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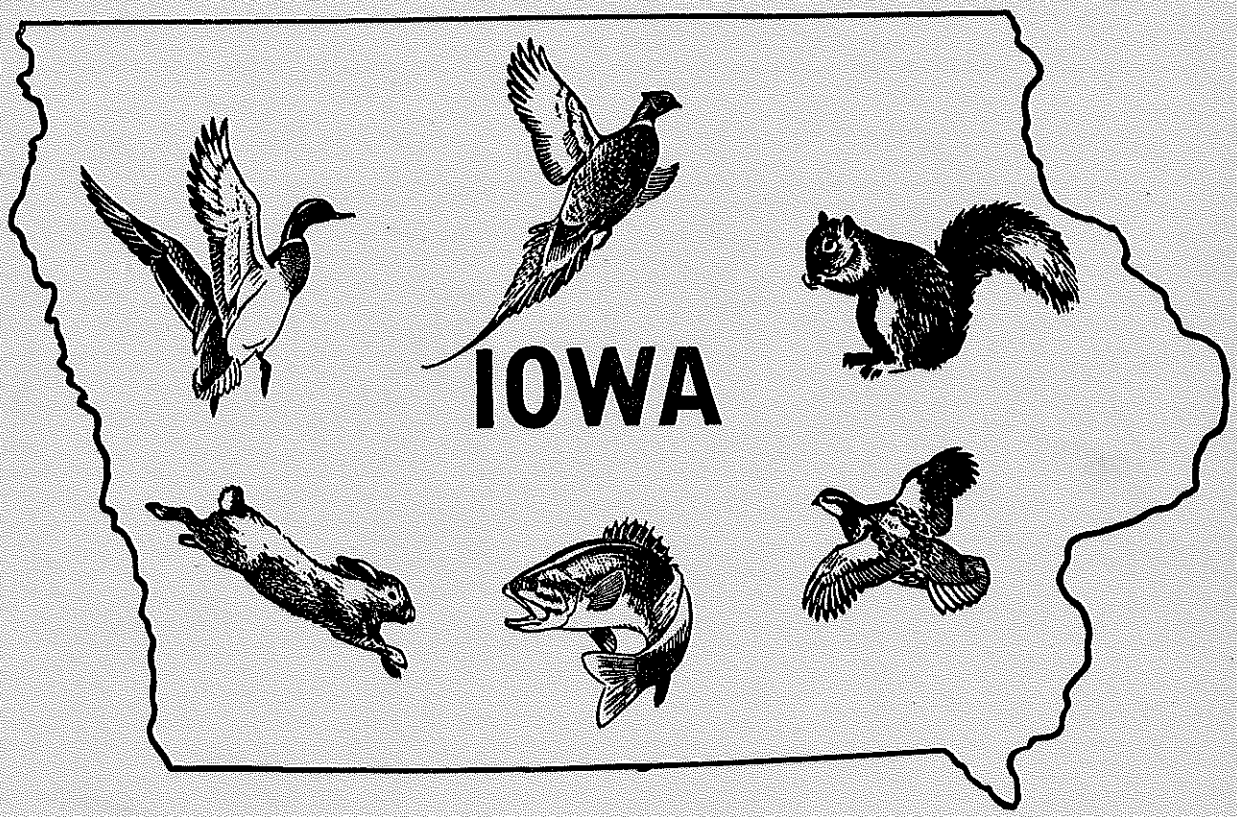

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STATE CONSERVATION COMMISSION

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SUMMARIES OF THE 1956 AND 1957 AERIAL RECREATIONAL SURVEYS OF THE MISSISSIPPI RIVER IN IOWA

R. E. Cleary
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A series of aerial flights were made over the Iowa waters of the Mississippi River as part of the Federal Aid to Fisheries Project F-24-R-3. These flights were originally set up so the entire reach of the river (Hastings, Minnesota-St. Louis, Missouri) would be covered on a single day. Variable flying and observing weather forced flights over certain areas to be cancelled. In 1956, five of sixteen flights, and in 1957 only seven of nineteen flights covered the entire Iowa portion of the Mississippi River (Minnesota border to tailwaters of the Lock & Dam No. 20).

The observer was asked to count the number of fishing boats, boat and bank fishermen, and the number of pleasure craft in each of his assigned pools. Further, during the open-water months of 1957, the Iowa observer was asked to locate, on a series of maps, the presence of each fishing boat and bank fisherman he observed. This procedure served to pin-point areas of angling pressure. This information was later mapped, indicating exact geographical locations and the needs for access areas based on angler concentrations.

Since the two annual reports with their supporting data are rather lengthy, for the purpose of this paper it will suffice to abstract only the summaries from each and present them below.

Summary of the 1956 Aerial Flight Data

As part of a recreational survey on the impounded reaches of the Mississippi River, a series of aerial censuses were made in the waters common to Iowa, Wisconsin and Illinois in 1956. Ten flights were made over Pools 9-12, and eleven flights over Pools 13 through 20 during the months of April through October. These flights gave qualitative data as to intra-and inter-pool comparisons of water recreational use, with the emphasis on fishing and boating.

These data will be used to determine the need for fishing access and boat landings, and as a check on the coverage of the sampling techniques of the co-phase of this project -- the contact creel census.

In rating Pools 9 through 19 according to fishing pressure, it was decided that the fishing pressure within a given pool was an expression of angler selectivity; although pool size and adjacent population were significant factors in ranking some pools. Pools 11, 13, 12 10 and 15 were the heaviest fished pools on holidays or week ends and are arranged above in order of their utilization. During week days the following pools were the most heavily fished and are ranked in order of utilization as: 10, 11, 19, 14 and 13.

Generally, there was a three-fold increase in river usage on week ends and holidays as compared with week-day use. Utilization of water resources dropped appreciably after Labor Day. This could be the result of summer home closures on the river or it could be the accepted midwest procedure of arbitrarily closing the "Water Season" on Labor Day.

In comparing the use of Iowa's waters with that in Illinois, it was found that there was heavier use of pleasure craft in Iowa waters; more anglers fish from the bank in Iowa than in Illinois; and in fishing-boat usage and boat angling the pressure in each state's territorial waters was about equal.

In comparing the aerial flight counts with ground census coverage, it was determined that the Iowa clerks were not sampling the two means of angling, boat and bank, in the proportion in which they existed.

Comparisons between average daily counts made at each lock and dam by the Corps of Engineers lockmasters and the average daily aerial counts were made. There was a rough relationship, and then only on a broad basis, between the counts made at the locks and dams and those made from the air covering the entire pool. It is hoped that through the use of additional flight data a factor can be applied to the lockmaster's daily count and that this figure can be projected into a daily picture of angler utilization of the entire river.

Summary of the 1957 Aerial Flight Data

A series of 19 aerial flights over the Iowa section of the Mississippi River was made in 1957 and early 1958; 16 similar flights were made in 1956.

Counts were made of bank and boat anglers, fishing boats and pleasure craft, by pools and portions of pools.

In certain flights the actual location of the fisherman and/or his boat was noted on individual maps of pools. These data gave us pin-point accuracy in locating areas of heavy angler use for the establishment of needed access areas.

A series of navigation charts covering the Iowa waters of the Mississippi River were utilized and were symbolically annotated showing present access areas, concentrations of angling pressure, average number of fishing boats and bank anglers per flight counted in these concentration points, and recommended general areas for establishment of access areas.

Based on counts of 35 aerial flights, made during the various quarters of 1956, 1957 and early 1958, there was a daily average of 1,248 anglers using the Iowa portion of the river on week ends and holidays. This figure declined to a 582 average during the week. These were instantaneous counts, not covering total daily use, and as such can be considered minimum figures. A projection of these statistics, weighted by specific daily averages, gives a minimum annual utilization figure of 289,020 angler days.

As could be expected, Sundays and holidays were the most heavily utilized days of the week. Week-day pressure was the heaviest on Thursday and the lightest on Friday.

On days in which the entire Iowa reach of the river had optimum fling and visual conditions to make a "complete coverage" flight, the average angler count determined through twelve "complete" flights was 1,024. These flights were made as follows: two were Mondays; one - Tuesday; two - Wednesday; one - Thursday; two - Saturday; and two - holidays.

The ratio of bank to boat anglers was nearly constant on the Mississippi River below Dubuque, Iowa during the two years (1: 1.2). However, above Dubuque it varied with the season to a high of more than 100 boat anglers to each bank angler.

In ten flights in 1956 there were an average of 369 fishing boats and 272 pleasure craft per flight; in 1957 this ratio was reversed with a flight average of 256 pleasure craft and 213 fishing boats, indicating the increased use of the river made by boating enthusiasts, and/or poorer fishing conditions due to a month of high turbid waters.

SUMMARIES OF THE 1956 AND 1957 EXPLORATORY FISHING SURVEY IN THE MISSISSIPPI RIVER, LA CROSSE, WISCONSIN TO BURLINGTON, IOWA

R. E. Cleary
Fisheries Biologist

In 1956, the Fish Technical Committee of the Upper Mississippi River Conservation Committee re-established the field investigational phase of its river surveys. The 1956 surveys were a cooperative venture; Illinois, Wisconsin and Iowa sharing the equipment and manpower requirements.

Since the two annual reports with their supporting data are rather lengthy, for the purpose of this report it will suffice to abstract only the summaries from each and present them below.

Emphasis was placed on gathering data concerning population structures as well as establishing a basis for comparison with future numerical trends in important game fish populations. In line with this goal over 3,000 scales from the more important game species were "read" and assigned to age classes within length frequencies.

Although the crews used gill nets, seines, trammel nets, and an electric shocking device, the 3 x 6 trap net was used as the criterion gear since it was the least selective fixed entrapment device, and since it was also used as the main entrapment device in some of the past surveys (1944, 1946 and 1948).

There was a 45:48 ratio of game to commercial species by weight in the Iowa-Wisconsin section of the river (Pools 8-11). In the Illinois-Iowa section this ratio was 29:63 (Pools 12-20).

In analyzing the structure of the catch according to the length frequency of various species of game fish it became apparent that:

(a) In the northern pike, there was no apparent gap in length ranges in any of the collections north of Dubuque, indicating that commercialization of this species has not reduced the adult section of the population by over-cropping.

(b) There was a difference in the age classes of sauger which made up the population in the main channel and those in the backwater lakes and sloughs. The younger and smaller fish inhabited the lakes and sloughs.

(c) The population peak or mode of bluegills and black crappies in the Iowa-Wisconsin waters averaged an inch greater in size than those forming the peak of population of their counterparts in the river south of Dubuque. The northern individuals proved to be faster growing than their downstream counterparts.

(d) The white bass and white crappies presented a seemingly contiguous population from La Crosse to Burlington, each having the expected accession of growth as the surveys progressed downstream and extended into summer.

The average weight at a given length was used as an indicator of population conditions for several species of game fish. These analyses indicated that despite larger pools and the longer growing season favoring the more southern fish, most of the game fish of the Wisconsin-Iowa section were generally heavier at a given length than their Illinois-Iowa counterparts; indicating that the limiting factor lay in other ecological features promoting growth rather than available space or length of growing season. This phenomenon of fish averaging more in weight in the upstream reaches of the same river is also apparent in the inland rivers in the state of Iowa.

While no concentrated effort was made to compare the 1946 with the 1956 netting data, some areas were compared and these comparisons ranged from reasonably identical to widely divergent; this despite the fact that comparison was made on the same areas fished with the same gear both in 1946 and 1956. No trends could be determined.

In comparing the mean daily water temperature with the corresponding trap-net catches of five important game species, the graphic representation presents a trimodular picture with peak catches made at temperatures between 72-74 degrees Fahrenheit, 78-80 degrees, and 82-84 degrees. Most fish were caught in the latter range.

No apparent relationship was discovered between trap-net catches and attending turbidity, with the exception of the northern pike, which had a depressed catch in either extremes of turbidity or clarity.

Although the trap net was used as the criterion gear for the survey, it was determined that the electric shocker was over 40 times more effective in the per-hour-catch category and nearly as non-selective, averaging 20.2 species per station to the trap nets' 23.6 species per station.

Of the 14,483 fish examined, only 21 showed evidence of recent lamprey parasitism. Of these fish, 10 were northern pike, 6 were miscellaneous game fish, and 5 were commercial species.

In 1957 the scope of the survey was reduced due to manpower limitations. Effort was concentrated in the upper river and more use was made of the electric shocker. The results of this survey are listed below with some comparison being made between the 1956 and 1957 data.

The 1957 U. M. R. C. C. survey crew took nearly 14,000 fish weighing five tons at 10 stations in the Mississippi River Navigation Pools 8-13. All fish were taken either in trap nets or with an electric shocker.

Major game fish species were subjected to routine life history determinations such as Age and Growth, L/F, and L/W studies.

The bluegills taken in the 1957 survey had a length-frequency mode of 6-7 inches in total length as compared to 7-8 inches in 1956.

Both black and white crappies were about the same mean lengths in 1957 as in 1956 (8-9 inches).

Bluegills and black crappies taken at downstream stations on the Mississippi River weighed less than those taken upstreams.

There was a 40 percent increase in numbers and a 20 percent increase in weight in the 1957 catch-per-hour figures in trap nets over those in 1956. This was thought to be the result of an increased 1957 water stage and an increase in mean water temperature, which in turn made the equipment used more effective. These comparisons were made at the same station and at the exact same net location in both years.

River habitats are seldom similar from one year to the next, and since even the slightest change may manifest a radical fluctuation in net catches, it is difficult to determine a fixed or standard relationship between catch and habitat. Only three of ten species caught most frequently exhibited the same habitat preference both in 1956 and 1957 as evidenced by catch comparisons.

Further comparisons between trap net and shocker catches were made in 1957 and the shocker was found to be less efficient in the taking of crappies and white bass, but more efficient in taking buffalo, carp and gizzard shad. It also took greater numbers and larger bass, and greater numbers and smaller bluegills than the trap net.

In 1956 the chestnut and silver lamprey scarring incidence amounted to only 0.14 percent of the entire catch. In 1957 this incidence dropped to 0.10 percent. The number of scars per individual host remained about the same 1.43 in 1956 to 1.57 in 1957. In both years the northern pike was the most prevalent host for the parasitic lamprey.

THE CONTRIBUTION OF STOCKED FINGERLING WALLEYES TO THE ADULT POPULATION IN SPIRIT LAKE

(Preliminary Report)

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Abstract

Test seining in Spirit Lake in 1956 indicated a low natural reproduction of walleyes or poor survival of hatchery stocked fry. To compensate, 125,000 fin-clipped fingerlings were stocked in the fall of 1956. In 1958, shocker and trawl catches indicated a high survival of these two year-old fish with nearly 20 per cent of the 1956 year-class walleyes from the marked segment. The 1958 creel census and lake surveys had a much lower percentage (about 7 per cent) of marked 2 year-olds. Because of the fairly uniform ratios the shocker and trawl data were deemed the most reliable at this time. As explained in the text, it is expected that the 1959 creel census data should provide more uniform and reliable ratios than in 1958.

Introduction

Efforts to bolster the populations of fish in lakes and streams by stocking of fry, fingerlings or adults have continued virtually unabated in this country. Few hatcheries have been abandoned or planted to beans despite logical de-emphasis a decade ago. Fortunately the trend is now toward more corrective stocking, more planting of fish in new impoundments, or for rehabilitation following poisoning operations. The indiscriminate stocking of the past in hopes of improving angling has largely disappeared in Iowa and elsewhere. Research that has been directed toward evaluation of stocking as it influences subsequent adult populations and harvest generally indicate that where the environment of a lake is suitable and the species is already present, further stocking is a wasteful practice. The maintenance of hatcheries and nurseries for stocking new lakes, or in lake and stream rehabilitation programs, is mandatory in any good fish management program.

Since a large part of the sportsman's dollar is spent on stocking, it is of the utmost important to evaluate the program as it applies to each body of water. Much of the original criticism of stocking was based on the assumed high mortality of fry, consequently emphasis has shifted to rearing fish to fingerling and larger sizes before stocking. The purpose of this paper is to indicate the effect of a heavy stocking of fin-clipped fingerling walleyes in Spirit Lake on the subsequent adult population and angler harvest.

Spirit Lake is the largest natural lake in Iowa, covering nearly 6,000 acres. It is a part of a chain of lakes in Dickinson County, and is considered fair walleye environment. It is stocked annually with 3,000 fry per acre and with varying quantities (dependent on supply) of nursery reared fingerlings. Adult populations have been calculated by the tag and recapture method from a low of about 30,000 to a high of around 50,000 with harvest percentages estimated from 15 to 28 per cent (Rose, 1949, 1955). Annual harvests of walleyes by anglers are considered high in comparison with other Iowa lakes. Last year's first complete-type creel census includes a calculated total catch of 30,120 walleyes (34,447 pounds).

The 1956 year-class of walleyes

Lake survey hauls using 500 feet of one-quarter inch mesh seine have yielded an average of 43 young-of-the-year walleyes per haul in the last ten years (range 3 to 137). Surveys in 1956 yielded an average of only 13 fingerlings per haul which indicated that a sub-normal reproduction and/or fry stocking survival occurred. A heavy stocking of marked fingerlings from the nurseries was therefore recommended to the management section.

In order to obtain an appraisal of what effect a large planting of fingerlings might have on future population density and angling, all of the fish were to be marked by fin-clipping. According to the record, 125,000 fingerling walleyes were marked (right pectoral excised) and stocked in Spirit Lake during October, 1956.

From three to eight men clipped the fish which were brought to the hatchery from the nursery and held in cold, clean water for clipping. Of necessity, the men worked fast in order to reduce holding time. Samples of marked fish were checked by Biologist Moen, who determined that slightly over 90 per cent were effectively marked with the crew was pressed for time and that 98 per cent were well marked when not under pressure. An incalculable mortality occurred after stocking. Some of weaker fingerlings were consumed by gulls and terns near the stocking area. It is probable that somewhat over 100,000 survived the operations of handling and clipping although the number would be difficult to determine.

Recapture of marked and unmarked fish

During the routine Biology investigations on Spirit Lake in 1957, a considerable number of yearling walleyes were obtained including some recaptures of the fin-clipped fish. In 1958, many more were observed, principally in the creel census. These data are combined in Table 1.

Table 1. Percentage of marked to unmarked 1956 year-class walleyes in Spirit Lake.

Month and Year	Method	Not Marked	Marked	Percentage Marked Recaptures
April, 1957	Shocker	38	3	7.9
July	Survey	127	19	15.0
Sept.	Trawl	32	0	0.0
April, 1958	Shocker	75	14	18.7
May-Sept.	Census	440	25	5.7
July	Survey	97	7	7.2
	Trawl	9	1	11.1
Sept.	Trawl	38	7	17.6
Grand Totals	All Methods	956	76	8.9

It is readily apparent from these data that the ratio of marked to unmarked

fish fluctuates widely within the methods of recapture. Some of the individual catch methods such as the survey hauls of 1957 together with the shocker and trawl catches in 1958 suggest a considerable component of marked fish and fairly uniform ratios. On the other hand, the low percentages of marked to unmarked observed in the creel census and surveys of 1958 indicate the relative unimportance of the stocked walleyes in this 1956 year-class. But, the creel census data may be biased since anglers doubtless returned some of the smaller marked fish to the lake.

The length distribution of the 1956 year-class (Table 2) includes all of the measurements of recaptured marked fish and from those not marked but within the length mode of the former. Scale readings confirmed the ages of the latter group.

Table 2. Length-frequency distribtuion of marked and unmarked 1956 year-class walleyes captured in 1958

Number	11	10	15	46	28	18	1	3
Length Interval	7.8 – 8.2	8.3 – 8.8	8.9 – 9.4	9.5 – 10.0	10.1 – 10.5	10.6 – 11.1	11.2 – 11.7	11.8 – 12.4

The great majority (84 per cent) of the fish were between 8.9 and 12.4 inches in total length, which is acceptable for most anglers. The length distribution noted (Table 2) is about the same as reported by Carlander (1950) for Minnesota and Iowa lakes. The smallest two-year fish in Minneosta were 8.2 inches as compared with 7.8 (T. L.) reported here. His Iowa measurements show a range of 8.6 to 14.4 inches which is somewhat larger than these 1956 year-class fish.

Discussion

At this early date it is difficult to systhesize this material into a positive statement of values regarding the stocking of fingerling walleyes in Spirit Lake. Preliminary search of literature has yielded no references of comparable studies which would aid in an appraisal.

Present evidence indicates that the percentage of marked fish in the angler's catch is not very significant -- only 5.7 per cent of the 1956 year class. Several year-classes are involved in the catch which of course reduces the stocked segment, the importance would not be minimized.

The 1956 test seining suggests a poor year-class of walleyes for that year; however, if this was in error and the magnitude of reproduction and/or survival of fry stocking was large, a small percentage of marked recaptures in 1958 would be expected even though survival to maturity of the stocked fingerlings in 1956 had been high. Survey and creel census records of 1958 (Table 1) suggests either a high reproduction survival of the 1956 year-class or a low survival to maturity of the marked fingerlings. On the other hand, the 1958 shocker and trawl data indicate just the opposite and perhaps more tenable position.

Since this 1956 year-class has just entered the angler's catch it is expected that the 1959 census data will provide more conclusive evidence of ratios and catch relationships.

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DES MOINES RIVER CREEL CENSUS, 1958

Harry M. Harrison
Fisheries Biologist

A creel census of Des Moines River fishermen was carried on in 1958. This is an annual extension of a project initiated in 1953.

The method of census involves fisherman interviews in the field at frequent but irregular intervals from the start of fishing in the spring, usually early April, until the end of September. The information taken from each angler is recorded on individual census cards and includes the following: the date, time and place of the interview, the amount of time spent fishing up to the time of contact, the kind and number of fish caught, the variety of fish that the contact wanted to catch, and the kind of bait used.

The reach of the Des Moines River, extending from the Scott Street Dam in the city of Des Moines to Humboldt, receiving major attention.

The catch data gathered for 1958, are given in Tables I and II, which also includes the related information for each year since the beginning of the project. Table 1 summates the total number of contacts made each year together with: the number of hours fished; the number of fish caught; and the number of fish caught per man-hour. Table II shows the rate of catch of the more important species caught during the six years of study.

Table I shows the rate of catch of all species to be 0.61, 0,75, 0.37, 0.39, .62 and .70 fish per rod hour in that order, for the past six years.

Comparing the catch by years, angling success was at approximately the same level in 1953, 1954, 1957 and 1958. The catch per man hour was considerably lower in 1955 and 1956. Poorer fishing for 1955 and 1956 was probably a reflection of drought conditions which prevailed in the Des Moines River watershed during that time. During the drought of 1955, abnormally high water temperatures and low water stages were prevalent. Attending this phenomenon fish losses were common across the entire state. To compound the problem, waterstages continued low into the winter of 1955-56, and coupled with this condition serious oxygen depletion which resulted in added fish losses.

Table I. Rate of Catch of Fish From the Des Moines River for the Years 1953 through 1958.

Year	Fishermen Contacted	Total Hours Fished	No. Fish Caught	Fish per Hour
1953	884	1,847	1,142	.61
1954	648	1,421	1,073	.75
1955	797	1,588	581	.37
1956	1,050	1,510	595	.39
1957	1,146	2,193	1,358	.62
1958	785	1,394	977	.70

The adverse condition of the drought period reduced some fish populations to near extinction in many stream areas. Some of these areas so adversely effected had provided good fishing before the onset of the drought. The loss of those areas as angling places contributed significantly to the poor angling success of 1955-56.

The 1958 angling year had the second highest rate of catch of the last six, and was up some over the year 1957. This slight gain over last year is quite likely tied in with sampling procedure, but it could have resulted from improved water conditions. Higher than normal flows for August and early September, 1958, and a relatively cool summer are two factors that may have resulted in better fishing success in 1958. Species-wise, carp were the most important fish taken; followed by black bullheads, channel catfish, crappie and walleye, in that order.

Table II. A Comparison of Rate of Catch by Species of Fish Caught from the Des Moines River for the Years 1953 through 1958.

No. Anglers	884	648	797	1,050	1,146	785
No. Hrs. Fished	1,847	1,421	1,588	1,510	2,193	1,394
	Number Caught Per Man Hour					
Year	1953	1954	1955	1956	1957	1958
SPECIES:						
Channel Catfish	.33	.29	.13	.16	.28	.18
Carp	.13	.11	.16	.40	.21	.43
Bullhead	.08	.28	.04	.08	.09	.33
Walleye	.03	.02	--	--	.01	.02

Although, bullheads were the second most abundant species caught, it should be mentioned that this rating resulted from a flurry of good bullheading that lasted for only a very few days in July. Other than for that time, bullheads were insignificant in the 1958 catch. They should properly be regarded as a species of little consequence in the Des Moines River fishery.

Now that the creel census project of the Des Moines River has been going for a considerable length of time, it should perhaps begin to show a pattern of harvest or what might be expected of the stream by way of producing fish for the creel. Although it will take more study to validate some of the things which seem to be shaping up out of the six seasons of census, it is believed worthwhile at this time to call attention to some aspects of the study that seem to form a pattern of angling success as may be related to stream conditions and fish populations.

A point of significance is the consistancy of angling success with that which could be considered as normal or usual water conditions. In the years 1953, 1954, 1957 and 1958, stream conditions in the Des Moines River were normal. There were no extended periods of extreme weather which resulted in adverse circumstances for fish life. In all four years angling success varied only 0.14 fish per hour. In light of the technique used to census fishermen in this particular study, it would seem that sampling procedure could and probably did account for much of this difference.

It this is so, it would appear that the Des Moines River under reasonably normal circumstances is only capable of producing fish for the "mill-run" angler at a rate of 0.6 and 0.7 fish per hour. Considering the composition of the catch, with minor or explainable exceptions, it seems to be relatively constant.

The channel catfish is the most sought-after species in the river. Disregarding the drought years of 1955 and 1956, the catch of this species has been at a rate of from .2 to .3 fish per hour. Surveys of catfish populations by means of netting and electrical shocker reveal a seemingly constant catfish population involving very large numbers of fish. For the most part these are of a size that have continued, for fourteen years of study, to be too small to be acceptable to the average catfisherman. Growth studies reveal slow growth. The perennial problem limiting catfishing in the Des Moines River is one of over-populations, and it will necessitate unusual natural conditions or, drastic management on the part of man before a better size structure in the catfish population can be expected. If and when this happens, many more catfish will enter the creel instead of being returned to the water to "grow-up".

Carp are the second most important species caught. The catch has varied between 0.1 and 0.4 fish per hour and runs inversely with that of the channel catfish. This would indicate that unsuccessful catfishermen turn to carp fishing. Our surveys have always shown the carp to be very abundant in the Des Moines River. With regard to their growth, they appear to put on length reasonably well, but they are slender compared to lake or river populations in areas where their numbers have been reduced. This too, demonstrates conditions of over-populations, and the correction of this might materially improve the quality of the fish and fishing.

Bullheads usually rate third in the creel, but in 1954 and 1958, they ranked second in abundance of fish caught. The bullhead provides an unusual fishery in the Des Moines River. Regarding their population, they always occur abundantly, but are of very small size. In two separate instances, one in 1954 and the other in 1958, bullheads large enough to take were caught in large numbers for a single period of a few days each. In 1954, this occurred near Humboldt, while in 1958 it took place at the lower dam in Fort Dodge. Both of these flurries lasted for no longer than four days, and insofar as our census was concerned, the bullhead produced no fishing of consequence at any other time.

Game fish including walleyes, crappie, northern pike, and smallmouth bass are caught upon occasion, but seldom in large numbers. Surveys have shown these species to be widely distributed in the census area, but they occur in far fewer numbers than the three species previously discussed.

Walleye and smallmouth bass populations vary from year to year and from place to place. In certain local situations both species occur in quite large numbers but for unknown reasons they are difficult to catch in the Des Moines River. As a consequence, they provide little to the run-of-the-river fishermen. Specialists take fair numbers of walleyes upon rare occasions.

Our technique of spot checking points of heavy fishing does not often bring us in contact with the specialist. For this reason the actual take of game fish from the Des Moines River by the specialist is not well known.

Summary

1. Catch of fish from the Des Moines River for the years 1953 through 1958 has been reported upon.

2. Channel catfish is the most important species sought in the census area. This is followed by carp, bullheads and other game fish in that order of importance.

3. The annual catch of fish from the Des Moines River under usual water conditions varies between .6 and .7 fish per rod hour.

NOTES ON THE USE OF A SIXTEEN-FOOT OTTER TRAWL FOR SAMPLING BULLHEAD POPULATIONS

Tom Moen
Fisheries Biologist

The otter trawl has been used for a great number of years in salt water commercial fisheries, and it has been a successful fish sampling device in various Great Lakes fisheries investigations. Worth (1957) and Helm (1957) have used small otter trawls with considerable success in the larger natural lakes of Wisconsin. Based on the results of trawling in Iowa natural lakes during the past two years it is obvious that the trawl is an excellent piece of gear for sampling bullheads.

During 1957 and 1958 approximately 200 hauls were completed in twenty-three lakes with a sixteen-foot otter trawl. Bullheads were taken in at least 95 per cent of these trawls. Most of the hauls were made during the months of July, August and September as part of routine fisheries survey work. In this survey work the principle piece of gear has been a 500-foot, $\frac{1}{4}$ inch seine. This seine was augmented in most surveys with three by six trap nets. The 16-foot otter trawl (314 inch mesh wings and $\frac{1}{2}$ inch mesh bag) was added as an additional sampling device to replace the trap nets.

Except in a few instances the trawl was towed with a 14-foot aluminum boat powered by either a 10 H.P. outboard motor or a $7\frac{1}{2}$ H.P. outboard equipped with a power propeller. The latter motor seemed to be a slightly better unit, providing the correct speed and power necessary for efficient operation.

The trawl was usually fished in the center of the lake in an attempt to obtain additional data from an area not sampled by the seine. The standard procedure consisted of making three hauls of five minutes each in each lake. For various reasons, discussed below, additional hauls were made in certain lakes. The average five minute haul covered approximately 0.5 acres as compared with 1.5 acres sampled by the 500-foot seine. The lakes sampled varied from 25 to over 5,000 acres in area; and from four to 25 feet in depth. Bottom materials were usually mud-silt with a few collections made over sandy or gravel bottoms. Table I presents a summary of bullhead catches in 173 trawls in 20 lakes compared with seine hauls from the same lakes.

It is the purpose of this paper to discuss the bullhead sampling ability of the trawl, but it is of interest to note that a total of 24 species of fish were represented in the collections made by the trawl during the past two years.

As one would expect with a schooling fish such as the bullhead, the number per haul varied considerably at times; yet an average of three hauls produced what appeared to be a fairly reliable index of the bullhead population. When the trawl collections were compared with the seine collections the evaluation of the population was more complete. However, several factors should be kept in mind in appraising a bullhead population. The gregarious habits of the bullhead was mentioned above. The tendency to follow lee shores during windy weather will show up in large numbers of bullheads per seine haul made "into the wind". Early season seine hauls produced more bullheads than hauls made during late summer after spawning activity had been completed and the fish moved off shore into deeper water.

Comparative Catches of Seine and Trawl

Except in extremely high or low populations of bullheads, there is little correlation between the catches of the seine and the trawl. This is evident if we compare the number per acre collected by each device. The trawl is relat-

ively inefficient in collecting all the fish in the area covered when compared with a seine haul, but at times the trawl collected many more bullheads per haul than the seine even though it covered only one-third the area seined. At Crystal Lake, for instance, the population of bullheads as based on seine hauls would be considered very low while the trawl indicated a minimum of 60 pounds per acre. The reverse situation occurred at Ingham Lake in 1957. Ingham Lake sampling during 1958 indicated a reasonable correlation between seine hauls and trawl hauls.

Where comparative data is available, the trawl collections show less fluctuation than these taken with the seine. If the trawls are made in various parts of the lake the results more nearly reflect the population status while the seine hauls more often reflect the activity pattern. Where individual trawl collections were made in the same vicinity and the same habitat covered by the seine haul, the correlation in catch was more pronounced. For example, at Lost Island Lake on July 17, 1958, one trawl collection took eleven bullheads and the seine haul collected eleven; a second seine haul took 62 bullhead and the trawl 82. At Clear Lake in early August, the trawl captured 10 bullheads compared to 8 in the seine haul in the same vicinity. In Spirit Lake in late August, three trawls were made in the same area of three seine hauls; both devices failed to take bullheads. When all collections are considered for Spirit Lake (Table 1) there appears to be substantial populations of bullheads. As one could expect from the size of the standard deviation for the seine hauls on Spirit Lake, one haul produced 96 per cent of the bullheads collected by that method. A night seine haul made on September 4, 1958, in Spirit Lake collected two bullheads and a trawl collection in the same vicinity also took only two bullheads.

Trawl Catches and Population Estimates

Bullhead population estimates were made in Lost Island and Center Lakes in 1957 and 1958. In both instances the trawl was used to collect fish for marking and sampling for mared fish. During the last two days of October, 1957, 5,265 bullheads were captured, marked (adipose fin clip) and released in Lost Island Lake. Sampling later that fall and during early spring of 1958 placed the population estimate at 1,350,000 bullheads. This represents 1,120 fish and 225 pounds per acre. In marking for the population estimate, eight hauls averaged 149 bullheads per haul (Table 1). Fifteen hauls made later that fall for the population estimate averaged 120 per haul. The difference between these two means is not statistically significant ("t" equals 1.057, 21 d.f.). If we assume that our data are reasonably correct up to this point and that the true mean number of bullheads per haul is represented by an average of these 23 hauls (130 fish), then the average haul in Lost Island Lake during the fall of 1958 collected about eleven per cent of the total number of bullheads per acre.

Five trawls made on July 17, 1958, produced an average of 85 bullheads per haul and 20 trawls on October 29, 1958 netted 85.6 bullheads per haul. These two samplings in 1958 represent a 44 per cent reduction in catch rate from those made in the fall of 1957.

Comprehensive creel data for May through August indicates that 743,500 bullheads were taken by hook and line with 95 per cent taken in the first three months. This hook and line catch thus reduced the population approximately 55 per cent from the estimate made for the start of the fishing season. There was no evidence of recruitment to the population during the year. With this reduced population, the trawl appeared to be more efficient, taking about 17 per cent of the total number of fish per acre in the average haul. The ratio of marked to unmarked fish collected during the trawling in October of 1958 was essentially the same as that for the original population estimate, one marked to 250 unmarked. When this ratio is applied to the hook and line catch and the resulting marked fish removed from the original marked segment, the new population estimate as of

Table No. 1. Number of bullheads taken per five minute trawl with a 16-foot otter trawl and with 500-foot $\frac{1}{4}$" inch mesh seine haul in several Iowa lakes during 1957 and 1958. Standard diviations (s) were calculated where applicable.

Lake	Area in Acres	Date		Trawl			Seine		
		Month	Year	Number Hauls	Bullheads Per Haul	s	Number of Hauls	Bullheads Per Haul	s
High	570	July	1958	2	2,048		1	6,675	
East Okoboji	1,400	Aug.	1957	7	820		3	4,800	
		Aug.	1958	5	1,050		3	17,500	
Center Lake	264	July	1958	8	800		1	2,387	
		Oct.	1958	5	921				
Tuttle Lake	981	July	1958	3	500		1	426	
Ingham	1,332	July	1957	5	227	144	3	5,800	3,020
		July	1958	3	173	80.5	2	663	
Minnewashata	75	Aug.	1958	4	154	118	2	709	
Lost Island	1,260	Oct.	1957	8	149	76	July 3	1,347	
		Nov.	1957	15	120	46			
		July	1958	5	85	58	4	128	109
		Oct.	1958	20	85	48			
Lower Pine	63	Aug.	1957	2	108		1	500	
		Aug.	1958	2	106		1	473	
Crystal	283	July	1958	2	94		1	1	
North Twin	569	July	1957	2	92		2	0	

Mill Creek	25	Aug.	1958	3	90		1	17	
Cornelia	385	Aug.	1957	2	75		1	675	
		July	1958	2	7		1	29	
Iowa	308	July	1958	3	58	24	2	408	
Storm	3,060	Aug.	1957	4	38	19	3	144	134
		Aug.	1958	4	58	15	2	100	
Black Hawk	957	Aug.	1957	2	30		2	24	
		Aug.	1958	5	12	9	2	36	
Blue Lake	125	Aug.	1957	2	17		1	59	
Spirit Lake	5,684	Sept.	1958	14	17.3	8.3	(July &		
		Sept.	1958	11	15.7	19.7	Aug.) 14	704	3,100
				25	16.6	14.5			
Clear Lake	3,643	July	1958	6	16	12	3	6.3	4.1
Silver Lake	1,058	July	1958	3	13.3	13	2	68	
		Aug.	1958	10	11.3	7			
Browns Lake	840	Aug.	1957	2			2		
		Aug.	1958	2			1		

October 1958 is 560,000. If we substract the hook and line catch from the original population estimate the new population would be 606,500. It seems rather unlikely that the correlation between the population estimates, trawl catches, and hook and line catches is a matter of pure chance.

Eight trawls in late June and early July of 1958 in Center Lake produced 800 small (30 per pound) bullheads per haul; 5,820 of these were marked and released. On August 12, a collection of 9,567 bullheads was made with the trawl. Twelve of these were marked, placing the population estimate at 4,640,000. A high percentage of the marked fish were taken in one locality, throwing some doubt on the validity of the estimate. Five trawls made on October 27, 1958 collected 4,606 bullheads for an average of 921 per haul. Five of these fish were marked, thus a population estimate of 5,336,000. There was no recruitment and no hook and line catch during the interim, therefore an estimate of five million appears fairly reliable. Based on 264 acres in the lake, the average trawl collected about five per cent of the total number of bullheads per acre.

Discussion

Additional and more detailed population estimates under varying conditions are needed before positive statements can be made about the size of the bullhead population via a series of trawl collections. Although further statistical analysis may bring out flaws in the population estimates discussed in this paper, the basis for obtaining a picture of the bullhead population through the use of the trawl is certainly demonstrated.

Additional data is needed on trawl catches in areas producing large numbers of bullheads in the seine. It is suspected that there would be less correlation under those conditions, i.e., small numbers of bullheads in the seine hauls were followed by small numbers in trawls in the same area but it is likely that large numbers in the seine would not mean proportionately large numbers in the trawl.

Based on the relationship of the trawl catches to the population estimates completed so far, it appears that under "normal" conditions the average five minute haul of the 16-foot trawl will collect from five to 25 per cent of the total number of bullheads per acre. This is a much more accurate sample of the population than is produced by seine hauls and it is done with much less effort.

For routine survey work, the number of hauls probably should be increased to at least five hauls per lake having 500 acres or less and one haul per 100 acres for all lakes over 500. Assessing the population during May and June should be avoided because of the bias introduced by the excessive congregation in shallow water during this period.

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THE ERADICATION OF THE FISH POPULATION FROM LAKE KEOMAH

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Fisheries Biologist

Lake Keomah, an 81 acre state-owned recreational lake in Mahaska County, was chemically treated to eradicate the fish population on September 15, 1958. A vast population of rough-fish, coupled with extreme overcrowding of pan-fish made the eradication expedient. Insignificant numbers of rough-fish had existed in the lake until the drought years of 1954-57. During this period these species multiplied rapidly until they became the predominate fishes in the lake.

The lake was constructed by the Civilian Conservation Corps during the years 1934-37. Public angling was first permitted in 1939. Keomah may be considered a typical state-owned recreational lake. The impoundment is located in a relatively long, narrow valley adjacent to the Skunk River. Two arms at the upper end of this valley form the main body of the lake. The original maximum depth was approximately 26 feet. This has been reduced only slightly since the initial impoundment of water. Bottom contours are relatively steep in the lower reaches of the lake, and shallow toward the upper end of each arm. The immediate shoreline is covered with climax woodland. An unknown amount of general agricultural practices is in use of the remainder of the watershed. Siltation has never been a serious problem primarily because of a settling basin at the upper end of the south arm of the lake. Chemical and physical studies prior to fish eradication revealed that the lake is stratified during summer months. On August 27 the thermocline was located between 14 and 18 feet. No dissolved oxygen was found below 16 feet.

Method of Treatment and Population Estimate

Prior to treatment the lake bottom was contour mapped at 5 foot levels. Marker bouys were located across the lake in a manner corresponding to line "A" on this map (Figure 1). This separated the impoundment into two segments which were designated as Areas I and II. The ten foot contour level was then located and marked with painted bouys in each of the two areas. (Contour Line "B" on Figure 1). Total volume of water and area in acres was then calculated for each five foot level. These calculations were then plotted in graphical form for field use (Figure 2).

The lake was treated in three different segments with a concentration of 1.5 parts per million emulsified Pro-Noxfish (synergized).

First the entire volumes of Areas I and II were treated with a concentration of 0.25 parts per million. This was applied with an airplane motor powered boom-spray boat. Immediately after the treatment the largemouth bass, channel catfish, crappie, and bluegills affected by this dosage were picked up and placed in fresh aerated water to salvage as many of these fish as possible. Minimal losses occurred with largemouth bass and channel catfish; however, there were heavy losses in salvaged crappies and bluegills.

Secondly, a concentration of 1.25 parts per million was applied to the portion of the lake lying outside of the marker bouys (the 10-foot contour). Thirdly, a concentration of 1.25 parts per million was applied to the volume of water inside of the marker bouys ten feet in depth. An additional concentration of 1.25 parts per million was applied by underwater apparatus to the volume of water below ten feet deep. In all cases Areas I and II were treated as separate units.

The estimated number of fish killed by the chemical treatment was recorded by counting the number of individuals as they were picked up by personnel cruis-

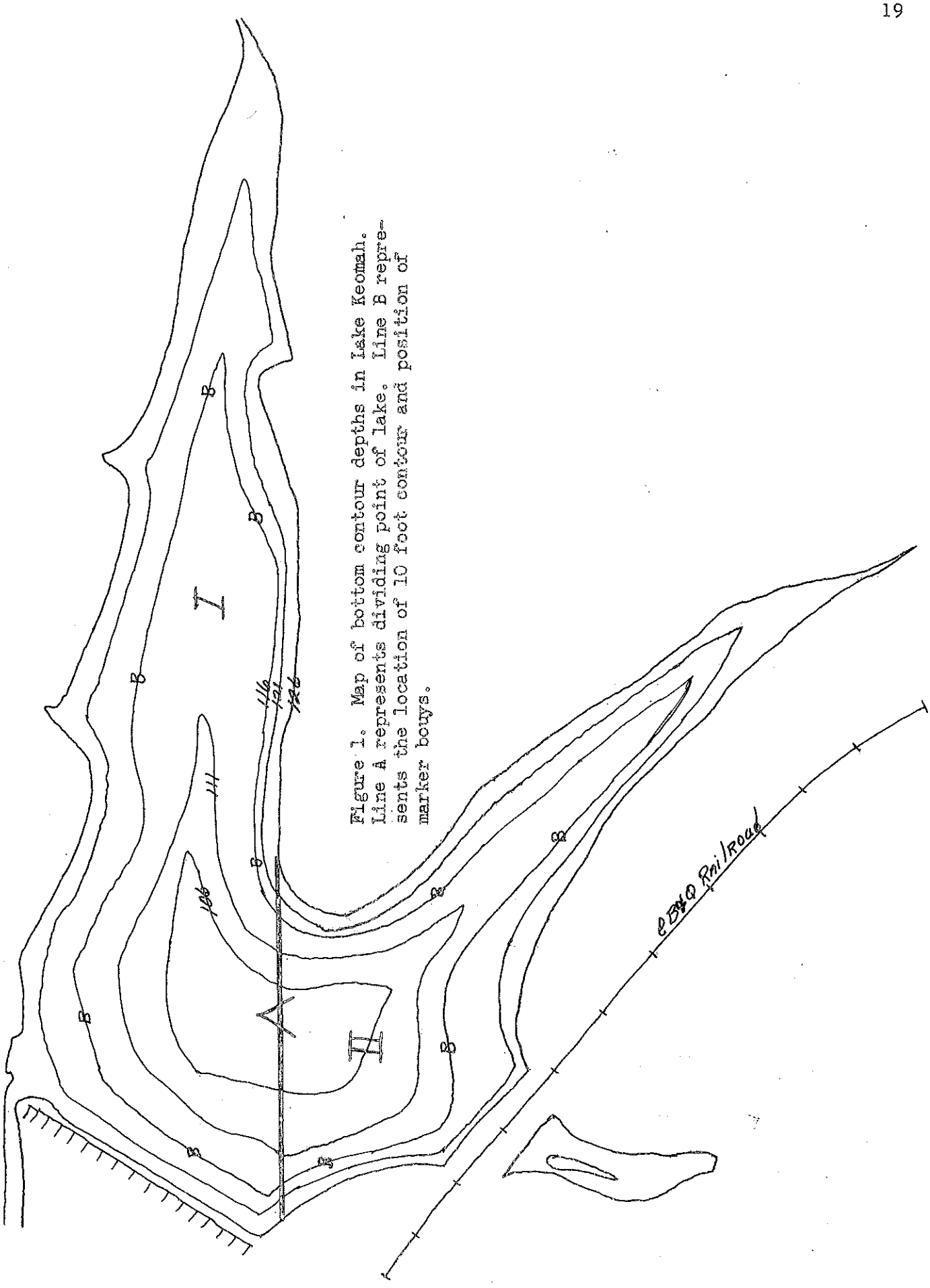

Figure 1. Map of bottom contour depths in Lake Keomah. Line A represents dividing point of lake. Line B represents the location of 10 foot contour and position of marker buoys.

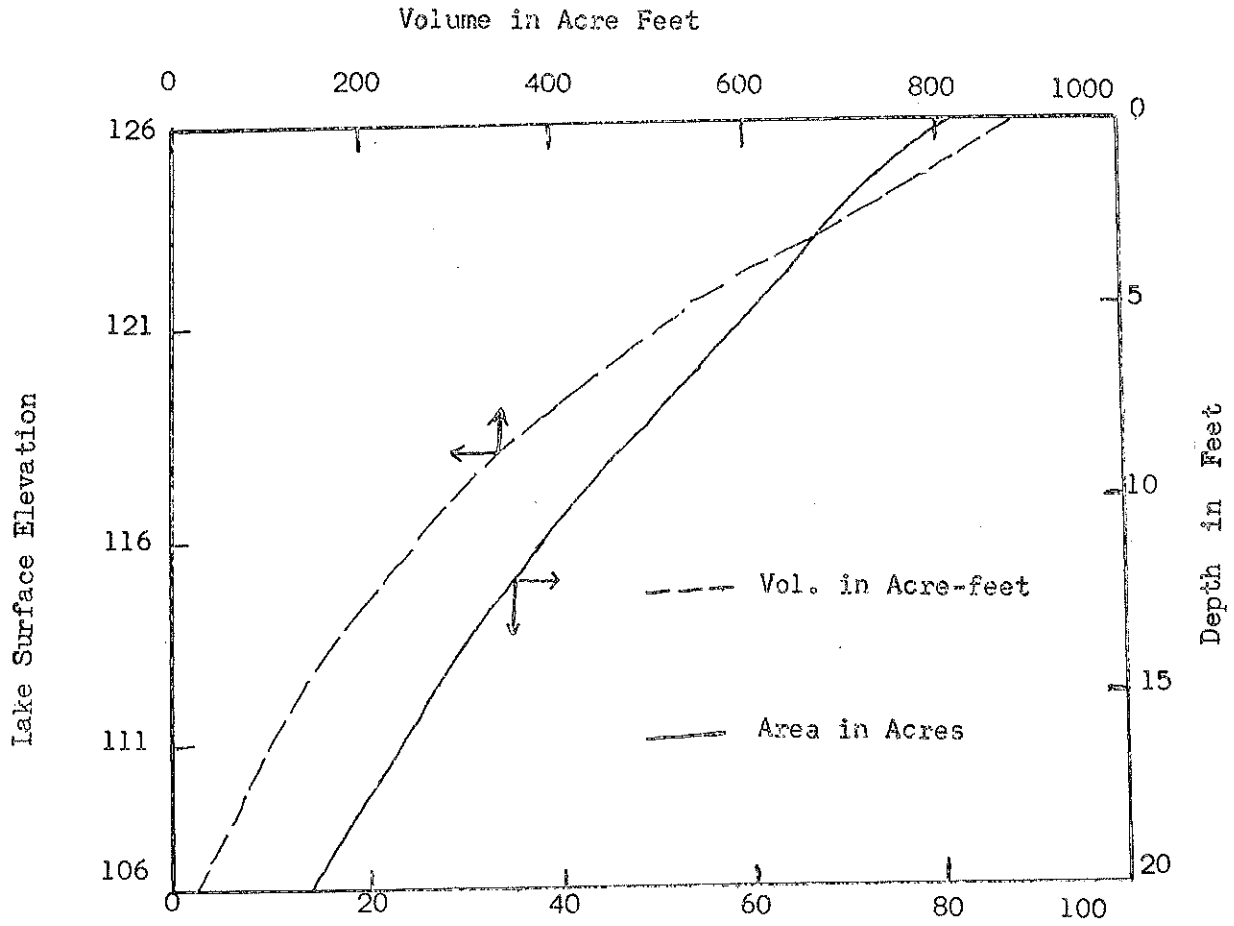

Figure 2. Volume of water and area in acres at each five-foot contour level in Lake Keomah, Iowa.

ing the lake in boats, or after they floated to shore two days after the treatment. Weight of specific populations was determined by using random scale samples and representative length frequencies to establish the percent of age composition within each species and applying the mean weight of fish recovered during the operation is only an estimate. An estimated 5,000 people were present during most of the project, and although many of them brought fish to operational headquarters to be tabulated, undoubtedly many fish were not counted. A small amount of error was also evident from people taking fish home between 8 P.M. and 5 P.M. after the application. There seemed to be little public interest in salvaging crappie and bluegills for table consumption. Hence, these figures are considered accurate. Many people also assisted in picking up largemouth bass and channel catfish for salvaging and restocking. Most of the public interest was directed toward salvage of carp and buffalo for personal use. It is unknown how many pounds of these species (especially carp) were not recorded. The total calculated population is a minimum figure, although from personal observations it is considered within 90 per cent accuracy.

Fish Populations

Thirteen species of fish were recovered in the chemical eradication of Lake Keomah. Largemouth bass, bluegill, white crappie, black crappie, channel catfish and carp comprised the major species in the impoundment. Small populations of black bullhead, flathead catfish, bigmouth buffalo, yellow perch, golden shiner, brook silversides, and common shiner were also present.

During the project a total of 135,703 fish weighing 58,546 pounds were recovered (Table 1). The mean weight of fish per acre was estimated at 723 pounds. Approximately 50 per cent of the standing crop by weight was comprised of undesirable species.

Table 1. The estimated fish population in Lake Keomah by number and weight.

Species	Total Number	Per Cent Composition	Total Weight	Per Cent Composition
Largemouth Bass				
Sub-Adult	1,934	1.4	484	0.8
Adult	422	0.3	1,184	1.9
Bluegill	58,898	43.4	11,779	20.2
White Crappie	33,341	24.6	5,557	9.4
Black Crappie	20,697	15.2	3,450	5.9
Black Bullhead	2,026	1.5	840	1.4
Channel Catfish	1,880	1.4	5,824	9.9
Carp	13,402	9.9	28,144	48.2
Golden Shiner	2,945	2.2	491	0.8
Yellow Perch	116	(T)	9	(T)
Buffalo	41	(T)	825	1.4
Flathead Catfish	1	(T)	22	(T)
Grand Total	135,703		58,546	

Largemouth Bass

A total of 2,356 largemouth bass weighing 1,602 pounds were recovered during the project. Slightly over 91 per cent of these fish were one year old (Table 2). Age group IV was the most abundant of the adult year classes. There was an obvious lack of two year old fish within the bass population. This particular year (1956) had an extreme deficiency in precipitation and water levels receeded quite rapidly throughout the spawning season. This may be a primary determining factor for the absence of this year class. Growth of largemouth bass

was considered normal for Iowa artificial lakes. Mean total length for the first eight years of life was 6.8, 10.7, 13.3, 15.4, 17.2, 19.0, 20.5, and 22.0 inches respectively. Average weight of 120 adult specimen selected at random was 2.65 pounds.

Table 2. Age composition of the major fish populations in Lake Keomah.

Species	No. in Sample	Percent in Age Groups							
		I	II	III	IV	V	VI	VII	VIII
Largemouth Bass	120	91.3	(T)	1.7	5.4	2.1	(T)	(T)	(T)
Bluegill	404	(T)	6.7	55.7	27.8	7.7	(T)		
White Crappie	414	5.2	25.4	61.4	7.9	-	-	(T)	
Black Crappie	106	4.7	28.6	58.6	9.1				
Carp	135	65.0	22.0	6.0	5.0	1.0	(T)		

Table 3. Average total length and weight at each year of life of major fish species in Lake Keomah. Weight in parenthasis.

Species	No. in Sample	Age Group							
		I	II	III	IV	V	VI	VII	VIII
Largemouth Bass	120	6.8 (2.3)	10.7 (9.3)	13.3 (1.2)*	15.4 (2.9)*	17.2 (3.4)*	19.0 (4.3)*	20.5 (6.1)*	22.0 (7.1)*
Bluegill	404	2.0 (0.8)	3.5 (1.3)	5.6 (2.5)	6.8 (3.0)	7.5 (4.3)	8.3 (6.1)		
White Crappie	414	4.3 (1.3)	6.0 (2.5)	7.3 (3.0)	8.5 (3.8)	- -	- -	14.5 (20.0)	
Black Crappie	106	3.8 (1.0)	5.6 (2.6)	7.0 (3.5)	8.1 (4.0)				
Carp	135	10.2 (8.0)	13.5 (1.0)*	16.0 (1.5)*	18.5 (2.3)*	22.1 (4.5)*	24.8 (8.5)*		

*Weight listed in pounds all others listed in ounces.

Bluegill

Bluegill were the most abundant species of fish in the impoundment. Approximately 43 percent of the standing crop by number was represented by bluegills. By weight, bluegills were the second most important species comprising 20 percent of the total weight. Age groups III and IV made up over 82 percent of the bluegill population. One and two year old fish were not present in significant numbers. Growth of bluegills in Lake Keomah was not exceptionally slow, but general physical condition of the fish was far below normal. Mean total length was 2.0, 3.5, 5.6, 6.8, 7.5, and 8.3 inches for the first through sixth years of life respectively (Table 3).

Crappie

The crappie population was composed of about 62 per cent white and 38 per cent black crappie. Annual fisheries inventories since 1947 indicate this has been a relatively stable ratio. Combined, these species were the second most abundant fish in the impoundment. White crappie represented 27 per cent of the population by number; whereas, black crappie comprised 15 per cent of the standing crop (Table 1). Age group III was the most vigorous year class in both species. Sixty-one per cent of the white crappie and 56 per cent of the black crappie population was made up of this year class. Growth of both species was somewhat below normal for this type of habitat. Black crappie attained 3.8, 5.6, 7.0, and 8.1 inches total length during the first four years of life. In comparison white crappie were 4.3, 6.0, 7.3, and 8.5 inches total length during the same period of time (Table 3). Black crappie were in better body condition than were the white crappie. Creel Census data during the past two years

reveal these species have supported the major portion of public angling harvest.

Carp

This species of fish comprised approximately 10 per cent of the total population by number, and 48 per cent by weight. Slightly over 347 pounds of carp per acre were known to have been removed from the lake during the project. Carp were not considered abundant until 1956 when an extremely vigorous year class was noted during the annual fisheries survey. In 1957 reproduction and survival of this species was also very successful. As expected, age groups I and II were dominant, comprising 87 per cent of the population (Table 2). Growth was calculated at an average of 10.2, 13.5, 16.0, 18.5, 22.1, and 24.8 inches total length for the first six years of life respectively. Average weight of 135 specimens was 2.1 pounds.

Channel Catfish

Channel catfish populations are maintained in most of the southern Iowa artificial lakes by periodic stocking. Natural reproduction is usually insignificant due to the unfavorable physical conditions that exist in the lakes. Population abundance is therefore controlled to some extent by supplemental planting. Although the number of channel catfish recorded was not significant to the population structure in the lake (1.4 per cent) this species comprised approximately 10 per cent of the standing crop by weight (Table 1). Average weight of 29 specimens was 3.1 pounds, and ranged from 1.0 to 14.1 pounds. No attempt was made to analyze the age composition of the channel catfish population.

Miscellaneous Species

Other species of fish present in the lake included black bullhead, flathead catfish, bigmouth buffalo, golden shiner, yellow perch, brook silversides, and common shiner. Black bullhead and bigmouth buffalo were the only species among this group that represented more than one per cent of the population by weight. The buffalo population was made up entirely of exceptionally large individuals averaging slightly over 25 pounds. Golden shiners were the most abundant fish in this group comprising 2.2 per cent of the population by number.

Summary

Lake Keomah was chemically treated with sufficient quantities of rotenone to make a concentration of 1.5 parts per million. A total of 13 species of fish were recovered during the project. Bluegill were the most abundant species by number. Carp were the most important species by weight. White crappie, black crappie, channel catfish, and black bullhead were next in importance respectively.

The total population was estimated at 135,703 fish with a combined total weight of 58,546 pounds or 723 pounds per acre. Specific populations were estimated by number through counting of individual fish as they were picked up in dip nets, or when they floated to shore two days after the treatment. Population weight was computed by using scale samples and length frequencies to establish age groups, and applying the mean weight of each group to the total population of each year class.

Age group composition of major fish populations are discussed. Total length and weight distribution of largemouth bass, white crappie, black crappie, bluegill, and carp are listed.

PHEASANT REPRODUCTION IN IOWA - 1958

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Game Biologist

Pheasant reproduction studies began early last spring to determine the relative success of the 1958 hatch. This report includes the results of surveys made by conservation officers, rural mail carriers, cooperating farmers and biologists.

The 1958 spring pheasant population was higher than normal, but nearly all of the increase was due to the excess cocks carried over from the 1957 season. Population counts showed an increase of 53 percent in crowing activity, but the spring hen index was only six percent higher than in 1957.

Weather conditions during April and May were reviewed to obtain the first indicator of hatching success. A warm spring denotes a good hatch - a cool one indicates below average reproduction (Table 1). According to this study, pheasant reproduction was above average this year. Temperatures for the first three weeks of April were four degrees higher than normal, which meant an early start of nesting activity. Cooler temperatures were recorded during the next two weeks but normal or above normal readings were obtained during the rest of the period.

Table 1. Reproduction Success and Mean Spring Temperatures 1953 - 1958

Year	Mean Temperature for April and May	Reproduction Success Young per Hen
1953	51.9	3.4
1954	54.1	3.7
1955	60.0	5.2
1956	54.7	4.2
1957	54.3	4.4
1958	56.0	4.5

The Weekly Weather and Crop Bulletin reported that about 60 percent of the first crop of alfalfa had been cut by mid-June. This may be compared with the 50 percent reported for both last year and the 1947-1956 ten-year average. Harvest of hay crops was delayed by rain in some areas.

Cooperating farmers returned 111 cards last spring with information on nests and birds observed while cutting the first crop of hay (Table 2). They reported more nests this year and a corresponding increase in the number of hens killed. There were 33 broods seen compared with 15 a year ago, which indicated an earlier hatch for 1958.

Rural mail carriers conducted their annual summer game count during the week of July 21-26. They reported a total of 586 broods for the week. The results of this survey indicated that reproduction success was slightly above average this year (Table 3). The average young-per-hen figure for this survey during the period 1952-1957 was 2.4.

The primary reproduction survey was taken by conservation officers from July 15 to August 15. During this period, officers reported a total of 2,980 broods with 18,439 chicks and 1,146 hens without chicks. There were 2,183 broods checked in 1957. The statewide average of 4.5 young per hen was better than in 1957 and also above the previous six-year average of 4.2 young per hen. This count indicated good reproduction but still somewhat below the high counts of 1955 when officers recorded a 5.2 young-per-hen figure. The index decreased somewhat in the north central district and was low in northeast Iowa; however, the pheasant population remained high in that area. Best counts were obtained in districts four, five and six through the central third of the state.

Table 2. Results of Farmer Cooperator Nesting Survey 1957 - 1958.

	1957	1958
Acres of hay cut	3,751	3,062
Number of nests seen	254	251
Nests seen per 100 acres	6.8	8.2
Average number of eggs per nest	9.7	8.9
Number of nests hatched	34	30
Number of hens reported injured	61	40
Hens reported injured per 100 acres	1.6	1.3
Number of hens reported killed	59	59
Hens reported killed per 100 acres	1.5	1.9
Number of broods reported	15	33
Average number in each brood	9.0	8.6

Table 3. Rural Mail Carriers Brood Counts 1953 - 1958

	1953	1954	1955	1956	1957	1958
Average brood size	5.9	6.5	6.1	6.0	5.6	5.8
Percent of hens with broods	36%	38%	43%	38%	43%	43%
Young per adult hen	2.1	2.5	2.7	2.3	2.4	2.5

According to the author's survey, reproduction success in Franklin county and vicinity decreased slightly this year but still remained above normal for this area (Table 5).

Table 4. District Results for Conservation Officers' Brood Counts for 1958. Statewide Results for 1953 - 1958

District	Young per Adult Hen	Average Brood Size	Percent of Hens With Broods
1. Northwest	4.4	6.3	69%
2. North central	4.0	5.8	69%
3. Northeast	4.1	5.5	74%
4. West central	5.3	6.8	77%
5. Central	4.9	6.4	76%
6. East central	5.5	7.1	77%
Southern 3 districts	4.8	6.9	70%
State 1953	3.4	6.4	53%
State 1954	3.7	5.7	64%
State 1955	5.2	6.8	77%
State 1956	4.2	5.9	71%
State 1957	4.4	5.9	74%
State 1958	4.5	6.2	72%

There were 62 broods observed closely enough to estimate their ages during this local study. According to these results, the peak of hatching in Franklin county occurred during the fourth week of June. Hatching seemed to be more evenly distributed over a longer period than usual.

Table 5. Pheasant Reproduction Success in Franklin County 1953 - 1958

Year	Young per Adult Hen	Average Brood Size	Percent of Hens With Broods
1953	3.1	6.0	52
1954	4.6	6.3	74
1955	5.2	6.7	78
1956	4.3	6.1	71
1957	5.2	6.2	84
1958	5.0	6.5	77

Summary

1. Pheasant nesting activity began early in April this year.

2. Mean spring temperatures indicated good reproduction.

3. Farmer cooperators reported 33 broods while cutting hay, which meant an early hatch.

4. Results of the rural mail carriers count indicated better than average reproduction.

5. Reproduction for the state was above normal according to the officers' summer count. Best results were obtained in districts four, five and six through the central third of the state. The rate of hatching success was lowest in north central and northeast Iowa.

6. Reproduction success decreased slightly in Franklin county but still remained well above normal. Hatching seemed to be more evenly distributed over a longer period than usual.

THE SUMMER COUNT OF WHISTLING QUAIL

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Game Biologist

Reliable early estimates of the fall quail population have been needed because the season was set in late summer. Though it was seldom necessary to alter regulations, a noticeable drop in the number of young would require either a change in shooting regulations or early notice to hunters. This need was met by counting whistling quail in July.

As explained in the 1957 fall quarterly, extensive but inconclusive work was done by wildlife workers on certain phases of the whistling by quail. Nevertheless, several years' study in Iowa indicated that, if properly used, some of the information from this type of work was reliable. For instance, whistling started at about the time of pairing, peaked during hatching and ceased when brooding ended.

Information was gathered throughout the state in selected areas. In addition to a statewide count, on some local areas a summer-long calling pattern was recorded for later comparison with the nesting pattern as illustrated by ages of young seen in summer, and the study of wings from quail shot by hunters.

Method

Early in July the letters of instruction, data sheets, and maps were sent to 45 participating Conservation officers asking that the work be done after July 10. Two routes, totaling about 25 miles, were in representative counties. These sampled prominent soil types. Routes were to be run at sunrise on clear, calm days. On each route, the first listening stop was one-half mile from the starting point, as quail can be heard for that distance. Thereafter, stops were one mile apart for the length of the route. Officers were asked to listen for three minutes at each stop. The number of male quail heard was recorded on the data sheet along with weather, date and county.

Only two-syllable "bob-white" whistles were recorded because some notes of robins, larks and cardinals resembled one-syllable notes of quail. Males call at the average rate of three times per minute, but either rapid calling or short periods of silence caused confusion when locating individuals; hence, listening time was limited to three minutes. If emergencies made it necessary to do work earlier or later than recommended, adjustment was made according to when the task was done.

From May till September the biologist in charge made several records of bobwhites along routes in Davis, Wapello and Mahaska counties. Data were collected during all types of weather in order to learn effects of various conditions.

Results: Statewide

During the 1958 census in 34 counties, 1,358 birds were heard along 895 miles of route. This was an increase over the birds heard per stop in 1957 in 38 counties when 991 miles were covered.

Results: By Districts

Within agricultural districts that had shootable populations of quail, the southeast had the highest number per mile. East-central was lowest: this latter district, however, had some productive areas though they were not as extensive as those in southern portions. Border counties, from Des Moines north, and along the eastern and western borders of Iowa were lowest in whistling birds per stop.

In each instance there was increase over 1957. The following table sets forth results of calling quail counts since 1953.

Number of Calling Quail in Iowa - 1953 through 1958

Agricultural District	1953	1954	1955	1956	1957	1958
SE	1.9	1.8	2.0	1.8	1.9	2.6
SC	2.2	2.1	1.9	2.0	2.2	2.4
EC	1.1	1.0	1.7	2.5	1.3	1.7
Border Counties	.3	.6	.6	.6	.8	1.0

The usefulness of this census procedure is demonstrated by matching a figure from the whistle count against one from hunting success. In the above table the count was high, and hunting was good (1.2 hours per quail) in 1956 in the south-central and in the east-central districts.

Results by Counties

Within the main range, the highest count of whistling birds was in Davis county where there was an average of 5.4 cocks per mile on 28 miles of route. In 1957 the count was 4.1. Next highest count of 3.1 was in Wayne county, where there was a count of 2.3 in 1957. Within the main quail range of southern Iowa, in Henry county, 1.1 bob-whites were heard per mile against the 1957 record of 1.0. Adams county, not previously sampled, had 1.0 per mile in 1958.

In Jefferson county, 1.3 birds per mile in 1958 was lower than the 1.8 per mile in 1957. However, in most counties sampled the trend was up from last season.

On the border of the range where populations were low, or scattered, the highest count was in Blackhawk where there were 1.5 birds per mile, an increase since 1957. Bremer county had a total of 12, an increase also. Audubon had two birds in 1958 on 17 miles of route where none was heard in 1957. Winneshiek had five callers, a slight decline.

Discussion

There was no soil map available to be used as a guide in laying out the Adams county route that covered the commonest soils, but the officer reported on what he considered a representative portion of the region.

A few officers reported the number of calls rather than number of quail. Usually this was due to difficulty in locating each bird, though it was comparatively easy to enumerate calls. There were a few delays or changes due to road construction, washed-out bridges, unsuitable days or vacations.

Activity peaks may have varied in different parts of Iowa, but as yet, there is no evidence that this occurred.

Returns since 1953 yielded evidence that it was necessary to use more than counts of whistling quail to predict how successful hunting would be. While the precedure sampled the breeding potential, this was no guarantee of how well it would indicate fall populations or hunting success.

As an example of how figures from these checks may be used, the 1954 figure of 1.4 preceeded successful hunting. Summer favored hatching, fall conditions favored hunters. A less successful season followed the similar 1953 whistling quail count. That year, excessive rainfall, then excessive drought created adverse hatching conditions, and when the season opened, hunters were handicapped

because of the continued dry weather.

The 1958 count of 2.6 indicated an above-average breeding population, since hatching weather was favorable, the fall population will be comparatively high. However, hunters were handicapped until abnormally rank vegetation is broken down by freezing. Windy or dry weather will be a handicap for shooters. If the fall is damp, success will be high. Wherever there was more than one calling bird per mile, the number of quail will be sufficient to furnish good shooting.

Summary

1. Some of the information gained by counting calling male quail can be used in estimating the fall population.

2. The Iowa summer count of whistling quail was begun July 10.

3. There was a statewide count of whistling quail in July 1958. In addition, the summer-long calling pattern was recorded on a few areas.

4. Southeastern Iowa had the highest count of birds.

5. Davis county was highest in number of quail counted.

6. The count of whistling quail, along with a record of summer weather, indicated the amount of hatching success. Warm, damp summer weather favored production.

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RESULTS OF THE JULY, 1958, ROADSIDE RABBIT SURVEYS

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Introduction

The annual July roadside rabbit count was continued in 1958. The survey had been conducted with slight modification every summer beginning in 1950. The survey is run 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. Jackrabbits were counted in 1958. They had not been included during previous surveys.

Records were kept of temperature, wind velocity, percent cloudiness, and date of last rain first in 1958. It was hoped that recording these weather factors might aid in evaluation of weather influences upon early morning, roadside rabbit activity. Dew was measured by all personnel. Dew readings have been included as part of the annual counts since 1955. Dew gauges and photograph keys were furnished by Richard Nomsen, Pheasant Biologist.

All participants in the roadside surveys were asked to record adult and juvenile cottontails seen during the survey period (July 10 - 20). It was hope the index (juveniles/adults) obtained could be used to express breeding success.

When the survey was compiled a departure from the past division of data was initiated. Instead of the nine agricultural areas used previously (Kline, 1957) the state was divided into seven ecologic areas (Figure 1) primarily based upon the five soil areas of Brown (1936). These soil areas are defined by Brown under Missouri loess, Wisconsin drift, Iowan drift, Mississippi loess, and southern Iowa loess; and differ principally in origin of soils from glacial drift and wind-blown materials.

However, it is sometimes difficult to lump data from Iowa and Muscatine counties, for instance, withthat from Allamakee county - all in Brown's Mississippi loess. Hence, the northeast "driftless" area was classed separately as a distinct area based upon work by Shimek (1948). Also, the Missouri loess area was divided near the south boundaries of the Iowa and Tazewell glacial drifts (Anonymous, 1955). This latter division can be justified on the basis of climatic differences in north and south areas (Anonymous, 1941 - pp. 862-872). In dividing the state into seven ecologic areas it need not be inferred that soil was the primary factor considered. It is accepted by ecologists that soil merely reflects conditions of climate, biota, and physical geology. The seven areas shown in Figure 1 differ considerably when these factors are considered.

All data from the rabbit surveys are reported by counties. No other alternative seems practicable, as territories for all conservation officers who conduct the survey are defined by counties. The ecologic areas were adjusted to political boundaries (counties) with some difficulty. In general, when a county was divided by two or more areas it was thrown into that area which occupied the greater part.

Results

Sixty-two routes totaling 2,108.8 miles were surveyed. In all, 1,446 cottontails were seen for an index of 6.86 cottontails per 100 miles of route (Table 1). Cottontails were most abundant in the southern loess area. Many were seen in the

Missouri loess, Tazewell drift (northwestern Iowa), and in the Mississippi loess. Fewest appeared in the Wisconsin and Iowan drift areas and particularly in the driftless area of northeast Iowa.

Comparison of the data with that from two previous seasons (Table 2) reveals cottontails have increased particularly in the southern loess where the index is twice as great as in 1956. A notable increase in the Missouri loess for the past

Table 1. Results of July roadside rabbit surveys for 1958.

Area	Number of Routes	Total Miles	Cottontails Observed	Cottontails Observed/ 10 Miles	Jackrabbits Observed	Jackrabbits Observed/ 10 Miles
Tazewell Drift	3	118.0	77	6.5	12	1.0
Missouri Loess	6	184.4	173	9.4	2	0.1
Wisconsin Drift	16	596.8	272	4.6	25	0.4
Iowan Drift	16	534.5	241	4.5	10	0.2
Driftless Area	2	61.4	17	2.7	0	0.0
Mississippi Loess	8	244.7	165	6.7	0	0.0
Southern Loess	11	369.0	501	13.6	0	0.0
Statewide	62	2,108.8	1,446	6.86	49	0.23

year is revealed. That area had a relatively low population in 1957. Only in the Iowan drift and the driftless areas have cottontails not increased.

Table 2. Comparison of July roadside rabbit surveys for years 1956, 1957 and 1958.

Area	Cottontails Seen per 10 Miles of Route		
	1956	1957	1958
Tazewell Drift	3.5	3.8	6.5
Missouri Loess	3.1	4.0	9.4
Wisconsin Drift	2.8	2.9	4.6
Iowan Drift	3.5	4.4	4.5
Driftless Area	2.6	2.6	2.7
Mississippi Loess	4.3	5.3	6.7
Southern Loess	6.2	8.5	13.6
Statewide	3.94	4.89	6.86

The index obtained from the 1958 survey is higher than all previous years (Table 3). Excluding the year 1955, it appears that a low in rabbit populations occurred in 1953 and 1954 with a steady build-up since.

Table 3. Comparison of July rabbit indices for years 1950 through 1958.

Year	Number of Rabbits Seen per 10 Miles of Route	Number of Juveniles per Adult
1950	4.28	2.2
1951	3.91	2.0
1952	4.17	2.6
1953	3.30	2.4
1954	3.35	2.5
1955	5.67	3.0
1956	3.94	2.7
1957	4.89	3.2
1958	6.86	2.67

Forty-nine jackrabbits were counted. The Tazewell and Wisconsin drift areas produced the highest indices (Table 1). No jackrabbits were seen in the Mississippi and southern loess areas and in the northeastern driftless area. These areas are out of the normal jackrabbit range.

Of 4,447 cottontails aged, 3,236 were juveniles for a ratio of 2.67 juveniles per adult (Table 4). This ratio was down considerably from 1957 when the ratio was 3.2 juveniles per adult (Table 3). It was a higher ratio than that obtained for years 1950 through 1954. Best production appears in the southern loess and Tazewell drift areas where cottontail numbers increased. Apparent inconsistencies in the data are revealed by low ratios obtained from the Missouri and Mississippi loess areas where roadside counts were up. One would normally expect high ratios of juveniles/adults in areas where cottontails had increased.

Higher dew readings were obtained than in 1957. Whether this influenced the roadside counts cannot be determined at present. Highest dew readings appeared from southern counties. However, some high readings appeared from all areas. An increase in rabbits seen coinciding with higher dew readings may be revealed in Table 5. Comparison with data from previous seasons reveals considerable inconsistency in the data. We need to further evaluate the role of dew when marking early morning rabbit counts.

Table 4. Age ratios of cottontails observed during July counts for 1958.

Area	Juveniles Seen	Adults Seen	Age Unknown	Juveniles/ Adults
Tazewell Drift	166	47	19	3.5
Missouri Loess	358	164	41	2.2
Wisconsin Drift	579	242	81	2.4
Iowan Drift	625	202	46	3.1
Driftless Area	144	72	4	2.0
Mississippi Loess	309	177	26	1.7
Southern Loess	1,055	307	176	3.4
Statewide	3,236	1,211	393	2.67

Table 5. Effect of dew upon numbers of rabbits seen during July rabble counts and comparison with counts for two previous years.

Dew Reading	Number of Routes	Number of Miles	Number Cottontails Seen	Index of Cottontails Seen/10 Miles	Comparative Indices for Previous Years 1956	1957
0	-	----	--	----	-	4.73
1	2	80.6	73	9.06	4.24	5.07
2	15	489.2	276	5.64	4.20	3.31
3	10	347.8	225	6.47	3.54	5.88
4	9	312.8	211	6.74	4.34	4.38
5	5	144.9	123	8.49	5.15	10.26
6	12	432.5	281	6.49	3.30	3.00
7	2	77.0	101	13.01	---	7.19
R/D	2	64.0	24	3.53	1.03	4.60

Summary

1. July roadside rabbit counts were conducted in 1958 as they have been for eight previous years.

2. The index of cottontails seen per 10 miles of route was large than any previous year - more cottontails were indicated.

3. Cottontail populations appeared highest in the southern loess area and high in the Tazewell drift and Missouri and Mississippi loess areas.

4. Population increases were most notable in the southern loess and Missouri loess areas.

5. Jackrabbits were most numerous in the Tazewell and Wisconsin drift areas.

6. The ratio of young per adult cottontails was lower than in 1957 but higher than all years previous to 1955. Best reproduction was indicated for the southern loess and Tazewell drift areas.

7. Dew was relatively heavy during the 1958 counts.

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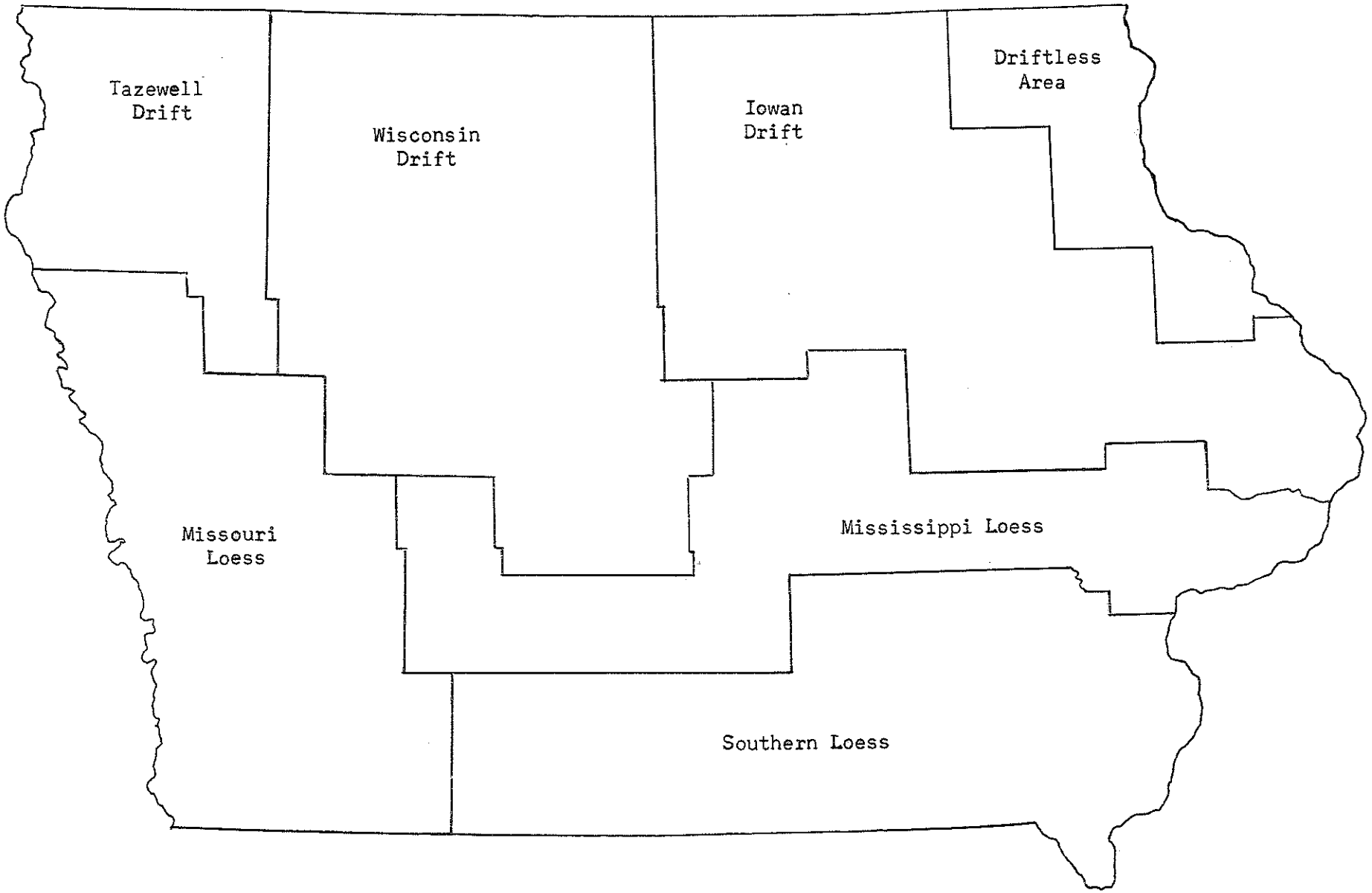
Figure 1. Delineation of ecologic areas.



WATERFOWL BREEDING-GROUND SURVEY - IOWA, 1958

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Iowa's annual waterfowl production has been reduced from several million birds prior to 1900 to a few thousand in 1958 because of habitat destruction through agricultural drainage. Breeding pairs and brood studies have been carried on during routine check counts in the remaining prairie marshes in the lakes region of northwestern Iowa since 1949. Wood duck stream surveys were initiated in 1953 and have continued in an attempt to determine wood duck production trends. Wood duck nesting-box checks have been completed on the Lake Odessa area in Louisa County to determine nesting-box utilization, and to evaluate local production each year since 1950. Random nesting-box checks have been made intermittently in northwest Iowa since 1949.

Aerial spot-checks of the prairie marshes have continued as a means of supplementing ground-survey studies.

Weather and Water Conditions, 1958

A very mild winter followed by an early spring with little run-off left many prairie marshes dry or almost dry as a result of semi-drought conditions of the past several years. Except for some severe local flooding, weather and water conditions were excellent for waterfowl production and survival. Semi-drought conditions have again prevailed in northwest Iowa since late July. The remainder of the state has not suffered from lack of rainfall, and in some areas it has been heavy.

Spring Migration

Spring migrants moved into and across Iowa early and rapidly in 1958. There were very few large concentrations, and the lack of temporary ponds and flooded fields caused most waterfowl to bypass or rapidly cross this state. The major passage of migrants along the Missouri and Mississippi Rivers was rapid with only a few concentrations. The movement of blue and snow geese through the Missouri River flats in southwestern Iowa was of short duration.

Waterfowl Production and Trends

Iowa's overall production of all species except the wood duck is of little consequence to the flyway population. Emphasis has been placed upon the study of the wood duck. Observations and reports indicate both increased breeding pairs present within the state this spring, and increased production of the species based upon stream survey data, and nesting box utilization counts (Tables 1 and 2).

Table 1. Wood Duck Stream Survey Data

Year	Stream Miles Censused	Males	Females	Pairs	Unident.	Total	Dates of Census
1953	66	11	8	10	12	51	May 5-14
1954	78	9	5	3	8	28	May 5-13
1955	90	8	1	0	6	15	April 26-May 16
1956	26*	0	1	1	12	15	May 3-June 9
1957	44*	2	0	0	5	7	May 18-June 3
1958	96*	6	4	0	2	12	May 5-July 3

*Many streams too dry to float in 1956, 1957 and 1958.

Table II. Wood Duck Nesting Box Occupancy at Lake Odessa, Louisa County, Iowa

Year	Number of Nesting Boxes Checked		Number of Nesting Boxes Checked	
	Wooden	Metal	Wood Duck	Hooded Merganser
1950	26		18	
1951	36		13 and 9*	
1952	24		18	
1953	30		15	
1954	22	50	7	4
1955	12	44	5	1
1956	6	42	5	3
1957	3	38	3	0
1958	0	32	11	0

*There were 13 nesting boxes occupied prior to flooding and nine afterwards.

On-the-spot check counts in the prairie marshes of northwest Iowa each spring and summer since 1949 have provided a studied opinion as to the production trends of ground-nesting species. The blue-winged teal and mallard are common nesters, but not numerically of great importance to the flyway. The trend of blue-winged teal and mallard production in Iowa appears to be upward. Most of these ducks and their broods have been observed during 1958 than in any other nesting season since 1951.

During 1958, nesting pintails have appeared in Iowa's lake region in the largest numbers observed during the past nine years. Total pintail production in this State is only a "drop in the bucket", but the response of this species to local habitat and phenological conditions in 1958 may be indicative of a more widespread dispersal of this species throughout other suitable fringe areas of its range. This large increase in pintail numbers in Iowa during 1958 may be a noteworthy observation even though the number of nesting pintails in Iowa is not important to the flyway.

Only a very few diving ducks, including ruddy, redhead, and occasionally a canvas-back, continue to nest in Iowa. Adult lesser scaup often remain in northwest Iowa well into the nesting season, but no nests, broods, or young have been observed. Nesting attempts of ring-necked duck have been reported during the last few years, but like the lesser scaup, no evidence of successful nesting has been witnessed. Divers are so few in number that no attempt has been made to evaluate their production.