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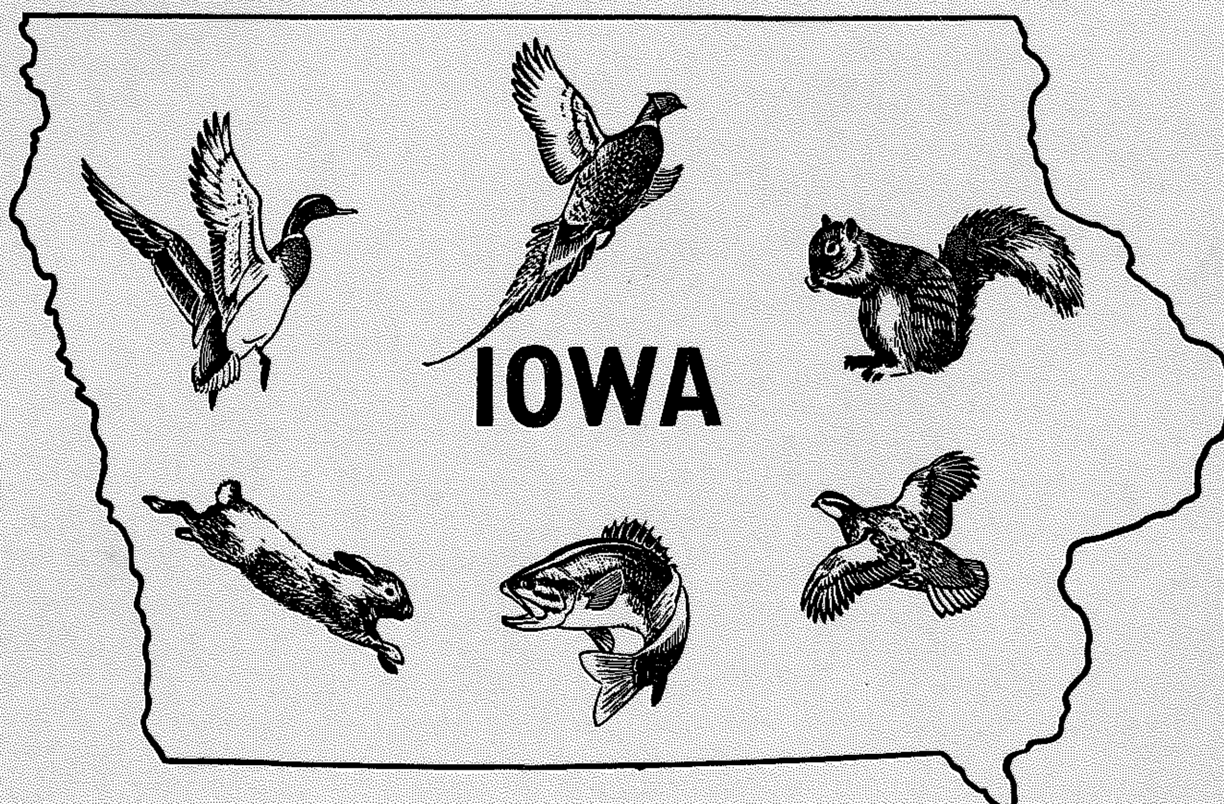

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STATE CONSERVATION COMMISSION

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THE 1955 SQUIRREL SEASON
IN IOWA

by
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Game Biologist

Iowa's annual squirrel season was open September 17 to November 15, 1955. As in all recent years, hunting was permitted for fox and gray squirrels in the entire state. Daily bag and possession limits were six and twelve respectively.

For the sixth successive year, beginning in 1950, a list of known squirrel hunters was compiled. Distributed throughout the state, these hunters were mailed a form, asked to fill it out, and return to the Conservation Commission office after termination of the season. The form provided space for recording each hunting trip the number of squirrels killed, crippled, and observed; sex of squirrels in the bag; number of hunters in each party; the number of hours hunted; whether or not a dog was used; county hunted in; and type of gun used. Each hunter was asked to record whether or not he felt there were more squirrels than during the previsos season. In addition, all were asked to save the right foreleg of bagged squirrels and return them with the forms.

Bones from the forelegs were used to age squirrels as in past years. Cartilaginous tissue at the distal end of the radius or ulna was used to distinguish juveniles from adults (Colin, 1949). Many thanks are due to Glen Sanderson, who so generously aged all of the 345 squirrels submitted from the 1955 season.

Hunter Success

As can be seen in Table 1, hunting success was nearly identical with that of 1954. The average hunter stayed in the timber 2.7 hours per trip to kill 2.2 squirrels, while crippling 0.1, and seeing 2.7 squirrels he neither killed nor crippled. This amounts to five squirrels seen per hunter every time he went hunting. On an hourly basis, the hunter saw 1.9 squirrels of which he bagged 0.8. In other words, 44 per cent of all squirrels seen were bagged. Not all nimrods hunted alone. Hunting parties averaged 1.5 individuals per trip.

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Table 1. Hunter Success for 1955 as Compared to 1954.

	1954	1955
Number hunters/party/trip	1.5	1.5
Number hours hunted/trip	2.7	2.8
Number squirrels killed/hunter/hour	0.8	0.8
Number squirrels killed/hunter/trip	2.2	2.2
Number squirrels crippled/hunter/hour	0.05	0.04
Number squirrels crippled/hunter/trip	0.1	0.1
Number squirrels seen but not killed or crippled/hunter/hour	1.0	1.0
Number squirrels seen but not killed or crippled/hunter/hour	2.7	2.7
Total number squirrels seen/hunter/hour	1.9	1.9
Total number squirrels seen/hunter/trip	5.0	5.2
Number squirrels crippled/kill	0.06	0.05
Per cent total observed squirrels in bag	43.6	44.0

Table 2 reveals 65.9 per cent of 44 hunters reported hunting better than the previous year, 1954. One-fourth of the hunters thought hunting was poorer, while fewer than one-tenth thought hunting remained similar to 1954. Because nearly two-thirds of the reporting hunters apparently thought hunting was good, it appears that the 1955 squirrel season was successful.

Table 2. Hunters' Replies as to Whether There Were More or Fewer Squirrels Than the Previous Year.*

	1950	1951	1952	1953	1954	1955
Number of hunters reporting	92	48	60	63	36	50
Number of hunters answering the questions	74	39	47	42	22	44
Per cent who said More squirrels than last year	47.3	53.8	59.6	59.5	63.6	65.9
Per cent who said Fewer squirrels than last year	37.8	30.8	17.0	23.8	27.3	25.0
Per cent who said Same number as last year	14.9	15.4	23.4	16.7	9.1	9.1

* The question was "Do you thihk there are more or fewer squirrels than there were last year?."

Age ratios obtained from leg bone studies indicate more juveniles in the bag for 1955 than during the previous season. Table 5 reveals 55.9 per cent of the fox squirrels and 78.3 per cent of the grays were juveniles. Both these figures are above those of the six-year average. The percentage of juvenile grays may be inaccurate, as only 23 were obtained for aging.

Table 5. Per cent of juvenile squirrels in the bag for years 1950-1955.

	1950	1951	1952	1953	1954	1955	Average
Fox Squirrels	57.2	52.5	56.4	59.0	53.2	55.9	55.7
Gray Squirrels	54.0	50.9	38.1	59.4	48.6	78.3	54.9

Sex and age ratios indicate our squirrel population is in good condition. Increases in pre cent of females should lead to good production during the following year. Increase in juveniles indicates good reproduction during the year in which they were taken.

Species Composition

Indication of gray squirrel distribution can be seen in Table 6. On a basis of percentage, more grays than fox squirrels were bagged in the northeast corner of the state. Many gray squirrels were taken in the east central and southeast regions, but fewer than the number of fox squirrels. In other parts of the state only fox squirrels were found in the bag with the exception of six widely scattered counties. These were Lucas, Tama, Hamilton, Humboldt, Greene, and Osceola. It appears the gray squirrels were very important in the northeast, less important in the east central and southeast, and insignificant elesewhere, with local exceptions.

Table 6. Number of Squirrels Seen by Hunters in Each County from Which Reports were Received.

County	Number Fox Squirrels	Number Gray Squirrels	Per Cent Fox Squirrels
Allamakee	59	68	46.5
Bremer	41	2	95.3
Buchanan	6	--	100.0
Buena Vista	24	--	100.0
Butler	26	--	100.0
Cherokee	19	--	100.0
Chickasaw	38	2	95.0
Clay	62	--	100.0
Clayton	34	18	65.4
Crawford	146	--	100.0
Davis	31	6	83.8
Delaware	7	--	100.0
Des Moines	1	--	100.0
Dickinson	162	--	100.0
Fayette	38	43	46.9
Greene	29	5	85.3
Grundy	8	--	100.0
Guthrie	33	--	100.0
Hamilton	36	1	97.3
Hardin	120	--	100.0
Henry	8	1	88.8
Howard	51	8	86.4
Humboldt	5	6	45.5
Iowa	5	--	100.0
Jackson	23	8	74.2
Jasper	18	--	100.0
Jefferson	18	3	85.7
Johnson	3	--	100.0
Jones	6	1	85.7
Kossuth	70	--	100.0
Lee	15	10	60.0
Linn	32	--	100.0
Louisa	2	6	25.0
Lucas	125	5	96.1
Madison	184	--	100.0
Mahaska	1	--	100.0
Marshall	18	--	100.0
Muscatine	32	2	94.1
Osceola	16	5	76.2
Polk	49	--	100.0
Pottawattomie	33	--	100.0
Poweshiek	48	--	100.0
Sac	1	--	100.0
Tama	54	1	98.2
Union	12	--	100.0
Van Buren	48	9	84.2
Wapello	36	8	81.8
Warren	106	--	100.0
Washington	41	--	100.0
Wayne	13	--	100.0
Winneshiek	1	2	33.3
Woodbury	110	--	100.0

The importance of the gray squirrel to hunters increased over the previous season (Table 7). Slightly less than one-tenth of all squirrels were of the gray species. Fox Squirrels made up 90.5 per cent of the total bag. Hence, on a statewide basis they are overwhelmingly most important.

Table 7. Species Composition of 1955 Squirrel Kill as Compared to years 1950 - 1954.

	Number Squirrels in Total Reported Bag for 1955.	Per Cent of Total Bag						
		1950	1951	1952	1953	1954	1955	Average
Fox squirrels	1,027	89.1	87.2	92.6	94.4	93.8	90.5	91.3
Gray squirrels	108	10.9	12.8	7.4	5.6	6.2	9.5	8.7

Type of Gun

Most Iowa squirrel hunters used the .22 caliber rifle (Table 8). Shotguns of sizes ranging from 12-gauge to 410-gauge were reportedly used by 17 hunters. Forty of the reporting hunters used rifles of various calibers. One even used a .36 caliber muzzle loader

Table 8. Types of Guns Used by 1955 Squirrel Hunters.

Caliber or Gauge of Gun		Number Hunters Reported Using
Pistol		
.22 Caliber pistol		1
	TOTAL PISTOL	1
Rifle		
.22 Caliber rifle		38
.30 Caliber rifle		1
.36 Caliber, muzzle loading rifle		1
	TOTAL RIFLE	40
Shotgun		
410-gauge shotgun		8
12-gauge shotgun		5
16-gauge shotgun		2
20-gauge shotgun		1
28-gauge shotgun		1
	TOTAL SHOTGUN	17

Summary

1. Iowa's annual squirrel season was held from September 17 to November 15, 1955.

2. The average hunter bagged 0.8 squirrels per hour of hunting effort, while seeing 1.9 squirrels per hour.

3. Hunting parties averaged 1.5 individuals per trip.

4. Two-thirds of 44 reporting hunters thought the 1955 season better than the previous season. One-fourth thought it was poorer, and one-tenth thought it was about the same.

5. Dog hunters bagged only 0.6 squirrels per hour, and saw only 1.3 squirrels per hour, while crippling more per squirrel killed than hunters with no dogs.

6. Female fox squirrels in the bag were up from 44.1 per cent in 1954 to 44.7 per cent in 1955, but slightly below the six-year average of 45.2 per cent. Female gray squirrels also increased in the bag.

7. Juveniles comprised 55.9 per cent of the fox and 78.3 per cent of the gray squirrels. Both percentages were above the six-year average.

8. Gray squirrels were very important to northeastern hunters, moderately important to east central and southeast hunters, and only locally significant elsewhere. Less than one-tenth of the total bag was gray squirrels.

9. Most hunters used .22 caliber rifles when hunting squirrels.

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NOTES ON IOWA RUFFED GROUSE AND RECOMMENDATIONS FOR THEIR MANAGEMENT

by
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Game Biologist

There was a reported increase in ruffed grouse seen in northeastern Iowa in 1954 and it was thought advisable to make a record of their abundance and distribution. This work was based on recent ruffed grouse studies in similar areas in Wisconsin and Michigan. These birds are not present in great enough numbers to furnish extensive hunting; their existence does not conflict with the welfare of another species. They interest the students, hunters, naturalists, visitors, farmers, town-dwellers, and those who fish the trout streams.

Some Previous Studies

Work done in territories similar to Alamakee County indicated that during the past 10 years the grouse population has experienced both increases and decreases. Polder (1952) found that a decrease was noted as early as 1907. He reported grouse had been present at one time in about 90 counties of the state of Iowa. During his period of study, he found that activities such as cutting, burning, and pasturing were reducing the grouse habitat. The Iowa Biennial Report of 1946 noted that the ruffed grouse population had declined recently, while the same publication stated in 1951, that there was a slight increase.

More Recent Studies in Iowa

Following a 1954 report from Conservation Officer George Kaufmen, that grouse had increased in Allamakee County, four brief studies were made. The first, in 1954, indicated the extent of the range. The second, in 1956, was on the suitability for ruffed grouse of plant life in state-owned timber in southern Iowa. Third was a survey, under guidance of Wisconsin Game Biologist, Robert Dorney, of the present range. Fourth was a count of drumming birds.

The first work was in the spring of 1954 when Stempel, aided by Kaufman, and local conservation commission personnel, made a field survey and conducted interviews which established boundaries of the range. Further, Emmett Polder, now of Loras College, Dubuque, formerly an Ames graduate student who made earlier habitat studies, gave his opinion on the extent of the range.

Thus it was established that the birds lived in an area between Dubuque and the Minnesota line, and between Decorah and the Mississippi River. Timbered river valleys in Allamakee County have most of the grouse.

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Habitat in Southern Iowa Forests

In 1956 a request was made that a study of plants be made in the state forests of southern Iowa. This was to determine whether the areas were suitable for ruffed grouse. Assistance was given by Sylvan Runkel, SCS Wildlife Specialist.

The plant life was similar to that in the northeast with the exception of aspen trees which were less common than in Allamakee County.

In addition to these observations, it was noted that there were fox tracks in the snow. Housecats, dogs, skunks, mink, crows, hawks and owls of unknown species had been seen by employees. However, signs indicating the presence of quail, squirrels, rabbits, mice and common wintering songbirds revealed that predation was not serious.

1956 Estimate of the Size of the Grouse Range

In May, 1956, Robert Dorney, a Wisconsin upland game biologist, who was contacted at the Indiana Wildlife Meeting, came to assist in evaluating the cover. He aided in making an estimate of the number of birds. This was done in company with the Area Game Manager, Tom Berkley, and conservation officers from Allamakee County and adjoining territories. Typical grouse areas were visited. Findings of these field observations were then expanded by means of looking at samples of aerial photographs which were supplied by an ASC office

The territory examined was an extension of fairly good Wisconsin grouse range. This Iowa range contained 20 sections of primary cover. There were 165 sections of poorer cover. Applying Wisconsin measurements, the grouse population then present was estimated at 5,000. It was suggested by Mr. Dorney that in the spring, sample counts of drumming grouse would aid in establishing the extent of the various population densities.

The 1956 Drumming Grouse Count in Iowa

During May the officers in Allamakee, Clayton, Fayette, and Winneshiek counties made checks of the number of ruffed grouse drumming on routes in the better areas. Stempel earlier made one of these counts in the Yellow River Forest area in southern Allamakee county. Table 1 presents the results of these counts.

Table 1. Counts of Drumming Ruffed Grouse, 1956

County	No. of Grouse	No. of Drums
Allamakee	10	13
"	20	22
Clayton	0	0
Fayette	2	
Winneshiek	1 (possible)	

In addition to the record in Table 1 the Winneshiek county officer picked up a dead grouse on a roadway last spring, and one farmer told the officer of seeing birds. A wildlife study group also reported flushing two grouse.

Willow leaves were 25 per cent mature at the time of the census. This indicates the season when drumming is done by the ruffed grouse cocks. There was some cloud cover; but grouse remain active under this condition. Light winds reported would have permitted hearing the birds during most of the counts.

Discussion

Ruffed grouse are scattered through several counties of northeastern Iowa and they range from Decorah to the Mississippi River and from Dubuque to Minnesota. It is believed that some reports of "native pheasants" in southern Iowa may indicate that ruffed grouse have been present not long ago. Prison laborers in the Lick Creek Forest area near Farmingion reported seeing ruffed grouse, in the spring of 1956.

In southern Iowa, near Chariton, and near Farmington, there are state forests having habitat similar to that where grouse now live. Plant lists were examined by Robert Dorney, Wisconsin upland game biologist. He was of the opinion that the birds would probably do well in the Iowa State Forests although the timbers were of limited extent and probably would not support anything but small populations of grouse.

Mr. Dorney has had considerable experience trapping ruffed grouse. It was his opinion that the birds could be captured in Iowa for about $40 each.

In Wisconsin it was learned that ruffed grouse could most easily be taken during August and September. Probably success in Iowa would not be as high as in Wisconsin where 60 birds were caught in 24 man-days when five traps were used.

Points of Special Interest

1. Wild live-trapped ruffed grouse can be transported with little loss.

2. Trapping of ruffed grouse is practical from August through October 15.

3. Drumming counts in Iowa indicate that some areas have about one-half the birds found in average Mighigan range. It is believed that this latter range is comparable to that in Wisconsin.

4. According to success in Wisconsin, Iowa has enough ruffed grouse that they could be successfully trapped though not as easily as in Wisconsin where they are more plentiful. Forty birds would be needed for stocking in southern Iowa.

5. Southern Iowa forests are similar to those in north-eastern Iowa.

6. During periods of high hatching success, the Sandhill Game Farm in Babcock Wisconsin can furnish some wild trapped stock.

7. Indiana has recently transplanted ruffed grouse but the results are unknown.

Recommendations

1. It would be practical to secure grouse for restocking southern Iowa forests. Birds could be trapped in Iowa or they sometimes can be purchased in Wisconsin.

2. Investigations will be continued to learn whether prison laborers actually did see ruffed grouse in the Lick Creek State Forest near Farmington.

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CONSERVATION OFFICERS' WINTER COUNT OF QUAIL

by
M. E. Stempel

Winter is the critical season for game, the late winter quail census reflects survival and can be safely used as one basis for estimating the abundance of brood stock.

In 1956, as the custom has been in recent years, each conservation officer was asked to make a count of birds in one or more of the counties in his territory. Spot checks were made under conditions recommended. This was done by the project biologist in order to have figures with which to compare results from all parts of the state. Several grades of cover were sampled in widely separated sections of the quail range.

Three covey ranges were searched in each county selected. When possible, counts were to be made when there was snow cover. With good tracking conditions quail could be counted by finding their trails, and the covey need not be located. Although only quail flushed or tracked were considered when making tabulations, estimates were entered on a part of the census form reserved for that purpose.

New officers were contacted and a field check was made with as many as could be reached. This insured uniformity. This winter, for the first time, each officer was asked to put down the exact amount of time spent.

Any man in the field who felt that the directions conflicted with conditions in his territory was asked to report, and during a visit to his area all points of the instructions were reviewed so the work would fit the local need.

In line with the policy of changing methods, and rewriting instructions after faults had been detected, it was found that a limit on time and area size would eliminate some error.

Photographs were sent to the men. These illustrated several types of cover, but in each case they pictured an area where shelter and food adjoined. This is considered the sort of place that most often contains wintering quail. It was believed that the pictures would aid in identifying spots to be checked.

Results: Statewide, 1954 to 1956

From the entire quail territory in 1956, the officers reported on 117 covey ranges, where 605 birds were flushed, which was 10.8 quail per occupied range. In 1955 the count was 99 ranges checked and 949 birds flushed, which was 13.0 per occupied range.

Table 1. Percentage of Quail Ranges Occupied 1954 to 1956

Year	Percentage of Ranges Occupied	Birds per Occupied Covey Range
1954	67	12.3
1955	74*	13.0
1956	53	10.8

*The apparent wide variation in percentage of ranges occupied will be discussed later.

For the first time we have a "Birds Flushed per Hour" figure which amounts to seven. The figure may be compared to the figure of 1.8 hours per covey flushed by hunting parties in 1955. The flushing rate is similar as the average covey size is about 12 quail.

During the 1956 winter count, 24 places were found occupied during the morning checks when 54 areas were visited; this amounted to 44 per cent occupancy. During afternoons, 29 places were in use when 63 areas were visited, or 46 per cent of them were occupied.

In 1956 there was some tracking snow when 72 per cent of ranges were checked, whereas in 1955 snow cover was found on 49 per cent. Snow cover was reported present on 49 per cent of the areas checked in 1954. The fact that more were seen or tracked in 1955 could have been due to more time spent on the work, or it could have been due to cold weather which caused quail to concentrate in recognizable cover which was quickly found.

Quail by Agricultural Districts

There are some indications that quail populations fluctuate locally almost every season, while statewide it may be that the average population remains about the same except during years when the weather pattern is unfavorable for wildlife. Therefore, a record is kept of changes within districts. Table 2 presents the numbers of quail within these.

Table 2. Quail Populations by Agricultural Districts 1955-1956

Agricultural District	Average No. of Quail per Occupied Winter Range		Av. No. of Quail on all of the Ranges Checked	
	1955	1956	1955	1956
East central	10.4	12.6	7.5	7.0
South central	9.2	12.1	7.4	8.1
Southeast	13.7	15.0	8.4	6.5
Border counties	14.5	8.2	12.7	3.5

In the main quail range there is an upward trend in the number of birds per occupied unit in 1956 over the number in 1955. A variation to this appears in the quail found on all ranges. Probably this can be accounted for by the tendency to find larger coveys which were located on a smaller number of areas.

In border counties less birds were reported. Much of this is due to changes in the method of recording results in the field. Lower counts in a few areas constitute most of the change. Rechecks indicated no actual falling off.

The Count by Counties

Though counts will vary, the more unusual must be checked to see that the method prescribed was not in error. Henry, Jackson and Marshall counties had high figures: In Henry this can be attributed to finding two coveys on one range though only an average amount of time was spent in the three areas. In Jackson there was old snow. This would hold tracks for days, and the same quail could have been both flushed and tracked. The count of one covey per range in Marshall can be accounted for in that some high figures are bound to occurr. Also, an extra amount of time was spent.

In Adams, Clayton, Dallas, Fayette, Jefferson and Woodbury no quail were seen. Other outlying counties reported findings grouped around the average.

Discussion

An undetermined amount of the change that has occurred in the quail population seen in the 1956 winter count compared to 1955 is due to the different method of censusing. Under the old one the officer was requested to cover what he considered one quail range, and he was free to spend any amount of time; whereas, under the new arrangement a limit was placed on time to be spent making a check.

Although progress was made in eliminating sources of error, one remained. On each data sheet was a place for entering the number of quail flushed. There was also a space for recording the size of coveys tracked in snow. Another was provided for the number flushed and tracked. There appeared to be confusion on how to record birds that were tracked, then flushed; this was also true of quail that were flushed and then tracked. This combined item is not included in this report.

Field work by the biologist proved that the figures on the first two items; birds flushed, and birds tracked, were usable figures. As far as could be determined there was no excessive count that represented a double count of the same quail.

One test of accuracy was to compare success with that of 1955 fall hunting parties: Hunters found quail at about the same rate as did the officers making the winter check when 14 quail were located per two hour period.

Neither the statewide nor the spot-checks revealed extensive areas where quail were unusually scarce. Apparent areas of scarcity were investigated. In all cases where this was done there was a logical reason for the reported condition, and sampling agreed with the indicated population figure.

Summary

1. During the late 1956 winter quail count, officers found birds at about the same rate as hunters found them in the 1955 hunting season.

2. Slightly more covey ranges were found occupied when work was done in the afternoon than when it was done in the morning.

3. A limit on time spent, and on the amount of area checked, resulted in some apparent, though not real, 1956 changes compared to 1955.

4. In some counties no quail were found. This is a natural result of this type of census.

5. No large sections of the state were found which actually had no quail; provided the sampling was done within the known quail range.

EVIDENCE OF EMERGENT AQUATIC PLANT GAINS DURING THE DROUGHT OF 1955-56 IN THE LAKES REGION OF NORTHWESTERN IOWA.

by
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Surveys of aquatic vegetation in Iowa's state-owned marshes, sloughs, potholes, and lakes have been made continuously since 1949. The semi-drought conditions of 1955-56, and the resulting low water levels, have greatly influenced emergent aquatic plant growth. This report will provide a brief record and discussion of observed emergent aquatic plant growth during this period.

The late summer and fall of 1955 were both hot and dry causing all water levels to recede and exposing additional peripheral shoreline in the deeper lakes and marshes. In some of the shallower marshes lack of moisture caused a complete disappearance of all surface water. Horseshoe Lake in Dickinson county "went dry" for the first time since observations were begun in 1949; and as far as is known this lake may have been dry only once during the nineteen forties. This intermittent drying, or semi-drying, is an essential part of the natural reproduction and re-establishment of many emergent aquatics in shallow water areas. Under these conditions of exposed lake bottom or shoreline, viable aquatic seeds already present can germinate, take root, and carry on photosynthetic processes enabling them to mature rapidly. Dense stands of emergent aquatics are the usual result as indicated by the seedlings collected at Horseshoe Lake from quadrats 100 square inches in area (Table 1). Failure of viable seeds to grow beneath even a few inches of standing water is imperfectly understood, but probably results from a series of factors such as : Insufficient scarifidation and germination, lake of root strength to force green shoots above the water thus prohibiting sufficient photosynthetic processes, or destruction of germinating seeds or seedlings by wave action before tiny seedlings become rooted or established.

Table 1. Numbers of Aquatic Seedlings Counted in a Partially Algal-Covered Quadrat Containing 100 Square Inches of Lake Bottom at Horseshoe Lake, Dickinson County, Iowa on July 3, 1956.

Species:	Arrowhead or Duck-Potato (Sagittaria spp. latifolia, cuneata)	Roundstem Bulrushes (Scirpus acutus or validus)	Bur-Reed (Sparganium eurycarpum)
Numbers and height of each seedling in inches:	3 - 1"	2 - 3"	2 - 2"
	4 - 2"	1 - 6"	1 - 4"
	2 - 3"	1 - 8"	1 - 5"
	4 - 4"	1 - 12"	1 - 6"
	1 - 5"	2 - 14"	1 - 10"
	1 - 6"	1 - 15"	
		1 - 16"	
		1 - 17"	
Total	15 seedlings	10 seedlings	6 seedlings

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Many factors govern the species and number of seedlings found in a given location. Not all of these factors can be readily explained. For instance, at Horseshoe Lake, old muskrat runs along the lake bottom are characterized by abundant growths of arrowhead along their entire length as contrasted to the adjacent non-vegetated algal covered lake bottom (Table 2). Perhaps these arrowhead seedlings were the result of better moisture conditions in the slight depression caused by the rat run; or they resulted indirectly from the animals physically destroying the matted blanket-like covering of dead algae (Rhizoclonium spp.) present over much of the lake bottom. This latter explanation seems logical after comparing the number of seedlings growing in another area not covered by the layer of dead algae (Table 3).

Table 2. Numbers of Aquatic Seedlings Counted in a Non-Algal Covered Quadrat (10" X 10") within a Muskrat Run Adjacent to Heavily Algal Covered Lake Bottom Entirely Devoid of Emergent Vegetation at Horseshoe Lake, Dickinson County, Iowa on July 3, 1956.

Species:	(Sagittaria Spp.)	(Scirpus acutus or validus)	(Sparganium eurycarpum)
Numbers:	36 plants;	3 plants	2 plants
Heights:	1"-10" in height	3"-10" in height	3"-6" in height

Table 3. Numbers of Aquatic Seedlings in Quardrats (10" X 10") Sampled in Non-Algal Covered Areas in Horseshoe Lake, Dickinson County, Iowa on July 3, 1956.

Species:	(Sagittaria spp.)	(Scirpus acutus or validus)	(Sparganium eurycarpum)
First Quadrat:			
Numbers:	None	1 plant	32 plants
Heights:		10" in height	1"-10" in height
Second Quadrat:			
Numbers:	69 plants	1 plant	None
Heights:	1"-7" in height	20" in height	

Management practices may require the removal of matted algal covering in some areas where additional emergent aquatic growth is desired. Sprouted aquatics were found beneath the matted algal covering, but apparently the seedlings were unable to penetrate through the algal blanket. In most places there were few if any emergent aquatic seedlings growing through a solid algal mat 1/8" thick, or thicker.

The dry period of 1955-56 has resulted in abundant growths of golden dock (*Rumex maritimus*) in the many newly exposed mud flats. This is an example of a species rapidly and readily occupying areas or zones ordinarily too wet or submerged. Another common invader of the mud flats has been American manna grass (*Glyceria grandis*). These two semi-aquatic species are merely examples of many plants invading new areas created by receding water levels. Seeds of these species are consumed by waterfowl, and flooding of these new aquatic pastures would make available tremendous quantities of food for waterfowl in 1956.

PHEASANT CROWING COUNT AND HEN INDEX
SPRING 1956

by
Richard C. Nomsen*
Game Biologist

The annual spring pheasant population survey was taken by conservation officers during the last week in April and the month of May. This report presents the results of the 1956 crowing count and compares them with figures obtained from previous surveys. Procedure remained the same as for earlier spring counts.

Changeable weather conditions continue to plague the personnel making this survey. Although temperatures were about normal and rainfall was below average, winds that were associated with the fronts hindered or delayed checks on many routes. Generally, weather conditions were much less favorable during 1956 than in 1955.

Even though many counts were made under adverse weather conditions, the 1956 results compared favorably with those of 1955 (Table 1). Officers recorded 29,355 calls at 3,479 stops along the 175 routes for an average of 8.4 calls per stop. In 1955, they averaged 8.5 calls per stop on 176 routes.

Since the crowing count indicates only the male segment of the population, hens must be added to complete the survey. The results of this count were used directly to determine pheasant distribution and indirectly to measure the spring population of hens. Hens produce the young and it makes no difference whether cocks make up 20 or 40 per cent of the population. Winter counts indicated an average of 3.3 hens per cock in the post season pheasant population. The spring hen index of 27.7 was then determined by multiplying the average number of calls per stop by the observed sex ratio (Table 1).

This figure was slightly lower than the results of 1955 but well above the previous six year average of 24.6. It was stated a year ago that a part of the increase at that time could possibly be the result of improved census conditions.

Table 1. Statewide Results of the Crowing Count and Hen Index 1950-1956.

Year	Av. No. of Calls Heard	Sex Ratio	Spring Hen Index[1]
1950	7.9	2.9	22.9
1951	8.1	2.9	23.5
1952	9.3	2.7	25.1
1953	9.4	2.2	21.7
1954	8.5	2.8	23.8
1955	8.5	3.6	30.6
1956	8.4	3.3	27.7

[1] Av. calls times sex ratio.

* Dick Nomsen, R. R. #2, Hampton, Iowa

Pheasant populations vary a great deal from one part of the state to another and trends are sometimes different than that for the state as a whole. The results by districts for the 1956 spring count are listed in Table 2 and these figures are compared with previous surveys in Table 3.

The spring hen index increased sharply in north central Iowa this spring, while a slight decrease was recorded in northeast Iowa. Both districts are much above the state average, with district two registering the highest figure of 71.3 for this survey.

The next three districts, namely, the northeast, west central and central, recorded spring hen populations of 38, 36 and 34 respectively. These figures represented a decrease for districts three and four but was slightly higher for central Iowa, with all being above the state average.

Results from east central Iowa indicated a decrease this year following a slight upward trend a year ago.

For the first time in six years, the spring hen index showed a decrease in southwest Iowa. However, the lack of snow during the winter sex ratio survey resulted in a small sample of birds reported and a possible source of error.

The south central district results decreased slightly while the average for southeast Iowa remained very low.

Table 2. District Results of the 1956 Crowing Count and Hen Index.

District	No. of Calls Heard	No. of Stops	Av. No. of calls per stop	Sex Ratio	Spring Hen Index
1 Northwest	7748	420	18.4	2.8	51.5
2 North central	8927	413	21.6	3.3	71.3
3 Northeast	3205	320	10.0	3.8	38.0
4 West central	3249	360	9.0	4.0	36.0
5 Central	3559	480	7.4	4.6	34.0
6 East central	1055	318	3.3	3.8	12.5
7 Southwest	680	319	2.1	3.0	6.3
8 South central	716	440	1.6	2.4	3.8
9 Southeast	216	409	0.5	2.0	1.0
STATE	29,355	3479	8.4	3.3	27.7

Table 3. Comparison of Crowing Count Results and Spring Hen Index

1954 - 1956

District	Year	Average Number of Calls Heard	Spring Hen Index
1 Northwest	1954	17.6	54.6
	1955	18.6	53.9
	1956	18.4	51.5
2 North central	1954	21.0	42.0
	1955	20.3	54.8
	1956	21.6	71.3
3 Northeast	1954	8.0	20.8
	1955	11.2	49.3
	1956	10.0	38.0
4 West central	1954	9.1	22.8
	1955	9.1	37.3
	1956	9.0	36.0
5 Central	1954	6.6	21.8
	1955	6.5	31.2
	1956	7.4	34.0
6 East central	1954	3.6	16.2
	1955	3.9	17.6
	1956	3.3	12.5
7 Southwest	1954	6.2	12.4
	1955	4.9	24.0
	1956	2.1	6.3
8 South central	1954	1.5	3.0
	1955	1.4	4.6
	1956	1.6	3.8
9 Southeast	1954	0.5	1.0
	1955	0.4	0.8
	1956	0.5	1.0

THE QUANTITATIVE CREEL CENSUS METHODS AT SPIRIT LAKE

by
E. T. Rose*
Fisheries Biologist

For the past ten years, the Iowa Conservation Commission has conducted creel censuses of several important fishing lakes to determine angling success from year to year. These have been reported regularly in the Quarterly Reports at the completion of the census periods. All of these have been of the so-called "spot" census type, in which fishermen are contacted principally while they are actively engaged in angling. While this type of census is satisfactory from many standpoints, such as determining average catch per unit effort, catch composition, age and length frequencies and trends, it is lacking in such basic considerations as total fishing pressure, total catch of fish and the total weight of the fish harvested. Only by calculation of these major factors can the productivity, and a more accurate determination of the other named factors, of a lake be evaluated.

Due to the obvious inadequacies of the "spot" census methods, an approach, new to Iowa, has been made to obtain a complete quantitative census by using statistical methods. Spirit Lake (5,684 Acreas) was selected as the most likely lake for the project. This paper describes in some detail the methods in use and some of the results obtained to date.

Methods

There are several means of obtaining a complete census of anglers who fish a body of water. Where there is but one access to the area, the census clerk simply contacts all the anglers who have completed their day's fishing and records data from them. Obviously there are few such situations in existence. Where there are many public and private access points, private cottages, homes and resorts, there could be employed many census clerks who could contact all the anglers that are through fishing and collect data from them. This highly impractical plan deserves no further comment. However, most of the fishing waters of Iowa and elsewhere fall into this latter category. Spirit Lake has a total of sixteen public boat liveries, thirteen public access areas, plus hundreds of cottages, permanent homes and resorts. Therefore, to calculate total catch on a lake with many access points, statistical methods must be used. In this, a comparitively small sample of anglers are contacted at the completion of their fishing trip and their catch data recorded by the clerk. These data are then expanded to include the calculated total of all anglers using the lake. This system has been in use in Minnesota for several years. Pioneering in this method was done in TVA waters by Tarzwell and Miller (1942)and Eschmeyer(1942). The methods described here are modifications of theirs and will doubtless be altered further in order to improve the techniques involved.

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Sampling Pattern. Iowa creel census employees are required to work six days a week and a minimum of eight hours per day. In order to census as much of the day-time and evening hours of heavy fishing pressure as possible, the sixteen hour period from 6:00a.m. to 10:00 p.m. was selected for work on the lake. This sixteen hour period was divided into "early" and "late" days, the early ones designated as "A" days and the late as "B" days. The A days are from 6:00 a.m. to 2:00 p.m. and the B days from 2:00 p.m. to 10:00 p.m. For this more or less experimental year, these days are arranged in pairs for the convenience of the census clerk, with two A days followed by two B days. One day off is permitted each week according to pre-arranged pattern as indicated in the following schedule for the month of July, 1956.

SUN.	MON.	TUE.	WED.	THU.	FRI.	SAT.
1 B	2 A	3 A	4 B	5 X	6 A	7 A
8 B	8 B	10 A	11 X	12 B	13 B	14 A
15 A	16 B	17 X	18 A	19 A	20 B	21 B
22 A	23 X	24 B	25 B	26 A	27 A	28 B
29 X	30 A	31 A	(X--Days Not Censused)			

In this, all days are considered equal, including holidays, Sundays and Saturdays. Week-end and holiday angling pressure does not appear to be significantly higher in this resort area than week days.

In the final calculation of results the average catch data of the A days are determined and multiplied by the number of days in the month and these sums are added to similarly calculated figures for the B days.

Census Methods. Ideally, in order to conduct a quantitative census of this type, the clerk should be able to count readily all fishing boats and shore anglers by the aid of binoculars and record them at regular intervals. Spirit Lake, being roughly similar to an inverted "L" is not ideal for this especially due to its large size; however, after careful checking, three areas have been found that permit ready and accurate counts of boats and most of the shore anglers.

Counts of fishing boats and shore anglers are taken promptly every two hours at 7:00 a.m., 9:00, 11:00 and 1:00 p.m. on A days and at 3:00 p.m. 5:00, 7:00 and 9:00 on B days. The number of boats is recorded at each interval at the bottom portion of Form A (appendix I). The number of shore fishermen is also recorded on Form A, using a separate sheet for each type. Between counts, as many anglers from complete trips as possible are contacted and their catch data recorded in the upper portion of Form A. This includes the recording of each boat, the number of anglers in each boat, the time of starting and ending fishing and the total time the angler's catch is also recorded on this form. To illustrate the calculation process, Form A (Appendix I) has been hypothetically filled in. In order to determine the total number of boats on the lake in this B day, the total of the two-hour interval counts is multiplied by 2(hours between counts)and divided by the average length of time the contacted boats were out fishing (9 boats out 22.5 hours--2.5 hours). This yields considerably less boats than the total of the interval counts, but since some boats are doubtless counted twice or more, and most boats will have been counted once, the system is fairly accurate if sufficient completed trip contacts are made to determine the average time factor. Therefore, in this case, there were 108 boats on the lake in the entire B period.

The average number of anglers per boat is determined from the contacts of completed trips (9 boats interviewed with 18 men, or an average of two men per boat). Thus the total number of boat fishermen for the period is 108 X 2---216. Since the 18 contacted anglers had fished an aggregate of 60 hours, the average length of trip was 60 ÷ 18--3.3 hours. The total fishermen hours was determined by multiplying the 3.3 by 216 (fishermen)--713 hours. This form and its counterpart for shore anglers are fully completed at the end of the census day. Next, expansions of the interview catch data are calculated for all species and their respective weights which are then entered on Form B (Appendix II).

The process of expanding the catch data from the small sample of interviewed anglers involves simple proportion. For example, the 18 contacted boat anglers caught a total of 200 bullheads--how many bullheads did the estimated total number of boat anglers (216) catch? --

$\frac{200}{18} \times 216 = 2{,}376$--total bullheads caught by boats in B period. Likewise, all other species are calculated and entered in Form B. Weights are calculated by determining the average weight of the fish from interview data and multiplying this figure by the calculated total number of the species (i. e.) 200 bullheads weighed 119 pounds (Form A), 119 ÷ 200 = 0.6 lb. X 2,376 = 1,426 pounds of bullheads. Forms A and B are completed by the census clerk for the boat and shore anglers each day and at the end of each week these are submitted to the station for checking and entering on the final tabulations forms C and D (Appendix III and IV). These record respectively the daily total catches and weights of each species and the total angler trips and hours for all of the A and B periods of the month. Averages for each of the periods are then calculated and multiplied by the number of days per month. In the example shown, walleyes for the month of June, 1956 are used for illustration in Form C. Form D includes the calculated total number of anglers and hours of effort during June for all species. Form E (Appendix V), includes the total catch of all species during the month by boat and shore anglers together with the respective weights. Also, the total trips by boat and shore, hours of effort, average catch per angler trip and average catch per hour are included in this final tabulation.

To date the system is working well and the clerk is enthusiastic about the project. Much personal time has been spent in working out forms, schedules and in checking and tabulating field data. It is hoped that there are not too many "bugs" in the overall plan and that any suggestions for improvement or correction will be presented.

By slight alteration of schedules, the clerk could census two lakes as is done in Minnesota; however, topographical features of neighboring lakes present a real obstacle. Providing the program is satisfactory in the year-round census of Spirit Lake it is suggested that it be used in the 8-week censuses for better seasonal comparisons.

In the final calculations, either monthly or annual, it is emphasized that the figures are estimates which if the sampling and mathematical processes involved are correct will represent a fair appraisal of the sport fishery on the lake. It is also pointed out that any figures will be minimal since the very early and late fishermen are certain to be uncensused. However, it is felt that the vast bulk of the anglers is sampled and that the results may be amazing at the end of the year. Heretofore, very little concept of the amount of fishing pressure this lake maintains could be determined. For example, in the "spot" census of Spirit Lake the average number of yearly contacts of anglers was around 25,000. To date the calculated total number of anglers for the month of May and June is over 40,000. Also it is important to note on Form E, (Appendix V) that more pounds of walleyes were taken than of any other species. This was true also in May, and indicates that the Iowa fishermen is not necessarily a "bullheader". Many significant factors can be determined in the final breakdown of results, such as pounds of fish per acre, total catch of each species and percentage of totals, success in numbers and pounds per unit effort, effort per acre, comparitive seasonal success and if need be, a monetary evaluation computed.

Post Script

In order to determine the degree of accuracy involved in the interval counts by the census clerk, aerial counts were made on June 19 and 20 with the Commission plane piloted by Frank Heidelbauer. The following table contains the results of the comparative counts.

Date	Aerial Counts		Time	Shore Counts by Clerk	
6-19	Boats	Shore		Boats	Shore
	48	35*	7:00 a.m.	39	20
	107	27*	9:00 a.m.	91	21
	87	60*	11:00 a.m.	91	28
	42	13*	1:00 p.m.	41	24
Total	284 BOATS			262 BOATS	
6-20	76	20	7:00 a.m.	47	28
	87	85	9:00 a.m.	74	54
	90	64	11:00 a.m.	95	61
	55	30	1:00 p.m.	51	49
TOTAL	308	199		267	192

*Anglers on grade not counted on first day by aerial count.

It should be noted that neither Frank nor I had exactly the same counts, with sometimes a variance of 10 between counts. These indicate that the census clerk obtained 99 per cent of the boats on the first day and on the second day 86 per cent of the boats and 96 per cent of the shore anglers.

E. T. R.

D-J-F24R

IOWA CONSERVATION COMMISSION
Angling Census
(example)

APPENDIX I

FORM A TYPE BOAT PERIOD B LAKE SPIRIT DATE 5-20-56

	TOTALS							
NO. BOAT	9	1	1	2	1	2	1	1
NO. F'MEN	18	2	2	6	1	2	3	2
TIME START		3	3	1	2	3	1	2
TIME END		5	5	5	6	7	4	5:30
TOTAL TIME	60	4	4	24	4	8	9	7
MAN HOURS	22.5	2	2	4	4	4	3	3½
PERCH NO.	16	5		11				
PERCH WT.	13	4		9				
CRAPPIE NO.	5				5			
CRAPPIE WT.	4				4			
B'HEAD NO.	200							
B'HEAD WT.	119			150				50
SUNFISH NO.				78				41
SUNFISH WT.								
WALLEYE NO.	14				4	10		
WALLEYE WT.	26.5				6.5	20		
NO.								
WT.								
NO.								
WT.								
NO.								
WT.								
NO.								
WT.								

BOAT AND ANGLER COUNTS

TIME	BOATS	SHORE	
7am			
9			
11			
1pm			
3	25		
5	60		
7	47		
9	4		
TOTAL INC.C	136		(X2 = 272 ÷ 2.5 =108)
EST. TOTAL INC.C	108		
AV NO F'MEN PER BOAT	2		(18 ÷ 9)
AV. LENGTH TRIP	3.3		(600 ÷ 18)
TOTAL F'MEN TRIPS	216		(108 X 2)
TOTAL F'MEN HOURS	713		(216 X 3.3)

APPENDIX II

FORM B

WEEKLY EXPANDED TOTALS

LAKE Spirit

		SUNDAY		MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY	
Date		BOAT	SHORE	BOAT	SHORE	BOAT	SHORE	BOAT	SHORE	BOAT	SHORE	BOAT	SHORE	BOAT	SHORE
May		20	20												
A-OYB		B	B	A	A										
PERCH	N	713													
	W	192#													
CRAPPIE	N	60													
	W	48#													
B'HEAD	N	2376													
	W	1426#													
SUNFISH	N														
	W														
WALLEYE	N	166													
	W	315#													
W.BASS	N														
	W														
N. PIKE	N														
	W														
LM.BASS	N														
	W														
	N														
	W														
	N														
	W														
T. N.		2686													
T. W.		1862													
T. H.		679													
T. T.		206													

(T. N. -- Total number of fish; T. W. -- Total weight; T. H. -- Total hours of fishing; T. T. -- Total trips by anglers).

APPENDIX III
DJ-F-24-R
Form C
Lake Spirit

IOWA CONSERVATION COMMISSION
MONTHLY SUMMARY OF ANGLING-SPECIES AND METHOD

Species Walleye

Period A	Tallied Fish		Expanded Fish		Expanded Wt.	
Date	Boat	Shore	Boat	Shore	Boat	Shore
6-3	67	5	956	20	1625	30
6-7	53	3	366	9	512	10
6-8	62	1	481	3	704	1
6-11	36	10	198	28	257	39
6-12	51	15	255	40	376	56
6-15	47	5	262	12	367	12
6-16	49	6	366	10	439	4
6-19	44	4	257	8	385	11
6-20	41	0	391	0	547	0
6-24	18	6	171	12	342	14
6-25	18	1	120	3	192	2
6-28	8	4	35	9	53	23
Totals A	494	60	3858	154	5799	202
Average A-Day			321	13	1.5 lb	3.3

Period B	Tallied Fish		Expanded Fish		Expanded Wt.	
Date	Boat	Shore	Boat	Shore	Boat	Shore
6-1	53	0	169	0	66.3	0
6-2	45	5	200	19	290	27.1
6-5	64	3	112	9	155	11
6-6	24	8	84	17	134	22
6-9	94	0	255	40	376	56
6-13	80	4	165	9	231	7
6-14	74	0	220	0	264	0
6-17	60	2	201	5	281	6
6-18	57	0	267	0	320	0
6-21	58	0	204	0	326	0
6-22	43	5	204	13	286	21
6-26	20	15	45	63	50	63
6-27	16	4	51	7	46	7
6-30	35	0	109	0	185	0
Totals B	723	46	2286	182	3010.3#	222.1#
Average B-Day			162	13	1.3	

Calculated Total Catch - Numbers

	A-Days	B-Days	All
Boat	9630	4890	14,520
Shore	390	390	780
Total	10,020	5,280	15,300

Calculated Total Weight-Pounds

Boat	15,445 lb	6357	21,802
Shore	1,287	507	1,794
Total	16,732	6,864	23,596 lb

Boat Calculation Summary

No. 12 A Days 3858÷12 = 321 (Av. A Day)X30= 9630-Total A Boats
14 B Days 2286÷14 = 163 (Av. B Day)X30= 4890-Total B Boats

Shore 13X30 = 390 - A
" 13X30 = 390 - B

Boat
Wt. 5799 ÷ 3858= 1.5-Av. Wt. Boat in A Days X 9630=15445 lb.
Wt. 3010 ÷ 2286= 1.3-Av. Wt. Boat in B Days X 4890= 6357 lb.

Shore
Wt. A - 390 X 3.3 = 1287 lb.
Wt. B - 390 X 1.3 = 507 lb.

Av. Wt.

APPENDIX IV
Form D
DJ-F-24-R

IOWA CONSERVATION COMMISSION
ANGLER TRIPS AND HOURS

June, 1956

Lake Spirit

Period A Date	Tallied Anglers Boat	Tallied Anglers Shore	Expanded Anglers Boat	Expanded Anglers Shore	Expanded Hours Boat	Expanded Hours Shore	Period B Date	Tallied Anglers Boat	Tallied Anglers Shore	Expanded Anglers Boat	Expanded Anglers Shore	Expanded Hours Boat	Expanded Hours Shore
6-3-56	51	30	702	118	3194	602	6-1-56	47	29	150	120	810	132
6-7-56	54	61	373	178	1298	534	6-2-56	43	43	191	159	1012	572
6-8-56	39	36	301	108	1354	302	6-5-56	20	87	85	211	399	886
							6-6-56	39	81	136	251	449	880
6-11-56	22	50	121	140	436	266	6-9-56	78	78	495	171	1682	566
6-12-56	47	37	235	99	816	328	6-13-56	55	67	110	155	550	310
6-15-56	45	44	251	105	903	210	6-14-56	64	60	190	100	723	260
6-16-56	76	58	567	98	2286	342	6-17-56	67	99	224	226	1187	520
6-19-56	60	41	351	81	737	186	6-18-56	77	64	361	199	1588	418
6-20-56	37	61	353	154	1337	384	6-21-56	86	75	302	171	1389	376
6-24-56	75	88	714	338	2642	642	6-22-56	61	83	290	209	1276	502
6-25-56	32	58	213	164	682	230	6-26-56	53	46	120	192	504	623
6-28-56	60	64	266	138	851	234	6-27-56	53	98	170	179	646	358
							6-30-56	59	61	134	288	791	460
Totals A	598	628	4447	1721	16536	4260	Totals B	802	971	3008	2631	12996	6972
Av. A-Day			371	144	1378	355	Av. B-Day			215	188	928	498

Calculated Total Anglers

	A-Days	B-Days	All
Boat	11,130	6,450	17,580
Shore	4,320	5,640	9,960
Total	15,450	10,290	25,740

Calculated Total Hours

	A-Days	B-Days	All
Boat	41,340	27,840	69,180
Shore	10,650	14,940	25,590
Total	51,990	42,780	94,770

Calculation Summary

A Days - Anglers-Boat-371 X 30 = 11,130
A Days - Anglers-Shore-144 X 30 = 4,320
A Days - Hours -Boat-1378 X 30 =41,340
A Days - Hours -Shore- 355 X 30 =10,650

B Days - Anglers-Boat- 215 X 30 = 6,450
B Days - Anglers-Shore-188 X 30 = 5,640
B Days - Hours- Boat - 928 X 30 =27,840
B Days - Hours-Shore - 498 X 30 =14,940

Approximately - 8% of Boat Anglers Actually Contacted.
Approximately - 16% of Shore Anglers Actually Contacted.

APPENDIX V

DJ F24R
Form E
Lake Spirit

IOWA CONSERVATION COMMISSION
CALCULATED MONTHLY TOTALS

Month June, 1956

Species	Number Boat	Number Shore	Total Number	Weight Boat	Weight Shore	Total Pounds	Remarks
Perch	2760	192	2952	1427	164	1591	
Crappie	1140	561	1701	639	307	946	
Bullhead	16440	20250	36690	8714	12758	21472	
Sunfish	90	45	135	27	14	41	
Walleye	14520	780	15300	21780	936	22716	
White Bass	240	37	277	144	22	166	
No. Pike	75	33	108	173	165	338	
L. M. Bass	198	207	405	257	269	526	
S. M. Bass	18	12	30	27	18	45	
Carp							
Sheepshead							
Total Fish by Method	35481	22117	57589	33188	14653	47481	
Total Trips by Method	17580	9960	27540				
Total Hours by Method	69150	25590	104770				
Av. Fish Per Angler	2.02	2.20	2.1				
Av. Fish Per Hour	0.51	0.86	0.55				

SUB-SAMPLING CREEL CENSUS DATA

by
Tom Moen
Fisheries Biologist

A considerable portion of recent fishery biology literature has been devoted to creel census techniques and results. The attendance at a creel census symposium held at Iowa State College in March of this year served to emphasize the great general interest in the subject. Most biologists agree on the basic concepts of creel census methods but the details are varied to fit a multitue of conditions which are rarely the same in any two localities.

During the past ten years the Iowa creel census methods have aimed at two primary objectives; (1) determination of fishing success and (2) composition of the catch. Methods of gathering the data and the length of the census period have varied from year to year and among lakes. Except where monetary problems were involved the changes were made with an eye toward improvement of the system. At the present time we have only one clerk that conducts a census on more than one lake. Although each clerk puts in full time on each lake (one exception) the compiled data can be considered no more than a large sample.

We have not attempted a complete creel census on any of our lakes from which a statistically accurate sample could be drawn that would show us the minimum sample needed to provide qualified figures regarding fishing success and species composit on. But through the use of the I.B.M. system we do have a day to day record of the large samples from each lake. Again statistical formulae can be applied to determine the number of contacts necessary to obtain results comparable to the original sample but for our purpose a little more realistic view point is necessary. A creel census clerk cannot be hired to work only 10 days out of a month. It would be more practical to have him shift from one lake to another according to a predetermined pattern. This type of sampling was proposed by Jim Mayhew at the creel census symposium mentioned earlier. The number of lakes that can or should be censused will depend on several factors. The more important of these would be distance between lakes to be checked. This paper describes a series of sub-samples drawn from data taken in 1955. In other words a hypothetical creel census where the results can be compared with the actual figures.

Methods

As mentioned above, several techniques were evaluated. Several of the Iowa lakes are censused over the period of May 15 through July 15. The Clear Lake data from 1955 happened to contain figures for each of the 62 days, and thus a good place to start the hypothetical census.

Method No. One: Following the technique described by Best and Boles (1956) each day of the four month period of April through July was numbered in chronological order from 1 to 122. A table of random numbers was used to select the days to be sampled. This method indicated that 16 days (about 25 per cent of the total) would be sampled. These 16 days included only three week-end days and no holidays, and there was a poor distribution of the number of days sampled in each month, with 6 days sampled out of 16 in May and only 7 days for the month of June. In spite of this the results were surprisingly close to the original sample (Table 1).

Method No. Two: Inasmuch as we consider week-end days and holidays the most important days to be censused they were stressed in this method the creel census clerk would be assigned three lakes designated as "A", "B", and "C". The week-end days were labeled, allowing one day off each week. This produced what appeared to be a random sample plus a good distribution of the important days. The designation of Clear Lake as "A" lake gave us a total of 18 days to be sampled, including 5 week-end days and one holiday. Again the results compare favorably with the original data (Table 1).

Method No. Three: If the foregoing two methods produced reasonable results it was only logical to try a smaller sample. For this method the clerk was assigned four lakes. Again week-end days and holidays were marked first from right to left on the calender, then the days off were circled. The week days were lettered in vertical columns. With Clear Lake as "A" lake in this method the census would be taken on 14 days embracing 4 week-end days and one holiday. The results were similar to those of the previous two methods (Table 1).

In the three methods described above the samples were all initiated on May 15 and the abnormally large sample recorded for that date may have influenced the results to some extent. Clear Lake was then sampled as "B" lake. The results improved in all but one item (Table 1).

Method number three was also applied to the data from Storm Lake as "A" lake and Black Hawk as "C" lake (Table 1).

Discussion of Results

Deviations from the known results exhibited no set pattern except in the fish per hour figures where the partial sample consistently fell below the actual figures. The greatest difference amounted to 14 per cent below the known figure in method three "A" at Clear Lake. Fish per man figures indicate underestimates in four samples and overestimates in two samples with a maximum deviation of 17 per cent fewer fish per man than the actual figure. Of these two indicators of fishing success the former is by far the most important. The consistently negative deviation in the fish per hour figures may be the result of a slightly heavier sampling of week-end days and holidays than occurred in the original sample, but this statistic is not proportionately higher or closer to the original in method number one where a minimum of these were sampled.

Difference between sub-sample and actual species composition results can usually be explained by the chance inclusion of an exceptionally good day of fishing for one or two species. For instance, the 5 per cent difference in the composition of crappies in the catch at Clear Lake under method one and number 3 "A" is due to a one day catch of crappies that amounted to nearly 50 per cent of the sub-sample and 23 per cent of the original sample. In general the differences were of greater magnitude among species which were of minor importance in the catch. For this reason it seems likely that it would be unwise to reduce the sample much further for fear of too much bias in these species.

These data have not been analyzed statistically, particularly the deviations, but I suspect that for the most part they are not significant. These sub-samples or partial samples seem to tell us about as much about fishing success as the original samples. Further refinements will be necessary, such as assigning periods of early and late sampling on successive dates or visits to each lake. The number of lakes assigned to each clerk would have to be juggled with the length of census period and distance between lakes. Time and space does not permit a discussion of this phase.

A PRELIMINARY REPORT ON THE AGE AND GROWTH OF THE YELLOW PIKEPERCH Stizostedion vitreum (Mitchill), IN THE CEDAR RIVER, IOWA

by
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In Iowa, as well as many other states, the yellow pikeperch (commonly referred to as the walleye) is one of the most sought after game-fish. This is borne out by the fact that management in suitable lakes and rivers has been geared primarily to the walleye. Because of their concern about the public pressure exerted upon the walleye, numerous states and agencies have undertaken studies to gain knowledge of the habits of this important species (Cleary 1949, Carlander 1945, and 1948, Schlomer and Lorch 1942, Rose 1949, Eschmeyer 1940, and Eschmeyer 1950). All of these studies have been concerned with yellow pikeperch from lake habitat and not with resident stream populations. Thus, walleye age and growth studies from river habitats are absent from fisheries literature.

For many years it has been common knowledge to biologists that the upper reaches of the Cedar River periodically contain walleye in fishable abundance. Angling success is apparently dependent upon the development of an extremely dominant year class, and the perpetuation of such a year class untilities depleted. During 1951 a program was initiated to introduce walleye fry into suitable pools on alternate years. The purpose of this program was generally twofold. Firstly, by age analysis of walleye in anglers catch over a period of years it presented a simple but accurate check of the relative success of fry stocking. Secondly, as has been previously pointed out by other studies in Iowa, annual anglers harvest is often heavy enough to deplete standing crop to the point where a year class failure could greatly effect future angling success. Hence, supplemental fry and fingerling stocking becomes desirable to temporarily insure successive year class strength.

Several local walleye anglers were requested to record specific data, such as, length, weight, sex, and scale samples on their catches from the Waterloo-Cedar Rapids pool. These men have been active in such a program since 1951. In addition, similar data are recorded on all walleye captured during routine fisheries survey in this pool. The following study is based on the data obtained from such sources.

Descriptions of Study Area

The Waterloo-Cedar Rapids pool in the Cedar River covers a distance of 74 river miles. In this distance the pool drops approximately 125 feet, or at a rate of 1 foot per mile of stream. Average depth is from two to three feet with "holes" up to 15 feet. Estimated average width of the pool is 75 to 100 yards.

Walleye are usually found in relatively long pools, one-quarter to one-half mile in length with depths up to 10 feet. The stream bottom is usually rock, either shattered limestone or glacial rubble. There arė at present 12 known walleye pools between Waterloo and Cedar Rapids.

All major towns in the Waterloo-Cedar Rapids pool have some form of sewage treatment. In the last six years there have been two major fish kills in this pool. The first was caused by chlordane introduced at Waterloo which killed fish as far as Vinton. The second was caused by potassium cyanide introduced at Cedar Falls which killed fish as far as Gilbertsville. Winter kill was moderately heavy in the pool during the past winter.

The pool drains Mississippi Loess to the west and Iowan Drift to the east. Drift sand is very much a problem in the pool, and while deposition of silt is found only in the bayous, turbidity is heavy after local rains. The river is discolored most of the summer months, but this is predominantly planktonic turbidity.

Test netting indicates a heavy population of Carpiodes in the pool. There is also an abundance of carp, Cyprinus carpio, and a small indigenous population of bigmouth buffalo, Ictiobus cyprinellus. Channel catfish, Ictalurus lacustris, black crappie, Pomoxis nigomaculatus, and smallmouth bass, Micropterus dolomieu, are the major game-fish species in the pool. Walleye and northern pike, Esox lucius, vary in fishable abundance according to year class success. The dominant sucker is the golden redhorse, Moxostoma erythrurum, and the dominant minnow species is the spotfin shiner, Notropis spilopterus.

Age and Growth

A total of 502 scale samples were examined over a catch period of three years to determine the age and growth rate of yellow pikeperch in the Cedar River. To eliminate any source of bias measuring fish, only scales from one angler were used for calculating growth. Since the anglers were not instructed to remove "key" scales, the body-scale relationship was not determined.

As in most studies, microprojection of the scale image was used to assess the age of each fish. Each annulus was located and marked on a paper tagboard strip. The mean standard length at the end of each year of life was then calculated by a direct proportion nomograph. All scale samples were read twice to eliminate descrepancies in the assessment of age.

Total length used in the study is the distance in millimeters between the snout and the distal end of the compressed lobes of the caudal fin. Standard length is the distance between the snout and the caudal peduncle. The weight of each fish was recorded in tenths of pounds in the field and converted to grams for mathematical purposes.

As shown in Table 1, the average calculated standard length from the first to the tenth annulus was 154, 266, 342, 408, 517, 556, 580, 618, and 670 millimeters. Average calculated growth increments were found to be 154, 111, 56, 49, 40, 51, 52, 24, 38, and 30 millimeters from the first to tenth annulus respectively.

Table 1. The Average Calculated Standard Length at Each Annulus of Yellow Pikeperch from the Cedar River.

Age Group	Mean S. L. at Capture	Mean Wt. at Capture	Mean S. L. at Each Annulus 1	2	3	4	5	6	7	8	9	10
I	259	--	161									
II	303	393	165	257								
III	354	608	159	270	321							
IV	400	1000	150	258	322	369						
V	492	1780	152	294	380	430	465					
VI	555	1814	165	270	358	470	519	543				
IX	612	3856	133	240	330	365	422	488	560	570	595	
X	690	4540	145	265	340	409	456	520	552	590	640	670
Mean Calculated Length			154	266	342	408	441	517	556	580	618	670
Equivelent Total Length (in)			7.3	12.5	16.1	18.2	19.7	23.1	24.9	26.0	27.6	30.0
Mean Annual Increments			154	111	56	49	40	51	52	24	38	30
Sum of Increments			154	265	321	370	410	461	513	537	575	605

Since previous studies of the age and growth of walleye are only available from lake populations, comparisons could not be made with streams in other areas. However, in comparing the lake walleye with those from the Cedar River, it is revealed the stream specimen is a faster growing fish (Table 2).

Table 2. Comparison of the Growth of Walleye from the Cedar River, Lakes in Iowa, and Other Areas[1].

Lake and Location	Standard Length at Each Annulus 1	2	3	4	5	6	7	8	9	10	11	12
Lake of Woods, Minn.	141	203	253	295	326	366	400	437	474	498	524	532
Lake Vermillion, Minn.	127	183	225	261	295	326	355	389	433	458	493	572
Bass Lake, Wis.	175	288	366	420	460	523						
Norris Lake, Tenn.	213	352	408	435	449	453	478	539				
Clear Lake, Iowa	124	230	308	384	409	454	499	557	573	588	595	
Spirit Lake, Iowa	155	239	309	376	427	476	512	533	557	577		
Cedar River, Iowa	154	266	324	380	465	517	556	580	618	670		

[1] Carlander (1950)

Length-Weight Relationship

In compilation of the length-weight relationship data the total length of each fish was recorded in appropriate 25 millimeter length intervals. Each corresponding weight was also recorded in the opposing column. The average total length and weight was then computed for each group interval.

The equation used in determining this mathematical relationship is the general parabola $W=cLn$, where

W=weight

L=length

c and n=mathematical constants.

This equation in logarithmic form becomes the linear regression line;

$$\text{Log } W = \text{Log } C + \text{Log } L\ n.$$

The total length-weight relationship as determined by this method for 152 walleye is Log W = -5.17661 + 3.05566 Log L.

Deviation of the empirical values from the calculated regression line is greatest in the larger size group. This is attributed mostly to the fact that the five largest groups are represented by only one specimen each. A comparison of the calculated and observed values are listed in Table 3.

Table 3. A Comparison of Calculated and Observed Weights of Walleye in the Cedar River.

Size Group	Mean Total Length	Weight Observed	Weight Calculated	Number in Group
225-49	241	116	126	3
250-74	259	136	154	3
275-99	290	227	218	1
325-49	339	357	358	9
350-74	360	396	431	21
375-99	386	524	533	36
400-24	410	622	641	23
425-49	433	740	757	19
450-74	458	850	899	12
475-99	488	1045	1092	7
500-24	507	1366	1217	6
525-49	533	1588	1431	2
550-74	562	1653	1661	2
575-99	584	2041	1871	1
650-74	660	2948	2747	1
675-99	699	3856	3667	1
725-49	749	4173	4044	1
775-99	887	4540	4704	1

Coefficient of Condition and Factors for Conversion Between Total and Standard Lengths

The coefficient of condition or "K" factor is used to determine the physical well-being or plumpness of fish. This factor is usually determined by the now generally accepted formula:

$$K = \frac{W\ 10^5}{L^3}$$

where

W = weight

and

L = length.

The average "K" factor was calculated for each age group of fish. Although only minor change in condition occurs with increasing age, there is a tendency for the older fish to have a lower factor. Mean "K" was 1.34 for the 152 individuals in the study. This figure is somewhat lower than that found in lake walleye.

In compilation of the factors for conversion of total and standard lengths each individual sample was recorded in 25 millimeter group intervals. The factor for conversion was then determined by dividing the mean length of each group interval by the average length of the opposing group. These factors were as follows:

Standard to Total length, under 13.8 inches--1.200
Standard to Total length, over 13.8 inches-- 1.136
Total to Standard length, under 13.8 inches--0.833
Total to Standard length, over 13.8 inches-- 0.870.

The noticeable change in ration between total and standard length was used for further comparison of larger group intervals. As indicated by previsos studies (Carlander and Smith, 1944) as the fish increases in length the tail becomes proportionally shorter.

Summary

The study is concerned with the age and growth of the yellow pikeperch in the Cedar River, Iowa. Scale samples were obtained from individual anglers within the Waterloo-Cedar Rapids pool. A description of the study area is presented.

Average calculated standard length from the first to tenth annulus was 154, 266, 342, 408, 441, 517, 556, 580, 618, and 670 millimeters. Mean annual growth increments for these years of life was 154, 111, 56, 49, 40, 51, 52, 24, 38, and 30 millimeters respectively.

The total length relationship as determined by the least squares method is $\text{Log } W = -5.17661 + 3.05566 \text{ Log } L$.

Average "K" was 1.34 for 152 walleye from the river. Very little change is noted in this factor with increase of size.

Factors for conversion of total and standard lengths are presented.

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CHANNEL CATFISH POPULATION ESTIMATES, HUMBOLDT AREA, 1953 THROUGH 1955

by
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Fisheries investigations in that area of the Des Moines River lying between the hydro-electric dams at Humboldt and Rutland have continued annually since 1949. In its broadest aspects, the study has for its purpose to gather basic facts concerning the life histories of the fish living in the area and to learn how these findings may be applied to maintain and improve stream populations in this and similar bodies of water. The reasons for selecting the area for study purposes, its description and some of the various results coming from the investigation have appeared in the form of progress reports in previous Iowa Conservation Commission Quarterly Biology Reports.

The present paper concerns that part of the study dealing with the estimated size of the channel catfish populations, and compares this information with that collected previously.

Method

The Petersen method is used for estimating the size of the Channel Catfish population.

$$P = \frac{A\ B}{C}$$

Where $\underline{A}$ is the number of marked fish in the area
$\underline{B}$ is the number of fish taken
$\underline{C}$ is the number of marked recaptured.

Ordinarily, fish are marked in the fall of the year by fin-clipping. They are permitted to mingle with the unmarked segment of the population over winter, and are then sampled by baited hoop nets the following spring. An exception to the foregoing occurred in 1955, when a sample of fish was marked in the spring and allowed to mix throughout the summer with an estimate being made in the fall. Hence, for that year we have both a spring and fall estimate.

As pointed out in previous reports, one disadvantage of the technique arises from the relatively long mingling period. In effect, our estimates are for populations that existed approximately six months prior to the time that the calculations are finally completed. In other words, the estimates determined in the spring apply to the population of the previous fall, and the fall estimates apply to the spring population level. However, due to the fact that marked catfish tend to avoid re-entrapment, due to the press of other activities and the weather, the long mingling period results quite largely by necessity.

Results

Estimates of the size of the channel catfish population living in the Humboldt area have been made each fall since 1953 and for the spring of 1955. The results of that work appear in Table I which gives the time of the estimate, the number of fish marked in each instance (A), together with the number of fish caught in the sampling (B), the number of marked fish retaken (C), and the estimated size of the population (P). Of these estimates, only those made in the fall are considered to be reliable. This is for the following reasons:

(1) The percentage of marked to unmarked fish was quite uniform.
(2) A large sample of fish was marked and a large number of the marked individuals were recaptured.
(3) The marked fish had an ample opportunity to mingle homogeneously with the unmarked segment of the population.
(4) Recruitment of smaller fish into the population would not be significant since catfish do not grow appreciably during cold weather,
(5) In the case of any mortality both the marked and unmarked fish should be effected similarly.

The estimate made for the spring of 1955, on the other hand, might very well be and probably was influenced by recruitment which would tend to make that calculation too high. However, that estimate was made in connection with other work and has been included in this report for the sake of interest only.

Returning to the discussion of the fall estimates, it will be noticed that the channel catfish population in the study area has fallen sharply but quite steadily since 1953. The decline amounted to 38,441 fish from the fall of 1953 to 1954 and 27,697 from 1954 to 1955. The reasons for the drop are not known for certain. The disease, whitespot, was prevalent in the area in 1954 and may have contributed heavily to the loss for that year. Whitespot has not been noticed since then and if it did persist, it did not appear in epidemic porportions.

There have been no reported catfish kills on the area during the investigations. However, in the summer of 1955, numerous fish kills occurred over the entire state. These, in most instances, were connected with drought conditions and abnormally high water temperatures. Because of the wide-spread distribution and frequency of these kills, one might suspect that various fish losses occurred in all reaches of every stream in the state. This most certainly would take its toll upon the weaker individuals and especially so in populations living in marginal habitat or otherwise being depressed by the developement of a stronger population of other species. Should such a phenomena occur, the continuous loss of a small per cent of a specific population every day over a one or two month interval might very well go on unnoticed and, in the long run, amount to a sizable number of fish.

Table I.
Channel Catfish Population Estimates, Humboldt Area 1953 Through 1955, by Petersen Method

Year	A No. Marked Fish	B No. Fish Taken	C No. Marked Fish Retaken	P Channel Catfish Population
Fall 1953	14,889	6,681	951	104,597
Fall 1954	25,000	5,880	2,222	66,156
Spring 1955	5,097	7,559	651	59,183
Fall 1955	7,007	5,469	999	38,459

It has not been determined whether or not this has occurred in the Humboldt Area. Nonetheless, certain observations tend to indicate that the foregoing might be a partial answer. For instance, bullheads represented only by scattered individuals in the catch in 1953 and before, are now the most abundant species taken in the nets. This is believed to be a consequence of the drought conditions which have persisted since the summer of 1954. Before that, the Humboldt Area even though an impoundment, more nearly represented a definite stream type of habitat and as such contained a stream-like composition of fishes. Since the onset of the drought, the area has lost some of its former rather distinctive stream-like characteristics and now leans somewhat more toward an impounded condition. The vast bullhead population and the much reduced flows are the most outstanding of these.

Competition for food and space are probably the important factors at work that have actually brought about physical reduction in the channel catfish population.

Although no quanitative studies of the forage organisms have ever been pursued in the area, close checks have been made on the body condition, growth rates, and size composition of the more important fish species living there. In this work, to be reported upon at another time, we have found the size composition, the body condition and growth rates of both the channel catfish and carp population to be much retarded at this time. With regard to the carp in particular, the body condition of those living in the Humboldt Area is at present the poorest ever witnessed by this writer in over fifteen years of working with fish. Actually, they are a rack of bones and it is a curiosity that animals so thin and emaciated could continue to live in the large number in which they persist in this reach of stream. Channel catfish, on the other hand, are poor but do not exhibit the extremes that the carp do. In the case of the channel catfish population, the most remarkable change than the reduced size of the population, has to do with the reduction in the size composition. In 1954, over 50 per cent of the area were over ten inches in total length. In 1955, only 2 per cent were longer than that figure. It is hardly reasonable to believe that the foregoing would or could occur in a lush food supply.

Going now to the item of competition for space, we encounter a factor much talked about in modern fisheries circles but one for which no good known measuring devices have yet been devised. Because of the large number of fish living in the area, it is felt that the space factor must certainly exert an important influence on the fishes there. Furthermore, it seems reasonable to assume that the stresses, resulting from crowding to the degree at which it has persisted in the Humboldt Area in the immediate past, might very well bring about the actual destruction of various segments of the population.

Conclusion

Actually, only one conclusion can be drawn from this particular part of the fisheries investigations being carried on at Humboldt. This is that the channel catfish population in the area has dropped precipitiously since 1953. Nonetheless, this, together with other aspects of the investigation have afforded an excellent opportunity to observe fish population dynamics at work. In addition, we have accumulated a backlog of information with which to study the effects of a concerted management program anticipated for the area in the near future.

OXYGEN DEPLETION AND WINTER FISH KILLS
IN NORTHEAST IOWA STREAMS-1956

by
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Northeast Iowa rivers reached record lows in discharge at numerous locations during the fall and winter of 1955-1956. Attending these reduced flow conditions were a multiple series of fish kills and low oxygen readings in specific areas of several rivers. Normal winter kill is usually confined to small creeks and certain small chronic kill areas in the major rivers. However, in 1956 these chronic areas served only as a focal or starting point, and the zones of depleted oxygen often covered 50 to 100 stream miles in length.

Most published material on water criteria lists 5 parts-per-million (p.p.m.) of dissolved oxygen (D. O.) as the minimum optimal concentration of oxygen for fish life. There are deviations from this norm with fish being asphyixiated at 6 p.p.m. and apparently doing quite well at 3 p.p.m. The various physical, chemical and biological features of the environment play an important role in determining just where in the D. O. scale a certain species or group of fish asphyixiate.

For example, predator species have a higher D. O. requirement because, being on a high protein diet, they have a higher metabolic rate and therefore, need more oxygen to maintain normal body functions. Certain species are more tolerant of a poor environment than others -- for example, the bullhead or carp. This tolerance may possibly be a genetic characteristic in herent to those species.

The physical activity of certain species may increase the oxygen demand two to four times over that needed in the resting stage or at the basal metabolism level. At the same time the chemical composition of the water is a very important factor in oxygen utilization or requirements. The pH of hydrogenion concentration and the CO_2 (carbon dioxide) tension play important roles in the oxyhemoglobin content of the blood. The higher the pH or the more alkaline the water, the more difficult it becomes for the fish to utilize the available dissolved oxygen in the water. (In the winter the average pH in northeast Iowa water is reasonably alkaline, at readings of 7.4 to 7.6). The ionic concentration of the water also effects the oxygen utilization.

In areas of industrial or organic pollution a reduced oxygen concentration may cause a fish kill where reduced oxygen is not the primary but the secondary or "triggering" cause of death. For example, if the oxygen concentration goes down, the toxicity of certain heavy metals such as chromium compounds and others go up. The toxicity of phenolic wastes are also increased with a dissolved oxygen reduction.

Physiologically, low oxygen can cause a breakdown in the fishes' general resistance mechanism and it becomes more susceptible to any adverse feature of

Table 1. Dissolved Oxygen Determinations - Northeast Iowa Rivers 1950 and 1956.

River	Location	January 1950	January 1956	February 1950	February 1956
Cedar	1. Charles City	9.0	-	7.8	4.0* (3.80)
	2. Nashua	10.4	-	9.7	2.8* (2.80)
	3. Cedar Falls	10.1	10.0	10.6	11.2
	4. Gilbertsville	12.1	15.2	12.1	9.2
	5. Mt. Auburn	12.0	6.6*(4.8)	9.2	7.1* (6.6)
	6. Vinton	12.8	5.7*(2.4)	12.5	4.6* (2.60)
Iowa	7. Eldora	7.7	7.5	7.2	7.0
	8. Le Grand	7.6	12.2	6.7	9.8
	9. Tama	9.7	8.4	7.6	1.6
Wapsie	10. Independence	14.4	13.8*(13.2)	10.2	9.6
	11. Dane Bridge	14.2	10.4	9.8	11.2
Maquoketa	12. Bailey's Ford	11.0	13.4	11.9	10.6

* Monthly average of multiple determinations. D. O.'s in parenthesis are lows for month.

However, Table 1 indicates that this is not completely the cause, for despite low waters, certain locations (numbers 3, 7, 8, 10, 11 and 12 - or six of twelve stations) had reasonably close February oxygen readings in 1950 and 1956. Therefore, low-water conditions as depicted by Table 2 were not the entire cause of oxygen depletion in many areas.

Table 2. Comparative River Stages on Northeast Iowa Rivers, 1950 and 1956.

River and Station	Mean Discharge Sec-Ft. Dec. - February 1950	Mean Discharge Sec-Ft. Dec.-Feb. 1956
Iowa-Marshalltown	83.4	49.6
Cedar-Waterloo	380.0	289.1

In reviewing the areas open to "Permiscuous Fishing," it seemed evident, that we had investigated other fish kills in those areas in the past. Checking back through the records of the last eight years, we discovered spring or summer fish kill reports for each area opened to permiscuous fishing except the extreme upper reaches of the Iowa River and I am sure that (unreported to me) they have occurred here, (see Table 3). These areas were obviously focal points of pollution and probably the source of the degraded condition causing the opening of the area to "Permiscuous Fishing."

Table 3. Previous Spring or Summer Fish Kills in Areas Open to Permiscuous Fishing in the Winter of 1955-1956.

River and County Open in 1956	Year of Spring or Summer Fish Kill	Causative Agent	Area Affected
Iowa R - 1	No abnormal kill reported	-	-
Iowa R - 2	Oct. 4, 1949	Industrial	Tama to Chelsea
Cedar R - 3	July, 1948	Industrial	Ellis Park area, Cedar Rapids
West Fork - 4	August, 1951	Organic	Vicinity of Hampton
Winnebago - 5	July, 1949	Organic	Vicinity of Forest City
Wapsipinicon - 6	March, 1950	Organic	Chickasaw County line to dam at Frederika
Wapsipinicon - 6	February, 1954	Organic	Tripoli to Dunkerton

1. Wright, Hancock, and Hamilton counties.
2. Tama, Iowa, and Johnson counties.
3. Linn County
4. Cerro Gordo, Franklin and Butler counties.
5. Worth and Cerro Gordo counties.
6. Chicksaw and Bremer counties.

Most of the critical areas for fish life were in the head-waters or upper reaches of the major rivers. The information found in Table 4 was abstracted from the U. S. Public Health Bulletins Nos. 55, 61, 62 and 71, Water Pollution Series, which covered the areas under discussion. Low water may have triggered these kills, but the primary cause of septicity seems to be the heavily polluted conditions found in these shallow upper reaches of our major water-way. When only 21 of 61 towns in the water-sheds have sewage disposal plants; when only 13 of 21 plants are capable of handling the sewage load; and when 19 agricultural products plants dump directly into these streams....is it any wonder that in periods of extended low water, these streams are anything more than open sewers?

Table 4. Organic Pollution Situation in Counties and Northeast Iowa River Open to Permiscuouc Fishing - Winter of 1955 - 1956

Rivers and Counties Open	Number of Towns Using River to Discharge Wastes	Number of Towns With Disposal Plants	Number of Disposal Plants Rated Satisfactory	Mfg. Plants Dumping Untreated Organic Waste
Iowa R - 1	7	2	2	3
Iowa R - 2	16	5	4	2
Cedar R - 3	3	1	0	5 plus
West Fork - 4	9	5	2	0
Winnebago -5	5	3	1	5
Wapsipinicon -6	11	5	4	4

1. Wright, Hancock and Hamilton counties.
2. Tama, Iowa, and Johnson counties.
3. Linn county
4. Cerro Gordo, Franklin, and Butler counties
5. Worth and Cerro Gordo counties
6. Chickasaw and Bremer counties

In the case of the Wapsipinicon River, the area above the Black Hawk County line or about 75 miles of the river's 225 mile length, has a measured B. O. D. at all sewage outlets of 7550. In the area below this line, roughly two-thirds of the watershed, with four times the human population of the upstream area, the B. O. D. (Biochemical Oxygen Demand) was only 4730. This points up the fact that in addition to the greater downstream volume of water for a dilution factor, the pollution load is lesser downstream than up, despite the increased watershed, much larger urban population, and heavier industrial buildup.