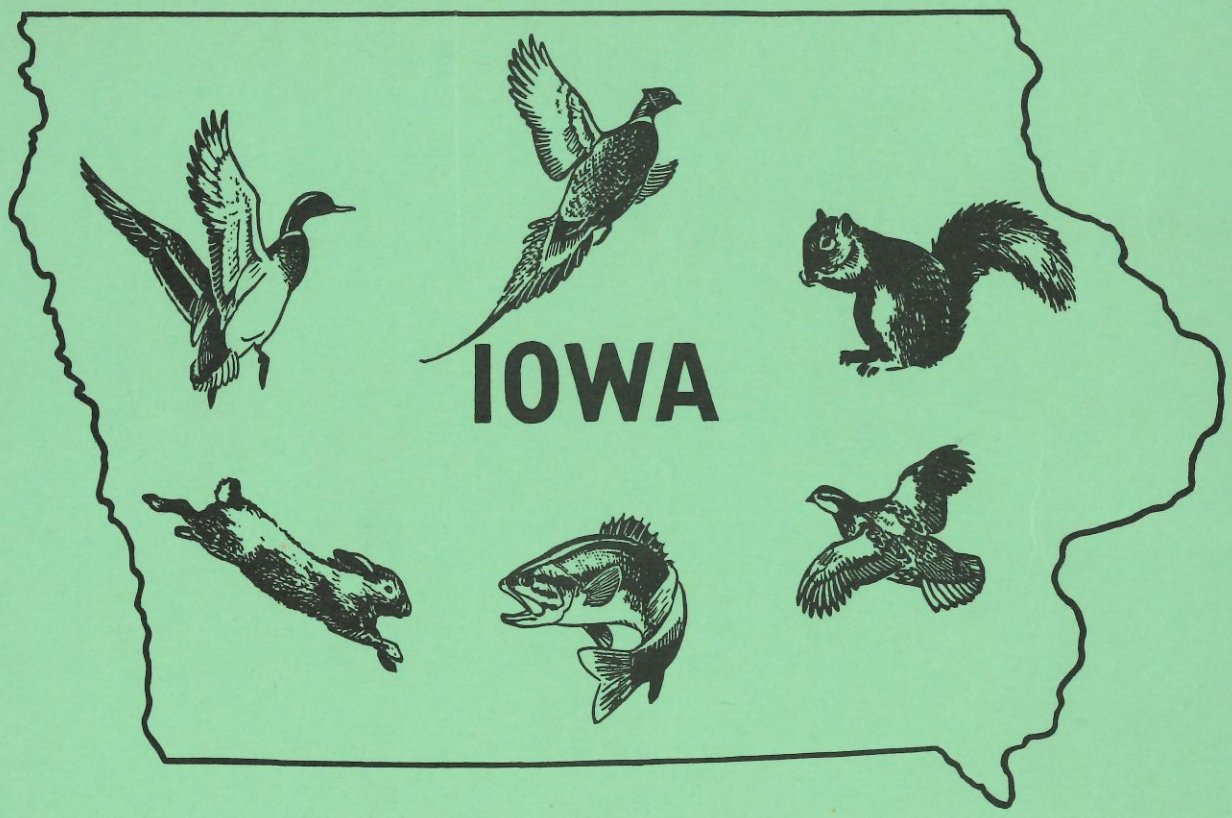
1964
Complete

QUARTERLY BIOLOGY REPORTS



FISH AND GAME DIVISION — BIOLOGY SECTION

STATE CONSERVATION COMMISSION

QUARTERLY BIOLOGY REPORTS

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ABSTRACTS OF QUARTERLY BIOLOGY REPORTS

PLEASURE BOAT NUMBERS AS COMPARED TO FISHING BOATS ON SEVERAL NORTHWEST IOWA LAKES, 1961, 1962, 1963

Tom Moen
Fisheries Biologist

Five northwest Iowa natural lakes were censused for pleasure boats as well as fishing boats as part of routine creel census operations. Three lakes were censused for the summer months of 1961, 1962, and 1963 while the other two were added to the census in 1963. The five lakes totaled 15,889 surface acres, representing nearly half the water surface available to water skiers in the natural lakes. Pleasure boating was the dominant form of boating used during the summer months in all but Spirit Lake where fishing boats consistently outnumbered the pleasure boats. Pleasure boating increased on week-ends as was expected but safe levels of boating were not exceeded except during a few instances. Black Hawk Lake sustained the highest level of boating on a per acre basis reaching single count peaks of one boat for 11 acres in July and one boat for 12 acres in August of 1963. On the larger lakes the maximum density seldom exceeded one boat on 40 acres during any single count.

A BRIEF PRELIMINARY REPORT ON COMMERCIAL CHANNEL CATFISH CATCH STUDIES IN THE MISSISSIPPI RIVER IN 1963

Roger Schoumacher
Fisheries Biologist

Because of a decline in the commercial catch of channel catfish from the Iowa waters of the Mississippi River in recent years, a study was begun of the problem in 1963. A total of 9,415 commercially caught fish were measured at markets and 1,761 of these fish were aged. Nearly half of the fish were under 14 inches long, 71 per cent were under 15 inches, and only 2 per cent were 19 inches or longer. Generally, age IV fish predominated the catch until July, when age III fish became most important. Fish in pools 9 and 19 seem to grow faster than in other pools. An intensive harvest of this species is suggested by the data, and studies will be continued.

A FISHERY INVESTIGATION OF FIVE MISSOURI RIVER OX-BOW LAKES DURING 1963

Bill Welker
Fisheries Biologist

A fishery investigation of five Missouri River oxbow lakes on the Iowa-Nebraska boundary was conducted during 1963 by biologists from the Iowa Conservation Commission, Nebraska Game Forestation & Parks Commission and the U. S. Fish and Wildlife Service. Gill nets, trammel nets, frame nets, bag seines, and electro-fishing gear were used to collect the fish. For comparative purposes, the lakes were divided into two groups -

those that open into the river at their downstream end (open lakes) and those that are completely separated from the river by levees (closed lakes).

Rough fish, mainly gizzard shad, were the most abundant fish collected in 4 of the 5 lakes. The catch of shad was signifcantly higher in the closed lakes than in the open areas. A higher per cent of larger shad were also found in the closed lakes than in the open lakes. Goldeye were significantly less abundant in the closed lakes. There is evidence that carp are less abundant in the open lakes. Carpsuckers, freshwater drum, buffalo, redhorse, and gar were other rough fish found in the lakes.

Crappie (mainly white) were the most abundant game fish taken at 4 for the lakes. Catches were significantly higher in the closed lakes. The largest number of channel catfish were taken from the newest formed lake. Fewer sauger were collected in the closed lakes than in the open lakes indicating their dependence upon the river environment. Walleye were more abundant in the closed lakes where they had been stocked than in the open lakes. Largemouth bass were caught in all of the lakes but were most abundant in areas where they were stocked. Northern pike, yellow perch, white bass, bluegill, paddlefish, and flathead catfish were other game fish collected in most lakes.

CORALVILLE RESERVOIR FISHERIES INVESTIGATIONS - 1963

PART II: LIMNOLOGY AND FISH POPULATIONS

Jim Mayhew
Fisheries Biologist

An intensive survey to study the physical, chemical, and biotic characteristics of Coralville Reservoir was completed in 1963. Temperature, dissolved oxygen, free carbon dioxide, and pH profiles revealed at normal summer conservation pool level the lake does not thermally stratify, but does have limited chemical stratification in deeper strata. Bottom samples from 7 sampling stations revealed 3 common species of organisms. Seventeen species of fish were found in the reservoir and tailwaters of the outlet structure. Carp was the most abundant species of fish in the reservoir. Bigmouth buffalo was most numerous in the tailwaters. Crappie was the most predominant game fish in both areas. Those species classified by statute as rough fish comprised more than 80 per cent of the population weight in both areas. Natural reproduction of black crappie, carp, largemouth bass, and channel catfish was found in the reservoir. No young of the year was found in the tailwaters. Growth of crappie, bluegill, and channel catfish was slow in comparison to other impoundments in Iowa. Other fish grew at an average rate.

THREE YEARS OF BANDING INFORMATION OBTAINED FROM BANDING BLUE-WINGED TEAL IN IOWA

Gene Goecke
Game Biologist

In the last three years of banding in Iowa, 6,102 blue-winged teal have been banded. Of the total banded, 201 recoveries have been returned. Seventy-nine per cent of the bands that were recovered came from birds banded as immatures. Of the band recoveries in Iowa, 85 per cent were taken during the first two weeks of October. Ninety-four band recoveries have been received from other states or countries. Of these, 30 have been received from Central and South American countries.

IOWA QUAIL HUNTING, 1963

M. E. Stempel
Game Biologist

Over much of the Iowa quail range, in 1963 hunters found about the same number of quail as in 1962. Hunting was good throughout the main quail range but best in the southeast. Conservation officers used field contact booklets to report hunting success for 370 hunters who reported on 1,069 man-hours of hunting when they took 485 quail at the rate of 2.2 hours per quail, compared to 1.9 in 1962. Hunting pressure was greatest the first 10 days of the shooting period, and 84 per cent hunted on Saturdays or Sundays. The biologist used field contact cards (of a type discontinued for officer use in 1960) to record hunting success of 133 hunters who had considerable quail shooting experience; they spent 1.2 man-hours per quail bagged. In 1962 the time was 1.0. Many continued to hunt quail throughout the season, but some quit when weather turned very cold after the first week of December. Both methods of recording success showed that while early season success was below that for 1962, later success was comparable to that for 1962. Average success was 1.8 hunter-hours per quail for the previous 10 years, and 1.2 for experienced shooters for the past 3 years.

HUNTING SUCCESS, AGE AND SEX RATIOS OF GRAY AND FOX SQUIRRELS*

Paul D. Kline
Game Biologist

Fox and gray squirrels, Sciurus niger rufiventer Geoffroy and S. carolinensis pennsylvanicus Ord, are commonly hunted in Iowa. Average hunting success for 12 years as reported by hunter-cooperators was 0.82 squirrels bagged and 1.81 seen per gun hour. Significant variations in hunting success from one season to another were found. One squirrel was reported crippled for every 14.85 killed. Fox squirrels comprised 87.13 per cent of the total kill; grays, 12.87 per cent. Conservation officer contacts indicated actual hunting success was below that reported by hunter-cooperators. The cooperators were assumed to be hunters with above average skill as compared to average ability of those contacted by conservation officers. Hunters average 6.1 trips per season and spent an average of 2.8 hours

per trip. The average size of hunting parties was 1.44. Hunting success varied little through the season. Two-thirds of all hunting effort was expended during the first month each season. Dogs were found detrimental to hunting success on the average.

Sex ratios of 119.2 males/100 females for fox and 110.3 males/100 females for gray squirrels were found. Age ratios varied somewhat from year to year. In fox squirrels the 14 year average was 53.9 per cent juveniles; in grays, 49.4 per cent juveniles. A convenient method of measuring tree mast yield is described. The data indicates mast yield influences production of juvenile squirrels and subsequent hunting success in Iowa, although not as drastically as has been reported in other states. Evidence is presented which indicates the mast influence is mitigated somewhat by intensive agriculture. Squirrels probably rely more on grain food in Iowa than in more heavily wooded states.

*Appeared in the Iowa Academy of Science Report

THE 1963 GUN SEASON FOR DEER

Keith D. Larson
Game Biologist

The 1963 gun season for deer consisted of a two and a three day zone. Permits were issued to 12,004 hunters and they reported 5,595 deer killed. A hunter success of 48% and increased kill over 1962 of 30.7% was indicated. Non-permittees (landowners, tenants, etc.) killed 1,017 deer, one less than last year. Bow permittees killed 538 which made the total hunting kill 7,151, an increase in total kill of 24.9 per cent. The increased kill statewide was achieved in the long zone while the short zone showed a 4 per cent reduction in kill.

SEX RATIOS OF PHEASANTS OBSERVED DURING WINTER COUNT - 1964

Richard C. Nomsen
Game Biologist

Conservation officers, unit game managers and biologists reported a total of 7,851 pheasants during January and February. Results of the 1964 winter survey must be examined with caution because of the extremely poor checking conditions. The observed sex ratio of 2.9 hens per cock indicated that hunters harvested 59 per cent of the cocks last fall. Results of the winter sex ratio count did not appear to indicate a significant change in the overall harvest of cocks. Because of the mild winter, Iowa's pheasant population should be in excellent condition to begin nesting activity this spring.

PLEASURE BOAT NUMBERS AS COMPARED TO FISHING BOATS ON SEVERAL NORTHWEST IOWA LAKES, 1961, 1962, 1963

Tom Moen
Fisheries Biologist

Almost every state is faced with ever increasing problems concerned with water-use management. The conflict among the different uses of surface water has been the subject of numerous articles in all types of news media from newspapers to publications dealing entirely with recreation. The major area of conflict centers around the use of available water by fishermen as opposed to those engaged in various forms of pleasure boating. Not only has the number of boats increased since World War II, the size and speed capabilities of the motors used on small waters especially, have increased beyond reasonable limits in a large share of our water areas. A speeding boat on a small lake will often create higher waves than would occur as the result of a high wind. A fishing boat travelling at 5 miles per hour is only using one-fifth of the space and/or distance required by a speed boat at 25 miles per hour. Thus, in many ways the speed boat places the fisherman at a disadvantage, increased the danger of accidents where crowding is evident, and may bring about an acceleration of damage to the shoreline of small bodies of water.

Any solution or attempt at solution of the boating conflicts must be based on some knowledge of actual levels of boating on the various bodies of water. The following data is presented in an effort to contribute a few boat use figures for several northwest Iowa natural lakes during the summer period of normally high pleasure boat use.

METHODS AND PROCEDURE

Creel census clerks have counted fishing boats since 1956. Pleasure boat counts were initiated in 1961. These counts of pleasure boats were made at the same time that fishing boats were counted. Details of the census technique have been described in detail in previous biology quarterly reports. Briefly, the day is divided into two 8-hour periods to cover early and late fishing. These periods are set into a pre-arranged schedule to allow for adequate coverage of the fishing for each month with special effort on week-ends. Boat counts were made every two hours during each 8-hour period on Spirit Lake and every four hours on all the other lakes. Personal contacts with fishermen after they had completed their fishing trip provided an average time for fishing boats on the lake.

During 1963, a limited number of interviews were conducted in relation to the amount of time spent on the lake by pleasure boaters, but in order to make comparisons for the three years, an arbitrary 1.5 hours per trip were assigned to all pleasure boats on all lakes. This assigned average of 1.5 hours per pleasure boat trip falls between the average of 1.9 hours per trip calculated from 60 interviews of pleasure boat operators on West Okoboji and the 1.1 hours per trip determined from 196 contacts made on Clear Lake in 1963. The data concerning the total number of hours for each type of boating was obtained by multiplying the average count for any one day times the number of hours in that day. This figure then becomes an estimate of the total boat hours for that day. An estimate of individual boats is then calculated by dividing total boat hours by the average time out for each type of boat.

The results were calculated for the months of June, July and August as the average number of boats and boat hours, both fishing and pleasure, for the average week day, average week-end day and the totals for each month for the years 1961, 1962, and 1963 on Spirit Lake, East Okoboji Lake and West Okoboji Lake (Tables 1, 2, and 3). Pleasure boat counts on Clear Lake and Black Hawk Lake were made only in 1963 (Table 4). Through the use of individual counts it is possible to determine the maximum density of boats at any one hour. For purposes of comparison these figures are presented as acres per boat (Table 5).

LAKES CENSUSED

All five lakes mentioned above and considered in this comparison are highly eutrophic lakes of glacial origin and support high populations of several species of fish. All five are subject to considerable pleasure and fishing boat activity during the summer months. Clear Lake and West Okoboji Lake have always supported large numbers of pleasure boats. Each lake has extensive summer cottage developments and many year-round homes. These five lakes have a combined surface area of 15,889 acres, nearly one-half (46%) of the boating water in natural lakes normally available to water skiing or other fast boat activities. Surface acres of the individual lakes are given in the appendix tables. A discussion of the results obtained from these counts will be presented by individual lake.

RESULTS

Spirit Lake: Fishing boats consistently exceeded the pleasure boats on this lake during the three year period. Only on week-ends of July and August of each year did the pleasure boats offer any competition to fishing boats. Total pleasure boat hours exceeded fishing boat hours on the average week-end day only once in the three year period (August, 1963). Fishing boat hours were much higher than pleasure boat hours on week days, ranging from 2 to 24 times that of the pleasure boats.

The maximum density of boats on Spirit Lake at any one count was reached in June of 1963. At this time there were 103 fishing boats and 14 pleasure boats, one boat for each 48 acres of water. Pleasure boats were never more dense than one boat per 138 acres (41 boats) during the three years.

East Okoboji Lake: Although pleasure boats occasionally outnumbered fishing boats on East Okoboji in June each year, the fishing trips were of longer duration. During July when fishing success on East Okoboji normally declines, the pleasure boating increases. Through the latter part of July and the month of August pleasure boats often outnumber fishing boats three to one. East Okoboji is connected to West Okoboji and water skiing parties move into this smaller lake during days of high wind or periods of high density on West Okoboji.

A maximum density of one pleasure boat for 33 acres was recorded in June of 1962. This happened to be a day for boat fishing also and the combined fishing and pleasure boats reduced the available space to one boat for each twenty acres on this 1,875 acre lake.

West Okoboji Lake: As opposed to the two foregoing lakes, the pleasure boats consistently outnumbered the fishing boats on West Okoboji each month during the three year period.

When the pleasure boats outnumbered the fishing boats four or five to one, the hours of pleasure boating usually averaged two to three times that of fishing boats. This decided difference has probably existed on West Okoboji during the summer months for some 20 or 25 years. The consistently high density of pleasure boats on this lake is increased considerably due to the fact that sail boats were added to the pleasure boat counts. Fishing from a boat on a "sail day" is restricted to a great extent.

Although the maximum density of boats did not reach one boat in 20 acres as it did on East Okoboji, the highs for each month were consistently greater. The maximum counts of all boats did not exceed one boat for 50 acres all during 1961 and one boat per 32 acres in 1963 (no data available for this comparison in 1962).

Clear Lake: Although this is the third largest natural lake in Iowa and a popular summer resort lake, the pleasure boat counts were not incorporated into the boat census until the summer of 1963. Pleasure boats outnumbered fishing boats in all comparisons throughout the summer of 1963, reaching a peak of 10,000 hours of pleasure boating in August. Average week day and week-end day concentrations were about the same as those on West Okoboji Lake for both fish and pleasure boats. Clear Lake's slightly smaller size brought about slightly higher concentrations than were found on West Okoboji Lake, with a maximum density of one boat for each 25 acres of water for one count in August (137 pleasure boats and one fishing boat).

Black Hawk Lake: This small (923 acres) lake has become important to pleasure boaters comparatively recently. Pleasure counts were initiated here in 1963 for the months of July and August. There were nearly as many hours of pleasure boating recorded on this lake as there were on Clear Lake for the same two month period. Due to its relatively small size the density of boats is considerably greater than on the other lakes being considered in this paper, attaining a maximum of one boat per 11 acres in July and one per 12 acres in August.

GENERAL DISCUSSION

The data presented on these five lakes indicates that pleasure boating is the dominant activity on all but Spirit Lake during the summer months. Although there is a definite increase in both fishing and pleasure boats on week-ends the ratio of increase is normally in favor of the pleasure boats. Boat counts made on 423 Wisconsin Lakes in 1960 indicated that fishing was the dominant activity pursued from boats. Although there was plenty of room for boaters on most of the Wisconsin Lakes one count did show only one boat per 0.48 acres.

Estimates of safe limits of boating have ranged from one boat per acre for fishermen to one boat to 40 for water skiers. The boating levels presented here are not considered excessively high even at the maximum intensity observed at any one count, except possibly the high counts recorded for Black Hawk Lake.

There are any number of additional avenues of comparison, such as fishing success and the level of pleasure boating, the hour of the day the peak intensities occur for each type of boating and relative space required by various types of pleasure boating in relation to speed, but the data presented here merely gives some indication of the level of boating on these five lakes that are popular pleasure boating and fishing lakes.

LITERATURE CITED

Threinen, C. W. and Kenneth Beghin. 1960. Some Observations On Levels of Boating Use of Wisconsin Lakes - 1960. Fish Management Division Misc. Rept. No. 5 (Mimeo).

TABLE 1. Comparison of the number of fishing and pleasure boats and boat hours for each on the average week day and week end day, plus the total boats and hours for the months of June, July, and August on Spirit Lake during 1961, 62, and 63

Month	Year	Type	Av. Week Day Number	Av. Week Day Hours	Av. Week End Day Number	Av. Week End Day Hours	Total for Month Number	Total for Month Hours
June	1961	F**	86	217	283	715	3,180	10,514
		P**	6	9	47	71	511	766
	1962	F	62	400	123	410	2,352	8,091
		P	16	25	57	84	816	1,209
	1963	F	85	288	158	553	3,280	11,298
		P	42	63	124	186	2,080	3,120
July	1961	F	117	291	177	444	3,267	10,704
		P	36	53	109	163	1,892	2,187
	1962	F	49	149	81	249	1,759	5,366
		P	27	41	57	85	1,077	1,616
	1963	F	70	217	67	274	2,075	7,091
		P	53	79	182	274	2,880	4,320
August	1961	F	63	158	176	440	2,867	7,156
		P	22	34	82	122	966	1,758
	1962	F	31	88	43	113	1,056	2,927
		P	36	54	95	183	1,588	2,382
	1963	F	88	232	93	311	2,772	8,310
		P	54	81	116	174	2,232	3,346

** F - Fishing boats
** P - Pleasure boats
* Spirit Lake - 5,660 acres

TABLE 2. Comparison of the number of fishing and pleasure boats and boat hours for each on the average week day and week end day, plus the total boats and hours for the months of June, July, and August on East Okoboji Lake*, 1961, 62, and 63

Month	Year	Type	Av. Week Day Number	Av. Week Day Hours	Av. Week End Day Number	Av. Week End Day Hours	Total for Month Number	Total for Month Hours
June	1961	F**	18	128	41	198	728	4,400
		P**	27	40	56	88	996	1,552
	1962	F	40	104	114	267	1,887	4,678
		P	31	47	200	300	2,293	3,739
	1963	F	27	113	45	124	990	3,500
		P	40	60	91	136	1,706	2,559
July	1961	F	13	68	19	96	483	2,416
		P	55	82	88	132	2,017	3,092
	1962	F	32	93	42	133	1,092	2,995
		P	55	82	54	81	1,685	2,542
	1963	F	24	73	36	115	852	2,639
		P	95	152	155	233	3,493	5,240
August	1961	F	14	68	15	74	433	2,156
		P	56	88	107	160	2,162	3,212
	1962	F	36	102	47	111	1,212	3,239
		P	61	91	186	278	3,009	4,512
	1963	F	30	88	19	27	831	2,183
		P	92	138	44	63	2,402	3,603

** F - Fishing boats
** P - Pleasure boats
* East Okoboji Lake - 1,875 acres

TABLE 3. Comparison of the number of fishing and pleasure boats and boat hours for each on the average week day and week end day, plus the total boats and hours for the months of June, July, and August on West Okoboji Lake*, 1961, 62 and 63

Month	Year	Type	Av. Week Day Number	Av. Week Day Hours	Av. Week End Day Number	Av. Week End Day Hours	Total for Month Number	Total for Month Hours
June	1961	F**	13	64	18	93	430	2,132
		P**	63	92	324	482	3,978	5,880
	1962	F**	43	142	41	135	1,281	4,187
		P	132	197	145	217	3,978	5,880
	1963	F	77	155	63	206	2,170	5,171
		P	201	301	320	330	6,220	9,330
July	1961	F	18	89	31	156	709	3,496
		P	176	229	218	267	5,926	7,512
	1962	F	55	136	61	125	1,759	4,045
		P	182	274	332	527	7,024	10,540
	1963	F	43	127	41	273	1,311	5,758
		P	190	284	348	521	7,314	10,971
August	1961	F	24	119	67	210	1,090	4,417
		P	119	178	382	572	5,816	8,670
	1962	F	43	115	67	143	1,510	3,886
		P	110	164	281	422	4,946	7,419
	1963	F	58	180	57	163	1,789	5,408
		P	216	324	404	606	8,388	12,582

** F - Fishing boats
** P - Pleasure boats
* West Okoboji Lake - 3,788 acres

TABLE 4. Comparison of the number of fishing and pleasure boats and boat hours for each on the average week day and week end day, plus the total boats and hours for the months of June, July, and August on Clear Lake and for July and August for Black Hawk Lake, 1963

Lake	Month	Type	Av. Week Day Number	Av. Week Day Hours	Av. Week End Day Number	Av. Week End Day Hours	Total for Month Number	Total for Month Hours
Clear Lake*	June	F**	48	155	47	88	1,420	4,890
		P	123	184	276	414	5,220	7,830
	July	F	42	132	62	208	1,420	4,890
		P	116	174	337	506	5,809	8,713
	August	F	34	117	54	168	1,244	4,084
		P	105	156	491	736	6,716	10,074
Black Hawk Lake	July	F	25	33	5	11	500	825
		P	102	153	521	782	6,940	10,408
	August	F	14	51	17	65	464	1,713
		P	88	131	308	461	4,699	7,041

* Clear Lake - 3,643 acres
Black Hawk - 923 acres

** F - Fishing boats
P - Pleasure boats

TABLE 5. Maximum density of fishing and pleasure boats recorded in a single count, presented as acres per boat for Spirit, West Okoboji and East Okoboji Lakes, Clear Lake and Black Hawk Lake

Lake	Year	Month	Fishing boats	Pleasure boats	Combined
Spirit Lake	1961	June	54	270	51
		July	68	183	62
		August	96	226	67
	1962	June	99	354	77
		July	118	354	101
		August	298	177	195
	1963	June	55	333	48
		July	87	162	57
		August	90	195	82
West Okoboji	1961	June	291	76	49
		July	237	59	47
		August	152	73	49
	1963	June	82	79	32
		July	152	35	31
		August	135	32	29
East Okoboji	1961	June	125	116	63
		July	170	116	81
		August	268	81	62
	1962	June	55	33	20
		July	134	110	60
		August	98	37	33
	1963	June	144	72	55
		July	110	52	45
		August	88	59	48
Clear Lake	1963	June	98	40	28
		July	191	54	47
		August	214	27	25
Black Hawk	1963	July	231	11	11
		August	103	12	12

A BRIEF PRELIMINARY REPORT ON COMMERCIAL CHANNEL CATFISH CATCH STUDIES IN THE MISSISSIPPI RIVER IN 1963

Roger Schoumacher
Fisheries Biologist

For the past several years complaints have been received from commercial fishermen who claimed that the catfish catch has been declining on the Mississippi River. Commercial fishing statistics verify this decline. A letter and questionnaire were sent to the 390 Iowa commercial fishermen in February, 1963, and the results indicated that most of the fishermen felt there has been a decline within recent years (Iowa Conservation Commission, Quarterly Biology Reports, (15)1).

During 1963, 9,415 commercially caught channel catfish were measured (total length to the nearest 1/10 inch) at landings and markets in Iowa and Illinois. Fish were taken from every pool except pools 15 and 20. Spines were collected from 1,761 fish for aging.

Length Frequency

Thirteen per cent of the fish measured were under the legal 13-inch size limit, ranging from a high of 29 per cent in pool 12 to a low of 4 per cent in pool 9 (Table 1). Forty-nine per cent of the fish were under 14-inches, and 71 per cent were under 15-inches. Only 2 per cent were 19-inches or longer.

Age Composition of the Catch

The catch was predominated by age III (51 per cent) and age IV (40 per cent) fish. Generally, age IV fish predominated the catch early in the season, with age III fish becoming more important as the year progressed. A pool by pool summary follows:

Pool 9: In mid-June the catch was comprised primarily of three age classes - IV, V, and VI - with numerous VII, VIII, and IX fish. By the end of July, however, the catch was approximately 75 per cent III and 25 per cent IV, with virtually no older fish.

Pool 10: In late June the catch was made up of III, IV, and V fish, mostly IV. By the end of July, III fish were dominant, with large numbers of IV. In mid-August 68 per cent of the fish were III and 28 per cent IV.

Pool 11: Data are available only for mid-July, when 54 per cent of the fish were III and 42 per cent IV.

Pool 12: In mid-July ages III and IV comprised over 90 per cent of the catch, with IV predominating.

Pool 13: In early July about 70 per cent of the catch were III and 23 per cent IV.

Pool 14: In mid-July 60 per cent of the fish were III and 35 per cent IV.

TABLE 1. Length frequency of the commercial channel catfish catch measured in the Mississippi River in 1963

Pool	Total no. fish measured	Per cent of catch in various length groups (inches)										
		11	12	13	14	15	16	17	18	19	20	21 and over
9	1,410	Tr.	4	43	18	11	10	5	4	2	2	1
10	176	1	4	41	25	11	8	8	2			
11	468	Tr.	8	31	29	16	6	4	3	Tr.	1	1
12	473	5	24	25	14	12	8	5	1	1	1	2
13	1,738	1	14	33	25	15	5	3	2	1	Tr.	Tr.
14	466		16	58	14	6	2	Tr.	1	Tr.	Tr.	Tr.
16	302	1	18	41	20	12	4	3	1	Tr.		Tr.
17	836		13	33	20	14	8	5	4	2	Tr.	Tr.
18	686	1	14	33	22	14	8	4	2	Tr.	Tr.	Tr.
19	2,860	Tr.	12	33	27	14	5	3	2	2	Tr.	Tr.
All pools combined	9,415	1	12	36	22	13	7	3	2	2	Tr.	Tr.

Pool 16: Data for mid-July and mid-August were similar, with about 30 per cent of the fish III and over 60 per cent IV.

Pool 17: In mid-July the catch was about 70 per cent IV and 30 per cent III. In mid-August it was 65 per cent IV and 35 per cent III, and by mid-September it was 40 per cent IV and 50 per cent III.

Pool 18: In early June the catch was 80 to 90 per cent IV and 5 to 19 per cent III. By mid-September it was 29 per cent IV and 71 per cent III.

Pool 19: In early June about 80 per cent of the catch were IV and 10 to 20 per cent III. By late July better than 50 per cent were III, over 35 per cent were IV, and about 10 per cent were II. In mid-September 26 per cent were II and 72 per cent were III.

Growth

The average size of fish of various ages was calculated by month for each pool (Tables 2-5). All if the fish taken in a pool during each month were lumped for growth averages. Averages were not computed if there was less than five fish in the sample. The average size of certain age fish in the commercial catch does not necessarily reflect the average size of that age fish in the population. For instance, the 13-inch size limit did not always allow the commercial fishermen to harvest the smaller age III fish, so the average size of age III fish in the commercial catch is larger than the average size of age III fish in the river population.

A statistical comparison of growth rates between pools was not undertaken. It appears, however, that fish in pools 9 and 19 grow the fastest, and those in pool 16 the slowest.

This data strongly suggests a very intensive harvest of channel catfish over the entire Iowa portion of the Mississippi River. Studies should and will be continued to collect sufficient data upon which to accurately determine the status and proper management of this species.

TABLE 2. Average size of various aged channel catfish taken by commercial fishermen in June, 1963, from the Mississippi River

Pool	Average size at various ages							
	II	III	IV	V	VI	VII	VIII	IX
9		12.6 (5)*	15.4 (30)	16.8 (45)	18.1 (33)	20.4 (16)	21.3 (10)	20.7 (5)
18		12.9 (16)	15.1 (132)					
19		13.2 (9)	16.6 (120)	20.2 (17)				

* Numbers in parenthesis indicate sample size.

TABLE 3. Average size of various aged channel catfish taken by commercial fishermen in July, 1963, from the Mississippi River

Pool	Average size at various ages						
	II	III	IV	V	VI	VII	VIII
9		14.0 (43)*	16.4 (19)				
10		14.2 (7)	15.4 (6)				
11		13.7 (32)	15.2 (28)				
12		12.7 (57)	15.5 (82)				
13		13.6 (111)	14.6 (30)				
14		13.2 (92)	14.8 (52)	17.6 (5)			
16		12.6 (21)	13.7 (47)				
17		13.0 (30)	14.8 (108)	17.3 (5)			

* Numbers in parenthesis indicate sample size.

TABLE 4. Average size of various aged channel catfish taken by commercial fisherman in August, 1963, in the Mississippi River

Pool	Average size at various ages						
	II	III	IV	V	VI	VII	VIII
10		13.7 (88)*	16.0 (38)				
16		13.4 (26)	14.2 (55)	16.3 (5)			

* Numbers in parenthesis indicate sample size

TABLE 5. Average size of various aged channel catfish taken by commercial fishermen in September, 1963, in the Mississippi River.

Pool	Average size at various ages						
	II	III	IV	V	VI	VII	VIII
17		13.7 (15)*	16.0 (7)				
18		13.4 (7)	13.9 (5)				
19		15.8 (17)					

* Numbers in parenthesis indicate sample size

A FISHERY INVESTIGATION OF FIVE MISSOURI RIVER OX-BOW LAKES DURING 1963

Bill Welker
Fisheries Biologist

INTRODUCTION

A general fishery investigation of five Missouri River Ox-bow Lakes on the Iowa-Nebraska boundary was conducted during 1963. These areas are important to the sport fishery of western Iowa and eastern Nebraska. Biologists from the Iowa Conservation Commission, Nebraska Game, Forestation and Parks Commission, and the U. S. Fish and Wildlife Service cooperated in a survey which was designed to gather some basic information about the fish populations in each lake. Knowledge about life histories of fish living in these areas is limited, especially in those lakes that are completely separated from the river by levees at their upstream and downstream ends. The lakes studied in this survey can be divided into two groups on the basis of their degree of separation from the Missouri River. Some differences between the fish populations of these two groups are examined.

DESCRIPTION OF THE AREAS

All five areas have the typical long, narrow, shape of most ox-bow lakes. The longest, DeSoto Bend, is 7 1/4 miles long. The surface area ranges between 200 and 900 acres; however, 4 areas have at least 600 surface acres.

Bullrushes and cattails compose most of the aquatic vegetation; they cover extensive areas only at Upper Decatur.

Since most of these areas have been subjected to various degrees of siltation from high water levels in the Missouri River, large areas of water less than three feet deep are present. This is especially apparent in the Upper Decatur. The deepest water is found by old wooden piling where depths of 15 and 20 feet are common. The deepest recorded depth (34 feet) was found at DeSoto Bend. Bottom soil types are sand in the shallows and silt in deeper water.

An important physical difference among the lakes is their degree of separation from the Missouri River which, in turn, affects their fish population. Using this criterion, the lakes can be divided into two different groups: those that are separated from the river at their upstream and downstream ends by rock and pile levees and those that are separated from the river only at their upstream end; opening directly into the river at their lower end. DeSoto Bend and Upper Decatur are in the former groups. DeSoto Bend was separated from the river in 1961 with water control structures built in each levee. Upper Decatur was completed in 1950 and has no water control structures. High water levels during recent years have damaged the levees at this lake allowing some river water and possibly fish to enter. This is not considered a serious influence on the existing lake fish population.

The three remaining lakes, Middle Decatur, Snyder Bend and Omadi, have rock and pile levees across their upstream ends. The downstream areas of these lakes connect directly

with the Missouri River allowing fish to move between the lake and river environments.

The Missouri River water level obviously controls the water levels in the three lakes opening into the river at their lower ends. The pervious levees at Upper Decatur also allow the water level of that lake to fluctuate with the river level. During the beginning of the Missouri River navigation season, about April 1, water is released from the upstream reservoirs which subsequently raises the water levels in the lakes. The reservoirs withhold water at the end of the navigation season, about November 1, decreasing the river water level for the winter drawdown period. These spring and fall changes in the river water level fluctuate the water levels in most of the ox-bow lakes at least three feet.

DeSoto Bend is a Federal Wildlife Refuge and managed primarily for waterfowl; therefore, the water level is controlled by structures built into the levees, especially during the spring and fall waterfowl migration periods. Although the DeSoto Bend water level changes during the year, it fluctuates less than the water levels in the other ox-bows.

"Rough fish" dominate numerically the fish populations in all of the lakes. Gizzard shad seem especially adapted to the ox-bow lake environment. Counts of over 1,000 shad per hour have been observed during electric fishing surveys at DeSoto Bend Lake. Fresh water drum, large and smallmouth buffalo, carp, carpsuckers, red horse, long and shortnose gar and goldeye compose the remainder of the rough fish populations.

Crappie (mainly white), channel catfish and sauger are the most important game fish in these areas. Although walleye are present in all five lakes, they have not adapted to the environment as well as the sauger. Walleye are found in the creel mainly during the winter ice-fishing season. Largemouth bass, white bass, channel catfish, flathead catfish, paddlefish, yellow perch, bluegill and northern pike are other game fish found in these lakes.

METHODS

Electro-fishing gear, 150 ft. experimental gill nets, 250 ft. trammel nets, 100 ft. bag seine and stationary frame nets were used to collect the fish. When possible, weather permitting, all gear was fished randomly, both day and night to help equalize the fishing effort at all lakes. The nets were lifted and checked daily. All of the fish collected during the survey were counted by species. Most of the rough fish and all of the game fish were weighed and measured. Scales or pectoral spines were also removed from a large sample in each length-frequency group for further age and growth study.

Since fishery data collected with electro-fishing gear are difficult to use when quantitatively comparing different lakes, they were excluded from the tables in this paper. These data, however, are used in the discussion since some species of fish are more easily caught with electro-fishing gear. The statistical comparisons listed in Table 3 were based upon a series of 15 gill nets fished an equal amount of time in each lake.

RESULTS AND DISCUSSION

Moyle and Lound (1960) described a method which permitted a statistical comparison

of net catches of fish from two or more lakes. The method is based on the logical assumption that the more fish present in a lake, of a size that can be caught, the greater the average catch per net. Each species of fish must be compared separately since nets are selective of the fish they catch. Moyle and Lound computed confidence intervals for medians from various sized series of net sets where most of the nets caught the species to be compared. If the confidence intervals from the two series of net catches did not overlap, it was assumed that each series represented a different parameter. Conversely, if the confidence intervals from each series did overlap, it was assumed that they measured a similar parameter; therefore similar populations based on abundance.

This method was used to compare the fish populations in the two groups of ox-bow lakes described in this paper (Table 3). An explanation of how to interpret the table is now presented. As an example, the 70 per cent confidence interval of crappie expected to encompass the true median catch in a series of 15 gill net sets at DeSoto Bend is 3-7 (Table 3). This means that we are 70 per cent confident that the true median catch of crappie in DeSoto Bend in each succeeding sample of 15 gill nets will be greater than 3 crappie and less than 7 crappie. The 70 per cent confidence interval for crappie at Upper Decatur is 3-5. Therefore, since the two intervals overlap, it is assumed that the sample series of 15 gill nets fished in each lake represent a similar parameter. The confidence interval of crappie for Snyder Bend is 2-3 (Table 3). Since this interval does not overlap the intervals from DeSoto Bend or Upper Decatur, is assumed that the sample from Snyder Bend measures a different parameter.

Since each lake was surveyed at a different time of the year, between May 20 and September 20, large numbers of yg-of-the-yr. were found in some of the lakes while other lakes were surveyed too early to record yg-of-the-yr. production. To eliminate the bias this would place on numerical comparisons between the lakes, all fish less than 5 inches were excluded in the statistical comparison (Table 3).

For the sake of brevity in the following discussion, the two lakes completely separated from the river by levees will be called "closed lakes" and the three remaining lakes "open lakes".

Rough Fish

The rough fish, numerically dominated by gizzard shad, were the most abundant group of fish collected in 4 of the 5 lakes (Table 1). The catch of shad was significantly higher in the closed lakes than in the open lakes (Table 3). Apparently, after the lake environment is separated from the river, the gizzard shad are able to maintain a larger population.

A study of length-frequency data shows a higher per cent of the larger shad in DeSoto Bend and Upper Decatur than in the three open lakes. At least 30 per cent of the shad caught in each of the closed lakes were over 7 inches long while less than 5 per cent of the shad in each of the open lakes were over 7 inches.

Carp suckers and/or freshwater drum were the next most numerous rough fish in all of the lakes (Table 1). There appears to be little difference in the abundance of these fish between each of the five lakes.

Apparently, goldeye populations decrease in areas that have been separated from the

river environment (Table 1). The 70 per cent confidence intervals of goldeye for the closed lakes is significantly lower than the intervals of the open lakes (Table 3). Only two goldeye, both over 12 inches long, were taken in DeSoto Bend indicating poor reproduction during recent years. This fish is very abundant in the Missouri River.

There is evidence that carp are more abundant in the open lakes than in the closed areas. Two of the open lakes, Snyder Bend and Omadi, have significantly higher confidence intervals than either of the closed lakes (Table 3). The remaining open lake, Middle Decatur, has the same interval as the closed areas. However, the Middle Decatur confidence interval could be low due to normal sampling variation. Seven of the 24 total gill nets fished in the lake did not catch any carp and 6 of these 7 were in the series of 15 used for the statistical comparison. The majority of the carp caught in each of the lakes were between 12 and 21 inches long.

Shortnose gar were found in all lakes; however, there appears to be little difference in abundance between the open and closed lakes (Table 3).

Although buffalo were present in all of the lakes, few were taken with gill nets; therefore, a statistical comparison could not be made.

Redhorse was the least abundant rough fish taken from any of the lakes and none were caught in DeSoto Bend (Table 1).

Game Fish

Crappies (mainly white crappie) were the most abundant game fish taken at each lake except Snyder Bend. These fish compose most of the sport fishermen's catch each year at all five lakes and are most abundant in the creel during early spring and late fall. There is evidence that the two closed lakes have a higher population than the open lakes (Table 3).

The larger shad population in the closed lakes might be partly responsible for the larger crappie population since the shad provide considerable forage throughout the summer.

DeSoto Bend appears to have the significantly highest channel catfish population (Table 3). This is the newest lake of the five surveyed and, therefore, still retains much of the large residual catfish population of the river. Reproduction of channel catfish in the lakes environment is limited. The average length of catfish above 5 inches in each of the closed lakes was greater than in any open lake. The 160,000 channel catfish fingerlings stocked in the lake since 1961 have not yet grown into the sport fishery.

Flathead catfish and paddlefish were taken from most of the lakes but in small numbers (Table 2). The total lengths of the flatheads ranged between 8 and 38 inches and the paddlefish between 29 and 56 inches.

Walleye and sauger were not caught in large enough numbers by the gill nets to allow a statistical comparison of abundance between lakes. However, there were more sauger than walleye caught in all of the lakes except Upper Decatur. There is some difficulty in separating the young fish of these two species; therefore, the numbers listed in Table 3 are approximate. Fewer sauger were taken in each of the closed lakes than in

TABLE 1. Total numbers of rough fish taken by all gear except electro-fishing gear from five Missouri River ox-bow lakes during 1963

Name of Fish	Lakes				
	DeSoto Bend	Upper Decatur	Middle Decatur	Snyder Bend	Omadi
Shad	591	1,514	1,024	881	2,100
Drum	23	334	204	66	752
Carpsucker	77	132	211	193	191
Gar	6	140	115	41	113
Buffalo	41	42	31	28	37
Carp	34	21	78	60	63
Goldeye	2	22	147	54	67
Redhorse	0	6	9	4	19
Totals	774	2,211	1,819	1,327	3,342

TABLE 2. Total numbers of game fish taken by all gear except electro-fishing gear from five Missouri River ox-bow lakes during 1963

Name of fish	Lakes				
	DeSoto Bend	Upper Decatur	Middle Decatur	Snyder Bend	Omadi
Sauger	16	25	35	123	33
Walleye	14	33	10	1	5
Crappie	1,178	500	98	84	371
Largemouth bass	14	3	16	1	3
White bass	43	77	68	34	22
Channel catfish	96	76	74	40	56
Flathead catfish	2	4	0	2	0
Paddlefish	0	4	1	1	4
Yellow perch	13	1	2	0	8
Bluegill	68	13	40	6	63
Northern	1	10	4	9	12
Totals	1,445	746	347	301	578

the open lakes indicating their dependence upon the river environment, where they are abundant. No sauger less than 13 inches long were caught in DeSoto Bend indicating poor reproduction since the lake was separated from the river in 1961. Snyder Bend appears to have the largest sauger population. The largest length-frequency group was between 11 and 14 inches.

The walleye stocking programs in each of the closed lakes is probably partially responsible for the larger catches of walleye in these areas than in the open lakes (Table 2). Approximately 2,600,000 walleye fry and fingerlings have been stocked in DeSoto Bend since 1961. Approximately 500,000 fry have been stocked in Upper Decatur since 1958.

The walleye tended to be larger in the closed lakes with at least one third of the total number caught in each lake between 19 and 24 inches long. No walleye over 13 inches were taken from the open lakes.

The completion of upstream reservoirs on the Missouri River has been a major factor in reducing the turbidity in the river. This, in turn, has improved the river environment for some of the larger sight-feeding fish such as the largemouth bass and northern pike. Subsequently, these fish have been found more frequently in the catch of Iowa Missouri River commercial fisherman during the past 15 years.

Most of the largemouth bass were caught with electro-fishing gear which is not included in Table 3. The majority ranged between 10 and 15 inches long. All of the lakes, except Omadi, have been stocked with largemouth bass fry or fingerlings since 1961. The two largest stockings were made in DeSoto Bend and Middle Decatur where 320,000 and 150,000 largemouth bass fingerlings were released, respectively. These two lakes rank first and second in the number of largemouth bass produced during the survey.

Northern pike were caught infrequently during the survey (Table 2) and ranged between 13 and 24 inches in total length. The two lakes ranking second and third in the number of northern produced during the survey, Upper Decatur and Snyder Bend, were each stocked with northern fry. Upper Decatur received 25,000 fry in 1958 and 89 sub-adults in 1961. Approximately 500,000 northern fry were put into Snyder Bend in 1961 and again in 1962.

Yellow perch were not abundant in any lake (Table 2). The majority were less than 6 inches long.

White bass were caught in all of the lakes and tended to average about the same length in all areas. At least three fourths of all white bass taken from each lake were between 3 and 6 inches long. The maximum length (11.2 inches) was recorded at Snyder Bend.

Bluegills have adapted to all of the lake environments; however, their growth appears slow. Few were caught during the survey over 5 inches long.

TABLE 3. Seventy per cent confidence intervals represented by ranges in number of fish per net which would encompass the true median catch in a series of 15 experimental gill nets fished in each of five Missouri River ox-bow lakes during 1963 [1]

Lake	Crappie	Channel Catfish	Shad	Goldeye	Carp	Carpsucker	Drum	Gar
DeSoto Bend [2]	3-7	4-5	9 - 30	0 - 1	0 - 1	2 - 4	0 - 1	0 - 0
Upper Decatur [2]	3-5	1-2	10 - 14	0 - 1	0 - 1	2 - 4	2 - 4	1 - 4
Snyder Bend [3]	2-3	1-3	1 - 1	1 - 4	2 - 3	2 - 3	1 - 2	2 - 5
Middle Decatur [3]	0-2	0-2	0 - 1	1 - 3	0 - 1	0 - 1	0 - 2	0 - 1
Omadi [3]	0-1	2-3	0 - 1	3 - 4	1 - 3	1 - 3	1 - 3	2 - 5

[1] See text for further explanation
[2] Separated from Missouri River by levees
[3] Open to Missouri River at downstream end

LITERATURE CITED

Moyle, John B. and Richard Lound. 1960. Confidence Limits Associated with Means and Medians of Series of Net Catches. Trans. Am. Fish. Soc. 89 (1)

SUMMARY

1. Fish populations in five Missouri River Ox-bow Lakes were surveyed by biologists from the Iowa Conservation Commission, Nebraska Game, Forestation and Parks Commission and the U. S. Fish and Wildlife Service.

2. For comparative purposes, the lakes were divided into two groups on the basis of their degree of separation from the river. The "closed lakes" were completely separated from the river by levees. The "open lakes" opened into the river at their downstream end.

3. Gizzard shad were the most abundant fish collected in 4 of the lakes. The catch was significantly higher in the closed lakes.

4. Goldeye were significantly less abundant in the closed lakes. There is evidence that carp are less abundant in the open lakes. Carpsuckers, freshwater drum, buffalo, redhorse and gar were other "rough fish" taken during the survey. The abundance of these fish in the open and closed lakes appears to be about the same.

5. Crappie (mainly white) were the most abundant game fish caught at four of the lakes and had significantly higher populations in the closed lakes.

6. There were more sauger than walleye taken at four of the lakes. Fewer sauger were taken in the closed lakes than in the open lakes indicating their dependence upon the river environment.

7. The significantly largest population of channel catfish was found in the newest closed lake. There was little difference in abundance of channel catfish among the other lakes.

8. Largemouth bass were caught in all of the lakes but were most abundant in areas where they were stocked.

9. Northern pike, yellow perch, white bass, bluegill, paddlefish, and flathead catfish were other less important game fish collected during the survey.

CORALVILLE RESERVOIR FISHERIES INVESTIGATIONS - 1963

PART II: LIMNOLOGY AND FISH POPULATIONS

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An intensive survey of limnological characteristics and fish populations was completed at Coralville Reservoir in 1963. The purpose of this inventory was to obtain basic information on the physical, chemical, and biotic characteristics of this flood control impoundment. Prior to this study fish population surveys were made in 1959 and 1961, but they were limited in scope and generally inconclusive. Routine fisheries investigations had also been conducted (communication of Robert Cleary filed in Conservation Commission office) during the pre-impoundment era, but were limited to the netting of channel catfish.

Limnology investigations were confined to temperature, dissolved oxygen, free carbon dioxide, and pH profiles at 3 sampling stations. Bottom fauna samples were obtained from 7 sampling stations. Fish populations were sampled by electro-fishing, hoop (bait) netting, pound netting, and small mesh drag seining.

From visual inspection of the Coralville Reservoir complex it is evident there is a wide variation in habitat. For sampling of fish populations the impoundment was separated into 3 different areas based on ecological criteria. These were headwaters, main body of the reservoir, and tailwaters of the outlet structure. After the data were analyzed species and age composition of fish populations were almost identical in the headwaters and reservoir. Therefore, they were considered a single unit. The tailwaters region was wholly different in species composition and was considered separately.

LIMNOLOGY INVESTIGATIONS

Seven bottom fauna sampling stations and 3 temperature and water chemistry sampling stations were located in the reservoir at equal intervals from the dam site to the headwaters.

At normal summer conservation pool level (El. 780) there was no evidence of thermal stratification. Near the dam site there was a decrease in water temperature of 2.2°F. from the surface to a maximum depth of 28 feet. The other stations were somewhat more shallow, but showed approximately the same distribution of isotherms (Table I).

Chemical stratification (depletion of dissolved oxygen to an extent incapable of supporting fish life) was found in the deeper regions of the impoundment. At Station I, near the dam site, dissolved oxygen concentration was less than 3.0 p.p.m. from 22 to 28 feet. Other water chemistry sampling stations had high dissolved oxygen concentrations at all strata.

TABLE 1. Temperature, dissolved oxygen, free carbon dioxide, and pH profiles of Coralville Reservoir at 3 sampling stations

Depth	Station I (near dam site)				Station II (midway in reservoir)				Station III (headwaters)			
(ft.)	Temp.	DO	CO_2	pH	Temp.	DO	CO_2	pH	Temp.	DO	CO_2	pH
0	85.5	9.0	(t)	8.0	85.0	7.0	(t)	7.0	85.1	7.0	(t)	7.0
2	85.5				84.8				84.8			
4	85.2	9.0	(t)	8.0	84.7	6.0	(t)	6.0	84.6	7.0	(t)	
6	84.7				84.6				84.3			
8	84.5	7.0	(t)	8.0	84.6	7.0	(t)		84.3	7.0		
10	84.4				84.6				84.2			
12	84.4	7.0	(t)	8.0	84.5	7.0			84.2	7.0	5.0	7.0
14	84.4				84.2							
16	84.4	6.0	(t)	8.0	84.1	6.0	2.0					
18	84.0				84.1							
20	83.9	6.0	(t)	8.0	84.1	6.0	2.0					
22	83.8				84.1	5.0	5.0	7.5				
24	83.4	1.5	9.0	7.5								
26	83.4											
28	83.3	0.5	9.0	7.5								

Free carbon dioxide and pH varied insignificantly, except for a rather high concentration of carbon dioxide in strata of low dissolved oxygen concentrations.

Bottom samples were taken at 7 stations with a Petersen dredge. The organisms in each sample were identified, counted, and measured volumetrically by water displacement.

Two species of Diptera, Chiromonid and Ceratopogonid, were found at all stations. Tuberficids were found only at stations 2, 6 and 7. As shown in Table 2, the number and volume of bottom organisms varied greatly at individual sampling stations. The number and volume of bottom fauna was much higher in the deeper regions of the reservoir.

RESERVOIR FISH POPULATIONS

During the fisheries investigations at Coralville Reservoir 17 species of fish were captured. These were largemouth bass, bluegill, crappie (white and black), black bullhead, channel catfish, flathead catfish, walleye, northern pike, green sunfish, white bass, carp, bigmouth buffalo, smallmouth buffalo, quillback, highfin carpsucker, and northern redhorse. Total effort of fish sampling was 61.5 hours of electro-fishing, 1,536 net hours of hoop and pound netting, a 2 hauls with 100 feet of 1/4 inch mesh drag seine.

Species Composition of Fish in the Reservoir

With all types of fishing gear 5,248 fish weighing 5,265.7 pounds were captured. Carp was the most abundant species, comprising 35.1 per cent of the sample by number and

45.3 per cent by weight (Table 3). Carpsucker was the second most numerous species, but bigmouth buffalo made up a greater proportion of the population weight. Those species statutorally classified as rough fish in Iowa comprised 69.0 per cent of the sample number and 85.5 per cent of the population weight. Crappie was the most abundant game fish, followed respectively by channel catfish and largemouth bass.

TABLE 2. Number and volume of bottom organisms in Petersen dredge samples from Coralville Reservoir. Volume was measured by cubic centimeter water displacement.

	Station Number													
	1		2		3		4		5		6		7	
Organism	No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.
Diptera														
Chiromonid	142	17	207	26	9	1	28	4	13	2	44	7	19	3
Ceratopogonid	5	(t)	2	(t)	1	(t)	3	(t)	1	(t)	3	(t)	1	(t)
Annelida														
Tuberficid	-	-	2	(t)	-	-	-	-	-	-	1	(t)	1	(t)

TABLE 3. Species composition of fish populations by number and weight in Coralville Reservoir

Species	Total Number	Per Cent Pop. Number	Total Weight	Per Cent Pop. Weight
Lm Bass	216	4.5	167.24	3.2
Bluegill	106	2.0	19.08	0.3
Crappie	642	12.4	321.0	6.4
Bullhead	34	0.7	5.78	0.1
Ch. Catfish	508	9.8	187.96	3.5
Fl. Catfish	12	0.2	35.28	0.6
Walleye	6	0.1	11.22	0.2
N. Pike	6	0.1	13.2	0.2
Gr. Sunfish	60	1.2	6.0	0.1
Carp	1,878	35.1	2,385.06	45.3
Bg. Buffalo	614	11.8	1,535.0	29.2
Sm. Buffalo	30	0.6	38.4	0.7
Carpsucker*	1,126	21.4	540.48	10.3
Grand Total	5,248		5,265.7	

* Carpsucker represent combination of quillback and highfin carpsucker

Age Composition and Growth

Natural reproduction was found for carp, black crappie, largemouth bass, and channel catfish. Other species apparently failed to successfully produce young of the year. Age analysis by the scale method and length frequency distribution of individual populations revealed channel catfish and carp were the only species successful in producing an age group each year. As listed in Table 4, other species varied considerably in year class strength.

TABLE 4. Age composition and growth of fish populations in Coralville Reservoir

Species	Sample Size	Age Group 0	I	II	III	IV	V
Carp	153	3	12	21	86	24	7
Per Cent		1.9	7.8	13.7	56.2	8.1	4.5
Length (mean)		3.1	6.9	9.1	12.7	15.2	18.9
(range)		2.8-3.7	5.8-8.6	8.9-11.7	10.7-14.3	14.0-16.3	18.3-19.6
Weight (mean)		.07	.17	.43	.66	1.41	2.73
(range)		.03-.09	0.8-.28	.33-.68	1.2-1.45	1.11-1.97	2.53-2.79
Bigmouth Buffalo	42	-	1	15	3	18	5
Per Cent		-	2.4	35.7	7.1	42.9	11.9
Length (mean)		-	10.3	16.2	18.1	19.9	22.9
(range)		-	9.1-10.9	14.7-18.9	17.0-19.9	18.1-23.0	21.0-26.1
Weight (mean)		-	.56	2.39	3.81	4.44	5.37
(range)		-	.40-.87	1.7-3.97	2.7-4.64	3.0-6.41	5.1-12.2
Black Crappie	18	10	3	-	5		
Per Cent		55.5	16.6	-	28.9		
Length (mean)		2.1	6.2	-	9.0		
(range)		1.8-2.3	5.3-7.6	-	8.3-9.8		
Weight (mean)		-	.15	-	.51		
(range)		-	.09-.25	-	.41-.56		
White Crappie	55	-	34		-	21	
Per Cent		-	61.8		-	38.2	
Length (mean)		-	6.6		-	8.8	
(range)		-	5.5-6.8		-	8.1-11.1	
Weight (mean)		-	.11		-	.35	
(range)		-	.06-.14		-	.21-.69	

(TABLE 4 continued)

Species	Sample Size	Age Group 0	I	II	III	IV	V
Lm. Bass	37	12	-	6	1	12	6
Per Cent		32.4	-	16.2	2.7	32.4	16.2
Length (mean)		2.5	-	7.3	10.0	14.7	17.2
(range)		2.0-3.4	-	6.5-8.5	8.6-12.3	13.7-15-7	17.0-18.5
Weight (mean)		-	-	.27	.62	2.22	3.9
(range)		-	-	.13-.41	.5-1.23	1.13-2.69	3.13-4.5
Bluegill	15	-	5	5	4	1	
Per Cent		-	33.3	33.3	26.7	6.7	
Length (mean)		-	4.4	5.2	6.4	7.8	
(range)		-	4.3-4.7	5.0-5.4	6.2-6.7	7.8.	
Weight (mean)		-	.06	.12	.22	.35	
(range)		-	.06-.07	.11-.14	.18-.25	.35	
Quillback	9	-	3	4	2		
Per Cent		-	33.3	44.4	22.3		
Length (mean)		-	9.6	13.4	15.2		
(range)		-	9.5-9.7	10.9-12.4	14.9-16.5		
Weight (mean)		-	.40	.58	.92		
(range)		-	.37-.43	.33-.85	.81-1.13		
Channel Catfish	345	124	162	23	25	7	4
Per Cent		36.0	47.2	6.6	7.2	2.0	1.0
Length (mean)		2.3	5.6	7.7	8.8	10.6	12.0
(range)		2.2-2.6	4.0-6.9	6.7-8.1	7.2-8.1	9.5-10.9	10.5-12.9
Weight (no weights were available from the survey)							

TAILWATER FISH POPULATION

Ordinarily strong current and turbulence would make it impossible to sample the fish population in the outlet tailwaters by any type of gear. With the cooperation of the resident engineer and regional office of the Corps of Army Engineers the outflow was reduced to minimum discharge (150 c.f.s.) for one hour to complete the fishery survey. Electro-fishing was used exclusively in this area.

Species Composition of Fish in the Tailwaters

Nine species of fish were found in the outlet tailwaters. All species were previously captured during the reservoir survey. Nine hundred two fish with a combined weight of 1,300.5 pounds were captured in 1 hour and 44 minutes of electro-fishing. The ratio of rough fish to game fish did not differ greatly from that found in the reservoir, but species composition of the population was vastly different. Bigmouth buffalo comprised 39.5 per cent of the population by number and 712. per cent by weight (Table 5). Crappie was the most abundant game fish, but largemouth bass represented a larger segment of the population weight.

Carp, the most numerous species of fish in the reservoir survey represented less than 5 per cent of the population in the tailwaters. Other species captured were bluegill, bullhead, channel catfish, flathead catfish, and quillback.

TABLE 5. Species composition of the fish population by number and weight in the outlet tailwaters of Coralville Reservoir

Species	Total Number	Per Cent Species Composition	Total Weight	Per Cent Species Composition
Lm. Bass	46	5.1	101.6	7.7
Bluegill	6	0.7	1.2	0.1
Crappie	256	28.4	76.24	5.8
Bullhead	16	1.7	7.36	0.6
Ch. Catfish	8	0.9	2.24	0.2
Fl. Catfish	4	0.4	8.0	0.6
Carp	42	4.6	52.34	4.0
Bm. Buffalo	356	39.5	925.6	71.2
Quillback	168	18.6	115.92	8.8
Grand Total	902		1,300.5	

Age composition of individual fish populations in the tailwaters was approximately the same as in the reservoir. The only difference was a complete absence of young of the year. Due to the extremely strong current and turbulence in this area it is doubtful if young fish could survive. Growth of fish in the tailwaters was also comparable to fish in the reservoir.

SUMMARY

An intensive survey to determine species composition, age composition, growth, and limnology characteristics of Coralville Reservoir was completed in 1963.

Temperature, dissolved oxygen, free carbon dioxide, and pH profiles indicated the reservoir does not thermally stratify, but has limited chemical stratification at normal summer conservation pool level.

Bottom samples revealed Chironomid to be the most important bottom organism. One other species of Diptera and one species of Annelida was also found.

Seventeen species of fish were captured in the reservoir and tailwaters of the outlet structure. Carp comprised 35.1 per cent of the reservoir population by number and 45.3 per cent by weight. Bigmouth buffalo was the most abundant species in the tailwaters. Crappie was the most numerous game fish in both areas. Other species captured were largemouth bass, bluegill, northern pike, walleye, channel catfish, flathead catfish, smallmouth buffalo, quillback, highfin carpsucker, northern redhorse, white bass, and green sunfish.

Natural reproduction was found in the reservoir for black crappie, carp, largemouth bass, and channel catfish. No young of the year was found in the tailwaters.

Channel catfish and carp were the only species without year class voids. Year class strength varied considerably in other species.

Growth of crappie, bluegill, and channel catfish was slow in comparison to other southern Iowa lakes. Other fish grew at an average rate.

THREE YEARS OF BANDING INFORMATION OBTAINED FROM BANDING BLUE-WINGED TEAL IN IOWA

Gene Goecke
Game Biologist

INTRODUCTION

The production of blue-winged teal, one of Iowa's most common nesting waterfowl, has been considered as an important contribution of the state to the Mississippi Flyway population. In 1961 a banding operation was begun to band "local" ducks in Iowa.* The banding of local ducks has been carried out the last 3 years - 1961, 1962, and 1963. In addition, in 1963 a bait trapping project was started to band "immatures" prior to the opening of the waterfowl season.* During this three year period, 6,102 blue-winged teal have been banded (Table I).

In order that the banding of waterfowl can be meaningful, the band returns from banded waterfowl that have been shot, found dead, or recaptured must be compiled, studied, and evaluated. The returns from such banding can provide needed information regarding setting of hunting season dates, migration movements, and life histories of waterfowl. From banding recoveries, information can be gathered which will help for species management of waterfowl, rather than just the management of waterfowl as a single unit.

METHODS

In drive trapping, an enclosed trap with a narrow entrance is set in shallow water or on land, and leads from a few yards to 50 yards or more in length were run from the trap to form a "V" leading to the trap. The marsh was then surrounded by drivers, and the young ducks were driven into the trap and banded. In bait trapping a pre-constructed trap is set in a desirable location and baited with corn, wheat, or other attractive foods. The ducks swim into the trap for the bait.

The bands used to band waterfowl are furnished by the U. S. Fish and Wildlife Service. Bands are made in various diameters and widths to accommodate the various leg diameters and lengths of waterfowl. Each band is serially numbered. A form furnished with the bands is used in recording the species, location, age, and sex of the waterfowl banded. This information is then sent to the U. S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, Maryland, where it is recorded.

When the band is recovered, the number or entire band was sent to the Research Center, with information being recorded as to location, date, and how the band was recovered. A form is then sent to the state where the bird was banded and to the state where it was recovered, giving a complete history of the bird from time of banding to time of recovery.

* In reporting banding data, the term "local" refers to young birds hatched in a known area, as opposed to "immatures" which are young of unknown geographic origin. The term juvenile is no longer used in reporting banding data.

RESULTS

A total of 201 band returns have been received from the 6,102 blue-winged teal banded the last 3 years in Iowa (Table 2). Of the 201 returns, 107 (or 53 per cent) have been recovered in Iowa. Of the 107 recovered in Iowa, 99 (or 93 per cent) were recovered in the fall of 1963. The high percentage of recoveries in the fall of 1963 was no doubt due to an early opening of the hunting season and the uncommonly warm late fall. The season opened the 5th of October in 1963 compared to an opening of October 27, 1962, and October 21, 1961.

An additional 30 blue-winged teal bands have been recovered in Iowa from birds banded outside of the state the last 3 years (Table 3). Twenty-eight of the recoveries were in 1963 and two were in 1962.

Although the recovery of bands was much higher in Iowa in 1963, 57 per cent of those recovered were taken the first day of the hunting season, October 5th (Table 4). Eighty-five per cent of the bands were recovered the first 8 days of the hunting season.

The recovery rate was highest on immature banded birds (Table 5). Seventy-nine per cent of the band recoveries have been from birds in the immature age class.

Ninty-four of the blue-winged teal banded in Iowa have been recovered in other states or countries (Table 6). Our neighboring states of Minnesota and Wisconsin have accounted for 48 of the recoveries. Countries south of the United States have recovered 33.

DISCUSSION

The last 3 years of blue-winged teal banding in Iowa has revealed several important facts that should be considered for species management:

1. The low percentage of band recoveries is an indicator that the blue-winged teal is an underharvested resource.

2. The season would have to be set earlier to harvest more of the adult and locally raised birds that migrate south before the season opens.

3. Increased efforts need to be made to band local and especially immature birds so that a larger sample can be available for study.

4. More information must be exchanged with other states regarding banding and banding recoveries so that a better over-all picture of blue-winged teal can be developed.

TABLE 1. Numbers, age, and sex of blue-winged teal banded in Iowa the last three years (1961-62 and 63)

Year	AM*	AF	ImM	ImF	LoM	LoF	Total
1961	200	107	-	-	293	288	888
1962	122	62	-	-	594	647	1,425
1963	376	328	1,044	959	573	509	3,789
Total	698	497	1,044	959	1,460	1,444	6,102

AM-adult male, AF-adult female, ImM- immature male, ImF-immature female, LoM-local male, LoF-local female.

TABLE 2. Numbers and percentages of banded blue-winged teal recovered (percentages are in parenthesis), 1961-63

Year	No. Banded	No. Recovered	No. Recovered in Iowa	No. Recovered Outside Iowa
1961	888 (15)	13 (1.5)	3 (0.3)	10 (1.2)
1962	1,425 (23)	42 (2.9)	5 (0.3)	37 (2.6)
1963	3,789 (62)	146 (3.9)	99 (2.6)	47 (1.3)
Total	6,102 (100)	201 (3.3)	107 (1.8)	94 (1.5)

TABLE 3. Blue-winged teal banded outside of Iowa, but recovered in Iowa (dates taken are in parenthesis)

Where Banded	AM	AF	ImM	ImF	LoM	LoF
Saskatchewan				2(10-6-63)		
Manitoba		1(11-8-63)	1(9-25-63)* 2(10-6-63)	1(9-26-63)* 5(10-6-63)		
South Carolina		1(10-21-63)				
Minnesota			1(10-12-63) 1(10-26-63)	1(9-22-63)* 1(10-5-63) 1(10-21-63)		2(8-26-63)* 1(10-5-63)
North Dakota	1(5-23-63)				1(9-14-63)* 2(10-5-63)	
South Dakota			1(10-6-63)	2(9-22-63)*		
Montana				1(10-5-63)		
Ohio		1(10-6-63)				

* Those recovered before October were recaptured while bait or drive trapping in Iowa.

TABLE 4. Periods when blue-winged teal bands were recovered in Iowa during the hunting season (percentages are in parenthesis)

Sex & Age	Oct. 1-5	Oct. 6-12	Oct. 13-19	Oct. 20-26	Oct. 27-Nov. 2	Nov. 3-9
AM	-	4	1	-	-	-
AF	3	2	-	1	2	2
ImM	36	15	4	2	2	-
ImF	28	12	2	2	-	-
LoM	2	3	-	-	-	-
LoF	4	-	1	-	-	1
Totals	73 (57)	36 (28)	8 (6)	5 (4)	4 (3)	3 (2)

TABLE 5. Number and per cent of blue-winged teal of each age and sex banded and recovered in Iowa

	AM	AF	ImM	ImF	LoM	LoF
No. Banded	698	497	1,044	959	1,460	1,444
Per Cent	11%	8%	17%	16%	24%	24%
No. Recovered	6	10	59	48	6	8
Per Cent	4%	7%	44%	35%	4%	6%

TABLE 6. Banded blue-winged teal that were recovered outside Iowa (date taken is in parenthesis)

Where Recovered	AM	AF	ImM	ImF	LoM	LoF
Virgin Islands				1(10-22-62)		1(11-62) 1(11-11-62)
Venezuela	1(10-62)		1(11-62) 1(2-25-63)	1(11-62) 1(12-16-62)	1(4-7-63)	1(10-62) 1(9-20-62) 1(10-19-62)
Columbia				1(12-62) 1(12-25-62)	1(12-62) 1(2-17-63)	1(11-62) 1(3-9-63) 1(4-10-63)
Guiana			1(10-9-62)	1(2-22-63)		
Panama			1(12-31-62)		2(12-61)	1(12-15-62)
Ontario	1(9-3-63)			1(10-7-63)	1(9-16-63) 1(9-21-63)	
Quebec	1(9-21-63)					
Haiti						1(11-18-62) 1(11-3-62)
Cuba						1(3-20-63)
Michigan				1(10-5-63)		1(9-24-62)
Wisconsin	1(10-63) 1(10-8-63)		6(10-5-63) 6(10-6-63) 1(10-7-63) 1(10-12-63) 1(10-19-63) 1(10-20-63) 1(10-63)	2(10-5-63) 3(10-6-63) 1(10-16-63) 2(10-63)	2(10-5-63)	1(10-5-63) 1(10-12-62)
Minnesota	1(10-5-63) 1(10-6-63)	2(10-13-63)	1(10-63) 1(10-7-63) 1(10-17-63)	1(10-5-63) 1(10-15-63)	1(10-14-63)	1(7-19-63) 1(7-26-63) 2(10-5-63) 2(10-63)

TABLE 6 (Continued)

Where Recovered	AM	AF	ImM	ImF	LoM	LoF
Florida		1(12-9-62)	1(12-1-63) 1(11-12-63) 1(11-30-63)			
Virginia			1(12-15-63)			
Texas			1(11-18-61)		1(6-3-63)	
Louisiana			1(12-1-63)		1(12-15-63)	1(12-1-62)
South Carolina					1(8-27-63)	

* All birds but two were recovered the same year as banded.

SUMMARY

1. In the last three years - 1961, 1962, and 1963 - 6,102 blue-winged teal have been banded in Iowa.

2. A total of 201 band recoveries have been returned from the birds banded, 107 being recovered in Iowa and 94 outside the state.

3. Recovery rates of immatures have been the highest for all categories of birds banded.

4. In Iowa, the biggest percentage of recoveries were obtained the first two weeks of October in 1963.

5. Thirty-three of the 94 banded blue-winged teal taken outside of Iowa have been recovered in Central and South American Countries.

IOWA QUAIL HUNTING, 1963

M. E. Stempel
Game Biologist

This is a report on Iowa quail hunting. Most of the material is from the 1963 season, but there are comparisons with a few past seasons (Table 1). Data are from hunters contacted in the field or on return from hunting.

Our quail population is rebuilding after an unfavorable period which followed the 1959-1960 winter. To compensate for fluctuations in numbers of quail, it has been customary to adjust hunting seasons. The past summer favored maximum production; hence the 60-day 1963 season was one of our longest.

METHODS

Hunting information was gathered by conservation officers and by biology and game section personnel. From 1946 to 1959 information was collected on special cards and since then a shorter contact book form used by conservation officers, both of which are further described in the March 1963 Quarterly Biology Reports. Use of the cards was continued by the biologist since these have space for recording more complete information than do the contact books. Many of the contact reports are of incomplete hunting trips, while completed trips are recorded on the cards. Hence, the card results usually indicate better hunting.

In this report many of the comparisons are made between counties in similar soil types. Hitherto, the comparisons were based on agricultural regions which were made up of groups of counties such as the southeast, or the south-central. In the following sections of this paper, hunter success is stated as hunter-hours per quail bagged.

RESULTS

Field Contact Records (Booklets)

In 1963, throughout the open hunting zone 370 hunters reported on 1,069 hours of shooting during which they took 485 quail. Forty-four per cent hunted the first day of the season. Eighty-five of the parties hunted during the first 10 days, while only 31 hunted during the last 50 days. Eighty-four per cent hunted on week-ends. During holidays (Veterans' Day, Thanksgiving, Christmas and New Year's) 3 parties were contacted. Success was at the rate of 2.2 hunter-hours per quail. The average for the previous 10 years was 1.8 (this figure includes data from the cards).

During the previous year (the 1962 quail hunting period) 273 hunters were contacted. They reported 1,134 man-hours of hunting, a take of 590 quail, and 45 per cent hunted the first day of the season. Seventy-six parties hunted during the first 10 days, but only 53 hunted durint the last 32 days. (There were fewer hunting days in 1962). Seventy-seven per cent of the parties hunted on week-ends. Success rate was 1.9 hours per bird.

Hunting Results in Different Soil Regions

Most important Iowa quail territory is in the southern Iowa loess region (Brown, 1936), which extends from central Taylor County to near the Mississippi River. The northern boundary is irregular. The widest portion extends north to Keokuk County, but the area is narrower to the east and to the west. It also extends south into Missouri. This good quail terrain is made up principally of three types of soils: The first is Grundy silt loam which is productive and gently rolling; second is Clinton silt loam which is level to steep and fairly productive; third is Lindley loam and silt loam which is fairly productive but very badly eroded as it is rolling to steep and rough. In or near the lightly used steeper portions of the above three regions we find brushy quail cover along fences, field borders, ditches and creeks.

Within this good quail country in 1963, 272 hunters indicated that in 840 man-hours of shooting, they took 385 quail at the rate of 2.2 hours per bird. Best success was in Jefferson, Henry, and Des Moines Counties where success was 1.6 hours per bird.

For those counties in the above location, average hunting success from November 2 to 21 was 2.5 hours per bird; from then to December 12 it was 1.5; from then until January 1964 it was 1.5.

Seventy-four per cent of hunters were contacted during the first period, 22 per cent during the second and 4 per cent at the end. Several officers indicated that the amount of hunting was reasonably well represented in the number of men per period. Eighty-one per cent of the shooters were successful in getting quail. Twenty-three per cent had some other game, and two of these had not planned to shoot quail, but were after other species.

The outer perimeter of the quail range lies in a territory which has productive soils which are intensively cultivated or pastured, and quail cover here is scarce. Some of this is in the edge of the southern Iowa loess (S. and S.E.), within the Iowan drift (E. and N.E.), in Mississippi loess (E.), in Missouri loess (S.W.) or in the Wisconsin drift area (Central Iowa).

In the above territory the hunter success rate was 2.3 hours per bird. Success ranged from 1.0 hours per quail in the southwest to 5.5 in the Wisconsin drift. In the latter two places there were only a few reports, and these were only on successful hunts.

Hunter Report

All of these records are from the best range, i.e. from southern and southeastern Iowa, which lie in the southern Iowa loess area. A total of 133 hunters invested 414 hours to get a return of 355 birds from 130 coveys. Rate of kill was 1.2 hours per quail. Fifty of the parties were asked their opinion of the season compared to 1962, and 49 thought 1963 was best.

All agreed that the dry early portion of November and the cold of late December were a handicap to the hunter because birds were wary and the dry vegetation prevented effective dog work. Many hunters quit going out when weather was cold (December 8 and later). Several indicated the number of successful trips; from this it is estimated that quail were seen during more than 95 per cent of trips.

SUMMARY AND DISCUSSION

Weather in 1963 favored survival of brood stock and production of young. Except for some precipitation November 16 to 23, this month was dry. From December 8 on, weather was very cold. Thus there were few favorable shooting days.

Many average shooters were interviewed before completing their hunt (contact books); their success was 2.2 hours per quail (Table 1). Another group, made up of experienced gunners using dogs and proper guns and ammunition, took quail at a rate of 1.2 hours per quail (cards). These men said that shooting was unusually good. In comparison the 1962 production was judged as nearly as good and there were many good shooting days. Average hunter success in 1962 was 1.9, while for the selected group the rate was 1.0.

Success for the entire 1963 season was under that for 1962 for both average and experienced shooters. Nevertheless most of them who were questioned thought the 1963 season was better than 1962. There are three, and probably many more, reasons for this. First, the production period was favorable and all believed quail were plentiful. Second, quail were very wild due to weather conditions and shooting was difficult. Third, hunters indicated that they saw many very large coveys.

In conclusion, a fairly high quail population was indicated by pre-season surveys and by the number of wings collected for an age study. Hunting success late in the 1963 season was equal to that of 1962 (Table 1).

LITERATURE CITED

Brown, P. E. 1936. Soils of Iowa. Spec. Rept. Iowa Agr. Exp. Sta., Ames. p. 10.

TABLE 1. Quail hunting results, 1963, 1962, 1961, from Conservation Officer contact books and hunter report cards

	Biologist's Cards			Officers' Contacts		
	1963	1962	1961	1963	1962	1961
% Hunting First Day	-	-	-	73	59	47
Party Hrs. per Covey	1.6	1.3	1.5	-	-	-
Hunter Hrs. per Quail	1.2*	1.0*	1.1	2.2**	1.9**	2.2

* Late success in 1963 was 1.0
Late " " 1962 2.4
** Late " " 1963 1.5
Late " " 1962 1.9

The 10-year average for average hunters was 1.8.
The 3-year average for selected hunters was 1.2.

THE 1963 GUN SEASON FOR DEER

Keith D. Larson
Game Biologist

INTRODUCTION

Although the below zero temperatures on all three days of the shotgun season, December 14, 15, and 16, made hunting conditions severe, the complete snow cover apparently balanced this adverse factor, and the hunters recorded another record year. Twelve thousand and four gun permits were issued for the statewide "any-deer" season with landowners, tenants, and their children allowed to hunt without a deer permit on property under their control. Twenty-five counties had a two-day season.

Data used in this report were taken from compulsory hunter card returns; Conservation Officer reports of tagged, farm-killed deer; and Officer estimates of untagged, farm-killed deer.

Hunter report cards were received from 11,768 of the 12,004 hunters, for a 98% return. Of those reporting, 358 said they did not hunt, but it was assumed that the 236 who failed to submit reports did hunt for tabulation purposes. Hunter success was calculated on the basis that 11,646 permit holders participated in the 1963 shotgun season.

RESULTS

Deer Kill and Hunter Success

A total of 5,595 deer were killed by permittees. Our eleventh season was better numerically than any previous season and represented an increase over last year of 30.7%.

Hunter success, however, was greater than in only seven of the previous seasons, with 1953, 1954, and 1961 exceeding the success rate of 48% for 1963 (Table 1).

Iowa hunters harvested more deer in 1963 than in any of the preceding seasons, with a total harvest of 7,151 (Table 1). The total was made up of 538 kills by bow permittees; 5,595 by gun permittees; 639 tagged, farm-killed deer; and 379 untagged, farm-killed deer.

A summary of the kill, by county, which includes deer killed by hunters and those killed by other causes, is given in Table 2. Totals are given for both short and long zone. These indicate that the short zone harvested 4% fewer deer in 1963 than in 1962, in contrast to the long zone which showed a 29% increase in kill from all forms of legal hunting.

Licensed farmers, who comprised 29 per cent of the gun permittees, had a hunter success ratio of 56 per cent and bagged 1,846 of the 5,505 deer taken by gun hunters. Urban permit holders registered a success ratio of 47%.

TABLE 1. Comparison of Iowa Shotgun Seasons for Deer, 1953-1963

Year	Number Permits	Shotgun Permit Kill	Total** Kill	Gun Hunter Success	Hrs. Hunted/ Deer Bagged	Season Length
1953 */	3,772	2,401	4,008	61.1%	21.5	5 days
1954 */	3,788	2,411	2,992	63.7	----	3
1955	5,586	2,438	3,062	43.6	28.9	3
1956	5,440	2,000	2,678	39.2	30.4	2
1957	5,942	2,187	2,805	36.8	31.1	2
1958	6,000	2,141	2,891	38.4	30.2	2
1959	6,000	1,935	2,731	33.1	37.2	2
1960	7,000	3,188	4,269	45.9	37.9	3
1961	8,000	4,033	5,364	51.6	29.5	3
1962	10,000	4,281	5,703	43.5	38.8	3
1963	12,004	5,595	7,151	48.0	30.3	2 zones
Totals	73,532	32,610	43,654	----	----	-
11-Yr. $\bar{x}$	6,684	2,964	3,968	45.9%	31.6	-

*/ All counties not open for deer hunting: 45 counties in 1953 and 51.5 counties in 1954.

**/ Includes kill of gun and bow permit holders and kill of non-permit holders (farmers, landowners, etc.).

TABLE 2. Summary of 1963 Iowa Deer Kill Data

County	Successful Permittees		Successful Non-Permittees			Total Hunter Kill	% Change	Traffic, Dog, Illegal, Misc. Kill	Total Reported Kill	Est. Fall 1963 Pop.	Pct. Fall Pop. Killed
			Tagged		Untagged						
	Bow	Gun	Bow	Gun	Gun						
1. Adair	2	60		3	1	66	+53%	7	73	321	23%
2. Adams	3	44		3	1	51	+ 8	4	55	42	128
3. Allamakee	3	222	0	19	45	288	+48	14	302	1,275	24
4. Appanoose	4	39	0	1	5	49	+133	19	68	142	48
5. Audubon	1	19		8		28	+ 8	9	37	147	25
6. Benton	9	35		1	0	44	+22	2	46	66	69
7. Black Hawk	12	46		3		60	+28	8	68	230	29
8. Boone	8	36		2		45	+22	4	49	180	27
9. Bremer	4	52		3		59	+40	5	64	198	32
10. Buchanan	5	30		0		35	+67	7	42	234	17
11. Buena Vista*	2	13	0	1	2	18	-44	5	23	86	27
12. Butler	10	64		0	0	74	+40	9	83	374	22
13. Calhoun*	0	1				1	-80	0	1	51	2
14. Carroll*	0	7	0	1	0	8	-58	5	13	59	22
15. Cass	5	82		18		105	+84	27	132	374	35
16. Cedar	0	18		0	5	23	+ 4	7	30	130	23
17. Cerro Gordo*	1	11				12	+ 9	1	13	42	31
18. Cherokee	6	92	0	16	10	123	+23	9	132	188	70
19. Chickasaw	3	51		3		57	+185	5	62	204	30
20. Clark	3	57		12	10	82	+46	10	92	765	12
21. Clay*	11	37		1	3	52	-69	2	54	190	28
22. Clayton	6	244		14		264	+27	9	273	1,955	14
23. Clinton	13	69		4	1	87	+12	15	102	272	38
24. Crawford	6	129		33		167	+51	13	180	637	28
25. Dallas	9	87	0	9	0	105	+16	17	122	411	30
26. Davis	1	28		1		30	+20	6	36	151	24
27. Decatur	1	89		11	15	116	+ 7	11	127	1,003	13

* 2-day zone

County	Successful Permittees Bow	Successful Permittees Gun	Successful Non-Permittees Tagged Bow	Successful Non-Permittees Tagged Gun	Successful Non-Permittees Untagged Gun	Total Hunter Kill	% Change	Traffic, Dog Illegal, Misc. Kill	Total Reported Kill	Est. Fall 1963 Pop.	Pct. Fall Pop. Killed
28. Delaware	15	68		5		86	+ 1%	4	90	481	19%
29. Des Moines	15	111		6		131	+124	11	142	697	20
30. Dickinson*	3	37				40	-81	10	50	127	39
31. Dubuque	2	30	0	3		35	+45	3	38	340	11
32. Emmet	5	37	0	7	1	50	-87	11	61	136	45
33. Fayette	3	86	0	4		93	+ 1	7	100	136	74
34. Floyd	5	51		2	5	63	+96	17	80	263	30
35. Franklin*	1	12		5		18	+50	3	21	229	9
36. Fremont	7	14				21	+ 5	12	33	380	9
37. Greene	0	17	0	5	1	23	-47	7	30	149	20
38. Grundy	0	4				4	+300	1	5	8	63
39. Guthrie	12	215		27	13	267	+88	24	291	895	32
40. Hamilton*	4	17		1	1	23	-30	4	27	188	14
41. Hancock*	1	14		2		17	+142	2	19	56	34
42. Hardin*	6	35		8	2	51	-11	6	57	195	29
43. Harrison	4	149		22	14	188	+44	46	234	442	53
44. Henry	2	26		4		32	+45	8	40	260	15
45. Howard	3	38		5	10	55	+48	9	64	280	23
46. Humboldt*	3	17	0	3	0	23	-26	3	26	136	19
47. Ida*	1	10	0	2	1	14	+17	2	16	96	17
48. Iowa	5	36		0	3	44	-25	17	61	215	28
49. Jackson	14	144		2	85	245	+40	20	265	1,011	26
50. Jasper	4	26	0	9	0	39	+11	10	49	180	27
51. Jefferson	0	27		2		29	+12	7	36	326	11
52. Johnson	4	42		5	2	53	+32	9	62	221	28
53. Jones	6	65		4	15	90	+88	11	101	272	37
54. Keokuk	0	32		4		36	-12	7	43	248	17
55. Kossuth*	10	32	0	2	0	43	+104	13	56	124	44
56. Lee	11	61		14	2	88	+29	13	101	402	25
57. Linn	9	39				48	0	7	55	374	15
58. Louisa	6	20	0	1	1	27	+42	8	35	144	24

County	Successful Permittees Bow	Successful Permittees Gun	Successful Non-Permittees Tagged Bow	Successful Non-Permittees Tagged Gun	Successful Non-Permittees Untagged Gun	Total Hunter Kill	% Change	Traffic, Illegal, Misc. Kill	Dog, Total Reported Kill	Est. Fall 1963 Pop.	Pct. Fall Pop. Killed
59. Lucas	9	142	0	11	6	168	+17%	27	195	901	22%
60. Lyon	11	141		13		165	+47	12	177	263	67
61. Madison	6	98	0	9	1	114	+37	17	131	510	26
62. Mahaska	2	42		4		48	- 4	14	62	236	26
63. Marion	1	74	0	9		84	+25	8	92	219	42
64. Marshall	1	34		2	4	41	+28	5	46	226	20
65. Mills	11	72		15	2	100	+49	26	126	448	28
66. Mitchell	6	30		5	5	46	+15	8	54	229	24
67. Monona	5	126		34		164	+ 4	12	176	1,317	13
68. Monroe	9	117			12	138	+15	16	154	484	32
69. Montgomery	4	36		8		48	+12	6	54	329	16
70. Muscatine	3	27	0	4		34	+26	11	45	136	33
71. O'Brien*	5	22		9	1	36	+ 3	1	37	59	61
72. Osceola*	2	10		4		16	+300	4	20	35	57
73. Page	3	26				29	+16	7	36	319	11
74. Palo Alto*	4	28	0	10	5	46	- 6	12	58	74	78
75. Plymouth	5	68		7		80	+27	28	108	535	20
76. Pocahontas*	2	7	0	1	0	10	-29	0	10	76	13
77. Polk	9	21		10		40	+33	39	79	204	39
78. Pottawattamie	48	170		25	38	281	+12	99	380	2,354	16
79. Poweshiek	0	16	0	1	0	17	+ 6	3	20	110	18
80. Ringgold	0	39	0	5	0	44	+ 7	7	51	144	35
81. Sac*	9	20	0	3	2	34	+183	7	41	147	28
82. Scott	1	10			0	11	-50	6	17	99	16
83. Shelby	9	88		17	9	122	+ 2	22	144	365	39
84. Sioux	10	64		19		93	+21	19	112	348	32
85. Story*	1	11		3		15	-21	6	21	122	17
86. Tama	4	37		3		44	+63	6	50	107	47
87. Taylor	1	16		4		21	+11	1	22	64	34
88. Union	3	83	0	3	0	88	+57	12	100	144	69
89. Van Buren	0	36		3	1	40	+60	11	51	185	28

County	Successful Permittees Bow	Gun	Successful Non-Permittees Tagged Bow	Gun	Untagged Gun	Total Hunter Kill	% Change	Traffic, Illegal, Misc. Kill	Dog Total Reported Kill	Est. Fall 1963 Pop.	Pct. Fall Pop. Killed
90. Wapello	1	38		5	5	48	+26%	16	64	275	23%
91. Warren	11	106	1	15		133	+34	27	160	244	65
92. Washington	1	51		2		54	- 5	7	61	408	15
93. Wayne	6	14	0	1	2	23	+92	3	26	204	13
94. Webster	8	46		6		60	+106	10	70	272	26
95. Winnebago*	7	24		1		32	- 9	4	36	102	35
96. Winneshiek	11	196		12	30	249	+ 6	11	260	1,317	20
97. Woodbury	13	175		27	2	216	- 1	48	264	629	42
98. Worth*	9	43		4		56	+51	3	59	119	50
99. Wright*	1	17		3		21	-16	6	27	122	22

County	Successful Permittees Bow	Successful Permittees Gun	Successful Non-Permittees Tagged Bow	Successful Non-Permittees Tagged Gun	Successful Non-Permittees Untagged Gun	Total Hunter Kill	% Change	% Fall Pop. Killed	Traffic, Illegal, Dog Misc. Kill	Total Reported Kill	Est. Fall 1963 Pop.	% Fall Pop. Killed
TOTALS	538	5,595	1	638	379	7,151	+25%	21.5%	1,129	8,280	33,219	24.9%
25 Counties Short Zone	88	483	0	76	19	666	-4%	24.4%	118	784	2,728	28.6%
74 Counties Long Zone	450	5,112	1	562	360	6,485	+29%	21.2%	1,011	7,496	30,491	24.5%

Deer Hit But Not Retrieved

Gun permit holders were asked if they had wounded deer which they did not recover, and 693 (5.9%) answered in the affirmative. They reported wounding but not retrieving 769 deer, for a wounded: recovered ratio of 14:100.

In 1961 and 1962, 7.6 per cent and 8.1 per cent, respectively, of the gun hunters said they had wounded deer which had not been recovered. As suggested by Mustard (1963) a correlation probably exists between snow cover and crippling losses.

Hours Hunted Per Deer Killed and Deer Observed

A total of 169,655 hours were taken to make this record kill for an average of 14.5 hours per hunter. This is a reduction of 2 hours per hunter from the 1962 season, and is probably not significant due to the different hunting conditions and the short zone in twenty-five counties.

Day Killed and Time of Day

Hunters indicated the day they bagged their deer for 5,515 of the 5,595 deer harvested. A separate tabulation was not made for the short zone but it is reflected in a reduction kill on the third day. They reported a success on each day of 39.5 per cent, 36.5 per cent, and 24 per cent, respectively.

As in past years, a slightly greater percentage of deer were killed in the morning than in the afternoon (Table 3).

Hunter Distribution

Since 1960, hunters have had a 3-day season, until 1963 when 25 counties were shortened to two days. Hunter report cards indicate that in 1963 hunters hunted an average of 1.19 counties. This compares with the previous years of 1.24, 1.18, and 1.23 counties hunted during 1960, 1961, and 1962, respectively.

Mustard (1962) indicated that Iowa hunters tended to distribute themselves according to deer populations. The short zone apparently didn't increase the number of hunters hunting more than one county, although the weather and road conditions probably discouraged travel more than anything.

Short Zone

A reduction of kill of 4 per cent was achieved in the short zone. The increased kill state-wide of 25% was achieved in the long zone. Numerically, about the same number of deer were killed in the short zone. Table 3 seems to illustrate significant percentages in relation to fall populations and kill figures for 1962 and 1963. Drawing conclusions from this would lead you astray because we have an increase of 30% in the deer populations for 1963 for this zone, as reported. I suspect some bias in this increase. Because of this questionable census figure doubt is cast if the short zone deer herd needed relief from hunting pressure. Because of these inconsistencies and others an analysis of the success of the short zone season must be based on age and sex criteria derived from field checkers data, which is in process.

TABLE 3. Percentage of Deer Killed, By Day and Time, Iowa Gun Seasons for Deer, 1960-1963

Year	Day Killed			Time Killed	
	1	2	3	AM	PM
1960	36.5%	35.1%	28.4%	51.9%	48.1%
1961	34.5	37.5	28.0	50.9	49.1
1962	33.8	36.8	29.4	51.1	48.9
1963	39.5	36.5	24.0	52.7	47.3

Non-Permit Kill

For the first time since 1960 the number of successful non-permit hunters decreased (by one). There were 1,017 reported. Much inconsistency of reporting is shown in this category, and consequently it should be treated separately in the future.

DISCUSSION

The significance of the record kill of 1963 lies in the fact that a sample of nearly 1,400 deer checked in the field revealed that this harvest was composed of 69 per cent fawns and one-and-a-half year olds. This is slightly greater than the average of the last four years. Therefore, we must conclude that an increase of 25 per cent in the kill did not produce an increased harvest of breeding stock. This fact together with incomplete winter 1964 estimates of breeding populations showing an increase in numbers attests to the possibility that we did not harvest the increase.

LITERATURE CITED

Mustard, Eldie W. 1963. Results of the 1962 Iowa Gun Season for Deer. Iowa Conserv. Comm. Quart. Biol. Repts. 14(2).

SUMMARY

1. Gun permits were issued to 12,004 hunters in 1963 for a two zone season for deer. Twenty-five counties had a two day season and the remainder of 74 had a 3-day season.

2. Hunter report cards were received from 98 per cent of the permittees and indicated a kill of 5,595 deer, a 30.7% increase over 1962.

3. A total hunting season deer kill of 7,151 was composed of bow permittees, 538; non-permittees 1,017; in addition to the gun kill by permittees.

4. Hunter success was 48 per cent and was surpassed in only three other years since an open season was created in 1953.

5. A reduction of kill of 4 per cent was achieved in the short zone. The increased kill state-wide of 25% was achieved in the long zone.

SEX RATIOS OF PHEASANTS OBSERVED DURING WINTER - 1964

Richard C. Nomsen
Game Biologist

The annual winter pheasant count was conducted from January 1 to March 15, 1964, to determine the sex ratio of Iowa's post-season pheasant population. The results were used to calculate the percentage of cocks harvested in 1963 and are needed to complete the 1964 spring population survey.

Forms and instructions were mailed to all officers, unit game managers and biologists this year to obtain a larger sample of birds. This was especially desirable following the extended season last fall and it was hoped that an accurate sex ratio would be obtained to study the effect of the longer season.

However, the winter of 1963-1964 was extremely mild with very little snow, which lowered the number of birds reported. Iowa experienced some cold weather in December and early January but snowfall was very light. Weather conditions were relatively mild with very little snow during late January and February. The heaviest snows occurred in March after the cocks had begun spring dispersal. Generally, census conditions during the winter count were very unfavorable and results should be examined with caution.

A total of 12,543 birds was recorded during the survey (Table 1). There were 6,851 pheasants checked in January with a sex ratio of 2.9 hens per cock. Only 1,000 birds were reported in February and the sex ratio was 3.1 hens per cock. A total of 4,692 ringnecks was observed in March and the sex ratio increased to an average of 5.4 hens per cock. The total for March included 3,786 birds reported by biologists on special counts in southwest, central and north central Iowa.

TABLE 1. Observed sex ratios of pheasants reported each month, 1964

Month	Hens	Cocks	Sex Ratio
January	5,091	1,760	2.9
February	754	246	3.1
March	3,962	730	5.4
Total	9,807	2,736	3.6

All birds reported during the winter count were included in Table 2. Counts have not been made in March prior to this year. However, due to the small sample it was decided to include them this year, since weather and snow conditions were favorable for accurate counts. There were 9,807 hens and 2,736 cocks reported with a ratio of 3.6 hens per cock. A year ago, 23,002 pheasants were counted with a sex ratio of 3.0 hens per cock.

TABLE 2. Observed sex ratios of pheasants by agricultural districts - 1964

District	Hens	Cocks	Sex Ratio
1 Northwest	1,201	503	2.4
2 North central	1,711	580	3.0
3 Northeast	965	228	4.2
4 West central	862	275	3.1
5 Central	2,583	675	3.7
6 East central	530	202	2.6
7 & 8 SW & SC	1,955	273	7.2
Total	9,807	2,736	3.6

The observed sex ratio of 3.6 hens per cock indicated that 70 per cent of the cocks were shot last fall compared with 61 per cent during the 1962 season. The substantial increase in the harvest of roosters was probably due to several reasons. The season was extended through the holiday period which permitted more hunting trips. No doubt many high school and college students took advantage of the holiday hunting season. All crops were harvested by opening day and fall plowing continued during the season which limited field cover. The mild weather permitted the birds to remain well scattered during most of the season.

According to results of this survey, harvest of roosters was best in southwest Iowa, also in northeast and central Iowa (Table 3). The sex ratio indicated a low harvest in the northwest district.

TABLE 3. Comparison of observed sex ratios by agricultural districts, 1960 - 1964

District	1960	1961	1962	1963	1964
1 Northwest	2.9	2.4	2.5	2.3	2.4
2 North central	2.6	2.9	3.5	3.1	3.0
3 Northeast	3.6	4.7	5.1	4.0	4.2
4 West central	3.1	2.4	2.9	2.6	3.1
5 Central	2.8	4.2	3.9	3.3	3.8
6 East central	3.3	2.0	2.3	4.5	2.6
7 & 8 SW & SC	3.0	2.6	3.1	2.8	7.2
State Average	3.0	2.8	3.1	3.0	3.6

The 54 day pheasant season in 1963 apparently resulted in a higher percentage kill of roosters in some areas of the state. This was most noticeable in the southwest district. The spring roadside count may help determine the accuracy of our winter survey and will be examined carefully.