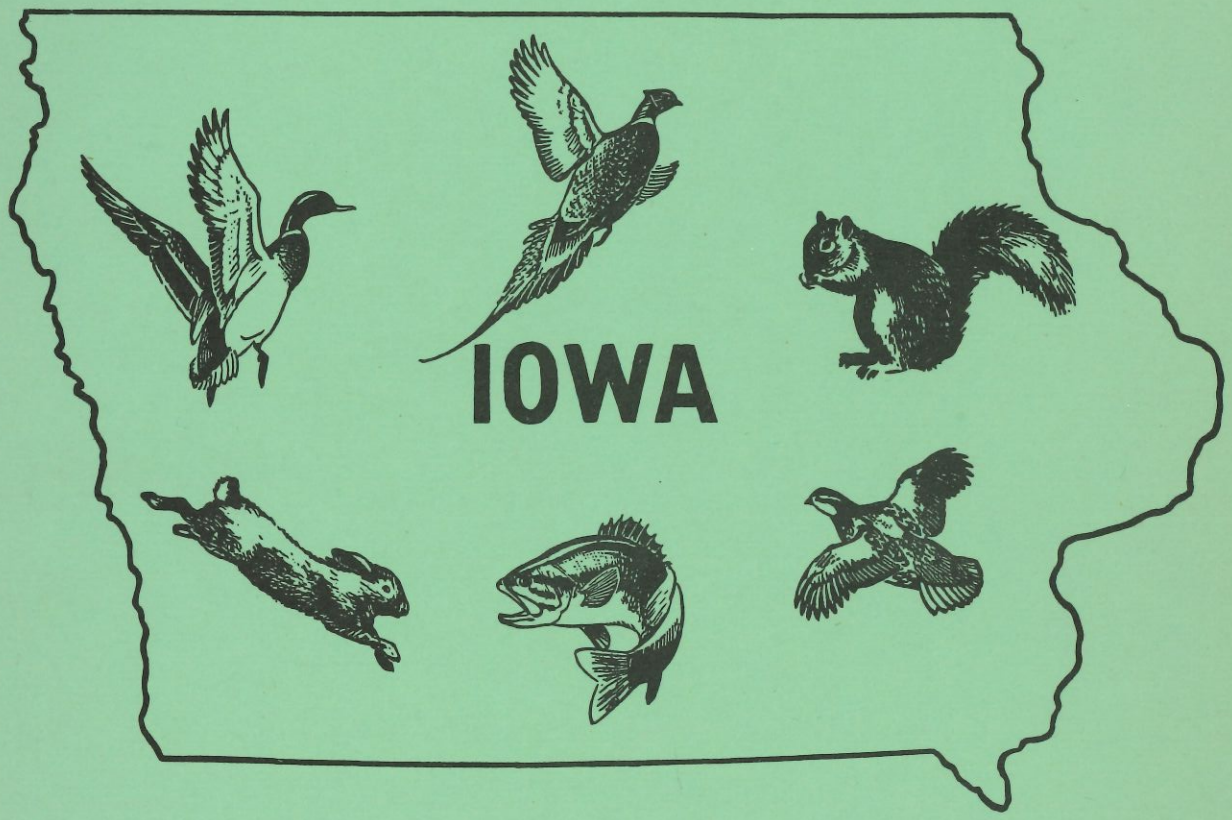
Fall "63"

Delmar J. Robinson
Fisheries Management Biologist

QUARTERLY BIOLOGY REPORTS



FISH AND GAME DIVISION — BIOLOGY SECTION
STATE CONSERVATION COMMISSION

TABLE OF CONTENTS

ABSTRACTS

****

GAME

FISHERIES

ABSTRACTS OF QUARTERLY BIOLOGY REPORTS

BOW HUNTERS DEER KILL REPORTS - 1963

Keith D. Larson
Game Biologist

Iowa bow hunters experienced their usual excellent season in 1963 when they bagged 538 deer and had a hunter success ratio of 18.8%, according to reports from 97% of the 2,858 bow permittees. It required an average of 254 hours of hunting for each deer reduced to possession, with the average hunter spending 47.1 hours hunting deer and the successful hunter spending 55.9 hours. The typical hunter saw 14.2 deer during the season, at the rate of 0.30 deer per hour of hunting. Age and sex ratios, as in past seasons, favored the adult males, with an indicated age ratio of 16 fawns:100 adults and a sex ratio of 191 males:100 females. Bow hunters harvested 46.8% of their deer in the morning and 53.2% in the afternoon hours. Approximately one-half of the deer were harvested during the last one-third of the season. The percentage of the hunters who said they had hit but failed to retrieve at least one deer was 11.6%, which closely agrees with previous seasons.

OFFICER DEER KILL REPORTS - 1963

Keith D. Larson
Game Biologist

A new high was set in 1963 (21% greater than in 1962) for the number of deer killed by traffic, illegal hunting, and miscellaneous causes, according to reports received from Conservation Officers. Reported deer deaths due to the preceding causes totaled 1,137 with traffic accounting for 900 (79.2%); illegal hunting, 131 (11.5%); miscellaneous accidents 90, (7.9%); and other causes, 16 (1.4%). As in former years, much of the road kill occurs during the rutting season during the hours of twilight and darkness. Kill by counties varied from none to 99. The trend toward increased kill exhibited by these reports matches the current deer population upswing in the state.

IOWA'S WATERFOWL HARVEST - 1963

Gene Goecke
Game Biologist

Iowa's 1963 waterfowl season was split into two parts - October 5-13 and October 26-November 17 - for ducks, with an October 5-December 13 season on geese. The primary purpose of the split season was to enable Iowa hunters to better harvest the local crop of ducks, primarily blue-winged teal and woodduck. These two species comprised 55 per cent of the total kill during the 9-day early part of the season, with blue-winged teal making up 35 per cent and woodducks 20 per cent.

Mallards accounted for 14 per cent of the kill during this period, green-winged teal 9 per cent, and other ducks (pintail, baldpate, shoveller, gadwall, etc.) the remainder. Divers and coot made up 3 per cent of the kill. During the early part of the season 93 per cent of the total waterfowl kill was comprised of ducks and 7 per cent of geese. It took an average of 2.1 hours to kill a bird during this period.

During the second segment of the season it took 4.5 hours to bag a bird. Mallards made up 32 per cent of the take, blue-winged teal 18 per cent, woodducks 11 per cent, and green-winged teal 8 per cent. The unusually warm, dry weather had considerable affect on the kill, resulting in a higher kill of teal and woodduck later in the season and delaying the major mallard flight until the last half of November.

RESULTS OF PHEASANT HUNTER CONTACTS, 1960-1963

Richard C. Nomsen
Game Biologist

Conservation Officers contacted between 6,500 and 9,000 pheasant hunters each season from 1960 to 1963. The number of pheasants checked per 100 hunters varied from 73 birds in 1960, to 81 in 1961, 77 in 1962 and 79 birds in 1963. Preliminary results show that hunting success in 1963 was excellent in the western third of the pheasant range; however, more time was needed in the rest of the state to bag a rooster. Weather remained quite mild during the first month of the 1963 season, and birds were well scattered, which made hunting difficult. Light field cover also made the birds more wary, as many flushed out range. The average number of hours required to bag a bird was 4.0 in 1960, 3.8 in 1961, 3.9 in 1962, and 4.3 in 1963.

AGE OF QUAIL TAKEN BY IOWA HUNTERS, 1963

M. E. Stempel
Game Biologist

Wings from 1,553 quail shot by Iowa hunters were collected from 29 counties in 1963. Eighty-nine per cent were juveniles. The hatch, as determined by data from wings and coveys seen in the summer began in May, peaked in June and remained high into August. The hatch was more extensive than in 1962. The majority of birds taken were mature or nearing maturity.

SKUNKS AND THE RABIES PROBLEM

Paul D. Kline
Game Biologist

Furs purchased by Iowa buyers have declined from nearly 95,000 striped skunks and 47,000 spotted skunks marketed annually during the 1934-42 period to less than

2,000 of each species during recent years. Low fur prices are responsible for this decline. Coincident with the lower harvest of skunks has been an increase in rabies reported in skunks during recent years. During the 1905-1948 period, inclusive, only 6.25 per cent of all rabies reported in Iowa was found in skunks. Since 1948 the total reported rabies cases has increased to nearly 20 per cent during 1949 through 1951, and averages slightly over 50 per cent for the past 10 years.

Summaries of food and denning habits, habitat requirements, life history, and abundance are presented in this paper. The inclination of skunks to feed on insects and rodents is advanced as evidence of their economic or ecologic value.

Under local circumstances, where it is known skunk populations are serious vectors of rabies, suggestions and means are presented for control. This control should be the responsibility of local land owners or organizations. Evidence is presented to show that statewide control would be a practical impossibility. Probably 50 to 100 thousand striped skunks alone would need be harvested annually in Iowa merely to negate the annual production. Should such massive population reduction be initiated there would be no guarantee that the incidence of rabies would decline.

CORALVILLE RESERVOIR AND LAKE MACBRIDE FISHERIES INVESTIGATIONS - 1963

PART I: CREEL CENSUS

Jim Mayhew
Fisheries Biologist

Coralville Reservoir and Lake MacBride form a large flood control and recreational complex on the Iowa River. A creel census was conducted on these impoundments from June 15 to September 2.

During 28 census periods 2,570 anglers were interviewed at Coralville Reservoir, and 3,070 at Lake MacBride. These anglers caught 1,880 fish in 4,322 hours and 3,956 fish in 4,090 hours respectively. Shore anglers had the best catch success in both impoundments.

Crappie, channel catfish, carp, and bullhead comprised the bulk of the fishery at Coralville Reservoir. Lake MacBride anglers caught bullhead, crappie, and bluegill in greatest abundance.

The average angler travelled 23.5 miles to fish in Coralville Reservoir compared to 12 miles to Lake MacBride.

Most anglers at both lakes expressed no preference in the species of fish they caught.

RESULTS OF A VOLUNTARY CREEL CENSUS ON NORTHEAST IOWA RIVERS IN 1963

Roger Schoumacher
Fisheries Biologist

A voluntary creel censu of better-than-average anglers was continued on northeast Iowa rivers, the names of the fishermen contacts being furnished by Conservation Officers. Seventy-three anglers reported 1,275 fishing trips and 3,940 hours of fishing. Seventy-six per cent of the trips were successful - at least one fish was caught. Catfish (49%), crappie (20%), carp (9%), and smallmouth bass (8%) were the primary species caught, with most of the fishing effort directed towards catfish. The 1963 fishing season was better than average on the Wapsie, about average on the Cedar and Iowa, and poor on the Shellrock, as compared to the 1950-1956 and 1962 seasons.

SUMMARY OF AQUATIC WEED TREATMENTS, 1962-63

Tom Moen
Fisheries Biologist

The Conservation Commission has carried on a limited aquatic weed and algae program for a number of years. Immediate supervision of these weed and algae treatments as they are concerned with northwest Iowa problems has been a fisheries biology function. This report presents a brief summary of routine and experimental aquatic weed and algae control activities that were carried out under the supervision of the author during 1962 and 1963.

Routine applications of copper sulfate crystals for the control of blue-green algae totalled 75,000 pounds used in 10 lakes in 1962 and 64,000 pounds in 12 lakes during 1963. The routine control of rooted aquatics in 1962 involved seven areas totalling 44 acres. During 1963 seven areas totalling 32.5 acres were treated. Chemicals used in these treatments included 5,300 pounds of 2,4-D pellets, 4,350 pounds of granular Aquathol, 100 gallons of liquid aquathol, and 4 gallons of Kuron. Approximately 75 acres of rooted aquatics were cut with a Hockney underwater weed cutter.

Experimental studies involved 19 trials using Diquat, three trials using M 2303, and one using Kurosal G. Each of the experimental chemicals show definite promise as aquatic herbicides at the recommended dosage rates and when label instructions are followed.

SPECIES COMPOSITION OF MISSOURI RIVER SURVEYS, 1963

Bill Welker
Fisheries Biologist

The annual 1963 survey of the Missouri River fish population was conducted between Sioux City and Onawa, Iowa, by the author. The total unit of effort consisted of 124 hoop net days and 2 hours of electrofishing. Two hundred ninety-six channel catfish were caught with the nets. The remaining fish taken with the nets include 3 flathead catfish, 11 crappie, 5 sauger, 1 white bass, 9 carp, 4 carpsuckers, 8 redhorse, 8 drum, 1 goldeye and 1 gar.

Shad and carp were the most numerous fish caught with the electrofishing gear. Other fish taken with this gear include 27 sauger, 3 channel catfish, 1 flathead catfish, 1 crappie, 1 walleye, 4 largemouth bass, 2 blue suckers, and 2 shovelnose sturgeons.

BOW HUNTERS DEER KILL REPORTS - 1963

Keith D. Larson
Game Biologist

INTRODUCTION

The 1963 bow season for deer marked the eleventh consecutive year bow hunting has been permitted in Iowa. Interest in the sport of bow hunting for deer has increased dramatically from the 10 permittees in 1953 to 2,858 permittees in 1963 (Table 1). The number of permits issued in 1963 increased by 19% over 1962.

Bow hunters were allowed a 51-day season, extending from October 12 to December 1 inclusive. Hunting was permitted from one-half hour before sunrise to one-half hour after sunset. Previous regulations were based on clock time, 6:30 A.M. - 5:30 P.M.. This represents the only change in the basic regulations from those of 1962.

RESULTS

Card Returns

The data presented in this report are taken from the hunt report cards submitted by 2,766 (97%) holders of the 2,858 permits which were issued in 1963. Seventy-six of the permittees indicated they did not use their permits. For the purpose of calculating the hunter success ratio, the 92 who did not report were assumed to have hunted.

Total Kill and Success Ratio

Bow hunters again broke all previous records with a total kill of 538 deer (Table 1). The hunter success ratio of 18.8% is an improvement from the approximately 1% variation of the last four seasons, which ranged from 16% to 17.1%. The total kill represents a 33.2% increase in number of deer killed.

Bow Kill by County

The number of deer reportedly killed in each county is given in Table 2, as is the number of hunters who said they hunted in the county. Pottawattamie County again had the greatest number of kills with 48; followed by Delaware, Des Moines, and Jackson, each with 14. Twenty-eight counties had 8 or more deer killed by bow; these twenty-eight counties had a composite kill of 332, or 61.7% of the total state kill of 538.

Hours of Hunting and Hours Hunted Per Deer Bagged

Collectively, bow hunters reported spending 131,270 hours hunting deer in 1963, or an average of 47.1 hours per hunter. The mean number of hours of hunting required to bag a deer (for all hunters furnishing sufficient data) in 1963 was 254 hours, which is a reduction from last year when 293 hours were required. The successful hunter

TABLE 1. Summary of data from bow seasons for deer, Iowa, 1953-1963

	1953	1954*	1955	1956**	1957	1958	1959	1960	1961	1962	1963
No. of Permits	10	92	414	1,280	1,228	1,380	1,627	1,772	2,191	2,404	2,858
Deer Kill	1	10	58	117	138	162	255	277	367	404	538
Hunter Success (%)	10.0	10.9	14.0	9.1	11.4	12.4	16.2	16.0	17.1	16.9	18.8
Total Hours/Deer Kill	-	-	-	432	370	363	252	311	283	293	254
Deer Sighted Per Hour	-	-	-	0.12	0.29	0.34	0.33	0.27	0.30	0.28	0.30
Length of Season - days	5	12	23	31	31	30	31	44	48	51	51

* First extended bow season for deer.

** First year a special permit was required to hunt deer with a bow and arrow.

averaged 55.9 hours of hunting.

Deer Observed

An average of 14.2 deer was sighted per hunter in 1963 at the rate of 0.30 deer per hour. The number of deer sighted per hour has remained relatively stable since 1957 (Table 1). The bow hunters said they observed a total of 39,688 in 1963 compared to 33,375 in 1962.

Sex and Age Ratio of Harvested Deer

Archers reported harvesting 347 males and 182 females for a sex ratio of 191 males: 100 females. This greatly unbalanced sex ratio in harvested deer is interpreted to mean that bow hunters are quite selective as to sex of the deer they kill. They also appear to be selective as to the age of deer they take, with an indicated age ratio of 16 fawns: 100 adults for the 70 fawns and 445 adult deer on which data were received.

Time of Day and Part of Season Deer Were Taken

Successful bow hunters were asked to indicate whether they killed their deer in the morning hours or afternoon hours. They reported that 46.8% were taken in the morning and 53.2% in the afternoon. This is similar to past seasons where typically more deer are taken in the afternoon than in the morning hours.

The 51-day season was divided into three 17-day periods for comparing rate of kill: October 12-28, October 29-November 14, and November 15-December 1. As in past seasons, the kill became progressively better as the season advanced, with 21 per cent of the kills occurring in the first period, 29.2 per cent in the second, and 49.8 per cent in the third.

Some plausible explanations for the greater number of kills which are reported during the third period were given by Mustard (1961). Briefly, they include: (1) changes in cover conditions, (2) shooting hours more closely coincide with periodicity of deer movements, (3) hunters may be less selective as season wanes, and (4) hunters may falsify their report so they can continue hunting with their companions. The occurrence of the rut during the third period should also be considered a paramount factor, while the change in shooting hours this year negates this factor as being important in increased hunter success. The low percentage of deer taken during the first period is attributed partially to the lesser activity on the part of the deer.

Deer Wounded but Not Retrieved

Approximately 11.6 per cent of the bow hunters said they had hit but failed to retrieve one deer in 1963. The percentage of hunters who wounded deer closely agrees with similar data from 1961 and 1962 when 10.9 and 10.8 per cent respectively reported they had wounded at least one deer and lost it.

Three hundred twenty-six bow permittees in 1963 indicated they had wounded a total of 360 deer which they failed to recover.

DISCUSSION

The Iowa bow hunter has experienced the best season in his 11-year history. He has increased in number, killed more deer, had a higher success rate, and spent less time achieving this record than in previous years.

SUMMARY

1. The eleventh Iowa bow season for deer was 51 days in length and was open statewide.

2. Permits were issued to 2,858 bow hunters; the 2,766 who participated bagged 538 deer and had a hunter success ratio of 18.8%.

3. Hunters averaged 47.1 hours of hunting and collectively spent 131,270 hours in deer hunting. They spent an average of 254 hours for each deer they reduced to possession and the successful hunter averaged 55.9 hours of hunting.

4. A total of 39,688 deer were observed at the rate of 0.30 deer per hour of hunting, with the average bowman sighting 14.2 deer during the season.

5. Bow hunters again showed their preference for adult male deer when they reported bagging deer in the ratio of 16 fawns:100 adults, and 191 males:100 females.

6. Hunters reported taking 46.8% of their deer in the morning and 53.2% in the afternoon.

7. Hunting became better as the season advanced, with bow hunters indicating they took 21% of their deer during the first third of the season, 29.2 per cent in the second, and 49.8 per cent in the third portion of the season.

8. A total of 326 bow hunters (11.6%) said they had wounded one or more deer and failed to retrieve it. A wounded:100 recovered ratio of 69:100 was determined.

LITERATURE CITED

Mustard, Eldie W.

1961. Results of Iowa's 1961 bow season for deer. Iowa Conserv. Comm., Quart. Biol. Repts. 13(4): 34-39.

TABLE 2. Number of deer killed and number of bow hunters hunting deer, by county, Iowa, 1963

County	Deer Killed	No. Hunters
1. Adair	2	17
2. Adams	3	20
3. Allamakee	3	21
4. Appanoose	4	6
5. Audubon	1	14
6. Benton	9	47
7. Black Hawk	12	119
8. Boone	8	45
9. Bremer	4	39
10. Buchanan	5	25
11. Buena Vista	2	12
12. Butler	10	59
13. Calhoun	0	16
14. Carroll	0	7
15. Cass	5	26
16. Cedar	0	13
17. Cerro Gordo	1	33
18. Cherokee	6	42
19. Chickasaw	3	34
20. Clark	3	30
21. Clay	11	40
22. Clayton	6	88
23. Clinton	13	108
24. Crawford	6	38
25. Dallas	9	46
26. Davis	1	10
27. Decatur	1	12
28. Delaware	14	91
29. Des Moines	14	111
30. Dickinson	3	17
31. Dubuque	2	45
32. Emmett	5	34
33. Fayette	3	36
34. Floyd	5	50
35. Franklin	1	17
36. Fremont	7	25
37. Greene	0	17
38. Grundy	0	1
39. Guthrie	12	58
40. Hamilton	4	31

TABLE 2 (cont'd)

County	Deer Killed	No. Hunters
41. Hancock	1	18
42. Hardin	6	40
43. Harrison	3	35
44. Henry	2	13
45. Howard	3	30
46. Humboldt	3	16
47. Ida	1	10
48. Iowa	5	40
49. Jackson	14	89
50. Jasper	4	32
51. Jefferson	0	1
52. Johnson	4	59
53. Jones	6	42
54. Keokuk	0	13
55. Kossuth	10	29
56. Lee	11	68
57. Linn	9	119
58. Louisa	6	26
59. Lucas	9	47
60. Lyon	11	54
61. Madison	6	50
62. Mahaska	2	16
63. Marion	1	32
64. Marshall	1	17
65. Mills	11	38
66. Mitchell	6	38
67. Monona	5	32
68. Monroe	9	28
69. Montgomery	4	15
70. Muscatine	3	21
71. O'Brien	5	18
72. Osceola	2	14
73. Page	3	13
74. Palo Alto	4	15
75. Plymouth	5	29
76. Pocahontas	2	6
77. Polk	9	105
78. Pottawattamie	48	186
79. Poweshiek	0	11
80. Ringgold	0	9
81. Sac	9	32
82. Scott	1	43

TABLE 2 (cont'd)

County	Deer Killed	No. Hunters
83. Shelby	9	29
84. Sioux	10	36
85. Story	1	40
86. Tama	4	17
87. Taylor	1	12
88. Union	2	26
89. Van Buren	0	9
90. Wapello	1	23
91. Warren	11	80
92. Washington	1	7
93. Wayne	6	15
94. Webster	8	35
95. Winnebago	7	29
96. Winneshiek	11	35
97. Woodbury	12	52
98. Worth	9	46
99. Wright	1	21

OFFICER DEER KILL REPORTS - 1963

Keith D. Larson
Game Biologist

Deer kills due to causes other than legal hunting were greater in 1963 (21%) than in 1962 or any previous year. Conservation Officers reported a total of 1,137 deer fatalities in their Officer Deer Kill Reports. This figure is a minimum one as many deer when hit by a vehicle continue away from the roads and are not found. For various other reasons many are not reported.

Reported kills varied from none in Calhoun and Pocahontas Counties to 99 for Pottawattamie County. Eighty-six counties reported 20 or fewer kills, seven had 21-30 kills, and Polk, Harrison, and Woodbury reported 39, 46, and 48, respectively.

Traffic accounted for 900 (79.2%), illegal hunting 131 (11.5%), miscellaneous accidents 90 (7.9%), and other causes 16 (1.4%) of the mortalities.

Estimates of damage to vehicles were received for 478 of the accidents. These totaled $69,594 or an average of $145 per accident which is identical to last year's average estimate of damage.

Data on the type of road on which 763 deer-traffic accidents occurred indicated 80.7 per cent occurred on hard-surfaced state roads, 6.2 per cent on hard-surfaced county roads, and 13.1 per cent on gravel roads.

The increased kill occurring during the last quarter of 1963 (650 or 47%) is traditional and believed a result of increased movements of deer during the rut. (Figure 1).

This 1963 report shows a somewhat sharper increase in fatalities than in 1962. This increase in kill for 1963 agrees with the increase in population estimate for that year (Figure 2). This agreement has held since 1957 when the current population upswing of the Iowa deer herd began its steady climb. This suggests that the non-hunting mortality is a valid index to population trends of the white-tail deer.

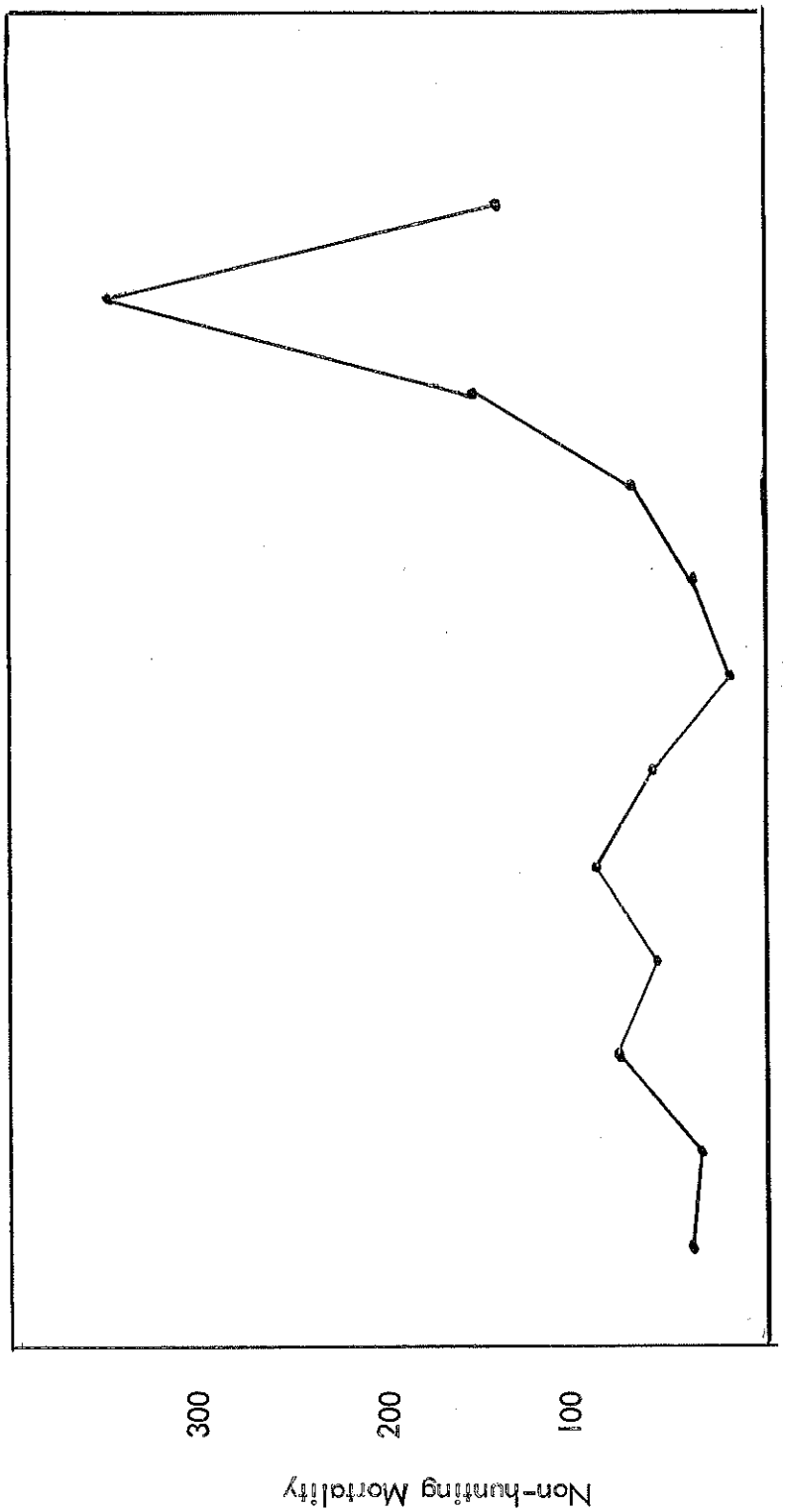


FIGURE 1. Non-hunting Mortality by Month, 1963

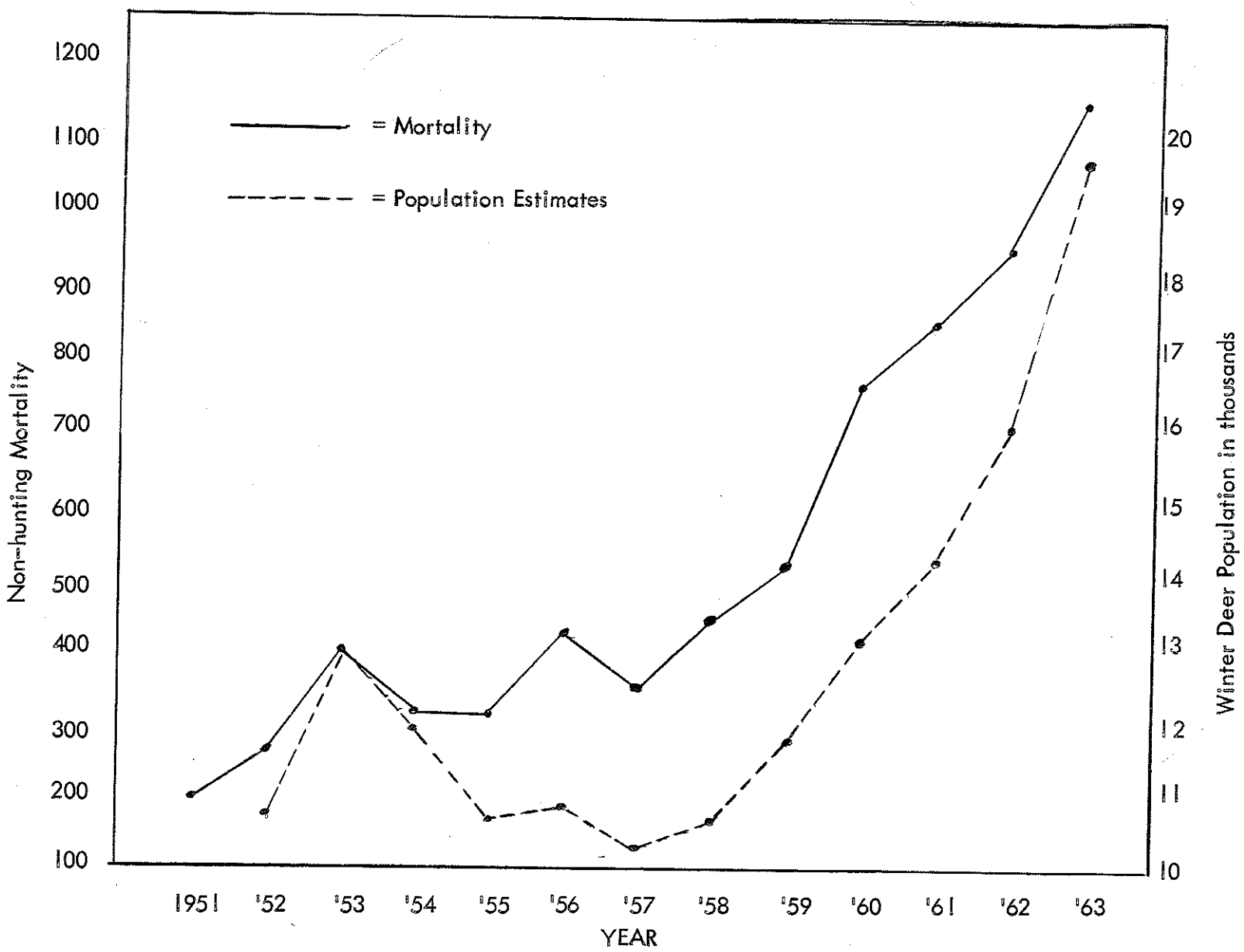


FIGURE 2. Annual Non-Hunting Mortality and Winter Deer Population Estimates

IOWA'S WATERFOWL HARVEST - 1963

Gene Goecke
Game Biologist

INTRODUCTION

Iowa's duck hunting season was split into two parts for the first time on record in 1963. The first segment of the season was from the 5th through the 13th of October. The second part of the season ran from the 26th of October through the 17th of November. The goose season was from the 5th of October through the 13th of December. Shooting hours were from noon to sunset on opening days and from sunrise to sunset throughout the rest of the season.

The daily bag limit of ducks was four with a possession limit of eight after the first day. Included in a daily bag there could not be more than one hooded merganser, two woodducks, and two mallard or black ducks. In addition to the above duck bag, five American or red-breasted mergansers could be taken daily. The daily bag limit of coot was eight with a possession limit of sixteen. The daily bag and possession limit of geese was five, but not over two of the limit could be Canada geese, sub-species of Canada, or white-fronted geese. The entire bag limit could be made up of five blue or snow geese.

The purpose of the split season was to give the Iowa hunter a chance to harvest some of the locally raised blue-winged teal. With the shortened season generally starting after the 15th of October the last few years, the blue-winged teal has dropped drastically from making up 25 to 30 per cent of the harvest in the middle and late 1950's to lows of 5 to 10 per cent of the bag in early 1960's. It was also hoped that the early part of the split season would give the hunter a chance at locally raised woodducks. The second part of the season was set to enable Iowa hunters to have a chance at the normal fall migration of mallards.

METHODS

The data that are used in this report were taken from Conservation Officer contact books and from contact cards used by Unit Game Managers.

In recording the data, the state was divided into the five different types of hunting regions found in the state (Figure 1). Region 1 is the Mississippi River and its flood plain. Region 2 is the Missouri River and its tributaries. Region 3 is the southern Iowa farm ponds and artificial impoundments. Region 4 is the northeastern Iowa rivers and artificial impoundments, and region 5 is the natural marsh and prairie pothole area of north central Iowa.

RESULTS AND DISCUSSION

Hunting was good during the first segment of the waterfowl season as the 2.1 hours

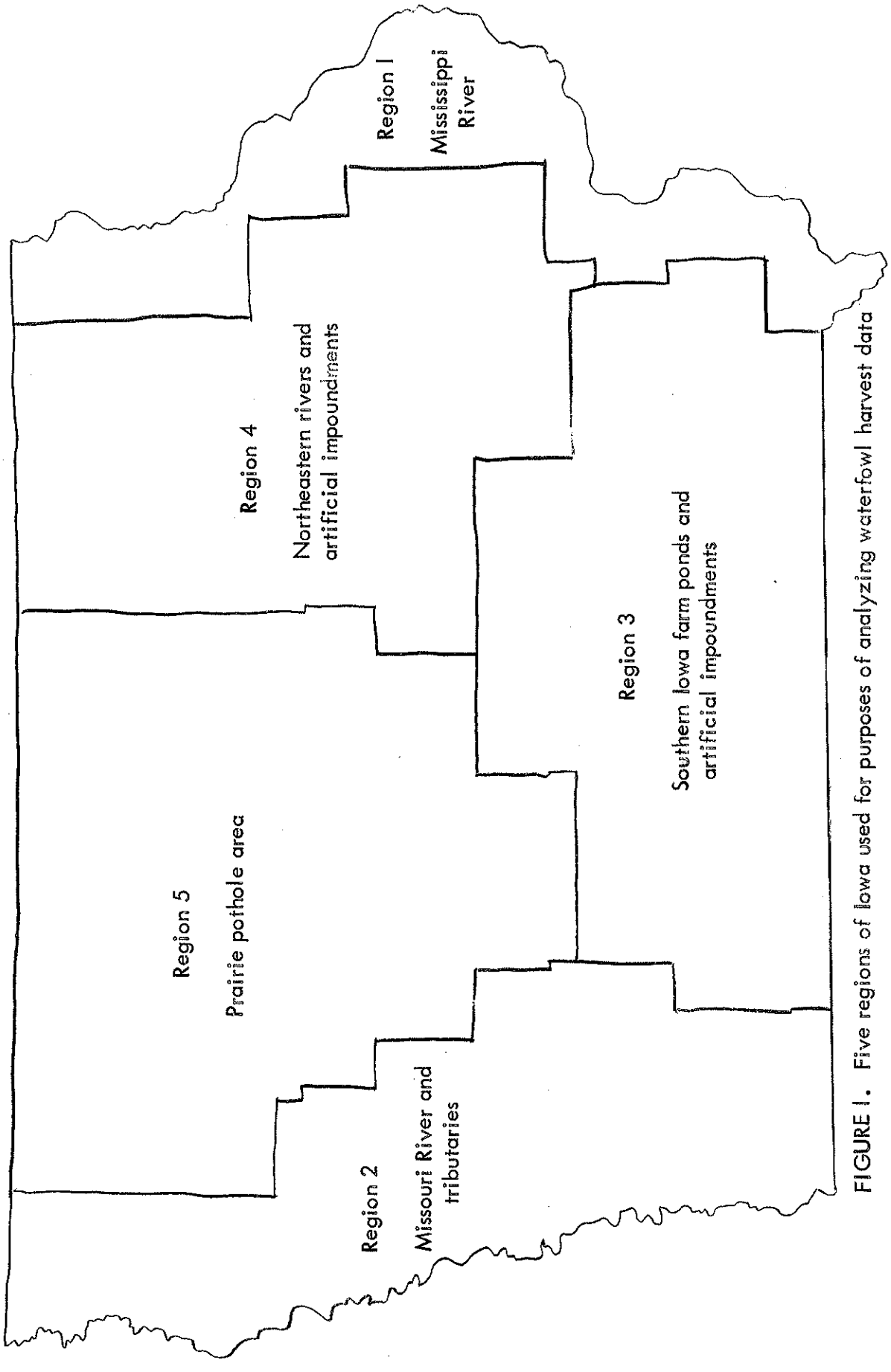


FIGURE 1. Five regions of Iowa used for purposes of analyzing waterfowl harvest data

to kill a bird indicates. In the five regions of the state during this period there were 4,968 hunters contacted that had hunted 16,045 hours to kill 7,722 ducks and geese (Table 1). During the second segment of the season, hunting was below average as the 4.5 hours it required to kill a bird (Table 2) was higher than in any previous season on record. In the second segment of the season 1,865 hunters reported hunting 6,310 hours to kill 1,395 ducks and geese.

The blue-winged teal made up 35 per cent, woodduck 20 per cent, and mallard 14 per cent (Table 3) of the harvest in the first segment of the season. Mallard rose to 32 per cent, blue-winged teal dropped to 18 per cent, and woodduck dropped to 11 per cent (Table 4) during the last segment of the season.

The weather no doubt had a lot to do with the high percentage of blue-winged teal in the bag during both segments of the season. The entire waterfowl season was characterized by having 70 to 90 degree temperatures with clear blue skies and southerly breezes. The warm weather no doubt had a detrimental effect on the quality of hunting the last segment of the season, as the normal fall flight of mallards usually starting through Iowa the last two weeks of October was delayed this year to the last two weeks of November.

TABLE 1. Hours per bird and birds per hunter first part of 1963 waterfowl season, October 5-13

Region of State	Total Hunters	Hrs. Hunted	Birds Killed	Hrs./Bird	Birds/Hunter
Region 1	1,232	3,951	2,217	1.7	1.8
Region 2	405	1,918	530	3.6	1.3
Region 3	407	1,682	495	3.4	1.2
Region 4	810	2,606	885	2.9	1.1
Region 5	2,114	5,888	3,574	1.6	1.7
Statewide	4,968	16,045	7,722	2.1	1.5

TABLE 2. Hours per bird and birds per hunter second part of 1963 waterfowl season, October 26-November 17

Region of State	Total Hunters	Hrs. Hunted	Birds Killed	Hrs./Bird	Birds/Hunter
Region 1	703	3,104	639	4.9	.90
Region 2	59	124	56	2.1	.94
Region 3	268	1,237	212	5.8	.79
Region 4	311	823	246	3.3	.79
Region 5	524	1,022	242	4.2	.46
Statewide	1,865	6,310	1,395	4.5	.66

TABLE 3. Per cent of harvest each species during first part of season - (7,722 birds in sample)

Species	Region 1	Region 2	Region 3	Region 4	Region 5	Statewide
Geese						
Canada	1%	6%	10%	2%	3%	3%
Blue and Snow	2	18	9	1	2	4
Ducks						
Mallard	16	10	6	15	18	14
Pintail	2	9	9	4	8	6
B.W.T.	28	35	22	35	40	35
G.W.T.	8	9	14	7	10	9
Woodduck	35	5	16	31	8	20
Gadwall	1	1	1	1	1	1
Baldpate	2	1	4	1	4	3
Shoveller	1	0	1	2	3	2
*Other	4	6	8	1	3	3

* Divers and coot are included in "other"; coot made up 72 per cent of these.

TABLE 4. Per cent of harvest of each species during second part of season - (1,395 birds in sample).

Species	Region 1	Region 2	Region 3	Region 4	Region 5	Statewide
Geese						
Canada	2%	3%	7%	3%	5%	3%
Blue and Snow	10	30	5	7	10	9
Ducks						
Mallard	42	19	31	23	18	32
Pintail	4	2	1	5	3	4
B.W.T.	15	12	2	26	34	18
G.W.T.	6	5	11	6	15	8
Woodduck	11	2	1	25	7	11
Gadwall	1	0	5	0	1	1
Baldpate	4	2	6	1	4	4
Shoveller	1	0	2	0	1	1
*Other	4	25	29	4	4	9

* Divers and coot are included in "other"; coot made up 58 per cent of these.

The average party size during the first part of the season was 3.5 men, and each party hunted an average of 5 hours. During the last part of the season, the average party size was 3 men and the party hunted an average of 10 hours.

The split waterfowl season in Iowa this year accomplished what was intended during the first segment of the season, the 5th through the 13th of October. The kill of blue-winged teal was back up to, or above, the 25 to 30 per cent of the harvest reported in the middle and late 1950's. The hunters also had a good chance at locally raised woodducks as the 20 per cent of the harvest indicates.

The hunter had good shooting during the first segment of the season as the 2.08 hours required to kill a duck or goose is below the 3.1 hours it required during the years 1955 through 1958.

The last part of the season from the 26th of October through the 17th of November was below average hunting. The 4.5 hours required to kill a duck or goose was longer than any other season on record.

The weather which was very warm and dry throughout the last part of the season no doubt was a major factor for the poorer quality hunting that was experienced during the last segment. The mallard flight that usually comes through Iowa starting the last two weeks in October did not come until the last two weeks of November this fall. The weather was also probably the reason the blue-winged teal and woodduck kill remained as high as it did.

RESULTS OF PHEASANT HUNTER CONTACTS - 1960-1963

Richard C. Nomsen
Game Biologist

Conservation Officers contact thousands of hunters during their regular patrol and enforcement work. Beginning in 1960, records of field contacts have been kept in special booklets which are processed to obtain information concerning hunter success. This report presents a summary of the information collected from pheasant hunters during the past four seasons.

From 6,500 to 9,000 hunters were interviewed each season and records made of total hunting hours and birds bagged (Table 1). The total number of hunters checked increased in 1962 and 1963 when the Officers recorded the results of parties instead of individuals.

The season length was increased considerably during the 4-year period and hunting was permitted one hour longer each day in 1963. These factors would tend to increase the time per bird as more contacts would be made during late season when hunting becomes more difficult. Pheasant hunting was permitted for 24 days in 1960; 35 days in 1961 and 1962 and a total of 54 days in 1963.

Hunting conditions during each season must be considered when comparing the average hunting success figures. Large fields of unpicked corn in 1960 favored the ringnecks and lowered the harvest. Cover conditions improved in 1961 over most of the pheasant range. However, southern Iowa experienced 'tough' hunting with very few crops harvested in that area. Weather and crop conditions were very favorable in 1962 and 1963. Nearly all crops were harvested by opening weekend and fall plowing continued rapidly which further limited field cover. Weather conditions remained mild during the 1962 season, but several periods of cold temperatures with some snow were reported in 1963. Birds remained well scattered for the most part during the milder weather. As a result, hunters had to work harder for their birds after opening weekend.

The number of birds checked per 100 hunters has changed very little during the past three seasons - being slightly lower in 1960 because of the heavy cover (Table 3). These figures are much below the record in 1958 when 118 ringnecks were recorded per 100 hunters.

Pheasant hunting success has varied considerably among the agricultural districts during this period (Table 2). Hunters in the western third of the state have experienced the best shooting the past three years - much better in 1963 than other areas of the pheasant range. Hunting success was below normal in north central Iowa during 1962 and 1963 but was excellent in 1960 and 1961. Hunting in central and eastern Iowa was below par except in 1962 when hunters had better than average success.

TABLE 1. Pheasant hunting data collected by Conservation Officers in different parts of the state during 1960-63 seasons

Agricultural District	Hunters	Hours Hunted	Birds Bagged	Hours per Bird
1960				
NW	1,250	3,974	932	4.3
NC	1,356	3,857	1,259	3.1
NE	720	2,261	500	4.5
WC	907	2,681	624	4.3
C	957	2,513	510	4.9
EC & SE	434	1,274	257	5.0
SW & SC	951	2,750	725	3.8
Statewide	6,575	19,310	4,807	4.0
1961				
NW	1,390	4,412	1,347	3.3
NC	979	2,813	946	3,0
NE	392	1,508	274	5.5
WC	1,062	2,955	853	3.5
C	1,034	3,414	718	4.7
EC & SE	476	1,387	338	4.1
SW & SC	1,166	3,929	827	4.7
Statewide	6,499	20,418	5,303	3.8
1962				
NW	1,981	5,739	1,555	3.7
NC	1,005	3,560	870	4.1
NE	743	2,233	636	3.5
WC	1,299	4,178	1,114	3.7
C	1,511	4,564	910	5.0
EC & SE	626	1,714	509	3.4
SW & SC	1,065	3,208	781	4.1
Statewide	8,230	25,196	6,375	3.9
1963				
NW	1,458	4,592	1,299	3.5
NC	1,303	4,687	1,076	4.4
NE	1,049	3,801	847	4.5
WC	1,382	4,459	1,142	3.9
C	1,818	5,968	960	6.2
EC & SE	857	2,723	596	4.6
SW & SC	1,313	5,032	1,352	3.7
Statewide	9,180	31,262	7,272	4,3

TABLE 2. Average pheasant hunting success by agricultural districts - 1960-63

District	Hours per Bird Bagged			
	1960	1961	1962	1963
NW	4.3	3.3	3.7	3.5
NC	3.1	3.0	4.1	4.4
NE	4.5	5.5	3.5	4.5
WC	4.3	3.5	3.7	3.9
C	4.9	4.7	5.0	6.2
EC*	5.0	4.1	3.4	4.6
S	3.8	4.7	4.1	3.7
State Average	4.0	3.8	3.9	4.3

* Includes several counties in southeast Iowa

TABLE 3. Birds checked per 100 hunters, 1960-1963

Year	Birds per 100 Hunters
1960	73
1961	81
1962	77
1963	79

AGE OF QUAIL TAKEN BY IOWA HUNTERS, 1963

M. E. Stempel
Game Biologist

The Iowa quail wing study began in 1946. It is based on data from wings of quail shot by hunters. Hatching dates were determined through this work; further, it was a means of learning how various weather patterns affected hatching. From it we learned which age groups were most often taken, and eventually we will learn whether long hunting seasons take excessive number of quail that would otherwise live until another production period. These data can be compared to summer whistling quail counts since both studies indicate progress of hatching. This report is based on results of the 1963 wing survey with supplemental data from roadside and field surveys. Comparisons are made with similar data for 1962.

METHODS

Before the 1963 quail season began, 84 cooperators were contacted. The first of these were the Officers and other department personnel in the quail range, where 69 counties were open for hunting quail. These men received letters of instruction with envelopes for mailing wings to the biologist. On these envelopes were spaces for recording date, place of kill and sex of birds. It was requested that any large collection of wings be mailed as soon as they were picked up. Smaller numbers of wings were to be mailed at the end of the season. I selected the second group of cooperators from among the many hunters in Appanoose, Davis, Jefferson, Monroe and Wapello Counties. The men agreed to save wings from quail shot during the season. Wings were collected several times during the fall.

Methods used to determine age of the wings are outlined in the Quarterly Biology Reports for July 1959. Briefly, in the young the growth and replacement of primaries continues until the bird is 150 days old. Age is indicated by the growth stage of primaries. Thus, only those under 150 days old can be aged. The additional information needed on earlier production (birds over 150 days old when shot) comes from data gathered during the summer when Officers and Biologists record the age of quail seen on roadsides and in fields.

The moult stage of adults is also recorded. This is similar to development in young. Adult moult begins after the brooding period. Thus the growth stage of primaries will indicate the moult period, which is also the post-brooding period. In simpler terms, an early moult reflects an early hatch.

RESULTS

A total of 1,553 wings was collected during and after the 1963 quail shooting season. These were from 29 of the 69 counties where quail hunting is legal. Eighty-nine per cent were young. There were 100 cocks per 87 hens. Other data are given in Table 1.

It is assumed that the collections were in proportion to the amount of hunting and in this respect, by November 17, 65 per cent of wings were gathered; November 18 to 30, 18 per cent were collected; and in late December and on January 1, 1964, 10 per cent.

While as stated above, hunters apparently took the most birds from the more numerous young segment, the true proportion in the field may not be represented. As shown in Table 1, the proportions vary (items 4, 5, 6). The ratios may be partially influenced by some or all of the following: (1) dry vegetation may lead to noisy walking by hunters and more wary birds are not flushed in gunshot; (2) some hunters may not get into the field at the time older, stronger quail are easiest to find; (3) some quail seem to prefer heavy cover, which is shunned by many gunners who prefer the easier "open" shooting of hedgerows and ditches in grain fields. Thus, some quail are never shot, while others may be flushed and gunned many times.

Quail Hatched in 1963

Fifty per cent of the wings received were from quail under 150 days old, and the age of these was indicated by growth stage of primaries. For this segment the hatch began about the middle of June. Forty per cent of the wings were from quail over 150 days old. In this class was 36 per cent of the young which were shot up to mid-November; and these birds would have hatched during mid-June or earlier.

Adults

About 10 per cent of the 1963 take was adult quail (over one year old). They moult all 10 wing primaries while the young usually shed only the inner 8 flight feathers. Fifty-three per cent of adults had moulted and regrown the primaries, or flight feathers. In the sample collected from December 1 to 15, 88 per cent of the adults wore mature flight feathers.

Supplementary Data from Summer Broods

No hatch date can be assigned to quail over 150 days old because feather growth is completed, and all primaries are full length. However, we have information on the age of 44 broods seen during the summer. These were reported to me by postcard by cooperating Officers, farmers, and biology personnel. These began to hatch about mid-May. Peak production was in June.

Summarizing the above information, the larger share of birds under 150 days old were mature in size when shot. The 150-day olds represent a good early hatch. Adults still in moult when shot indicate a good late hatch. Data from observation of summer broods indicated good early production, and the beginning of sustained high summer production. Altogether, after an early start, a high rate of hatch was soon reached and good success was maintained, with a resulting high fall population.

DISCUSSION

In 1963, good production was indicated by data from 1,553 wings, 1,404 of which

were accompanied by information on the kill. Twenty-nine counties were represented. Fifty per cent were young that could be aged and their hatch dates established. Forty per cent were young with fully matured flight feathers. Fifty-three per cent of adults bore matured plumage. Additional information was gleaned from observations of 44 summer broods.

In 1962 there were 1,067 wings with detailed information on 567. These were from 24 counties. Forty-two per cent of the young had fully grown flight feathers while 46 per cent were under 150 days old. Seventy-three per cent of adults bore fully developed flight feathers. Thirty-two broods were reported during the summer. It is evident that hatching was more extensive in 1963.

Each year more than one-half of the quail were shot early in November; and the bulk of adults and young were in good flight condition.

TABLE 1. A tabular compilation of data on Iowa quail wings collected in 1963 and 1962

	1963	1962
1. No. of wings	1,553	1,067
2. No. of wings accompanied by information	1,404	567
3. No. of counties represented	29	24
4. Per cent young in counties bordering Missouri	91	90
5. Per cent young in second tier of counties*	89	82
6. Per cent young in third tier of counties*	86	94
7. Per cent young in secondary range	89	93
8. Per cent young that were mature or nearly so	90	90

* Tiers of counties are counted north from the Missouri-Iowa line.

SKUNKS AND THE RABIES PROBLEM

Paul D. Kline*
Game Biologist

INTRODUCTION

Iowa is inhabited by two species of skunks, the well-known striped (Mephitis mephitis) and the spotted (Spilogale interrupta), commonly called civet cat. Both occur throughout the state. Once a valuable fur resource, low fur values during recent years and increasing reports of rabies in skunks have weakened the economic status of these species.

From 1934-35 through the 1941-42 fur seasons an average of 94,886 striped skunks and 46,624 spotted skunks were marketed for fur annually in Iowa (Mimeo. Reports, Iowa Conserv. Comm.). The numbers of skunk furs sold dropped sharply during the 1940's (Table 1). In recent years the number of each species sold in Iowa generally has been fewer than 2,000 per season. This decline in annual harvest of skunks doubtlessly results from low values of long-haired furs.

Coincident with the declining harvest for fur an increase in confirmed laboratory cases of rabid skunks occurred in the late 1940's (Annual Rabies Reports, Iowa Dept. Public Health). Through the period 1905-1948, inclusive, rabies in both species of skunks comprised only 6.25 per cent of all confirmed rabies cases in Iowa. Starting in 1954, rabid skunks have comprised near half or more of all confirmed cases in Iowa (Table 2). This startling rise in rabies incidence in skunks during recent years and the knowledge that they probably transmit the disease to domestic animals does give rise to questions regarding their economic value.

Probably the principal economic assets of skunks are their food habits. Both species feed heavily on insects in summer and fall. Most of these insects are generally considered harmful species; grasshoppers, crickets, cutworms, and white grubs are commonly taken. During winter and spring mice and rats are important in the diet. Of course, skunks use some insects, mammals, birds, etc. that are generally considered valuable to man. But everything considered, their food habits are very beneficial. Probably the most important ecological niche they fill is related to their food habits and the resultant aid which they render in control of insects and small mammals. Selko has reported on one study of skunk food habits (Selko, Lyle F. 1937. Food habits of Iowa skunks in the fall of 1936. Jl. Wildl. Mgmt. 1(3-4): 70-76). Part of his Table I is reproduced in this report (Table 3).

LIFE HISTORY ASPECTS

HABITAT Skunks use a variety of habitats but prefer brushy woodland borders or fence corners, fence rows, and open grassy fields broken by ravines or potholes. Spotted skunks, perhaps more so than the striped species, commonly live around farm yards where they may

* Game Biologist, Iowa State Conservation Commission

use nooks in buildings and hay or straw piles as denning sites. Because of their habits and habitat skunks are almost invariably tied to the farm scene in Iowa.

DENNING Skunks are not true hibernators. The striped species commonly dens up, often in communal dens with as many as a dozen individuals using the same den at once. There seems to be some evidence that not more than one male will use a den at any given time. In other words when multiple denning occurs it may consist of a number of females and not more than one male. This relationship, however, needs confirmation.

Striped skunks may spend several days or even weeks without leaving winter dens in Iowa. They do not lower their temperature, however, as do true hibernators. If they are disturbed by an intruder they are quite active. They may forage during warm winter nights. When temperatures drop to reach 20 degrees F. back to the dens they go. Spotted skunks are active almost every night, no matter how severe the weather. Although they may share dens as they travel about through the year, seldom can more than one spotted skunk be found in a den at one time (Crabb, W. D. 1948. The ecology and management of the prairie spotted skunk in Iowa. Ecol. Monographs. 18: 201-232).

REPRODUCTION The breeding season of striped skunks in Iowa begins early in March most years. At that time, and continuing for about a month when females not bred during the early part of the period again come into heat (some for the first time), the males are very active and travel widely in their search for mates.

Gestation in the striped skunk usually lasts 9 weeks. Most of the young are born in May. They are very dependent on the mother until weaning time about 2 months later. Striped skunks usually produce only one litter per year. Spotted skunks may produce two, but this needs confirmation. Litter sizes average near 4-6 and 4-5 young for the striped and spotted species, respectively. The age ratio of striped skunks in the fall is about 2.3 juveniles per adult (Verts, B. J. Personal letter to the writer under date Nov. 11, 1963).

ABUNDANCE Skunks, like most nocturnal mammals, are more abundant than most persons realize. During peak harvest years of 1936-1941, inclusive, the annual harvest averaged 1.96 striped and 0.83 spotted skunks per square mile in all of Iowa. No doubt actual populations were well above that. Scott and Selko reported finding populations of striped skunks averaging 4.04 and 1.64 per square mile respectively in areas of Boone and Clay Counties during 1938 (Scott, Thomas G. and Lyle F. Selko. A census of red foxes and striped skunks in Clay and Boone Counties, Iowa. JJ. Wildl. Mgmt. 3(2): 92-98). Much higher populations probably occur. Counts of highway kills by Rural Mail Carriers and Iowa Highway Patrolmen in 1962 indicated populations of skunks in south central and southwest Iowa may be lower than over the remainder of the state. Other factors, such as volume of traffic, may have influenced this survey.

THE RABIES PROBLEM

The skunk-rabies problem in Iowa lacks adequate factual information. The information available does indicate but does not confirm the following. Since the decline of fur prices during the 1940's Iowans have harvested relatively few skunks. Fur trapping is no longer a population control. Consequently, skunk population controls may depend more on diseases - one of which is rabies. Whether or not rabies has become a prominent factor in skunk

ecology and livelihood as an indirect result of inadequate harvest is speculative. But it is quite possible this may have occurred.

If skunks spread the disease only among their own kind, there would be no problem. Unfortunately they probably are responsible for many instances of rabies in domestic animals. A rabid skunk is not reluctant to attack humans, the possibility of which creates a certain amount of fear among farmers, outdoorsmen, etc..

Since the peak in laboratory confirmed cases of rabid skunks occurs in late winter and early spring, it is reasonable to assume that the disease is spread among denning skunks. During the mating season and spring dispersal from winter dens rabid skunks bite domestic animals. Then following a reasonable incubation period the disease appears in livestock, particularly cattle. This pattern seems consistent year after year.

CONTROL

At first glance it might be easy to assume that control of rabies in skunks would easily be achieved by reducing the population (or eliminating them entirely) so as to reduce spread of the disease within the species. With skunks scattered over all of 55,000 plus square miles of Iowa and a potential of more than tripling their population (through reproduction) annually this becomes a practical impossibility. Probably 50,000 to 100,000 striped skunks alone would need be eliminated annually just to wipe out the annual surplus.

Probably the only control possible in Iowa would be that exercised on a local basis. In locales where serious rabies outbreaks develop, skunks could be trapped or gassed in their dens, using carbon monoxide gas from tractor or automobile exhaust. Farmers will have to take the attitude that whenever the situation on their property warrants it is their responsibility to reduce populations of skunks known to be rabies vectors.

Since rats and mice near buildings tend to attract skunks, another preventive control around farm buildings would be reduction of numbers of these rodents. Buildings could be rat-proofed, old junk piles eliminated, piles of waste straw, hay bales, etc. could be burned or hauled away. The result would be farm building sites less attractive to skunks, partially because populations of rodents were lowered, but also because most places attractive to prospective denning skunks would have been eliminated.

Skunks habitually are nocturnal. It is unusual to see them abroad during daylight hours except very early morning or evening twilight. Since rabies is known to stimulate unusual activity in infected animals, it follows that rabid skunks may be abnormally active during daylight.

Consequently, one effective preventive control would be destruction of skunks found active during daylight under the assumption that the daytime activity denoted unusual behavior possibly due to rabies. Of course discretion would need be exercised if such a policy were carried on by rural residents over all of Iowa. Consideration of twilight hours or accidental daytime disturbance of sleeping skunks should be resolved in favor of the skunks. On the other hand, skunks seen in pursuit of domestic animals should be destroyed no matter what the time of day.

Iowa law does permit elimination of protected animals whenever they are known to be

damaging property. Therefore, skunks could be controlled as above even though trapping seasons were closed.

IOWA SKUNK HARVEST

TABLE 1. Annual harvest of skunks in Iowa based on reports of fur-buyers

Seasons (Inclusive)	Average Number of Striped Skunks per Season	Average Number of Spotted Skunks per Season
1934-35 to 1935-36	72,066	41,221
1936-37 to 1940-41	109,224	45,921
1941-42 to 1945-46	44,194	49,150
1946-47 to 1950-51	12,896	14,055
1951-52 to 1955-56	2,951	1,702
1956-57 to 1960-61	2,346	1,604
1961-62 to 1962-63	1,562	1,050

REPORTED RABID SKUNKS

TABLE 2. Total annual laboratory confirmed cases of rabies in skunks in Iowa

Years	Cases in Skunks (Two species)	Total Cases Reported in all Species	Per cent of total in Skunks
1905-1948 incl.	118	1,887	6.25
1949	52	252	20.63
1950	80	373	21.44
1951	98	404	24.25
1952	99	228	43.42
1953	72	184	39.13
1954	157	305	51.47
1955	98	200	49.00
1956	105	205	51.21
1957	128	247	51.82
1958	127	230	55.21
1959	101	200	50.50
1960	103	189	54.49
1961	221	349	63.32
1962	175	352	49.71

TABLE 3. Volumetric food of skunks in fall of 1936, reproduced in part from Selko, 1937, Table 1.

Food Material	Percentage of Total Contents	
	Mephitis	Spilogale
Arthropod	64.06	30.78
Mammal	7.36	30.66
Bird	6.37	25.14
Vegetable	4.31	1.59
Inert	17.88	11.83

CORALVILLE RESERVOIR AND LAKE MACBRIDE FISHERIES INVESTIGATIONS - 1963

PART I: CREEL CENSUS

Jim Mayhew
Fisheries Biologist

A creel census was conducted at Coralville Reservoir and Lake MacBride during the summer of 1963. Although these impoundments were constructed several years before, this was the first attempt to evaluate angler exploitation of the sport fishery. The project was a cooperative effort between the Fisheries and Biology Sections of the Iowa Conservation Commission. The former provided the equipment and personnel; the later supervised the census and analyzed the data.

DESCRIPTION OF THE STUDY AREAS

The Coralville Reservoir-Lake MacBride complex is located on the Iowa River several miles upstream from Iowa City, in Johnson County. It is approximately 83 miles upstream from the confluence of the Iowa and Mississippi River. The project is an integral unit in the general comprehensive plan for flood control in the Upper Mississippi Basin.

Congress authorized construction of Coralville Reservoir in 1938. The Rock Island District, U. S. Corps of Army Engineers constructed and operate the reservoir. Construction began in 1949, and the project was operational in 1958.

From July 1 to February 1 the water level is stabilized at elevation 680, except when flood waters are temporarily stored. At this level the conservation pool has a surface area of 4,900 acres. During floods the pool may increase to spillway elevation 712 and impound 24,800 surface acres of water.

From February 1 to June 1, in anticipation of spring floods, the pool is gradually lowered to elevation 670. Maximum surface area at this level is 1,820 acres.

Discharge rate from the dam is regulated by the volume of water stored in the reservoir. Maximum discharge when the reservoir is at flood capacity is 10,000 c.f.s.. In dry seasons, outflow is regulated to 150 c.f.s.. This insures adequate downstream flow for fish, wildlife and pollution abatement.

Lake MacBride is in effect a sub-impoundment of Coralville Reservoir. The lake was initially constructed for recreation in 1936 by the State Conservation Commission. Originally the lake impounded 138 surface acres of water. In 1956 the dam was rebuilt and enlarged to prevent flooding from Coralville Reservoir. At spillway elevation the lake now has a surface area of 935 acres. Spillway elevation is identical with that of Coralville Reservoir.

SAMPLING DESIGN OF THE CREEL CENSUS

The sampling design of the census was a modification of the method used by Mayhew (1956) in other Iowa artificial lakes. The only change was to extend the census periods from 2 to 6 hours each. This was because more time was required for the clerk to adequately cover Coralville Reservoir. The original method censused 3 lakes per day with a shorter angler sampling period.

Complete censuses were made at both impoundments on alternate time periods (8 A.M. to 2 P.M. -- 2 P.M. to 8 P.M.) every third day beginning June 15. Additional census periods were added on consecutive days preceeding or following the July 4 and September 2 holidays. The census clerk interviewed all fishermen possible in the alloted time. When he found it impossible to contact all fishermen on the reservoir within 6 hours he was instructed to leave at the end of the time period. Three times during the census the time alloted was insufficient to contact all anglers on Coralville Reservoir. The census was terminated on September 2.

Anglers at Coralville Reservoir were divided into 3 catagories: boat anglers, shore anglers, and tailwater anglers. Lake MacBride fishermen were divided into the first two groups only. Information was obtained from each fishing party on the number of people in the party, hours fished, number and species of fish caught and kept, species fishing for, and distance traveled to the lake.

RESULTS

Coralville Reservoir

During the 28 census days the clerk interviewed 2,570 fishermen (Table I). The number of anglers contacted in each of the 3 catagories was as follows: 1,206 tailwater anglers, 782 boat anglers, 582 shore anglers. These fishermen caught 1,880 fish after fishing 4,322 hours, or at a rate of 0.43 fish per hour. Shore and tailwater anglers had the best success, 0.58 and 0.55 fish per hour respectively. Boat anglers caught 0.27 fish per hour.

Crappie, channel catfish, carp, and bullhead comprised the bulk of the sport fishery. Crappie were caught in greatest numbers by both tailwater and shore anglers. Channel catfish were most prevalent in the catch of boat anglers. Carp, an undesirable fish in most waters, were caught in vast numbers by tailwater fishermen. Largemouth bass, smallmouth bass, bluegill, and bigmouth buffalo were also recorded.

TABLE 1. Catch rate and species composition of the sport fishery in Coralville Reservoir

Type Contact	Total Men	Total Hours	Total Fish	Fish/ Hour	L. M. Bass	S. M. Bass	Bluegill	Crappie	Bullhead	Catfish	Carp	Buffalo
Boat	782	1,501	394	0.27	2	-	16	88	94	144	50	-
Shore	582	833	486	0.58	4	2	10	160	130	150	28	2
Tailwater	1,206	1,488	1,000	0.55	-	-	12	396	88	228	266	10
Combined	2,570	4,322	1,880	0.43*	6	2	38	644	312	522	344	12

* mean catch rate

Most angling parties interviewed indicated they had no preference as to what species of fish they caught. Consequently over 60 per cent were not fishing for a specific kind of fish (Table 2). Of those that indicated a preference, channel catfish fishermen were most prevalent in all angling catagories.

TABLE 2. Species preference of fishermen at Coralville Reservoir

	Number of anglers contacted fishing for each species			
Species	Boat anglers	Shore anglers	Tailwater anglers	Combined
No preference	206	152	338	696
L.M. Bass	-	6	4	10
Bluegill	-	4	-	4
Bullhead	14	24	18	56
Crappie	10	16	42	68
Walleye	2	2	-	4
Carp	6	2	14	22
Channel Catfish	60	60	72	192

The impact of a vast recreational complex such as Coralville Reservoir-Lake MacBride could drastically alter the "hometown" tendency of the Iowa artificial lake fisherman. Thus, the distance fishermen travel to fish in these lakes is relatively important to recreational planning of the area. Over 470,000 people reside within a 50 mile radius. During the study 826 fishing parties were interviewed concerning the distance they traveled to the reservoir. Most of these anglers traveled less than 25 miles with the mean 23.5 miles (Table 3). Tailwater anglers drove the farthest, 24.9 miles, compared to 23.3 miles for boat anglers, and 22.2 miles for shore anglers.

TABLE 3. Distance traveled by anglers to fish in Coralville Reservoir

Miles Driven	Number of fishing parties interviewed			
	Boat anglers	Shore anglers	Tailwater anglers	Combined
0-10	70	92	72	234
11-25	162	142	122	426
26-50	16	14	56	86
51-100	30	14	18	62
Over 101	2	6	10	18

Lake MacBride

During the census 3,070 fishermen were interviewed at Lake MacBride (Table 4). The number of boat and shore anglers were about equally divided. These fishermen harvested 3,956 fish in 4,090 hours. Shore anglers had the best success, averaging 1.06 fish per hour. Boat anglers caught a mean of 0.9 fish per hour. Bullhead, bluegill, and crappie comprised about 90 per cent of the fishery. Largemouth bass, walleye, northern pike, and channel catfish were also recorded in the catch.

TABLE 4. Catch rate and species composition of the sport fishery in Lake MacBride

Type Contact	Total Men	Total Hours	Total Fish	Fish/ Hour							
Boat	1,502	2,328	2,090	0.9	18	698	608	730	6	4	6
Shore	1,568	1,762	1,866	1.06	6	304	246	1,256	4	-	-
Combined	3,070	4,090	3,956	0.98*	24	1,002	854	1,986	10	4	4

* mean fish per hour

Lake MacBride anglers drove considerably shorter distances to fish than those at Coralville Reservoir. Average distance traveled by the 1,198 parties interviewed was slightly more than 12 miles (Table 5). There was no significant difference between the distance traveled by boat and shore anglers. It is difficult to determine why Coralville Reservoir anglers drove almost twice as far as those at Lake MacBride when the areas are adjacent. Part of this might be due to contacting a high per cent of local summer home owners at Lake MacBride. Also, Coralville Reservoir is relatively new; whereas, Lake MacBride is long established recreational area, and the "newness" of a large flood control reservoir might attract fishermen from greater distances.

TABLE 5. Distance traveled by anglers to fish in Lake MacBride

Miles Traveled	Number of fishing parties interviewed		
	Boat anglers	Shore anglers	Combined
0-10	188	96	284
11-25	318	330	648
26-50	32	52	84
51-100	92	52	144
Over 101	18	20	38

SUMMARY

1. A creel census was conducted on Coralville Reservoir and Lake MacBride from June 15 to September 2. During 28 census days 2,570 anglers were interviewed at Coralville Reservoir and 3,070 at Lake MacBride. These anglers caught 1,880 fish in 4,322 hours, and 3,956 fish in 4,090 hours respectively. Lake MacBride anglers caught 0.98 fish per hour compared to 0.43 fish per hour at Coralville Reservoir.

2. Crappie, channel catfish, carp, and bullhead comprised the bulk of the anglers harvest in the reservoir. Lake MacBride anglers caught more bullhead, crappie, and bluegill than any other species of fish.

3. Most of the anglers in both impoundments indicated no preference in the species of fish caught.

4. The average angler traveled 23.5 miles to fish in Coralville Reservoir and 12 miles to Lake MacBride.

LITERATURE CITED

Mayhew, Jim

1956. Sampling design for Iowa artificial lakes creel census. Quarterly Biology Report. Vol. VIII. No. 1. 13-17. (mimeographed)

RESULTS OF A VOLUNTARY CREEL CENSUS ON NORTHEAST IOWA RIVERS IN 1963

Roger Schoumacher
Fisheries Biologist

A voluntary creel census was continued in 1963 on major northeast Iowa rivers. Conservation Officers in the various counties were asked to furnish a list of 6-10 "better-than-average" fishermen whom they had contacted and who had agreed to keep a record of their angling activities on postcard report forms. A detailed discussion of the techniques was given in the January, 1963, Quarterly Biology Reports, as well as results for the 1950-1956 and 1962 seasons.

One hundred forty-three names were furnished by Officers and an additional 88 fishermen who had cooperated in the 1962 census were again contacted. Of these 231 names, 73 (32%) returned at least one census card.

The 73 fishermen reported 1,275 fishing trips and 3,940 hours of fishing, an average of 3.1 hours per trip and 15.2 trips per year. Eighty-seven per cent of the fishing effort was directed at four of the major rivers in the area - the Wapsipinicon, Iowa, Cedar, and Shellrock. Information on the other streams was too limited to justify tabulation and interpretation.

Seventy-six per cent of the fishing trips in 1963 were successful - at least one fish was caught. This is about average as compared to former years. As in the past, two methods were used to interpret the data. Tables 1 and 2 give the basic data as to number of trips, hours fished, fish per hour catch, and catch by species. Table 3 gives the fish per hour catch for certain kinds of fish for which the angler was specifically fishing.

Wapsipinicon River

On 301 trips and 986 hours of fishing, anglers reported a catch of 1,200 fish at a rate of 1.22 fish per hour (Table 1). This is better than average compared to former years. Crappies made up 50 per cent of the catch and catfish 33 per cent (Table 2). Crappies were caught at the rate of 2.61 per hour by crappie fishermen, and catfish at a rate of 0.71 (Table 3). Compared to former years this is good crappie fishing and average catfishing. Fishing for bass was a bit below average, whereas walleye and northern fishing was about average. Fifty-three per cent of the effort was directed at catfish and 23 per cent at crappie. Eighty-four per cent of the fishing trips were successful.

Iowa River

Three hundred fifty-seven trips and 972 hours produced 873 fish for a catch rate of 0.90 fish per hour (Table 1). This catch rate indicates better than average fishing. Seventy-two per cent of the trips were successful. Channel catfish comprised 46 per cent of the catch, carp 17 per cent, smallmouth bass 15 per cent, and bullheads 9 per cent (Table 2). Catfishing was about average, or perhaps slightly better, and bass fishing was better than average.(Table 3). Virtually all of the bass and northern pike were taken in the Alden-Iowa Falls-Steamboat Rock area which was chemically treated in 1960. This same

phenomenon was apparent in the 1962 census results.

Fifty-four per cent of the fishing effort was directed to catfish, 12 per cent to smallmouth bass, and 8 per cent to walleye.

Cedar River

Three hundred eighty-six trips, 76 per cent of which were successful, and 1,194 hours of angling on the Cedar River resulted in a catch of 1,033 fish at the rate of 0.86 fish per hour (Table 1). This is about average as compared to former years. The catch consisted primarily of channel catfish (67%) and smallmouth bass (8%) (Table 2). Fishing effort was 74 per cent catfish, 8 per cent smallmouth, and 1 per cent each largemouth bass, crappie, and carp (Table 3). Catfishing was about average, as was smallmouth fishing, but crappie fishing was below average.

Shellrock River

Sixty-seven trips, 61 per cent on which were successful, and 340 hours of fishing produced 152 fish at the rate of 0.45 per hour (Table 1). Catfish received virtually all of the pressure and comprised 73 per cent of the catch (Table 2). Both catfishing and overall fishing was the poorest of any year for which statistics have been gathered.

SUMMARY

1. A voluntary creel census of better-than-average anglers was continued on northeast Iowa rivers.

2. Seventy-three fishermen reported 1,275 fishing trips and 3,940 hours of fishing. Seventy-six per cent of the trips were successful - at least one fish was caught.

3. Catfish (49%), crappie (20%), carp (9%), and smallmouth bass (8%) were the primary species caught, with most of the fishing effort directed towards catfish.

4. The 1963 fishing season was better than average on the Wapsie, about average on the Cedar and Iowa, and poor on the Shellrock, as compared to the 1950-1956 and 1962 seasons.

TABLE I. Creel census information for the 1963 voluntary creel census on the Wapsie, Iowa, Cedar, and Shellrock Rivers

River	No. of trips	Per cent successful trips	Hrs. fished	Fish per hour	Total no. fish caught
Wapsie	301	84	986	1.22	1,200
Iowa	357	72	972	0.90	873
Cedar	386	76	1,194	0.86	1,033
Shellrock	67	61	340	0.45	152
TOTALS	1,111	76	3,492	0.93	3,258

TABLE 2. Numbers of various species of fish caught on the Wapsie, Iowa, Cedar, and Shellrock Rivers during the voluntary creel census of 1963. Numbers in parenthesis are percentages.

River	Total	Bluegill	Crappie	L.M. Bass	S.M. Bass	Walleye	Northern	Channel Cat.	Flathead Cat.	Bullhead	Carp	Misc.
Wapsie	1200 (100)	22 (2)	602 (50)	59 (5)	35 (3)	11 (1)	30 (2)	400 (3)	1 (tr.)	6 (tr.)	30 (2)	4 (tr.)
Iowa	873 (100)		12 (1)	6 (1)	132 (15)	37 (4)	24 (3)	404 (46)	5 (1)	79 (9)	146 (17)	28 (3)
Cedar	1033 (100)	2 (tr.)	48 (5)	12 (1)	78 (8)	9 (1)		695 (67)	14 (1)	36 (3)	112 (11)	26 (3)
Shellrock	152 (100)		8 (5)	1 (1)	11 (7)			110 (73)			12 (8)	10 (6)
TOTALS	3258 (100)	24 (1)	670 (20)	78 (2)	256 (8)	57 (2)	54 (2)	1609 (49)	20 (1)	121 (4)	300 (9)	69 (2)

TABLE 3. Fish per hour catch for various species of fish for which anglers were fishing specifically. Numbers in parenthesis represent the per cent of fishermen who were fishing for each of the various species.

River	All Species	Channel Catfish	Smallmouth Bass	Largemouth Bass	Crappie	Carp	Northern Pike	Walleye	Flathead	Mixed Bag
Wapsie	1.22	0.71 (53)	0.41 (3)	0.47 (2)	2.61 (23)		0.45 (3)			0.95 (16)
Iowa	0.90	0.71 (54)	0.96 (12)	0.58 (1)		1.54 (6)	0.43 (1)	0.41 (8)	0.25 (1)	1.13 (16)
Cedar	0.86	0.70 (74)	0.61 (8)	0.75 (1)	1.00 (1)	1.42 (1)				1.35 (15)
Shellrock	0.45	0.34 (100)								

SUMMARY OF AQUATIC WEED TREATMENTS, 1962-63

Tom Moen
Fisheries Biologist

Our water areas today, instead of being a place for escape, have become a center of activity so complexly organized that the beauty of blossoming lily pads receives little attention. Cabins have been built, sanitary facilities constructed, jetties, piers, and land fills have been installed. Water courses have been diverted, water characteristics changed, and the general tranquility disrupted by motorboats. Thus, individuals interested in the intrinsic values of our lakes and streams, as well as property owners and the recreation minded public, have become increasingly aware of the problems created by certain weed and algae growths.

The growth of aquatic weed and algae often reaches such proportions as to be a nuisance and detrimental to the best recreational use of many localities. Often entire bodies of water are removed from all recreational use, especially during the summer months. Increased efforts in the control or management of the weed and algae growths are necessary if we are to utilize our aquatic natural resources to the greatest extent.

The Conservation Commission has carried on a limited aquatic weed and algae control program for a number of years. This program has been augmented considerably since 1960 by legislative appropriations for state-wide weed and algae control work administered by the Waters Section. Immediate supervision of the weed and algae treatments as it is concerned with northwest Iowa problems has been a fisheries biology function. This report presents a brief summary of routine and experimental aquatic weed and algae control activities that were carried out under the supervision of the author during the 1962 and 1963 seasons.

Blue-green Algae Control

No strictly experimental chemicals or methods were tried on this aquatic nuisance during the 1962 or 1963 season. Routine applications of copper sulfate crystals totaled 75,000 pounds in 10 lakes during the summer of 1962 and 64,000 pounds in 12 lakes during 1963. Although fair to excellent control was achieved in most of the lakes treated, Center Lake was the only lake where near complete and consistent abatement was attained. The summer of 1963 marked the fourth consecutive season in which this degree of control has been attempted and maintained on this 300 acre body of water. The amounts of copper sulfate used in treating this lake has increased considerably during the past two years with 1,750 pounds, 1,500 pounds, 2,500 pounds and 4,100 pounds used in 1960, '61, '62, and '63 respectively. The 1963 treatments totaling approximately 14 pounds per acre are considerably below the 21 pounds per acre used on East Okoboji where only a fair degree of control was achieved. Algae control on larger bodies of water is admittedly more difficult.

Control of Rooted Aquatics

Routine applications: During 1962 seven areas were treated with chemicals for aquatic

weed control. These chemical treatments involved 44 acres requiring 3,650 pounds of 2,4-D pellets, 1,400 pounds of Aquathol granules, and four gallons of Kuron. Except for one plot of 30 acres, the treated areas ranged from 0.5 to 5 surface acres. Seven areas were chemically treated again in 1963 involving 32.5 acres using 2,950 pounds of granular Aquathol, 1,650 pounds of 2,4-D pellets and 100 gallons of liquid Aquathol. None of these treatments could be listed as an unqualified success; all of them did provide some measure of control, and in 10 of the 14 areas the degree of control was such that the primary goal of providing better use of the water was realized.

Early treatments of chronic problem areas with plant regulatory chemicals appears to be the most reasonable method of controlling objectionable rooted aquatics. Selection of a chemical to treat existing problems is dependent on the species or species composition of aquatics to be treated, maturity of plants, size and location of area, and water quality factors such as turbidity and temperature. There are a number of good aquatic herbicides available but some preliminary experience in determining dosage rates and method of application is usually necessary for successful treatments.

Mechanical cutting through the use of a Hockney underwater weed cutter was quite successful in alleviating aquatic problems where lanes could be cut to allow boat passage. Weeds were removed from approximately 75 acres of water during the two seasons. Mechanical cutting is normally used under conditions that preclude the use of chemicals. The disadvantages of cutting are well known but in many situations this is the only feasible method. Mechanical cutting followed by application of a selected chemical shows promise of providing the combination of quick removal and lasting effects.

Experimental Studies: Experimental studies during 1962 and 1963 involved a series of trials using Diquat, M 2303, and Kurosal G, and a series of biological control experiments using carp. The latter group of biological control experiments were reported on by William Tate at the 1963 Midwest Wildlife Conference and will not be discussed here. For purposes of this paper, only a note of description and a brief summary of the results are presented for each chemical.

Diquat (ORTHO Division of California Chemical Co.) is a relatively new herbicide for use in preharvest applications in order to facilitate either mechanical or hand harvesting of non-food crops. It is also recommended for the control of a wide variety of weeds where a directed spray can be used. The label, approved for aquatic weed control by the Pesticide Labeling Division of the U. S. Department of Agriculture, lists the active ingredient as 1:1' - ethylene-2:2' - dipyridylium dibromide. Most calculations concerning the use of this aqueous solution are based on two pounds Diquat cation per gallon. Thus, a one ppm treatment would require 1/2 gallon of material as it comes from the container. Its qualifications and use as an aquatic herbicide appear quite favorable at this time. Diquat has a low oral mammalian toxicity and is safe for fish at several times the expected dosage levels. It is rapidly absorbed by plants and becomes inactive upon contact with the soil.

Ten individual experimental applications of Diquat were made in 1962 and nine in 1963. Two of the 19 applications were conducted with emergent vegetation. Applications were made in a variety of ways: standard power operated spraying equipment, hand sprayers, diluting about 1 to 5 and aspirating with a boat bailer, and by simply diluting and pouring the solution in the prop wash of a boat or along the edge of the area to be

treated. Diquat is highly soluable in water and an excessive treatment along shore may remove all the plants from a small pond. Surface applications, including emergents, were made at the rate of I quart to I gallon per acre. Excellent results were obtained in the control of cattails but the results were not as permanent and the cost considerably greater in comparison with other chemicals available for this type of control. Excellent control, although temporary at low dosage levels, was achieved on filamentous algae and duck weed. Applications of one (I) ppm or less for the control of several species of Potamogeton were quite successful. Successful treatments at .25 ppm were obtained in clear water and relatively light stands of sago pondweed (P. pectinatus). Diquat has proven to be one of the more effective herbicides for the control of Elodea canadensis (at about I ppm) normally an aquatic plant with a high resistance to chemicals. Chara species have proven to be the most resistant to applications of Diquat and can not be recommended for treatment of this algae. Clear water is necessary for good control of aquatics with Diquat at the lower dosage rates.

The chemical M 2303 is a specially formulated product (at the time of its use) for experimental purposes. The liquid formulation contains I.5 pounds of disodium endothal technical and 5 per cent silvex acid. These two chemicals were mixed to provide a broader spectrum of control than either chemical alone. Two trials with the granular material and one with the liquid combination were made in 1962. One of the trials with the granular material proved successful but not as permanent as had been expected. The second treatment made in an effort to control a heavy, mature, stand of Elodea and water milfoil proved ineffective. A shoreline treatment of Hydrodictyon and bushy pond weed (Najas) with the liquid material proved very successful. All applications were made at recommended dosages. Additional experiments are needed with this product in order to work out the correct dosages under varying conditions.

Kurosal G is a granular formulation of silvex. This formulation is based on an 8/15 mesh Attaclay and contains 22.8 per cent by weight of the potassium salt of 2,4,5-T (20 per cent silvex acid equivalent). Only one trial of this material was conducted. This plot was laid out on the same date and adjacent to the area used in the successful M 2303 experiment. The results of this one comparison indicated that the Kurosal G provided good control but somewhat less effective than the M 2303 on the same aquatic weed situation. Kurosal G is recommended for small plot applications in recreational areas used for fishing, swimming and around boat docks.

Fish of various species were present in all experimental areas. There were no fish losses noted. Zooplankton volumes were checked in one of the experiments (using Diquat) and no reduction in numbers were noted immediately following treatment. Four days after treatment Diaptomus and Bosmina were more abundant than prior to treatment. No bottom fauna studies were carried out.

Each of the experimental chemicals show definite promise as aquatic herbicides at the recommended dosage rates and label instructions are followed.

SPECIES COMPOSITION OF MISSOURI RIVER SURVEYS, 1963

Bill Welker
Fisheries Biologist

INTRODUCTION

Annual surveys of the Missouri River are conducted by Iowa State Conservation Commission Biologists. The main purpose of these surveys is to check the species composition of the fish population in an effort to note trends or sharp changes within the population.

The Iowa-Nebraska portion of the Missouri River has undergone considerable physical change during the past 30 years due to the navigation and flood control work conducted by the Army Corps of Engineers. This change, in turn, has affected the composition of the fish population.

Catfish, the most important game fish in the river, have been directly affected by the physical change in the area. This fish is the second most important taken by Iowa Missouri River commercial fishermen annually; however, most of these fishermen will readily tell how their annual catch of catfish had decreased during the past 20 years. Although this decline in the catfish population has been noticeable, the river still maintains a large, reproducing population of catfish. Since the navigation and flood control work on the Iowa-Nebraska portion of the river is almost completed, the present catfish population level should not fluctuate greatly in the near future.

Prior to the beginning of the river work, the Missouri River was a turbid, uncontrolled stream with many smaller meandering channels on both sides of the main channel. These smaller channels were important to the catfish population since they provided good spawning areas. As the river work progressed, these areas were separated from the main channel by wooded piling and rock levees. This work made the Iowa-Nebraska portion of the Missouri River a narrow, uniformly shaped, fast flowing stream devoid of many natural catfish cover and spawning areas.

Although the river work has probably been a major factor in the decline of the catfish population, it also has made the environment more favorable to other species of game fish by reducing the high turbidity in the water. For many years the river was known as the "Muddy Missouri". Construction of upstream reservoirs has been most responsible for this reduction in turbidity by reducing the silt load. This decrease in turbidity has corresponded to an increase in the catch of crappie, largemouth bass, sauger and white bass north of Omaha. Northern pike have also been caught in this portion of the river in recent years; whereas it was very uncommon to catch this fish in the same area 20 years ago.

The Missouri River environment below Omaha is still influenced during much of the year by the Platte River which enters the Missouri River about 10 miles south of Omaha. Products of industrial expansion in the Omaha-Council Bluffs metropolitan area must also be considered as influencing the river environment for some distance downstream. Past surveys by Iowa biologists have found no largemouth bass and few crappie in the river south of Omaha; however, these fish are more frequently found in the Iowa-Nebraska portion of the river

above Omaha.

METHODS OF SURVEY

The physical change in the river has made it possible to use new methods in sampling the fish population. Cheese-baited hoop nets are still the most effective gear used to catch catfish; however, the available locations to set the nets have been reduced in recent years due to the channelization project. Prior to the river work, there were many areas in the river with slow or moderately moving water which, if the depth was sufficient, provided good locations for hoop netting. The present river is narrower with large areas of water too swift for good hoop net locations.

During 1963, hoop nets were fished a total of 124 days between Omaha and Sioux City.

Trammel nets can be set below rock piling and produce some good catches. The larger carp, buffalo, and catfish are most susceptible to this type of gear.

The reduction in turbidity brought about by the construction of upstream reservoirs has also made it possible to use electro-fishing gear during part of the year. Most of the species of fish present in the river have been caught with this gear during past surveys; however, sauger and walleye seem especially susceptible. Four hours of electro-fishing were conducted during 1963.

RESULTS AND DISCUSSION

Hoop Net Survey

Two hundred ninety-six channel catfish were caught with hoop nets during 1963 and they ranged between 5.2 and 17.1 inches in total length. When the fish caught during October (about 75 per cent of the catfish) were arranged on a length-frequency table, apparent year classes were noted at about 6 inches, 7.5 inches, 10 inches, and 12.5 inches. Preliminary age and growth work on pectoral spine samples collected from each of these length groups has indicated they represent age groups II, III, IV, and V, respectively. The mesh size of the hoop nets was too large to adequately sample younger catfish. Three flathead catfish ranging between 8.0 and 19.5 inches long were also caught with the nets.

The hoop nets were fished more in 1963 than 1962 and caught more catfish; however, the ranges in total lengths of the catfish taken during each year were about the same: 6.3 to 18.1 inches in 1963 and 5.2 to 17.1 inches in 1962.

Eleven white crappie (4.0 to 9.5 inches); 1 white bass (7.0 inches); and 5 sauger (11.6 to 14.7 inches) were other game fish taken with hoop nets during 1963.

Carp were the most numerous rough fish caught with hoop nets. Nine were taken ranging between 8.5 and 21.6 inches long.

Eight redhorse, 8 freshwater drum, 4 carpsuckers, 1 goldeye, and 1 gar composed the remaining catch of rough fish by hoop nets.

Electro-fishing Survey

Electro-fishing gear was used during 4 hours of the 1963 survey. Rough fish outnumbered the game fish in the sample collected. Gizzard shad were so numerous at times that even an estimate of the total number seen would not have been practical; however, samples were collected so that scales could be sampled and lengths measured.

These shad ranged between 4.5 and 10.6 inches in total length with the majority between 6 and 9 inches. Scale samples indicated that this length range was composed of 1 and 2 year old fish. Annual electro-fishing surveys of the river since 1958 have found gizzard shad very abundant. Apparently, channelization work on the river has had little detrimental affect on this species.

Thirty-six carpsuckers, 6 carp, 2 shovelnose sturgeon, and 2 blue suckers were the other rough fish taken with the electro-fishing gear.

Sauger were easily caught with this type of gear. Forty-nine young of the year and 29 sub-adults and adults ranging between 2.8 and 16.2 inches long were collected. This species has produced good annual year classes since 1958 and appears to be well adapted to the channelized river.

The walleye population is small although it appears not to have fluctuated greatly in recent years. Only 1 young of the year and 3 sub-adults were taken by electro-fishing.

Catfish were difficult to catch with this type of gear. Only 1 channel catfish (5.9 inches long) and 5 flathead catfish (7.1 to 12.8 inches long) were recovered. These fish are generally found in the deeper water during the daytime so would be unavailable in the shallower areas where shocking techniques were used.

The remaining game fish collected by electro-fishing included 4 largemouth bass, 1 white bass, 4 bluegills, and 1 green sunfish.

Goldeye are a very abundant but only 1 was found during the 1963 survey. This is probably because the species usually inhabits part of the swifter moving water areas and the hoop nets and electro-fishing gear were used in the slower moving water along the banks. Goldeye are at times caught abundantly with trammel nets fished in the deeper, swift moving areas of the river.

SUMMARY

1. Hoop nets were fished a total of 124 days in the Missouri River between Omaha and Sioux City.

2. Two hundred ninety-six channel catfish were caught in the nets and ranged between 5.2 and 17.1 inches in total length. Age and growth work on this sample indicated it was composed of 2, 3, 4, and 5 year old fish.

3. Only 3 flathead catfish ranging between 8.0 and 19.5 inches long were caught with the nets.

4. Eleven white crappie, 1 white bass, and 5 sauger were other game fish taken by hoop nets.

5. Carp were the most numerous rough fish caught by hoop netting with hoop nets. Nine ranged between 8.5 and 21.6 inches long. Eight redhorse, 8 freshwater drum, 4 carpsuckers, 1 goldeye, and 1 gar composed the remaining catch of rough fish.

6. Gizzard shad between 6 and 9 inches were the most abundant fish collected by shocking. The majority of these fish were 1 and 2 years old.

7. Thirty-six carpsuckers, 6 carp, 2 shovelnose sturgeon, and 2 blue suckers were the other rough fish taken by electro-fishing.

8. Sauger were the most abundant game fish collected by electro-fishing techniques. Forty-nine young of the year and 29 sub-adults and adults ranging between 2.8 and 16.2 inches were caught.

10. The remaining game fish observed with the electro-fishing included 1 channel catfish, 5 flathead catfish, 4 largemouth bass, 1 white bass, 4 bluegills, and 1 green sunfish.