCUSSION

It is difficult to understand the actual impact of extreme thermal stratification on the growth of fishes. There is no doubt that at least a majority of bluegill develop false annuli at the identical point of severe stratification and hypolimnion stagnation. At this approximate time, growth is also greatly retarded in relation to its pre-stratification pattern. Later in the summer, growth increases significantly with the advent of eplimnion expansion and the beginning of fall overturn. This information strongly indicates stratification is a primary controlling factor in growth of bluegill in Red Haw Lake. No data are available for other species of fish, but it is assumed that they would be effected in a similar manner. It is also quite possible that other species might be effected in direct relation to the effect thermal stratification has upon the vertical movements during the summer stagnation.

DESOTO BEND CREEL CENSUS, 1963

Bill Welker
Fisheries Biologist

INTRODUCTION

A cooperative fishery investigation of DeSoto Bend Lake in western Iowa was initiated by Iowa and Nebraska biologists in 1962. A creel census composed part of the investigation and was to be conducted on an alternate year basis by each state, beginning with Nebraska in 1963. This census was conducted between May 1 and September 15, which is the only open fishing period allowed at the lake during the year because of the waterfowl management program. This paper reports upon the total fishermen visitation, total fish caught, species composition of the catch, total pounds caught per surface acre, and catch per unit of effort.

DeSoto Bend Lake is part of the Federal DeSoto Bend Refuge located in the southwest corner of Harrison County, Iowa and is managed primarily for waterfowl. The lake was formed in 1960 from a 7 1/2-mile bend in the main channel of the Missouri River by construction of impervious levees across the upper and lower ends of the bend. Water control structures were built into both levees connecting the lake with the new Missouri River channel. The lake has slightly more than 700 surface acres and the width varies between 700 and 1,200 feet. Depth survey work along the long center axis of the lake indicates the mean depth is between 10 and 15 feet. The area has only two access roads.

This lake inherited the fish population of the old Missouri River channel. Recent surveys have found that rough fish, especially gizzard shad, numerically dominate this population. Other rough fish in the lake include carp, carpsucker, buffalo, freshwater drum, and goldeye.

Crappie, bluegill, channel catfish and largemouth bass are the most numerous game fish in the lake and in approximately that order of abundance.

METHODS

Since the lake has only two access roads, a "visitor contact upon leaving" type of creel census was considered best. Fishermen were interviewed only after they had completed their fishing trip.

Each work day had two possible 8-hour sampling periods: 6 a.m. to 2:30 p.m. or 2 p.m. to 10 p.m.. The census clerk worked one of these periods each work day, six days a week, including Saturday, Sunday, and holidays. The period worked each day and the access chosen for the interview station were randomly selected.

Instructions were given the clerk to stop all cars leaving the area by his station and interview the occupants if the traffic was not too heavy. During periods of heavy traffic, such as on weekends and holidays, the clerk selected cars to stop which reduced the delay to other outgoing traffic; however, he continued to count the total number of vehicle axles leaving the area. Electric car counters at each access were also used to count the total number of axles leaving the area each day. Information gathered in the interview included:

1. Number and sex of fishermen in party
2. Number of hours fished
3. Method fished (casting, still-fishing, flyfishing, or trolling)
4. Bait used (artificial, prepared or natural)
5. Number and kind of fish caught
6. Boat or shore fishing

During periods of little traffic, the clerk also gathered information on the lengths and weights of individual fish in the creel. This data was later expanded to estimate the total pounds of fish removed from the lake per surface acre.

RESULTS AND DISCUSSION

The limited access to this lake certainly was helpful to this creel census since all fishermen visiting the lake had to use one of the two possible access roads. Unlimited access has been a major problem in creel census work, especially on the larger lakes. It was estimated that about 20 per cent of the total number of fishermen visiting the lake were interviewed by the census clerk.

The total fishermen visitation to DeSoto Bend Lake between May 1 and September 15 was estimated to be 22,849 persons, which represents as average of slightly more than 1,000 fishermen per week. These values do not seem unusually high, however, since the large metropolitan areas of Omaha and Council Bluffs are only about 25 miles south of the lake. Most of the fishermen contacted during the creel census were from these two cities.

The highest fishermen visitation occurred during the first 2 weeks of the census when an estimated 5,205 fishermen came to the lake. Large numbers of fishermen are typical on many lakes during the first few days of the fishing season. The number of fishermen visiting the lake during the remaining 2-week periods of the census, excluding the last 12 days, ranged from 672 to approximately 3,000.

When the species composition of the catch is considered on a weekly basis, excluding the last 5 days of the census, crappie were the most numerous fish in the creel during 16 of the 19 weeks. This was expected since recent surveys have found crappie the most abundant game fish in the lake.

Channel catfish were most numerous in the creel during 2 of the 19 weeks. One of these 2 weeks occurred during their July spawning period which undoubtedly affected the catch.

Carp were most numerous in the creel during only one week: July 11 to July 17.

Other fish in the creel were northern pike, walleye, sauger, yellow perch, largemouth bass, white bass, bluegill, green sunfish, orange-spotted sunfish, bullheads, freshwater drum, goldeye, and sturgeon. Excluding the bluegills and drum, the remaining fish each composed

less than 5 per cent of the total catch during any week of the census. The bluegills and drum were important in the creel during only 2 weeks. Bluegills composed 14 per cent of the catch between June 12 and June 20 and the drum composed 33.4 per cent of the catch between July 3 and July 11.

Approximately 24,409 fish were caught in DeSoto Bend Lake during the 138 days of the creel census. These fish weighed a total of approximately 14,641 pounds. An average of about 20 pounds of fish per surface acre of lake were removed by fishermen during the census.

The catch per hour was low. The highest value was recorded during the first 2 weeks of the census when fishermen caught an average of .43 fish per hour. Values during the following 2-week periods, excluding the last 12 days of the census, ranged between .18 and .34 fish per hour. The lowest catch per hour (.18) was recorded between May 29 and June 13.

The large rough fish population in the lake is probably most responsible for the low catch per hour values. Actual counts of over 1,000 yearling and adult shad per hour have been made during past electro-fishing surveys. These fish spawn several times during the summer and therefore provide a large amount of available forage for the game fish during much of the year.

This creel census will be continued in 1964 by the Iowa Conservation Commission staff. Since the area is fairly new, this information will be a valuable aid in the formulation of future management plans.

SUMMARY

1. Between May 1 and September 15, 1963, a creel census was conducted on a 700-acre Missouri River ox-bow lake by biologists from the Iowa Conservation Commission and the Nebraska Game, Forestation and Parks Commission.

2. Since the area has only two access roads, a "visitor contact upon leaving" type of census was considered best.

3. An estimated total number of 22,849 fishermen visited the area during the census period.

4. Approximately 24,409 fish were caught in the lake during the 138 days of the census. An average of about 20 pounds of fish per surface acre of lake was removed by fishermen.

5. Crappie were the most numerous fish in the creel during 16 of the first 19 weeks of the census. Channel catfish or carp were most important in the creel during the remaining 3 weeks.

6. The highest catch per hour (.43 fish) was recorded during the first 2 weeks of the census. Other values during subsequent 2-week periods, excluding the last 12 days of the census, ranged between .18 and .34 fish per hour.

QUAIL WHISTLING COCK CENSUS IN IOWA, 1963

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Game Biologist

INTRODUCTION

The quail whistling cock census was first used in Iowa in 1947. In the original plan, four routes of about 12 miles (12 listening stops) were laid out in each of a number of counties in the quail range, their exact location being based on soil types. The number of routes was later changed to two per county, and other counties were added in both the principal and marginal quail range. Usually, each Conservation Officer censused one county. Further changes aimed at improving the results obtained were made in 1963.

There have actually been two types of whistle counts made in recent years. The first, and most important, is the statewide (within quail range) census referred to in the preceding paragraph. The second involves a series of counts on a given route made throughout the summer by the Biologist. The latter type of count is necessary to determine the duration of calling - particularly the number of weeks when the calling rate is high. Such information is necessary for the evaluation of the statewide counts. It is intended that the statewide count be made during the same portion of the summer bobwhite whistling period each year. The instructions to take the counts are mailed to the cooperating personnel when it is believed this proper peak in the calling cycle is being approached - usually about July 1. However, there is always the possibility that the calling behavior in a given year will not follow the predicted pattern. In such a situation, as happened in 1962, the data from the long series of counts can be used to adjust the statewide counts to comparable levels.

METHODS

On each assigned route, the observer is to listen for exactly 3 minutes at each stop and determine the number of different cock quail calling at that stop. The count at the first stop is to be started at sunrise on a clear, calm morning. Cooperating personnel usually receive their instructions and data forms about July, with the actual counts generally being made during the period of about July 5-20. The forms have spaces for listing county, date, name of observer, time, wind velocity (a Beaufort scale is included), and the number of different quail heard. Also reported on the form are the numbers of quail, rabbits, pheasant broods and hungarian partridge sighted while conducting the whistle count. In addition, the cooperator was asked his opinion on the current status of the quail population in his area.

Three categories of Conservation Officer counts were made in 1963. One group of Officers made their counts on the same 10 to 14 stop routes as used in previous years, usually two per county. Another group censused new 10-stop routes in counties that had previously been censused, the old routes being discarded and only one route being run by each Officer. The third group involved new 10-stop routes in counties that had not previously been censused for quail, again only one route being assigned per Officer.

Last spring each Officer received one map for each county in his territory with a set of instructions for setting up one route in the best quail range in each county. From these maps the Biologist selected one route for each Officer. The selections were made so that alternate counties

were sampled, when possible, and with an age toward sampling all major types of quail range. By 1965 each Officer will have only one 10-stop quail whistle count route. The gradual transition is necessary to avoid gaps in our comparative information for the years concerned and to allow for the evaluation of several plantings of pen-raised quail made on several routes in 1961 and 1962.

Another type of whistle count was initiated for certain Biology and Game Section Personnel. This involves censusing a pre-selected 10-stop route once during each of 3 months - June, July and August. The Officer's counts will show statewide annual fluctuations and these "three-time" counts, in addition to supplementing the Officer counts, will show changes in calling routes as the summer advances and better pinpoint calling peaks in different areas of the state. These particular routes were laid out to sample different parts of the quail range.

In addition to the foregoing types of counts, the Biologist will continue making whistle counts over the entire span of the reproductive season (about April through September). These counts will give the picture of the calling pattern throughout the season in the best quail range (route is located in Wapello and Davis Counties). Counts are made as frequently as weather and time permit, with the aim of obtaining at least one count per week throughout the entire period.

RESULTS

In 17 counties the whistle counts were to be made along the same 28 routes in 1963 as in 1962. There were 358 miles of route (or stops) censused in 1963, with 292 quail heard calling and 35 quail being sighted (Table 1). In 1962 there were 327 stops censused, with 172 quail calling (birds sighted were not recorded prior to 1963). These data indicate 0.8 whistling quail per stop in 1963 and 0.5 in 1962. After adjusting the latter figure for being made at a low period in the calling cycle, instead of during the usual high, the 1962 count becomes just over 0.6 calling birds per stop.

In 22 counties previously censused by the old system of two 10-14 stop routes in each, new 10-stop routes were run in 1963. There were 191 calling cock quail heard on 230 stops and 11 quail sighted during the counts. This resulted in 0.8 quail heard per stop and one quail per 29 miles of driving (Table 2). These figures are not directly comparable to those from the routes used in previous years, since most were all new routes or included only portions of the old routes. The 0.8 birds per stop figure is the same as that shown above for the old routes repeated in 1963.

In the 15 counties not previously censused (all of which are in the northern part of the state presently closed to quail hunting), only 14 quail were heard calling on 150 stops (0.09 per stop) and only 2 quail were sighted (Table 2). These counties are all on the margin of the bobwhite quail range.

A total of 240 stops were censused in five counties during June, July and August by Game and Biology Section Personnel (more than one route in some counties and some routes run more than others). A total of 250 quail were heard whistling. Calling was near a peak in early June and remained high in July. In August, calling was still high in southern Iowa, but was low in Story County in marginal range. This may indicate that associated brood activities end earlier in the more northern counties.

Results from the Wapello-Davis Counties route run repeatedly by the Biologist indicated

TABLE 1. Results of 1963 quail whistling cock counts on previously censused routes of 10 to 14 stops each

County	No. of Stops		No. of Calling Quail		Quail Sighted **
	1963	1962	1963	1962	1963
Adams	10	14	1	4	2
Audubon	25	24	0	0	0
Benton	14	14	9	4	2
Buchanan	27	28	4	26	2
Clarke	26	28	24	9*	16
Jefferson	28	28	78	41	0
Johnson	27	28	27	14	0
Louisa	23	23	6	8	0
Madison	24		6		0
Marshall	24	28	10	20	6
Mills	13		7		0
Monroe	13	13	36	15*	5
Sac	12	15	0	0	0
Scott	28	28	4	0	0
Union	24		21		2
Warren	14	28	12	10	0
Wayne	26	28	47	25	0
Totals	358	327	292	172	35

* From 20 to 50 per cent of the calling males were not active at the time the census was taken.

** Quail sighted were not recorded prior to 1963.

TABLE 2. Results of 1963 quail whistling cock counts on new routes of 10 stops (miles) each, one route per county

County	No. of Calling Quail Per 10-Stop Route	Quail Sighted
* Adair	2	0
* Allamakee	3	1
* Black Hawk	4	1
* Boone	7	0
* Cedar	16	0
Cerro Gordo		
Cherokee	0	0
* Chickasaw	3	0
Clay	0	0
* Clayton	5	0
* Davis	28	0
* Des Moines	31	6
Dickinson	0	0
* Dubuque	5	0
Emmett	0	0
*Fayette	0	0
Franklin	0	0
* Fremont	6	0
* Greene	5	0
Hardin	1	2
* Harrison	2	0
Humboldt	0	0
* Jackson	11	0
* Lee	33	2
* Linn	7	1
Lyon	0	0
Mitchell	1	0
* Monona	10	0
Palo Alto	0	0
* Polk	6	0
* Pottawattamie	1	0
Sioux	0	0
* Wapello	3	0
Webster	12	0
* Woodbury	3	0
Worth	0	0
Wright	0	0
Totals	205	13

* These counties were censused previous to 1963; other counties in this table were first censused in 1963.

that calling was well underway by mid-April, but then declined. Calling increased late in May, then peaked in mid-June. The calling rate remained high through July, but diminished somewhat by mid-August. Some calling continued through the first week of September. The high rate of calling and the protracted whistling period are similar to those which have occurred in former years when production of young was high.

The overall results of the various foregoing counts showed that the highest rate of calling occurred in southeastern Iowa. Lee County had the 1963 high count of 3.3 calling quail per stop (10-stop route), followed by Des Moines County with 3.1. Three other southeastern counties - Davis, Jefferson and Monroe - all averaged 2.8 per stop. By contrast, Clarke, Union and Wayne Counties in south central Iowa averaged 0.9, 0.0, and 1.8 calling quail per stop, respectively.

SUMMARY

1. The quail whistling cock census has been used in Iowa since 1947.

2. Revisions of this census system have been made over the years, culminating in 1963 with fewer and shorter routes for Conservation Officers, and with added routes to be checked by Game and Biology Section Personnel.

3. The best 1963 quail populations are in southern Iowa as usual, and the best of this range is in southeastern Iowa. On comparable routes in southern Iowa there was an average of 2.1 whistling cocks per mile, compared to 1.4 in 1962 - a 50 per cent increase.

4. The statewide census indicates that from the good southern Iowa quail areas a smaller population of quail extends northward along the Mississippi, Missouri and Des Moines Rivers.

WOODCOCK SINGING GROUND COUNTS IN IOWA, 1961-62-63

Eugene D. Klonglan
Game Biologist

INTRODUCTION

Woodcock singing ground counts were made in Iowa for the first time in 1961. This survey is a part of a program coordinated by the U. S. Fish and Wildlife Service, with Iowa being one of 24 cooperating states and Canadian provinces. Most of these states and provinces have been making such counts for many year. The purpose of this survey is to obtain an index to woodcock breeding population size and thus determine annual trends in breeding woodcock densities.

TECHNIQUES

This survey is essentially an audio count of "displaying" woodcock males during their evening courting period in the spring. In the spring, male woodcock have a characteristic call ("peent") that is audible for about 0.2 mile. Counts of males "peenting" on the same routes each year provide a means of measuring their relative abundance during the breeding season. The following description of the technique used in making the counts is summarized from the detailed instructions provided each cooperator by the Fish and Wildlife Service.

Since the count can be made most effectively by using an automobile, a driveable route must be selected. A stretch of road bordered by open young mixed growths or young hardwood stands, especially where numerous small openings, fields or pastures occur, will probably contain woodcock cover. Care must be taken to avoid areas where excessive noises will occur, such as heavily travelled highways or a series of small ponds or wet ditches which are likely to contribute noisy choruses of frogs. The length of route, or number of stops, must be based on the distance that can be covered during the period of time that woodcock males will call under suitable conditions - usually around half an hour.

Counts are to be made after migration has ceased in a given locality and before the peak of the hatching period. In Iowa the latter part of April and early May appear to be the best time to run this survey. Counts are made during the evening period of singing. The average male woodcock begins to "sing" about 10 to 30 minutes after sunset, depending on weather conditions. The period during which woodcock perform on their singing ground varies from about 20 to 45 minutes, averaging about 35 minutes in length. It is most desirable for a route to start at a place where a woodcock is likely to be heard, so the starting time for any given evening may be accurately determined. Counts should not be made during the period of 2 days before a full moon to 1 day afterward (4 days in all), as it has been found birds are very inconsistent in performing then. Best results will be obtained on warm, clear, quiet evenings.

Listening points should be no closer than a straight line distance of 0.4 mile. Intervals between stops may be increased to the extent necessary to avoid non-woodcock habitat or exceptional disturbances. Preliminary statistical studies of this census method indicate it is preferable to run more routes once rather than fewer routes more than once. Occasionally, however, factors such as wind, temperature, traffic, or other noise may result in a non-representative count and necessitate repeating the route.

Once the approximate starting time has been decided upon, the observer listens for 2 minutes, counting all different birds heard. At the end of 2 minutes the observer proceeds rapidly to the next stop and listens there for 2 minutes, again counting all birds heard, and this procedure is repeated over the entire route. The "peent" call given by the woodcock on the ground should be used for counting entirely, if possible, as being more reliable for separating different individuals. The flight song should be resorted to only if it can be definitely distinguished as a separate bird, or if disturbing noises such as frogs make it impossible to hear the ground calls..

Since the first stop may not have a performing bird each evening and since the commencement of singing activity may vary between given evenings, a certain amount of discretion must be used in selecting the time to start listening at the first stop. The suggested procedure, in case no bird is singing at the first stop, is to wait 5 minutes after the latest expected commencement of song and then drive on to the second stop. The experienced observer will know approximately what time birds in his area will start performing on a given evening. Because of this, as well as other reasons, it is desirable for a new cooperator to receive instruction (particularly in the field) from someone experienced with woodcock ground calls and flight songs and with the survey technique before starting out on his own. In the event it is not possible for a new cooperator to obtain field guidance from an experienced individual, he should certainly familiarize himself with tape recordings or phonograph records of the calls which are available.

RESULTS

Four woodcock singing ground counts were run in extreme northeastern Iowa in 1961, with 10 birds being heard on 46 stops (Table 1). The same four routes were censused in 1962, and a new route in central Iowa was added. Five more routes were added in 1963, all in the eastern half of the state. Woodcock were heard on almost every route during the 3-year period, a total of 51 different individuals being heard on 187 stops - a mean of 0.27 per stop (Table 1). There was very little variation between years. However, the small number of routes run would probably not provide sufficient data to make valid year-to-year comparisons for Iowa alone.

The presence of woodcock on nearly every routes indicates that breeding woodcock may be more common in the state than generally believed. Further substantiation of this was obtained when, upon making inquiries of several key individuals around the state, verified records of three young woodcock broods having been sighted in late spring and early summer this year were received. One of these broods was sighted, and photographed, along the Mississippi River south of Burlington (Lee County) in extreme southeastern Iowa. Another was found near Stephens State Forest (Lucas County) in south central Iowa. The third was observed along the Missouri River north of Council Bluffs (Pottawattamie County) in extreme western Iowa. Since these three brood sightings bracket the entire state, it appears possible that breeding woodcock may occur anywhere in the state where suitable habitat occurs. However, since such habitat is rare in Iowa, chances of locating breeding woodcock in the state remain quite limited.

DISCUSSION

The limited coverage of the state by the recently initiated woodcock singing ground survey precludes any detailed analysis or conclusions regarding Iowa alone. However, these data, when combined with that from other cooperating states and provinces, provide an important contribution to the over-all picture of woodcock population trends on breeding grounds over a wide area of the eastern half of the continent. The results of these counts are reported annually by the U. S.

TABLE 1. Results of woodcock singing ground counts in Iowa, 1961-62-63

Route No.	County Located	Name of Route	No. Birds Heard	No. of Stops	Mean Birds Per Stop
			1961		
1	Allamakee	Luster Hts.	6	12	.50
2	Allamakee	Paint Creek	1	13	.08
3	Allamakee	Sand Cove	2	10	.20
4	Clayton	Sny-Magill	1	11	.09
TOTALS			10	46	.22
			1962		
1	Allamakee	Luster Hts.	2	8	.25
2	Allamakee	Paint Creek	4	9	.44
3	Allamakee	Sand Cove	0	9	.00
4	Clayton	Sny-Magill	1	9	.11
5	Jasper	Rock Creek	2	7	.29
TOTALS			9	42	.21
			1963		
1	Allamakee	Luster Hts.	6	8	.75
2	Allamakee	Paint Creek	3	10	.30
3	Allamakee	Sand Cove	2	7	.29
4	Clayton	Sny-Magill	5	9	.56
5	Jasper	Rock Creek	0	8	.00
6	Clayton	Buck Creek	4	10	.40
7	Winneshiek	Canoe Creek	1	10	.10
8	Bremer	Wapsie Bottoms	4	10	.40
9	Tama	Otter Creek	0	10	.00
10	Lucas	Colyn Area	7	10	.70
TOTALS			32	92	.35
3-YEAR TOTALS	19 counts made		51	187	.27

Fish and Wildlife Service in their Special Scientific Report series under the title, "Woodcock Status Report - (Year)". Reference should be made to those reports already published by those interested in information from past years, and to future reports by those interested in having the latest information on woodcock population trends each year.

IOWA'S LATE SUMMER PHEASANT POPULATION - 1963

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and
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INTRODUCTION

The roadside pheasant count made in August is the primary source of information on the status of the pre-hunting season pheasant population. These counts have been made in August since 1954; prior to that time they were usually taken in September or October. Previous to 1962 three routes were run in each county by Conservation Officers. In 1962 this scheme was changed to give each Officer only two 30-mile routes whether he is assigned one or two counties. New routes were designated for all counties, being laid out to incorporate the shorter spring crowing cock count and roadside routes first used in 1962 (see July-September 1962 Quarterly Biology Reports, pp. 12-22, for discussion of revised system). Similar routes were designed for Unit Game Managers and Biologists as well.

Additional information on the prospective fall population has been obtained each year from counts made by rural mail carriers during a 1-week period in late July and from sight records made by Conservation Officers while driving on their regular duties. The key figures obtained from these two surveys are young per hen, average brood size, and per cent of hens with brood.

Iowa experienced a relatively mild winter as far as potential hardship to pheasants was concerned, the lack of severe snowstorms being particularly fortunate. Winter mortality of pheasants was thus less than normal. Spring populations over the state were slightly higher than in 1962, but not significantly so (see April-June 1963 Quarterly Biology Reports).

The spring of 1963 was one of the earliest experienced for many years. March was the warmest since 1946. April was the warmest since 1955, with little rain till late in month when moderate to heavy showers brought the precipitation total for the month up to normal. At the end of the month, vegetation was reported 2 weeks ahead of normal. Farm work was 10 days to 2 weeks ahead of average. Early May was also warm, though an unseasonable late freeze on May 22 and 23 resulted in average temperatures for the month being about normal. Rainfall was subnormal over all but the north central district, with seasonal deficiencies the greatest in the northwestern district. June was the warmest since 1956 and was unusually dry (particularly in the east central and southeast districts). There were some localized heavy thunderstorms in west central and northern Iowa. July had near normal temperatures, being the warmest since 1957. However, precipitation in July had been exceeded significantly only twice in the last 40 years. Rainfall ranged from near normal in southwest and west central Iowa to more than twice normal in the north central and east central districts (being the wettest in 33 years in the latter two districts). August was the coolest since 1952, about 2° below normal, with rainfall about normal and well-distributed throughout the month. (Above weather information taken from Climatological Data, U. S. Weather Bureau, Iowa Section, for months concerned).

Such conditions during spring and early summer favor early nesting activity and in the past have usually resulted in an above normal hatch and a better than average hunting season. Reports of early-hatched broods were more prevalent this year than usual, with a few instances of broods

hatched in late April being reported. Hence the results of the late summer pheasant surveys were awaited with considerable anticipation to see whether the expected increase in the population occurred.

METHODS

The techniques used this year were essentially the same as in 1962. Each pre-designated route is 30 miles in length and is laid out as much as possible on all-weather, secondary, gravelled roads. The count is started at sunrise and the route driven at a speed of about 15-20 mph.. Instructions are to take counts only on mornings with heavy dew, sun shining (or partially obscured at most), and wind velocity of less than 8 mph.. The prime census period during which the counts are to be completed if at all possible is the first half of August. The data are recorded by 5-mile segments of route. Information recorded includes number of adult cocks sighted, number of hens without brood, number of hens with brood and number and age of chicks in each brood. Also recorded are numbers of cottontails, jackrabbits, bobwhite quail, and hungarian partridge sighted. (again see July-September 1962 Quarterly Biology Reports for more detailed discussion of technique used).

For purposes of analysis and comparisons, the state is divided into six major regions (Figure 1). These regions were set up to each contain more than 20 census routes, with the aim of obtaining at least 20 good counts each year from each region in order to make valid year to year comparisons. Other items considered in delineating the divisions were similarity of soil types, pheasant populations and agricultural practices, and recognizeable geographical areas of the state (partially for publicity purposes).

RESULTS AND DISCUSSION

Birds Per Mile

In August 1963 there were 11,729 pheasants sighted on the 144 30-mile routes (4,320 miles) censused, for an average of 2.72 birds per mile (Table 1). This is a 42 per cent increase over the 1.92 birds per mile sighted in 1962. (The 1962 results from all counts made by Conservation Officers, Unit Game Managers and Biologists are given in Table 2; these regional means thus differ somewhat from those reported for Officers only in Table 1, p. 16, of the July-September 1962 Quarterly Biology Reports). It is 47 per cent greater than the statewide mean of 1.84 per mile from the preceding 9 years during which counts have been taken in August (range of 1.28 in 1954 to 2.51 in 1958) and is 8 per cent higher than the previous high mean of 2.51 recorded in the excellent "pheasant year" of 1958 (Figure 2).

The greatest pheasant population this fall will be found in the Northwest and North-central regions, followed closely by the Southwest region. Good populations will also be found in the eastern third of the Central region. On a more localized basis, the highest population in the state appears to be in Adair County and surrounding territory to the south and west. On one count made in Adair County, 810 birds (27.00 per mile) were sighted - including 131 broods. This is the highest single count made during the 10-year span of August roadside counts, the previous high being 761 birds (25.33 per mile) in Howard County in 1958.

The greatest rate of increase over 1962 was the 114 per cent recorded in the Southwest region, this being due primarily to the large increase in the Adair County vicinity. The second highest rate of increase was the 103 per cent in the South region, this being primarily a reflection of increases in the western third of this region.

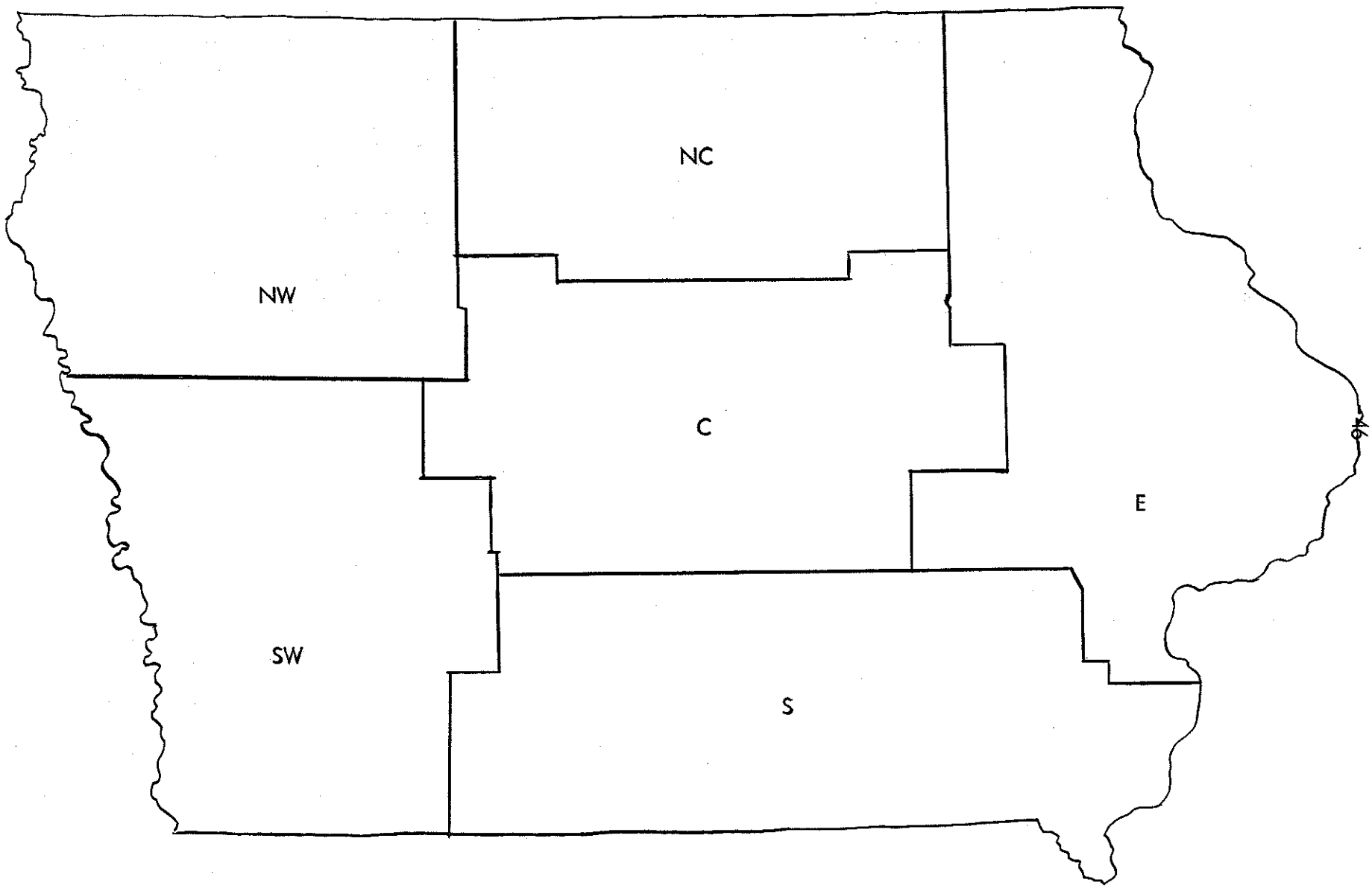

FIGURE 1. Six major regions of Iowa for purposes of analyzing pheasant population data and comparing annual trends.

TABLE 1. Results of 1963 August roadside pheasant counts, and comparison with 1962 counts

Region of State	No. of Counts	No. Miles Driven	Total No. Birds Sighted	Birds Per Mile	1962 Birds Per Mile	% Change from 1962
Northwest	20	600	2501	4.17	2.94	+42%
North-central	22	660	2702	4.09	3.92	+4%
Southwest	21	630	2277	3.61	1.69	+114%
Central	27	810	2214	2.73	1.93	+41%
East	24	720	919	1.28	1.12	+14%
South	30	900	1116	1.24	0.61	+103%
STATEWIDE	144	4320	11729	2.72	1.92	+42%

TABLE 2. Results of 1962 August roadside pheasant counts by Conservation Officers, Unit Game Managers and Biologists (for comparison with 1963 figures)

Region of State	No. of Counts	No. Miles Driven	Total No. Birds Sighted	Birds Per Mile
Northwest	19	570	1678	2.94
North-central	20	600	2351	3.92
Southwest	19	570	962	1.69
Central	24	720	1387	1.93
East	24	720	809	1.12
South	28	840	512	0.61
STATEWIDE	134	4020	7699	1.92

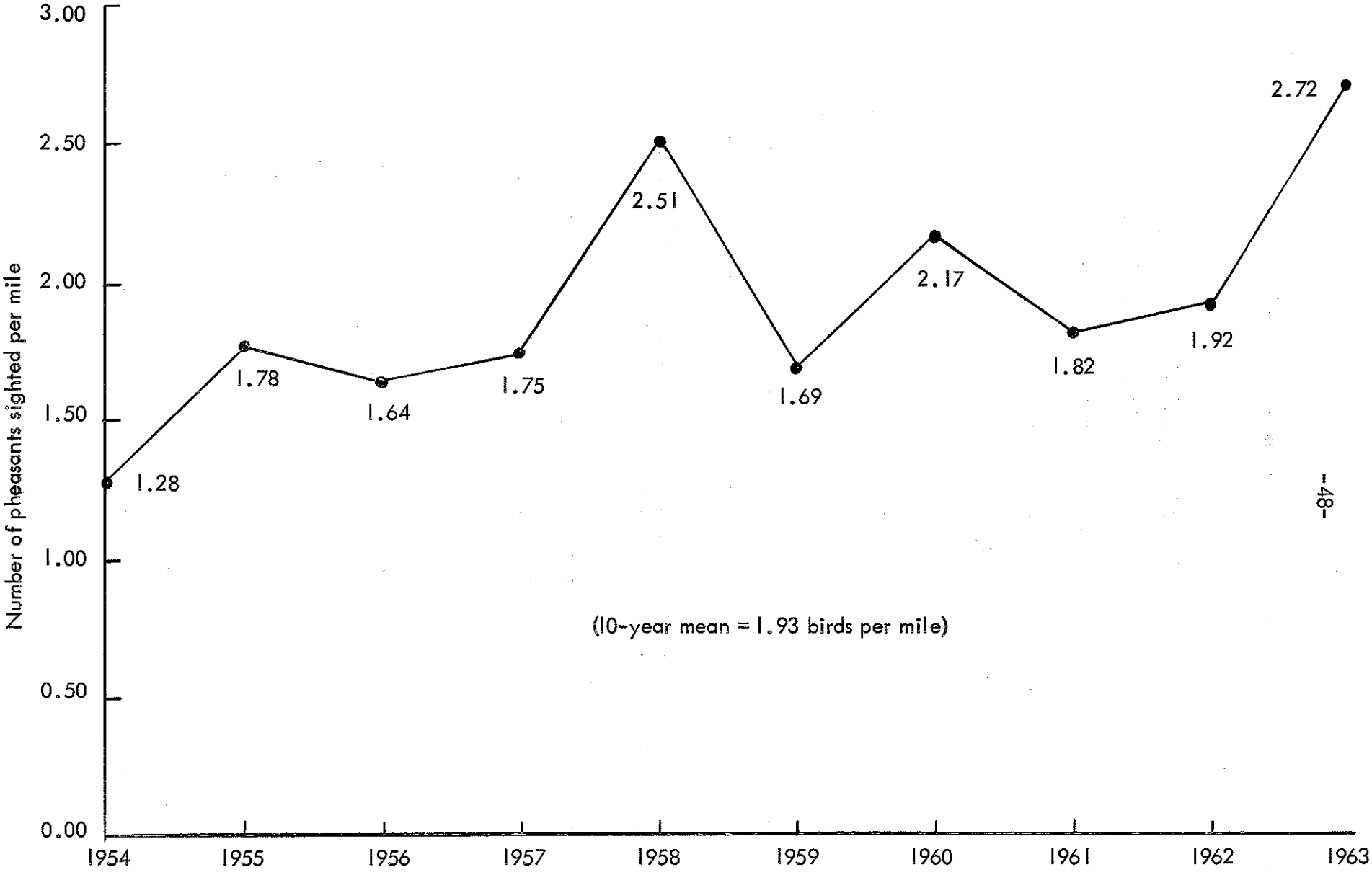

FIGURE 2. Pheasants sighted per mile on August roadside pheasant counts, statewide, 1954-1963.

The 42 per cent increase indicated for the Northwest region was rather general throughout the area encompassed. The 41 per cent increase in the Central region could be attributed primarily to the eastern third of the area. Only a 14 per cent increase was found in the East region, most of this occurring in the part of the area adjacent to the Central region.

The North-central region was the only one that showed very little change from 1962 (though it is still near the top in terms of pheasants sighted per mile). This area experienced some unusual rain and hailstorms during the latter part of the nesting season. Thus even though a good early hatch occurred, renesting attempts (which are usually rather important in the northern part of the state) were greatly hampered. It is also possible that greater than normal mortality of young chicks occurred as a result of this severe weather, though in the absence of intensive field studies such cannot be stated for certain. Both the North-central and East regions, the two areas with the lowest rate of increase, experienced the wettest July in 33 years.

Broods per 30-Mile Count

There were 1,493 broods sighted on the 144 counts, an average of 10.4 per 30-mile route (Table 3). This is a 53 per cent increase over the 6.8 per count sighted in 1962 (910 broods on 134 counts). In general the rate of increase in number of broods sighted exceeded that of total birds per mile, indicating an above average reproductive season. The lack of change in the North-central region was shown in rather striking fashion by the brood data.

This index to comparative reproductive success in different years also conveys an idea of relative population levels from region to region and year to year - something that is not done by several other indices to reproductive success, such as per cent of hens with brood, young per hen, average brood size, etc.. This is shown quite well by the results given in Table 3.

Per Cent of Hens with Brood

Of the 1,687 hens sighted, 69.4 per cent (1,169) were seen with a brood (Table 4). This is nearly identical to the 69.1 per cent of hens with brood recorded in 1962 (The 1962 results from all counts made by Conservation Officers, Unit Game Managers and Biologists are given in Table 5; these regional means thus differ slightly from those reported for Officer counts only in Table 2, p. 17, of the July-September 1962 Quarterly Biology Reports. This applies to all columns in the two tables). Thus from this index there was little indication of increased reproductive success in 1963 over 1962. The highest rate of success was in southwest Iowa, though the biggest increase over 1962 occurred in the South region. In general, the northern part of the state showed a slight decline, the southern part a slight increase over 1962.

The above figures were computed by dividing the number of hens with brood by the total of all hens sighted (sum of hens with and without brood). Another way of calculating an index to successful hens that has been used by some states is to divide the total number of broods sighted by the sum of the number of broods plus hens without brood. This method was used prior to 1962 in Iowa. If computed on this basis for 1963, this index would be 74.2 per cent; in 1962, 72.4 per cent. These compare to only 63 per cent in 1961. Thus we have actually had two consecutive years of above average success, no doubt an important contributing factor to the pheasant population increase occurring this year.

In 1963, no hen was sighted with 22 per cent (324) of the 1,493 broods recorded. In 1962, 15 per cent (135 of 910) of the broods were sighted without a hen. The more advanced age of

TABLE 3. Comparison of numbers of broods sighted on August roadside pheasant counts in 1963 and 1962.

Region of State	No. Broods Sighted	Broods Per 30 Mile Count	No. Broods Sighted 1962	1962 Broods Per Count*	% Change in Broods
Northwest	314	15.7	198	10.4	+51%
North-central	343	15.6	315	15.8	- 1%
Southwest	288	13.7	100	5.1	+169%
Central	256	9.5	178	7.4	+28%
East	120	5.0	59	2.5	+100%
South	172	5.7	60	2.1	+171%
STATEWIDE	1,493	10.4	910	6.8	+53%

* See Table 1 for number of counts made in each region in 1963 and Table 2 for number of counts in 1962.

TABLE 4. Data from 1963 August roadside pheasant counts

Region of State	No. of Cocks	No. of Hens	Sex Ratio Index M:F	Hens Without Brood	Hen With Brood	% Hens With Brood	No. of Young Chicks	No. of Young Per Hen	No. of Young Per Brood*
Northwest	311	429	1:1.38	144	285	66.4%	1,761	4.10	5.61
North-central	348	431	1:1.24	156	275	63.8%	1,923	4.46	5.61
Southwest	178	268	1:1.51	59	209	80.0%	1,831	6.83	6.36
Central	218	259	1:1.19	76	183	70.7%	1,737	6.71	6.79
East	102	153	1:1.50	50	103	67.3%	664	4.34	5.53
South	109	147	1:1.35	33	114	77.6%	860	5.85	5.00
STATEWIDE	1,266	1,687	1:1.33	518	1,169	69.4%	8,776	5.20	5.88

* See Table 3 for number of broods in each region.

TABLE 5. Data from 1962 August roadside counts by Conservation Officers, Unit Game Managers and Biologists (for comparison with 1963 results)

Region of State	No. of Cocks	No. of Hens	Sex Ratio Index M:F	Hens Without Brood	Hen With Brood	% Hens With Brood	No. of Young Chicks	No. of Young Per Hen	No. of Young Per Brood*
Northwest	265	254	1:0.96	73	181	71.3%	1,114	4.39	5.63
North-central	305	409	1:1.34	133	276	67.4%	1,908	4.42	6.06
Southwest	92	97	1:1.05	16	81	83.5%	684	7.05	6.84
Central	146	218	1:1.49	69	149	68.3%	1,122	5.15	6.30
East	53	65	1:1.23	24	41	63.1%	374	5.75	6.34
South	78	79	1:1.01	32	47	59.5%	379	4.80	6.32
STATEWIDE	939	1,122	1.19	347	775	69.1%	5,581	4.97	6.15

* See Table 3 for number of broods in each region.

the broods in 1963 (as discussed in later section on hatching date distribution) with a possible resultant greater rate of desertion of broods by hens and breaking up of broods may have contributed to this observed difference. This would tend to minimize any true differences between the 2 years, and suggests that reproductive success in 1963 was actually better than in 1962.

Young per Hen

The young per hen index in 1963 was 5.20 (Table 4). This compares to 4.97 in 1962 (Table 5), which again indicates slightly better reproductive success this year. The Southwest region was again the highest, followed by the Central and South regions. The northern part of the state again showed the lowest indices.

There are several factors that may play a part in the lower indices recorded to the north. Renesting has in the past always been of more importance to total production in these areas. Later broods have been shown by many studies to average smaller in size and would result in fewer young per hen for these broods. Broods in northern Iowa average younger in age than those in the southern part of the state at the time the counts are taken. With smaller chicks making up a greater portion of the total, it is easier to fail to see some of them - particularly in the re-growth of oat stubble fields. Heavy rains in July may have resulted in a greater rate of mortality of late-hatched chicks in the North-central region (note that this index was also low for the East region, an area that also received very heavy July rains).

Average Brood Size

The statewide average brood size for 1963 was 5.88 chicks per brood (Table 4). This represents a decline from the 6.15 observed in 1962 (Table 5). At first glance, this would appear to mean lower rate of reproductive success in 1963. However, past experience shows that average brood size, per se, has been an unreliable indicator of relative reproductive success. In 1963, there are two main factors that might have been important in causing this apparent decline from 1962. First, broods were, on the average, older in 1963. As a result exposure to potential mortality factors had been in effect longer, and some of the older broods had no doubt begun to break up by August. Secondly, the peak of hatching extended over a much longer period in 1963. This points to a greater rate of successful renesting with its usual accompanying smaller size of later broods. It should, however, be pointed out that the more advanced age, and hence larger chicks, in 1963 would make the young birds easier to see and tend to mitigate to some extent the influence of the above two factors.

Sex Ratio Index

The observed adult sex ratio on the 1963 August roadside counts was 1.33 hens per cock (Table 4) compared to 1.19 hens per cock in 1962 (Table 5). (Remember, these are roadside observed ratios and not the true ratio in the population at this season of the year. There was not much variation between the six regions. The slightly greater number of hens per cock in 1963 may have resulted from better than usual hen survival through the rather favorable preceding winter and/or from a slightly higher rate of cock harvest in some areas during the previous hunting season.

The sex ratio index of 1.33 hens per cock from the August roadside counts compared to an index of 1.44 observed during the spring (late April and early May) roadside counts. A similar

drop was noted in 1962. This decrease in hens from late April and early May to August, which encompasses the main nesting season, would be expected because of the higher rate of mortality to which hens are subjected durint this period (for example, mowing losses in hayfields).

Hatching Date Distribution

This was the second year in which personnel making the August roadside counts were asked to age the broods sighted. In 1963 age estimates were obtained on 1,743 broods. This number exceeds the total number of broods reported on the scheduled routes, the additional broods being from observations made by Biologists at other times than on given routes.

In general, the peak of hatching was about 1 to 2 weeks earlier in 1963 than in 1962 (Table 6 and Figure 3). A noticeable difference from most years was that hatching was more evenly distributed over a wider period than usual, in particular, from the last few days of May to almost the end of June. The mid-point of the hatch was June 12, with about half of the reported broods hatching before this date and half afterward. Regional mid-points varied from June 15 in the North-central to June 6 in the South region.

About 65 per cent of the hatch took place in the month of June. May was next in importance with 20 per cent, followed by July with 13 per cent and August with less than 2 per cent. June was also the most important month in 1962, with 69 per cent of the hatch, but July was second with 18 per cent and May third with 13 per cent. August had less than 1 per cent of the hatch in 1962 (see Table 7 for 1962 figures based on 10-day periods; figures were given on a bi-monthly basis in last year's report). It must be remembered that the counts were run in August, many being completed before the middle of the month. Therefore, any broods hatched in August would not have an equal chance of being reported; and many late July broods would be so small the chicks would be difficult to see in the heavy cover present at this time of year. Thus the percentages for these later months are no doubt low. Several reports of very young chicks yet unable to fly were received in September. However, many nesting studies have shown that the amount of production this late in the season is relatively insignificant insofar as determining whether the season will be a really good one or a poor one.

Rural Mail Carrier Counts

The first summer count to determine pheasant reproductive success in 1963 was conducted by cooperating rural mail carriers during the week of July 22-27. This survey is used primarily as a preliminary indicator of what the pheasant picture for the coming season will be. The variability in weather conditions that may be encountered from year to year at this time of the season makes it impossible to use the mail carrier data in terms of numbers of pheasants sighted. As a result, their reports are analyzed from the standpoint of young per hen, average brood size and per cent of hens with brood.

According to the 1963 survey, statewide production was better than in 1962 (Table 8) and was the highest since the excellent hatch in 1958. The carriers averaged 1.9 broods per card (they record their observations for their 6-day week on a postcard form) in 1963 compared to 1.6 broods per card in 1962. Reproductive success appeared to be best in the western third of the state, which matches the results of the August roadside counts quite well.

TABLE 6. Distribution of the 1963 Iowa pheasant hatch by region and statewide (figures given are percentages by 10-day periods)

Date of Hatch	Northwest	North-central	Southwest	Central	East	South	Statewide
May 1-10	----	----	0.8	1.2	0.6	2.6	0.7
11-20	10.8	5.6	4.1	6.7	1.7	6.5	6.0
21-31	15.9	5.1	10.2	11.8	29.0	24.5	13.5
June 1-10	22.7	21.1	25.4	32.0	21.6	24.5	24.8
11-20	18.7	31.3	22.6	20.0	21.6	20.6	23.1
21-30	15.6	18.3	23.2	15.1	16.5	8.4	17.2
July 1-10	10.5	8.7	7.1	4.5	4.5	6.5	7.2
11-20	3.1	7.6	4.8	3.0	3.3	3.9	4.6
21-31	1.0	1.5	1.0	2.4	0.6	1.3	1.4
August 1-10	0.3	0.8	0.5	0.6	0.6	0.6	0.6
11-20	1.4	----	0.3	2.4	----	0.6	0.8
21-31	----	----	----	0.3	----	----	0.1
No. Broods in Sample	295	393	393	331	176	155	1,743

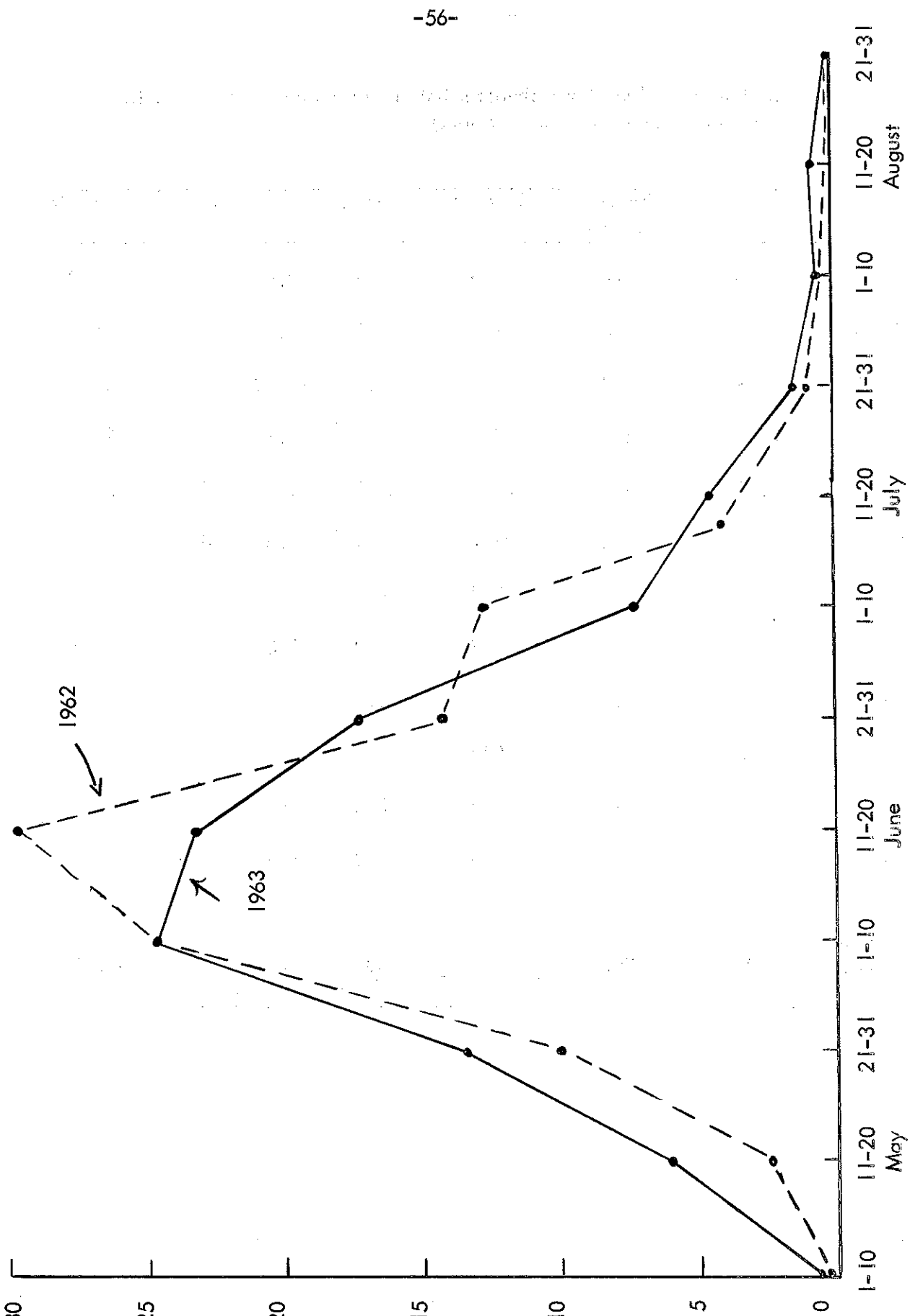

FIGURE 3. Distribution of 1963 pheasant hatch as compared to 1962.

TABLE 7. Percentage distribution of 1962 Iowa pheasant hatch by 10-day periods (given to enable direct comparison with 1963 results)

Date of Hatch	Northwest	North-central	Southwest	Central	East	South	Statewide
May 1-10	----	----	----	0.8	----	----	0.2
11-20	1.1	2.4	----	5.4	1.0	----	2.4
21-31	3.8	8.2	5.7	11.6	28.6	11.3	10.0
June 1-10	20.4	25.3	35.3	19.1	24.5	43.4	24.8
11-20	35.5	29.7	32.4	27.4	23.5	26.4	29.7
21-30	20.4	16.6	7.6	12.1	6.1	13.2	14.2
July 1-10	16.7	10.1	11.4	17.4	12.2	3.8	12.9
11-20	1.6	5.2	7.6	3.3	3.1	1.9	4.0
21-31	0.5	1.1	----	1.7	1.0	----	1.0
August 1-10	----	1.1	----	0.4	----	----	0.5
11-20	----	0.3	----	0.4	----	----	0.2
21-31	----	----	----	0.4	----	----	0.1
No. Broods in Sample	186	367	105	241	98	53	1,050

TABLE 8. Statewide results of rural mail carriers' July pheasant counts, 1962-1963

YEAR	YOUNG PER HEN	AVERAGE BROOD SIZE	% OF HENS WITH BROOD
1962	2.1	5.3	39%
1963	2.6	5.7	45%

Conservation Officers' Sight Records

Conservation Officers are asked annually to record on a postcard form pheasants sighted while driving on their regular duties in late July and early August. As with the mail carrier counts, interpretation of the data cannot be made on the basis of numbers alone, but must be done on the same basis as the carrier data. According to the sight records for 1963, reproductive success increased again this year (Table 9).

TABLE 9. Statewide results of Conservation Officers' sight records, 1961-1963

YEAR	YOUNG PER HEN	AVERAGE BROOD SIZE	% OF HENS WITH BROOD
1961	4.0	6.3	63%
1962	4.3	6.2	69%
1963	4.5	6.2	72%

Pheasant Broods Sighted on Rabbit and Quail Counts

In 1963 for the first time, a specific instruction was issued to record all pheasant broods sighted during the course of the annual rabbit roadside count and quail whistling count. The rabbit count is taken from July 10-20 and the quail count from July 5-20. These periods are too early in the season to obtain worthwhile data on young per hen, per cent of hens successful, etc.; hence the instructions to record simply the number of broods sighted. It is hoped this will serve as a supplementary preliminary indicator of current trends.

Since this is the first year such information has been recorded, no comparisons with previous years can be made. The data are presented here to furnish the basis for next year's comparisons (Table 10). In general, the results paralleled those from the regular pheasant routes quite well. One exception occurs in the Southwest region. It so happens that the five best pheasants counties in this region do not have a rabbit route in them, hence the non-representative picture. In the case of both the rabbit and quail surveys, it should be kept in mind that these routes are laid out

TABLE 10. Pheasant broods observed on 1963 mid-July rabbit roadside survey and quail whistling counts

Region of State	Rabbit Survey			Quail Survey			Combined		
	No. Miles	No. Broods	Broods per 100 Miles	No. Miles	No. Broods	Broods per 100 Miles	No. Miles	No. Broods	Broods per 100 Miles
Northwest	377	50	13.24	92	10	10.87	469	60	12.79
North-central	296	34	11.49	70	7	10.00	366	41	11.20
Southwest	311	10	3.22	118	15	12.71	429	25	5.83
Central	445	39	8.76	308	26	8.44	753	65	8.84
East	418	22	5.26	185	22	11.89	603	44	7.30
South	484	12	2.48	265	5	1.89	749	17	2.27
STATEWIDE	2,331	167	7.16	1,038	85	8.18	3,369	252	7.48

for the purpose of sampling the particular species in question. Their location then may not be in the area of the county with the best pheasant population.

SUMMARY

1. The August roadside pheasant count is the primary source of information on the status of the pre-hunting season pheasant population. It is supplemented by rural mail carrier surveys, Conservation Officer sight records and information recorded on the rabbit roadside and quail whistling surveys.

2. Following a very favorable winter and spring, an increase of 42 per cent in the number of pheasants sighted on the August roadside counts was recorded over 1962 (2.72 vs. 1.92 birds per mile). This is the highest in the 10 years these counts have been taken in August, and 8 per cent above the previous high of 2.51 recorded in 1958.

3. The best pheasant populations are in northwest, north-central and southwest Iowa. The highest population on a localized basis is to be found in Adair County and vicinity in southwest Iowa.

4. Various indices to reproductive success indicate production was better in 1963 than 1962, which was also a fairly good production year, and well above average. The hatching peak was 1 to 2 weeks earlier than usual.

5. Rural mail carrier counts and Conservation Officers sight records both showed that 1963 was the best "pheasant year" for some time.

RESULTS OF THE JULY, 1963, ROADSIDE RABBIT SURVEYS

Paul D. Kline
Game Biologist

INTRODUCTION

The annual July roadside rabbit counts were continued in 1963. The survey has been conducted with slight modification every summer beginning in 1950. It is made by Conservation Officers and Biologists who drive predetermined routes 30 to 40 miles long on gravelled roads. Participants drive 25 miles per hour starting at sunrise and count and record all rabbits seen along the routes. The July counts were developed for use in surveying cottontail populations. However, starting in 1958, jackrabbits were counted as well.

Each participant in the roadside surveys was asked to record numbers of adult and juvenile cottontails observed during the survey period (July 10-20). The age of rabbits seen during the roadside counts was recorded separately for use in computation of the fall population index. Counts of mourning doves which had been part of this survey were discontinued in 1963. Instead of doves, the participants were asked to record numbers of quail, Hungarian partridge, and numbers of pheasant broods seen during each survey. These data were given to the quail and pheasant biologists for their evaluation. Similar data on cottontails and jackrabbits taken in conjunction with quail and pheasant surveys were received from those biologists and are reported in this paper.

RESULTS

Sixty-seven routes totalling 2,287 miles were surveyed. In all, 1,284 cottontails were seen for an index of 5.61 cottontails per 10 miles of route (Table 1). Cottontails were most abundant in the southern loess area where they have been most abundant since 1953 (Table 2). The other three areas produced indices below the statewide average. Lowest populations appeared in the eastern and northern counties (Figure 1). Traditionally, lowest populations have always occurred in the extreme northeast counties. The same trend appeared in 1963.

The statewide index indicates populations have increased sharply over 1962. From a high of 6.86 in 1958 the index of cottontails dropped to 6.33 in 1959 and 4.56 in 1960, climbed slightly to 4.79 in 1961, and dropped to 3.88 in 1962. The average for all years, including 1963, is 4.62 cottontails seen per 10 miles of route. All of the four areas used in compilation of the data showed sharp increases over 1962. Populations in 1963 were higher in three of the areas than the 14-year means. In the western loess the index was nearly the same as the 14-year mean.

Forty jackrabbits were counted during the surveys. The index of jackrabbits seen per 10 miles was 0.17, slightly higher than the index for 1962 of 0.11. These data indicate a decline in jackrabbit populations since the 1958-61 period when indices were 0.23, 0.44, 0.33, and 0.2 respectively. These indices may or may not be indicative of population changes of jackrabbits as the survey is designed specifically for cottontails and not for jackrabbits. As is normal, most jackrabbits were seen in northern and western sections of Iowa.

Of 3,006 cottontails aged, 2,125 were juveniles for a ratio of 2.41 juveniles per adult (Table 3). This ratio is up from 1962 (2.06) but below the 14-year average of 2.51. Best

TABLE I. Results of July 1963 roadside rabbit surveys

Area	Number of Routes	Total Miles	Cotton-tails Observed	Jack-rabbits Observed	Cottontails Observed/ 10 Miles	Jackrabbits Observed/ 10 Miles
Western Loess	10	351.2	185	10	5.27	0.28
Northern Glaciated	32	1,070.3	448	29	4.19	0.27
Southern Loess	15	501.5	510	1	10.17	0.02
Eastern	10	364.0	141	0	3.87	0.00
Statewide	67	2,287.0	1,284	40	5.61	0.17

TABLE 2. Comparison of July roadside rabbit surveys for years 1950 through 1963 (cottontails per 10 miles)

Year	Area				
	Western Loess	Northern Glaciated	Southern Loess	Eastern	Statewide
1950	4.75	3.87	6.83	2.22	4.29
1951	6.69	3.37	5.68	2.13	3.92
1952	6.74	3.70	6.14	1.78	4.18
1953	4.26	2.70	4.23	3.33	3.31
1954	3.90	2.97	4.55	2.36	3.35
1955	3.55	4.60	6.03	5.31	4.96
1956	3.51	3.06	5.99	4.44	4.07
1957	4.72	3.32	7.59	4.79	4.87
1958	8.46	4.68	12.95	4.65	6.86
1959	7.92	4.36	10.46	4.66	6.33
1960	5.07	4.62	5.41	1.80	4.56
1961	6.12	4.25	6.58	2.19	4.79
1962	3.53	2.94	6.97	1.80	3.88
1963	5.27	4.19	10.17	3.87	5.61
Average	5.26	3.75	7.11	3.24	4.62

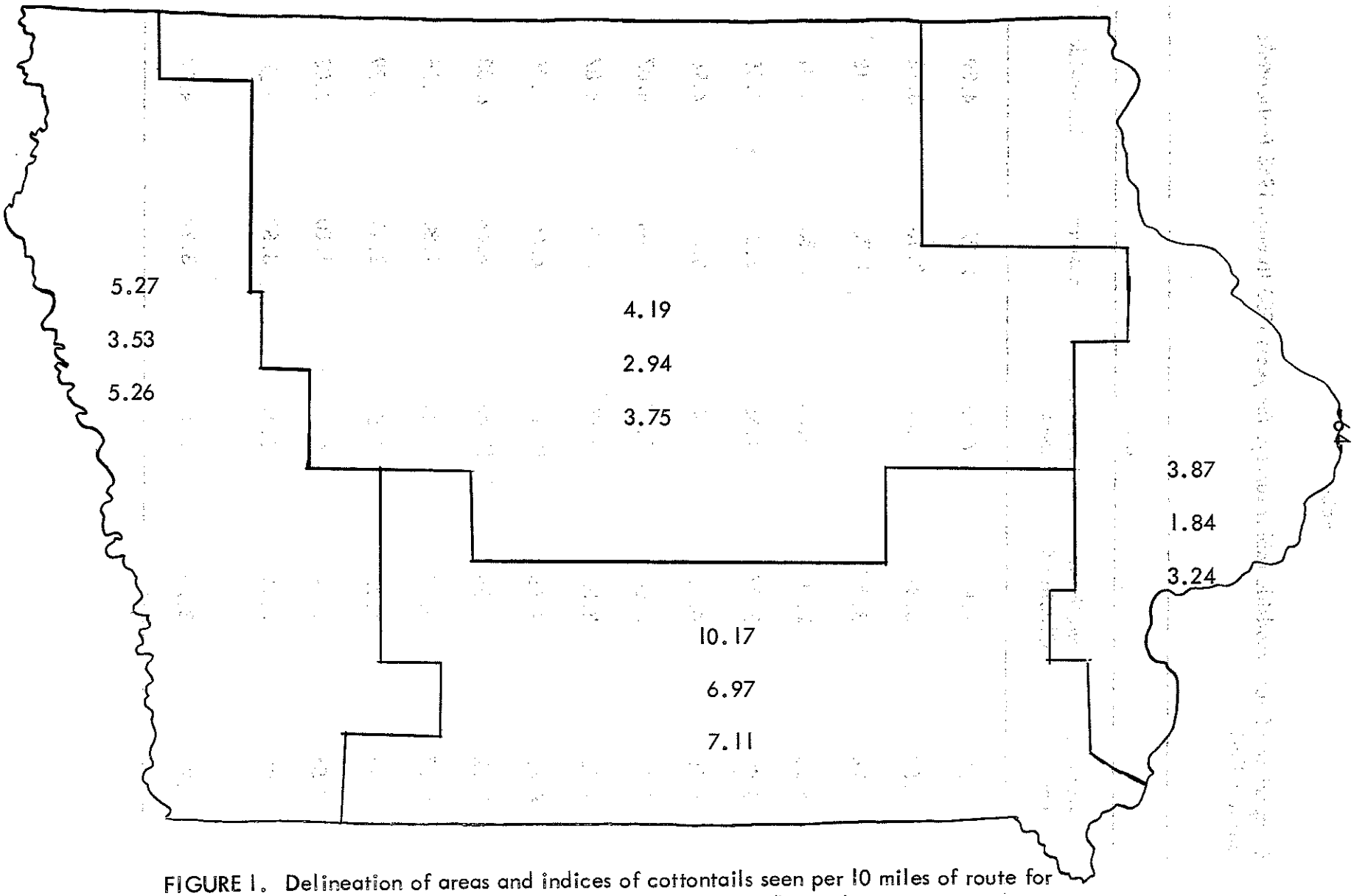

FIGURE 1. Delineation of areas and indices of cottontails seen per 10 miles of route for 1963 (top), 1962 (middle), and 14 year average (bottom).

TABLE 3. Age ratios of cottontails observed during July 1963 surveys

Area	Number of Adults	Number of Juveniles	Juveniles per Adult
Western Loess	199	372	1.87
Northern Glaciated	325	812	2.50
Southern Loess	242	743	3.07
Eastern	115	198	1.72
Statewide	881	2,125	2.41

TABLE 4. Rabbits seen during 1963 spring pheasant surveys

Area	Number of Miles	Cottontails Observed	Jacks Observed	Cottontails per 10 Miles	Jacks per 10 Miles
Western Loess	1,093	167	26	1.53	0.24
Northern Glaciated	2,907	353	98	1.21	0.34
Southern Loess	1,751	268	0	1.53	0.00
Eastern	744	107	11	1.44	0.15
Statewide	6,495	895	135	1.38	0.21

production appeared in the southern loess where the index was 3.07 juveniles per adult.

The fall population index, which is obtained by dividing the number of juvenile cottontails seen along the survey routes by the number of miles traversed during surveys and multiplying by 10, was 3.94 as compared to 2.33 for 1962, 3.79 for 1961, 2.73 for 1960, 4.07 for 1959, and 4.51 for 1958. This indicates rabbit hunting in Iowa will be better than any season since 1959 and much better than during the 1962-63 season.

Numbers of cottontails seen during the spring pheasant surveys averaged slightly less in 1963 (1.38 per 10 miles) than in 1962 (1.43 per 10 miles). This indicates the breeding stock for 1963 was very near the same as the previous year, despite the low populations occurring during the 1962-63 season. Highest populations indicated by these pheasant surveys occurred in the western loess and southern loess areas (Table 4).

Cottontails seen during the 1963 August roadside pheasant surveys increased (2.50 per 10 miles) over 1962 (1.91 per 10 miles). Highest indices were obtained from the southern loess (4.08) and western loess (3.75). These data corroborate those obtained from the summer rabbit surveys (Table 5). On the quail whistling surveys, made during the same approximate time as the rabbit counts, 5.00 cottontails were recorded per 10 miles. Again, highest indices were obtained from the southern and western loess areas (Table 6). These data agree with the results of the roadside rabbit surveys. Since cottontails were not recorded on the quail routes prior to 1963, there can be no comparison with data from previous years.

DISCUSSION

Conditions have been favorable for cottontail rabbits during the past year. Iowa experienced an "average" winter with really severe conditions of deep snow and intense cold only during part of January. At that time some rabbits were found in poor condition in some areas of southern Iowa. These conditions did not persist, however, and it appears the cottontail population as a whole wintered rather well. The relatively stable breeding population as compared to 1962, indicated by the spring pheasant surveys, lends weight to this belief.

Warm April weather and drier than normal conditions during spring and summer in most areas have been very favorable to rabbit production and survival during the present breeding season. Prevalence of pregnancy indicated by the spring breeding study reached 100 per cent by March 14 which was 1 week earlier than any other spring previously recorded and 2 weeks earlier than every spring except 1959.

This early breeding may accout for the age ratio index of 2.41, which the writer believes cannot be truly indicative of actual production during 1963. The early born cottontails may have reached a size by July whereby they would be classed as adult from visual observation and thereby distort the age ratio, favoring the adults.

The participants in the roadside surveys were asked again this year to record adults and juveniles observed during the actual counts. However, for the first time, a space was provided to record these on the forms for roadside counts. Previously they had been recorded on the age-ratio forms. Oftentimes the participants failed to do this. The age ratios from the routes are particularly valuable since they are used in calculation of fall population indices.

Recording of cottontails and jackrabbits seen during the pheasant and quail surveys does

TABLE 5. Rabbits seen during 1963 August roadside pheasant surveys

Area	Number of Miles	Cottontails Observed	Jacks Observed	Cottontails per 10 Miles	Jacks per 10 Miles
Western Loess	720	270	13	3.75	0.18
Northern Glaciated	2,310	367	56	1.59	0.24
Southern Loess	990	404	1	4.08	0.01
Eastern	540	100	5	1.85	0.09
Statewide	4,560	1,141	75	2.50	0.16

TABLE 6. Rabbits seen on quail whistling surveys, July 1963

Area	Number of Miles	Cottontails Observed	Jacks Observed	Cottontails per 10 Miles	Jacks per 10 Miles
Western Loess	138	83	23	6.01	1.67
Northern Glaciated	247	87	30	3.52	1.21
Southern Loess	222	157	0	7.07	0.00
Eastern	121	37	0	3.06	0.00
Statewide	728	364	53	5.00	0.73

appear to add weight to the data taken from the regular July rabbit surveys. These had not been recorded prior to 1962 for pheasants and to 1963 for quail. Since the data from these surveys does corroborate the regular survey indices, we can have increased confidence that our regular surveys are indicative of rabbit populations available for fall and winter hunting. The spring pheasant surveys, in particular, may fill in a gap regarding spring breeding populations of cottontails.

The August pheasant counts are made at a time after roadside activity of cottontails has diminished seriously and can never replace the regular rabbit surveys. Previous work has shown rather conclusively that accurate roadside counts of cottontails may be taken only during the month of July. Quail whistle surveys, while taken at the proper time, are not designed specifically for cottontails and can never take the place of the regular counts. They probably will give more representative indications of rabbit populations than the pheasant surveys. However, only about one-third of the number of survey miles are recorded on the quail routes as on the rabbit routes. This will be a limiting factor.