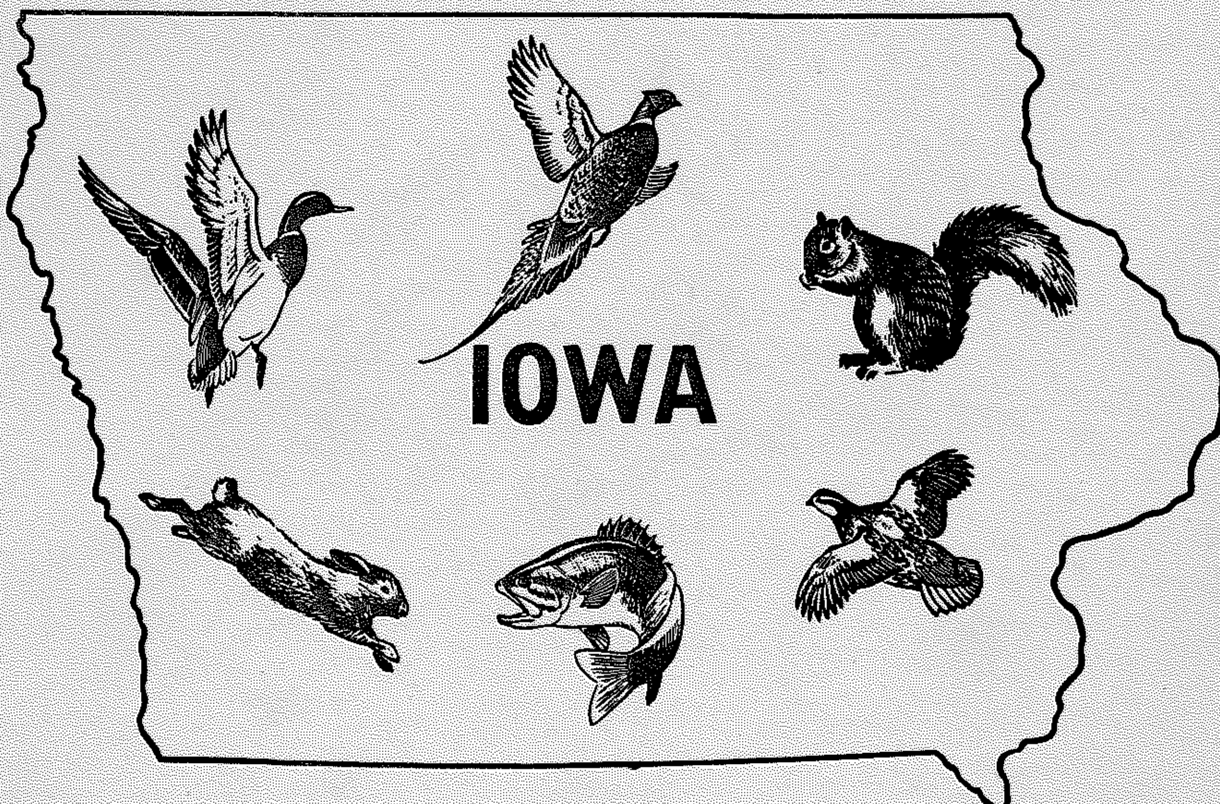
1957

QUARTERLY BIOLOGY REPORTS



FISH AND GAME DIVISION — BIOLOGY SECTION

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QUARTERLY BIOLOGY REPORTS

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SOME ASPECTS OF THE SUMMER COUNT OF WHISTLING QUAIL

Elden Stempel
Game Biologist

One characteristic of the male bobwhite quail is his calling throughout the summer. Since World War II, studies of this activity have been made by the Iowa Conservation Commission and Iowa State College. In several states the calling was used in estimating populations of adults. Reeves, (1951) used the calling quail index to estimate statewide changes in the population of quail in Indiana. Bennitt (1951) adopted this method to predict fall hunting success in Missouri. Rosene (1957) wrote on work in Alabama and South Carolina that indicated the number of calling quail was closely correlated with the number of fall coveys on censused areas. Stoddard (1932) reached the conclusion that in the south the unmated cocks called, but that mated and unmated cocks each year made up about the same proportion of the flocks. On an Iowa check area, the number of successful hatches of young corresponded to the number of calling cocks.

On the Iowa area the males that whistled were counted several times in summer. The age of quail was indicated first by observing the size of the young in coveys flushed in early fall; second by study of wings taken from quail shot by hunters. Fall coveys did not equal the number of summer callers because some coveys combined with others.

The author interviewed one game farm manager in Missouri and two in Iowa to get their opinion on some aspects of whistling. None knew which cocks called. Each was of the opinion that this activity rose, then diminished with laying. Since captive quail did not nest, there was no opportunity to observe the whistling pattern of nesting birds.

Summer callers in some cases indicated the number of fall coveys. But there may be partial, or complete nesting failures resulting in small coveys that tended to join others to form groups of about 12. Such units contained stray adults in addition to parent quail. Further work is necessary to demonstrate some of the processes through which one calling male comes to represent one fall covey.

Method

In each of 44 counties, two 12 mile routes were to be censused by Conservation Commission personnel. Sampling was based on soil types. Major land areas extend beyond county lines, therefore the results indicated the condition of the population in all 63 counties open for quail shooting.

The counts were started after July 10, and continued to July 23. Each route was begun at sunrise on a day when the sky was clear, wind was below eight miles per hour, and temperature was moderate. Additional checks were made by the biologist in Wapello, Davis, and several other counties. These were used primarily to establish the rate of calling during May, June, July and August.

Difficulties encountered during the checks were: muddy roads, high winds, rain, cloudiness, and low temperatures. There were additional variations created by changes in officer personnel. Vacations, and other commitments as well as illness caused delays.

Results

By July 28, over one-half of the completed census forms were returned. On that date reminder cards were mailed and soon thereafter all except one county reported. A total of 1,075 miles of route were checked. Weather was moderate; rainfall was near average and temperatures averaged slightly above normal. The average number of calling quail was 1.6 birds per mile of route. This figure varied only slightly for the last several years. The number of calling quail per mile from 1953 through 1957 have averaged 1.4, 1.5, 1.6, 1.5 and 1.6. If however, these figures are to be used, it must be considered that there is considerable turnover in personnel and some of the figures were arrived at before all late reports were in. Nevertheless, the poor hunting year of 1953 was indicated by the lowest figure. A change of over 10 per cent apparently would indicate a noticable shift. A lesser change apparently was not noticable. Except for 1953, hunting success has varied little.

Results by Districts

Soil type distribution enabled us to get estimates on areas larger than a single county. It is further necessary to have information on larger units having recognizable policical boundaries.

For this purpose, records are kept within agricultural districts. On this basis all of south-central Iowa appears to have had an increase in the adult population over 1956. This also extended into Wapello County. Western counties had good numbers, and only the extreme southeast had a decline.

There were instances when changes in numbers of calling quail represented a like trend in the adult population. This would be reflected in the hatch. In Iowa, the call counts were not always made where the hunting was done. Further, unfavorable weather appeared to retard production. Hence, calls would not represent all birds that hatched and later were harvested. In contrast, in southern states during the years the study was carried on, weather may not have influenced hatching.

The short, 1953 season in Iowa was reflected in covey composition that differed from that of years when the moderate weather prevailed. In the latter case, ages varied considerably within districts. Combining of broods resulted in a smaller number of fall coveys than the number of broods that hatched. Further inspection of this and other data leads to the following conclusions: (1) the number of hatches was related to the number of adults; (2) young survived best in the absence of drouth, floods, cold weather and short nesting seasons. At present, it is believed that in Iowa, dewfall throughout the summer and moderate hatching weather lasting ten or more weeks is more important than the number of breeders.

Results by Counties

In the main quail range, increases were reported over 1956 in Clarke, Davis, Jefferson, Mahaska, Ringgold, Scott, Warren, and Wayne counties.

In Monroe there was a good quail count though the number changed little from last summer.

Low population counties that had increases were: Harrison, Montgomery, Pottawattamie, Story, and Tama. In spite of this apparent increase, heavy rainfall may have damaged the crop of young.

Lower counts than those of 1956 occurred within the main range in Henry, Lee and Louisa. In outlying areas, there were lower counts in Audubon, Jasper, Jones, and Woodbury counties.

Some extreme changes, both up and down, occurred in scattered areas. In Davis the count rose to 115 in 1957; the 1956 count was 89. Nearby Jefferson county, also had an increase. Marginal counties, Jasper and Jones declined considerably. Counties having high counts of breeder quail may have suffered losses due to bad weather, but the areas that had low counts of breeders could make up the deficiency since temperatures and moisture conditions were suitable.

Special Counts and Their Implications

Records from a Wapello county area revealed that the duration of calling was a better indicator of the number of fall coveys than was the number of calling quail. This conflicted with reports that fall coveys are represented about a one-to-one ratio, by summer callers. Hunting, the critical test of production, depended to a great extent on other factors paramount among which were the amount of moisture, and the age of quail.

In July 1956, Dick Tellier, Conservation Officer for Webster County, made a count of whistling quail near Fort Dodge in the vicinity of a planting of birds from the Boone State Game Farm. Previously farmers reported there were no native wild quail here.

Only one quail was heard in 1956: During July, 1957, the count was repeated and five birds were heard.

Summary

1. Most of the 1957 summer count of whistling cock quail was completed by early August.

2. Research demonstrated that changes in numbers of calling cock quail indicated changes in numbers of fall broods.

3. In southeastern Iowa, as far east as Wapello county the 1957 count of calling quail increased over the 1956 count.

4. Western Iowa also had more calling birds.

5. In extreme southeastern Iowa the number of calling cocks decreased from the number found in 1956.

6. Increases in callers must be accompanied by good nesting conditions to have a like number of fall coveys.

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PHEASANT REPRODUCTION IN IOWA - 1957

Richard C. Nomsen
Game Biologist

Studies began early in the spring of 1957 to evaluate pheasant reproduction. Counts by conservation officers, rural mail carriers, farmers and biologists were made and the results compared with previous surveys to determine the relative success of the present hatch.

The 1957 brood stock of pheasants was lower than the previous year. The pheasant population dropped sharply in the western part of the state, which had experienced a severe drought in 1956. There was a noticable increase in the supply of hens over the eastern third of Iowa.

A study of weather conditions during April and May indicated an average hatch for 1957 (Table 1). The first half of April was cold and wet, which meant a late start of nesting activity. Spring came quickly after April 15th as temperatures averaged well above normal for the rest of the month. Iowa cooled again in May with temperatures at most points averaging slightly below normal.

Table 1. Reproduction Success and Mean Spring Temperatures, 1951 - 1957.

YEAR	MEAN TEMPERATURE FOR APRIL AND MAY	REPRODUCTION SUCCESS YOUND 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
1957	54.3	4.4

The Weekly Weather and Crop Bulletin reported that the first cutting of alfalfa was slightly behind normal in 1957. About one-half had been cut by mid-June compared with about three-fourths a year ago. Rains delayed cutting in some areas.

Cooperating farmers returned 112 cards last spring with information on nests observed while cutting the first crop of hay (Table 2). They also reported fewer nests in hayfields this year; however, the number of hens killed or injured remained the same. Fewer nests indicated a lower spring population. The reason for the similar hen loss was that incubation was farther advanced this year and the hens were reluctant to leave the nest. The delay in cutting caused by rains probably allowed a few more nests to hatch. Farmers reported 15 broods this year compared with 8 in 1956 but the average brood size was smaller.

Table 2. Results of Farmer Cooperator Nesting Survey 1956 - 1957.

	1956	1957
Acres of hay cut	3,823	3,751
Number of nests seen	315	254
Nests seen per 100 acres	8.2	6.8
Average number of eggs per nest	9.1	9.7
Number of nest hatched	32	34
Number of hens reported injured	63	61
Hens reported injured per 100 acres	1.6	1.6
Number of hens reported killed	66	59
Hens reported killed per 100 acres	1.7	1.5
Number of broods reported	8	15
Average number in each brood	10.0	9.0

Rural mail carriers conducted their annual summer game count during the week of July 29 - August 3. They reported 2.4 young per hen compared to a 2.3 ratio in 1956. The mean of the ratios obtained from 1951-1956 was also 2.4. The carriers' survey showed that the percentage of hens with broods increased, but the average brood size was smaller than in 1956.

Table 3. Rural Mail Carriers Brood Counts 1952 - 1957.

	1952	1953	1954	1955	1956	1957
Average brood size	6.3	5.9	6.5	6.1	6.0	5.6
Percent of hens with broods	41%	36%	38%	43%	38%	43%
Young per adult hen	2.6	2.1	2.5	2.7	2.3	2.4

Conservation officers began their summer brood counts on July 15th. During the next 31 days, they reported 2,183 broods with 12,965 chicks. They checked 776 hens without broods. According to the results of this survey, pheasant reproduction in 1957 appeared to be slightly better than in 1956. Although the average brood size remained the same - a higher percentage of the hens had broods this year. The resultant 4.4 young per hen was better than the previous six-year average of 4.1 juveniles per hen. The rate of hatching success decreased in northeast and central Iowa. Counts in all other areas indicated better reproduction. Best results were obtained in north central, east central and southern Iowa (Table 4).

Table 4. District Results for Conservation Officers Brood Counts for 1957. Statewide Results for 1952-1957.

District	Young per Adult Hen	Average Brood Size	Per cent of Hens with Broods
1. Northwest	4.1	5.6	72
2. North central	4.7	6.0	78
3. Northeast	3.7	5.1	73
4. West central	4.5	6.5	70
5. Central	3.7	6.1	61
6. East central	5.0	6.4	78
Southern 3 districts	5.4	6.6	83
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
State 1957	4.4	5.9	74

According to the author's survey, reproduction success in Franklin county and vicinity was much improved this year. The average brood size was the same as 1956, but the percentage of hens with broods was very high (Table 5). Officers in the north central district also reported a good hatch.

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

Year	Young per Adult Hen	Average Brood Size	Per cent of Hens with Broods
1953	3.1	6.0	52
1954	4.6	6.3	74
1955	5.2	6.7	78
1956	4.3	6.1	71
1957	5.2	6.2	84

There were 131 broods observed closely enough to estimate their ages. According to the results of this study, the peak of hatching occured during the last two weeks of June, or about the same time as in 1956.

Summary

1. This report includes results of all pheasant reproduction studies made in 1957.

2. Mean spring temperatures indicated an average hatch.

3. Farmer cooperators reported fewer nest in hayfields this year. The hen loss was similar to 1956.

4. Results of the rural mail carrier count showed a normal hatch.

5. Reproduction success for the state was slightly better than the six-year average of the officers summer count. Hatching success appeared to be poor in northeast and central Iowa. Best results were obtained in north central, east central and southern Iowa.

6. Reproduction success in Franklin county and vicinity was much improved this year.

RABBIT HUNTING PROSPECTS FOR THE 1957-58 SEASON AS INDICATED BY THE JULY SURVEYS

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Game Biologist

Cottontail rabbit hunting has always been a favorite winter pastime for many Iowans. Cottontails are among our most abundant game species. They are able to survive under conditions of intense ecological disturbance by mankind. Continuously improving economic conditions create every year more leisure time for the average citizen. Much of this leisure time is spent hunting. Hence, it appears the cottontail will long remain an important Iowa game mammal.

The Iowa Conservation Commission has long recognized the importance of cottontails. Beginning in 1950 they have conducted annual surveys of rabbit populations. The July and February roadside counts, July age-ratio survey, rabbit hunter-cooperator project, and rural mail carriers counts, are the more important of these annual surveys. A report on the July, 1957, roadside counts and age ratio surveys is the purpose of this paper.

The July roadside counts are conducted by all conservation officers and biologists throughout Iowa. Predetermined routes 30 to 40 miles long, over gravelled, secondary roads are used whenever possible. Participating personnel are asked to conduct the counts sometime between July 10-20 inclusive. They are asked to drive at 25 m.p.h. starting at sunrise, and count and record all rabbits seen along the route. The number of rabbits seen over the number of miles driven gives an index expressed as rabbits seen per 10 miles of route.

The method of conducting the survey was changed slightly in 1956 and again in 1957. During the first six years the counts were completed sometime between July 15-31. However, research by the Iowa Cooperative Wildlife Research Unit indicated early morning rabbit activity decreases towards the end of July. Hence, the time was changed to July 10-20 to eliminate this possible variable. Also, during years 1950-55 personnel were asked to drive 20-30 m.p.h. while carrying on the survey. If some men drive 20 m.p.h. and others 30 m.p.h. another variable would be introduced. This possibility was minimized in 1956 and 1957 by instructing participants to drive at 25 m.p.h.

It has long been known that weather factors influence the surveys. However, until recently, exactly what weather factors were most important was not known. Until 1957 instructions merely asked that the surveys not be made during extreme weather conditions. Because more was known about weather influence, the 1957 instructions asked that surveys not be made when the wind was blowing more than 8 m.p.h. or when skies were overcast. More specific instructions will be incorporated in the future.

Beginning in 1955 recordings of dew were made by every participant while making a July roadside count. Dew gauges and photograph keys were kindly furnished by Richard C. Nomsen, Pheasant Biologist.

In addition to the roadside counts, personnel were asked to record all juvenile or adult rabbits observed during the period, July 10-20. The resulting ratio, the number of juveniles per adult, could be used in comparison with that obtained during previous years. During all previous years, 1950-1956, the age ratio survey was carried on during the entire month of July. Also, participants were asked to age at least 100 rabbits during that time. However, a survey carried on for a month cannot always be given full attention by those who take part. It was felt a survey requiring less time probably would command more intensive effort, and perhaps be more accurate. Hence, in 1957, the time for the survey was shortened to eleven days and the number of rabbits to be aged to 50.

Sixty-four roadside counts were completed for the July, 1957, survey. On 2,218 miles of survey route, 1,084 cottontails were counted for an index of 4.9 (Table 1). The index indicated more rabbits throughout Iowa than in any other year except 1955 (Table 2), and considerably exceeded the 1956 index of 4.0. The average for seven previous years was 4.1.

Table 1. Results of July 1957 roadside rabbit surveys and comparison by agricultural areas with 1956 surveys.

Agricultural Area	Number Routes	Number Miles	Number Rabbits Seen	Rabbits Seen/10 Miles	Rabbits Seen/10 Miles, in 1956
Northwest	8	289.0	112	3.87	3.54
North Central	8	284.4	95	3.34	2.50
Northeast	9	306.2	88	2.87	3.01
West Central	5	180.0	71	3.94	3.58
Central	7	220.7	68	3.07	2.77
East Central	7	252.0	155	6.14	4.91
Southwest	4	138.0	64	4.59	3.21
South Central	7	235.5	158	6.71	4.81
Southeast	9	311.2	273	8.77	6.85
Totals	64	2,218.0	1,084	4.89	4.02

The survey indicated rabbit numbers were not evenly distributed throughout Iowa. Smallest indices were obtained by surveys made in the central (3.1), northeast (2.9), and north central (3.3) agricultural areas (Table 1). These data are comparable with 1956 indices obtained for central (2.8), north central (2.5), and northeast (3.0) Iowa when the statewide average was 4.0.

Table 2. Statewide 1957 averages for officers' July roadside counts and juveniles/adult compared to similar counts for seven previous years.

Year	Number of Rabbits Seen per 10 Miles of Route	Number of Juveniles per Adult
1950	4.28	2.2
1951	3.91	2.0
1952	4.17	2.6
1953	3.30	2.4
1954	3.35	2.5
1955	5.67	3.0
1956	4.02	2.7
1950-1956 average	4.10	2.5
1957	4.89	3.2

In 1957, as in 1956, the highest indices were obtained in the east central (6.1), south central (6.7) and southeast (8.8) agricultural regions. The survey indicates cottontails are abundant in southeast Iowa at the present time.

Results of rabbit counts classified by dew readings are tabulated in Table 3. Neither in 1956 nor 1957 did dew appear to affect the survey. Perusal of the data indicates dew does not influence our rabbit counts. However, there is a definite possibility dewfall may be correlated with other weather factors as an influence upon rabbit activity along roadsides in early mornings of mid-July.

Table 3. Effect of dew upon number of rabbits seen during officers' July rabbit counts and comparison with 1956 counts.

Dew Reading	Number of Routes	Number of Miles	Number Rabbits Seen	Rabbits Seen/10 Miles	Rabbits Seen/10 Miles, 1956
0	14	500.7	237	4.73	----
1	16	537.4	272	5.07	4.24
2	11	408.2	135	3.31	4.20
3	12	404.7	238	5.88	3.54
4	3	96.0	42	4.38	4.34
5	2	77.0	79	10.26	5.15
6	2	74.0	22	3.00	3.30
7	1	32.0	23	7.19	----
R/D	2	63.0	29	4.60	1.03

Age was visually determined for 3,975 rabbits throughout Iowa. Of these, 3,019 were young, and 956 adults, for a ratio of 1:3.2 (Table 4). This is a higher ratio than has been obtained for any previous year (Table 2), and considerably exceeded the 1950-56 average of 2.5. The 1956 ratio was 2.7 young per adult. These data indicate excellent rabbit productivity during 1957.

Table 4. Results of July age-ratio rabbit surveys and comparison by agricultural areas with 1956 survey.

Agricultural Area	Number Adults	Number Juveniles	Juveniles per Adult	1956 Juveniles per Adult
Northwest	134	314	2.34	1.64
North Central	56	199	3.55	2.52
Northeast	67	250	3.73	2.54
West Central	80	188	2.35	2.78
Central	52	2.9	4.21	2.24
East Central	121	244	2.02	2.68
Southwest	68	183	2.69	2.59
South Central	192	775	4.04	3.76
Southeast	186	653	3.51	3.36
Totals (Averages)	956	3,019	3.16	2.67

Summary

1. July roadside rabbit counts and age ratio counts were completed for the eighth successive year in 1957.

2. The roadside count and age-ratio survey have been changed slightly since their introduction in 1950.

3. The index of rabbits seen per 10 miles of route in 1957 was 4.9, greater than the average of seven previous years (4.1), and considerably exceeded the 1956 index of 4.0.

4. Indices obtained were largest in the south central (6.7), southeast (8.8) and east central (6.1) agricultural areas.

5. Neither in 1956 nor in 1957 did dew readings taken during the survey indicate a relationship between rabbits seen and amount of dewfall.

6. The ratio of young/adults (3.2:1) was greater than all previous years and exceeded the 1950-56 average of 2.5:1.

THE FORECAST AND ADVENT OF MASS MIGRATION OF WATERFOWL THROUGH IOWA IN THE FALL OF 1957

James G. Sieh
Game Biologist

Modern meteorological methods and weather forecasting via radio and television can help Iowa waterfowl hunters determine conditions suitable for mass fall migrations. Hochbaum (1955: 106-7, 137) stated that ducks select anticylonic (high pressure) weather for the start of their mass migrations. He indicated that high pressure, with its attendant clear sky and favorable wind, is a prerequisite for the beginning of mass migration. Bellrose (1957:21) concluded that the mass migrations of October 31-November 3, 1955 and the famous waterfowl migration on November 11, 1940 were not begun under the conditions stipulated by Hochbaum.

Meteorological conditions suitable for fall mass migrations cannot always be absolutely clearcut; however, the analysis of weather data provide sufficient information for both the novice and the expert to make their own analysis and forecast. Hochbaum (1955:104) has stated that major flights of blue-winged teals in September, canvasbacks and redheads in October, and lesser scaups and mallards in November occurred with a west-east opposition of high and low pressure areas, with a trough of wind flowing down the middle between the two air masses. Using the preceeding rule of thumb, the Iowa prognosticator must remember that these weather patterns usually develop with cold fronts moving from the artic southward; or more precisely from northwestward to southeastward. There is a progressive transition of cold fall weather from north to south with sudden thrusts of winter weather moving southward toward the Gulf. Meteorologically speaking, these are the unstable fall weather patterns establishing the more stable weather patterns of winter.

In the early fall, freezing temperatures in the higher latitudes and permanent snow cover tend to concentrate most species of ducks in southern Canada and in the northern U.S.A. Sudden thrusts of winter weather from the arctic to the gulf tend to coincide with mass migrations into Iowa. These mass migrations are usually accompanied by freezing temperatures, snowfall, and sustained winds from the northwest down the great plains to the Gulf. The most spectacular fall mass migration into Iowa is aptly termed "the grand passage". This passage is comprised largely of mallards and scaup. The local hunter anticipates this event, and a probable forecast of suitable flight conditions would be of great help.

Blue-winged teal migrate through Iowa in descriptive "creep or drift" movements beginning in late August, reach peak numbers about mid-September, and complete their migration during October. The blue-wings have been a neglected species as far as harvest is concerned except for the opening day "shoot". The majority of this species migrate through Iowa before the "framework dates" permit an open season. The recruitment of teal in Iowa during the fall migratory period have made it difficult to appraise their response to meteorological patterns as far as mass migration is concerned.

Mass fall migrations of waterfowl were successfully forecast several days in advance of the flight dates in Iowa during the autumn of 1957. These forecasts were a part of the experimental program of the Technical Section of the Mississippi Flyway Waterfowl Council. According to prearranged plans, Mr. Ivory Rennels, Meteorologist in Charge of the Sioux City Weather Station, telephoned us at 10:30 A.M. on October 21, 1957, concerning impending bad weather and meteorological conditions suitable for mass fall migration in Canada. A telephone call from Mr. William Leitch, Chief Biologist of Ducks Unlimited in Winnipeg, Manitoba on the evening of October 21 confirmed that some migration was already in progress in Canada and mass movements likely or imminent. A telegram from Alex Dzubin, Canadian Wildlife Service, from Kindersley, Saskatchewan sent on October 22, 1957 indicated "blowing snow and large mass of cold air covering southern Alberta and Saskatchewan. Should force out most birds from this region during next two days. Over 50 large flocks of ducks, mostly mallards, and some pintails moving south". Another telephone call from the U. S. Weather Bureau at Sioux City, Iowa on October 23, 1957 at 11:30 A.M. stated a high pressure area was over northern Montana and the North Dakota border. The high pressure area was expected to move into Iowa by the morning of October 24, 1957. This was sufficient information to assume that mass fall migration had been triggered in Canada, and that waterfowl could be expected to arrive in Iowa with the advance of cold Canadian air and the frontal system from the northwest. A telephone call at 9:00 P.M. on October 23, 1957 from Frank Bellrose, Illinois Natural History Survey, anticipating mass migration corroborated this assumption. A night letter sent out October 23, 1957 by Alex Dzubin from Kindersley, Saskatchewan noting a heavy migration of ducks near Kindersley of over 100 flocks of mallards moving south until early afternoon, and further communication from Bernard Gollop of the Canadian Wildlife Service and Mr. Frank McKinney of Delta Waterfowl Research Station positively confirmed this assumption.

Mass fall migration was in progress in Iowa at daylight on October 24, 1957 and continued throughout the day until approximately 5:00 P.M. Strong northerly winds and heavy overcast sky characterized the flight conditions during the day. Especially large numbers of migrating geese passed over Iowa, with a comparatively small passage of ducks. These migrants utilized the wind currents and as the strong northerly winds began to subside about 3:30 P.M., the rate of passage of migrants was observed to diminish in the lakes region of Iowa. The wind had subsided by 5:30 P.M. and for all practical purposes mass migration also stopped. By 5:45 P.M. a band of clear sky was visible west and north of Estherville, Iowa and by 6:00 P.M., in Spirit Lake, the sky had completely cleared, the wind had stopped, and mass migration ceased. A telephone call to Aberdeen, South Dakota, approximately 300 miles northwest of Spirit Lake, confirmed the assumption that the cloud cover and northerly winds had abruptly subsided there about noon the same day. Mass migration was in progress there during the morning hours coinciding with suitable wind and weather conditions.

During the early morning hours of October 25th and 26th, migrating waterfowl were observed to arrive in northwestern Iowa. These laggards were the aftermath of the preceeding mass migration. These morning flights were comprised largely of mallards with considerable numbers of divers. These migrants provided a sprinkling of waterfowl in Iowa, and locally some excellent shooting.

The number of mallards which were observed during the mass migration on October 24th indicated many more birds remained north of Iowa. Likewise, the weather pattern with its rapid passage of wind and cloud cover indicated many migrants were stalled en-route. In other words, pressure pattern flying conditions were short lived and more mass migration appeared probably with suitable weather.

Weather conditions again became critical in Canada on November 6, 1957. A letter dated November 6, 1957 from Mr. Rennels of the U. S. Weather Bureau in Sioux City, forecast the advance of a cold front through northern Minnesota, northern Wisconsin, the Great Lakes, and New England. A telegram from W. G. Leitch on November 8 at 7:57 A.M. stated "strong north winds, snow and falling temperatures indicate possibility of movement of most remaining waterfowl from Canada in next 24 hours. Delta advises considerable movement from north yeaterday and today through station and on south". At 11:45 A.M. on November 8, 1957, Mr. James Nelson of the Saskatchewan Wildlife Service telephoned from Saskatoon this message: "Gradual movement of ducks south up to the 6th of November. On November 5th had snowfall in most areas. Clear sky the 7th with mallards moving south. Most geese gone. Few remain. Most mallards and scaup have now moved south with very few mallards remaining in territory". A telegram from Mr. Frank McKinney sent at 3:50 P.M. on November 8th reported "Mass migration underway at Delta".

Mass migration was underway at daylight on November 8, 1957 in the lakes region of Iowa and throughout the state. Strong northwest winds, gusts up to 50 miles per hour, and occasional snow squalls with patches of blue sky between characterized the local weather. By telephone at 1:45 P.M., Mr. Rennels summarized the situation as, "Low center forming over Duluth and 100 miles east. Quite windy, 35 m.p.h. winds. Heavy snow in northern Minnesota, northern Wisconsin and also 100 miles east of the Dakotas. Ten degree temperatures in northern Minnesota and 15 degree temperatures in southern Minnesota".

Migration continued throughout the daylight hours of November 8th and it was assumed well into the night hours (bright moonlight). The wind abruptly subsided during the night, the sky cleared, and a dead calm prevailed. In northern Iowa ice up to two inches thick formed on the shallow lakes. At day break on November 9, 1957 inactive groups of tired ducks on the ice and in open holes were all that indicated the mass migration of the previous day. The sun came up over the broad expanse of the prairie in a clear blue sky, and the tired waterfowl were resting from their journeys.

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THE ROTENONE TREATMENT OF TWO IOWA LAKES

Tom Moen
Fisheries Biologist

Progressively poor hook and line fishing, low water levels, and unbalanced fish populations which failed to respond to normal management techniques resulted in the decision to completely eradicate the fish populations from Blue Lake in Monona County and Five Island Lake in Palo Alto County. Pro-Noxfish, a synergized, rotenone bearing compound was used in the treatment of both lakes.

Although no special biological studies were incorporated in these two projects there were a number of general observations that seemed worthy of recording. These observations along with notes on the fish populations and general conditions prior to treatment form the basis of this paper. Each lake will be discussed separately.

Blue Lake

During normal rainfall periods this Missouri River oxbow lake has a surface area of 918 acres. In the past three or four years the water level has gradually receded until only approximately 125 acres remained September 1, 1957. At this acreage the lake had a maximum depth of 8 feet and an average depth of three feet. Eighty-five acres of the lake were dredged to an average depth of 9 feet in 1950.

Prior to the reduction in water level the lake had produced excellent fishing for largemouth bass and crappies, and fair fishing for northern pike and channel catfish. The lake also had a reputation as being "full of spoonbills". Rough fish seining crews often caught as many as 15 of these paddlefish in each seine haul, but by 1955 the population began to show signs of decline. Carp, largemouth buffalo, sheepshead, gizzard shad, and shortnosed gar were present in considerable numbers. Walleyes, saugers, bluegills, bullheads, and several species of minnows completed the list of fish to be found here.

Routine survey hauls with 500 feet of $\frac{1}{4}$ inch seine have been conducted in Blue Lake each year since 1945. These surveys revealed that there has been little or no game fish reproduction since 1953. The seine hauls of 1957 indicate that young of the rough fish species outnumber the young of game fish by 17 to 1. By weight, the rough fish taken in these hauls totaled 234 pounds as compared to 17 pounds of game fish; carp made up 90 per cent by weight of rough fish and one adult northern accounted for 35 per cent of the weight of the game fish. In the past three years the potential fish food organisms have failed to average 0.1 c.c. per square foot. Condition factors of most species have steadily declined. Carp growth rates have been extremely poor with three and four year old carp averaging 11 and 12 inches in total length.

An experimental area treated with 0.5 p.p.m. Pro-Noxfish substantiated the finding of the seine hauls. In addition, the treatment failed to kill all the carp and killed no bullheads. Based on this and past experience in other Iowa waters it seemed desirable to treat the lake at a minimum of 1.0 p.p.m. in order to insure a complete kill.

In determining the volume of water to be treated, the depth was measured at approximately 100 foot intervals across the lake, thus 5 to 9 depth recordings were made for each transect. A transect of this type was taken at 400 foot intervals along the longitudinal axis of the entire lake. Based on the depth survey completed on August 27 the lake contained 365 acre feet of water. In the following two weeks, rainfall and subsequent runoff brought the water level up another eight inches thus adding at least 80 acre feet to the volume as originally determined.

Commencing on September 16 at 9 A.M. three units applied 176 gallons of Pro-Noxfish to the lake in 3.5 hours. These three units consisted of: one air boat powered by a 65 h.p. continental airplane engine; one air boat powered by a 4.5 h.p. out-board motor. The large air boat applied the rotenone bearing material through the use of a "boom" sprayer similar to those used on farm tractors with a ten foot boom extending out from each side of the boat. This outfit could pump an average of 2 gallons of mixture per minute and was assigned to shallow water along the edge of the lake where an out-board motor could not operate. Both the small air motor and the out-board unit used small gear pumps and a boom with 3 spray nozzles grouped at the end of the boom. The small air boat was assigned to the upper part of the lake, a narrow, shallow area containing approximately one million cubic feet of water. The third unit was assigned to the deep water areas. Toward the end of the application period all three units were working in the main body of the lake.

Air boat surveys at 4 P.M. indicated some doubt as to the success in the upper and lower end of the lake. An additional 8 gallons of chemical were added to the shoreline of the upper area and another 30 gallons at the south end of the lake. The latter was added with the thought that the strong south wind would circulate the material through most of the lake. Thus a total application of 214 gallons probably brought the concentration to well over one p.p.m.; actually 1.4 p.p.m. if volumes were accurately determined.

Weather conditions were nearly ideal during treatment. Surface water temperature was 62°F by noon. There was little or no wind until about noon, but there was an excellent mixing of the material by some 10 out-board motor boats operated by conservation officers in an unsuccessful attempt to salvage game fish. Less than 10 per cent of the 100 or so game fish retrieved while in distress lived to be stocked in a nearby lake. Young sheepshead surfaced within 15 minutes after application started; small crappies in 20 minutes; small bass in about 35 minutes; adult northern in one hour. Buffalo and carp began to surface after 2.5 hours of exposure and bullheads were not noted until nearly 5 hours of elapsed time. Several lively short-nosed gar were observed at 3:30 P.M. This observation prompted the addition of more chemical at the upper end where they were noted. At 4 P.M. three adult carp were observed swimming away from a stop net at the south end of the lake, apparently unaffected by the rotenone. This area was given the additional treatment of 30 gallons as noted above. At the same time there were large numbers of dead fish of all species drifting ashore. Less than half the fish drifted to shore the first day of treatment.

The species composition as observed during the rotenone treatment appeared to vary little from that of the seine hauls or the experimental rotenone work completed earlier, except for the possibility that there were even fewer game fish than had been anticipated. There were less than 100 catfish observed;

fewer than 25 northern pike (all adults from 5 to 10 pounds); no more than 25 largemouth bass (shocker work in 1956 failed to take a single bass); and only 8 crappies were retrieved. One paddlefish was captured early in the afternoon. These counts are visual estimates and represent less than the actual number.

All the fish killed by chemical application were not picked up or buried, hence, no accurate figure can be placed on the pounds per acre or total kill. If we take the seine haul of August 13 as representative, the pounds per acre figures approaches 260 with 80 per cent made up of carp. General observations led us to believe that this was a very conservative figure.

Blue Lake was quite turbid before treatment, a Secchi disc could be seen only six inches beneath the surface. On October 1 the reading had increased to 5 feet. Also on October 1 two seine hauls made with 1,000 feet of seine failed to catch a single fish. Thirty-five minutes of trawling with a 16 foot otter trawl collected one short nosed gar. Similar trawl work prior to treatment had netted 359 fish in 14 minutes.

In spite of a treatment in excess of one p.p.m. detoxification took place in less than two weeks. Fingerling largemouth bass and bluegills placed in the lake on September 30 showed no ill effects after 44 hours of exposure. The fish management section started stocking desirable fish almost immediately after the detoxification determinations had been made.

Five Island Lake

Five Island Lake was treated on September 23. This long, narrow body of water covers 945 acres at crest elevation. A sounding survey on September 12 indicated a considerable reduction in water area and volume. There were some 132 acres of dry lake bed at the north end of the lake and an additional 96 acres were subtracted as exposed shoreline, leaving 717 acres to treat.

Depth variations and the configuration of the lake presented a convenient means of division into four segments. There was considerable variation in surface area among the segments but surprisingly little in water volume. Dredging operations in 1939 and in 1948 accounted for the variations in the volumes of the various segments. Based on a proposed treatment of one p.p.m. Pro-Noxfish there was only a 29 gallon variation between the smallest amount needed and the largest amount needed for the four segments. There was a 300 acre difference among the surface areas.

The success of aerial application at Storm Lake in 1956 prompted Commission personnel to try this method on Five Island Lake. Due to the fact that the town of Emmetsburg borders the southernmost segment (No. 1) only the three segments lying north of number one were treated with aerial spraying. The pilot was briefed on the acreage of each area and the amount needed for treatment with instructions to cover the entire surface first and then make repeat runs in the deeper parts of the segments. Starting at 6 A.M. he was able to spray 385 gallons of material to 647 acres in two hours and 45 minutes (7 trips with 55 gallons per trip). The 80 acres of segment number one was treated with three surface units, two out-board motor units using the small gear pumps described previously and the large air boat equipped with the boom spray. Starting at 9 A.M. these three units applied 130 gallons of material over a period of two and one-half hours. Almost 3 hours elapsed before fish were noted in distress in the area first covered by the aerial spraying while fish began to show in 15 minutes in segment one where a number of out - board motors thoroughly mixed the material. Observations later in the day revealed no difference in the effectiveness of the two types of application. Bullheads were in distress in all segments by 3 P.M. Surface water temperatures were 50°F at the start of the operation and reached 64 by mid afternoon.

Observations of fish activities at 3 P.M. indicated that perhaps additional material should be added along the windward shores. Thus an additional 40 gallons were applied to the entire length of the lake in the shallow waters of the windward side, bringing the total application to 545 gallons. This represents an application rate of 1.2 p.p.m. but loss through wind drift and over non-water areas during the aerial spraying likely reduced this figure.

Fish populations in Five Island Lake were dominated by carp and largemouth buffalo. Seine hauls with 500 feet of $\frac{1}{4}$ inch web indicated that these two species made up 96 percent of the total fish populations calculated at 348 pounds per acre. Bullheads accounted for most of the remaining four per cent. Two seine hauls completed by a management crew with 2,200 feet of $\frac{1}{2}$ inch seine indicated a population of over 1,000 pounds per acre in segment number one. This was brought about by the fact that all the buffalo and many of the carp were concentrated in this segment. The Pro-Nox-fish treatment verified this figure. The 46,000 pounds of fish caught by the management crew were removed and another 30,000 pounds were removed on the day of treatment. Estimates placed the fish remaining in segment one at 100 to 200 pounds per acre. The rotenone treatment appeared to indicate that the bullheads made up more than 4 per cent of the total weight but probably less than 10 per cent.

Conditions prevailing prior to treatment were largely the result of a severe freeze-out during the winter of 1955-56 that eliminated an excellent population of game fish but left a seed stock of carp, buffalo and bullheads. Carp reproduction during the summer of 1956 was high and the stocking of walleye fry and largemouth bass fingerling appeared successful. But the success of the game fish stocking was shortlived, even the carp fingerling showed a poor growth averaging only 5.1 inches for 12 to 14 month of growth.

Post-treatment investigations were not as complete as those at Blue Lake. No seine hauls had been completed as of October 5th but four hauls with the 16 foot trawl on September 26 indicated that a number of bullheads survived the application of over one p.p.m. Two hauls, each of 5 minute duration, in segments one and three netted 28 live bullheads. There are no trawl results for comparative purposes but from past experience with the trawl a catch of 1.4 bullheads per minutes would indicate a very small population. In both Blue and Five Island Lakes the clams survived the treatment. In Blue Lake large numbers of adult corixids were noted on October 1, these were also present in large numbers before treatment. At Five Island Lake there was only one small midge larvae in five samples of bottom taken with a small Ekman dredge. Prior to the elimination of the fish population at Five Island Lake the Secchi disc readings ran from 4 to 10 inches, on October 7 a Secchi disc could be viewed at three feet.

SUMMARY

Two Iowa lakes, Blue Lake in Monona County and Five Island in Palo Alto County, were treated with Pro-Noxfish to eliminate the entire fish populations. Both lakes were dominated by rough fish populations, predominately carp. Blue Lake with a surface area of approximately 125 acres was treated on September 16 with 214 gallons of material with the use of three surface units. Subsequent seining and trawling took only one fish, a short-nosed gar. Caged bass and bluegills held for 44 hours indicated that the lake had lost its toxicity in less than two weeks. Water clarity improved from a Secchi disc determination of six inches to five feet.

Five Island Lake with a surface area of 717 acres was laid out in 4 segments of about equal volume but of considerably different surface areas. Segments number two, three and four were treated with 385 gallons of chemical by aerial spraying on September 23. Segment number one was treated with 130 gallons of chemical by three surface units. The entire lake was also given an additional 40 gallons along the windward shores. Three days after treatment, 10 minutes of trawling in each of two segments revealed the presence of a limited survival of bullheads but no other fish. Turbidity at Five Island was also greatly reduced by the elimination of the fish population. Paper shell clams survived the treatment in both lakes.

CATCH COMPOSITION OF INLAND RIVER TRAP NET RAISES IN NORTHEAST IOWA, 1949-1956

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Fisheries survey stations were established at specific locations on several inland rivers in 1949. From that year to the present, each station has been visited during the same week and month as the previous year with few exceptions.

The crew normally spent five days at each station; setting trap nets or hoop nets on Monday and raising them every day until they were removed on Friday. In the case of trap nets, the amount of suitable netting water, which varied with the changes in the physical habitat in the area, determined not only the number of effective sets but how long they remained effective. Stable water, of medium depth (3-4 ft.) and minimum current, was necessary for effective trap-netting.

The nets used were constructed of 1-inch (bar) cotton mesh, leashed to seven 21-inch hoops, with 2 x 4 ft. frames. The leads were also of 1-inch webbing and average 30 feet in length. They were raised, cleaned and re-set every 24 hours; and depending on the number set, water fluctuation, holes in the webbing and other mechanical failures, the nets could preceivably fish effectively 960 hours per station (10 nets in use for four days). However, very seldom were there more than 600 effective net hours per station.

The data in Table 1 are based on catches made at two stations on the Cedar River; two on the Wapsipinicon; and one on the Maquoketa. Other stations on these and other rivers were not visited during one or more of the eight- years covered in the table and, therefore, are not included in this discussion.

Categorically, the term "rough fish" comprises the carp, bigmouth buffalo, the members of the genus Carpiodes, and the gizzard shad; "forage fish" - the golden, sliver and northern redhorse, common and hog suckers, stone cat and mad toms, and the members of the cyprinids (sans carp) which are large enough to be retained in a 1-inch bar-mesh webbing. The "game fish" are those mentioned in the Iowa Code plus the eel and the green and orangespotted sunfishes. (The actual numbers and weights of each species can be found in the annual reports of test netting on file at, the Des Moines office).

There is no pattern behind the fluctuations in the numbers of fish caught (Table 1). In the Cedar River, when the game fish are depressed, the rough fish increase. In the Wapsipinicon, the slack caused by a de-pression in game fish is seemingly taken up by the forage species; a similar phenomenon is noted in the Maquoketa River. Fluctuations in the game fish in the Cedar are exactly opposite the fluctuations in the Wap-sipinicon, and the fluctuation pattern in the Maquoketa is different from both the Cedar and the Wapsipinicon. This feature strongly indicates that different flowing water areas, surveyed at different times of the year, are not comparable!

There is also a great danger in comparing just numbers of fish from year to year or station to station. A specific population composed of

Table 1. Species Composition of Trap Net Catches Expressed as Percent Numbers.

River	1949	1950	1951	1952	1953	1954	1955	1956	Average
				Game Fish					
Cedar	41	36	47	19	32	14	10	62	33
Wapsipinicon	63	66	50	62	27	46	58	41	52
Maquoketa	97	93	97	80	79	60	56	52	77
				Forage Fish					
Cedar	4	11	12	11	16	6	8	1	9
Wapsipinicon	12	16	7	19	27	35	35	45	25
Maquoketa	2	6	3	12	8	30	30	44	17
				Rough Fish					
Cedar	55	53	41	70	52	80	82	37	59
Wapsipinicon	25	18	43	19	46	19	7	14	24
Maquoketa	1	1	--	8	12	9	14	4	7

adequately balanced size groups usually has much more utility value than another population of the same species five times as large but entirely dominated by small, slow-growing fish. Therefore, Table 2, perhaps, has more practical value than Table 1 because it deals in groups of fish be weight; weights being more indicative of population shifts and adjustments than numbers.

Table 2. presents a very different picture in certain years when comparing the fluctuations in weights with those in numbers. In general, the compensatory exchange between shows that the game-fish and rough-fish categories have a more positive relationship between each other than either of these two categories and forage fish.

It is hoped that with the investigations of the factors influencing trapnet catches, carried on during the past summer, we will smooth out some of the radical fluctuations in the catch statistics by applying certain corrective factors to these and future data.

Table 2. Species Composition of Trap Net Catches Expressed as Percent by Weight.

River	1949	1950	1951	1952	1953	1954	1955	1956	Average
					Game Fish				
Cedar	46	23	61	25	20	10	9	47	30
Wapsipinicon	83	45	35	59	27	26	53	33	45
Maquoketa	77	83	93	27	60	17	14	18	49
					Forage Fish				
Cedar	4	9	8	13	57	5	3	2	13
Wapsipinicon	7	25	12	17	23	42	32	46	26
Maquoketa	7	13	7	46	10	39	46	66	39
					Rough Fish				
Cedar	50	68	31	62	23	85	88	51	57
Wapsipinicon	10	30	53	24	49	32	15	21	29
Maquoketa	16	4	--	27	30	44	40	16	22

DES MOINES CREEL CENSUS, 1957

Harry M. Harrison
Fisheries Biologist

A creel census of Des Moines River fishermen was carried on in 1957. This continues a project started in 1953 and reported upon yearly since that time.

The method of study involves fishermen interviews in the field at frequent but irregular intervals throughout the open water season. The information sought from each angler is logged on individual census cards, and includes the following: the date, time and place of the interview; the amount of time spent fishing up to the time of contact, and how much longer he intended to fish; the kind and number of fish caught; the kind of fish that the contact wanted to catch; the number of fishing trips made each week; the value of the tackle being used; and the distance that the contact traveled to fish. All interviews are made by Biology Section Personnel, and for the most part the work is carried on in conjunction with, but secondary to other duties. Because of this, it is not possible to census areas or reaches of stream with a great deal of uniformity. Hence, it is impossible to compare fishing success by locality. However, our other work takes us to about the same areas year after year, at or near the same time each season, and for about the same amount of total effort, and it is believed that the census technique does enable us to make annual comparisons.

The catch statistics assembled for the present year are given in Tables I and II, which also include the related data gathered for each year since the inception of the project. Table I summarizes the total number of contacts made each season together with the number of hours fished, the number of fish caught and the fish caught per rod hour. Table II shos the rate of catch by the more important species for the five years of study.

Table I. Rate of Catch of Fish From the Des Moines River for the Years 1953 through 1957.

Year	Fishermen Contacted	Total Hours Fished	No. Fish Caught	Fish per Rod Hour
1953	884	1,847	1,142	.61
1954	648	1,421	1,073	.75
1955	797	1,588	581	.37
1956	1,050	1,510	595	.39
1957	1,146	2,193	1,358	.62

Beginning with the year 1953, Table I reveals the rate of catch for all species combined to be .61, .75, .37, .39 and .62 fish per rod hour in that order for the past five years. By way of comparison, it will be noted that the angling success was at approximately the same level in 1953, 1954 and 1957. It was appreciably lower in 1955 and 1956. This pattern, it is believed, is quite likely a reflection of drought conditions which prevailed in the Des Moines River watershed during 1955-56. In conjunction with the drought, abnormally high water temperatures were particularly prevalant in the summer of 1955, and in connection with this, fish losses ascribed to the extremes of low water stage and high temperature were a common occurrance in Iowa. Furthermore, water stages continued low into the winter of 1955-56 and along with this, situations of low dissolved oxygen developed which resulted in added fish losses. In their combined effect, the adverse conditions of 1955 reduced some fish populations to virtual extinction in many stream areas. Some of these reaches adversely effected had provided good fishing prior to the drought. The loss of these areas to fishing contributed significantly to the poor angling success in 1955-56.

Table II. A Comparison of Rate of Catch by Species for Fish Caught From the Des Moines River for the Years 1953 through 1957.

No. Anglers	884	648	797	1,050	1,146
No. Hrs. Fished	1,847	1,421	1,588	1,510	2,193
	Number Caught Per Rod Hour				
Year	1953	1954	1955	1956	1957
SPECIES:					
Channel Catfish	.33	.29	.13	.16	.28
Carp	.13	.11	.16	.40	.21
Bullhead	.08	.28	.04	.08	.09
Walleye	.03	.02	--	--	.01

Fishing success was up again in 1957. A large part of this gain resulted from an increased catch of small or fiddler catfish. Of 602 catfish examined in the creel, 20 per cent were 12 inches or longer in length. An estimated 70 percent were between 10 or 12 inches in total length while 10 per cent were less than 10 inches long. Even though the numerical success was up in 1957, the quality of the fishing was not considered too good. The smaller catfish appearing in the creel may be the forerunners of an improved quality of fishing in 1958.

Table II shows the harvest of channel catfish follows closely the general pattern for all species demonstrated in Table I. That being a comparable catch at a comparatively high level for the years 1953-54 after which success fell abruptly in 1955, continuing so through 1956 and then rising again in 1957. A part of this pattern results from the fact that the channel catfish makes up a substantial part of the catch from the Des Moines River and would naturally throw considerable weight into the figures dealing with total harvest. Smaller catfish (those less than 12 inches in total length) were largely responsible for the better fishing in 1956. It is highly significant that the increase took place in three areas where heavy fish kills occurred during 1955-56.

Growth studies on channel catfish from these kill areas when compared to those where kills had not happened, showed a significantly larger size

(2-3 inches total length) for catfish of identical age groups in the reaches having had the fish losses. The increased growth resulted from an over-all population reduction. As a consequence, fish of younger age groups but large enough to be acceptable to the angler were more abundant in the catfish population. Subsequently, fewer of the fish caught from the kill areas were so small that they were returned to the water.

Carp are the second most sought after fish in the Des Moines River system. Table II shows the annual catch of this species to fluctuate inversely with that of the channel catfish. Much of this pattern is believed to be a reflection of angler choice. River fishermen turned to the carp during the adverse stream conditions of 1955 and 1956. The carp, a very formidable species in Iowa waters were not greatly effected by the foul waters produced by the prolonged drought with its accompanying high water temperatures and reduced oxygen supplies.

The take of bullheads and game fish have not for the last five years, made up an important segment of the Des Moines River fishery. During normal years they may account for from 1 to 4 percent of the total catch. A heavy run of bullheads for a few days in an isolated spot in 1954 resulted in an exception to this general rule, but for practical purposes the species is and has been relatively unimportant in the Des Moines system.

Game fish, including walleyes, small mouth bass, crappie and northern pike, in that order of importance were taken only rarely in three out of the five years of study. They were almost absent from the catch during 1955-56. Again, this set of circumstance is ascribed directly to the reduced habitat in these drought years.

It was mentioned above that certain data relating to the fishermen is also taken at the time of the census interview. By topics, this information follows.

Length of Time Fished per Trip: At the time of contact, fishermen were asked how long they had fished and how much more time they expected to continue on that particular trip. Of 767 replies, 89 said they would fish less than two hours; 230 would fish two or three hours; 167, three or four hours; 103, four or five hours; 178, five to seven hours.

Value of the Tackle: During the time of interview, the census clerk made an estimate of the "on thespot" value of the equipment being used. These estimates are subject to some error but in all cases they were held conservative. In all, 1,065 appraisals were made and of these, 14 outfits were considered to be worth less than five dollars; 33 rigs were appraised between five and ten dollars; 445 between ten and twenty dollars; 471 between twenty and fifty dollars; and 102 outfits in excess of $50.00. Only in sight equipment was appraised and in addition to actual fishing gear such things as boats, motors, tents, car-top carriers, trailers, etc; were included.

Principal Species Contact Wanted to Catch: Of the nine hundred and twenty parties contacted, 513 expressed a desire to catch catfish; 197, carp; 79, catfish and carp; 31, anything that would bite; 25, bullheads; 25, walleyes; 14, walleye and bass; 9, flatheads; 5, small mouth bass; 5, carp and bullheads; 5, catfish and bullheads; 4, catfish and bass; 3, catfish and walleyes; 3, crappie; 1, bass and crappie and 1, carp and flathead.

Round-trip Distance Traveled: One thousand and sixty-five parties were interviewed with respect to the round trip distance between the port of contact and their residence. Of these, 366 parties traveled less than five miles; 286, from five to ten miles; 189, eleven to twenty-five miles; 152, twenty-six to fifty miles; 72, fifty-one to one hundred miles and 18 parties had traveled over 100 miles to fish on the Des Moines River. These figures show that the bulk of fishing is quite local, but on the other hand, the stream attracts a few fishermen from considerable distance.

THE 1957 ARTIFICIAL LAKES AND RESERVOIR FISHERIES SURVEY

Jim Mayhew
Fisheries Biologist

During the summer of 1957, fish populations of 19 state-owned artificial lakes and of 18 city water supply reservoirs were surveyed. The purpose of these routine investigations is to determine the magnitude of reproduction and detect any major changes in the adult fish populations. Although the sampling is limited in nature and suited only for gross analysis it is the best inventory method available at present for fish management purposes.

The method and equipment used in the survey were essentially the same as used during the past three years. Electric "shockers" were the principal means of sampling fish populations. Fyke nets and a small drag seine also were used in lakes where a more diversified sample was desired or lake porphometry permitted. The shocker boat was propelled along the shoreline for a predetermined time period (usually 20 minutes) and as many paralyzed fish as possible are picked up in dip nets. Average shocking time on each lake was 112 minutes. Approximately 8,000 feet of shoreline can be covered in this amount of time. The complete shoreline was shocked on lakes of relative small size. Representative lengths, weights, and scale samples were taken from size groups of each species. The fish are then returned to the water.

Along with the fisheries inventory a study of physical and chemical properties was also conducted on each impoundment. Checks for the presence of chemical and thermal stratification were made at 32 lakes. Alkalinity and pH samples were also obtained from all state-owned impoundments.

Last year, lakes in southern Iowa were considered by different groups rather than individually. This was essential because the great number of lakes involved would make such a report voluminous. Hence, lakes in this report were analyzed by their similar characteristics of topography, morphomentry, and fish populations.

Group I

This group includes most of the state-owned artificial lakes and several city water supply reservoirs. The lakes are characterized by similar wooded shorelines, deep basins, and steep-sloping bottoms. All of the lakes in this group exhibit thermal and chemical stratification during the summer months. Fish populations in this group of lakes are relatively stable, and vary only slightly from year to year depending on the development of strong year classes. Lakes in this group include: Geode, Williamson, Red Haw Hill, Keomah, Ahquabi, Nine Eagles, Three Fires, Commerce, Keosauqua, Springbrook. and Wapello.

Reproduction during 1957 was considered the best in recent years (Table 1). Largemouth bass and bluegill reproduction was found in all but two lakes. Crappie reproduction was considered poor in most areas, but this may be due to sampling errors rather than lack of reproduction and survival. Game-fish populations, especially largemouth bass, bluegill, and crappie are extremely high. This is mostly due to increased water level after three years of drought. Growth rates are above average in most of these impoundments.

Table 1. The relative abundance of young-of-the-year, yearling and adult fish captured by fisheries survey crew in Group I lakes, 1957.

		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
Geode	205	A	C	C	A	A	A	*	A	A	*	*	R	*	*	*	*	*	*	*	*	*
Williamson	27	A	C	R	A	A	A	*	*	*	*	*	R	*	*	*	*	*	*	*	*	*
Red Haw	72	A	C	C	A	A	A	*	*	C	*	*	R	R	*	R	*	*	*	*	*	*
Keomah	82	R	R	C	A	A	A	R	*	A	*	*	*	*	*	R	*	*	*	R	*	A
Ahquabi	150	A	A	C	C	A	C	*	R	R	*	*	*	*	*	R	*	*	*	*	*	R
Nine Eagles	56	A	R	C	A	C	C	*	R	*	R	*	*	*	*	*	*	*	*	*	*	*
Three Fires	125	A	C	A	*	A	A	*	*	A	*	*	*	*	*	*	*	*	R	*	C	C
Commerce	200	A	C	R	A	*	A	*	R	R	*	*	R	*	*	R	*	*	*	*	*	*
Keosauqua	27	*	R	R	R	C	C	*	*	*	*	R	*	*	*	*	*	*	*	*	*	*
Wapello	287	C	C	C	A	C	R	*	*	C	*	*	*	C	*	A	*	*	*	*	*	A

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

Group II

This group of lakes is characterized by their similar open unwooded shorelines, shallow basins, and gently sloping bottom contours. Most of these lakes do not have severe chemical or thermal stratification, but may have temporary oxygen depletion during summer months. Lakes included in this group are: Darling, Green Valley, Rock Creek, Allerton, and Diamond.

Almost all of these impoundments were affected adversely by drought during the past two years. This year rainfall was normal and most of the lakes recovered to normal water levels.

Fish reproduction was considered good in all of these impoundments in 1957 (Table 2). Crappie and bluegill populations were found extremely abundant. Growth rates are average for this type of habitat, but overcrowding and stunting often develops rapidly when strong year classes occur. This usually is due to two strong successive year classes rather than one abundant age group.

Table 2. The relative abundance of young-of-the-year, yearling, and adult fish captured in Group II by survey crew, 1957.

		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	C	A	A	A	A	*	*	A	*	*	*	*	*	*	*	*	*	*	*	*
Green Valley	400	A	R	C	A	R	A	*	*	A	*	*	R	*	*	C	*	*	*	*	*	*
Rock Creek	640	C	C	A	A	A	A	R	C	R	*	*	*	*	*	*	*	*	*	*	*	*
Allerton	106	*	*	R	C	A	A	*	*	A	R	*	R	*	*	*	*	R	*	*	*	C

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

Management of the Group II lakes is generally confined to bullheads and channel catfish because of the habitat available. Reproduction of these species is limited, and adults must be stocked to maintain a catchable population. Largemouth bass, bluegill, and crappie fishing is available periodically but dependant upon development of abundant year classes for success.

Group III

Thisgroup of lakes are largely water supply reservoirs for various cities in southern Iowa. Public fishing agreements are obtained from city water officials before fisheries management is conducted in these impoundments. They are characterized by low fertility, extremely clear water, and have routine copper sulfate treatments for algae and vegetation control. One primary characteristic of the smaller reservoirs is the rapid fluctuation of water levels. Part of these lakes exhibit thermal and chemical stratification in the summer, but this is dependent upon depth and protection from wind action. Lakes surveyed in this group during the year were: Fairfield No. 1 and No. 2, Centerville, Upper and Lower Albia, McKinly, East and West Osceola, Ellis, Morris, Corydon, Binder, Loch Ayr, Mt. Ayr, Nodaway, Humeston, and Corning.

Reproduction of game-fish species, particularly largemouth bass and bluegill, was extremely successful in this group (Table 3). Part of this is undoubtedly due to tremendous increases in water volume prior to the nesting season. Growth rates in Group III lakes vary considerably with the type of environment available. Many of these lakes have definite overcrowded conditions, particularly of bluegill and yellow bass.

Table 3. The relative abundance of young-of-the-year, yearling, and adult fish captured in Group III lakes by survey crew, 1957.

		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	C	*	A	R	*	A	*	*	A	*	*	*	*	*	*	*	*	*
Fairfield 2	20	R	*	A	R	A	A	*	*	A	*	*	*	*	*	*	*	*	*	*	*	*
Centerville	100	R	R	A	C	C	A	R	*	A	*	*	*	*	*	A	*	*	R	*	*	R
Albia (Upper)	35	*	R	R	A	A	A	*	*	*	*	*	R	*	*	A	*	*	*	*	R	R
Albia (Lower)	25	A	R	*	*	A	A	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
McKinley	50	A	C	A	R	*	C	*	*	C	*	*	*	*	*	*	*	*	*	R	C	A
Osceola (E)	25	A	R	R	A	C	A	*	*	R	*	*	*	*	*	*	*	*	*	*	*	*
Osceola (W)	30	C	R	C	A	A	A	C	*	A	*	*	*	*	*	*	*	*	R	*	*	*
Ellis	110																					
Morris	200	A	C	R	C	C	A	*	*	A	*	*	*	*	*	*	*	*	*	*	*	R
Corydon	125	A	R	A	C	C	A	*	R	A	*	*	R	*	*	A	*	R	C	*	*	C
Binder	150	A	*	R	A	*	R	*	*	A	*	*	*	*	*	*	*	*	*	*	R	R
Loch Ayr	135	C	*	A	A	*	A	*	*	A	*	*	*	*	*	A	*	*	*	*	C	C
Mt. Ayr	15	A	R	A	C	*	A	*	*	*	*	*	A	*	*	*	*	*	*	*	*	*
Nodaway	50	C	*	R	C	A	A	*	*	R	*	*	*	*	*	*	*	*	*	*	*	*
Humeston	25	R	R	R	*	*	A	*	*	*	*	*	C	*	*	*	*	*	*	*	*	*
Corning	10	R	R	A	A	A	A	*	*	R	*	*	C	*	*	*	*	*	*	*	*	*

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

Group IV

This group of lakes consists of the river oxbow and man-made river bottom impoundments. All of these areas are characterized by shallow, turbid, slough type habitat. Lake Manawa and Lake Odessa are natural lakes; whereas, Brown's Slough, North Colyn, and South Colyn lakes are man made.

Reproduction in 1957 was particularly good in Lake Odessa and Lake Manawa (Table 4). Brown's Slough had a successful hatch and survival of crappies and largemouth bass. Since the Colyn Lakes were stocked last year, reproduction was not found in 1957. Adult game fish populations are extremely high in this group of lakes, and appear reasonably stable. Rough fish are a definite problem in the natural river oxbows, and intensive mechanical and chemical control measures have been continuous projects.

Table 4. The relative abundance of young-of-the-year, yearling, and adult fish captured in Group IV lakes by survey crew, 1957.

		Lm. Bass			Bluegill			Crappie			Walleye			Y. Bass			Bullhead			Shad			Carp		
Lakes	Acres	Yg	Yr	Ad	Yg	Yr	Ad	Yg	Yr	Ad	Yg	Yr	Ad	Yg	Yr	Ad	Yg	Yr	Ad	Yg	Yr	Ad	Yg	Yr	Ad
Brown's S.	200	A	R	R	*	C	C	A	*	A	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
N. Colyn	199	R	R	*	R	*	R	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
S. Colyn	99	*	R	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	R	*	*	*	*	*	*
Odessa	2700	R	*	A	*	*	A	*	*	A	R	*	C	*	*	*	*	*	*	A	*	*	R	C	A
Manawa	957	R	R	C	R	A	C	*	*	A	*	*	*	*	*	R	*	*	A	A	*	C	C	A	A

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

General Observations and Discussion

In general, reproduction of game-fish was considered the best in several years. Adults and sub-adult game fish are extremely abundant after the drought of 1955 and 1956. The increase of water volume is thought to be a major factor for the increased reproduction and survival of young fish. The increase in food availability due to larger water volume is also thought to be responsible for the above average growth of fishes during 1957.

Problem lakes, of course, do exist in the artificial lakes and reservoirs, but vary considerably in intensity and longevity. Most of these problems evolve from (1) overcrowded conditions and retarded growth due to one or more strong year classes of the same species, (2) ill-balanced populations because of poor predator-prey relationships, and (3) overpopulation of undesirable species such as carp, suckers, and yellow bass.

The Group I lakes have the most stable populations of the four described. Over populations or ill-balanced populations usually not serious and short in duration. Group II lakes are more stable than the remaining two groups, but fluctuate more readily than the Group I lakes. One species will dominate the standing crop in the lake for a short time, and then be replaced by another species, or in many instances a secondary age group. Corrective measures are needed badly in most of these lakes, and species control should be attempted by mechanical and/or chemical methods.

Although it is virtually impossible to disucss general observations that could fit all impoundments, several factors were evident in almost all lakes. They are:

1. Reproduction of largemouth bass was higher than any previous survey indicated.

2. Bluegill reproduction was approximately the same as the last two years.

3. Several lakes in each group have population balance problems, and it is recommended that representative lakes in each group be selected as special study areas.

4. Mechanical and chemical control methods are needed for ill-balanced populations.

5. Increased water levels were responsible, in part at least, for above average growth of young fish.

6. Drought conditions in 1956 and 1955 apparently had little effect on Group I, II, and IV lakes, but definitely caused year class lags in Group III impoundments.

THE RECAPTURE OF TAGGED WALLEYES FROM DICKINSON COUNTY LAKES

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Several walleye tagging programs have been conducted by the Biology Section of the State Conservation Commission, in the Dickinson County lakes during the past few years. These have been designed primarily to obtain population estimates which usually are completed within one year to minimize recruitment from distorting results. However, records are maintained on all tagged recaptures from year to year until the age classes involved have disappeared. This paper contains a brief summary of the available recapture data that has accumulated to date on the tagged walleyes from Spirit and the Okoboji lakes.

Tag Returns from Spirit Lake

In 1947, adult walleyes caught in spring gill netting operations for the hatchery were tagged and released in Spirit Lake. By means of creel census, the ratio of tagged recaptures to untagged fish caught by anglers indicated an adult population of nearly 31,000 in the lake. Of the 556 walleyes tagged, 157 were recaptured that year indicating anglers harvested around 30 per cent of the adult crop (Rose, 1947).

Since 1947, the number of tagged recaptures reported from this tagging operation has declined annually as follows: 31, 19, 14, 8, 4, 4, 4, 1 and 1. None have been reported in 1957. Thus a total of 243, or 43.7 per cent were reported caught in this ten year period. It is assumed that the year- classes involved in this tagging have been completely eliminated and that no further recaptures will be obtained.

Again in 1954, 110 recaptures were obtained from anglers indicating only 11.1 per cent harvest of the adult crop in contrast to the 30 percent return in 1947. In 1955, there were 57 recaptures from the 1954 tagging and in 1956, 72 were recorded. In 1957 only eleven recaptures have been recaptured to date, suggesting a normal mortality process. The unusually large number of tag returns in 1956 cannot be expalined by the exceptionally good walleye angling that year because the low average weight (1.4 pounds) of these fish (Rose, 1956) excludes most of the remaining tagged fish present indicating heavy recruitment to the most vulnerable size group (13-16 inch fish).

It is assumed in all population studies which utilize the creel census to obtain ratios of tagged to untagged fish, that no variance in feeding occurs and the catches represent the true proportion of the population in the body of water. Tag returns and census data suggest a considerable variance and possible error in this assumption. In the spot censu of 1954-55, winter anglers caught 27 per cent of the walleyes; however, less than four per cent of the tagged recaptures were taken during the winter. On the other hand, the censu of 1955-56 showed very little contrast; with about 18 per cent of the total walleyes caught by winter anglers and 20 percent of the tags returned. This suggests that netting or other means of obtaining ratios may be more reliable than creel censuses in estimating populations.

Tagging in Okoboji Lakes

During spring spawning runs in 1955, over 1,000 adult walleyes were captures on the shoals by electric shocker, tagged and released in the Ojoboji lakes. Tag numbers, together with the area of capture and release were recorded for the 509 walleyes in East Okoboji and the 502 in West Okoboji. Population estimatés obtained from creel census data were calculated at about 60,000 adults in West Okoboji and about 11,000 in East Okoboji.

Tag Returns

From the 509 tagged walleyes in East Okoboji at the start of the angling season on May 15, 1955, a total of 164 had been caught and the data recorded by the close of the season on February 15, 1956. This indicated a harvest of 32.2 per cent by anglers during one fishing season. This apparently is the highest percentage return for this species that has been reported anywhere to date and points up the potential impact heavy angling pressure may exert on a fish population. In addition, we can be certain that a considerable number of tags were not reported so it can be assumed that the real percentage would be closer to 40 or 50 percent even though every effort was made to obtain recapture information.

Of the 164 known recaptures, fifty were caught in the adjoining chain of lakes, suggesting a considerable amount of movement. Ten were recaptured in Minnewashta Lake and 40 from West Okoboji. Thus we may assume the walleye population in the lake may not be distinct. Tag returns from the West Okoboji fish suggest less migration tendency for only ten were reported from the adjoining East Okoboji and none from the other lakes in the chain.

During the winter of 1955-56, a severe fish-kill occurred in East Okoboji due to decline of dissolved oxygen. As a consequence only five recaptures were obtained during the 1956 season, and but one in 1957.

Of the 502 tagged walleyes in West Okoboji at the start of the season in 1955, a total of 111 recaptures had been recorded by the close of the season on February 15, 1956. This indicates a harvest of about 22.1 per cent of the crop during the one season which should not be considered excessive. Open water anglers accounted for 88 (79.2 percent) while ice fishermen returned 23 tags (20.8 per cent). The total catch recorded by the census clerk in the spot census for the entire season was 6,505 walleyes. Of this total, 2,115 were taken by winter anglers (32.5 per cent), indicating a some recruitment; otherwise, the percentage should have been closer to the 20.8 percent tag returns in winter.

Length frequencies of the winter caught fish (Rose, 1956) strongly suggest the entrance of another year-class to the adult population which would have distorted the population estimate if the ratio of tagged to untagged adults had remained constant.

In the population study, no voluntary reports of tagged or untagged fish were accepted, only those observed by the clerk were included as noted on Table 1. Two separate estimates were calculated one on the basis of the open water angling and the other during winter when the ratio of tagged to untagged returns decreased even though considerable recruitment was evident. Calculations were made by the familiar "Petersen method" in which the number

Table 1. West Okoboji Lake walleye population estimates based on summer and winter calculations.

Dates	Number observed not tagged "A"	Tagged "C" Recaptures	C/A Ratio	Population Estimates
(summer)				
6-24---7-13, (1955)	463	2	.0043	
7-13---8-24	399	2	.0050	
8-25---9-23	248	2	.0079	
9-24---10-3	184	2	.0109	
10-3---11-12	293	2	.0068	
Sub-totals (1)	1,597	10	(av.).0063	79,850
(winter)				
11-13---12-10	245	3	.0122	
12-11---12-20	296	3	.0100	
12-21---1-9 (1956)	331	3	.0092	
1-10---1-19	348	5	.0144	
1-20---2-15	442	3	.0068	
Sub-totals (2)	1,662	17	(av.).0102	48,882
TOTALS	3,259	27		60,352

of markedfish (500 in this case) present at the start of the study is multiplied by the unmarked sample catches and the product divided by the number of marked recaptures. The ratio C/A is fairly uniform in the open water period lending some credence to the larger estimate of 79,850 adults in the lake as of May 15, 1955. Applying the 0.95 Confidence Limits (Ricker, 1942), to the most likely variable in the final calculation, the 27 recaptures, we have 18 and 39 as values for C., and the corresponding population estimates ranging from 41,782 to 90,526. These approximate the separate summer and winter estimates (Table 1, sub totals 1 and 2) and indicate that the final estimate of approximately 60,000 may be as nearly correct as sampling vagaries will permit.

Discussion

The tagging of fish to obtain some concept of the magnitude of populations, behavior patterns, age and growth data or other factors intrinsically involved in dynamics is recognized as a fundamental approach to many fisheries problems today. Many of the factors limiting reliability of results are known and compensated for so that valuable use may be made of the data in the management of the fisheries.

As indicated in the results of tagging walleyes in these three Iowa lakes, it is obvious that a wide divergence exists in harvest-ability of walleyes by pole and line fishing. Some southern states have a very low harvest from their large reservoirs and the elimination of all angling restrictions were logically recommended for their waters. Their year-round growing conditions, low fishing pressure, high forage densities and other factors justify these measures as biologically sound. On the other hand, northern waters, with short growing seasons, high fishing pressures and potentially high harvests of valuable predator species (30 to 40 per-cent per year) must suggest to the biologist and the administrator a re-appraisal and perhaps another "long look" at restrictions as a management tool.

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