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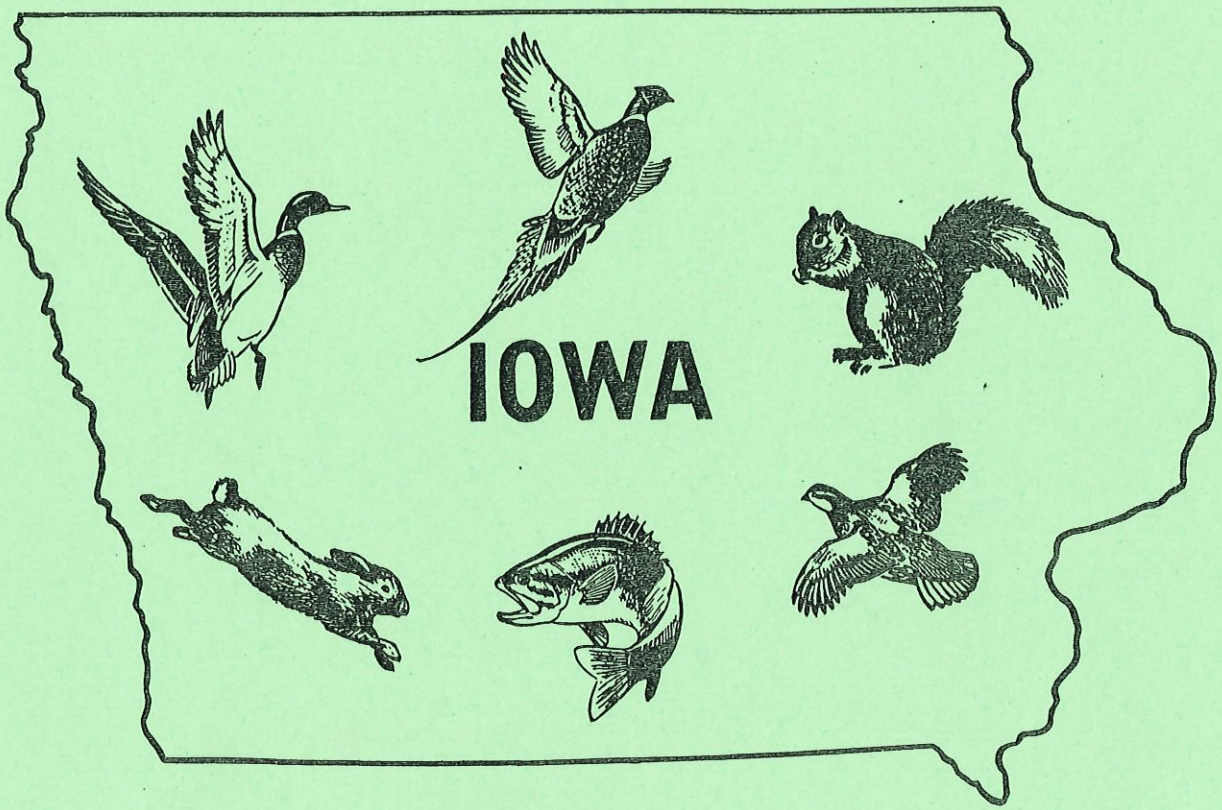
QUARTERLY BIOLOGY REPORTS



QUARTERLY BIOLOGY REPORTS
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Submitted by
Biology Section

Harry M. Harrison
Superintendent

Eugene D. Klonglan
Assistant Superintendent

James K. Mayhew
Assistant Superintendent

State Conservation Commission
E. B. Speaker, Director

Fish and Game Division
Earl T. Rose, Chief

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GAME PAPERS

IOWA'S LATE SUMMER PHEASANT POPULATION - 1967

Richard C. Nomsen
Game Biologist

The August roadside pheasant count is the primary source of information on the status of the pre-hunting season pheasant population. Wintering conditions were relatively mild, but drastic weather changes occurred during the spring and disrupted nesting activity. Observers recorded 9,056 pheasants at the average rate of 1.66 birds per mile - a decrease of 14 per cent from the 1966 statewide count. Counts were 25 per cent lower in the northwest half of the state and were the same or higher in the southeast half of the range. Results of the various indices showed a below normal rate of production in 1967. Highest populations were recorded in southwest Iowa and areas of east central Iowa.

IOWA QUAIL POPULATIONS, 1967

M. E. Stempel
Game Biologist

Winter and spring 1967 quail counts indicated more brood stock than a year ago. July counts of calling quail also indicated more breeding quail than in 1966. A count by rural mail carriers in late July also indicated an increase in quail compared to their 1966 counts. Combined results from the July rabbit, July quail and August pheasant roadside counts showed quail numbers are comparable to those of 1966. It is thus concluded that numbers of quail are near those of last year, and the 1967-68 hunting success should be similar to that for 1966-67. A good quail season is in prospect.

RESULTS OF 1967 RABBIT SURVEYS

M. E. Stempel
Game Biologist

The July roadside rabbit survey for 1967 indicates a high rabbit population and good prospects for the current hunting season. The 6.11 rabbits per 10 miles is well above the long-term average of 5.04, being exceeded only three times in the past 17 years (1958-6.86, 1959-6.33, 1964-6.69). Highest populations by far, as usual, are to be found in southern Iowa. A mild

FISHERIES ABSTRACTS

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Jim Mayhew
Fisheries Biologist

Don Kline
Fisheries Biologist

During investigations of commercial fish species in 1967, 17,401 fish weighing 7,648.1 pounds were captured. Channel catfish comprised 87 per cent of the total catch. Carp and carpsucker followed in numerical abundance. Approximately 15 per cent of the channel catfish population was exploited in a mock commercial fishery. These fish were transported to nearby recreational lakes. All carp, carpsucker, buffalo and flathead catfish were also removed from the study area. Catch success varied from 4.4 to 42.9 fish per net day in 7 bi-weekly periods. Exploitation and effort had no effect on catch success.

CORALVILLE RESERVOIR AND LAKE MACBRIDE CREEL CENSUS - 1967

Larry R. Mitzner
Fisheries Biologist

Creel data were collected from May 1 to September 14, 1967 on the Coralville-MacBride complex. From expanded data 41,678 anglers traveled 469,789 miles and caught 60,669 fish after fishing 76,816 hours. Their success averaged 0.79 fish per man hour. Bullhead, crappie, channel catfish and carp were the most preferred and caught species.

PROGRESS REPORT ON THE 1967 MISSISSIPPI RIVER CHANNEL CATFISH STUDIES

Don Helms
Fisheries Biologist

Samples of small channel catfish were netted in the Mississippi River in 1967. Special attention was devoted to 4 pools. Although spines samples have not been aged, length-frequency data indicates a strong 1965 year-class in most pools. Maximum growth was observ-

NOTES ON SMALLMOUTH BASS REPRODUCTION IN NORTHEAST IOWA - 1967

Robert Schacht
Fisheries Biologist

A survey of smallmouth bass reproduction was made in several selected streams in northeast Iowa. Ten streams in five counties were surveyed. These included the Volga River, Little Turkey River, and Brush Creek in Fayette County; Bear Creek, Pine Creek, and Lime Creek in Buchanan County; Buffalo Creek and Coffin Creek in Delaware County; Silver Creek in Jones County; and Roberts Creek in Clayton County. Nest counts were made on six of the streams in May and all were seined for fingerlings during the last week of July and all of August.

IOWA'S LATE SUMMER PHEASANT POPULATION - 1967

Richard C. Nomsen
Game Biologist

INTRODUCTION

The roadside pheasant count made in August is the primary source of information on the status of the pre-hunting season pheasant population. There were 182 routes checked by Conservation Officers, Unit Game Managers, and Biologists in 1967.

Additional information is obtained from counts made by rural mail carriers during a one-week period late in July. Pheasant broods are also counted along rabbit and quail routes during July. Preliminary indications of reproductive success are obtained from these July counts.

The winter of 1966-1967 was marked by frequent weather changes which included tornadoes and ice storms. Although several blizzard-like storms caused some pheasant mortality in Northern Iowa, pheasants in most regions of the state experienced a relatively mild winter.

Drastic weather changes occurred during the spring of 1967 and were unfavorable for nesting activity. Weather conditions during early April were excellent and very favorable for early start of nesting activity. Temperatures dropped sharply near the end of April and early May. Temperatures averaged 12 degrees below normal during the first week of May with freezing temperatures reported throughout the northwest two-thirds of the state on May 9th. June was the second wettest in 95 years and heavy rains were common over much of the pheasant range.

RESULTS AND DISCUSSION

Birds per mile

There were 9,056 pheasants sighted on the 182 routes (5,460 miles) censused, for an average of 1.66 birds per mile (Table 1). This count represents a 14 per cent decrease from the 1.92 birds per mile reported in 1966, and was equal to the results of the 1965 survey.

Regional figures varied considerably from the northwest to the southeast region. Counts were 25 per cent lower in the northwest half of the state and were the same or higher in the southeast half of the range. Highest pheasant populations this fall will be found in the southwest region and in areas of east central Iowa.

Broods per 30 - mile count

Table 3. Data from 1967 August roadside pheasant count

Region of State	No. of Cocks	No. of Hens	Sex Ratio Index M:F	Hens Without Brood	Hens With Brood	% Hens With Brood	No. of Chicks	No. You Per
Northwest	172	155	1:0.9	65	90	58.1%	516	3.
North Central	240	332	1:1.4	166	166	50.0%	1002	3.
Southwest	175	332	1:1.9	133	199	59.9%	1242	3.
Central	247	373	1:1.5	167	206	55.2%	1225	3.
East	173	306	1:1.8	116	190	62.1%	1164	3.
South	174	236	1:1.4	84	152	64.4%	992	4.
STATEWIDE	1,181	1,734	1:1.5	731	1,003	57.8%	6,141	3.

There were 1,734 hens sighted and 1,003 (57.8%) were with broods (Table 3). This is somewhat below the average for the previous 5 years of 67.9 per cent of hens with brood. The per cent of hens with brood was highest in the eastern and southern regions and lowest in north central Iowa. Nesting activity was apparently disrupted over all of Iowa's pheasant range this year as indicated by these figures. Normally, about 70 per cent of the hens are with broods at this time. Renesting is quite important during years of unfavorable spring hatching seasons. Very young broods were being reported in late August and early September as a result of renesting attempts. These reports are more frequent following unfavorable spring weather conditions.

Average Brood Size

The statewide average brood size for 1967 was 5.5 chicks per brood (Table 3). This was also below the 5.8 average last year and the previous 5-year average of 6.0 chicks per brood.

Young per Hen

The statewide young per hen index for 1967 was 3.5 (Table 3). This figure indicated a lower rate of reproductive success this year - it was 4.5 young per hen in 1966.

Production was best in the southeast portion of Iowa's pheasant range this year.

Hatching Date Distribution

The peak hatching period occurred during the first 10 days of June followed very closely by the mid-June period. Although the peak appeared to be earlier this year, almost 21 per cent were hatched in July compared to 13 per cent in 1966. There also appeared to be a dip in the hatching curve during the mid-June period in northwest and north central Iowa.

Rural Mail Carrier Counts

Iowa rural mail carriers made their annual count during the week of July 24 - 29. According to this survey, the rate of pheasant reproduction was below normal in 1967. They reported 37 per cent of the hens with broods compared to 45 per cent in 1966 Surveys made in July tend to be less reliable during a late hatching season.

Table 5. Statewide results of rural mail carriers July pheasant counts, 1962-1967

Year	Young per Hen	Average Brood Size	% of Hens with Broods

Table 6. Pheasant broods observed on 1967 mid-July rabbit roadside survey and quail whistling cou

Region of State	Rabbit Survey			Quail Survey			Combined	
	No. Miles	No. Broods	Broods per 100 Miles	No. Miles	No. Broods	Broods per 100 Miles	No. Miles	No. Broods
Northwest	390	7	1.8	138	7	5.1	528	14
North Central	450	20	4.4	151	12	7.9	601	32
Southwest	360	13	3.6	113	5	4.4	473	18
Central	450	18	4.0	195	6	3.1	645	24
East	600	30	5.0	246	4	1.6	846	34
South	630	18	2.9	240	9	3.7	870	27
STATEWIDE	2,880	106	3.7	1,083	43	4.0	3,963	149

IOWA QUAIL POPULATIONS, 1967

M. E. Stempel
Game Biologist

The July count of whistling cock quail is the primary means of determining breeding quail populations. A resume of this procedure is given in the 1963 July-September Quarterly Biology Reports. The method as used in Iowa is based on 95 ten-stop routes distributed throughout the state.

Additional information used in calculating the prospective fall population is obtained each year from other game surveys on which quail are recorded. These censuses are taken from April through August. In late July, rural mail carriers also count quail, together with other small game species, during a single week. Information from all these counts gives a fairly complete picture of post-winter survival summer adult populations, and of the production up to late summer.

Favorable weather preceeding pairing and nesting is necessary so that breeding quail will be in prime condition. In this respect, in the primary quail territory the 1966-67 winter had no excessive snowfall, though January had some of the coldest days in recent years. This was followed by a very warm period. Spring quail populations were higher than in recent years. February and March were mostly dry. February produced some brief blizzards, but there were also some pleasant days. In April there were storms, while May began as cool and dry, but ended with rain; The rain continued into June which was one of the wettest ever recorded in Iowa. The balance of summer brought drouth-like conditions, but there was some moisture throughout the period; and this was favorable to production of quail. (The above weather information for dates concerned is from Iowa Climatological Data and Iowa Weekly Weather and Crop Reports).

The censusing system was essentially the same as described in the Quarterly Biology Reports for July-September 1964, and, as indicated there, the changeover to uniform ten-stop routes was completed in 1965.

RESULTS

Whistling Quail Census: Statewide

This July count measures annual variations in the number of Iowa breeding quail (Table 1). The 1967 count was made on 95 routes. On the total of 950 stops, 1,615 cocks were heard calling. This [illegible]

On August Roadside Pheasant Count - A late summer roadside pheasant count is made in August, with quail sighted also being counted. Along 5,490 miles of route, 386 quail were seen. This was an average of 7.03 per 100 miles, which is less than the 8.86 for 1966 (Table 4). but it is greater than the count for 1965. Of the six districts, there was increase in the northwest, and slightly fewer numbers elsewhere. Only the southern portion has significant numbers of quail sighted during any recent year.

On Calling Quail Surveys - Records are also kept of quail seen on whistling quail routes. In 1967, 70 quail were seen along routes comprising 950 miles or 7.37 per 100 miles (or more correctly per 100 listening stops since some stops are more than one mile apart). (Table 5). In 1966, 92 quail were seen along routes having 940 stops, or 9.79 quail per 100 miles. In 1965, 42 quail were seen along routes having 1,047 stops, or 4.01 per 100 stops.

DISCUSSION

In April and in May, the first count is made of the adult quail which eventually produce the new coveys. This is done in conjunction with the spring pheasant survey, and this year it indicated that more quail survived the 1966-67 winter than had survived the 1965-66 winter. Next to be taken is the whistling cock quail count in early July, and this count also indicated an increase. On this same census, 84 cooperators said they thought there were as many or more quail as in 1966, while only six thought there were fewer. The latter were in marginal quail range. The June, July and August calling quail counts were made this year on the Wapello and Decatur-Wayne Research sites; another similar count was made in Story County. Those formerly repeated in other counties were discontinued. On the Research sites we now have 2 year's data, and the 1967 record shows more calling cocks than in 1966; furthermore there were more calling over a comparatively long period (May through August) and this indicates extensive production. Early July quail counts along rabbit survey routes indicated good production. About the same number of young quail coveys was seen in 1966, 1965 and 1964. The number of these is always small, and none were seen in 1967.

Because of the relatively small number of quail sighted on the quail, rabbit and pheasant surveys made during the summer by Commission personnel, it is likely a better idea of the overall quail picture can be obtained by combining the data from these three counts. When this was done, it was found that 6.67 quail were seen per 100 miles in 1967 as compared to 8.38 in 1966, 5.68 in 1965 and 4.84 in 1964 (Table 6). It may be that dry weather caused a reduction in the number seen in 1967 (since it would not be necessary for birds to seek the roads to find a dry place). An 8 per cent increase was shown by the rural mail carrier's July survey. It must be remembered that those counts made in July are actually not sampling the entire years production, since the hatching season is not yet over at the time. Many of the bird

Table 3. Quail observed on the July rabbit count Iowa, 1967

Region of state	No. Rtes.	No. Miles	No. quail seen	quail seen per 100 miles	1966 no. per 100 miles	Per cent change from 1966
N.W.	13	390	0	0.00	0.00	0
N.C.	15	450	0	0.00	0.00	0
C.	16	480	10	2.08	1.19	+ 75
E.	20	600	30	5.00	8.17	- 39
S.W.	12	360	23	6.39	3.61	+ 77
S.C. & S.E.	21	630	105	16.67	20.83	- 20
STATEWIDE	97	2,910	168	5.77	6.88	- 16

Table 4. Quail sighted on the August pheasant count, Iowa, 1967

Region of state	No. routes	No. miles driven	No. quail seen	No. quail seen / 100 miles	1966 no. quail seen /100 miles	Per cent change from 1966
N.W.	27	810	18	2.22	0.67	+ 231
N.C.	25	750	0	0.00	0.00	0
C.	34	1,020	8	0.78	9.17	- 92
E.	34	1,020	64	6.27	1.41	+ 345
S.W.	22	660	24	3.64	4.40	- 17
S.C. & S.E.	41	1,230	272	22.11	25.40	- 13
STATEWIDE	183	5,490	386	7.03	8.86	- 21

RESULTS OF 1967 RABBIT SURVEYS

M. E. Stempel
Game Biologist

INTRODUCTION

The annual July rabbit roadside counts were continued in 1967. This survey has been conducted with slight modifications every summer beginning in 1950. It is made from July 10 to 20 by Conservation Officer, Biology and Game Section personnel. In 1967 they drove predetermined 30-mile routes on gravelled roads. Participants drive 20 to 25 miles per hour, starting at sunrise, and record all rabbits sighted along the routes. The July counts were developed for use in surveying cottontail populations. However, starting in 1958, jackrabbits were counted as well.

The age of rabbits was recorded as adult or juvenile to obtain age ratios and for computation of the fall population index. Numbers of quail, Hungarian partridge, and pheasant broods sighted during each survey were also recorded. These data are given to the Biologists responsible for these species for evaluation. Similar data on cottontails and jackrabbits taken in conjunction with quail and pheasant surveys are reported in this paper.

RESULTS

Ninety-seven routes totaling 2,910 miles were surveyed. This is a slight decrease in miles due to a change to a newly standardized length of 30 miles per route (had varied from about 25 to 40 miles before). In all, 1,778 cottontails were seen for an index of 6.11 per 10 miles (Table 1). Cottontails were most abundant in the southern Loess area, where they have traditionally been most abundant (Table 2). Populations of cottontails in other areas ran, in ascending order, as follows; Eastern, Northern Glaciated, Western Loess. The order of relative abundance was similar to the 17-year average for the four areas (Table 2).

The statewide index indicates populations may have increased very slightly from 1966 though the difference between 6.11 and 6.07 per 10 miles would not be significant. The highest populations within the past 17 years were in 1958 (6.86) with the low in 1953 (3.31); the indices have been above 6.0 only six times - including the last 4 years. Average index for the 18 years including 1967 is 4.99 cottontails per 10 miles of route. There were increases over 1966 in the western part of the state, with some decrease elsewhere. In all regions the 1967 figures were higher than was the 18-year average.

Twenty-seven jackrabbits were counted during the surveys, the same number as in 1966.

Table 1. Results of July rabbit survey for Iowa 1967

Area	No. of Routes	Total Miles	Cottontails observed	Jackrabbits observed	Cottontails per 10 miles	Jackrabbits per 10 miles
Northern glaciated	44	1,320	523	24	3.96	0.18
Western Loess	12	360	312	2	8.67	0.06
Southern Loess	26	780	769	1	9.86	0.01
Eastern	15	450	174	0	3.87	0.00
STATEWIDE	97	2,910	1,778	27	6.11	0.09

Table 2. Comparison of July roadside rabbit surveys for years 1950 through 1967. Cottontails observed per 10 miles

Year	Western Loess	Northern Glaciated	Southern Loess	Eastern	STATEWIDE
1950	4.75	3.87	6.83	2.22	4.29
1951	6.69	3.37	5.68	2.13	3.92
1952	6.74	3.70	6.14	1.78	4.18
1953	4.26	2.70	4.23	3.33	3.31
1954	3.90	2.97	4.55	2.36	3.35
1955	3.55	4.60	6.03	5.31	4.96
1956	3.51	3.06	5.99	4.44	4.07
1957	4.72	3.32	7.59	4.79	4.87
1958	8.76	4.68	12.95	4.65	6.86
1959	7.92	4.36	10.46	4.66	6.33
1960	5.07	4.62	5.41	1.80	4.56
1961	6.12	4.25	6.58	2.19	4.79
1962	3.53	2.94	6.67	1.80	3.88

Table 5. Rabbits sighted on quail whistling survey, July 1967

Area	Number miles	Cottontails observed	Jacks seen	Cottontails per 10 miles	1966 index	Jacks per 10 miles
Northern glaciated	420	255	6	6.07	4.48	0.14
Western loess	120	112	0	9.33	8.09	0.00
Southern loess	250	293	0	11.72	10.67	0.00
Eastern	160	70	0	4.38	3.99	0.00
STATEWIDE	950	730	6	7.68	6.36	0.06

Table 6. Rabbits sighted during 1967 August roadside pheasant surveys

Area	Number miles	Cottontails observed	Jacks seen	Cottontails per 10 miles	1966 index	Jacks Per 10 miles
Northern glaciated	2,460	342	94	1.39	1.63	0.38
Western loess	720	227	25	3.15	4.17	0.35
Southern loess	1,500	787	2	5.25	9.10	0.01
Eastern	810	93	1	1.15	1.52	0.01
STATEWIDE	5,490	1,449	122	2.64	4.24	0.22

RESULTS OF A HUNTER PERFORMANCE STUDY DURING THE SPECIAL TEAL SEASON

Richard Bishop
Game Biologist

INTRODUCTION

The third year of the experimental special teal season came to an end September 24th. This special season was another attempt to further evaluate the feasibility of species management. The blue-winged teal is a species that was believed to be under-harvested for the past several years. The special teal season was designed to test the hypothesis that the blue-wing population could withstand added gunning pressure and to gain knowledge on hunter performance during a fairly simple attempt at species management.

The previous two teal seasons brought considerable condemnation of this experiment from many people. The kill of ducks other than teal was the main complaint. Hunters reported large numbers of illegal ducks killed, and they were very upset to think that they were trading good mallards, pintails and woodducks for the unwanted little teal. The scope of complaints was very large and it indicated a very large illegal kill. This would be very alarming if it were not for the fact that the State Conservation Commission had about forty trained men in the field observing hunters to determine the actual extent of the illegal shooting. These data indicated a considerable number of illegal ducks were killed, but the total number was not such as to significantly effect the population of any one species.

Even with these data at hand, many comments were made which hinted at the fact that our observations were on single parties and the parties that were observed were not the ones doing the illegal shooting. At any rate, there were a few doubts as to the validity of these observations being expanded for a given area to determine general hunter performance.

Prior to the third, and probably the final, year of the teal season, it was decided there was a need for facts that would give complete data on hunter performance on an entire area. Thus, two areas in northern Iowa were set up to gather this information. Dan Green Slough near Ruthven in Clay County and Harmon Lake in Winnebago County were the two areas that were chosen. Dan Green Slough is a relatively long, open prairie marsh comprising about 310 acres of water. Harmon Lake encompasses 483 acres of which about 220 acres are in water in the form of 3 main relatively open pools and 3 potholes ringed with vegetation.

PROCEDURE

The two projects were set up slightly different. On Dan Green Slough three men checked

Table 1. Results of teal season hunter performance study on Dan Greene Slough

9-16-67	
No. Hunters checked	64
No. birds observed killed	183
No. birds checked	186
175 bwt. 9 gwt. 2 sh.	
No. hours hunted	117
9-17-67	
No. hunters checked	39
No. birds observed killed	52
No. birds checked	47
40 bwt. 7 gwt.	
No. hours hunted	$76\frac{1}{2}$
9-18-67	
No. crippled teal found	28
25 bwt. 3 gwt.	
No. dead teal found	19
17 bwt. 2 gwt.	
All 3 days	
No. illegal birds found	13
1 pintail, 5 mallards, 2 shovelers & 5 coot	
Sex and age of 173 blue-winged teal:	
28 A M 23 A F 65 I M 57 I F	
Sex and age of 15 green-winged teal:	
3 A M 2 A F 4 I M 6 I F	

Table 3. Teal season hunter performance study on Harmon Lake

9-16-67	A.M.	P.M.
No. Parties Checked	40	11
No. Hunters Checked	97	32
No. Birds Killed	141	62
Species of Teal	106 bwt 35 gwt	52 bwt 9 gwt
No. illegal birds observed shot (1 shoveler, 2 ruddy ducks, 2 mallards, 1 pintail, 1 wood duck)	7	
No. illegal birds found (1 mallard, 6 coot, 1 shoveler)	8	
Crippled teal found	14 bwt	
Crippled teal reported	15	

9-17-67	A.M.	P.M.
No. Parties Checked	17	6
No. Hunters Checked	35	15
No. Birds killed	19	8
Species of teal	13 bwt 6 gwt	7 bwt 1 gwt
No. of illegal birds observed shot (1 mallard, 1 pintail)	2	
No. of illegal birds found (1 coot, 1 mallard - mallard was one observed on 9-16-67)	2	
Crippled teal found	3 bwt	
Crippled teal reported	8	

Table 4. Spy blind observations on Harmon Lake

9-16-67

AM.		Entire hunt	Partial observations	Totals
No. parties present	40			40
No. hunters present	97			97
No. hunters under observation		24	8	32
No. hunter hours under observation		25	12	37
Total hunter hours on the marsh	168			168
No. teal bagged		31	4	35
No. teal lost		10	1	11
No. illegal ducks killed		1	3	4
No. times illegal ducks were shot at		5	5	10
No. times big ducks were passed up		15	3	18
No. shots fired at teal		184	24	208
No. shots fired at illegal ducks		9	10	19

P.M.		Entire hunt	Partial observations	Totals
No. parties present	11			11
No. hunters present	32			32
No. hunters under observation		14	10	24
No. hunter hours under observation		$18\frac{1}{2}$	$9\frac{1}{2}$	28
Total hunter hours on the marsh	56			56
No. teal bagged		8	11	19
No. teal lost		3	4	7
No. illegal ducks were shot at		5	3	8
No. times big ducks were passed up		3	3	6
No. shots fired at teal		109	68	177
No. shots fired at illegal ducks		6	5	11
No. illegal ducks killed		0	0	0

plenty of water. The lack of water concentrated the ducks and likewise the hunters, which made the job of observing hunters much easier. The one adverse condition caused by low water was a reduced kill of teal. Hunters did not have nearly as successful a hunt as they did a year ago. The teal did not fly back and forth from pool to pool as they have done in the past, but apparently pulled out to other water areas. Very few limits were checked this year compared to a majority of hunters having their limits checked on opening weekend in 1966.

Harmon Lake had considerable numbers of ducks other than teal on opening day of the teal season - approximately 125 mallards, 300 pintails, 150 widgeon, 30 woodducks, and about 900 teal. Big ducks were readily available; however, due to their nature, they usually flew high and stayed out of gun range after the shooting started. This fact lessened the potential of the illegal kill.

The data from the two areas closely parallel each other and it indicates that the illegal kill is not as large as some have been led to believe. The illegal kill usually appears greater to the casual observer than it actually is. The project did produce some interesting information on hunter success, crippling loss and duck hunters' ability. A more complete evaluation of the entire picture will be made when the statewide information becomes available.

SIGNIFICANCE AND VALIDITY OF BIOLOGICAL DATA FOR DETERMINING EXPLOITATION LEVELS OF DEER POPULATIONS

Keith D. Larson
Game Biologist

Field collections of biological data during deer hunting seasons have routinely been performed in Iowa since 1953, the beginning of recent deer hunting in Iowa in this century. Masses of data have been collected also via the hunters mandatory deer report card. In recent years, a random postcard survey of hunters also included deer. These surveys in total have produced a tremendous volume of data.

Some of the data that has resulted has questionable validity and may lack accurate relationship to the true situation. Interpretations of such data can be difficult.

The mandatory deer hunt report from participating deer hunters provides some data that is available in no other way. The total kill, county of kill, and zone of kill are the significant parts of this report. From this information comes the needed determinations which reveal hunter success and hunter distribution and pressure by area.

The primary concern in biology is to determine the extent of harvest for each management unit. The hunter success in each management unit is the key information for this determination obtainable from this survey and available presently only from this survey.

The random postcard survey of hunters has provided data that is widely divergent from that of the special deer hunter report cards, (Larson, 1967c), and therefore is largely invalid without adjustment. There is only a suggestion from this survey that the harvest taken by unlicensed but legal farmers hunting on their own land may be larger than estimates indicate. More accurate information will become available under the new law requiring farmers to have a license. It would be pointed out that this survey was designed specifically for small game, and not deer, hence the sample size is too small to give valid results.

One of the most direct means of determining extent of harvest is to measure the cumulative effect of known annual kills on the age structure of the population. This data is obtained by the field examination of enough deer killed during the season to adequately represent the composition of the kill. Principal information obtained is the age, and sex, of deer awaiting processing in locker plants. (see Larson, 1967d, for age data, 1953-66). The location of kill is verified with the deer hunter report. This sample may only represent the age structure of the kill and not necessarily that of the population. Actually, the degree that it represents

Management relies heavily on the technique of aging deer by determining wear and replacement of cheek teeth. This technique is highly valid for fawns and 1 1/2-year olds. The age of these classes is determined by the presence and replacement times of certain deciduous teeth. The standards of the technique for determining wear have not been varified for Iowa conditions and thus the precise age of deer 2 1/2 and older cannot be determined with great accuracy. Current research has been directed toward comparing two existing techniques developed for conditions in New York State (Severinghaus, 1951) and in Michigan (Ryel, et al, 1961). A study of their application in Iowa must be inaugurated as current interpretations based on the older age classes do not have a good foundation in fact.

The final proof for determining level of exploitation is available only through accurate census. With deer, this is a difficult task. Complete census of perscribed areas is essential to support other indices to population levels and to support the more abstract methods described previously. The ultimate goal of biological data collection is to determine accurately the degree of resource utilization.

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THE EFFECT OF SAMPLE SIZE IN POSTAL CARD SURVEYS OF DEER HUNTERS, 1964-1966

Keith Larson
Game Biologist

INTRODUCTION

A random survey of Iowa hunters has been made annually since 1963. Deer were not included in the 1963 - 1964 survey but were reported on in each subsequent year. The methods used in this survey were described by Kline (1965). Approximately 2% of Iowa hunters were asked to report results of hunting various species following the close of seasons.

Deer hunters are also required by law to return a special Deer Hunter Report card within 3 days following the close of the deer season. This is essentially a 100% sample survey. There are available, then, hunting statistics from two surveys of extreme variation in sample size. This report presents the results of these two surveys for the deer seasons of 1964 through 1966, inclusive. Deer were included on the random survey specifically to gain further insight into the possible biases that exist in this type of survey. It was realized that sample sizes that might be adequate for small game would be inadequate for deer.

RESULTS AND DISCUSSION

The comparisons of the results of the two surveys for shotgun deer hunters are presented in Table 1 for bow hunting, the results are presented in Table 2. The 100% sample is listed in these tables as the Special Report and the 2% sample as the Random Survey. For purposes of interpreting results, the 100% sample will be considered to reflect the true situation. The 2% sample consistently gave total figures of much higher value than the 100% sample to a degree which discredits the survey results for deer. This was expected, based on results in other states. A set of conversion factors to correct the random survey results to a level obtained by the special report survey are presented in Table 3. This table has been prepared to show primarily the average degree of difference between the surveys.

Although some of the results show rather close agreement for some categories, the random survey results are largely invalid and the sample size is completely inadequate for bow hunting information in particular. Of the bow hunters reporting for 1965, because of the minimum participation in this sport, only 52 of 1823 returned cards indicated participation. Only four killed a deer. Shotgun deer hunting involved only 7 - 9% of total hunters. Card returns from shotgun deer hunters totaled from 200 - 250 for the three surveys, indicating a 12-14% participation. These returns are also considered inadequate due to small sample size.

Table 1. Comparison of shotgun deer hunting data from two types of postcard surveys for the three years

	Statewide Bag		No. hunting this species		% of all hunters hunting this species		Total hours hunted	
	Special Report	Random Survey	Special Report	Random Survey	Special Report	Random Survey	Special Report	Ran Sur
1964	9,025	15,480	20,000	36,000	7%	12%	276,680	594,
1965	7,880	12,059	21,500	32,106	8%	11.65%	299,515	549,
1966	10,740	16,026	24,000	38,525	9%	13.71%	336,240	617,

	Avg. Trips /Hunter/ Season		Avg. Hours/ Hunter/ Season		Avg. Hours /Hunter/ Trip		Avg. Bagged /Hunter/ Season		Avg. Bagged /Hunter/Trip		Av /H
	Special Report	Random Survey	Special Report	Random Survey	Special Report	Random Survey	Special Report	Random Survey	Special Report	Random Survey	Spe Rep
1964	2.1	2.3	13.8	16.5	6.6	6.3	0.47	0.40	0.2	0.2	0.
1965	2.9	2.5	13.9	17.1	4.7	6.8	0.39	0.38	0.1	0.15	0
1966	2.1	2.26	17.0	16.0	4.2	7.1	0.45	0.41	0.1	0.18	0.

Table 3. Conversion factors for interpretation of Random Survey Results based on results of 1964 - 1966

	Statewide Bag	No. hunting This species	% of all hunters Hunting species	Total hours Hunted	Total hunti Trips mad
Shotgun	63.5%	61.7%	64.1%	51.9%	74.1%
Bow	59.6%	53.8%	47.9%	45.0%	56.1%

	Avg. Trips /Hunter/ Season	Avg. Hours/ Hunter/ Season	Avg. Hours /Hunter/ Trip	Avg. Bagged /Hunter Season	Avg. Bagged /Hunter/Trip	Avg. B /Hunte
Shotgun	None	90.3%	77.6%	110%	74.7%	104
Bow	75.5%	82.6%	86.9%	96.9%	None	Non

DEER POPULATION LOSSES TO HIGHWAY TRAFFIC

Keith D. Larson
Game Biologist

Mortality of deer in highway traffic accidents continue to climb moderately. An increased loss of 6% was recorded for 1966. These losses exceeded 1000 deer annually in 1965 and 1966. In the last three years 4 human lives have been lost in accidents where vehicle swerved to miss deer and control of the vehicle was lost.

The importance of this problem is easily recognized. There is risk to human life. A valuable portion of a natural resource is lost as well. Deer in the wild have been valued by various states and agencies at $50 to $300 each in the economy. The loss of 1000 deer then would be a loss of 50 to 300 thousand dollars.

It has been postulated that only about half of these accidents are reported. These losses may exceed 2000 animals or as much as $600,000 in Iowa per year.

This depletion of the deer resource is particular heavy at two periods during a year. There is high loss which takes place in April and May and coincides with a period in which family groups break up when the adult does leave for fawning. The second peak occurs in late October, November and early December and coincides with the increased movement of deer of all ages during the rut or breeding season. A large proportion of adult bucks are killed on highways during this period while in the spring the adult does out number the bucks in this kill.

REVIEW OF PROBLEM

Other states with larger deer populations have been facing this problem much longer than Iowa has and have been unable to find a solution even to reduce the losses somewhat. New York state recorded 24,000 deer killed on highways in 1964. Pennsylvania was second high with 14,394, Wisconsin third with 8,017, California fourth with 7,614 and Michigan fifth with 5,979.

Thompson (1966) in a report of nationwide activity concerning this problem indicates a $33,000,000 property damage loss and a $6,000,000 loss of deer at $50 each. Iowa had one of the three human fatalities reported. Human casualty (personal injury) figures were considered very unreliable but totalled 675 nation-wide. In this report he also reviews current projects for solutions to the problem. These include: installation of reflectors (16 states), highway deer crossing signs (33 states), clearing right-of-way (17 states), fencing (7 states), game passes (7 states), controlled hunting (8 states), watering units (1 state) and speed reduction projects (4 states).

ECONOMIC CONSIDERATIONS

The 1966 Iowa traffic deer kill report indicate approximately 500 major deer crossings were involved. The average highway length of these crossings is much longer than the mirror study sites. No information is available for determinations, but the average is probably 2 to 3 times the length of the study sites. At twice the length, the cost of this type installation for materials alone would be $78,000. Installation costs would exceed material costs quite possible and maintenance costs necessary to keep effective and neat could be accomplished by existing personnel as part of regular duties. Great costs in time of these personnel would be necessary. Thus, if such installations would prove feasible, initial cost of approximately $150,000 minimum would be required. No research results to date indicate conclusively that these devices are functional. Thus this magnitude of expense is unwarranted even though resource losses may be four times that figure annually at $300 a deer.

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CORALVILLE RESERVOIR AND LAKE MACBRIDE CREEL CENSUS - 1967

Larry R. Mitzner
Fisheries Biologist

This year was the fourth summer of creel census on the Coralville-MacBride complex. The first comprehensive census was conducted in 1963 by Jim Mayhew followed by Helms (1964) and Helms (1965). The continuance of this creel census is necessary to obtain fundamental information, on the sport fishery of these lakes.

Coralville Reservoir and Lake MacBride are located on the Iowa River several miles upstream from Iowa City in Johnson County. The reservoir has a maximum capacity of 475,000 acre-feet at elevation 712 m. s. l.. Minimum conservation pool has a storage capacity of 17,000 acre-feet at elevation 670 m. s. l.. During the majority of the year the elevation is maintained at 680 m. s. l. or a capacity of 53,750 acre-feet. Lake MacBride has 935 surface acres at spillway crest level.

METHODS

The program is a stratified-random design modified after the method used by Mayhew (1956) in other artificial lakes. Procedure was identical with 1963, 1964 and 1965 censuses.

The census began on May 1 and terminated September 17. Sampling was conducted on 40 of the possible 140 days. Complete censuses were made at both impoundments on alternate time periods (8 A.M. to 2 P.M. and 2 P.M to 8 P.M.) on a predetermined schedule. The census clerk interviewed all fishermen possible on the impoundment during the alloted time period and moved to the other areas regardless of the number of fishermen he failed to interview. The information obtained was; the number of people per party, hours fished, number and kind of fish caught and kept, species desired and distance travelled to the lake. On Coralville Reservoir parties were catagorized as boat, shore, and tailwater anglers. Lake MacBride parties were divided into boat and shore anglers.

These data were expanded by multiplying the sample by the ratio of all possible census time to the actual census time.

CORALVILLE RESERVOIR

Anglers use of Coralville Reservoir was 15,897 people fishing 31,808 hours; catching 17,801 fish. Shore anglers in the pool (4,830) expended 7,933 hours catching 6,706 fish. Boat fishermen caught 1,841 fish while angling 3,892 hours. The tailwaters area was more popular to

Table 2. Estimated catch and species composition of the sport fishery in Coralville Reservoir for the summer of 1967.

Species	Number of fish caught by type contact				
	Boat	Shore	Tailwaters	Combined	per cent
Bullhead	826	4158	665	5649	31.7
Carp	392	903	2884	4179	23.4
Crappie	392	1050	2121	3563	20.0
Channel catfish	140	266	1995	2401	13.5
Walleye	14	70	518	602	3.4
Buffalo	7		539	546	3.1
Northern pike	42	7	266	315	1.8
White bass		175	133	308	1.7
Largemouth bass		42	105	147	0.8
Bluegill	21	21	14	56	0.3
Green sunfish	7	7		14	0.1
Carpsucker			14	14	0.1
Sucker		7		7	--
Total	1841	6706	9254	17801	99.9

Table 3. Species preference of fishermen in Coralville Reservoir for the summer of 1967

Species	Boat	Shore	Tailwaters	Combined	Per cent
No preference	44	148	307	499	44.7
Channel catfish	17	45	182	244	21.8
Crappie	17	46	78	141	12.6
Bullhead	14	72	9	95	8.5
Walleye	2	3	48	53	4.7
Northern pike	1	1	41	43	3.9
Carp	1	3	26	30	2.7
Largemouth bass		3	4	7	0.6
White bass		2		2	0.2
Buffalo			2	2	0.2
Bluegill		1		1	0.1

Boat fishermen were more successful; 7,896 anglers fished 16,291 hours and caught 17,318 fish. Shore fishermen spent 28,711 hours angling; and caught 25,550 fish. Sixty-nine per cent of the people interviewed were shore anglers with the remaining 31 per cent fishing from boats.

Fishing success increased to a high of 1.84 fish per man hour for the period of May 29 to

Table 5. Estimated catch and species composition of the sport fishery in Lake MacBride for the summer of 1967.

Species	Number of fish caught by type contact			
	Boat	Shore	Combined	per cent
Bullhead	10,577	16,821	27,398	63.9
Crappie	3,689	6,307	9,996	23.3
Bluegill	2,702	1,561	4,263	9.9
Green sunfish	21	371	392	0.9
Walleye	147	182	329	0.8
Largemouth bass	119	126	245	0.6
Channel catfish	63	119	182	0.4
Carp		56	56	0.1
Northern pike		7	7	--
Total	17,318	25,550	42,868	99.9

Table 6. Species preference of fishermen in Lake MacBride for the summer of 1967

Species	Number of parties contacted			
	Boat	Shore	Combined	Per cent
No preference	144	406	550	35.6
Bullhead	132	413	545	35.2
Crappie	104	129	233	15.1
Largemouth bass	43	12	55	3.6
Channel catfish	8	12	20	1.3
Bluegill	58	47	105	6.8
Walleye	20	9	29	1.9
Carp	2	2	4	0.3
Green sunfish		2	2	0.1
Northern pike	2		2	0.1

Table 7. Distance traveled by anglers to fish in Coralville Reservoir for the summer of 1967

Distance (Miles)	Number of parties contacted				
	Boat	Shore	Tailwaters	Combined	Per cent
0 - 10	6	41	35	82	7.8
11 - 25	61	250	508	819	78.3
26 - 50	6	9	48	63	6.0
51 - 100	7	8	36	51	5.0
over 100	7	5	19	31	3.0

PROGRESS REPORT ON THE 1967 MISSISSIPPI RIVER CHANNEL CATFISH STUDIES

Don Helms
Fisheries Biologist

Beginning in 1960 a drastic decline was noted in the commercial fishery for channel catfish on the Mississippi River. Commercial fishing statistics show harvest in the Iowa segment of the river decreased approximately 44 per cent from 1959 to 1961. (Nord, 1967). Radical fluctuations have occurred since that time.

Studies by Schoumacher (1964 and 1965) indicated a major portion of the commercial catch is composed of age-groups III and IV. Fish over 20 inches in length contribute less than 5 per cent to the catch. With the commercial fishery depending largely on 2 age groups, year-class failures could be responsible for observed fluctuations in harvest.

Previous studies of this problem have centered around fish over the 13 inches legal length. The present phase of investigation is devoted to learning more about fish prior to reaching the legal commercial size limit. The objective of this study is to determine year-class strength, determine at what stage development of year-classes are established and relate possible causes.

METHODS

Four navigation pools were selected for intensive study. Pools 9 and 11 are located in the northern portion of the river and border Wisconsin; pools 13 and 18 in the southern portion border Illinois. Samples of channel catfish were taken in these pools during the last two weeks of each month May through October. The remaining pools were sampled during August only.

Fish were captured with $\frac{1}{2}$ and 3/4 inch mesh hoop nets and slat nets. The number of nets varied from 7 to 15. Soybean cake and cheese were used for bait. Spine samples were collected at rate of 10 per $\frac{1}{2}$ inch total length interval. Additional fish were measured to the nearest $\frac{1}{2}$ inch.

Bait nets did not effectively capture fish under 6 inches in length so supplementary seining to collect young-of-the-year fish was necessary. This was accomplished by making 20 to 25 seine hauls with a 30 foot, $\frac{1}{4}$ inch mesh drag seine at various locations in September. Seining effort was confined primarily to the sand and gravel dredge spoil deposits. The exact location of each area seined was charted on maps to facilitate comparable sampling in the future.

Table 1. Monthly length-frequency distribution of channel catfsih in pool 9 in 1967

Length	May	June	July	August	September	October
Under 6.0		1	7		1	
6.0 - 6.4	1		9	6	4	1
6.5 - 6.9	1		8	30	52	2
7.0 - 7.4	2		7	111	183	7
7.5 - 7.9	4		10	142	190	11
8.0 - 8.4	3	2	66	62	82	9
8.5 - 8.9	1	2	153	36	25	4
9.0 - 9.4		3	131	79	34	4
9.5 - 9.9		2	77	119	35	3
10.0 - 10.4		1	40	132	43	2
10.5 - 10.9		4	24	73	39	
11.0 - 11.4		2	17	34	15	
11.5 - 11.9		2	15	18	13	
12.0 - 12.4		2	12	7	4	
12.5 - 12.9		1	9	3	2	1
13.0 - 13.4		12	1	8	2	
13.5 - 13.9		5	3	7	3	
14.0 - 14.4		2	5	6	1	

Table 3. Monthly length-frequency distribution of channel catfish in pool 13 in 1967

Length	May	June	July	August	September	October
Under 6.0		4	19	1	6	18
6.0 - 6.4	2	3	1	2	3	105
6.5 - 6.9	16	20	2	2	7	238
7.0 - 7.4	23	25	10	1	19	460
7.5 - 7.9	19	23	39		12	260
8.0 - 8.4	7	8	55	2	8	81
8.5 - 8.9	7	6	49	2	9	46
9.0 - 9.4	6	6	27	13	18	65
9.5 - 9.9	2	5	21	11	22	51
10.0 - 10.4	5	3	19	10	23	31
10.5 - 10.9	5	6	27	10	12	8
11.0 - 11.4	5	4	12	11	16	8
11.5 - 11.9	12	1	14	11	16	6
12.0 - 12.4	4	4	10	6	15	3
12.5 - 12.9	7	2	6	5	13	1
13.0 - 13.4	7	2	7	5	17	1
13.5 - 13.9		1	5	7	14	1
14.0 - 14.4	1	2	1	5	17	

Table 5. Length-frequency distribution of channel catfish caught in all pools in August 1967

Length	9	10	11	12	13	14	16	17	18	19	All Pools Combined*
6.0 - 6.4	6	17	11	7	2	33			2		20.3
6.5 - 6.9	30	83	43	32	2	53			1		65.3
7.0 - 7.4	111	113	31	23	1	23				1	75.6
7.5 - 7.9	142	47	19	10		13			1		44.0
8.0 - 8.4	62	8	16	4	2	38	2		3	1	28.5
8.5 - 8.9	36	4	71	7	2	109	15	4	12		78.9
9.0 - 9.4	79	3	83	18	13	179	26	5	14	1	207.1
9.5 - 9.9	119	5	103	29	11	122	16	11	7	2	136.6
10.0 - 10.4	132	2	58	12	10	85	16	5	3	2	90.5
10.5 - 10.9	73	5	46	10	10	76	13	1		2	59.9
11.0 - 11.4	34	3	43	12	11	65	12	1	2	6	66.0
11.5 - 11.9	18	1	32	8	11	48	7	2	3	5	56.9
12.0 - 12.4	7	1	29	9	6	20	5		9	5	46.7
12.5 - 12.9	3		21	5	5	7	2		2	5	27.7
13.0 - 13.4	8	1	16	2	5	5	1		3	5	25.5
13.5 - 13.9	7		22	2	7	6			1	6	26.1
14.0 - 14.4	6	1	13	3	5	3	3		2		15.7
14.5 - 14.9	4		15	1	2	4	1		3	1	13.1

BRIEF SUMMARY OF SPIRIT LAKE CREEL CENSUS FROM 1945 TO 1966

Terry Jennings
Fisheries Biologist

Spirit Lake is located in northwestern Iowa. It is Iowa's largest natural lake having a surface area of 5,660 acres. This glacial formed lake has a maximum depth of approximately 25 feet. Spirit Lake is eutrophic and supports high populations of fish important to anglers.

Creel census was first used on the lake during May and June, 1945. From that time through 1951 only May and June were censused. Since 1951 the entire fishing season (May through February) has been censused.

There have been 3 methods used for collecting catch data from Spirit Lake. The first (1945-52) was a contact type census with certain boat liveries and other interested parties cooperating with the census clerk in collection of data. Thus, the clerk did not check all contacted anglers but relied on information supplied by others for part of the data. The second method (1953-55) was a contact type census conducted only by the census clerk. Third, a comprehensive type census has been employed from 1956 to the present time. Estimates of total harvest and fishing pressure are obtained by this method.

ANGLER HARVEST

Bullhead

Bullheads have dominated the catch of fish from Spirit Lake 18 of the 22 years. (Table 1). With the exception of 1945 when no bullheads were among 2,545 fish observed, they comprised between 54 and 87 per cent of the fish harvested. Since 1952, when the entire fishing season was censused, they have composed between 8 and 75 per cent of the harvest. During 1949, 1950, and 1951 bullhead fishing was excellent with 82,157, 84,642, and 79,068 respectively being observed. During the 11 years a comprehensive type census has been used on Spirit Lake, the total estimated bullhead catch has exceeded 79,000 six times. Upon comparison of the May and June totals for the 1957-66 period with similar totals from the 1945-51 period, bullheads were making up a greater portion of the fish creeled during the earlier period than during latter years. Rose (1951) indicates that bullhead fishing from 1946 to 1951 was excellent. He also states the walleye harvest, as well as, several other species, was quite low during most of the period. Peak harvests of bullhead has occurred every 5 to 7 years. The harvest pattern seems to be a gradual increase to a peak year followed by sharp decline in subsequent years. Average weights per fish each year indicates harvest of bullhead is greatly dependent upon large year classes. Generally, the average weight will increase steadily for about 5 years followed by a sharp drop. The average weight of the bullheads creeled between 1957 and 1966 ranged between 1.0 pounds

ANGLING PRESSURE

Rose (1953) indicates that prior to 1953 creel data contained information which was not directly observed by the census clerk. The clerk obtained creel information taken by cooperating boat liveries and other interested parties in addition to that gathered himself. For this reason the angler contacts during this period are not comparable with data collected by either of the other two census methods. Assuming data collected before 1953 is consistant with fishing pressure, indications are that pressure fluctuated widely, ranging between 9,002 and 22,171 (Table 4). The 1945 and 1952 data are not included in the above statement. Since 1945 was the first year of creel census and only 1,115 contacts were recorded, it is doubtful that sampling techniques and time spent were comparable with succeeding years. During 1952 the entire fishing season was censused.

From 1953 through 1955 a straight contact type census was employed with the census clerk observing all recorded data. During these 3 years contacts ranged between 22,228 and 32,075. The number of recorded contacts during this period indicates an abundance of fishermen on the lake.

Since 1956 angler trips represent an estimated total and are not directly comparable with previous data. However, trends would be comparable with the 1953-1955 data since both are based on similar collection techniques. Throughout this period estimated angler trips have ranged between 42,352 and 98,662.

After 1952 there has been a decided decline in time spent per fishing trip. The author can not explain the 33 per cent drop except to say that between 1945 and 1952 much creel data was collected by untrained personnel. From 1953 through 1966 the average fishing trip lasted 2.89 hours.

Recently, there has been much concern in some quarters about present and future increased fishing pressure on the lakes, rivers, and streams of the United States. As illustrated in Figure 1, in recent years there has generally been a trend toward less fishing pressure on Spirit Lake. Assuming each year from 1953 through 1955 the census clerk contacted 33 per cent of the angling trips, which undoubtedly is a very maximum figure, and expanding recorded figures by 3 times, an estimate of total trips can be made. It appears from the illustration 1960 was when the downward trend began. Assuming this to be the case, a percentage of decline can be calculated by averaging estimated total angler trips prior to and after 1960. Using this method a 30 per cent decrease in fishing pressure was noted. This figure probably is minimal since the 1953-1955 estimates were included and it is only remotely possible the census clerk contacted as many as 33 per cent of the anglers these years. There was an 18 per cent reduction in numbers of fish creeled; but, there has been a 4 per cent increase in number of fish creeled per trip in recent years. The average time spent per trip for each of these two

Table 1. Number, per cent of total, and average weight of bullheads, yellow perch, and walleye cr
Spirit Lake, 1945-1966

Year	Bullhead			Yellow Perch			Wal	
	No.	%	Avg. Wt.	No.	%	Avg. Wt.	No.	%
				Contact Type Census				
1945				614	24		70	3
1946	57,019	63		5,921	7		12,917	14
1947	41,601	67		2,019	3		7,685	12
1948	69,227	54		32,958	26		4,185	3
1949	82,157	74		3,802	3		6,023	5
1950	84,642	82		657	1		4,153	4
1951	79,068	87		1,858	2		2,291	3
1952	25,935	75		4,164	12		1,846	5
1953	30,617	42		17,828	25		15,477	21
1954	23,389	35		27,984	41		6,915	10
1955	46,925	40		42,697	36		11,489	10
				Comprehensive Type Census				
1956	91,007	54		32,037	19		33,275	20
1957	44,850	32	0.73	44,850	30	0.50	30,120	20
1958	73,092	41	0.46	64,864	31	0.54	25,113	14
1959	210,039	69	0.39	56,670	19	0.56	20,908	7
1960	315,945	71	0.53	26,231	6	0.70	42,513	10
1961	69,057	60	0.75	5,946	4	0.77	24,824	22
1962	26,643	24	1.00	44,970	43	0.68	22,142	22
1963	12,626	8	0.98	66,676	41	0.53	40,260	28
1964	92,503	52	0.29	31,547	19	0.65	29,072	16
1965	116,421	73	0.31	14,493	9	0.68	19,454	13
1966	199,417	70	0.41	42,031	15	0.56	24,566	8

Table 4. Angler trips contacted before 1956, estimated total angling trips 1956-66, hours, and time per trip for Spirit Lake, 1945-1966

Year	Angler Trips	Hours	Hours per Trip
1945	1,115	4,157	3.72
1946	20,937	66,345	3.17
1947	9,952	43,570	4.38
1948	22,171	101,382	4.57
1949	15,614	66,339	4.25
1950	9,002	42,168	4.68
1951	9,736	45,902	4.71
1952	7,541	36,267	4.81
1953	26,481	76,859	2.90
1954	22,228	58,061	2.61
1955	32,075	85,644	2.67
1956	94,230	284,387	3.02
1957	80,947	234,814	2.90
1958	64,157	195,642	3.05
1959	66,035	207,811	3.15
1960	98,662	314,950	3.19
1961	51,201	154,483	3.02
1962	52,627	138,425	2.63
1963	69,864	196,903	2.82
1964	57,550	168,131	2.92
1956	42,352	112,489	2.66
1966	55,988	166,670	2.98

MISSOURI RIVER COMMERCIAL FISHING STATISTICS: 1960 - 1966

Bill Welker
Fisheries Biologist

Each year Missouri River licensed commercial fishermen are required to report their catch. Estimates of the catch are made for three categories: nets and traps, seines and trot lines. This paper discusses the commercial fishing statistics collected during the seven year period between 1960 and 1966.

All aspects of Iowa's Missouri River commercial fishing have declined in recent years. This has been a result of the changing habitat caused by the channelization work of the United States Army Corps of Engineers (Robinson, 1963). The ultimate goal of this work is to provide a uniform river channel nine feet deep and approximately 300 feet wide between Omaha and Sioux City by 1970. At present this work is over 90 per cent completed. In addition to the uniform river channel, construction of upstream reservoirs have reduced the volume of flow during much of the year. Thus, the entire habitat has been radically altered The commercial catch of channel catfish has been probably adversely affected by this change.

Number of commercial fishermen

Two types of commercial fishing licenses issued by Iowa, owners and operators. The owners license is required by all fishermen using more than one box trap or one trot line. An operators license is required for each additional person needed by the owner to help fish his gear.

The number of owners licenses issued annually ranged between 33 and 60 with a noticeable decline after 1963 (Table I). The number of operators licenses also declined after 1963.

Table I. Total number of owners and operators commercial fishing licenses issued by Iowa between 1960 and 1966 for the Missouri River

Year	Owners Licenses		Operator's licenses	Total
	Resident	Non-resident		
1960	49	7	100	156
1961	52	8	110	170
1962	44	-	112	156
1963	54	6	111	171
1964	38	1	76	119
1965	37	-	69	106

Table 2. Total number and type of fishing gear licensed by Iowa for use in the Missouri River betwee

Year	Trot lines	Box traps	Hoop nets	Trammel nets	Gill nets	Fyke nets	Pound nets	Seines	To
1960	68	117	104	41	2	2	-	-	
1961	63	157	99	37	6	3	1	-	
1962	80	159	92	42	-	3	1	-	
1963	33	109	116	33	-	67	-	1	
1964	37	55	81	26	-	1	-	-	
1965	23	43	54	22	1	1	-	-	
1966	29	12	66	21	-	-	-	-	

NOTES ON SMALLMOUTH BASS REPRODUCTION IN NORTHEAST IOWA - 1967

Robert Schacht
Fisheries Biologist

In 1967 reproduction of smallmouth bass was surveyed in selected streams in northeast Iowa. Ten streams in five counties were surveyed. These streams were : Volga River, Little Turkey River, and Brush Creek in Fayette County; Bear Creek, Pine Creek, and Lime Creek in Buchanan County; Buffalo Creek and Coffin Creek in Delaware County; Silver Creek in Jones County; and Roberts Creek in Clayton County. The survey was completed in two phases. The first phase included a nest count on one mile of stream. At this time all brood bass observed were also counted. A second phase included sampling the fingerling population. A 500 foot segment of each stream is seined with a 14 foot x $\frac{1}{4}$ inch mesh modified bag seine in July and August. The number of fingerling smallmouth taken in seining surveys provide an index of reproductive success. Data from previous surveys are comparable because sampling and efficiency remain constant. Results of these surveys will allow management to best utilize hatchery reared smallmouth by stocking fish where they are needed the most. In years of good reproduction hatchery fish are stocked in marginal smallmouth streams. In years of below average natural reproduction, stocking is done in the better smallmouth streams.

In 1967, a cool spring delayed spawning until the middle of May. May temperatures were generally the coldest since 1954 with 4.4 °F deficient for the month. June was marked with heavy precipitation.

Monthly totals ranged from 4.09 at Cascade to 7.95 at Independence. Cleary (1953) stated that survival of smallmouth fingerlings depend on climatic and edaphic features that prevail during the post nesting period. Temperature and stream flow were very important. He found that in years in which average precipitation was less than 7.0 inches between the 15th of May and June 30th, hatching and survival were considered good. Total rainfall was over 7.0 inches at 6 of 18 weather stations in northeast Iowa during this period. However, rainfall cannot be considered entirely by itself. Years of heavy rainfall have in some instances been years of better than average reproduction.

Nest counts were made on the Volga River, Little Turkey River, Lime Creek, Bear Creek, Pine Creek, and Coffin Creek. (Table 1). First checks were made on May 8th. No nesting activity was noted at this time. Water temperature was 50 degrees. With warming water temperatures nesting activity with the peak occurring in the third week in May. Stream temperatures reached the low 60's at this time. Lime Creek, which had the highest nest count per mile, had a water temperature of 61 degrees.

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REPORT ON THE SECOND YEAR OF STUDY OF COMMERCIAL FISH SPECIES IN THE DES MOINES RIVER[1]

Jim Mayhew
Fisheries Biologist

and

Don Kline
Fisheries Biologist

Investigation into the suitability of developing a fishery with commercial or industrial value began in the Des Moines River in 1966. The first year of the project was devoted to obtaining basic knowledge of resident fish populations. Studies were completed during the initial year for species composition, age composition, growth rate, and population size (Mayhew and Mitzner, 1967). This report includes investigations during the second year of study when fish populations were exploited at a controlled rate. Preliminary studies of factors influencing catch success of channel catfish in baited hoop nets are also included in this report. Further analysis of the impact of accelerated harvest upon fish populations will subsequently follow.

Field operations began on May 19 and continued until late autumn. The year was divided into 10 bi-weekly intervals with each interval considered an independent sampling period. Netting was suspended from June 16 to July 8 because of flooding and from September 10-23 because of low flow and equipment repair. These periods were excluded from this report with the remaining periods numbered in sequence.

Baited hoop nets, slat nets and buffalo nets were used for more than 840 net days. These nets were fished in paired sets in approximately 11 miles of the study area. Nets were raised, emptied of fish, and rebaited at 24-hour intervals except on weekends during mid-summer when they were not closed. All fish caught were counted, weighed in aggregate, and transported to a central work area in aerated holding tanks aboard the workboat. All carp, carpsucker, flathead catfish and buffalo were removed from the study area. Channel catfish were scheduled for exploitation to a maximum of 20 per cent of the population estimate. Channel catfish were transported and restocked in nearby recreational lakes.

SPECIES COMPOSITION AND CATCH STATISTICS

During the year 17,401 fish weighing 7,648.1 pounds were captured (Table 1). Numeric-

Table 2. Catch of fish at bi-weekly intervals in the Des Moines River

	Period	Carp		Ch. Catfish		Fl. Catfish		Carpsucker		Others*	
		Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight
(1)	May 19 May 31-	23	41.6	958	292.0	1	.5	99	93.1	20	5.9
(2)	June 1 June 15	45	70.1	1,645	396.6	-	-	80	61.5	17	6.6
(3)	July 1 July 15	118	273.9	3,784	784.8	-	-	16	27.6	16	6.1
(4)	July 16 July 29	304	450.2	4,760	1,260.8	13	14.7	119	117.5	15	3.9
(5)	July 30 Aug. 12	304	617.2	2,525	826.9	8	11.9	265	259.0	10	7.7
(6)	Aug. 13 Aug. 26	315	657.6	720	379.4	12	18.6	172	186.3	9	11.8
(7)	Aug. 27 Sept. 9	156	322.9	737	294.6	7	15.5	121	127.4	7	4.2
	Total Catch	1,265	2,433.5	15,129	4,235.1	41	61.2	872	872.4	94	46.2
	Total Fin Clip	108	178.0	178	327.7	-	-	54	54.2	-	-
	Total Exploited	1,157	2,255.5	14,348	3,907.4	41	61.2	818	818.2	94	46.2

* Includes crappie, redhouse, bullhead, stone cat, white sucker, bluegill, largemouth bass, sheepshead and eel.

EXPLOITATION AND CATCH SUCCESS OF CHANNEL CATFISH

Estimates of the channel catfish population in 1966 revealed a density of about 102,000 fish. Originally the project specified controlled exploitation of 20 per cent of this population without regard to size or sex of fish. During 7 bi-weekly periods the rate of exploitation reached 14.9 per cent. The original figure would have easily been achieved if netting was continuous throughout the summer.

Catch success is defined as the ratio of total catch and netting effort. This ratio varied from 4.4 to 42.9 fish per net day (Table 3).

Table 3. Catch success and exploitation rate of channel catfish in the Des Moines River

Period	Total Catch	Cumulative Catch	Effort net day	Success Ratio	Exploitation Rate
(1)	958	958	114	8.4	.94
(2)	1,645	2,603	118	13.9	2.56
(3)	3,784	6,387	93	40.7	6.28
(4)	4,760	11,147	111	42.9	10.95
(5)	2,525	13,672	124	20.4	13.43
(6)	730	14,402	166	4.4	14.15
(7)	727	15,129	132	5.5	14.87

Preliminary analysis of the data indicated the selected rate of exploitation did not influence catch success. Until exploitation rate reached 10.9 per cent in period 4, catch success also increased at a rapid rate. After this period there was an abrupt 10-fold decline in catch success. Closer inspection of the data was expedient to determine if this decline was the result of exploitation

Trial plots of the variables, catch success (Y) and rate of exploitation (X), were completed for the 7 bi-weekly periods. A linear regression line was fitted to the data by the least squares equation, $Y = a + bX$, where Y is catch success, X is rate of exploitation, and a and b are constants. This relationship is best described by the equation $Y = 20.5 + 0.22\ X$ (line AB Figure 1).

Visual inspection of the plots suggested extremely high catch success values of periods (3) and (4) might have influenced this relationship to a point of positive correlation. Further regression coefficient was calculated for the data excluding these two periods. The resulting equation $Y = 9.5 + 0.11\ X$ best expressed the relationship. (Line CD, Figure 1). Differences

Table 4. Test of significance of correlation coefficients of catch success (Y) and rate of exploitation (X)

Regression Line	Number of Pairs	Degrees of Freedom	r	Conclusion of Hypothesis (P = 0)
AB (Y =20.5 + 0.22X)	14	12	0.515	rejected at the 0.05 level
CD (Y = 9.5 + 0.11X)	10	8	0.316	strongly rejected at 0.05 level

Change in netting effort is important to catch success because it is used to establish this ratio. This effect was tested by using covariance, as suggested by Snedecor (1953:150) of catch success and effort in the 7 periods. Negative values ($F = -26.05$, 10 d. f.) indicate larger values of catch success are strongly associated with smaller values of effort. The correlation coefficient of these variables ($r = 0.22$, $P < 0.05$, 10 d.f.) was strongly rejected. Increased effort did not result in higher catch success ratios. Rather for this study higher catch success was recorded with less effort.

SUMMARY

During 1967, 17,401 fish weighing 7,648.1 pounds were captured in the Des Moines River. Channel catfish was the most abundant species in the catch. Carp and carpsucker followed in numerical importance.

Approximately 14.9 per cent of the channel catfish population was exploited. All carp, buffalo, flathead catfish and carpsucker were also removed from the study area.

Catch success varied from 4.4 to 42.9 fish per net day during 7 bi-weekly periods. Exploitation and increased or decreased effort had no influence on catch success.

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NOTES ON CLEAR LAKE YELLOW BASS

Robert W. Hollingsworth
Fisheries Biologist

Clear Lake in Cerro Gordo County is a eutrophic lake of 3,643 acres. It has a maximum depth of about 20 feet, but only 15 per cent of the lake exceeds 15 feet in depth (Bailey and Harrison, 1945). It contains various types of habitat. Included are mud bottom areas supporting dense stands of bullrush, sandy areas void of vegetation, and rock and gravel reefs. This range of habitat is reflected in the varied fish population. At least 43 species inhabit the lake (op. cit.).

HISTORY OF THE YELLOW BASS IN CLEAR LAKE

Yellow bass has been one of the most important species in Clear Lake for the last 20 years. It has composed over 50 per cent of the estimated total catch in some years (Jennings, 1965). It was accidently introduced into Clear Lake with other fish stocked from the Mississippi River in the 1930's (op. cit). By 1940, the lake was well known for yellow bass fishing.

The Biology Section has conducted annual fishery surveys of Clear Lake since 1940. Survey records show yellow bass over 12 inches long were common at least until 1945. Fish to 10 inches long were taken until 1953. After that mean total length decreased until a low of 5.6 inches was reached in 1959. The lake level was severely reduced by drought this year and decline in size was accompanied by an increasing population (Table 1). The average length increased after 1959 and has been fairly stable since 1963. However, avarage condition factors declined through 1965.

YELLOW BASS MORTALITY OF 1965

The yellow bass population was high and the fish were in poor condition in 1965. Heavy mortality occurred in early summer and late autumn. Fish examined by the Fish Control Laboratory, La Crosse, Wisconsin, carried high infestations of Aeromonas salmonicida which is the causative organism of furunculosis. The effect this estimated kill of 100,000 to 300,000 fish is demonstrated by a reduction of yellow bass in the 1966 and 1967 fishery surveys. It is also illustrated by the 92.6 decline in catch of yellow bass (Table 2).

GROWTH SINCE 1965

Improved growth of the survivors often results from heavy mortality. A yellow bass kill which reduced angler harvest 90 per cent occurred in 1955 (Di Costanzo and Ridenhour, 1957).

not completed on August 21 when the sample was collected, it will probably be below that of 1966 in most age groups. Young-of-the-year taken on September 5 had a mean total length of 2.1 inches. Survey records show this to be identical to the poor early growth of the 1965 year class.

SUMMARY

1. Since introduction into Clear Lake, yellow bass have increased but average size of individuals has declined.

2. Heavy mortality caused by furunculosis sharply reduced the population in 1965.

3. Lake survey records indicate little change in growth since 1965, except the fish are in better condition.

4. Yellow bass collected to investigate post-1965 growth also showed improved body condition.

5. The body-scale relationship was found to be $L=1.55 + .049R$.

6. Average calculated lengths in inches at each annulus are 3.3, 5.0, 6.2, 6.9, 7.5, 7.7, 8.0, and 8.3 respectively.

7. The 1960 and 1961 year classes failed to form annuli in 1966.

8. The void created by 1965 mortality did not result in improved growth of the remaining yellow bass population. Young fish grew well in 1966, but the older individuals did not. Growth in 1967 will be below that of 1966 for most age groups, but fish are still in better condition than they were just prior to the kill.

Table 1. Number of adult yellow bass taken in a 500 foot survey seine, 1945-1967

Year	No. Fish Per Haul	Avg. Total Length (Inches)	Average Weight (lb.)	Average Condition Factor (C_{TL})
1945	1	10.5		
1946	1.6	10		
1947	1	11.3		
1948	5.8	8.5		
1949	3	8.5		
1950	4.5	7.0		
1951	14.3	7.5		
1952	1.3	9.0		
1953	19.6	8.4	.38	6.411
1954	3.8	8.0	.35	6.835
1955	20	8.9	.26	3.688
1956	1	8.1	.26	4.892
1957	0	---	---	-----
1958	38	6.5	.11	4.005
1959	28.5	5.6	.11	6.263
1960	21.1	6.2	.10	4.195
1961	30.5	6.0	.11	5.092
1962	5	7.0	.15	4.373
1963	27.5	7.7	.24	5.257
1964	15.1	7.8	.21	4.425
1965	30	7.6	.18	4.100
1966	.5	7.0	.19	5.539
1967	1.8	7.6	.24	5.172

Table 2. Estimated harvest of Clear Lake yellow bass for May through September, 1963-67

Year	Total Fish