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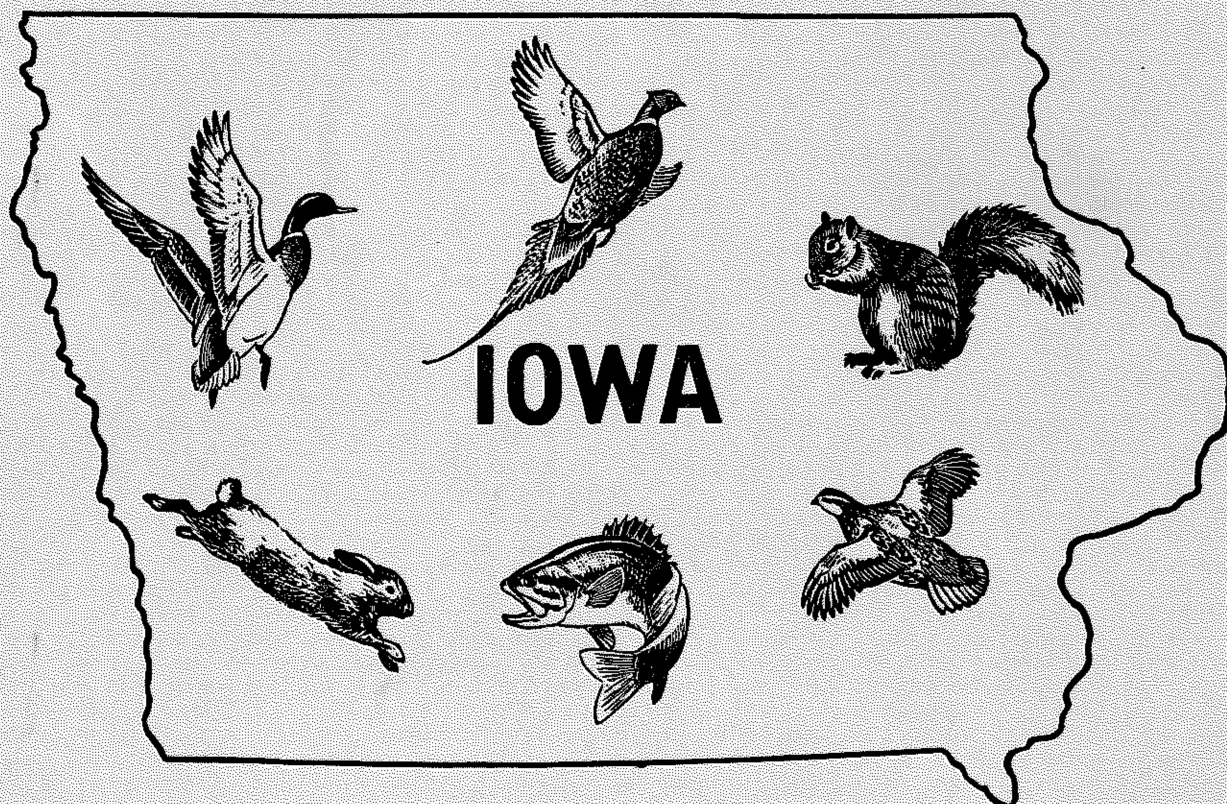

FISH AND GAME DIVISION — BIOLOGY SECTION

STATE CONSERVATION COMMISSION

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Submitted by

Biology Section
Everett B. Speaker, Supt.

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* **Erratum:** In paging this issue page *
* number 5 was omitted. All of the text*
* is complete and continues from page 4 *
* to page 6. *
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State Conservation Commission
Bruce F. Stiles, Director

Fish and Game Division
Ray W. Beckman, Chief

East 7th and Court St.
Des Moines, Iowa

SUMMARY OF THE COOPERATIVE EXPLORATORY FISHING OPERATIONS IN THE WISCONSIN-ILLINOIS-IOWA SECTIONS OF THE MISSISSIPPI RIVER - 1956

The following is a brief summary of the 1956 activities of the Illinois-Iowa-Wisconsin cooperative survey on the fish of the Mississippi River. This survey, conducted over a three-month period, had as its main goal, the establishment of a basis for future investigations of the various important game fish inhabiting the river.

Emphasis was placed on gathering data as to population structure, catch per unit effort as a basis for future years' comparison, and other pertinent information which could be obtained incidenal to the main features of the project. All walleyes, saugers, northern pike and black bass taken were processed individually according to standard age and growth procedures. Individual weights and measurements were taken on the first 300 forms of black and white crappies, bluegills, and white bass taken at each well defined sub-station or station. At least 30 scales were taken from each of these panfish groups on a representative basis so as to completely cover the total length range. These data will be incorporated in a L/F-age class analysis of individual populations. At the same time they can be worked up into a length-weight relationship for individual sub-station or pool populations. If over 300 forms were taken of a species at a station or sub-station, length frequency information was secured but the fish were weighed in the aggregate. This same treatment was accorded the shovelnose sturgeon, paddlefish, and the yellow bass and yellow perch at stations where they accounted for a representative portion of the net catch. All other species taken were counted and weighed in the aggregate.

The northern crew fished at various locations in Pools 7 through 11 and the southern crew in Pools 12, 13, 14, 15 and 19. An effort was made to fish in the same specific areas as did the various 1944-'48 U. M. R. C. C. survey crews. The data in the following surveys were kept on a weekly basis by gear and station. Not all, but most of the information was kept on a specific basis with L/F and scales from a specific lake or slough annotated distinctly from another lake or slough in the same general area. Obviously, information from some areas may be so scant as to preclude comparison with any other area. However, if an analysis of this type is desired, the data are so set up as to allow for it.

The main piece of gear used by both crews was the trap net. Six nets, with 33" x 6' frames and 33" hoops (7) constructed of $1\frac{1}{4}$" cotton web, were fished by each crew. Since the trap net can be used only in a certain type of habitat (minimum current), the data gathered at each station are comparable with other stations on a broad basis. Gill nets of various lengths and mesh size were used at most stations. Trammel nets and drag seines were also used periodically. The southern crew also used a 230-volt A. C. shocking device with boom-mounted electrodes on a large flat boat.

Besides keeping track of the hours each piece of equipment was used on a weekly basis, climatic information as to daily maximum-minimum water temperature, daily water stage at each station and average daily turbidity at all nets were sucured.

The lamprey incidence was noted at all stations after July 7, and an abnormal group of hump-backed crappies were found in Skunk Slough, below Burlington. The incidence of this deformity suggests a hereditary abnormality or vitamin deficiency rather than a mechanical injury. There was also a major incidence of (10-15%) eye worm in Grant Slough above Princeton, Iowa. Polluted conditions in the main channel below Clinton caused a gelatinous build-up on the nets and prevented their use.

The survey in the vicinity of Onalaska, Wisconsin, was accomplished during September 4 to 15. Lake Onalaska, in reality a terminal impoundment of the Black River, is for all intents and purposes an adjunct to the Mississippi River Proper. The water is two to three times as clear and some of the species found in this area are out of proportion to their normal populations in the main river adjacent to this impoundment.

In the lower portions of the lake, trap nets were fished 376 hours, accounting for 225 fish weighing 337 lbs. Gill nets were fished 44 hours and took 307 fish weighing 371 lbs. Both pieces of gear were fished in the same habitat.

In the upper lake trap nets fished a total of 516 hours and took 828 fish weighing 1019 lbs. The gill net, fished in the same area, took 1238 fish weighing 1213 lbs. in 67 hours.

In the La Crosse survey (Jule 9-28), the gill nets were used only during the third week and were set off sand bars in the vicinity of the Root River outlet. They were set expressly to take walleyes and saugers. Gill nets were fished at this sub-station 84½hours and accounted for 76 fish weighing 93.3 lbs. Trap nets were fished 542 hours in Target Lake; 525 hours in Broken Arrow and Fish Sloughs; and 475 hours in the Root River outlet. This gear took 2231 fish weighing 2803 lbs. in these three localities.

In the Lansing-DeSoto survey (June 18-July7), with the exception of 96 buffalo-net hours with a total catch of 5 fish, the balance of the catch was the product of 1648.5 effective trap-net hours. In this survey the data were not kept on a specific basis as to net set locality. The major portion of the effort was made in the DeSoto Bay area, with other sets being made in the Lansing-Bis Lake area and below the grade on the Wisconsin side.

The Prairie du Chien-Harpers Ferry station was surveyed in a two-week period, August 20-31. The first week's netting was done in the sloughs and lakes north of Prairie du Chien on the Wisconsin side. The second week was spent in the vicinity of Harpers Slough below Lock & Dam 9. Trap nets were fished a total of 899 hours and took 2188 fish weighing 1853 lbs. A tree took off 50 feet of the 2-inch mesh on the experimental gill net and 200 feet were fished a total of 99.5 hours, taking a total of 278 fish weighing 177.1 lbs. Unlike the gillnet sets in the southern sections these nets were not fished behind wing dams specifically for walleyes and saugers, but were fished primarily in sloughs and similar habitats which availed themselves to the use of trap nets.

Th The northern crew worked three weeks (July 30-Aug. 18) in the vicinity of Guttenberg, Iowa. Gill nets were run 104 hours in Pussy Lake; 64 hours in 12-Mile Slough; and 84 hours in Cassville Slough; accounting for 538 fish weighing 480 lbs. The trap nets fished 512 hours in Pussy Lake, 535 in 12-Mile Slough; and 265 in Cassville Slough, taking 1901 fish weighing 1950 lbs. Trammel net floats of 2300 yds. (125' x 5' net) were made below the Guttenberg dam, and took 11 fish weighing 25 lbs. ("hacks" and blue suckers). The crew observed 2300 yds. of trammel net floats in which 74 "hacks" weighing 97 lbs. were taken.

The Nine-Mile Island area below Dubuque was fished from August 27 to 31. The area was a running slough, with ssteep banks and all-in-all marginal, trap-net "country". This piece of gear accounted for only 211 fish weighing 209 lbs., despite the fact that 475 net hours were spent trap-netting. The 200-foot gill nets were fished 129 hours in the main channel behind wing dams, and accounted for only 23 fish weighing 31 lbs. As in all other southern stations, the shocker was used. A total of 2 hours of shocking accounted for 170 fish weighing 181.3 lbs.

In the Sabula-Savanna survey (June 18-July7), more different types of gear were used. The first two weeks the trap nets were set in Brown's Lake and the gill nets ($1\frac{1}{4}$"mesh) on the Iowa side of the channel behind wing dams. The 220-volt shocker was run in Brown's Lake and in the vicinity of Keller's Island. Trammel net floats were made in the channel adjacent to the Savana shore. The third week trap nets were set in the Savanna Slough area with gill nets run on the Illinois side of the channel behind wing dams, and shocking was done adjacent to Island 268. Trap nets were fished a total of 1614 effective hours; gill nets ($1\frac{1}{4}$" bar mesh) fished 246.5 - 100-foot hours; the shocker ran $4\frac{3}{4}$ hours; one haul with a 300' x 1" seine was made; the trammel nets accounted for 1 fish. Inexperience, perhaps, but the crew observed several dry-floats by commercial operators also.

Rock Creek and Grant's Slough were the major areas covered at the mouth of the Wapsipinicon River north of Princton, Iowa by the southern crew during August 20 to 25. The trap nets were fished a total of 517 hours, and took 630 fish weighing 475 lbs. After several attempts the use of gill nets in the main channel was abandoned due to a sphaerotilus build-up on the net, turning it into a gelatinous wall in a period of 8 hours. The shocker was used only 2 hours but accounted for 141 fish weighing 116.1 lbs.

In the Andalusia survey (July9-28) the crew fished three weeks in the vicinity of Andalusia, Illinois, and Buffalo, Iowa. The first two weeks all netting was confined to Islands 317, 318 and 319 and the channels bordering them. The last week had trap nets set in the lakes and sloughs of Andalusia Island. The gill nets were set behind two wing dams on the main channel (Illinois side) and were fished a total of 410 net hours. They accounted for 181 fish weighing 123 lbs. The trap nets were fished a total of 894 hours in channel sets and 492 hours in the Andalusia lakes and sloughs; accounting for 1143 fish weighing 765 lbs. Twelve hundred feet of 5' trammel net was dead set a d 2760 yards were floated with a 100' x 5' trammel net. This endeavor accounted for 82 fish weighing 98 lbs., mostly sturgeon.

The 220-volt A. C. shocker was run $2\frac{1}{2}$ hours. (Wind prevented its use most of the time.) This gear took 72 fish weighing 60.2 lbs. Obviously the highest per-effort take of any piece of eqpipment used. Many fish were seen, but these were only the specimens which could be taken. Shocking at night and in highly turbid water caused an amendment in the method of reporting the catch of this gear. Instead of fish seen, only fish which could be dip-netted were reported as caught by the shocker.

One haul with a 400' x 10' x 1" seine took 70 fish weighing 71.8 lbs. This was made off Horse Island in an attempt to take paddlefish. Some specimens of paddlefish and hackleback were relieved of genital organs and all samples were processed for age and growth. In addition to the above effort by the southern crew, they accompanied commercial fishermen from both sides of the river to get additional data on game fish, paddlefish and hackleback. These fish processed according to the approved methods but are not included in the attached tabular summary.

The southern crew spent three weeks (July 30-Aug.18) in the vicinity of Burlington, Iowa. Gill nets were run 307 hours in the vicinity of burlington Island, 504 hours in the vicinity of Skunk Slough and 162 hours below the check dam above Burlington. As in the past, these sets were all made behind wing dams to take walleyes, saugers and sturgeons. They accounted for 424 fish weighing 338 lbs. The trap nets fished 624 hours in the vicinity of Burlington Island; 504 in Skunk Slough; and 528 in the vicinity of O'Connell Island; taking 1839 fish weighing 1507 lbs. The southern crew did no trammel netting but aided in commercial hauls in which 1416 fish weighing 2849 lbs. were taken. The necessary data were secured from all game fish, "hacks" and paddlefish. The shocker was used $1\frac{1}{2}$ hours at each sub-station and took 140 fish weighing 81 lbs.

Respectfully submitted

R E Cleary

R. E. Cleary
Fisheries Biologist

TOTAL NUMBERS AND WEIGHTS OF FISH TAKEN BY COMBINED GEAR AT UPPER MISSISSIPPI RIVER FIELD STATIONS, 1956

		LANSING		HARPERS FERRY* PRAIRIE DU CHIEN	
Species		Number	Weight	Number	Weight
COMMERCIAL FISHES					
Shovelnose Sturgeon		-	-	-	-
Paddlefish		-	-	-	-
Blue Sucker		-	-	-	-
Bigmouth Buffalo		-	-	221	61.0
Black Buffalo		-	-	27	30.0
Smallmouth Buffalo		-	-	93	76.7
Ictiobus Sp.		267	170.7	-	-
Carpiodes Sp.		3	1.9	78	231.6
Northern Redhorse		194	261.5	3	6.8
Carp		396	988.5	185	357.4
Channel Catfish		37	60.1	12	11.7
Brown Bullhead		-	-	2	2.3
Black Bullhead		24	18.9	-	-
Yellow Bullhead		1	1.1	7	6.0
Flathead Catfish		32	97.7	3	13.9
Freshwater Drum		25	61.3	77	57.2
American Eel		-	-	6	-
	Totals	979	1661.7	975	1001.8
SPORT FISH					
Northern Pike		56	171.0	36	150.3
White Bass		140	87.6	125	82.0
Yellow Bass		-	-	18	14.2
Smallmouth Bass.		-	-	-	-
N. Largemouth Bass		38	45.9	19	19.8
Warmouth		3	1.3	-	-
Green Sunfish		-	-	-	-
Pumpkinseed		1	.3	-	-
Bluegill		468	165.2	197	72.7
Orangespotted Sunfish		-	-	-	-
Northern Rock Bass		139	46.5	-	-
White Crappie		291	124.4	328	132.9
Black Crappie		974	376.1	898	382.7
Sauger		65	54.1	116	104,0
Walleye		62	130.6	4	6.1
Yellow Perch		31	18.7	-	-
	Totals	2268	1221.7	1745	966.6
PREDATORY FISHES					
Longnosed Gar		-	-	4	12.3
Shortnosed Gar		44	8.9	37	55.6
Bowfin		273	181.8	10	39.7
	Totals	277	190.7	51	107.6
FORAGE FISHES					
Goldeye		-	-	2	1.4
Mooneye		147	84.6	44	20.0
Gizzard Shad		89	42.2	53	25.9
Spotted Sucker		16	17.8	27	45.9
Common Sucker		11	15.1	28	34.7
Silver Redhorse		-	-	1	.7
Golden Redhorse		-	-	-	-
Silver Chub		-	-	-	-
Golden Shiner		-	-	-	-
	Totals	263	159.7	155	128.6

TOTAL NUMBERS AND WEIGHTS OF FISH TAKEN BY COMBINED GEAR
AT UPPER MISSISSIPPI RIVER FIELD STATIONS, 1956

Species		GUTTENBURG Number	GUTTENBURG Weight	DUBUQUE Number	DUBUQUE Weight
COMMERCIAL FISHES					
Shovelnose Sturgeon		5	11.5	7	9.0
Paddlefish		-	-	-	-
Blue Sucker		7	16.6	-	-
Bigmouth Buffalo		26	125.1	5	24.9
Black Buffalo		18	26.6	1	1.6
Smallmouth Buffalo		77	99.1	40	27.4
Ictiobus Sp.		-	-	-	-
Carpiodes Sp.		60	167.3	7	11.5
Northern Redhorse		46	102.7	6	6.9
Carp		151	357.2	40	187.9
Channel Catfish		59	65.5	12	5.4
Brown Bullhead		-	-	-	-
Black Bullhead		-	-	-	-
Yellow Bullhead		3	3.6	-	-
Flathead Catfish		15	52.5	5	11.9
Freshwater Drum		194	149.3	42	13.0
American Eel		-	-	-	-
	Totals	661	1177.0	165	299.5
SPORT FISHES					
Northern Pike		25	83.6	2	6.4
White Bass		145	103.4	13	6.1
Yellow Bass		-	-	-	-
Smallmouth Bass		1	.3	4	2.7
N. Largemouth Bass		29	24.7	12	8.8
Warmouth		1	.4	-	-
Green Sunfish		-	-	-	-
Pumpkinseed		5	1.8	-	-
Bluegill		464	184.5	41	8.7
Orangespotted Sunfish		1	.1	-	-
Northern Rock Bass		1	.4	2	.6
White Crappie		288	120.5	51	14.0
Black Crappie		937	384.9	61	14.9
Sauger		64	59.6	15	7.0
Walleye		8	27.9	-	-
Yellow Perch		43	14.7	-	-
	Totals	2012	1006.8	201	67.2
PREDATORY FISHES					
Longnosed Gar		40	115.9	3	11.3
Shortnosed Gar		23	44.5	5	8.7
Bowfin		6	22.5	13	13.2
	Totals	69	182.9	11	33.2
Forage Fishes					
Goldeye		4	3.2	-	-
Mooneye		34	16.9	6	1.3
Gizzard Shat		99	16.3	17	1.2
Spotted Sucker		10	12.7	3	5.8
Common Sucker		-	-	-	-
Silver Redhorse		1	1.5	-	-
Golden Redhorse		-	-	2	2.3
Silver Chub		-	-	6	.4
Golden Shiner		-	-	-	-
	Totals	148	50.6	34	11.0

TOTAL NUMBERS AND WEIGHTS OF FISH TAKEN BY COMBINED GEAR AT UPPER MISSISSIPPI RIVER FIELD STATIONS, 1956

Species	SABULA Number	SABULA Weight	PRINCETON Number	PRINCETON Weight
COMMERCIAL FISHES				
Shovelnose Sturgeon	-	-	-	-
Paddlefish	-	-	-	-
Blue Sucker	-	-	-	-
Bigmouth Buffalo	60	139.3	21	53.3
Black Buffalo	15	41.5	2	3.0
Smallmouth Buffalo	356	245.9	26	12.9
Ictiobus Sp.	96	120.2	-	-
Carpiodes Sp.	240	214.3	74	123.8
Northern Redhorse	6	6.8	-	-
Carp	286	675.0	60	152.6
Channel Catfish	32	27.3	3	1.5
Brown Bullhead	-	-	-	-
Black Bullhead	20	16.0	-	-
Yellow Bullhead	2	1.5	4	3.6
Flathead Catfish	9	19.0	6	6.8
Freshwater Drum	43	108.1	17	2.5
American Eel	-	-	-	-
Totals	1165	1614.9	213	360.0
SPORT FISHES				
Northern Pike	13	57.4	1	3.8
White Bass	90	90.8	25	6.9
Yellow Bass	20	7.2	31	2.1
Smallmouth Bass	-	-	-	-
N. Largemouth Bass	35	43.8	11	6.0
Warmouth	-	-	2	.6
Green Sunfish	1	.2	-	-
Pumpkinseed	-	-	-	-
Bluegill	198	44.7	50	9.3
Orangespotted Sunfish	1	.1	2	.1
Northern Rock Bass	-	-	-	-
White Crappie	413	159.5	323	118.8
Black Crappie	498	151.7	85	22.9
Sauger	38	25.9	4	2.2
Walleye	10	2.6	-	-
Yellow Perch	-	-	-	-
Totals	1317	583.9	534	172.9
PREDATORY FISHES				
Longnosed Gar	31	73.2	-	-
Shortnosed Gar	43	62.7	4	5.9
Bowfin	274	121.4	20	58.0
Totals	348	257.3	24	63.9
FORAGE FISHES				
Goldeye	-	-	-	-
Mooneye	34	13.3	1	.4
Gizzard Shad	26	20.6	4	11.3
Spotted Sucker	13	10.5	1	1.5
Common Sucker	-	-	-	-
Silver Redhorse	-	-	-	-
Golden Redhorse	-	-	-	-
Silver Chub	-	-	-	-
Golden Shiner	-	-	-	-
Totals	73	44.4	6	33.2

TOTAL NUMBERS AND WEIGHTS OF FISH TAKEN BY COMBINED GEAR
AT UPPER MISSISSIPPI RIVER FIELD STATIONS, 1956

Species	ANDALUSIA Number	ANDALUSIA Weight	BURLINGTON Number	BURLINGTON Weight
COMMERCIAL FISHES				
Shovelnose Sturgeon	49	40.2	34	23.7
Paddlefish	11	24.6	-	-
Blue Sucker	1	2.5	1	1.9
Bigmouth Buffalo	11	28.9	39	81.3
Black Buffalo	5	7.7	6	11.0
Smallmouth Buffalo	41	18.9	109	48.6
Ictiobus Sp.	-	-	-	-
Carpiodes Sp.	195	274.9	167	165.3
Northern Redhorse	24	37.4	6	7.5
Carp	75	195.5	333	751.6
Channel Catfish	20	11.4	70	39.4
Brown Bullhead	-	-	-	-
Black Bullhead	4	2.1	28	19.6
Yellow Bullhead	3	2.1	1	.8
Flathead Catfish	12	24.1	15	18.7
Freshwater Drum	84	48.4	146	58.4
American Eel	1	5.5	-	-
Totals	536	724.2	955	1227.8
SPORT FISHES				
Northern Pike	-	-	-	-
White Bass	70	33.2	94	64.2
Yellow Bass	2	.3	21	6.8
Smallmouth Bass	-	-	-	-
N. Largemouth Bass	13	8.2	28	25.6
Warmouth	2	.4	-	-
Green Sunfish	1	.2	-	-
Pumpkinseed	-	-	-	-
Bluegill	124	25.5	185	44.8
Orangespotted Sunfish	-	-	1	.1
Northern Rock Bass	-	-	-	-
White Crappie	251	62.0	508	200.7
Black Crappie	305	63.0	316	98.1
Sauger	98	47.8	97	52.9
Walleye	23	28.0	6	1.7
Yellow Perch	2	.6	-	-
Totals	891	268.4	1256	494.9
PREDATORY FISHES				
Longnosed Gar	18	30.3	9	8.6
Shortnosed Gar	32	45.0	20	29.4
Bowfin	2	7.1	15	49.3
Totals	52	82.4	44	87.3
FORAGE FISHES				
Goldeye	3	3.3	3	1.1
Mooneye	38	14.6	11	4.8
Gizzard Shad	15	2.7	52	30.1
Spotted Sucker	2	2.4	1	.8
Common Sucker	7	.6	-	-
Silver Redhorse	-	-	-	-
Golden Redhorse	1	1.5	-	-
Silver Chub	9	.7	-	-
Golden Shiner	1	.01	-	-
Totals	76	25.8	67	36.8

TOTAL NUMBERS AND WEIGHTS OF FISH TAKEN BY COMBINED GEAR AT UPPER MISSISSIPPI RIVER STATIONS, 1956

	ONALASKA		LA CROSSE	
Species	Number	Weight	Number	Weight
COMMERCIAL FISHES				
Shovelnose Sturgeon	-	-	-	-
Paddlefish	-	-	-	-
Blue Sucker	-	-	-	-
Bigmouth Buffalo	3	22.8	6	5.0
Black Buffalo	-	-	1	.3
Smallmouth Buffalo	-	-	1	15.0
Ictiobus Sp.	-	-	-	-
Carpiodes Sp.	5	21.0	40	136.2
Northern Redhorse	41	61.1	48	82.3
Carp	84	335.4	225	765.0
Channel Catfish	12	33.6	16	19.4
Brown Bullhead	1	1.6	40	37.3
Black Bullhead	2	2.2	5	4.7
Yellow Bullhead	21	21.8	18	15.9
Flathead Catfish	9	29.5	42	206.7
Freshwater Drum	6	11.9	99	108.6
American Eel	-	-	-	-
Totals	184	540.9	541	1396.4
SPORT FISHES				
Northern Pike	46	150.6	131	502.6
White Bass	5	5.2	58	60.8
Yellow Bass	43	17.2	-	-
Smallmouth Bass	-	-	-	-
N. Largemouth Bass	10	13.6	21	25.6
Warmouth	-	-	-	-
Green Sunfish	-	-	-	-
Pumpkinseed	18	4.1	3	1.0
Bluegill	321	101.2	223	78.4
Orangespotted Sunfish	-	-	-	-
Northern Rock Bass	37	12.7	5	2.0
White Crappie	32	20.5	105	65.9
Black Crappie	144	77.0	1048	511.9
Sauger	1	.3	10	9.9
Walleye	9	21.1	23	50.9
Yellow Perch	116	36.3	7	3.7
Totals	782	459.9	1635	1313.3
PREDATORY FISHES				
Longnosed Gar	1	.8	20	35.0
Shortnosed Gar	14	27.5	4	4.3
Bowfin	13	33.5	60	194.8
Totals	28	61.8	84	234.1
FORAGE FISHES				
Goldeye	-	-	5	5.1
Mooneye	26	20.4	14	6.4
Gizzard Shad	195	30.0	3	2.5
Spotted Sucker	54	128.4	33	47.2
Common Sucker	2	5.2	1	2.7
Silver Redhorse	-	-	-	-
Golden Redhorse	6	13.1	8	15.2
Silver Chub	-	-	-	-
Golden Shiner	1	.1	-	-
Totals	284	197.2	64	79.1

An Experimental Treatment of a Segment of the Des Moines River in Iowa to Increase Desirable Fish by Suppressing Undesirable Forms.

By Harry M. Harrison
Fisheries Biologist

The problem of over-population of fish, be it caused by the so-called rough species or large number of pan fish, in lakes and ponds has been made quite clear in the past two decades. In line with this, a great deal of work has been directed toward a correction of the dilemma, and much has been accomplished toward providing a better sport fishery through the removal of excessive numbers of fish by concerted seining efforts, draw-downs, and by spot, partial or complete poisoning programs with rotenone or other chemical.

Compared to the work accomplished with regard to managing over populations in lakes and ponds, the literature contains very little if any reference to the problem of rough fish controls or over-populations in warm water streams or river. There are, of course, papers dealing with growth rates of stream fishes which show a difference in the rate of growth of a particular species from one place to another, but to the author's knowledge, reduced growth of fish in flowing warm waters has not been boldly attributed to the problem of rough fish or over-population of pan fish. Nonetheless, there are no reasons why these factors could not occur in flowing water. Certain stream studies in Iowa indicate that these are a very real problem in some if not many reaches of our major streams and rivers.

Work on the growth of the channel catfish in Iowa's inland streams show the species to grow quite slowly and in many instances growth has been appreciably retarded. For example, age and growth work on the species in some areas of the Des Moines River indicate annual gains in length not to exceed an inch a year after the initial growing season, and for the river as a whole, growth seldom exceeds two inches a year after the first year of life. Channel catfish introduced into new waters, principally artificial lakes or ponds, or those living in a few of our natural lakes make growths much above these figures and many times reach a size of 12 inches in their third year. Such information certainly shows that slow growth of channel catfish is not genetically controlled, and points up a possibility for management to do something to stimulate the growth of this fish in flowing waters.

In the Des Moines,River, we have had a reach of stream known to be very heavily populated with rough and channel catfish under surveillance for the past ten years. Locally, the place is known as the Humboldt Impoundment, but for the Iowa Conservation Commission and others interested in fisheries work it has been identified as the Humboldt study area. This particular area is closed off at either end by low head dams. It is five and a half miles long, and for two-thirds of its length, the area is impounded by the dam at Humboldt. The main channel runs from three to a maximum of sixteen feet deep with much of it going over six feet in depth. In width, it varies from 400 feet at the dam at the lower end to an average of approximately 200 feet wide in the unimpounded section. It has a surface area just short of 200 acres. The channel floor is wholly of shattered lime stone generously sprinkled with glacial boulders ranging in sizes from a few pounds up to several tons. The bars and shoals are, on the other hand, composed of silt, sand, gravel or mixtures thereof. Diciduous forest line both bankes, and by the process of erosion and cave-in, many trees have fallen into the stream. These, together with the before mentioned boulders, and under water limestone, crevices, make up an abundance cover for fish.

Fish of significance inhabiting the area in their order of numercial abundance include carp, channel catfish, quillback, northern redhorse, golden redhorse, and black bullheads. Other species, but of very minor importance, residing there involve walleye pike, smallmouth bass, northern pike, silver redhorse, stone cat, crappie, sunfish and several varieties of minnows.

Population work in the study area has revealed estimates as follows: channel catfish, 104,000 in 1953; 68,000 in 1954; 38,000 in 1955; and 28,000 in 1956; carp, 48,000 in 1955 and 69,000 in 1956; and quillback, 25,000 in 1956. These figures do not include fish smaller than sub-adults and the estimates are believed to be quite accurate in that they were designed to avoid most of the errors that accompany population work.

Combing the estimates for a respective year, and considering further the fish living there not studiedfor population size, figures of substantial proportions develop for a population of fish to inhabit a 5.5 mile length of stream which involves no more than 200 surfact acres.

With regard to the poundage of fish in the area, we have only one set of values. In an eradication program that will be discussed later, we hauled from the area nearly 95,000 pounds of fish this past fall. In addition to those recovered, there were several thousand pounds of dead fish remaining after the clean-up operations ceased. Based on the poundage of fish removed and those left, it is conservatively estimated that in the neighborhood of 600 pounds of fish per acre occupied the Humboldt study area in 1956.

Channel catfish is the only species that has been studied for age and growth in the Humboldt Area. That work divulged a much retarded growth for the species. In a growth study conducted in 1954, the calculated standard length at the time of annulus formation for each year of life for the first eight years in inches was 2.8, 4.9, 6.2, 7.1, 8.0, 8.9, 9.8, and 10.9, respectively. This represents a considerably slower rate of growth than that found in most other parts of the Des Moines River, on the Upper Mississippi River, in Missouri and in Oklahoma.

Even though age and growth has not been determined for other species, the carp in particular have always been visibily thin and are believed to have been growing comparitively slow. Quillback, buffalo and suckers, on the other hand, usually appeared to be in good flesh, irregardless of whatever their growth might be.

Long before the data were in, the problems of over-populations of channel catfish and damages caused by rough fish, principally the carp, were suspected if not intiuitively known. In line with this thinking, several experiments were set up and tried in an effort to correct the situation. Among those things tried included, (1) seining to remove the coarse fish (2) erection of barriers to heavily used spawning grounds of the rough varieties, (3) the removal of a large segment of the catfish population by traps and (4) finally an attempt to remove excessive numbers of fish by the use of electrical shocking devices and techniques. These experiments met with some success but any benefits derived proved to be short lived and very expensive. They did, however, point up a need for a better and more radical way for removing excessive stream populations.

Angling had reached an all time low in the Study Area this past summer. Because of this, it was resolved to employ more drastic means than those used previously to remove the vast populations. Rotenoning was decided upon. This was to be followed by restocking immediately with suitable species of fish to fill the void caused by the eradication of the rough varieties and stunted channel catfish.

To protect the experiment, it was further decided that the extermination scheme be extended upstream from the study area to avoid reinfestation by rough fish from the impoundment and river immediately above. Furthermore, the restocking plan was extended into the upstream reaches with the hope of establishing a fishable population there too, and also to have a predator population on hand to meet the reproductive efforts of the noxious varieties.

The species used for restocking included channel catfish, walleye pike, large mouth bass, small mouth bass, crappie and forage fish. In the stocking program the various species were introduced into habitats best suited for each of the varieties being planted.

Returning now the extermination project, approximately twenty miles of the Des Moines River was dosed with a 5 per cent emulsified solution of rotenone in late September, 1956. This was introduced at 2 p.p.m., in accordance with the rate of flow of the stream at the upper end of the area. The technique set upon was to form a slug of contaminated water of sufficient length so that fish in any reach of the stream would be bathed in treated water for a period of several hours duration as the slug moved down stream over them. The slug thus formed was followed day by day and where ever and when ever visual inspection deemed that some fish might survive, it was re-enforced with added chemical to insure as complete a kill as possible.

From the twenty mile stretch of stream, it was estimated by methods of recovery of fin clipped fish marked previous to poisoning, and by counting dead fish along segments of the shore line that we exterminated in the neighborhood of 400,000 pounds of fish. Something in excess of 95% of this poundage was made up of noxious fishes including carp, quillback, buffalo and other suckers. The remaining five per cent was composed mostly of channel catfish. Game species were comprised of walleye pike, northern pike, small mouth bass, and white crappie. In the aggregate, these last named varieties did not amount to more than 500 pounds. Of the total poundage of fish killed, 90% or more occupied the impounded sections. The unimpounded areas, on the other hand, while not containing a large poundage of fish were very heavily populated with young rough fish of the kinds found in the back waters of the dams. Because of their very extreme numbers and small size, no attempts were made to estimate the population of these young fish or evaluate their poundages. It is felt, however, that the destruction of the young rough fish was of paramount importance to the success of the project.

As regards the success of this venture into stream management, only work of the next few years can tell the complete story. None the less, a few certain conclusions and some immediate benefits have already come to light. Among some of these, the following are worthy of mention.

(1) It has been established that rough fish may exist in populations of sufficient size in warm water streams to exert a suppressive effect upon the desirable species.

(2) In Iowa, at least, this particular work has opened the door to rough fish controls in streams. The project demonstrated to the angling fraternity that chemical treatment is the only known tool by which noxious fishes can be removed from rivers in adequate amounts for real accomplishment. Many sceptics who were firmly against the destruction of any game fish regardless of reason or possible gain, now see rotenoning as efficient, economical, and necessary. By this, we do not propose to run headlong over the state pouring rotenone into every stream because fishing is thought to be poor because of rough fish problem, rotenoning or other equally effective methods will be seriously considered, and with, I sincerely believe, the support of the main body of stream fishermen.

(3) The study has shown that the use of rotenone can be controlled in flowing waters. That which can be exacted in controlling its use in streams will require much more investigation. In this particular work with the facilities that we had at hand, we were able to kill the lethal effects of the treated water in a very short length of stream. The technique used would require a lengthy discussion. They will come out in a paper next spring. If, however, time permits, and you are interested, there might be time to hit the highlights of our technique in the discussion period alloted this paper.

(4) Cost-wise, chemical treatment in streams holds much promise. By the slug-forming technique, it becomes necessary to treat only short reaches of stream. As the slug moves, downstream areas get benefit from the chemical introduced above. In effect, many acres of water receive treament by the dosage of a contrastive few. This, of course, results in low cost for chemicals and application. The big expense encountered in our work came from the necessity of removing many of the dead fish. It so happened that the kill area passed through two small towns and a country club. For the sake of public relations, we were duty bound to keep obnoxious odors at a minimum. This cost, although quite high, was quite largely off set by the sale of the quality fish, principally buffalo.

(5) One of the most striking results to come out of the project was the instantaneous clearing up of the turbidity. Before treament, the Secchi disc reading was less than five inches. In the wake of the rotenone slug, the reading increased to over five feet. This cleared water condition persists to date, and it is felt that this item alone will benefit sight feeding fish a great deal.

(6) Placton and bottom fauna organisms sampled a month after treatment were well established. As a matter of fact, both showed increase in abundance. Although our data is yet very meager on this point, there is, nonetheless, some evidence that rotenone treatment does not obliterate the bottom fauna and placton complet to the degree that it does the fish populations.

It was mentioned above that only time will tell the whole story as regards the benefits to be derived from rough fish controls in this area. As a final word, and on the subject of that expected, it is anticipated that the rough fish will most certainly come back. The thing that we are particularly interested in is how long it will take, and if and how much fish we can provide in the time intervening by the species stocked in the void created.

Selective Poisoning of Gizzard Shad in Storm Lake
Preliminary Report

by
Earl Rose
Fisheries Biologist

Introduction

Storm Lake, in Buena Vista County, Iowa, is one of Iowa's largest lakes, covering 3,060 acres at crest elevation. For the past three year gizzard shad have infested the lake causing a vast decline in angling success by the huge annual crops of young which are ideal forage. Previously the lake had supported a splendid sport fishery for walleye, crappie, white bass and channel catfish. Previous to 1954, the lake developed tremendous blooms of blue-green algae each summer and fall; however, since the shad population development little or no algae (blue-green) have been observed. Presumably the shad consume these plankton organisms in sufficient quantities to keep the lake clean. Aquarium tests have failed to verify this presumption however. In an effort to reduce the population of shad, state rough-fish removal crews have devoted much time and effort in seining the lake annually. But, due to the vast population and tremendous reproductive potential these efforts have been unsuccessful. It was obvious that if angling improvement was to be achieved, other control measures would be namdatory. Factor considered were complete drainage, a heavy treatment with roteonone to kill all fish, or to attempt selective poisoning by a very light application of rotenone as had been done in Kentucky (Bowers, 1955) and a few other areas.

Preliminary Experiments

Several studies were conducted using aquaria and fish tanks on a distribution truck in which varying concentrations of roteonone were used to test reactions on gizzard shad and game fishes. All indicated that in water temperatures of about 60°F. that a concentration of 0.1 parts per million would effectively kill shad with a minimal loss of game fish. Further tests were made using a thirty acre area of Storm Lake treated with rotenone to make a concentration of 0.1 parts per million. This too indicated that a high degree of control in shad could be obtained with a minimal loss of game fishes. Inasmuch as the level of Storm Lake has receded to about one-half its crest level volume and the high probability of severe winter kill (average depth about 4.0 feet) the department was provided with an "everything to gain and nothing to lose" proposition in attempting a large scale experiment in shad control. The local people were enthusiastic about the program and gave their moral support.

Application

Orginally it was planned to use the department's algae control spray barge to apply the rotenone; however, after careful consideration it was decided to spray the lake with planes. The barge would have required about 12 hours of continuous operation to obtain a fairly even distribution. This factor, plus the shallowness of the shoals would have prevented marginal spraying.

Two commercial crop spraying planes were employed to spray the lake. The treatment started at 7:45 a.m. on September 24, 1956. At this time a slight breeze was blowing from the southwest(about 4.0 m.p.h.). The south and west shores were therefore sprayed first, and from that time to the completion of the project one plane sprayed the south half and the other the northern portion. Eight boats, manned by Conservation officers and fisheries personnel were stationed as markers for the planes and were moved accordingly for 100 foot swaths as the planes traversed the lake along its long axis. By 9:45 a.m. the wind had increased to roughly 30 m.p.h. making low flying difficult and dangerous. Some overlapping of swaths occurred due to this and the inability to keep target boats in position. Following consultation, the spraying was completed at 12:30 p.m.

A total of 340 gallons of emulsifiable rotenone was used in the operation to treat the calculated 3,400,000,000 gallons of water in the lake to a 0.1 parts per million concentration.

Results

At this early date it is impossible to give a complete appraisal of the results of the treatment. A very heavy kill of shad was obtained. These were the first fish to show signs of distress. About three hours after the starting of application the entire lake was glittering with young-of-the-year and adult shad that were dead and dying. Most of these sank to the bottom after death and floated again three or four days later. High southerly winds piled them up on the north shore causing unbearable living conditions for the residents of the city of Storm Lake. Rapid deccomposition occured due to 90° F. temperatures consequently emergency disposal was mandatory. A crew of 75 men and two drag lines buried an estimated 600,000 pounds of fish along the beaches. The vast bulk of these were shad; however, game fish losses were of greater magnitude than anticipated.

Several counts of areas considered typical along shore were made to obtain some concept of game fish losses. Heaviest losses occurred in yearling channel catfish and adult walleyes. From these counts it was estimated that 8,000 channel catfish yearlings; 50 adult channel catfish; 2,400 adult walleyes; and 2,000 yearling perch were killed by the treatment. Losses of crappie, wjite bass, northern pike, largemouth bass, carp and buffalo were very slight.

It was not expected that a complete kill of shad would be obtained in this light treament and under the adverse application conditions. In order to obtain a preliminary appraisal of the effectiveness of the treatment, test hauls were made with the Biology Section's survey seine (500 feet, one-quarter inch mesh) on October 1. These hauls averaged 1,673 shad (y.o.y) per haul. Hauls made with the same seine during August.of 1956 averaged 48,138 per haul. If comparble, this indicates that there has been a reduction of 96.6 per cent of the 1956 year-class shad. Adult shad (two-year) averaged 258 per haul indicating an ample survival to re-infest the lake with young next summer if winter kill is not severe. Good survival of crappie, catfish, bullhead, yellow bass, carp and buffalo were noted. Losses of walleyes may have been more than shore counts indicated. Four 200 foot gill-nets were set on October 2 and raised on the following day. Only one walleye was obtained. Extensive seining with long seines (3,000 feet) is planned for this winter to obtain a final appraisal of the program and to salvage game fishes that are quite certain to perish from low dissolved oxygen.

Discussion

Varying reaction prevail regarding this first use of rotenone as a selective poison on a large scale in Iowa. Most observers are very enthusiastic and feel that we finally have a tool with which effective shad control can be achieved with a minimum of effort and expense. It is difficult for the writer to share entirely this view at this time. First of all, it is obvious that even though a tremendous tonnage of shad was killed, there remains sufficient brood stock to repopulate the lake next summer. Also, under the adverse flying conditions at the time of spraying, poor distribution must have occurred or the margin of safety for game fish is narrower than experiments indicated. This seems especially true for the walleye and channel catfish. Very likely, game fish losses would have been less severe and shad control more extensive if the application would have been under more favorable flying conditions. Any future projects of this kind should take advantage of weather bureau services and the work should be timed accordingly. Certainly we have gained much in the way of experience in this important milestone.

Literature cited.

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Results of Early Summer Creel Census of Five Northern Iowa Lakes, 1956

Fisheries Biologist
Tom Moen

The creel census program for the northern Iowa natural lakes was conducted in three phases during 1956. Spirit Lake was censused through a special method in an attempt to obtain a "complete" census and harvest picture[1] Two lakes (East Okoboji and West Okoboji) were continued on a year-round census and three lakes were censused for only the two month period of May 15 - July 15. This report will briefly summarize the data for the two month period for the following five lakes: Storm, Black Hawk, Clear, West Okoboji, and East Okoboji. This data is comparable to creel census material that has appeared in previous seminar reports under the designation of "45-day creel census".

Census Methods

Census methods have remained essentially the same for these lakes during the past five years. The only significant change during this time has been the change to the IBM system of recording and handling catch data. All material is collected through personal contacts by creel census clerks on each lake. All figures pertaining to species, hours, number of fishermen, etc. were codemarked on IBM cards by the census clerk. These cards were tabulated at ten day intervals for administrative purposes.

The creel census clerks for East Okoboji, West Okoboji, and Clear Lakes were provided with boats from which to make their contacts. At Storm Lake and Black Hawk the clerks were not provided with boats, hence, they made a disproportionate number of contacts with shore and dock fishermen. Boats have not been provided for census work on these two lakes in previous years, thus the data can be compared with that of former reports.

The results from each lake will be discussed separately.

Storm Lake: This lake has had poor fishing since 1950 and this year was no exception. Catch per hour figures show an improvement of nearly 60 per cent over those for 1955 and also an improvement over the 5-year average (Table 1). This gain was considered negligible due to the fact that the catch was made up of 73 per cent small bullheads and 16 per cent small crappies. Boat fishing was nearly non-existent; shore and dock fishermen caught over 90 per cent of all the fish taken. (This shore and dock catch is not due entirely to the lack of a boat for the clerk). A high gizzard shad population furnised abundant food for the larger game fish such as walleyes and channel catfish. Low water level, high turbidity and rough fish problems have reduced the fishing potentials of this lake to a very low point.

1-This census on Spirit Lake is being conducted by E. T. Rose and will be reported elsewhere.

Table 1. Fishing success expressed as fish per hour in five northern Iowa lakes in 1956 compared with the success in 1955 and for the 1951-55 average.

YEAR	LAKES				
	Storm	Black Hawk	Clear	East Okoboji	West Okoboji
1956	0.82	0.27	1.29	0.97	0.90
1955	0.35	0.40	1.07	1.31	1.31
1951-55 average	0.45	0.70	1.19	1.40	1.07

Black Hawk Lake: Fishing success at Black Hawk Lake was slightly below that of 1956 and considerably less than the five year average (Table 1). Considerable management effort has been expended on this lake, but fishing has not improved proportionately. Gizzard shad are the major source of trouble in this lake. A relatively poor hatch of shad in 1956 resulted in an improved catch of walleyes, but the catch of crappies and large mouth bass did not show a corresponding improvement. Walleyes made up 20 per cent of the catch in 1956 and only four per cent in 1955. Although channel catfish are not usually considered a good lake species, they were important in the catch at Black Hawk Lake, not only because they composed five per cent of the catch, but also because of their better than average size. (One 19-pounder was caught).

Clear Lake: Due to unavoidable circumstances the census of this lake was discontinued July 1 rather than July 15. During these 50 days of censusing, the censusing, the success of nearly 10,000 anglers was ascertained. These anglers were 17 per cent more successful than 1955 anglers and slightly more successful than recorded for the five year average (Table 1). The species composition of the catch changed considerably from that recorded in 1955. This change was due to a decided decline in the catch and/or the availability of the yellow bass. Yellow bass made up only 7 per cent of the catch as compared to 36 or 50 per cent in the past three years. Bullheads made up for the shortage in yellow bass and was easily the number one fish, composing 75 per cent of all the fish on the stringers. Although bluegill were the most important fish to the wading fisherman, they declined 100 per cent from 1955 when all types of fishing are considered. Crappies, perch, walleyes, northern pike, and largemouth bass appeared in the catch at about the same rate as during 1955. Catch per fisherman compiled by members of the Iowa State College Fisheries Research Unit over a longer census period (May 6 - Aug. 30) indicated that the average fisherman caught considerably less than one fish per hour (about .75) but the species composition of the catch was about the same at that recorded by the Conservation Commission's shorter period of censusing. It is quite reasonable to expect success to diminish after July 1.

During the past few years there has been considerable discussion concerning the value of creel data based on completed fishing trips against incomplete fishing trips. About 20 per cent of the contacts made at Clear Lake were completed trips. When results of the completed trips are compared with the combined data from both completed and incompleted trips (normal results from a straight contact type census) the fish per hour figure is slightly higher for completed trips. But as one might expect, the fish per man data is important from the standpoint of a "complete" census or total harvest picture but not in a censusing method based only on a small sample of the fishermen using the lake in any one season.

East Okoboji: East Okoboji experienced a severe winter kill in the northern half of the lake during the winter of 1955-56. This winter kill eliminated large numbers of more desirable game and pan fish leaving the bullheads to furnish the bulk of the fishing. Bullheads have always been the important fish in this lake, comprising 50 to 75 per cent of the total catch each year, and this year 90 per cent of the catch. The rate of catch fell to about one fish per hour, somewhat below the 1955 figure and lower than the five year average (Table 1).

West Okoboji: This lake has been a consistent producer of fish during the past 10 years. The early 1956 season failed to measure up to the 1955 season and fell slightly below the success of the five-year average (Table 1). Bullheads were first in importance in the catch during this period, composing 45 per cent of the fish creeled. Perch, one of the more popular species fished for during winter, were second in importance, making up 20 per cent of the total catch. This was a decided increase over the last two years when perch comprised only 4 and 7 per cent of the total catch in 1954 and 1955 respectively. Walleye fishing was considerably poorer than in 1955 but about the same as 1954, comprising 8 per cent of the catch in 1956. Bluegills and crappies were also important in the catch during this early summer period. The phenomenal smallmouth bass fishing in this lake took place just after the close of this census period and will be noted in the summary of the yearly census figures.

The 1956 Artificial Lakes and Reservoir Fisheries Survey

Jim Mayhew
Fisheries Biologist

During the summer of 1956, 20 state-owned, and 19 city water supply reservoirs were surveyed to sample the adult fish population present, and determine the magnitude of reproduction during the current year. This is an all time high in the number of impoundments surveyed by the joint co-operation of the Biology and Fisheries Sections of the Iowa Conservation Commission. [1]

The method and equipment used for these inventories was essentially the same as the past two years. A 230 volt alternating current "shocker" was the primary sampling device. Under certain conditions the sample size was enlarged by the use of two modified pound nets, and a 60 foot, one-quarter inch mesh drag seine. This gear also was used when additional effort was desired for one particular species, which was difficult to capture with the shocker.

In the fisheries inventory of the lakes several sampling problems had to be taken into consideration. Generally these were (1) selectiveness of one type of equipment, (2) severe sloping contours of the bottom, (3) extremely clear water, and (4) dense vegetation due to low water levels.

The shocker boat was propelled slowly along the shoreline by outboard motor in water six to eight feet deep. An observer in the front of the boat counted and recorded all fish that could be easily identified in a predetermined time period (time periods were usually of twenty minutes duration). Several size groups of each species of fish were picked up in dip nets by the observer for measuring and obtaining scale samples.

Along with the routine fisheries survey a check for the occurrence of thermal and chemical stratification was made on each impoundment. Temperature readings were taken at three foot interfals by a series of maximum-minimum thermometers. Any drop in temerature of 1.6 degrees Fahrenheit per foot of depth was considered as the location of the thermocline. Several dissolved oxygen samples were taken at various depths of establish the extent of chemical stratification.

Description of the Lakes and Grouping by Characteristics

In the past several years, reports on annual fisheries survey have usually considered each lake individually. Since there were so many more lakes surveyed this year it would be difficult to discuss each lake separately and keep the report as a reasonable length without forfieting the value of the data. Hence, instead of considering each lake individually the impoundments were divided into groups by similar characteristics of topography, morphometry, fish populations, and location.

1. The author wishes to express his gratitude to the men from the Drakesville Fisheries Station for their assistance during survey. Special thanks is due to Dale Stufflebeam for his help in orientation to most of the lakes, and history of past fisheries management in the areas.

Group 1

This group includes most of the state-owned artificial lakes and several reservoirs. In this group are the following lakes; Lake Geode, Williamson Reservoir, Red Haw Hill, Lake Keomah, Lake Ahquabi, Nine Eagles Lake, Cold Springs Lake, Lake of the Three Fires, Springbrook Lake, Commerce Reservoir, Lacey-Keosauqua, and Lake Wapello.

The lakes are characterized by their similar wooded shorelines, relatively deep basins, and moderate to extremely steep sloping bottom contours. Almost all the impoundments in this group have some degree of thermal and chemical stratification. The fisheries population in these lakes are usually fairly stable, and vary only slightly due to exceptionally strong year classes of one species of fish. Reproduction during the summer of 1956 was considered only fair (Table 1). Bluegill and largemouth bass reproduction was good in most of the lakes, but crappie apparently failed to reproduce with any success. Adult game-fish populations are reasonably high following two years of extreme drought. Growth rates are above average in most of these areas.

Problem lakes, of course, do exist in this group, but are rather infrequent and are usually of only a temporary occurrence. Most of the problems evolve from (1) overcrowded conditions and poor growth due to one or more strong year classes of one species, (2) ill-balanced populations because of poor predator-prey relationship, and (3) over-population of undesirable species, such as carp and suckers.

Group 11

This group of lakes is characterized by their similar shallow basin, open or unwooded shorelines, and gentle sloping bottom contours. Most of these impoundments do not have well defined thermal stratification, but may have temporary oxygen depletions at the bottom during summer months. Lakes included in this group are Lake Darling, Diamond Lake (Montezuma), Green Valley Lake, Rock Creek Lake, and Allerton Reservoir.

In 1956 reproduction in all these lakes was generally poor except for bluegills (Table 2). Sub-adult and adult populations are at the present exceptionally high. Most of these lakes were effected greatly by two years of below normal rainfall, which may account for the low reproduction of most fish. The populations in this group have a tendency to fluctuate more readily than the Group I impoundments. Growth rates are about average for this type of habitat, but crowded conditions and stunting often develop quite rapidly when a strong year class of fish appears. This is usually not apparent when only one class is abundant, but rather on the occurrence of two successive strong year classes.

Management of these lakes has generally been directed toward the bullhead because of the representative habitat. Reproduction of this species is very static, and stocking of adults is periodically required if the population is maintained in catchable abundance. Limited largemouth bass fishing occurrs periodically, with bluegill and crappie angling available mostly in the spring of the year.

Group lll

This group of lakes consists of largely city water supply reservoirs. For the most part they are all relatively unfertile, and treated with copper sulfate for algae and vegetation control. In several of the lakes this routine treatment is often rather heavy and excessive. Many of the impoundments in this group are stratified during the summer, but this is dependent upon the depth and protection from wind action. One outstanding characteristic of the smaller reservoirs is the fluctuation of water levels, which may vary up to eight feet within one season. The lakes included in this group are; Fairfield Reservoirs, Albia Reservoirs, Centerville Reservoirs, Osceola City Reservoirs, McKinely Lake, Ellis Lake, Morris Lake, Corydon Reservoir, Binder Lake, Lock Ayr, Mt. Ayr Reservoir, Nodaway Lake, Afton Reservoirs, and Fisher Lake.

Reproduction of major game-fish species during the current year was very poor in this group of lakes (Table 3). In several of these impoundments there was revealed a definite year class failure of largemouth bass and bluegill for the past two years. At many areas the adult largemouth bass populations are entirely adequate, but are often only very large specimens. In this case if there were no year classes to replace the adult populations, recommendations were made to supplement the population with fingerling and yearling bass stocking.

The adult crappie and bluegill populations are extremely static and vary considerably over a short period of time. One species will dominate the populations in the lake for a short time (two or three year), and then be replaced by the other, or in some instances by a secondary year class. In many cases the stunted gear class will be accompanied by a good population of extremely large specimens of the same species. Reproduction of the opposing species is very poor in the meantime. Probably when this situation occurrs there exist a break in the food chain, wherein growth rates become progressively worse because of a food shortage. Corrective measures are needed badly in most of these lakes, and should include an attempt at species control by partial and selective rotenone treatment.

Group lV

This group consists of the oxbow and river bottom lakes. Most of these lakes are shallow, turbid, and of slough type habitat. Brown's Slough and the Colyn Lakes in Lucas County are man-made; whereas, Lake Manawa and Lake Odessa are natural lakes.

Reproduction during 1956 was poor to good depending upon the area. Lake Manawa had good reproduction of bluegill and white bass, Lake Odessa had reproduction of shad only, and Brown's Slough had a large hatch of bullheads (Table 4). Adult populations are usually considered high and are apparently rather stable. Rough fish are a definite problem in some of these lakes, and intensive seining and removal has been a continuous project.

This year marked the first fisheries survey of Brown's Slough since it was constructed in 1954. The slough was initially stocked during that year with largemouth bass and bluegill. To date the species list also includes crappie, channel catfish, bullhead, and carp. Stocking of these totally undesirable species in this area has undoubtedly been by the unknowing angler and his persistance to stock fish for his own desires. Management techniques under such conditions are throughly handicapped in their long range effects.

General Observations and Discussion

During the most part of 1955 and 1956 southern Iowa has been in a period of extreme drought. Rainfall dificit in this district ranged up to 16.4 inches during the time. Most of the impoundments have been effected to varying extents. A few of the lakes were not effected greatly, but most of the city water supply reservoirs had critically low water levels.

It is doubtful that the drought had any appreciable effect on the adult populations in the lakes, but may have curtailed reproduction of late spawning fish. During the major part of the spawning season water levels were receeding very rapidly. This could quite possibly cause nests to be stranded on dry land. A few nests in shallow water were observed frequently at Red Haw Hill and were found abandoned shortly after water levels dropped rapidly.

The excessive growth of vegetation due to the drought could also alter the population balance in the near future. Protection from predation would undoubtedly favor the bluegill and crappie, and be a disadvantage to the largemouth bass. Hence, with protection from heavy predation there is a chance of overcrowding of pan-fish in the next few years.

Although it is virtually impossible to discuss general observations that could fit all impoundments there are a few apparent in most lakes. They are as follow:

1. Reproduction of largemouth bass was considered fair in 1956.

2. Bluegill reproduction was generally good in artificial lakes.

3. Crappie apparently failed to reproduce in most impoundments during the past season.

4. Drought conditions had little effect on the adult populations, but may have hindered reproduction of largemouth bass and crappie.

5. Several lakes in each group have definite population balance problems, and it is recommended that a representative lake in each group be selected for detailed study.

See tables 1, 2, 3 & 4 next pages.

Table 1. The relative abundance of young-of-the-year, yearling, and adult fish captured by fisheries survey crew in Group 1 Lake, 1956.

		Lm. Bass			Bluegill			Crappie			Bullhead			Perch			Catfish		Carp		
LAKE	Acres	Yg	Yr	Ad																	
Geode	205	A	R	C	A	C	A	A	R	C	*	*	*	*	*	*	*	*	*	*	*
Williamson	27	R	*	A	R	A	A	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Red Haw	72	A	C	C	C	A	C	*	C	C	R	R	C	R	*	R	*	R	*	*	*
Keomah	82	A	C	C	A	C	C	R	R	A	*	*	C	A	C	R	*	*	A	*	C
Ahquabi	150	A	A	A	A	A	A	R	R	A	*	*	*	*	*	C	*	R	*	*	R
Nine Eagle	56	A	C	C	A	R	A	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Cold Spring	16	A	A	A	A	R	A	*	*	*	*	*	C	*	*	*	*	*	*	*	*
Three Fires	125	R	R	C	C	C	A	R	R	A	*	*	*	*	*	*	*	*	*	*	C
Commerce	200	C	A	C	A	A	A	*	R	C	*	*	*	*	*	*	*	*	*	*	R
Keosauqua	27	R	C	C	A	C	C	*	R	*	*	*	R	*	*	*	*	*	*	*	*
McBride	152	R	C	C	C	C	C	*	C	C	*	*	*	*	*	*	*	*	*	*	A
Wapello	287	C	C	A	A	A	A	*	C	A	*	*	R	R	R	C	*	*	C	R	C

A---Abundant C---Common R---Rare *---not taken in survey

Table 2. The relative abundance of young-of-the-year, yearling, and adult fish captured in Group 11 by survey crew, 1956.

		Lm. Bass			Bluegill			Crappie			Bullhead			Perch			Catfish			Carp		
LAKE	Acres	Yg	Yr	Ad	Yg	Yr	Ad	Yg	Yr	Ad	Yg	Yr	Ad	Yg	Yr	Ad	Yg	Yr	Ad	Yg	Yr	Ad
Darling	302	A	R	R	A	A	C	*	R	A	C	R	A	*	*	*	*	*	R	*	*	*
Diamond	110	C	C	C	A	C	C	*	*	A	*	*	*	R	R	C	*	*	*	*	*	*
Green Valley	400	*	C	A	R	A	A	*	R	C	*	*	R	*	*	*	*	*	R	*	*	*
Rock Creek	640	A	A	C	A	A	C	C	*	A	*	*	*	*	*	*	*	*	*	*	*	*
Allerton	106	*	R	A	*	C	C	*	*	A	*	*	C	*	*	*	*	*	*	*	*	C

A---Abundant C---Common R---Rare *---not taken in survey

Table 3. The relative abundance of young-of-the-year, yearling, and adult fish captured in Group III lakes by survey crew, 1956.

		Lm. Bass			Bluegill			Crappie			Bullhead			Y.Bass			Catfish			Carp		
LAKES	Acres	Yg	Yr	Ad	Yg	Yr	Ad	Yg	Yr	Ad	Yg	Yr	Ad	Yg	Yr	Ad	Yg	Yr	Ad	Yg	Yr	Ad
Fairfield 1	75	*	R	R	*	*	A	*	*	A	*	*	A	*	*	*	*	*	*	*	*	*
Fairfield 2	20	*	R	C	*	*	A	*	*	*	*	*	A	*	*	*	*	*	*	*	*	*
Centerville	100	R	C	C	C	A	A	*	*	R	*	*	C	*	*	A	*	*	*	*	*	*
Albia (Up)	35	*	*	C	R	C	A	*	*	*	*	*	*	*	*	C	*	*	*	*	*	*
Albia (Low)	25	*	*	R	*	C	A	*	*	*	*	*	C	R	A	A	*	*	*	*	*	*
McKinely	50	R	R	A	*	*	*	*	C	A	*	*	*	*	*	*	*	*	*	*	*	A
Osceola (E)	25	R	R	C	C	A	A	*	*	*	*	*	C	*	*	*	*	*	*	*	*	*
Osceola (W)	30	*	*	C	*	*	A	*	*	A	*	*	*	*	*	*	*	*	A	*	*	*
Ellis	110	R	A	A	C	A	R	*	*	C	*	*	*	*	*	*	*	*	R	*	*	A
Morris	200	*	A	C	C	A	A	*	*	C	*	*	R	*	*	*	*	*	*	*	*	C
Corydon	125	*	*	C	*	*	A	*	C	A	*	*	*	*	*	A	*	R	R	*	*	C
Binder	150	R	R	A	C	*	A	R	*	C	*	*	*	*	*	*	*	*	*	*	*	R
Look Ayr	135	*	*	C	A	C	*	*	C	A	*	*	C	*	*	A	*	*	*	*	*	C
Mt. Ayr	15	*	C	A	A	A	A	*	*	*	*	*	C	*	*	R	*	*	*	*	*	*
Nodaway	50	*	R	A	C	A	A	*	*	C	*	*	*	*	*	*	*	*	R	*	*	*

A---Abundant C---Common R---Rare *---not taken in survey, but may be present some in lakes.

Table 4. The relative abundance of young-of-the-year, young-of-the-year, yearling, and adult fish captured in Group lV lakes by survey crew, 1956.

		Lm. Bass			Bluegill			Crappie			Walleye	Y. Bass			Bullhead			Shad			Carp		
LAKES	Acres	Yg	Yr	Ad	Yg	Yr	Ad	Yg	Yr	Ad	Ad	Yg	Yr	Ad	Yg	Yr	Ad	Yg	Yr	Ad	Yg	Yr	Ad
Brown's S.	200	*	C	A	*	A	A	*	A	*	*	*	*	*	C	*	*	*	*	*	*	*	R
Odessa	2700	*	*	C	*	*	C	*	*	A	A	*	*	C	*	*	*	A	A	C	*	*	A
Manawa	957	*	R	C	A	*	C	R	*	A	*	A	C	*	*	*	C	A	A	C	*	*	A

A---Abundant C---Common R---Rare *---not taken in survey but may be present in lake.

A Brief Discussion of Factors Known to Influence Mass Fall Migrations of Waterfowl in Iowa.

James G. Sieh
Waterfowl Biologist

Weather conditions suitable for mass fall migration of waterfowl into the Mississippi Flyway could be forecast with accuracy. The U. S. Fish and Wildlife Service in cooperation with the U. S. Weather Bureau could provide weather and waterfowl information direct to radio and television outlets. This timely information would help the average duck hunter in Iowa to prepare for a successful duck hunting trip. Public demand for such hunting information could make this service available to the public.

Briefly, spectacular mass fall migrations of waterfowl are not observed every year, but require large numbers of ducks in the northern U. S. and Canada coinciding with a continental weather pattern which "triggers" a simultaneous exodus of a species or several species. One of the most spectacular fall mass migrations in at least several decades occurred last year on November 1 and 2, 1955 (Sieh, 1956). This flight was observed throughout Illinois, Iowa, Nebraska and probably extended beyound these boundaries east and west.

Generally speaking, blue-winged teal are known to migrate in September, redheads and canvasback during mid-October, and scaup and mallard in November. Hochbaum (1955) states: "Though fall departure occurs at about the same time each year, weather has a "trigger effect" which influences the exact day when mass migration will start. Regardless of the stage of the autumn ----mild September or cold November --- mass fall migrations begin with the arrival of clear sky and fair weather of the anticyclone; but once started, migration may overtake and continue through bad weather."

During the last seven years, three mass fall migrations have been observed in Iowa. The calendar dates were November 8 and 9, 1950; November 20 and 21, 1953; and November 1 and 2, 1955. Weather data have been obtained through the courtesy of the U. S. Weather Bureau and studied to try and determine what weather conditions were responsible, and if similar conditions could be forecast. Although this study is incomplete, some interesting weather parellels were noted during each mass fall migration on record. During each mass fall flight studied, continental air mass (pressure systems) provided strong northwesterly winds all the way from the breeding grounds to the gulf coast. This phenomenon, known as pressure pattern flying, has been scrutinized by ornithologists (Bagg, et all. 1948, 1950). Unfortunately, very little has been written concerning the role of fall mass migration of waterfowl and the cause-effect relationship of pressure-pattern flying. Hochbaum (loc cit) has recently treated this subject well, but the overall continental picture needs more study and regional clarification.

In the lakes region of northwest Iowa fall migration of mallard and scaup is usually preceeded several weeks by a much smaller migration of miscellaneous species coinciding with cold weather and the first hard freeze-up of shallow waters to the north. Usually a few thousand waterfowl including some mallard, scaup, ring-necked duck and other divers arrive during the hours of darkness. These transients rest throughout the day on the larger lakes, and resume migration the following evening about sundown. Coincidentally or not, a strong northwest wind and clear or clearing skies generally prevail about sundown; even though the preceeding daylight hours may or may not have been overcast or windy. Apparently these waterfowl anticipate optimum flight conditions at the sundown hour, or other unknown reasons resume their migratory journey at this time of day.

Mass fall migration in the lakes region of northwest Iowa is a much more spectacular event. The larger lakes provide temporary resting areas for many, many thousands of mallards and lesser numbers of divers, especially scaup. The mallards appear to migrate in leap-frog waves throughout the daylight hours. The majority of mallards fly just ahead, through, and behind the greatest storm activity. Apparently some birds rest and feed, however, the majority of migrants ultimately ride with the wind and bad weather. A small proportion of the mallards filter out along the migratory pathway remaining in local areas for several days or weeks as temporary residents. The major waves of mass fall migration have been of approximately 24 hours duration in northwest Iowa. A south-southeasterly course was maintained each time with little or no variations between individual flocks of migrating birds. Divers have presented a somewhat different picture in that they tend to accumulate upon the larger lakes and leave throughout the sundown hour resuming migration. Isolated flocks of divers during the daylight hours have been the exception rather than the rule.

Hochbaum (loc cit) has explained the "trigger effect" which influences the exact day when mass migration will start. Briefly, weather maps studied on the dates of Iowa's recorded mass migration indicate troughs of southeasterly winds down the great plains from Canada to the Gulf. These winds originated from large high pressure systems in arctic and were facilitated by a series of highs and lows supporting the southeasterly winds and descending foul weathers from the north on a broad front east and west across the great plains. Although there was no identical pattern of high and low pressure districution in continental north America during each mass fall migration observed, the weather conditions suitable for mass migration most certainly could be forecast as probable "fowl weather".

U. S. Weather Bureau personnel of the Waterloo, Iowa station indicated this weather pattern usually initiates a major change-over from autumnal instability to a more stable pattern of winter weather. This rather abrupt change-over from fall weather to winter is a recognizeable meterological fact.

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AGE OF QUAIL IN THE HUNTER'S BAG

1955

By M. E. Stempel
Quail Biologist

Study of theage of game shot by hunters revealed that successful seasons resulted from populations of varying composition. In quail hunting sometimes it was birds hatched during early summer that made up a large part of those shot; again, those produced later in July or August were more plentiful.

In this study, dates were determined by examining wings furnished by hunters. This showed the age of young and thus hatching peaks became known. Using this as a basis, it was learned that nesting was to a certain extent, governed by the amount of favorable weather. This also may be applied to future seasons. It was evident that in 1956 quail had ample opportunity to hatch during much of the summer although spring was late and cold.

Method of Securing Wings

Conservation Officers located in the quail range and hunter cooperators who expressed interest in this work were asked to keep one wing from each quail shot. Some of the men used a different container for the take of the trip. They also recorded date, place, and in some instances, the sex of quail shot.

Method of Classification

For study purposes the wings were firstclassified according to county of origin. When date of kill was unknown, wings were identified by the stage of development of flight primaries; thus young were distinguished from the old. When date of kill was known the age could be determined for young less than 150 days old. If over this, the young were listed in a single category. Those over one year old were identified by blunt or by brown outer primary flight feathers.

RESULTS OF CLASSIFICATION

Table 1 - Per cent of Young Quail in the Hunter's Bag.

1946 - 1955

YEAR	PER CENT OF YOUNG QUAIL
1946	85.7
1947	82.7
1948	87.2
1949	88.2
1950	83.1
1951	85.6
1952	87.0
1953	83.4
1954	90.0
1955	89.0

Of the 2410 wings that were in condition to be handled there was information on date and place of kill for 676. Some wings were in sealed containers. Many of these decayed.

Dated wings came from Appanoose, Clarke, Davis, Decatur, Lucas, Monroe, Ringgold, Van Buren, Wapello and Wayne counties. Data from the usable wing sample indicated that hatching began late in May, and rose to a peak in the forepart of July; which is the same as in 1954. Quail over 150 days old amounted to 62 per cent while in 1954 the figure was 55 per cent.

Though the 1955 and 1954 springs were not identical the hatching periods were under way at about the same time, and the bulk of young came off during July. There were local changes. Some of this undoubtedly came about because of a change in opening dates. In other words, the later 1955 opening prevented collecting of the very young birds that appeared some other years. No attempt was made to measure this possible change.

There was a high percentage in the group that had reached 150 days of age, and which was collected throughout the 1955 shooting season. This was greater than in 1954. Hatching peaked in July and fell off gradually through September. In the following table the percentage in three age groups are given.

Table 2 - Age Variations in Young Quail Bagged During November Expressed as per cent of Year Class.

Hatching Year	1-120 Days Old	121-149 Days Old	150 Days Old or Older
1950	39	24	37
1951	59	27	12
1952	40	11	48
1953	37	24	37
1954	32	11	57
1955	22	22	51

Data from other seasons on quail indicated that the various hatching periods were characterized by certain features. Though in 1950 spring was late, fall shooting was good. The 1951 spring was still later in arriving, also it was wet, cold, and otherwise generally unsuitable so that as a result only 12 per cent of the bag of young was the desirable mature size quail. The 1952 spring warmed up early. It was considered normal, and 48 per cent of the young were over 150 days old. The 1953 season was poor in some spots and good in others though the spring was similar to that of the previous year. Spottiness may have been due to destructive summer storms that occured in some areas. The 1954 spring was warm. A late August wet spell added to the hatching season, and hunting was good as a result. In the 1955 warm weather of April and May was interrupted by a cooler June. Hunting was fair to good. The indicated harvest of young was probably beneficial since this removed the least mature that would not reach full size before cold weather set in. Table three below gives the number of young as a percentage of the bag taken at various times during the season.

Table 3 - Per cent of Matured-size Young Quail in the Hunter's Bag by Hunting Periods During the 1953-55 Seasons.

Hunting Period	Per Cent over 150 days old 1953	1954	1955
November 1-15 *	35	33	34
November 16-30	53	61	67
December 1-15	90	84	79

* For the first time in recent years the season opened November 5 instead of November 1. This was in 1955.

Thompson and Kabat (1950) suggested that the stage of moult in the adult quail should correspond to the stage if moult in the young. Early moult and early maturity of new primary feathers in both young and adults should follow an early hatching season. The percentage of adult wings with mature plumage in December 1955 was 44 per cent while in 1954 this figure was 3 per cent.

A partial record is available of the sex of quail killed by some cooperators in the dated wing project. From this record the take by sex was: in 1951, 92 hens per 100 cocks; in 1952 and 1953 104 hens per 100 cocks; while in 1954 this figure was 90 hens per 100 cocks; and in 1955 it amounted to 90 hens to 100 cocks.

Summary

1. In a sample of quail wings taken by hunters in 1955 there were 2,410 wings of which 89 per cent were of young birds.

2. Quail hunting was fair to good in most areas and a large part of the bag were of older young quail.

3. A high percentage of adults had completed growth of primary feathers by December.

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Pheasant Reproduction in Iowa - 1956

by

Richard Nomsen
Pheasant Biologist

Surveys designed to evaluate pheasant reproduction success form the most important part of the year round program. An over-all picture of what the pheasants were doing from month to month during the critical period of early spring and through the summer was drawn from frequent checks by conservation officers, rural mail carriers, farmers, and biologists. Records of similar studies taken during previous years were compared with the latest findings in order to determine the relative success of the present hatch.

Production of any species begins with the parent stock. Iowa's 1956 brood stock of pheasants was high. Spring counts indicated an excellent carry-over of birds through the winter months.

Our first indication of hatching success comes from a study of spring weather - temperatures in particular. In the past, mean temperatures for April and May have revealed the probable success of reproduction. (Table 1). A warm early spring denotes high nesting success -- a cool one, poor reproduction. Temperatures were about normal last spring so we could expect average success for the nesting hens.

Table 1. Reproduction Success and Mean Spring Temperatures. 1951-1956

Year	Mean Temperature for April and May	Reproduction Success Young per Hen
1951	53.3	3.9
1952	54.8	4.3
1953	51.9	3.4
1954	54.1	3.7
1955	60.0	5.2
1956	54.7	4.2

The Weekly Weather and Crop Bulletin reported that the first cutting of alfalfa was behind the early cutting of 1955, but about on schedule with the nine year average.

There were 129 cards returned by cooperating farmers last spring with information on nests and hens seen while cutting the first crop of hay. The reported 22 per cent more nests in hayfields in 1956 than were seen in 1955, Table 2. This increase was due mainly to a higher population of hens and partly to later nesting activity caused by cooler temperatures. Only eight broods were checked this year compared with 28 a year ago, and more hens were killed or injured per 100 acres of hay cut.

Table 2. Results of Farmer Cooperator Nesting Survey for 1955 - 1956.

	1955	1956
Acres of hay cut	4,892	3.823
Number of nest seen	330	3.5
Nests seen per 100 acres	6.7	8.2
Average number of eggs per nest	9.6	9.1
Number of nests hatched	30	32
Number of hens reported injured	74	63
Hens reported injured per 100 acres	1.5	1.6
Number of hens reported killed	65	66
Number of hens reported killed per 100 acres	1.3	1.7
Number of broods reported	28	8
Average number in each brood.	10.5	10.0

Rural mail carriers made their summer reporoduction count during the last week of July. They reported 813 broods during the period which was a substantial increase over the 505 broods reported in 1955. However, weather conditiona are an important limiting factor in the number of birds observed during mid-day, and for that reason, this count is not used as a population survey. It was very hot and dry for the 1955 count which no doubt lowered the number of broods reported. Temperatures were near normal this year with light showers in the northern third of the state. The carriers reported 2.3 young per hen compared with 2.7 a year ago. According to this survey, the brood size remained about the same while the percentage of hens seen with broods decreased. The average for the period 1951-1955 was 2.4 juveniles for each hen, (Table 3).

Table 3. Rural Mail Carriers Brood Counts 1951-1956.

	1951	1952	1953	1954	1955	1956
Average brood size	5.9	6.3	5.9	6.5	6.1	6.0
Per cent of hens with broods	39%	41%	36%	38%	43%	38%
Young per adult hen	2.3	2.6	2.1	2.5	2.7	2.3

The primary survey to measure pheasant reproduction was taken by conservation officers from July 15th to August 15th. This includes the results of the sight record count as well as the regular August roadside check. They reported 2,165 broods during the period with a total of 12,806 chicks. They also saw 876 hens without broods. The young per hen figure dropped from 5.2 in 1955 to 4.2 in 1956 which was equal to the previous 6-year average. A lower percentage of hens was reported with broods this year and the average brood size decreased. Pheasant reproduction appeared to be best in northeast, central and east central Iowa, (Table 4).

Table 4. District Results for Conservation Officers Brood Counts for 1956 - Statewide Results for 1951-1956.

	Young per Adult Hen	Average Brood Sizes	Percentage of Hens with Broods
Northwest	3.8	5.5	68%
North central	3.9	5.4	73%
Northeast	4.5	6.5	70%
West central	4.0	6.4	62%
Central	5.4	6.7	80%
East central	4.9	6.4	76%
Southern 3 districts	4.5	6.5	70%
State 1951	3.9	6.2	62%
State 1952	4.3	6.6	66%
State 1953	3.4	6.4	53%
State 1954	3.7	5.7	64%
State 1955	5.2	6.8	77%
State 1956	4.2	5.9	71%

Hatching success in Franklin county was down according to the author's survey in this area, results were similar to those for the state as a whole, (Table 5).

Table 5. Pheasant Reproduction Counts in Franklin County for Past Five Years.

	Young per Adult Hen	Average Brood Size	Percentage of Hens with Broods
1952	5.3	6.5	82%
1953	3.1	6.0	52%
1954	4.6	6.3	74%
1955	5.2	6.7	78%
1956	4.3	6.1	71%

A total of 84 broods was observed closely enough to estimate their ages. The peak of 1956 hatching occured about 12 days later than in 1955.

Iowa's 1956 fall population of pheasants is expected to be down slightly from the 1955 crop. More hens produced fewer chicks this year. Results of the August roadside count revealed a population décrease of eight per cent. Northeast and east central districts recorded increases while the rest of the state remained about the same or experienced a loss of birds.

Summary

1. This report includes results of all pheasant reproduction studies made in 1956.

2. Lower temperatures during April and May delayed nesting activity. Mean spring temperatures indicated an average hatch.

3. Farmer cooperators reported 22 per cent more nests in hayfields this year. More hens were killed or injured.

4. Results of the rural mailcarrier count showed a normal hatch.

5. Reproduction success for the state was equal to the six-year average of the officers summer survey. Best results were obtained in northeast, central and east central Iowa.

6. A normal hatch was observed in Franklin county.

THE DEER SITUATION, OCTOBER 1, 1956.

Paul D. Kline
Game Biologist

The February, 1956, deer survey conducted by conservation officers reveals our deer population has stabilized or increased slightly in total numbers. The indicated herd of 10,811 deer is up from the 1955 estimate of 10,674 after a known fall harvest of 3,035 animals.

As Table 1 illustrates, Allamakee county again had more deer than any other with a reported herd of 1,000. Other northeast counties reported: Jackson, 480; Clayton, 400; and Dubuque, 350. Western counties with high counts were: Monona, 465; Woodbury, 365; and Pottawattamie, 342. One county, Grundy, reported no deer.

By agriculture areas (Table 2) the northeast has most with 2,511. Next is the west central area with 1,829 deer; while the east central had 1,351. Fewest deer were reportedly in the southeast where officers estimated the herd at 669.

Because deer are essentially woodland or brushland species we should expect the most deer where we have the most ungrazed woodland. Table 1 reveals this is not true in all of Iowa. Allamakee county ranks first in number of deer and second in acres of unpastured woodland. However, Monona county ranks third in number od deer and 21st in acres of unpastured woodland; and Hancock county ranks 22nd in number of deer and 99th in acres of ungrazed woodland.

Tabulated by agricultural areas (Table 2) we see a much clearer picture of the unbalanced nature of our deer herd. While the southeast and south central have 16.7 and 15.4 percent respectively of the state's ungrazed woodland, they have but 6.2 and 10.8 percent of the deer herd.

Table 1. Comparisons of deer populations with acres of woodland in each county.

County	Ungrazed * Woodland (Acres)	Total Woodland (Acres)	1953# Deer Estimate	1956 Deer Estimate
Clayton	1' - 23,957	2 - 98,169	3 - 800	4 - 400
Allamakee	2 - 20,895	1 -113,942	2 -1,000	1 -1,000
Lee	3 - 12,469	3 - 72,717	93 - 10	47 - 83
Washington	4 - 10,281	20 - 36,732	62 - 53	61 - 37
Van Buren	5 - 10,173	4 - 62,685	83 - 18	64 - 55
Winneshiek	6 - 9,364	9 - 52,145	36 - 105	16 - 150
Iowa	7 - 9,345	26 - 33,891	17 - 196	30 - 107
Harrison	8 - 8,973	14 - 38,902	10 - 234	13 - 178
Dubuque	9 - 8,830	6 - 53,505	16 - 200	6 - 350
Linn	10 - 8,365	16 - 37,096	66 - 45	18 - 140
Jones	11 - 8,185	19 - 36,958	59 - 56	31 - 102
Johnson	12 - 8,043	32 - 30,903	55 - 77	40 - 94
Appanoose	13 - 7,933	10 - 51,202	52 - 84	43 - 93
Marion	14 - 7,658	13 - 39,269	74 - 31	59 - 61
Fayette	15 - 7,461	12 - 42,580	57 - 75	47 - 80

* Data from 1950 census compilation. # Winter estimates by Conservation officers.
' Numbers preceeding dashes in each column represent numerical order of abundance from county having most (1) to least (99).

Pottawattamie	16 - 7,404	39 - 24,666	1 -1,500	7 - 342
Madison	17 - 7,401	11 - 43,333	25 - 152	25 - 118
Keokuk	18 - 7,029	27 - 32,680	56 - 76	32 - 100
Monroe	19 - 6,827	8 - 51,370	22 - 164	28 - 111
Monona	20 - 6,755	21 - 36,588	15 - 210	3 - 465
Jackson	21 - 6,746	5 - 76,733	31 - 121	2 - 480
Wapello	22 - 6,682	18 - 36,995	70 - 37	29 - 110
Woodbury	23 - 6,547	43 - 21,942	5 - 520	5 - 365
Decatur	24 - 6,395	7 - 52,337	13 - 223	15 - 170
Warren	25 - 6,106	41 - 22,838	81 - 20	63 - 56
Davis	26 - 5,992	22 - 36,436	78 - 24	82 - 37
Lucas	27 - 5,867	25 - 35,219	38 - 104	14 - 175
Fremont	28 - 5,689	54 - 16,356	69 - 37	17 - 142
Ringgold	29 - 5,674	49 - 17,784	26 - 150	56 - 65
Clinton	30 - 5,639	44 - 21,897	67 - 42	33 - 100
Louisa	31 - 5,563	28 - 31,571	96 - 9	81 - 40
Guthrie	32 - 5,425	23 - 36,376	9 - 253	8 - 217
Des Moines	33 - 5,004	15 - 37,305	86 - 14	83 - 35
Tama	34 - 4,962	42 - 22,375	51 - 85	51 - 75
Mills	35 - 4,962	63 - 14,191	33 - 119	29 - 130
Jefferson	36 - 4,928	30 - 31,213	84 - 15	76 - 42
Delaware	37 - 4,662	36 - 27,614	20 - 175	10 - 200
Clarke	38 - 4,510	33 - 28,772	39 - 100	25 - 118
Jasper	39 - 4,307	46 - 21,235	18 - 42	78 - 41
Mahaska	40 - 4,271	45 - 21,796	60 - 55	34 - 100
Cedar	41 - 4,159	40 - 24,596	75 - 30	72 - 50
Polk	42 - 4,151	38 - 26,083	27 - 145	35 - 100
Muscatine	43 - 3,978	35 - 28,161	90 - 12	84 - 35
Henry	44 - 3,946	24 - 36,105	88 - 14	88 - 27
Dallas	45 - 3,944	29 - 31,509	45 - 93	38 - 96
Buchanan	46 - 3,752	48 - 18,137	72 - 35	68 - 50
Poweshiek	47 - 3,506	62 - 14,551	99 - 3	98 - 10
Webster	48 - 3,447	34 - 28,750	50 - 86	46 - 85
Boone	49 - 3,434	31 - 31,008	24 - 162	67 - 51
Black Hawk	50 - 3,419	51 - 17,460	7 - 260	37 - 98
Wayne	51 - 3,080	37 - 26,864	77 - 27	52 - 75
Union	52 - 2,932	52 - 17,350	40 - 100	55 - 73
Taylor	53 - 2,928	55 - 16,323	41 - 100	86 - 28
Bremer	54 - 2,825	58 - 15,389	42 - 100	88 - 45
Benton	55 - 2,774	50 - 15,505	46 - 92	9 - 215

Scott	56 - 2,702	64 - 13,622	91 - 12	87 - 28
Hardin	57 - 2,538	47 - 18,555	23 - 163	39 - 95
Montgomery	58 - 2,470	74 - 9,660	89 - 14	60 - 59
Chickasaw	59 - 2,401	56 - 15,947	49 - 87	67 - 50
Page	60 - 2,218	57 - 15,895	85 - 15	90 - 23
Howard	61 - 2,169	71 - 10,738	71 - 37	73 - 45
Floyd	62 - 2,132	65 - 13,364	37 - 105	36 - 100
Marshall	63 - 2,033	61 - 14,768	54 - 79	54 - 74
Mitchell	64 - 1,969	66 - 12,069	47 - 92	26 - 115
Butler	65 - 1,933	60 - 14,937	30 - 124	23 - 120
Cherokee	66 - 1,741	75 - 9,323	19 - 178	21 - 130
Cass	67 - 1,713	70 - 10,959	86 - 15	77 - 42
Adair	68 - 1,705	69 - 11,200	32 - 120	44 - 90
Adams	69 - 1,686	67 - 11,476	64 - 50	92 - 20
Plymouth	70 - 1,670	72 - 10,483	6 - 381	27 - 115
Wright	71 - 1,610	76 - 8,282	63 - 50	79 - 40
Crawford	72 - 1,589	68 - 11,201	35 - 110	11 - 200
Kossuth	73 - 1,550	78 - 7,497	12 - 225	42 - 94
Greene	74 - 1,533	59 - 15,142	65 - 49	74 - 45
Story	75 - 1,360	53 - 16,753	80 - 20	93 - 20
Hamilton	76 - 1,245	73 - 10,320	43 - 100	41 - 94
Franklin	77 - 1,224	77 - 7,835	92 - 12	80 - 40
Cerro Gordo	78 - 1,121	81 - 6,257	94 - 10	89 - 25
Sac	79 - 1,090	82 - 5,840	79 - 23	70 - 50
Audubon	80 - 1,009	87 - 4,943	98 - 7	96 - 12
Buena Vista	81 - 998	79 - 7,466	61 - 54	65 - 55
Carroll	82 - 993	85 - 5,488	76 - 28	85 - 31
Worth	83 - 848	86 - 5,475	29 - 131	71 - 50
Humboldt	84 - 946	83 - 5,822	28 - 145	50 - 80
Winnebago	85 - 944	92 - 2,974	14 - 217	57 - 65
Shelby	86 - 942	80 - 6,326	4 - 523	12 - 180
Ida	87 - 888	97 - 2,102	73 - 35	53 - 75
Palo Alto	88 - 865	90 - 4,145	58 - 60	91 - 21
O'Brien	89 - 844	93 - 2,703	82 - 20	94 - 20
Clay	90 - 827	84 - 5,803	34 - 115	19 - 132
Lyon	91 - 815	91 - 3,996	8 - 260	48 - 81
Calhoun	92 - 738	88 - 4,564	97 - 9	97 - 11
Emmett	93 - 714	89 - 4,425	44 - 99	58 - 64
Sioux	94 - 615	94 - 2,512	21 - 169	62 - 57
Osceola	95 - 528	99 - 1,017	53 - 80	95 - 19
Dickinson	96 - 508	96 - 2,254	18 - 187	66 - 55
Grundy	97 - 499	92 - 3,658	95 - 10	99 - 0
Pocahontas	98 - 381	98 - 2,046	48 - 92	75 - 45
Hancock	99 - 270	95 - 2,482	11 - 233	22 - 126
Totals	418,130	2,320,501	12,632	10,811

On the other hand, the west central, northwest, and north central have 8.7, 2.5, and 3.5 percent respectively of the ungrazed woodland, but support 16.9, 7.4, and 7.9 percent of the deer herd. Other areas appear to be essentially balanced. With this condition we can expect deer trespass trouble areas to develop where there are more deer than the woodland will support; very likely, the west central, northwest, and north central.

Table 2. Numbers and percentages of totals in acres of unpastured woodlands in agricultural areas as compared to officers February deer estimates for 1953, 1955, and 1956.

Area	1953 Estimates		1955 Estimates		1956 Estimates		Acres of Unpastured Woodland	
	Number of Deer	Percent of Total	Number of Deer	Percent of Total	Number of Deer	Percent of Total	Number of Acres	Percent of Total
Southeast	325	2.6	510	4.8	669	6.2	69,656	16.7
South central	1,102	8.7	1,039	9.7	1,168	10.8	64,383	15.4
Southwest	1,970	15.6	1,280	11.9	876	8.1	30,775	7.4
West central	2,001	15.9	1,790	16.7	1,829	16.9	36,382	8.7
Northwest	1,675	13.3	908	8.5	794	7.4	10,506	2.5
North central	1,344	10.6	1,120	10.5	855	7.9	14,647	3.5
Northeast	2,874	22.7	2,090	19.5	2,511	23.2	89,735	21.5
East central	683	5.4	1,165	10.9	1,351	12.6	59,936	14.3
Central	988	7.8	774	7.2	741	6.9	35,426	8.5
Totals	12,632		10,674		10,811		418,130	

The above condition is not really bad, but from ecological and management standpoints we should expect our deer herd to increase considerably in the southeast and south central, while decreasing in the west central, northwest, and north central areas.

That this change is already taking place can be seen by the percentages of total population from 1953 as compared to 1956 (Table 2). In 1953 the southeast and south central had 2.6 and 8.7 percent of total population; now they have 6.2 and 10.8 percent respectively. Little change has taken place in the west central. However, the northwest and north central have decreased from 13.3 to 7.4 percent and from 10.6 to 7.9 percent respectively.

In the southwest, one of the worst trouble spots before, the population has decreased from 1,970 animals (15.6 percent) to 876 (8.1 percent). This herd is now nearly in line with the amount of ungrazed woodland available, (7.4 percent).

Hunting is probably responsible to a great extent for the shift toward a balance between the deer population and amount of woodland. Table 3 shows harvest has been consistently greatest in areas where deer are most numerous and where they are most exposed to hunting pressure by lack of cover. In other words, deer are easier to take by hunters in areas where they are more numerous than available ungrazed woodland would justify.

In the southeast and south central where few deer are protected by abundant cover the kill was 2.8 and 4.0 percent of the total harvest. For the same year, 1955, the west central, northwest, and north central with comparatively numerous deer and sparse cover yielded 15.0, 17.3, and 11.7 percent respectively of all deer killed.

Table 3. Known deer harvest by agricultural areas for 1953, 1954 and 1955 seasons.

Areas	1953		1954		1955	
	Number Harvested	Percent of Total	Number Harvested	Percent of Total	Number Harvested	Percent of Total
Southeast	0*	---	18	0.7	85	2.8
South central	215	5.4	162	6.6	122	4.0
Southwest	620	15.5	166	6.8	175	5.8
West central	775	19.3	326	13.3	456	15.0
Northwest	760	19.0	293	11.9	524	17.3
North central	288	7.2	388	15.9	356	11.7
Northeast	1,088	27.1	928	37.9	802	26.4
East central	22	0.5	134	5.5	223	7.3
Central	240	6.0	24	1.0	292	9.6
Totals	4,008	100.0	2,446	100.0	3,035	99.9

* In 1953 no counties were open to hunting in the southeast.

The above situation probably has resulted from focal points of repopulation. Areas which had in 1953 a surplus of ddr or were already well stocked were the areas first re-inhabited by the species. Deer herds were first established from escaped near Avoca in Pottawattamie County, Keota in Washington County, and Ledges State Park in Boone County (Sanderson and Speaker, 1954). Herds in north and particularly northeast Iowa seemed to have been re-established by natural means.

Our deer herd, being like most animal populations in the wild, fluctuates considerably in numbers during one year's time. The maximum number of deer can be expected immediately after the fawns appear in early summer. Therefore, the toll of disease, parasites, predators, accidents, poaching, and hunting reduce the population until the next crop of fawns appear during the following summer.

Hence, the number of deer we have in the state during future hunting seasons will depend upon survival of the present stock, plus reproduction during succeeding years. Table 4 presents the calculated spring and summer populations based upon conservation officers' estimates and upon calculated reproduction. Reproduction is obtained by use of data secured at checking stations. Precent of fawns in the bag can be converted to reproduction.

Table 4. Yearly fluctuations of Iowa's deer population.

YEAR	Officers February Estimates	Known * Accidental Kills	Percent of Fawns in Bag at Checking Stations	Calculated Reproduction in Percent	Theoretical Maximum Summer Population
1947	1,650				
1948	2,024				
1949	no census	taken			
1950	4,530				
1951	6,897	196			
1952	10,721	246			
1953	12,632	393	27.4	37.7	17,394
1954	11,892	310	41.7	70.6	20,288
1955	10,674	305	34.7	53.9	16,427
1956	10,811	---	----	60.0'	17,298

* Includes all those deer reportedly killed by cars, dogs, poaching, and miscellaneous accidents.

' This is an estimated figure.

The fluctuation appears to be somewhat violent. For example, 20,288 calculated deer present in summer of 1954 were reduced to 10,674 estimated by officers in the late winter of 1955: And 16,427 deer for the summer of 1955 were reduced to an estimated 10,811 by spring of 1956. Reproduction for these two years was 70.6 percent and 53.9 percent. Using the 1955-56 fluctuation we find the herd was reduced by 5,616 deer from mid-summer 1955 to late February 1956. Approximately 3,300 deer were taken by hunters during the three day season of 1955. This leaves 2,316 lost to other mortality factors.

It appears that we are: 1. Harvesting only part (30-60 percent) of our annual surplus; 2. Under estimating the size of the herd in late winter or early spring; and (or) 3. Having less than calculated reproduction. The first possibility is the most plausible one. Although it appears hard to account for loss of 2,316 deer from one year to the next, this is a common biological phenomena which affects all relatively short-lived species. In 1955,305 deer were known killed by autos, poaching, dogs and miscellaneous factors. (Table 4).

Conclusions From the foregoing paragraphs it appears that we have a basic deer herd of from 10,500 to 11,000 animals. The herd is not properly distributed in available ungrazed timber, but apparently is gradually improving its distribution under natural processes of reproduction and with the aid of hunting pressures.

Reproduction of 60 percent or more should enable us to safely harvest 3,500 deer annually. The remaining 2,950 reproduction will serve as a bulwark against disease, parasites, predators, accidents, and poaching.

Statewide seasons permitting the kill of all age classes and both sexes will help keep our herd compatible with its available range and with agriculture. To close any one area to hunting will allow deer to increase beyond the carrying capacity of that area and lead to encroachments upon agriculture.

Six to seven thousand permits issued annually should allow a harvest of 3,500 deer during a three day season. To issue more permits may lead to excessive farmer-hunter conflicts; eventually to a closed season and subsequent herd increase; and finally to a situation beyond control of our Conservation Commission.

Local situations can be expected to develop where the herd is over-protected by state parks, large timber tracts, etc.. However, hunting pressure when applied on a state-wide basis should reduce or disperse concentrations and keep at a minimum competition with agriculture.

References:

Sanderson, Glen C., and E. B. Speaker. 1954. Results of Iowa's First Deer Season in Recent Years. Proc. Iowa Acad. Sci., Vo. 61: pp. 615-630.