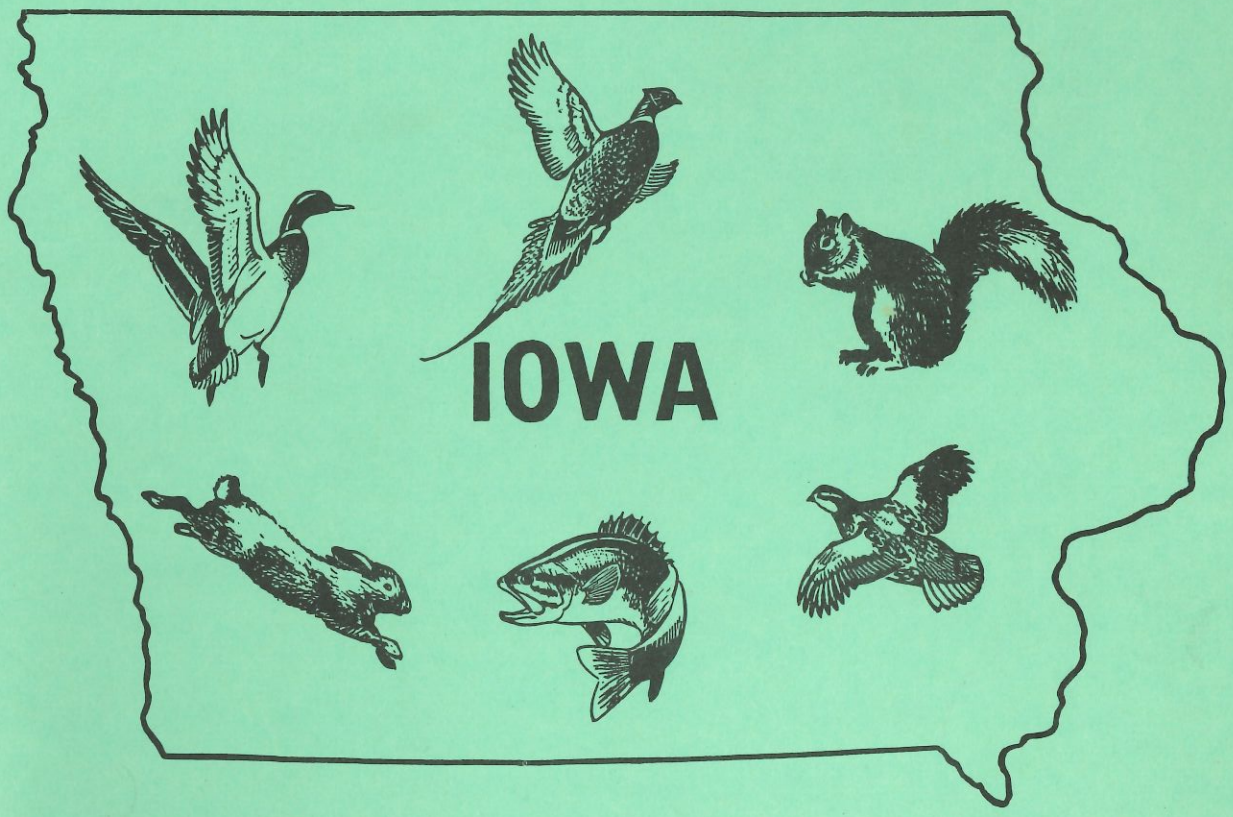
1967
2 short
Jan Feb Mar
Oct Nov. Dec.

QUARTERLY BIOLOGY REPORTS



FISH AND GAME DIVISION — BIOLOGY SECTION

STATE CONSERVATION COMMISSION

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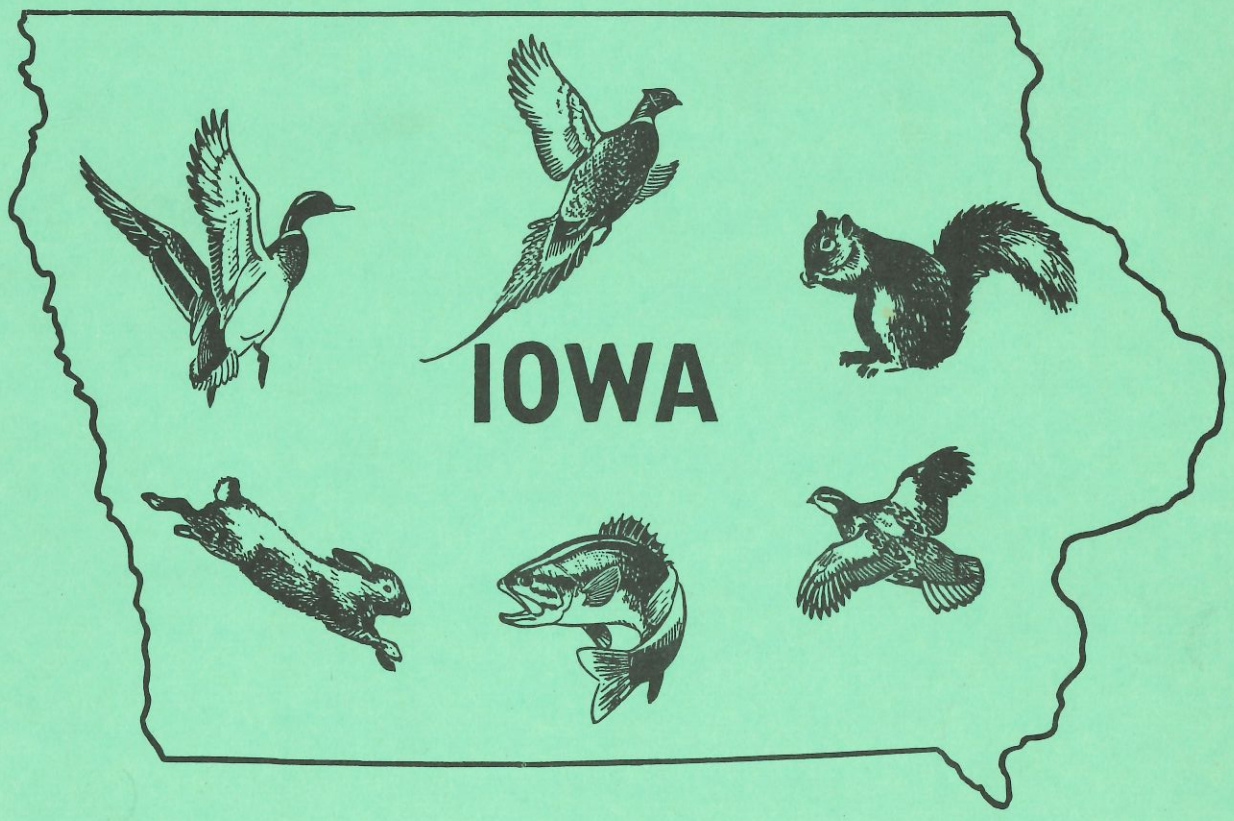

FISH AND GAME DIVISION — BIOLOGY SECTION

STATE CONSERVATION COMMISSION

QUARTERLY BIOLOGY REPORTS

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East 7th & Court Streets
Des Moines, Iowa

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ABSTRACTS OF PAPERS PRESENTED AT QUARTERLY BIOLOGY SEMINAR, JULY 13, 1967

FISHERIES ABSTRACTS

Progress Report : RESULTS OF A TROUT FISHERMAN CREEL CENSUS AND QUESTIONAIRE FOR JUNE 1967

Robert Schacht
Fisheries Biologist

A creel census was conducted by Biology Section personnel on trout streams in Clayton, Delaware, and Fayette Counties starting in June of 1967. Streams censused were Richmond Spring, Klienlein, Glovers, Elk and Grannis Creeks. The paper discusses data obtained from the following questions that were asked during the census: distance traveled, hours fished, fish caught, number of fishing trips up to the time of contact, estimated number of trips per year, number of years the fisherman has fished for trout in Iowa, favorite streams, whether or not the fisherman fished during December through March, type of gear used, bait preference, species of trout preferred, estimated number of trout caught to the time of contact, whether or not the fisherman knew when the stream was stocked last, place of trout stamp purchase, day of the week preferred to fish, and whether or not the trip involved over-night stays.

CLEAR LAKE CREEL CENSUS, 1966

Robert Hollingsworth
Fisheries Biologist

Data are presented from the 1966 comprehensive creel census on Clear Lake. The census period extended from May 1 through September 30. Species rank in order of abundance were bullhead, crappie, walleye, yellow bass, and yellow perch. Bullheads made up 54 per cent of the estimated total harvest of 143, 114 fish. Fishermen caught 2.82 fish per trip at 1.15 fish per hour. Yellow bass kills in 1965 reduced catch rates and the 1966 estimated total harvest from previous year's totals. The average surface acre of the lake was fished for 34.2 hours and yielded 15.2 pounds of fish.

CREEL CENSUS RESULTS OF FOUR NATURAL IOWA LAKES - 1966-67.

Terry Jennings
Fisheries Biologist

Data are presented on the results of a comprehensive creel census conducted on four natural lakes in Dickinson County, Iowa. The census period on Spirit and West Okoboji Lakes extended from May through February while East Okoboji and Center Lakes were censused only from May through September. These four lakes, totaling about 11,152 acres, sustained an estimated fishing pressure of 157,258 angling trips lasting 441,003 hours. An estimated 875,705 fish weighing 387,166 pounds were harvested. The average trip produced 5.57 fish caught at a rate of 1.99 fish-per-hour. Twelve species made up the total catch. Bullheads and yellow perch comprised 38 and 37% of the total harvest respectively. Blue-

gill (16%), crappie (4%), and walleye (3%) were the only other species making up the remainder of the catch. Of these four lakes West Okoboji contributed the most fish to the total harvest followed in decending order by Spirit, Center, and East Okoboji. Approximately 58% of the fish harvested from West Okoboji were taken during December, January, and February. On the other hand 94% of the fish creeled from Spirit were taken during open water fishing. Winter fishing on East Okoboji and Center Lakes is insignificant.

MISSOURI RIVER OX-BOW LAKE FISHERY
Part 3: Crappie

Bill Welker
Fisheries Biologist

Crappie populations in five Missouri River ox-bow lakes were surveyed in 1963 and 1964 by the Iowa Conservation Commission, Nebraska Game, Forestation and Parks Commission, and the United States Fish and Wildlife Service. In general, crappie were statistically more abundant in the lakes separated from the river than in those lakes open to the river. There was evidence growth was slower in those lakes separated from the river than in the lakes open to the river. Population density may be a factor affecting this slow growth. Reproduction was evident in all lakes.

EXPERIMENTAL USE OF ANTIMYCIN A TO CONTROL SPAWNING CARP IN BACKBONE LAKE

Don R. Helms
Fisheries Biologist

Backbone Lake was treated experimentally to test the recently developed Antimycin A as a selective agent for controlling carp. Antimycin was applied at a high concentration to four select areas in the lake where carp were spawning. Subsequently, carp entering the area were exposed to a lethal dose of the toxicant. The poor success obtained was attributed to weather which was not conducive to maximum carp spawning activity following application of the toxicant.

GAME ABSTRACTS

IOWA'S SPRING PHEASANT POPULATION - 1967

Richard C. Nomsen
Game Biologist

The 1967 spring pheasant count showed very little change in Iowa's pheasant population. The statewide average of 12.7 cock calls per stop was down slightly but was above the previous 5-year average of 11.8 calls per stop. The 1967 spring hen index was 40.6 compared to 41.9 in 1966 - no significant change. There were 4,842 birds sighted on 182 routes for an average of 2.66 birds per mile. This part of the spring survey showed a 2 per cent increase in the spring hen population - again no significant change. All regions reported a slight increase in hens except the region in southwest Iowa.

VEGETATIONAL PREFERENCES OF NESTING BLUE-WINGED TEAL ON A FEW STATE-OWNED MARSHES

Richard Bishop
Game Biologist

A project was initiated in June 1967 to determine the amount of use that alfalfa and clover fields received from nesting blue-winged teal. Blue grass uplands and hay fields were checked with a rope drag to flush nesting hens. A total of 32 teal nests, 4 mallards nests and one gadwall nest was found. Bluegrass was the most highly favored vegetational type, with 22 teal and 2 mallard nests; alfalfa and clover fields produced 6 teal and 2 mallard nests; 3 teal nests and 1 gadwall nest were found in mixed grass and hay. Of nests that were found, 11 were in the laying stage, 13 were in incubation, and 12 nests had been destroyed. The data indicate that significant use is being made of hayfields as nesting sites and that possibly the seeding of alfalfa on state areas to replace cover-bound areas would be a good management practice.

PRODUCTIVITY OF DEER BASED ON EMBRYO COUNTS, 1966-1967

Keith D. Larson
Game Biologist

A survey of road-killed does indicates an average embryo count of 1.58 for 110 does. Embryos per fawn doe averaged 1.22 and for adult does the average was 1.84. The percentage of fawns bearing young was 77.6%. Of 64 adult does examined, 43, or 67.1%, were bearing twins; 7, or 10.9% were bearing triplets; and 12, or 18.3% were bearing single fetuses. The fawn data is biased somewhat in favor of younger and more vulnerable fawns, which suggests that productivity of the fawn class may be greater than indicated.

LAND CLEARING IN THREE SOUTHERN IOWA COUNTIES SINCE 1956

Elden Stempel
Game Biologist

A preliminary survey was made of the amount of land clearing in Davis, Monroe and Wapello County. The figures used are current records now available in local offices, as most records are forwarded to a central office. The three counties concerned made similar reports on methods and results. Under the ASC program, since 1965 the estimated annual clearing per county per year, for all types of woody cover removed was 29 farms and about 13 acres per farm. This included both poor upland game cover and good cover. According to 14 Wapello County farmers, 28 per cent of the best upland game cover has been removed in 10 years.

RESULTS OF THE 1966-67 TRAPPERS QUESTIONNAIRE

Robert L. Phillips
Game Biologist

The results of the 1966-67 trapper questionnaire are presented in this report. Iowa trappers reported harvesting 760,153 muskrats, 64,522 raccoons and 30,455 mink. Harvest figures for all species were up in 1966, but fur prices were lower than the previous year. A discussion is presented on the validity of harvest figures from the fur buyer reports in comparison to those of the trapper questionnaire. This is the first year the latter has been used to obtain a measure of the Iowa fur harvest.

STABILITY SHOWN IN THE 1967 WOODCOCK ABUNDANCE FOR THE IOWA BREEDING POPULATION

Gene Hlavka
Game Biologist

The Iowa woodcock survey is conducted each spring in cooperation with the U. S. Fish and Wildlife Service to obtain an index of abundance to the breeding population. The number of different males heard "peenting" on the ground forms the basis for the evening roadside counts. In 1967, 13 singing-ground counts were conducted in the eastern half of Iowa. There were 22 woodcock heard at 99 stops --- an index of 0.22 birds per stop. This 1967 index equals the 5 year average and is almost the same as last year's index. In 1967 no woodcock broods were reported to the writer. A woodcock sighting was reported in Dickinson County. Wide woodcock distribution is indicated by scattered sightings and this survey.

PRODUCTIVITY OF DEER BASED ON EMBRYO COUNTS, 1966-67

Keith D. Larson
Game Biologist

Management of a deer population requires some knowledge of both natality and mortality factors. This study evolved from a lack of sufficient conclusive information of recent date concerning natality in the deer population.

PROCEDURES

The data were obtained from the regular Conservation Officers miscellaneous deer kill reports. The report card was modified to include information on number of embryos present in carcasses of road-killed does during the late winter and spring months. If no foetuses were present, a check for lactation was requested. They were requested to remove the lower jawbone and mail with their report so that uniform age determinations could be possible.

RESULTS

Data are presented from two seasons, 1966 and 1967. Complete data were received on 110 female deer - 46 fawns and 64 adults. These are presented in Table 1.

Fawn Productivity. The data indicate that for the 2-year study involving 49 fawns, 77.6% were productive. During the 1967 season only, 86.2% were productive (25 of 29). These data include three fawns which were not carrying young but were lactating at time of death.

The combined data indicate a foetus count of 1.22 per fawn doe. The 1967 data alone reveals 1.50 foetuses per fawn doe. For the latter half of the 1967 season only this count was 1.64 for 17 does.

Adult Doe Productivity. Sixty-four adult does were examined and all but two were carrying young. The embryo count was 1.84. Forty three, or 67.1%, were bearing twins, 7, or 10.9% were bearing triplets, and 12, or 18.3% were bearing single foetuses.

Total Productivity. The sample contained 41.8% fawns. For a population with this age ratio, the mean embryo count indicated by these data would be 1.58.

DISCUSSION

There appears to be close agreement in adult doe embryo counts between these data, previous records, and data from Nebraska. Havel (1967) indicates a 1.87 embryo count for does 2 years or older based on 103 samples over a 5-year period, 1961-1966. These data appear to be adequate to reflect productivity in adult does.

The embryo count indicated for fawns, however, has varied from 0.85 in 1966, 1.50 in 1967, 1.03 for 1966 and early 1967, and 1.64 for late 1967. The combined data indicate 1.22

foetuses per fawn doe with 46 fawns in the sample. This compares with 0.71 foetuses per fawn doe reported by Havel (1967) for eastern Nebraska.

There were no reports of lactating adult does being killed on the highway from April 15 to July 1st, 1967. In contrast, a very high percentage of the fawn kill was composed of very young fawns. This category should be the poorest producers. Thus, this data on fawn productivity is apparently biased in favor of young fawn does and the actual productivity of fawns in Iowa could be greater than indicated.

These data represent an approximation of the basic reproductive rate. The sample was taken statewide and indicates high reproduction over a large area of cornbelt habitat. The rate for fawns quite possibly is the highest ever recorded for the species. Additional data should be obtained to further document the productivity of fawns in Iowa.

The combined rate of 1.58 for the population as represented by the age ratio of the sample suggests a basic rate of increase at parturition of 79%.

LITERATURE CITED

Havel, Robert.
1967. Surveys and management of deer. PR Project W 15 R23. Nebraska G F & P Comm.

Table 1. Embryo counts of road killed does, 1966-1967

Study Period	Parturition Age*	Number with Embryos Present Each Class 0	1	2	3	Total Does	Total Embryos	Embryo Count
'66 Road Kill	Fawns	7	9	4	0	20	17	0.85
	Adults	2	6	17	4	29	52	1.79
'67 Road Kill-First Half	Fawns	1	6	2	0	9	11	1.22
	Adults	0	4	8	1	13	22	1.69
-Second Half	Fawns	3	9	5	0	17	28	1.64
	Adults	0	2	18	2	22	44	2.00
'67 Total	Fawns	4	15	7	0	26	39	1.50
	Adults	0	6	26	3	35	66	1.89
	Mean					61	105	1.72
'66 & '67 Combined	Fawns	11	24	11	0	46	56	1.22
	Adults	2	12	43	7	64	118	1.84
	Mean					110	174	1.58

* Determined from jawbones submitted by Conservation Officers in all cases.

AGE AND SEX RATIOS OF WHITETAILS FROM SIGHT COUNTS, 1965 - 1966

Keith D. Larson
Game Biologist

INTRODUCTION

There are three methods used in Iowa for obtaining estimates of annual recruitment rates in the whitetail population. Two are based on data taken from dead deer - the deer killed during the hunting season and deer killed by traffic in the first six months of the year. The third method is based on deer sighted and identified as to sex and age by field personnel during the months of September and October. This report is based on the latter method with comparisons to the results using the first two methods.

REVIEW OF METHODS

All field personnel of the Fish and Game Division participated in this sight record survey. Personnel from the Forestry Section and the Parks Section of the Lands and Waters Division also cooperated. Positive reports were received from approximately one-third of the personnel participating. They were asked to list deer in categories as shown in Table I. No special effort to locate deer was necessary; only deer seen during the course of regular duties were to be recorded.

AGE AND SEX RATIOS

Results of this survey for the years of 1965 and 1966 are listed in Table I. Observation of 1402 deer were made in 1965 and 892 sightings were recorded for 1966.

An adult sex ratio of 41 bucks per 100 adult does is revealed for 1965 and 50: 100 for 1966.

The age ratio of greatest validity indicated by these data is 159 fawns per 100 adult does for 1965 and 162: 100 for 1966. Only fawns and does observed together are included in this ratio. The lone does and lone fawns were not included.

RECRUITMENT

Employing the above age ratio, the rate of recruitment to the population, as represented by the young of the year present during September and October, is 79.5% for 1965 and 81% for 1966.

COMPARISON OF AGE RATIOS

Embryo counts from road-killed does have provided data that suggest a basic reproductive rate of increase for the years of 1966 and 1967 of 79%, (Larson 1967). This is based on a 158: 100 ratio of embryos per 100 does.

During the 1965 and 1966 season the average age ratio in the kill was 166 fawns: 100 does. From this data, a rate of increae of 83% is indicated.

In review then the embryo-counts indicate a 79% potential increase at fawning; the fall site counts indicate an 80% average rate of increase for the two years, and the two year sample of the hunting kill indicates an 83% rate of increase.

This relationship is inverse to the expected trend of differential mortality of the young. Several explanations for this relationship exist. The embryo count method has the greatest potential for validity when seeking basic reproductive rates and when performed by qualified personnel. These criteria were not completely met in this survey in which certain biases became evident.

In the sight count, the information obtained enumerating adult females with single fawns, adult females with twins, and adult females with triplets, is not in agreement with any previous study and is considered questionable in this respect. A higher percentage of twinning actually occurs (Table 2) and a lower percentage have single fawns. Thus, the ratio of fawns per 100 does should be considerably higher than is indicated for this reason. However, the ratio must be less than that obtained from embryo counts so the possible bias in the survey must be considered. There is thus a suggestion that there is parallel mortality of adult does of significant numbers to increase this ratio to higher than either indicated, or actual, levels.

The percent increase obtained from a sample of the kill is biased in favor of fawns being killed. Thus, this ratio is too high. It is not currently being used to calculate fall population from breeding stock estimates for this same reason. Until further information is obtained this calculation is being made using a standard rate of increase of 67% obtained from averages of age ratios during the 1954 through 1959 period. There is strong evidence obtained from interpretation of all the data available since 1953, that the rate of increase in Iowa is a constant factor. These three sources of data are being used to determine the best estimate of this suggested constant.

LITERATURE CITED

Larson, Keith D.
1967. Unpublished. Qtr. Biology Reports 18 (2): 1-3.

Table 1. Tabulation of deer seen during September and October, 1965 and 1966, in a sight count production survey

	1965	1966
1. Number of bucks	181	205
2. Number of does without fawns	183	191
3. Number of does with one fawn	115	99
4. Number of does with two fawns	136	101
5. Number does with three fawns	9	17
6. Number of lone fawns	117	111
7. Number of unidentified deer	247	224

Table 2. Age structure and other statistics from deer sight counts

	1965	1966
Total deer seen	1402	892
Number of adult bucks	181	205
Number of adult does	443	408
Number of fawns	531	463
Total adults	624	613
Adult sex ratio	41:100	50:100
Fawns per 100 adults	85:100	76:100
Fawns (with does) per does (with fawns)	159:100	162:100
Fawns (all) per 100 does (all)	120:100	113:100
Percentage increase	79.5%	81%
Apparent percent single births	44.2%	45.6%
Apparent per cent twinning	52.3%	46.5%
Apparent percent triplets	3.5%	7.9%

SIGNIFICANCE OF MISCELLANEOUS DEER MORTALITY DATA
(including statistics from 1965 & 1966)

Keith D. Larson
Game Biologist

Management of a big game species like the whitetailed deer depends upon some knowledge of all decimating factors and the degree to which they operate in limiting the population. In an agricultural state such as Iowa with its intensive road development and intensive farming some of these factors take a larger toll than would be expected under conditions found in other states. The extent of loss seems to be somewhat in proportion to the population of deer and, therefore, serves as a valuable index to the population when data are collected uniformly.

METHOD

Each conservation officer is asked to complete and submit a postal card form on every deer, other than legal kills, which he has reason to believe has been killed in his territory. These cards are tabulated and analyzed at the Wildlife Research Station at Boone, Iowa.

MORTALITY DURING 1965 AND 1966

Mortality and other information reported for this 2-year period is presented in Table 1, for 1965 and in Table 2 for 1966. Comparisons for these and previous years data are summarized in Table 3. Table 4 presents traffic and total kills from 1951 to 1966.

The increase of 71 deer killed by miscellaneous causes is a 6% increase during this two year period. A two year period of 1961 to 1963 is chosen for a comparison. During that period the kill increased by 36%. The selection of this period for comparison rather than the immediately previous 2 year period was necessary as some obvious bias was introduced in 1964.

The increase in traffic kill amounted to 153 during the 1965-1966 period which was a 4.4% increase. The previous comparable period of 1961-1963 showed a 31% increase in road kills.

Four counties recorded no miscellaneous losses during 1965 while three counties reported none in 1966.

Pottawattamie county had the highest kill during both years. As in the other counties of the state, these are mostly traffic kills. Polk County reported the second highest miscellaneous kill in 1965 while Lee County reported the second highest kill in 1966.

The total reported illegal kill declined from 80 to 66 during the 2-year period.

DISCUSSION

The rate of increase of road killed deer can serve as an index to deer populations if data is uniformly collected from year to year. Anything that interferes with the faithful report of deer mortality from these various causes constitutes bias and must be evaluated. In recent years, an effort has been made to improve the reporting of this information by the field force through emphasis of its importance and personal contact. Consequently their data have been influenced enough to consider the data somewhat biased. This would mean the actual percentage change in the deer herd from 1951 to 1966 was less than that indicated in Table 2.

Although a 6% increase over the 2-year period , 1964-66 is indicated, if better reporting has in fact taken place, then there could actually be a decline in the deer population.

There also is a bias present for decreased rate of reporting in that other personnel from parks and county sheriffs have been assisting in disposal of road-killed deer. There has thus been created conditions that promote less accurate reporting of road-killed deer.

In some districts, highway commission personnel are also participating in the disposal of deer carcasses from deer-auto accidents with the same effect on reporting accuracy.

The effect of this bias is to reduce the value of these data as a population parameter. Although these data still indicate an increasing population (but at a slower rate), there may in fact be a decline of modest size.

Table 1. Misc. reported deer kill - 1965

Total Reported Killed		Sex			HOW KILLED				Amt. Car Dam.	TYPE OF ROAD			TYPE OF CROSSING		
		Unk.	♂	♀	Traff.	Misc.	Illegal	Dog		State Hwy.	Co. Hd. Surf.	Grav.	Marked	Major	Minor
10	Adair		6	4	9		1		1370.00	6	2	1		3	
7	Adams		1	6	7				430.00	6		1			
34	Allamakee	16?	9	9	14	3	6	11	500.00	9	2	1		4	
16	Appanoose	4?	8	4	11	2	3		1335.00	8		2		4	
7	Audubon		4	3	5	1	1		200.00	3		2			
6	Benton		6		6				2125.00	6			3	4	
13	Black Hawk		8	5	12		1		1485.00	7	3	2	2	2	
7	Boone		4	3	6	1			285.00	6				4	
1	Bremer		1		1				200.00	1					
3	Buchanan		3		3					3					
5	Buena Vista	1?	3	1	3	1	1		625.00	2	1			2	
7	Butler		3	4	7				1145.00	6	1		1	3	
0	Calhoun														
3	Carroll	1?	1	1	3				300.00	2		1			
23	Cass		9	14	22		1		2400.00	17	1	4	6	6	
8	Cedar		4	4	6	1	1		455.00	5		1	4	5	
0	Cerro Gordo														
12	Cherokee		6	6	10	2			1775.00	7	1	1		3	
9	Chickasaw		4	5	8		1		650.00	5	1	1	1	1	
9	Clark		8	1	6	2		1	195.00	6			1	4	
4	Clay	1?	2	1	3		1		275.00	1	2			3	
12	Clayton		5	7	12				150.00	10	1	1	4	7	
18	Clinton	3?	8	7	12	5		1	2307.00	10	2	1	2	7	
3	Crawford	2?	1		3				150.00	2				1	
22	Dallas		13	9	20	1	1		50.00	17	1	2	1	2	
12	Davis	1?	1	10	10		1	1	1240.00	8		2		7	
10	Decatur		5	5	8	2			365.00	6		2	4	4	
9	Delaware		3	6	7	1	1		525.00	6		1		2	
19	Des Moines		14	5	14	2	2	1	945.00	11		2	10	12	
10	Dickinson		5	5	9	1			985.00	7	2			3	
12	Dubuque	1?	6	5	11	1			1325.00	10				3	
8	Emmett		5	3	6	2			395.00	2	2	2		1	
8	Fayette	1?	2	5	8				800.00	3	2	6			

Total Reported Killed		SEX			HOW KILLED				Amt. Car Dam.	TYPE OF ROAD			TYPE CROSSING		
		Unk.	♂	♀	Traf.	Misc.	Illegal	Dog		State Hwy.	Co. Hd. Surf.	Grav.	Marked	Major	Minor
7	Floyd		3	4	6	1			665.00	3	2	1	2	3	
2	Franklin			2	1	1				1					
19	Fremont		12	7	16		2	1	1910.00	10	6		3	5	
12	Greene		3	9	10	1	1		455.00	6	1	3	4	4	
0	Grundy														
28	Guthrie		14	14	27		1		1605.00	19	2	6	3	11	
2	Hamilton		1	1	2				200.00						
6	Hancock		3	3	6					5		1			
13	Hardin	2?	6	5	11	1			565.00	8		4	1	4	
42	Harrison	6?	23	13	37		5		1032.50	28	5	4	3	4	
15	Henry		9	6	13		1		895.00	7	4	1	3	3	
5	Howard		2	3	4	1			15.00	2	1	1			
0	Humboldt														
3	Ida		1	2	3				100.00	3					
17	Iowa		9	8	14	1	2		1900.00	11	1	2	6	6	
15	Jackson	1?	7	7	14		1		1335.00	12		1	6	9	
15	Jasper	10?	5		4	1			1610.00	4				1	
14	Jefferson	1?	6	7	11	3			835.00	9	1	1	3	3	
24	Johnson	2?	8	14	21	1	2		2815.00	19	1	1	10	12	
13	Jones	1?	4	8	10		3		535.00	9		1	1	1	
5	Keokuk		4	1	5				235.00	5			1	2	
3	Kossuth			3	2	1			400.00	2				1	
11	Lee		5	6	11				200.00	10		1	3	3	
7	Linn		2	5	5		2		960.00	3	2				
10	Louisa	1?	5	4	5	4	1		200.00	4		1		3	
22	Lucas		11	11	22				1385.00	20			11	14	
8	Lyon	1?	4	3	8				570.00	6	1	1	1	4	
22	Madison		9	13	20	1	1		830.00	10	1	9	2	2	
2	Mahaska		2		2					2					
11	Marion	1?	6	4	10		1		2025.00	10			1		
5	Marshall			5	5				540.00	5					
37	Mills	2?	17	18	28	7	1	1	2570.00	13	5	6	3	3	
9	Mitchell		4	5	8	1			305.00	5	2	1		2	
5	Monona		4	1	5				300.00	4	1		1	1	

Total Reported Killed		SEX			HOW KILLED				Amount Car Damage	TYPE OF ROAD			TYPE CROSSING		
		Unk.	♂	♀	Traffic	Misc.	Illegal	Dog		State Hwy.	Co. Hd. Surf.	Grav.	Marked	Major	Minor
16	Monroe		7	9	15	1			1430.00	14		1	1		4
6	Montgomery		4	2	5		1		475.00	5		1			
10	Muscatine	1?	5	4	5	3	2			2	3		1		3
3	O'Brien		1	2	1		2		300.00						
1	Osceola			1			1								
13	Page	1?	8	4	13				1730.00	12		1	3		8
4	Palo Alto	1?		3	2		2		250.00		1	1			1
18	Plymouth		11	7	15		3		1806.00	14	1		9		10
2	Pocahontas		1	1	1	1			150.00			1			
67	Polk	2?	31	34	64	4	1		2250.00	52	8	1	4		5
72	Pottawattamie	7?	42	23	65	3	4		6050.00	49	8	6	8		14
7	Poweshiek		4	3	7				775.00	7					1
4	Ringgold		2	2	3		1		325.00	2	1				
7	Sac		3	4	6		1		800.00	2	2	2			1
8	Scott		7	1	8				175.00	7	1		2		2
20	Shelby	6?	5	9	19	1			1525.00	10	4	4			1
13	Sioux		8	5	8	5			1910.00	7	1				3
4	Story			4	4				150.00	4					1
3	Tama	1?	1	1	3				200.00	2			1		2
4	Taylor		1	3	4				200.00	3		1			
17	Union		5	12	16	1			780.00	13	2	1	2		2
12	Van Buren		5	7	5	4	3		285.00	2	1	2			
31	Wapello	1?	18	12	26	3	1		3800.00	18	3	3	11		21
36	Warren	1?	17	18	33	1	1		4125.00	27	5	2	19		21
12	Washington		5	7	7	2	3		1600.00	6	1				3
4	Wayne		1	3	4				155.00	4					
10	Webster	1?	4	5	7	2	1		750.00	6	1		1		1
3	Winnebago		2	1	3				135.00	2	1		1		
27	Winneshiek	2?	11	14	20	2	2		1335.00	14	1	5	7		12
37	Woodbury	6?	13	18	30	3	5		525.00	25	4		5		9
12	Worth	1?	5	6	10	2			585.00	5	2	2			2
5	Wright		2	3	5					4		1			
1224	TOTALS	90?	576	558	1022	92	80	17	86,546.50	771	111	115	182		325

Table 2. Misc. reported deer kill - 1966

Total Reported Killed		SEX			HOW KILLED				No. of Fetuses	Does Lactating	Amt. Car Dam.	TYPE OF ROAD			TYPE OF CROSSING		
		Unk.	♂	♀	Traff.	Misc.	Illegal	Dog				State Hwy.	Co. Hd. Surf.	Gravel	Marked	Major	Minor
5	Adair		3	2	4	1					525.00	4				4	
4	Adams		2	2	4							2		2			
13	Allamakee		10	3	11	3	1		2		510.00	6	2	2		6	3
16	Appanoose		7	9	10	4	4		12	1	535.00	6		3		4	3
0	Audubon																
2	Benton		1	1	1		1				150.00		1			1	
10	Black Hawk		6	4	9		1				825.00	3	2	1			
12	Boone		9	3	10	1	1		1		890.00	6	1	1			
3	Bremer		1	2	3				3			3					1
4	Buchanan		3	1	3			1			200.00	3					
3	Buena Vista			3	3							3					1
11	Butler		4	7	10				2		1025.00	3	3	1	1	2	
1	Calhoun			1	1							1					
5	Carroll	1?	3	1	5						1750.00	2	1				1
22	Cass		13	9	21	1					1950.00	20	1		6	7	4
6	Cedar		4	2	6						350.00	5	1		3	2	1
4	Cerro Gordo		4		4						300.00	2		2			
10	Cherokee		6	4	8		2				1625.00	7	1				4
11	Chickasaw	1?	5	5	11	1			2		1150.00	6	3	1	2	2	1
12	Clarke	1?	4	5	9	1			4			6		2	1	3	
6	Clay	2?	2	2	6						230.00	2	2	2	1	1	
10	Clayton		7	3	7	1		1	4		150.00	8			2	5	
12	Clinton		4	8	10	2			3		600.00	9	1		1	2	
13	Crawford		8	5	13						1350.00	12	1		4	6	3
17	Dallas		10	7	13	2	1	1			80.00	12	1		1	1	6
14	Davis		5	9	11	3			3		2285.00	8	1	2			
8	Decatur		2	6	7	1			2		645.00	3		4	1	1	1
6	Delaware	2?	1	3	2		4				275.00	1	1			1	
18	Des Moines		6	12	16		2		2		1600.00	8	2	4	3	6	
20	Dickinson	1?	10	9	13	2	2		4		1035.00	8	4	1		4	
16	Dubuque		6	10	13	1		2	4		665.00	13					8
7	Emmett		3	4	4	3					340.00	2	1	1		2	
11	Fayette		8	3	10		1				685.00	7	3	1	1	1	

Total Reported Killed		Sex			How Killed				No. of Fetuses	Does Lactating	Amt. Car Dam.	Type of Road			Type Crossing		
		Unk.	♂	♀	Traff.	Misc.	Illegal	Dog				State Hwy.	Co. Hd. Sur.	Gravel	Mark	Maj.	Min.
6	Floyd		3	2	6						150.00	4	2			1	3
4	Franklin		2	2	3		1					2		1			
28	Fremont		19	9	26	1	1		2		2740.00	14	8	4	4	3	9
10	Greene		7	3	10						965.00	8		2	3	5	3
0	Grundy																
36	Guthrie	20?	6	10	35			1			1000.00	13	1	3		5	
11	Hamilton	3?	4	4	7	1	3				300.00	3	4			3	
1	Hancock		1		1									1			
8	Hardin	1?	5	2	4	2	1				250.00	3	1			3	
29	Harrison	8?	8	13	21	6	1		0		410.00	15	2	4	1	2	10
8	Henry		6	2	6	2					985.00	3	2	1	1	1	
2	Howard			2	1		1					1					
7	Humboldt		4	3	5	2					285.00	1	1	3		1	
8	Ida		1	7	7		1		0		1045.00	3	1	2		2	
16	Iowa		8	8	15		1		1		1350.00	16			6	8	
13	Jackson		7	6	13				2		1480.00	11		1	4	4	2
6	Jasper		2	4	6						593.76	6				1	
19	Jefferson	2?	9	8	11	5	2	1	4		1600.00	6	1	3	2	2	3
21	Johnson	1?	10	10	15	4	2		1		775.00	10	3	1	4	4	6
10	Jones	1?	6	3	7	1	2				850.00	4	3			3	3
10	Keokuk		6	4	10				6		1180.00	7	2	1	2	4	1
2	Kossuth		1	1	2				2		150.00	1	1				1
54	Lee	54?			54												
10	Linn		9	1	10						1230.00	10					
7	Louisa		4	3	7						1400.00	5		2		4	2
16	Lucas	2?	8	6	12	1	2				1060.00	12		2	9	9	
11	Lyon	1?	4	6	7	3			2		275.00	3	4		2	1	1
23	Madison	2?	12	9	15	4	4				1115.00	12		3	1	1	10
2	Mahaska		1	1	2				3		550.00	1					
10	Marion	1?	5	4	10						1308.00	5	2	3		2	
2	Marshall			2	2						60.00	2			2	2	
18	Mills	1?	9	8	16	3					350.00	12	1		2	8	
10	Mitchell		4	6	10						1465.00	2	7	1		3	3
20	Monona		7	13	20				2		850.00	12	1	6		5	11

Total Reported Killed		Sex			How Killed				No. of Fetuses	Does Lactating	Amt. Car Dam.	Type of Road			Type of Crossing		
		Unk.	♂	♀	Traf.	Misc.	Illegal	Dog				State Hwy.	Co. Hd. Sur.	Gravel	Mark	Maj.	Min.
23	Monroe	2?	8	12	20		2		2		1025.00	16		2	2	6	3
8	Montgomery		4	4	6	2					400.00	6			1	3	
11	Muscatine		6	5	11		3		2		1025.00	9	1			6	
5	O'Brien		3	2	5						120.00	2	1	2			
3	Osceola		1	2	3						75.00	1	1	1			
16	Page		12	4	12	2		2			980.00	11		1	3	5	4
4	Palo Alto		2	2	4						540.00	4			2	2	
26	Plymouth		12	14	23	2	1				2995.00	23			17	7	1
0	Pocahontas																
50	Polk		27	22	50				1		900.00	41	8		4	4	2
98	Pottawattamie	10?	49	39	96	1	1			1	5715.00	85	2	8	13	33	33
7	Poweshiek		2	5	5	1	1					4	1				
2	Ringgold		2		1	1						1					
7	Sac		3	4	5		2		1		155.00	3		3		1	
5	Scott		2	3	5						525.00	5			1	2	
15	Shelby	7?	5	3	9	6					490.00	6	2	1			4
15	Sioux		6	9	13	1	1				1230.00	8	3	3	3	2	3
5	Story		3	2	5						224.50	5					
3	Tama		2	1	2		1				550.00	2				1	
11	Taylor		6	5	10	1					475.00	6	1	2		2	
5	Union		1	4	5						335.00	4			1	1	
8	Van Buren		3	5	4	3	1				800.00	2		1		1	
27	Wapello	1?	11	15	26	2			2		2155.00	16	8	1	9	7	7
32	Warren	3?	13	16	29	3			2		2295.00	27	1	2	19	19	6
23	Washington		9	14	12	2	9				525.00	9	1	1	1		1
6	Wayne		1	5	6						875.00	5		1		1	
12	Webster		5	7	12						600.00	4	7		2	2	
11	Winnebago		3	8	8	3			6		395.00	3	4		1	6	1
13	Winneshiek	4?	5	4	10	3					210.00	5	3				2
25	Woodbury	1?	14	10	21	3	1				650.00	21			5	8	
12	Worth		9	3	10	1	1				610.00	8	1	2		5	4
5	Wright		2	3	5						300.00	5					

Table 3. Comparisons of data from miscellaneous deer kills for 1964, 1965, and 1966

	1964	1965	1966
Total Miscellaneous kill	1,170	1,224	1,241
Numerical Increase	32	54	17
Percent Total Increase between 1964 & 1966			6%
Traffic Kill	914	1,022	1,067
Percent Increase	1.5%	11%	4.4%
Percent Total Increase between 1964 & 1966			16.7%
Sex Ratio (Males/Females)	101/100	103/100	105/100
Traffic Mortality by type of highway			
state highway	77%	77%	76%
County Hd. Surf.	11%	11%	13%
Gravel	12%	12%	11%
Marked Crossings	19%	36%	25%
Major Crossings[1]	37%	64%	45%
Total Estimated Vehicle Damage	$68,532	$86,546	$73,481
Average Per Collission	$75.	$85.	$76.

[1] Includes marked crossings.

Table 4. Annual deer losses to traffic, illegal hunting, dogs, and miscellaneous causes, as reported by Conservation Officers, 1951-1966

Year	Number of Deer Reported left from all causes other then legal hunting	Percent change in all causes	Traffic Kills Only	Percent Change in Traffic Kill
1951	192	-	120	-
1952	256	33.3%	173	44.2%
1953	393	53.5%	273	57.8%
1954	310	- 21.1%	229	- 16.1%
1955	306	- 1.3%	216	- 5.7%
1956	419	36.9%	286	32.4%
1957	345	- 17.7%	261	- 8.7%
1958	438	27.0%	314	20.3%
1959	508	16.0%	379	20.7%
1960	753	48.2%	546	44.1%
1961	839	11.4%	683	25.1%
1962	939	11.9%	726	6.3%
1963	1138	21.2%	900	24.0%
1964	1170	2.8%	914	1.6%
1965	1224.	4.6%	1022	11.8%
1966	1241	1.4%	1067	4.4%
Total (1951-1966)	10,471	546.4%	8109	789.2%

RUFFED GROUSE 1967 SPRING DRUMMING SURVEY

Eugene D. Klonglan
Asst. Supt. of Biology

Spring roadside drumming surveys of the ruffed grouse population in northeast Iowa have been conducted on a systematic basis since 1961. In 1967 there were 12 counts completed on 9 routes by Biologista and Conservation Officers. Data from seven of these routes were suitable for comparison with counts from previous years. The mean of 1.5 drums heard per stop on the highest count from each of these seven routes compared closely with the means from previous years (Table 1), thus indicating there has been no significant change in the grouse population in northeast Iowa, as measured by this survey technique, over the past 7 years. Detailed information on the 1967 counts is presented in Table 2.

Table 1. Indices to ruffed grouse abundance in northeast Iowa, 1961-67, as measured by the spring roadside drumming count (comparable routes only)

Year	No. Routes	No. Stops	Total Drums	Drums Per Stop
1961	6	89	137	1.5
1962	8	111	189	1.7
1963	9	130	217	1.7
1964	9	133	203	1.5
1965	9	135	227	1.7
1966	(2)*	(30)	(54)	(1.8)
1967	7	105	154	1.5
7 years	50	733	1181	1.6

* Unfavorable weather during peak drumming period prevented obtaining good counts on all but 2 routes.

Table 2. Results of spring 1967 ruffed grouse drumming counts in northeast Iowa

Route	County	No. Stops	Drums Heard	Drums Per stop
Yellow River State Forest	Allamakee (SE)	15	31	2.1
Village Creek	Allamakee (C)	15	18	1.2
Harpers Ferry-Wexford	Allamakee (E)	15	15	1.0
Upper Iowa	Allamakee (N)	15	21	1.4
Highlandville-North Bear	Winneshiek (NE)	15	51	3.4
Sny Magill - Bierbaum	Clayton (NE)	15	9	0.6
Bloody Run	Clayton (NE)	15	9	0.6
Totals		105	154	1.5
Other counts made - not used for long-term comparisons (Poor Weather, Lower count, Other Reasons)				
Yellow River St. Forest	Allamakee (SE)	15	13	0.9
Upper Iowa	Allamakee (N)	15	15	1.0
Lower Yellow River	Allamakee (SE)	15	6	0.4
Highlandville-North Bear	Winneshiek (NE)	15	27	1.8
Garnavillo-Buck Creek	Clayton (EC)	12	5	0.4

THE 1967 INDEX OF WOOD COCK ABUNDANCE

FOR THE BREEDING POPULATION SHOWS STABILITY

Gene Hlavka
Game Biologist

Each spring singing-ground surveys are conducted in the states and provinces where woodcock nest. The Iowa survey in cooperation with the U.S. Fish and Wildlife Service is conducted to obtain an index of abundance for the breeding population. In the fall no wing-collection survey is made because Iowa has a closed season on woodcock.

The male woodcock courtship performance consists of "peenting" on the ground and "twittering and chirping" in the air. The males begin their performances from 10 to 30 minutes after sunset, depending on the amount of cloud cover. The number of different woodcock heard "peenting" in a 2-minute listening period formed the basis for the 1967 singing-ground survey.

Survey dates for Iowa were April 20 to May 10, both dates inclusive. Established routes along roads were used. Selected stops on the routes are at least 0.4 mile apart. The counts are limited to 35 minutes and are conducted by experienced Game and Biology personnel.

In 1967, 13 singing-ground counts were made in the eastern half of Iowa. Woodcock were heard on 9 routes. There were 22 woodcock heard at 99 stops --- a mean of 0.22 birds per stop (Table 1). This 1967 index of abundance for the breeding population is almost the same as last year's index and equals the 5-year average (Table 2). In 1967 no new routes were added.

No woodcock broods were reported to the writer in 1967. However, on May 5, 1967, T. Sellers, Lucas County farmer, sighted what he believed were two woodcock --- one of which acted "crippled". R. Hollingsworth, fisheries biologist, and H. Dexter sighted one woodcock on March 28, 1967 at Marble Lake, Dickinson County, Iowa. This is the first recorded sighting of woodcock in Dickinson County, at least since 1961, the year the counts started. That woodcock are widely distributed in Iowa is indicated by the singing ground survey and scattered sightings of adult birds.

Table 1. Results of spring, 1967, woodcock singing-ground counts in Iowa

Route	County	No. of Countable Stops	No. of Woodcock Heard	Woodcock Heard per Stop
Paint Creek	Allamakee	7	1	0.14
Luster Heights	Allamakee	7	0	0.00
Wapsie Bottoms	Bremer	8	2	0.25
Buck Creek	Clayton	9	4	0.44
Sny Magill	Clayton	9	3	0.33
Rock Creek	Jasper	6	3	0.50
Sugar Creek	Lee	6	0	0.00
Klum Lake	Louisa	9	2	0.22
City Lakes	Lucas	8	2	0.25
Colyn Area	Lucas	8	4	0.50
Otter Creek	Tama	10	1	0.10
Blakesburg	Wapello	3	0	0.00
Canoe Creek	Winneshiek	9	0	0.00
Totals 13 routes		99	22	0.22

Table 2. Indexes of woodcock abundance for the breeding population in the eastern half of Iowa, 1961-1967

Year	No. of Stops	No. of Woodcock Heard	No. of Woodcock Heard Per Stop	No. of Routes
1961	46	10	0.22	4
1962	42	9	0.21	5
1963	92	32	0.35	10
1964	108	17	0.16	12
1965	84	14	0.17	10
5-yr. Avg.	74.4	16.4	0.22	8.2
1966	113	26	0.23	13
1967	99	22	0.22	13

IOWA'S SPRING PHEASANT POPULATION - 1967

Richard C. Nomsen
Game Biologist

The crowing cock count is the primary method for obtaining information on the spring pheasant population in Iowa. A 10-mile roadside count was added in 1962 when routes were shortened to ten stops. There were 182 routes checked this year compared to 184 in 1966. Routes were checked by Conservation Officers, Unit Game Managers and Biologists.

The winter of 1966-1967 was marked by frequent weather changes - from tornadoes in January to ice storms in February! Several blizzard-like storms caused some pheasant mortality in northern Iowa as the high winds whipped the snow and dust across the plowed fields. Temperatures in February were quite cold but were much above normal in March. Generally, pheasants in most regions of the state experienced a relatively mild winter.

METHODS

The technique for conducting the spring crowing and roadside counts remained the same as in previous years. Results are given for the six major regions as well as statewide.

The winter pheasant count was conducted from January 1 to March 15, 1967 to determine the sex ratio of Iowa's post-season pheasant population. These results are presented and are used to complete the crowing cock count interpretation.

RESULTS AND DISCUSSION

Sex Ratio Count

Conservation Officers, Unit Game Managers and Biologists reported a total of 15,863 pheasants during the winter survey (Table 1). Adequate snow cover, which is desirable for this count, was not available in many areas the past winter. Only in Northwest and North Central Iowa were checking conditions favorable for any length of time. Snowfall in the Southwest region was extremely light, which no doubt reduced the number of birds reported and the reliability of the results. The observed sex ratio of 2.4 hens per cock there was low for the state, while normally the highest hens per cock figure is obtained from this region of the pheasant range.

The observed statewide sex ratio of 3.2 hens per cock indicated that hunters harvested 64 per cent of the cocks last fall - the same as in 1965. The rate of harvest appeared to be quite low in Northwest Iowa.

Crowing Cock Count

The 1967 crowing cock count showed little change from the statewide figure obtained in 1966 (Table 2). Crowing intensity decreased in North Central and in the Eastern regions. Counts from all other regions showed no change or slight increases. The statewide average of 12.7 calls per stop was above the previous 5-year average of 11.8 calls per stop. Although the total statewide harvest of roosters was up considerably last fall, a high population of cocks was still available for the 1967 brood stock.

Censusing conditions were quite unfavorable in 1967. Weather conditions were extremely variable once the crowing peak was reached. The average completion date this year was May 7th which was only 5 days later than in 1966. However, early spring weather conditions were quite warm and crowing activity began earlier than usual. The average wind velocity in 1967 was 2.9 mph compared with 3.1 mph in 1966 (Table 3).

The statewide hen index indicated that the 1967 population of hens was nearly the same as in 1966 (Table 4). The hen index of this year was 40.6 compared to 41.9 in 1966 - a difference of -3 per cent. The 1967 index was slightly higher than the previous 5-year average of 38.5. The hen index was determined by multiplying the average number of calls per stop by the observed sex ratio from winter observations.

Spring Roadside Count

Results of the 1967 spring roadside count showed very little change from the previous year (Table 5). There were 4,842 birds sighted on the 182 roadside routes censused this spring - an average of 2.66 birds per mile compared to 2.57 birds per mile in 1966. No significant change was noted for the number of cocks and hens reported. The observed sex ratio was 2.1 hens per cock compared to 2.2 hens per cock in 1966.

Thus, when all counts are considered, Iowa's 1967 statewide spring pheasant population was about the same as in 1966 (Table 5). Obervers reported a slight increase in the number of hens sighted in each region except the Southwest region. There were 12 per cent fewer hens recorded in Southwest Iowa but the regional figure still remained high - nearly double the statewide figure.

Table 1. Observed sex ratios of pheasants, by regions, during the winter survey, 1966 - 1967

Region	Number Of Hens	Number Of Cocks	Sex Ratio 1967	Sex Ratio 1966
North west	3,326	1,184	2.9	2.8
North central	4,888	1,368	3.6	2.7
South west	893	377	2.4	4.4
Central	1,553	493	3.2	3.3
East	1,416	365	3.9	4.2
South	591	225	2.6	3.1
Statewide	12,076	3,787	3.2	3.2

Table 2. Results of the 1967 spring crowing cock counts made by Conservation Officers, Unit Game Managers, and Biologists, and comparison with 1966 counts

Region of State	1967 No. of Counts	1967 Mean Calls per stop	1966 No. of Counts	1966 Mean Calls per Stop	Change From 1966
North west	27	14.2	29	12.6	+13%
North central	26	16.7	27	18.7	-11%
South west	23	17.5	23	16.9	+4%
Central	31	13.3	32	11.9	+11%
East	34	7.2	32	8.5	-15%
South	41	10.7	41	10.2	+5%
Statewide	182	12.7	184	13.1	-3%

Table 3. Comparison of dates on which spring pheasant counts were taken and mean wind velocity during counts, 1967 vs. 1966

Region of State	Mean Date of Counts		Mean Wind (mph)	
	1967	1966	1967	1966
North west	May 11	May 5	2.2	3.2
North central	May 10	May 4	3.5	4.0
South west	May 1	April 28	2.0	2.2
Central	May 8	May 8	3.5	3.0
East	May 8	May 5	2.3	3.0
South	May 5	April 30	3.7	3.0
Statewide	May 7	May 2	2.9	3.1

Table 4. Results of spring population counts, 1962 - 1967

Year	Calls Per Stop	Hen Index	Cocks per Mile	Hens per Mile	Birds per Mile
1962	11.6	36.0	6.74	1.02	1.77
1963	12.9	38.7	0.95	1.36	2.31
1964	11.9	42.8	0.80	1.96	2.76
1965	9.4	32.9	0.61	1.36	1.97
1966	13.1	41.9	0.80	1.77	2.57
1967	12.7	40.6	0.85	1.81	2.66

Table 5. Results of the 1967 spring roadside counts

Region of State	Number of Miles	Number of Cocks	Number of Hens	Total Birds	Cocks per Mile	Hens per Mile	Total Birds per Mile	Observed Sex Ratio
North west	270	172	244	416	0.64	0.90	1.54	1.4
North central	260	258	544	802	0.99	2.09	3.08	2.1
South west	230	299	885	1,184	1.30	3.85	5.15	3.0
Central	310	301	516	817	0.97	1.67	2.64	1.7
East	340	220	479	699	0.65	1.41	2.06	2.2
South	410	291	633	924	0.71	1.54	2.25	2.2
Statewide	1,820	1,541	3,301	4,842	0.85	1.81	2.66	2.1

RESULTS OF THE 1966-67 TRAPPER QUESTIONNAIRE

Robert L. Phillips
Game Biologist

INTRODUCTION

Iowa is one of the leading states in fur production. The economic value of furs trapped each year is nearly a million dollars. In order to properly manage this fur resource, it is necessary to have good information on the annual harvest.

In past years fur buyer reports have been the only measure of fur harvest. This year a trapper questionnaire was initiated to obtain comparable information. There has been some discussion by Commission personnel as to the value of fur buyer reports because of the lack of complete returns, invalid reporting, and other inherent biases.

METHODS

A 24 percent sample was drawn from the duplicate file of trapping licenses. Approximately 2,000 of the 8,209 licensed Iowa trappers were contacted. Sampling was stratified on the basis of the number of licenses sold per county.

Each cooperator was mailed a letter of instruction and a card at the close of the long-haired trapping season (Feb. 28). He was asked to record on the card the number of each of the 11 listed furbearers he trapped during the season. Also, each trapper was directed to indicate whether his furs were sold in or out-of-state and the average price he was paid for his furs.

RESULTS

Thirteen percent of the total of licensed trappers returned 1,117 cards for a response of 56.8 percent of those sampled. This compares with a 35 to 45 percent response to the similar hunter postcard questionnaire.

Of those responding to the survey, 96.4 percent indicated they trapped muskrats, 76.8 percent trapped raccoon and 63.3 percent trapped mink. These figures most likely do not reflect exactly the number of trappers pursuing a particular species as some animals are caught incidental to trapping for others.

Harvest data for all furbeareres is presented in Table 1. The expanded data revealed a total catch of 760,153 muskrats, 64,522 raccoons and 30,455 mink.

Average fur prices for all species except mink and beaver were down in 1966 in comparison with the previous year (Table 2). Beaver was the only species showing a significant increase in fur value, going from $8.07 in 1965 to $8.44 in 1966. Perhaps the trappers responded to the value of beaver because the number of pelts sold to dealers more than doubled that of the previous year. The low prices for all species were the result of an abundant supply of all

fur and a lack of demand for fur in Europe.

DISCUSSION

The most significant result of this survey is the discrepancy that exists between the total harvest figures computed from the trapper questionnaire and those from the fur buyer reports (Table 3). The 13 percent sample is more than adequate statistically speaking, and should produce reasonably accurate harvest data. If there is any bias in the data because of trappers who caught the most fur being slightly more likely to send back the postcard, this should be offset by the fact that non-licensed trappers (primarily farmers and farm boys) were not sampled and their catch, the total of which is believed small in comparison to that of licensed trappers, is not included.

The low harvest figures as indicated by the fur buyers reports are probably the result of many buyers reporting lower figures than what they actually purchased. Another error is the lack of reporting by 29 buyers. However, it is believed by the writer, that the purchases by these buyers would not contribute much to the overall harvest figures. Most likely, the non-respondents are those who purchased little or no fur.

According to the trapper questionnaire, 8 percent of the Iowa trappers sell their fur to out-of-state dealers. Taking all the above factors into consideration, the gap between the harvest figures is somewhat explainable.

Another interesting aspect of this survey was the percent of the tatal trappers trapping different species. As was expected, muskrats were caught by practically all trappers, followed by raccoon and mink. Only the specialized trappers caught beaver, fox and coyote.

Both surveys show that the 1966-67 season was a good year for the trapper. Even though fur prices were down, the total fur catch netted Iowans nearly a million dollars.

Table 1. Results of 1966-67 Iowa trapper questionnaire

Species	percent reporting trapping this species	No. reported trapped	Avg. catch/ trapper	Total expanded catch
Muskrat	96.4	98,434	92.60	760,153
Mink	63.3	3,949	3.71	30,455
Raccoon	76.8	8,352	7.86	64,522
Beaver	38.0	2,593	2.44	20,030
Red Fox	26.1	2,705	2.54	20,851
Gray Fox	5.0	174	0.16	1,313
Coyote	3.6	189	0.18	1,478
Opossum	31.1	1,698	1.60	13,134
Civet	9.4	193	0.18	1,478
Skunk	19.5	765	0.72	5,910
Badger	4.4	90	.08	657

Table 2. Furs purchased from Iowa trappers as reported by Iowa fur dealers in 1966-67 Season

Species	Number Taken	Percent change From 1965-66	Avg. Price Per Pelt	Total Value
Raccoon	85,563	+6	$2.17	185,671.71
Opossum	4,654	+31	0.28	1,303.12
Muskrat	389,242	+49	0.98	381,457.16
Mink	16,269	+24	7.84	127,548.96
Civet	764	-32	1.66	1,268.24
Skunk	1,349	+23	0.88	1,187.12
Badger	212	+44	1.16	245.92
Red Fox	13,072	+20	3.02	39,477.44
Gray Fox	441	+46	1.30	573.30
Weasel	85	+63	0.40	34.00
Coyote	864	+18	1.50	1,296.00
Beaver	8,991	+110	8.44	75,884.04
			Total Value	$815,957.01

* Compiled by Game Biologist Robert Phillips from reports of Fur dealers submitted to Supt. of Licenses Don Criswell. (146 of 175 Licensed Dealers Reporting).

Table 3. A comparison of the total fur harvest for the 1966-67 season as indicated by fur buyer reports and the trapper questionnaire

Species	No. Reported sold to Iowa buyers*	No. sold to out-of-state buyers**	No. sold to Iowa buyers**
Muskrat	389,242	60,838	699,315
Mink	16,269	2,437	28,018
Raccoon	85,563	5,164	59,358
Beaver	8,991	1,603	18,427
Red Fox	13,072	1,669	19,182
Gray Fox	441	105	1,208
Coyote	864	118	1,359
Opossum	4,654	1,051	12,083
Civet	764	118	1,359
Skunk	1,349	473	5,437
Badger	212	53	604

* From fur buyers reports

** Computed from trapper questionnaire

VEGETATIONAL PREFERENCES OF NESTING BLUE-WINGED TEAL ON A FEW STATE OWNED MARSHES

Richard Bishop
Game Biologist

INTRODUCTION

A study was initiated in 1966 on two marshes in north central Iowa to document nesting populations of ducks in correlation with changes in the vegetation, the muskrat population, and flyway regulations. Field work during the nesting season of 1966 indicated a number of blue-winged teal hens were nesting in hayfields off the state areas. The number of nests found in blue grass uplands on Myre Slough and Harmon Lake were few in comparison to the nesting population. Harmon Lake, located in Winnebago County, occupies about 483 acres and roughly 190 of this is useable uplands. Myre Slough, also located in Winnebago County, occupies 430 acres and approximately 80 acres are desirable uplands. Both of these areas have good blue grass uplands for nesting blue-wing teal.

We are mainly interested in the blue-wing because it is the number one nesting duck in Iowa. The wood duck and mallard are the other two more important nesters. The wood duck does not nest on the ground and the mallard is so diversified in its nesting that it does not demand a definite type of upland management. The blue-wing, however, does require certain nesting conditions so we have directed our management toward this species.

Blue grass areas close to marsh edges are considered the prime nesting habitat of the blue-wing, and for this reason it was very interesting to note that teal were using other areas. It was questioned whether these birds were possibly selecting hay fields in preference to the blue grass uplands. If this were the case, the planting of alfalfa and clover on state areas where grass cover becomes too rank may be a valuable management practice. In addition to improved waterfowl nesting, the added benefits to pheasants by planting alfalfa should be considerable.

Thus a project was started in the spring of 1967 to check blue grass uplands and hayfields on a few state marshes to determine if alfalfa and clover fields were being used more than just occasionally. The results should be of use to those dealing with the management of state areas.

PROCEDURE AND RESULTS

Nests were found by three men dragging two 24-foot lengths of rope over the vegetation and flushing the hens. Each rope had several cans hanging from the main rope by nylon leaders. Each can had several rocks in it to make a jingling noise as the cans drag over the grass. Marsh areas were chosen that had somewhat comparable areas of alfalfa or clover and blue grass. These areas were drug during the middle of June. The results are shown in Table 1. A total of 32 blue-winged teal nests, 4 mallard nests and 1 gadwall nest was found. Of the area searched, approximately 26 1/2 acres were blue grass, 29 1/2 acres were alfalfa or clover and 6 1/2 acres were mixed grass and hay. The majority of the nests found were in blue grass uplands- 22 teal

nests and 2 mallard; 6 teal nests and 2 mallard nests were found in alfalfa or clover; and 3 teal nests and one gadwall nest were found in mixed grass and hay uplands.

Data on position and status of the nests when found are presented in Table 2. Eleven hens were in the process of laying, 13 were incubating and 12 nests were destroyed.

DISCUSSION

To properly evaluate much of this data, one would have to evaluate thoroughly several site factors which influence the nesting of hen blue-winged teal. The detailed measurements necessary to accomplish this were not included within the scope of the current study. The difficulty of finding areas of blue grass and alfalfa or clover on comparable sites was tremendous and the result was that most desirable looking grass uplands and most hay fields on or near the selected marshes were checked for nests. Most of the grass areas were close to the marsh and were for the most part more ideally located for nesting blue-wings. The alfalfa and clover fields were most generally at greater distances from the marshes, thus making them less desirable.

One other large problem encountered was the low breeding populations of blue winged teal on our state areas during the study. It was difficult to find areas that had a sufficiently high breeding population to obtain good comparable data. Our spring surveys indicated a reduction of 25 to 30 per cent in breeding blue-wings on Iowa marshes. This problem in itself limited the results of this project considerably.

Shown in Table I is roughly the number of acres that were checked of each cover type and the number of nests found. The number of nests cannot be used as an accurate nesting density figure because some hens were just in the process of nesting and some work was done in the afternoon when laying hens would not be on the nest. Also, some hens well along in incubation probably did not flush, which throws additional bias into the figures. We have found hens on nests during 1966 that did not flush from the rope drag and one hen was captured by hand while on the nest. This indicates that some hens sit so tight as not to flush for the drag. The figures presented are not intended to indicate total number of nests per acre.

The percent of destroyed nests found in the different cover types is also a mis-represented figure. It is easier to find destroyed nests in grass cover than in alfalfa or other vegetation. We found "0 percent" destroyed nests in hay fields while about 42 percent of the nests found in bluegrass were destroyed. It has been noted by other authors that nests in alfalfa fields are not as highly exploited as are nests in grass and weed areas. Vermin populations also tend to be higher on undisturbed ground than on cultivated areas.

The most important aspect of these data is the fact that teal are nesting to some extent in alfalfa and clover fields, which are to some degree less desirable locations than are the blue grass uplands. The alfalfa field near Barringer Slough, where two teal nests were found, is bordered by thick cover plantings on two sides. The trees are between the field and the marsh and 180 yards away from the marsh area. Another interesting observation was made on Ventura Marsh. In 1965 the grass area on the south side of Ventura Marsh had grown up to a thick stand

of large grasses and weeds: A sizeable portion was plowed up and seeded to alfalfa and corn in 1966. Two teal nests and a mallard nest were found on the seeded area compared to no nests located on the unplowed portion of the area during nest searching this year. From this limited data it appears that alfalfa or alfalfa and grass may be better nesting habitat than areas grown up to heavy stands of large grasses.

The project was set up as an exploratory one to check out the extent of teal nesting in hay fields and the data is by no means conclusive. It does, however, indicate that some use of hayfields for nesting teal is taking place. To what extent I do not know because exact and sufficient data are not available. In 1966 two teal nests were found in alfalfa fields on private ground some distance from the marshes. It was impossible to check out all of these nearby fields, so use is probably greater than shown here. Bennett (1938) reported finding 14 per cent of the blue wing teal nests over a 4-year period in alfalfa fields. He suggests that maybe they preferred alfalfa to native prairie vegetation. One area near a marsh in the Ruthven vicinity of northwest Iowa produced one nest per acre over a 4-year period compared to no nesting ducks in adjacent native prairie. To correctly check this out you would have to have alfalfa fields in similar locations and have a substantial nesting teal population. The data that was collected this year looks encouraging and more data could be collected next year if it is deemed important.

One other bit of information that might be of use in management is the difference of clover and alfalfa. Alfalfa is about the right height at the beginning of the nesting season, when clover is generally too short. Most nests in clover fields are usually real late nests or renests. If hay is to be seeded on state areas, I believe alfalfa would be superior to clover. Alfalfa is also preferred nesting cover for mallards in comparison to blue grass.

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Table 1. Number of duck nests found by cover types on several state areas

Area	Total Nests by Species	Cover Types and Approximate Acreage					
		Blue Grass		Alfalfa & Clover		Mixed Grass & Hay	
		Acres	No. Nests	Acres	No. Nests	Acres	No. Nests
Harmon Lake	3 BWT	11	3 BWT	9	0	1 1/2	0
Myre Slough	22 BWT 2 Mall.	11	18 BWT 1 Mall.	10	4 BWT 1 Mall.	0	0
Ventural Marsh	3 BWT 1 Mall.	4	1 BWT	4	1 BWT 1 Mall.	1	1 BWT
Jemmerson Sl.	1 BWT.	2	0	3	0	2	1 BWT
Hottes Lake	0	2		4	0		
Blue Wing Marsh	1 Gadw.					2	1 Gadw.
Barringer Sl.	3 BWT 1 Mall.	4	1 BWT 1 Mall.	3 3	1 BWT 1 BWT		1 BWT 1 BWT
TOTALS	32 BWT. 4 Mall. 1 Gadw.	34	22 BWT 2 Mall.	36	6 BWT 2 Mall.	6 1/2	3 BWT 1 Gadw.

Table 2. Information on individual duck nests found

Area & Date	Species	No. Eggs	State of Nest	Vegetative Type	Distance From Water
Harmon Lake	BWT	9	Laying	Blue grass	40 yds.
June 6	BWT	5	Laying	Blue grass	40 yds.
	BWT	-	Destroyed	Blue grass	45 yds.
Myre Slough	BWT	-	Destroyed	Blue grass	50 yds.
June 12, 13, 14	BWT	3	Laying	Blue grass	70 yds.
	BWT	9	Early Incubat.	Blue grass	50 yds.
	BWT	5	Laying	Slough grass	30 yds
	BWT	-	Destroyed	Blue grass	40 yds.
	BWT	-	Destroyed	Blue grass	50 yds.
	BWT	-	Destroyed	Blue grass	50 yds.
	BWT	11	Incubating	Clover	150 yds.
	BWT	3	Laying	Clover	200 yds.
	BWT	9	Incubating	Blue grass	30 yds.
	BWT	10	Incubating	Blue grass	100 yds.
	BWT	11	Early Incubat.	Blue grass	15 yds.
	BWT	-	Destroyed	Blue grass	40 yds.
	BWT	12	Early Incubat.	Blue grass	20 yds.
	BWT	2	Laying	Blue grass	100 yds.
	BWT	5	Laying	Blue grass	50 yds.
	BWT	9	Early Incubat.	Blue grass	20 yds.
	BWT	8	Laying	Blue grass	110 yds.
	BWT	8	Laying	Alfalfa	70 yds.

Table 2 continued

Area & Date	Species	No. Eggs	State of Nest	Vegetative Type	Distance From Water
Myre Slough	BWT	6	Laying	Alfalfa	130 yds.
	BWT	-	Destroyed	Blue grass	50 yds.
	BWT	-	Destroyed	Blue grass	55 yds.
	Mallard	-	Destroyed	Blue grass	50 yds
	Mallard	-	Not Located*	Oat field	190 yds.
Ventura Marsh	BWT	11	Incubating	Alfalfa	175 yds.
June 9	BWT	9	Early Incubat.	Alfalfa grass	80 yds.
	BWT	7	Incubating	Blue grass	20 yds.
	Mallard	10	Incubating	Alfalfa	180 yds.
Jemmerson Slough June 22	BWT	-	Destroyed	Alfalfa & grass & weeds	100 yds.
Blue Wing Marsh June 23	Gadwall	1	Laying	Alfalfa & grass	150 yds.
Barringer Slough June 23	BWT	-	Destroyed	Grass hummocks	40 yds.
	BWT	-	Destroyed	Alfalfa & Grass	250 yds.
	BWT	10	Early Incubat.	Alfalfa	250 yds.
	Mallard	9	Incubating	Grass	150 yds.

* Dog flushed hen - nest not located.

MISSOURI RIVER OX-BOW LAKE FISHERY
PART 3: CRAPPIE

Bill Welker
Fisheries Biologist

The Iowa Conservation Commission; Nebraska Game, Forestation and Parks Commission; and United States Fish and Wildlife Service conducted an investigation of the fishery in five Missouri River ox-bow lakes in 1963 and 1964 This paper presents data collected from crappie caught during the surveys.

Surface area of the five lakes ranges between 200 and 900 acres. Three of the lakes (Omadi, Snyder, and Lower Decatur) open into the Missouri River at their lower ends. Upper Decatur was separated from the river by a rock and wooden pile levee prior to 1963; however, during 1963 a small opening was made in the levee to allow boats access from the river to the lake. The other lake (Desoto) is completely separated from the river by earth levees.

Although rough fish numerically dominate the fish populations in all lakes, crappie are the most abundant game fish in each area. A previous Biology Quarterly Report (Vol. 16, No. 1) describes the over-all fishery in these lakes.

The surveys were conducted in Desoto in late May both years; other lakes were surveyed between mid-July and mid-August both years.

ABUNDANCE

Moyle and Lound (1960) described a statistical method that could be used to measure the relative abundance of a given species in different lakes. Briefly, the method involved computing confidence intervals around the median in a series of net catches. This method was applied to the data collected in each lake during 1963 and 1964 (Table 1).

Table 1. Total crappie caught in 8 trap nets and range in number of fish around median catch at 93% confidence limits in five Missouri River ox-bow lakes during 1963 and 1964.

	1963			1964		
	Total caught	Range		Total caught	Range	
Desoto[1]	1122	67	225	2750	213	444
Upper Decatur[1]	260	12	44	63	4	11
Snyder[2]	17	0	5	23	1	3
Lower Decatur[2]	40	0	10	120	6	22
Omadi[2]	15	1	5	57	2	10

1. Lakes which are closed to the river.
2. Lakes which are open to the river.

As an example, the range in 1963 for Desoto is 67 to 225 crappie. This means that we are 93% confident the true median catch of crappie in a series of 8 trap nets would vary between 67 and 225 fish. If ranges from different lakes do not over-lap, this indicates population abundance is significantly different in each lake. Since the ranges in 1963 for the two lakes separated from the river do not over-lap the ranges from the lakes that are open to the river, we can assume that crappie were more abundant in those lakes closed to the river. Furthermore, crappie were more abundant in Desoto than in any other lake.

In 1964 crappie were again most abundant in Desoto. However, there was no significant difference in abundance of crappie at Upper Decatur and two of the lakes open to the river (Lower Decatur and Omadi). The remaining lake (Snyder) had the lowest abundance of any lake.

It appears, therefore, crappie may be more abundant in at least some of the lakes separated from the river than in those lakes open to the river. Availability of food does not appear to be a factor since forage has been abundant in all lakes. Population density of other species may affect crappie abundance.

AGE AND GROWTH

Although age groups between 0 and 5 years were collected from most lakes, few fish over three years old were caught in any lake.

There is evidence the growth rate of crappie in the lakes separated from the river is slower than in the lakes open to the river (Table 2). Although sample size was generally small, mean total lengths from three year classes caught in 1964 were smallest in the two lakes closed to the river. Since there is evidence crappie may be more abundant in the lakes closed to the river, this greater population density may have hendered the growth rate.

Table 2. Mean total lengths of sample from three year classes of crappie caught in 1964.

Lake	1961 year class		1962 year class		1963 year class	
	Number	Mean total length	Number	Mean total length	Number	Mean total length
Desoto[1]	14	7.2	7	6.7	10	4.8
Upper Decatur[1]	18	9.0	14	6.8	7	5.2
Snyder[2]			3	10.8	12	7.8
Lower Decatur[2]	2	11.4	11	7.6	2	5.7
Omadi[2]	2	10.6	18	8.7	17	6.9

1. Lakes which are closed to the river.
2. Lakes which are open to the river.

Another age and growth study of crappie in Upper Decatur during 1962 was reported in a previous Biology Quarterly Report (Vol. 15, No. 1). In general, growth was similar to that found during the 1963 and 1964 surveys. Mean total lengths for crappie between the first and fifthe year of life was 2.3, 5.3, 7.9, 10.6, and 11.2 inches, respectively.

REPRODUCTION

Reproduction was evident in all lakes except Desoto. Desoto was surveyed too early in the year (May) to sample young-of-the-year crappie. However, it is assumed reproduction occurred since considerably more crappie were caught in Desoto than in any other lake.

A very large year class was produced in Omadi in 1963. This year class did not appear significantly larger than usual during the 1964 survey. No explanation is offered concerning this apparent reduction in a large year class.

SUMMARY

1. Crappie populations in five Missouri River ox-bow lakes were surveyed in 1963 and 1964 by the Iowa Conservation Commission; Nebraska Game Forestation and Parks Commission; and United States Fish and Wildlife Service.

2. Crappie were statistically more abundant in the lakes separated from the river than in those lakes open to the river at their lower end.

3. There was evidence growth was slower in lakes separated from the river than those open to the river. Population density may be a factor affecting this slow growth.

4. Reproduction was evident in all lakes.

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CLEAR LAKE CREEL CENSUS, 1966

Robert Hollingsworth
Fisheries Biologist

Clear Lake, located in Cerro Gordo County, is Iowa's third largest natural lake. Its surface area is 3,642 acres and maximum deth about 20 feet. The bottom is roughly saucer-shaped and only 15 per cent of the lake exceeding 15 feet in depth (Bailey and Harrison, 1945).

A comprehensive creel census described by Rose (1956) has been used on Clear Lake since 1958. The census is conducted annually from May 1 through September 30. Fishing during the remainder of the year is unimportant.

CREEL CENSUS RESULTS

Bullheads were the most frequently caught fish. They replaced yellow bass which dominated the catch from 1961 through 1965 (Hollingsworth, 1966; Jennings, 1965; Moen, 1962). The estimated 76,913 bullheads caught represents 54 per cent of the total harvest (Table 1). The bullhead population has been increasing since 1960. The 1966 catch is the highest to date.

Crappies ranked second in abundance comprising 29 per cent of the total estimated harvest. The 41,273 crappies creeled averaged 0.37 pounds, a significant increase over the 0.29 pound 1965 average (Hollingsworth, 1966). Table 1 indicates good early crappie fishing that slowed as the summer progressed.

Walleye was the third most abundant species creeled. The best walleye fishing occurred in June when nearly 65 per cent of the total 7,991 were caught. The average weight of these fish dropped from 1.68 in 1965 to 0.93 in 1966 (Hollingsworth, op. cit.).

From 1961 through 1965, Clear Lake fishermen creeled more yellow bass than any other species. An estimated 98,516 yellow bass representing 44.9 per cent of the total catch were taken in 1965 (op. cit.). Fish kills caused by high infestations of Bacterium salmonicida occurred in the spring and fall of 1965. Yellow bass were affected almost exclusively and a large segment of the population died. Effects of the kills were apparent in 1966 when an estimated 7,301 yellow bass were creeled. This reduction of 92.6 per cent over the 1965 catch caused yellow bass to drop to fourth place in abundance in the creel. It also reduced the total estimated harvest from 214,544 fish in 1965 to 143,114 in 1966.

The yellow perch harvest became significant in 1966 when an estimated 3,535 were caught ranking them fifth in abundance. Low numbers of perch were present in the creel prior to 1966. They composed less than one per cent of the total harvest in 1965 compared to 2 per cent in 1966.

Bluegills, pumpkinseeds, and sunfish combined ranked sixth in abundance. June was the best fishing for these species. An estimated 3,498 panfish were creeled.

Table 1. Total harvest of fish, as determined by comprehensive creel census methods, from Clear Lake during the open water fishing period of May through September, 1966

Species	May	June	July	August	Sept.	Total	% Total	Total Weight	Average Weight
Bullhead	16,504	35,631	19,488	2,478	2,812	76,913	54	21,535	0.28
Crappie	11,019	26,452	3,334	163	305	41,273	29	15,271	0.37
Walleye	1,474	5,193	741	449	134	7,991	6	7,432	0.93
Yellow Bass	688	1,562	531	147	4,373	7,301	5	1,752	0.24
Yellow Perch	105	1,345	499	689	897	3,535	2	601	0.17
Bluegills	271	1,483	1,173	296	275	3,498	2	933	0.27
Northern Pike	855	332	26	31	78	1,322	1	2,234	1.69
Carp	18	457			19	494	T	4,031	8.16
Largemouth Bass	80	275	36	13	7	411	T	621	1.51
Channel Catfish	9	37	178	61	26	311	T	1,110	3.57
White Bass		38		5	22	65	T	22	0.34
Totals	31,023	72,805	26,006	4,332	8,948	143,114	99+T	55,542	
Total Angler Trips	13,435	17,829	10,691	5,126	3,660	50,741			
Total Hours Fished	33,564	45,643	25,211	11,481	8,489	124,388			
Fish Per Man	2.31	4.08	2.43	0.85	2.44	2.82			
Fish Per Hour	0.92	1.60	1.03	0.38	1.05	1.15			
Number Contacts	1,121	1,106	826	663	526	4,242			
% Fishermen Contacted	8.34	6.20	7.73	10.90	14.54	8.36			

The Clear Lake northern pike catch has been subject to wide fluctuation in recent years. The 1,322 northerns caught in 1966 represents poor fishing success. Over 64 per cent of them were taken in May.

The remaining species censused comprised less than 1 per cent of the total catch. They were carp, largemouth bass, channel catfish and white bass. Of these, only catfish have been significant in the harvest recently. In 1965, 1,868 catfish were creeled compared to 311 in 1966.

By weight, relative abundance of each species in the creel for bullheads, crappies, and walleye was 38.8, 27.5 and 13.4 per cent, respectively. Carp comprised 7.2 per cent and northern pike 4 per cent of the total. The remaining species made up 9.1 per cent of the weight.

Clear Lake fishermen caught 1.15 fish per hour in 1966 compared to 1.64 in 1965. Fish per hour rate varied from 1.60 in June to 0.38 in August. Fishermen averaged 2.82 fish per fishing trip. This was down from 5.42 per trip in 1965. The lower fish per hour and fish per trip rates in 1966 reflect the importance of yellow bass in the 1965 census. In some years yellow bass comprised over 50 per cent of the estimated total catch (Moen, op. cit.).

Fishermen made an estimated 13.9 fishing trips and fished 34.2 hours per surface acre on Clear Lake in 1966. The fishery yielded 39.3 fish weighing 15.2 pounds per acre to this effort.

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CREEL CENSUS RESULTS OF FOUR NATURAL IOWA LAKES - 1966-67

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The 1966-67 creel census marked the 22nd consecutive year creel data have been collected from Spirit Lake. Collection and expansion of creel information have been thoroughly explained by Rose in previous Quarterly Biology Reports. Spirit Lake was censused for 10 months extending from May through February. A limited amount of fishing occurs during March and April but pressure is too light to warrant a full-time census. To conform with past reports, the data are divided into open water fishing - May through November - and winter fishing - December through February.

Open Water Fishing, 1966. During this period bullheads continued as in former years to dominate the catch, making up 77% of the estimated harvest (Table 1). Yellow perch, walleyes, and bluegill comprised 10, 8, and 3% of the harvest respectively. These species together composed 98% of the total harvest. Seven other species made up the remaining 2%. Only 10 channel catfish were caught, but their presence is noteworthy since this is the third consecutive year they have appeared in the catch following 5 years of intensive fingerling stocking.

The 260,805 estimated total harvest of fish represents a 73% increase over the open water take of 1965. Yellow perch increased 3-fold during 1966. Numerically, bullheads had the greatest increase in 1966. The estimated walleye catch increased over 6,000 fish from 1965.

When listed by weight, bullheads, walleye, yellow perch, and crappie comprised 59, 21, 10, and 3% of the harvest, respectively.

Catch rate was good during open water fishing, averaging 1.87 fish-per-hour. July produced the highest catch rate, 2.71 fish-per-hour. November was lowest, with only 0.56 fish-per-hour being caught.

Winter Fishing, 1966-67. Yellow perch and walleye made up 82 and 15% of the winter fishing catch, respectively (Table 2). This is approximately 10 trips and 29 hours per surface acre. Forty-nine fish weighing a total of 27 pounds were harvested per acre.

WEST OKOBOJI

The census on this 3,788 acre lake extended from May through February. A limited amount of fishing also occurs during March and April. Data are divided into open water and winter periods. The open water census encompassed May through November; the winter period extended from December through February.

Open Water Fishing, 1966. Yellow perch dominated the catch, comprising 66% of the total harvest (Table 3). Bullhead, bluegill, and crappie followed in importance, making up 17, 10, and 4%. Six species combined to make up the remaining 3%.

Fishing for all species except crappie was considerably below 1965. Bullheads declined approximately 43,000 fish. Fishing was unproductive during the early part of the season. Catch

Table 1. Total estimated harvest of fish from Spirit Lake, May through November, 1966

Species	May	June	July	August	Sept.	Oct.	Nov.	Total	% Total	Fish
Bluegill	265	1,197	4,545	1,126	508	-	-	7,641	3	0.47
Crappie	1,309	228	42	20	19	-	-	1,618	1	0.79
Walleye	5,539	8,378	2,606	840	3,066	1,429	15	21,873	8	1.38
White Bass	221	184	162	-	102	-	-	669	T*	2.14
N. Pike	198	275	78	66	95	178	-	890	T	2.44
Bullhead	38,978	44,809	55,742	41,636	16,997	1,212	29	199,403	77	0.41
LM. Bass	-	133	254	28	11	-	-	426	T	2.27
SM. Bass	37	53	-	50	11	29	-	180	T	1.59
Sheepshead	12	281	302	155	158	-	-	908	T	1.69
Perch	37	1,784	5,425	8,444	6,073	4,935	408	27,187	10	0.55
Catfish	-	-	-	10	-	-	-	10	T	4.50
TOTALS	46,596	57,322	69,156	52,375	27,040	7,783	535	260,805	99	0.53
Total Angler Trips	9,662	11,413	8,206	9,205	6,504	2,612	422	48,024		
Total Hours	24,372	34,367	25,401	24,822	20,316	8,898	946	139,212		
Fish per Trip	4.82	5.02	8.43	5.69	4.16	2.98	1.26	5.41		
Fish per Hours	1.91	1.67	2.71	2.11	1.33	0.87	0.56	1.87		

* Less than 1%

Table 2. Total estimated harvest of fish from Spirit Lake, December through February, 1966-67

Species	December	January	February	Total	% Total	Ave. Wt. per fish (lbs.)
Crappie	-	-	4	4	T*	1.00
Walleye	1,056	938	699	2,693	15	1.62
N. Pike	95	161	107	363	2	2.09
Bullhead	14	-	-	14	T	0.50
Sm. Bass	-	25	56	81	T	2.49
Perch	9,710	3,882	1,252	14,844	82	0.59
TOTALS	10,875	5,006	2,118	17,999	99	0.78
Total Angler Trips	3,382	3,366	1,218	7,966		
Total Hours	11,467	11,484	4,507	27,458		
Fish per Trip	3.22	1.48	1.47	2.26		
Fish per Hour	0.95	0.44	0.47	0.67		

* Less than 1 per cent

success was below 1.0 fish per hour for June, July and August.

Winter Fishing, 1966-67. Yellow perch were the most abundant fish caught during winter. They contributed 89% of the estimated harvest (Table 4). Bluegill comprised 8% of the catch. Walleye, crappie, smallmouth bass, northern pike, and largemouth bass made up the remainder.

The yellow perch harvest of 177,035 fish is the largest estimated catch on record. There are several factors which contributed to the high catch. Increasing daily catch limits from 15 to 25 would increase total catch. Monthly catch rates ranged between 3.32 and 1.44 fish-per-hour. Also, the number of anglers was the largest ever recorded.

Fishermen averaged 14 angling trips totaling 42 hours for each surface acre in West Okoboji, Total harvest was approximately 91 fish weighing a total of 35 pounds per acre.

EAST OKOBOJI

East Okoboji, has a surface area of 1,875 acres. A creel census during open water program is not new to East Okoboji since one type or another has been in operation annually since 1945. The comprehensive census has been in operation since 1957. There is no census on this lake during the winter.

Open Water Fishing, 1966. Bullheads dominated the catch, contributing 86% of the total estimated harvest (Table 5). Yellow perch (9%) and bluegill 2% ranked second and third in abundance. Eight other species accounted for the remaining fish harvested.

During 1966 the estimated catch of channel catfish was the highest on record for this lake. This is the fourth consecutive year estimated catch of channel catfish has increased. These increases are attributed to four consecutive years of sub-adult stocking from 1962 through 1965 (Hollingsworth, 1966).

Fishing in East Okoboji was fair. The estimated total harvest by species other than catfish was considerably below 1965 estimates. Catch rate varied between 2.55 and 1.74 fish-per-hour. Mean catch success for more than 20,000 anglers trips was 2.16 trips per hour. East Okoboji sustained a yield of 62 fish weighing a total of 27 pounds fish per acre.

CENTER LAKE

Center Lake is a small natural lake of 264 surface acres. A complete eradication of the fish population was achieved with toxaphene in 1958. (Moen, 1962). The lake was restocked with largemouth bass, bluegill, crappie, yellow bullheads and northern pike. Due to slow growth, bluegill and crappie did not become desirable to the angler until late 1962. The comprehensive census was not employed until 1963.

Bluegill were the most abundant fish, accounting for 73% of the estimated harvest (Table 6). This was followed in importance by crappie (18%) and bullhead (7%). Largemouth bass, northern pike, and yellow perch accounted for the remaining 2%.

Table 3. Total estimated harvest of fish from West Okoboji, May through November, 1966

Species	May	June	July	August	Sept.	Oct.	Nov.	Total	% Total	Ave. wt. per fish (lb)
Bluegill	804	1,590	2,474	3,944	3,782	645	-	13,239	10	0.29
Crappie	3,701	169	-	294	1,286	975	-	6,375	4	0.32
Walleye	154	270	167	194	132	980	190	2,087	1	2.64
White Bass	-	-	29	-	31	38	-	98	T*	1.84
N. Pike	210	156	122	227	97	81	11	904	T	2.62
Bullhead	7,753	8,056	4,822	1,912	996	66	175	23,780	17	0.44
Lm. Bass	1,209	500	49	37	-	-	-	1,795	1	2.10
Sm. Bass	38	-	8	115	88	43	6	298	T	1.80
Perch	238	59	1,811	4,615	22,483	42,773	22,680	94,660	66	0.32
Catfish	-	7	62	-	-	-	-	69	T	1.87
TOTALS	14,108	10,807	9,544	11,338	28,845	45,601	23,062	143,305	99	0.41
Total angler trips	5,154	4,659	4,150	4,644	3,436	4,046	2,603	28,692		
Total Hours	10,895	11,337	9,652	11,630	9,978	12,116	7,773	73,381		
Fish per trip	2.74	2.32	2.30	2.44	8.39	11.27	8.86	4.99		
Fish per Hour	1.29	0.95	0.99	0.97	2.89	3.76	2.96	1.95		

* Less than 1%

Table 4. Total estimated harvest of fish from West Okoboji, December through February, 1966-67

Species	December	January	February	Totals	% of Total	Avg. Wt. per fish (lbs)
Bluegill	1,302	14,847	741	16,890	8	0.36
Crappie	92	1,337	-	1,429	T*	0.43
Walleye	573	1,867	118	2,558	2	2.06
N. Pike	108	208	16	332	T	4.01
Lm. Bass	24	27	-	51	T	1.98
Sm. Bass	-	526	16	542	T	3.30
Perch	90,814	77,003	19,118	177,935	89	0.33
TOTALS	92,913	95,815	20,009	199,737	99	0.37
Total Angler Trips	8,644	13,273	4,009	25,926		
Total Hours	27,709	42,610	13,868	84,187		
Fish per Trip	10.75	7.22	4.99	7.66		
Fish per Hour	3.32	2.25	1.44	2.37		

* Less than 1 per cent

Table 5. Total estimated harvest of fish from East Okoboji Lake, May through September, 1966

Species	May	June	July	August	Sept.	Total	% of Total	Avg. Wt. per fish (lbs.)
Bluegill	-	603	159	598	1,442	2,802	2	0.35
Crappie	-	331	90	29	119	569	T*	0.38
Walleye	627	209	17	13	35	901	1	0.90
White Bass	53	25	10	-	-	88	T	0.91
N. Pike	147	28	-	-	32	207	T	2.80
Bullhead	25,581	20,821	10,809	23,904	19,042	100,157	86	0.42
Lm. Bass	-	-	-	10	-	10	T	4.00
Sm. Bass	10	-	-	-	54	64	T	0.72
Perch	-	66	95	3,967	6,432	10,560	9	0.32
Catfish	9	28	191	532	178	938	1	1.47
Buffalo	42	-	-	-	-	42	T	7.95
TOTALS	26,469	22,111	11,371	29,053	27,334	116,338	99	0.43
Total angler trips	5,481	4,799	2,671	4,620	3,276	20,847		
Total Hours	11,610	12,694	6,482	12,462	10,722	53,970		
Fish Per Trip	4.83	4.61	4.26	6.29	8.34	5.58		
Fish Per Hour	2.28	1.74	1.75	2.33	2.55	2.16		

* Less than 1%

There was a decline in fishing pressure in 1966 due to lower catch success. Fish were harvested at a rate of 2.19 fish per hour.

During the 1966 census, Center Lake sustained an average fishing pressure of 98 trips providing 238 hours of fishing recreation per acre. Nearly 521 fish weighing a total of 194 pounds were estimated to have been harvested per acre.

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Table 6. Total estimated harvest of fish from Center Lake, May through September 1966

Species	May	June	July	August	Sept.	Total	% of Total	Avg. Wt. per fish (lbs.)
Bluegill	22,293	34,597	31,774	7,761	4,617	101,042	73	0.33
Crappie	5,918	6,132	5,947	4,300	3,203	25,500	18	0.43
Bullhead	1,572	4,085	2,921	1,303	46	9,927	7	0.46
Lm. Bass	-	167	198	103	154	622	1	1.73
No. Pike	86	101	54	-	46	287	T*	3.79
Perch	-	43	-	-	-	43	T	0.30
TOTALS	29,869	45,125	40,894	13,467	8,066	137,421	99	0.37
Total Angler Trips	5,842	6,152	5,484	5,477	2,849	25,804		
Total Hours	13,134	15,870	14,230	12,964	6,597	62,795		
Fish per Trips	5.00	7.17	7.46	2.46	2.83	5.33		
Fish per Hour	2.28	2.84	2.87	1.04	1.22	2.19		

* Less than 1%

PROGRESS REPORT: RESULTS OF A TROUT FISHERMAN CREEL CENSUS AND QUESTIONNAIRE FOR JUNE 1966

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The Iowa trout program is maintained completely by periodic stocking of catchable size trout. In order to set a basis for future production and distribution, knowledge of fishery pressure and harvest is desirable.

Prior to 1967 data was provided by Conservation Officers. This census provided information from a minimum number of fishermen. The census was discontinued in 1967 and a new creel census was begun by the Biology Section.

The new census included questions on the number of hours fished, number of fish caught, distance traveled, number of fishing trips up to the time of contact, estimated number of trips per year, number of years the fisherman has fished for trout in Iowa, favorite streams, whether or not the fisherman fished during December through March, type of gear used, bait preference, species of trout preferred, estimated number of trout caught to the time of contact, whether or not the fisherman knew when the stream was stocked last, place of trout stamp purchase, day of the week preferred, and whether or not the trip involved overnight lodging. (Figure 1). In addition each fisherman contacted was asked if he would answer a questionnaire mailed to him later in the year. This questionnaire will give a more complete picture of the annual harvest. The results presented here are for the month of June and will give an indication of that segment of the year.

The census was conducted in Clayton, Delaware, and Fayette counties including Richmond Springs, Klienlein, Glovers, Elk, and Grannis creeks. One hundred and three trout anglers were contacted. The following data reflects the results of these interviews.

RESULTS

Forty-two per cent of the anglers contacted fished for trout in Iowa for a period of 2-5 years. Twenty-six per cent had fished ten years or over, 16 per cent had fished only one year, and 16 per cent had fished 6-9 years.

Gear preference was divided evenly between spinning, fly, and spin casting with about one-third preferring each. Bait was dominated by use of natural bait. Nearly 70 per cent of the fishermen used either worms or salmon eggs. Ten per cent of the fishermen used artificial lures only. The remaining 20 per cent used both natural and artificial baits.

Fishermen reported taking 787 trips this year with an estimated total of 2,079 by the end of 1967. This indicates an average of 20 trips per fisherman per year. The average trip was 63 miles from the place of residence. Thirty-eight per cent of the fishermen traveled 51-75 miles, 25 per cent less than 25 miles, 19 per cent over 76 miles, and 18 per cent 26-50 miles. Almost one out of four fishing trips was made in conjunction with overnight camping.

One hundred and four fishing trips were recorded during the priod. Fishermen fished 207 hours and caught 164 trout. This is at a rate of 0.79 fish per hour. Composition of the catch was 98 brown, 52 rainbow, and 14 brook trout.

Fishermen did not indicate any species preference. Most fishermen were satisfied catching a trout. Thirty-five reported fishing during the winter months of December through March. Thirty-nine of the 103 fishermen (38%) did know when the stream was stocked last. Favorite streams varied and not always the same stream at which the contact was made. Day of the week preferred to fish usually varied according to individual work schedules. Place of trout stamp purchase was most often in the home town of the individual.

SUMMARY

1. Fifty-two per cent of the fishermen had fished for trout in Iowa 5 years or less.
2. Equal numbers of fishermen used spinning, fly, and pincasting gear.
3. Natural bait was preferred by a majority of fishermen.
4. The average trip taken was 63 miles. One trip out of four involved overnight stays.
5. One out of three fishermen reported fishing during the winter months.
6. During June the catch rate was 0.79 fish per hour based on 103 fishermen contacted.
7. Fishermen did not indicate any preference for one species of trout.

TROUT FISHERMAN QUESTIONNAIRE

Stream_____ Date_____

Name_____ Address (town)_____

Dist. Traveled (miles)_____ Hrs. Fished_____ No. Fish caught B.____ Br.____ RB____

No. Trips this year todate_____ Est. No. Trips per year_____

How many years have you fished for trout in Iowa?_____

List favorite trout streams in order of preference:

1. 4.
2. 5.
3. 6.

Do you fish trout during the winter: Dec. - March?_____

Type of gear used_____

Bait preference_____

What species of trout do you prefer?_____

Est. No. trout caught to date this year?_____

Do you know when this stream was last stocked?_____

Where did you purchase your trout stamp? (town)_____

Which day of the week do you prefer to fish?_____

Does this trip involve over-night?_____ If so: are you camping?_____

Staying at Commercial lodging?_____ or with friends?_____

Would you answer a questionnaire if mailed to you at a later date?_____.

ESTIMATES OF THE CHANNEL CATFISH POPULATIONS IN CORALVILLE RESERVOIR

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Exploratory investigations have been conducted on the channel catfish populations of Coralville Reservoir to establish the status of this species in terms of commercial exploitation. Part of this investigation has dealt with determining absolute numbers in the population.

METHODS

Population estimates were determined in two arbitrarily designated areas; the pool area which has water characteristic of lake and headwaters area which can be classified as a river.

Schnabel estimate of population density made on both areas. Marked fish were distinguished by clipping the right pelvic fin in the pool and the left fin in the headwaters. Fishing was done throughout representative areas of the reservoir, but concentrated effort was expended in prime habitat.

POPULATION ESTIMATES

Pool. Between June 8 and October 7, 895 fish had been captured, 752 of which were marked and released. Eighteen were recaptures giving an estimate of 37,391 (limits of 95% confidence - 25,420 to 70,490). This figure is representative of estimates previous to this date (Table I). In this period 9 age groups were found ranging from 7.25 to 21.50 inches (Figure 1).

Table 1. Population estimates for channel catfish in Coralville Reservoir for various bi-weekly periods

Period	Pool	Headwaters	Combined
June 18-July 1	37,730		37,730
July 2-July 15	32,903		39,903
July 16-July 29	35,494		35,494
July 30-Aug. 12	36,327		36,327
Aug. 13-Aug. 26	37,293		37,293
Aug. 27-Sept. 9	37,475		37,475
Sept. 10-Sept. 23	38,177		38,177
Sept. 24-Oct. 7	37,391		37,391
Oct. 8-Oct. 21	80,489	120,360	200,849

Table 1. Continued

Period	Pool	Headwaters	Combined
Oct. 22-Nov. 4	97,234	77,465	174,699
Nov. 5-Nov. 19	108,399	87,921	196,320

After October 7, a substantial shift to younger age groups was evident (Figures 1 and 2). Subsequently, more fish were caught and recaptured of the smaller size and the population estimate became larger. By November 19 the estimate had increased to 108,399 (limits of 95% confidence - 89,000 to 138,700).

During the spawning season both ripe females and bait were used to attract other fish into the traps and bait nets. It would seem from the shift in age distribution in the later part of the year the use of ripe females was more important than bait in determining age distribution of the catch during the spawning season. After July 15, fewer fish were caught, marked or recaptured, therefore, the estimates prior to October 7 are probably more representative of the spawning population. The estimates following October 7 would be a combination of the spawning and non-spawning populations. The accuracy of these estimates may be biased by the introduction of a different segment into the population.

Headwaters. Recaptures were not taken in the headwaters until October 10. Fishing pressure prior to this date was relatively light because of undesirable fishing conditions and to maximize the use of the pool area for intensive fishing.

During the period, October 8 through November 19, 94.5 percent of the fish were captured During this time the population estimates varied greatly. On November 19 the population estimate was 87,921 (limits of 95% confidence - 71,750 to 113,200). Six groups were present ranging in size from 6.8 to 19.3 inches.

MOVEMENT

Eleven fish marked in the headwaters were recaptured in the pool and 10 fish marked in the pool were recaptured in the headwaters. The minimum distance traveled by each of these migrants was 10 miles and a maximum distance of 18 miles. These migrants accounted for 13.4 per cent of the recaptures.

A dam on the upper end of the study area prevents marked fish from escaping upstream and the reservoir dam at the lower end of the study area was a barrier for unmarked fish entering the study area. Two sources of possible error (unmarked fish entering the upper study area and marked fish leaving the lower study area) did exist. It was assumed that fish leaving the area would be proportionate to the ratio of marked to unmarked in the reservoir. Dilution of marked fish from migrants into the upper area was considered negligible.

CONCLUSIONS

1. An estimate of 37,391 was determined for the spawning population in the pool. An estimate of 108,399 was determined for a combination of spawners and non-spawners.

2. For the headwaters area an estimate of 87,921 is considered to be the non-spawning and a minor part of the spawning population.

3. Recaptured fish moved a minimum of 10 and a maximum of 18 miles throughout the study area.

This paper contribution of Project 4-11-R-1, U.S. Fish and Wildlife, Bureau of Commercial Fisheries and Iowa Conservation Commission cooperating.

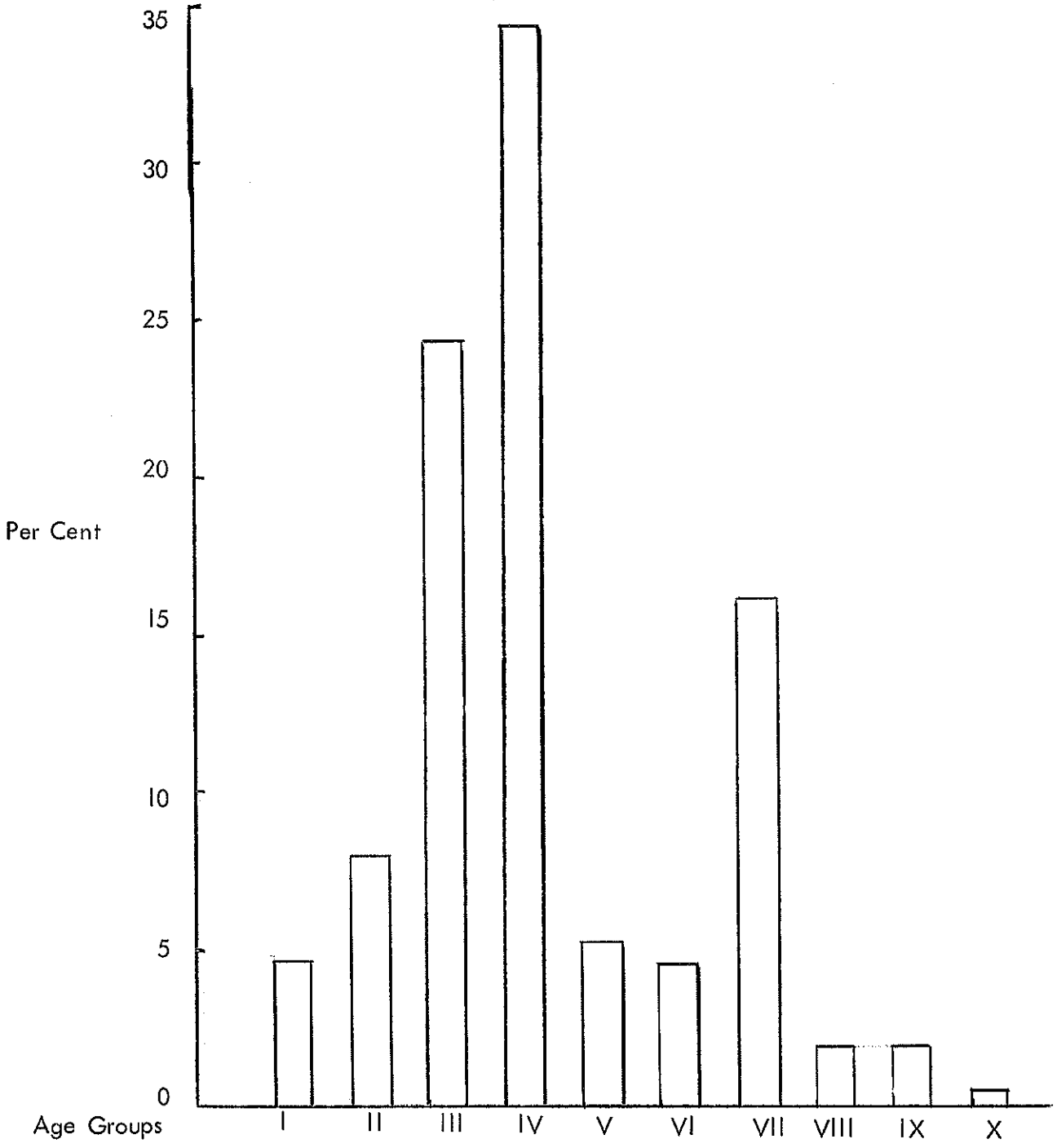

Figure 1. Age distribution of channel catfish in the pool area of the Coralville Reservoir from June 18 to October 7.

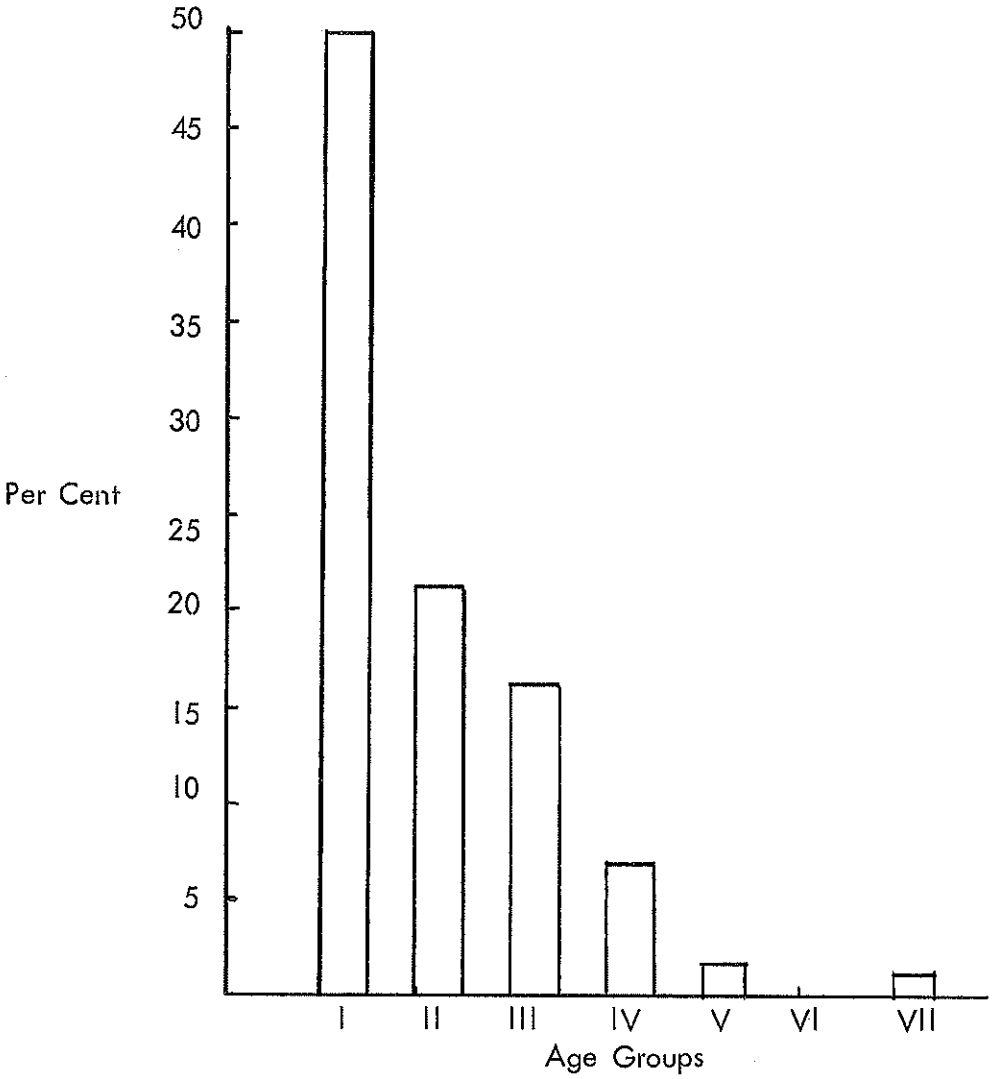

Figure 2. Age distribution of channel catfish in the pool area of Coralville Reservoir From October 8 to November 19

EXPERIMENTAL USE OF ANTIMYCIN A TO CONTROL SPAWNING CARP IN BACKBONE LAKE

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Antimycin A is a recently discovered fish toxicant having several unique characteristics. Most of its uses in fish management are not duplicated by other toxicants. This report is concerned with the experimental use of Antimycin A to selectively control spawning carp. It is the first time Antimycin A has been used in this manner.

The procedure was to apply a high concentration of the toxicant to areas heavily used by spawning carp. The toxicant has no taste or odor, nor does it repel carp. They willingly go into the treated areas, spawn and leave without being aware the chemical is present. Exposure would be sufficient to caude eventual death to adults. Since shallow areas used by carp for spawning are not frequented by large numbers of other species, the kill would consist mostly of carp.

DESCRIPTION OF STUDY AREA

Backbone Lake, a 125 acre lake in Delaware County was chosen for the experiment It was originally formed in 1935 by the construction of a dam on the Maquoketa River. Average discharge is about 50 c.f.s. Sedimentation has reduced its volume considerably. Maximum depth is 12 feet but averages less than 7 feet. The lake has a stunted crappie population and heavy populations of carp and white suckers.

APPLICATION AND RESULTS

On June 6, 1967, Fintrol-5 (commercial sand formulation of Antimycin A) was applied to 4 areas of Backbone Lake. These were used heavily by spawning carp. Application was made at a rate of 50 p.p.b. active ingredient. This concentration would be lethal to adult carp after 30 minutes exposure.

Prior to treatment all experimental areas were staked off with 4 foot wood laths. The toxicant was evenly spread with a cyclone seeder modified by the addition of a battery powered motor on the fan of the unit.

Several passes were made through each area with each pass parallel to the proceeding. Each pass was marked with wood laths while en route to prevent overlap. Distribution of the toxicant was made between 5:00 and 6:00 p.m.

Area No. 1 was the largest segment treated. It consisted of 5 surface acres in an isolated cove in the upper portion of the lake. Approximately one-half of the area contained sparse wood cover of the genus Potamogeton. Carp used the bay extensively. Diffusion of the chemical from this area was expected to be quite slow, so the concentration of toxicant remained high for a considerable period.

Area No. 2 consisted of a small circular shaped bay covering approximately 1/4 surface acre. It also contained some vegetation , and anticipated diffusion of the chemical from the area was at a moderate rate.

Area No. 3 was a 600 foot strip of shallow shore line. There was a 50 foot wide band of heavy vegetative cover extending its entire length. Antimycin was applied throughout the weeded area (an estimated 3/4 acre). Due to its openness to the lake, toxicity of this area was of short duration.

Area No. 4 was located at the south eand of the lake between the swimming beach and spillway. It consisted of a 1 acre mud flat with moderate weed cover. Dilution of the toxicant below lethal dosage was probably moderate to rapid due to wind action.

The first post treatment observation was made at 8:30 p.m., 3 hours after the treatment. The sky was clear and wind was calm. Carp spawning activity was evident in all areas.

June 7, it rained 2 inches from 2:00 to 3:00 a.m.. At 6:30 a.m. some spawning activity was evident, but no fish were observed in distress. At 11:00 a.m. five carp were observed in distress. The affected fish were swimming aimlessly on the surface without sense of awareness. The weather remained inclimate all day and the lake level raised 3 inches.

On June 8, 2 days after treatment, 15 dead carp were floating. On June 9, 1,200 lb. of bloated carp were picked up. During the following 3 days, another 1,000 lb. were picked up Total mortality was about 2,200 pounds.

Accidental mortality of other species was quite limited. Eight largemouth bass from 4 to 6 pounds and a small number of crappie and bluegill were observed. An accurate count of the smaller fish was not made due to their advanced stage of decomposition at the time of pick up.

DISCUSSION

The experiment was a success in that fish did go into the treated areas to spawn and subsequently died from it. However, the number killed in this experiment was far short of the number necessary for population control. This shortcoming can be blamed partly on the foul weather following application These conditions were not the best for maximum spawning activity.

It is difficult to treat all areas that carp find suitable for spawning. Some will be found spawning at nearly any given location during the course of the spawning season.

Repeated treatments would be necessary due to the length of the spawning period compared to the length of time Antimycin A remains toxic.