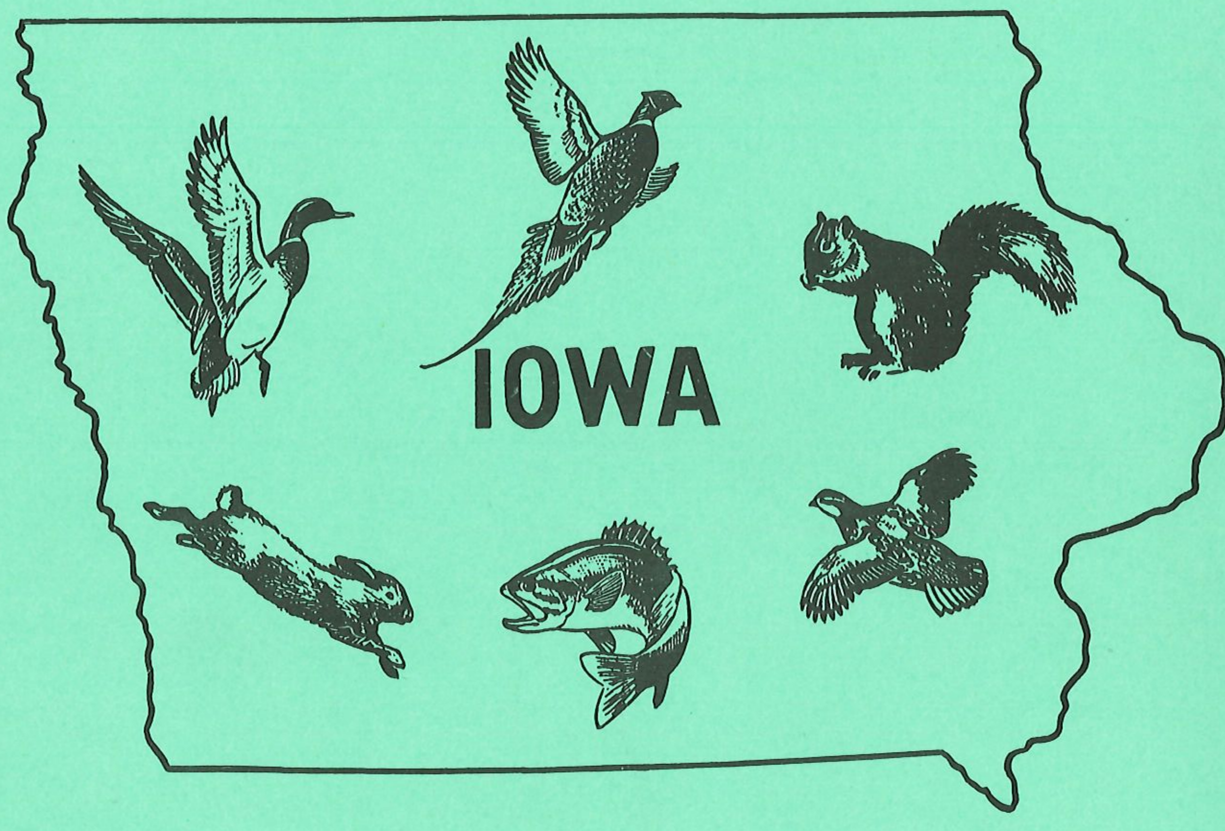
1969

QUARTERLY BIOLOGY REPORTS



QUARTERLY BIOLOGY REPORTS

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1969

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AN ANNOTATED LIST OF FISHES OF THE FLOYD RIVER DRAINAGE

Don Kline
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The study continues an inventory set up by Meek, 1894 and Commission Biologists, 1945-1955. The Floyd River and West Branch Floyd River were sampled with rotenone, siene and hoop nets. Rotenone proved to be the most effective sampling technique. River carpsucker, white crappie, channel catfish and slender madtom were added to the list of fishes of the Floyd River Drainage. Large numbers of minnows were found throughout the drainage. Fishing for channel catfish and bullheads was productive as far upstream as the Plymouth-Sioux county lines.

PRELIMINARY RESULTS OF SLIME DISTRIBUTION STUDIES ON THE MISSISSIPPI RIVER

Don R. Helms
Fisheries Biologist

A study was initiated in the Dubuque area to determine seasonal density and distribution of the slime bacteria, Sphaerotilus natans. Preliminary sampling indicate the slime bed is limited to the Iowa side of the river and has a minimum downstream distribution of 6.5 miles. No conclusion has been reached relative to seasonal density at this time because variation in river discharge during the sample period tended to mask quantitative trap results.

MOVEMENT AND HOME RANGE OF DEER AS DETERMINED BY RADIO-TRACKING (A working plan for Iowa project)

Lee Gladfelter
Game Biologist

The proposed 2½-year project involves the study of deer movements and home range in the Des Moines River Valley. Radio-tracking equipment will be purchased for this study, with one of the main objectives being to evaluate equipment and tracing techniques for movement studies in Iowa. The cost of the project will be approximately $3,000 with the majority of funds being used to purchase transmitters, receivers, and antennas for the project. From 3 - 6 wild deer will be captured and equipped with transmitters. Signals will be monitored for a period of 18 months to determine deer movements, home range, center of activity, and habitat preferences. Climatological data will also be collected to compare with daily and seasonal movement patterns.

CANADA GOOSE BANDING TRIP
Cape Churchill, Manitoba

Ron Andrews
Game Biologist

With the recent declines in duck populations, particularly the mallard, waterfowl hunters are becoming increasingly interested in goose hunting, particularly for Canada geese as they are considered trophy birds. The Mississippi Flyway Council and the states involved desire to maintain maximum goose hunting opportunities for the hunter, but because of increased demand the Council deems it necessary to build the Swan Lake, Missouri, post-hunting season goose flock from 123,000 to 200,000 within the next few years. The Council is currently sponsoring a portion of Al Pakulak's research work on the Canada goose flock at Cape Churchill, Manitoba. It is believed that the majority of the geese that nest and breed on the Cape winter at Swan Lake. The states of Iowa, Missouri, and Minnesota are "footing" the majority of the money supplied by the Flyway Council. Missouri and Iowa are also providing one man each for the nest searching in June and one each for the banding in late July and early August. This paper deals with the report of the banding operations that took place in late summer on the Cape and some of the highlights of our northward journey. A total of 937 geese were banded, including 496 young of the year and 441 adults.

IOWA'S LATE SUMMER PHEASANT POPULATION - 1969

Richard C. Nomsen
Game Biologist

The August roadside pheasant count is the primary source of information on the status of the pre-hunting season pheasant population. There were 174 routes checked by Conservation Officers, Game Section personnel and Biologists in 1969. A preliminary indication of reproductive success is also obtained from pheasant broods reported on July rabbit and quail routes. Pheasants experienced a long, rough winter in Iowa. The adverse winter weather conditions caused above normal mortality in the northwest region of our pheasant range. Temperatures for April averaged 1-3 degrees above normal and were near normal for the month of May. Melting snow and frequent rains kept fields wet which delayed field work. Only 20 percent of the oats was planted by April 20 compared to the average of 75-80 percent. June was a cool, cloudy and wet month which caused a delay in hay mowing.

RESULTS OF THE 1968-69 TRAPPER QUESTIONNAIRE AND FUR BUYERS REPORTS

Ron Andrews
Game Biologist

For the third consecutive year the Iowa Conservation Commission sent out a trapper questionnaire to nearly 2,000 of Iowa's licensed trappers. Trappers reported harvesting approximately 604,400 muskrats, 68,100 raccoon and 26,500 mink. With the exception of the beaver take, harvest figures were up from the previous year. Raccoon, fox and coyote figures showed very significant increases over last season. Fur buyer harvest data was significantly different than trapper questionnaire data. There are some reasonable suggestions for these differences but it is believed that the trapper questionnaire is more valid than the fur buyer reports. These are the only two measures of fur harvest we have and it is generally felt that fairly reliable trend information is readily obtainable from either survey. It is interesting to note that fur harvest figures fluctuate closely with fur prices.

AGE COMPOSITION OF THE 1969 DEER HERD

Paul D. Kline
Game Biologist

Ages of 1,589 deer were determined from the 1968 gun harvest. Life tables were constructed for the state and for each of the four zones. The statewide death rate was 56.9 per annum. Production for 1968 was 84.8 percent. Mean expectation of life ranged from 1.52 years for fawns to 0.95 years for deer aged $4\frac{1}{2}$ years or older. No significant differences were found in age structure of herds from the four zones. A significant change in age structure of the herd was detected between 1967 and 1968. The herd at present is composed of more young and fewer old deer than in 1953-62. Hunting mortality has been responsible for this change.

RESULTS OF 1969 RABBIT SURVEYS IN IOWA

Gene Hlavka
Game Biologist

The July rabbit survey was conducted for the 20th consecutive year. Ninety-three routes were surveyed in 1969. This survey indicated a decline in the cottontail population of 33 percent from that of last year and a decline of 16 percent from the 19-year average. Three other surveys also indicated declines in cottontail populations. The fall population index showed a 32 percent decline in the cottontail rate

CORALVILLE RESERVOIR CRAPPIE INVESTIGATIONS

Part I: Movement

Larry Mitzner
Fisheries Biologist

Inventory surveys and creel censuses by Mayhew, 1964; Helms and Mayhew, 1964; Helms, 1965 and 1966; and Mitzner, 1967 showed crappie is a major sport fish in Coralville Reservoir. Crappie ranked in the top three in the creel census conducted in 1963, 1964, 1965 and 1967. In 1965 they were surpassed only by bullhead and 1967 by bullhead and carp. Crappie were second to channel catfish in 1963. Anglers declaring a species preference ranked crappie second in 1964 and 1967, and third in 1963 and 1965.

Basic knowledge of the life history of crappie and their relationship to other species is essential to fish management in Coralville Reservoir and a study to obtain this information was initiated in 1965. Objectives of the investigation were to determine growth, physical condition, age structure, movement, abundance and importance to the sport fishery. This paper is a contribution to part of the investigation and will evaluate crappie movement with special reference to population estimates.

Population estimates were conducted in 1968 and 1969. Representative study areas were designated for marking and recapture to increase the efficiency and precision of the experiment. An impairment to the accuracy of the estimates was dilution of marked fish by movement past imaginary study area boundaries. Design of the population estimates were altered to incorporate movement determinations.

The study area in 1967 was 5 miles in length with the lower boundary located 5 miles above the dam. The area was further equally divided into 10 segments which contained a total of 1,111 surface acres at elevation 680' msl. Fish in each one-half mile segment were differently marked by fin clipping to establish their origin. Marking was started on 27 March and continued to 17 June; but capture and recapture effort was extended to 30 July.

Experimental design was changed in 1969 to increase recapture rate and decrease the complexity of data collections and evaluations. The study area was lengthened 5 miles upstream and subdivided into one-mile segments. In both years segments were numbered consecutively from downstream to upstream. Fish marked in segments 4 and 5 received a left pelvic fin clip as distinguished from fish in segment 6 and 7 which received a right pelvic fin clip. Surface area was 1,188 acres at elevation 680' msl for segments 4-7.

RESULTS

In 1968, 2,608 crappie were caught, 959 of these were marked and 37 were recaptured. The recaptured fish were classified to distance from point of release (Figure 1). Frequency distribution was approximately normal; 16 stayed within the segment where they were marked, 9 moved downstream and 12 moved upstream.

Standard deviation was computed for the distribution to predict frequency of marked crappie at combinations of segments in the study area. The normal distribution was assumed to be equal in all segments. Standard deviation was 1.25 miles and mean movement was 0.24 miles upstream.

In 1969, 1,983 fish were caught, 1,868 of which were marked and 115 were recaptured in segments 4-7. Distribution of marked crappie was computed by combining recaptures in segments (s) with recaptures in segments (s+2) where (s) = any segment from 1-10 (Figure 2). These curves were combined to increase precision of the normal distributions of left and right marked recaptures. In segments 5 and 7, 50 crappie were recaptured within the segment they were marked and 37 were recaptured in segments 4 and 6. Recaptures outside the marking area was 38. Standard deviation of this distribution was 1.21 miles with mean movement 0.27 miles upstream.

Probability of a marked fish remaining within any segment can be computed for the equation

$$z = \frac{X - m}{\hat{s}_d}$$

where z = a unitized distance from the mean of a standard normal curve, X = distance from the mean of the emperical distribution, m = mean of the distribution and $\hat{s}_d$ = standard deviation of the distribution (Aler and Roessler, 1962). The probability (P_1) of a marked crappie remaining in the segment in which it was marked was 0.156 in 1968. Further evaluation showed the probability was 0.442 that a marked fish remained in any segment plus two (P_3) adjoining segments. The value for P_s was 0.671, followed by 0.829, 0.922, 0.968 and 0.989 for computations involving P_7, P_9, P_{11}, and P_{13}.

One method to determine the loss of marked fish from the study area was by computation of movement of marked fish from a particular segment. This method involved 80 multiplications, 70 divisions and 70 subtractions for the 10-segment study area. The method was tedious, time consuming and prone to calculation and recording error.

A less cumbersome method was developed based on the equation

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RED ROCK RESERVOIR INVESTIGATIONS-1969

Gaige Wunder
Fisheries Biologist

INTRODUCTION

Red Rock Reservoir was authorized by the United States Congress in 1938 as part of the upper Mississippi River basin flood control project. Construction began on the earthen dam in September 1960 and was completed in March 1969.

The dam is located on the Des Moines River approximately 50 miles below the city of Des Moines at mile 154 above its confluence with the Mississippi River.

The reservoir will have a profound effect upon studies of commercially valuable fish species carried on in this area since 1964 as the characteristics of the environment change from stream to lake. These studies have accumulated fishery data over the previous three years and will be compared with fish population data in the subsequent years.

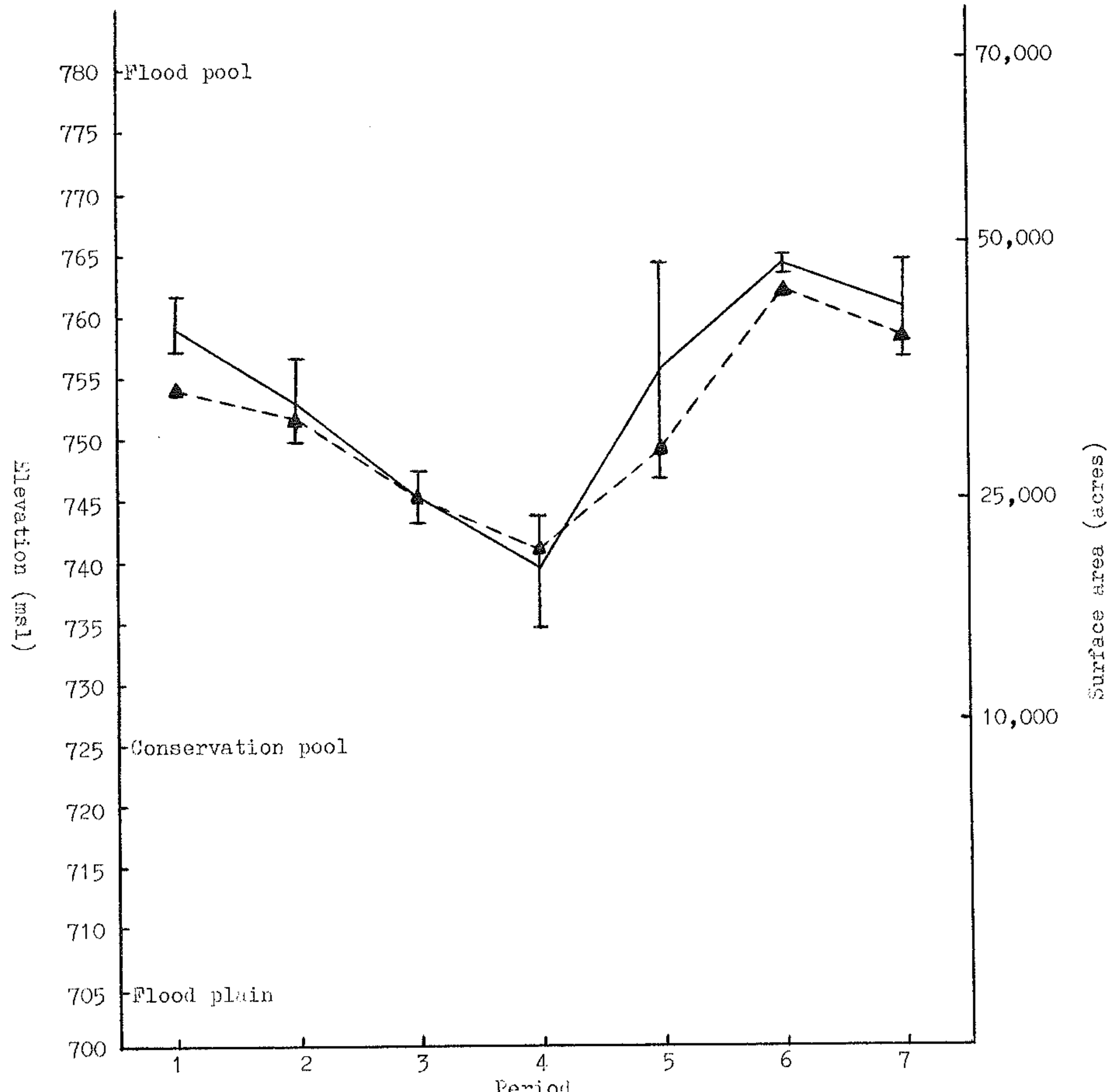
DESCRIPTION OF THE RESERVOIR

Maximum fluctuation of the reservoir is from 725 msl at conservation pool to 780 msl at flood pool. At conservation pool the reservoir will cover a surface area of approximately 8,200 acres. During periods of flood water storage this is increased to about 66,000 surface acres. Minimum effluent is 300 cfs, but may range up to 130,000 cfs during high water.

Accumulation of an average ten inch snow cover throughout the reservoir drainage in the winter of 1968-69 accelerated the time required to fill the reservoir to conservation pool from an anticipated two months to only three days. Moisture from this spring runoff and accompaning above normal summer precipitation held the reservoir above conservation pool during the entire summer. Pool level and surface area fluctuations exhibit bimodal distribution as shown in Figure 1. Surface area of the reservoir ranged from approximately 14,500 acres on 27 June to 44,000 acres 2 August with a mean of 31,000 acres. Pool depth at the dam varied between 30 and 60 ft.

METHODS AND PROCEDURES

Experimental netting commenced in the reservoir on 12 May and was continuous until 7 August. This period was separated into 7 bi-weekly netting periods. Only


780
775
770
765
760
755
750
745
740
735
730
725
720
715
710
705
700
Flood pool
Conservation pool
Flood plain
Elevation (msl)
70,000
50,000
25,000
10,000
Surface area (acres)
1
2
3
4
5
6
7
Period

Seine hauls were made in shallow areas with 60 ft of $\frac{1}{4}$-inch minnow seine to study early life histories of fish too small to be vulnerable to the pound nets. Hauls of 100 ft length were made weekly in the same region of the lake followed by a reverse direction haul over the same area. All fish were counted and weighed in aggregate.

RESULTS

During seven bi-weekly periods 62,466 fish weighing 21,243.5 lbs were captured (Table 1). Carp dominated the numerical catch with 66.0%. Bullhead ranked second comprising 18.7% and river carpsucker third with 10.3%. Channel catfish and buffalo, which have considerable economic value in a commercial fishery, comprised 3% of the reservoir sample. Bluegill, crappie, green sunfish, largemouth bass, gizzard shad, northern redhorse, white sucker, northern pike, golden shiner, freshwater drum, shortnose gar, yellow perch, and white bass, which have no commercial value, made up 2.3% of the catch and are listed in the table as others.

Table 1. Catch statistics of commercial fish in seven bi-weekly periods at Red Rock Reservoir

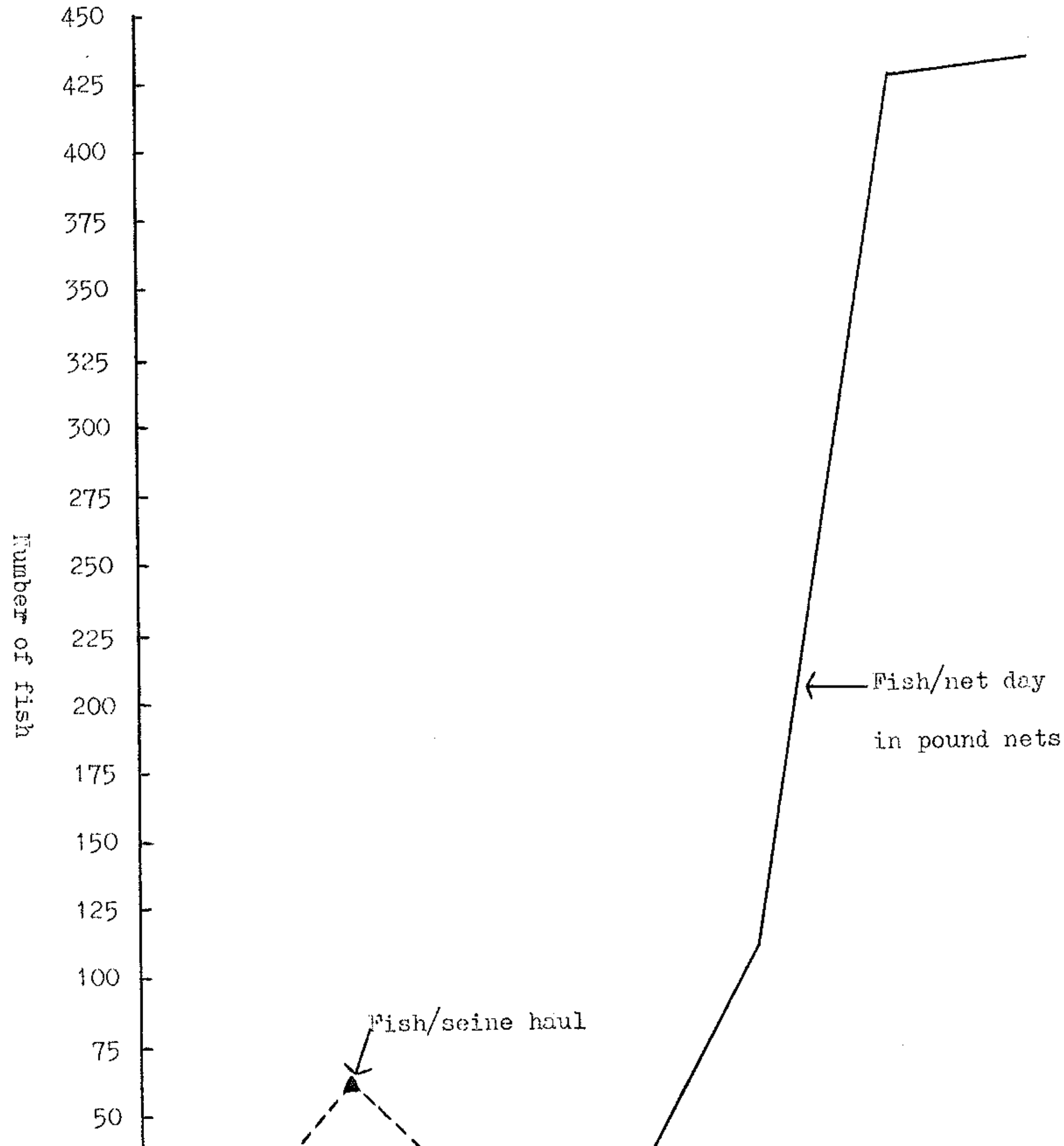
Species	Total Number	% Number	Total Weight	% Weight	Mean Weight
Carp	41,284	66.0	13,079.6	61.6	.32
Buffalo	1,281	2.1	828.6	3.9	.65
River carpsucker	6,479	10.3	3,902.0	18.4	.60
Channel catfish	200	0.3	169.8	0.8	.85
Bullhead	11,725	18.7	2,953.4	13.9	.25
Others	1,497	2.3	310.1	1.4	.21
Total	62,466		21,243.5		

Carp also dominated the catch by weight making up 61.6%. River carpsucker ranked second with 18.4% followed by bullhead with 13.9%. Channel catfish, buffalofish and others contributed 0.8%, 3.9% and 1.4%, respectively.

Catch success of carp (Table 2) increased from 7.9 fish/net day to 433.5 fish/net the rapid reduction of mean weight obviously makes increased catch success in pound nets in periods five through seven due to recruitment of young-of-the-year fish into the population vulnerable to the pound nets. Figure 2 compares the catch success of carp in pound nets and seine hauls.

Table 2. Catch success and mean weight of commercial fish for seven bi-weekly netting periods

Species	1	2	3	4	5	6	7
Carp							
Fish/net day	18.3	7.9	11.4	16.5	112.1	427.0	433.5
Mean wgt(lbs)	1.60	1.86	1.54	1.07	0.36	0.19	0.23
Buffalo							
Fish/net day	2.5	0.2	0.1	1.1	0.3	8.3	17.7
Mean wgt(lbs)	2.51	2.81	1.87	2.86	3.13	0.17	0.21
River carpsucker							
Fish/net day	31.82	6.9	12.9	59.1	11.9	14.3	8.6
Mean wgt(lbs)	0.69	0.69	0.63	0.50	0.65	0.43	0.58
Channel catfish							
Fish/net day	0.7	0.2	0.2	2.0	0.3	0.3	1.2
Mean wgt(lbs)	1.06	1.24	1.01	0.56	0.87	0.66	0.96
Bullhead							
Fish/net day	15.5	23.7	23.4	72.7	66.0	30.4	36.0
Mean wgt(lbs)	0.33	0.28	0.23	0.25	0.22	0.24	0.27


450
425
400
375
350
325
300
275
250
225
200
175
150
125
100
75
50
Number of fish
Fish/net day
in pound nets
Fish/seine haul

PROGRESS REPORT OF SPIRIT LAKE WALLEYE STUDIES, NATURAL REPRODUCTION

Terry Jennings
Fisheries Biologist

INTRODUCTION

As reported in previous Iowa State Quarterly Biology Reports, Spirit Lake supports a moderate to high population density of walleye. Personal observation and gill net catch statistics indicate these fish spawn naturally. However, the extent of natural reproduction has not previously been reported.

The current study was initiated in 1964 and continued through 1969. It was started as a joint study with an evaluation of walleye fry stocking at Spirit Lake. Hopefully, knowledge of natural reproduction could make for a more meaningful fry stocking evaluation.

This paper will only record some basic facts of natural walleye reproduction in Spirit Lake.

DESCRIPTION OF STUDY AREA

Several researchers have stated that walleye prefer to spawn over rock-rubble type habitat (Eschmeyer, 1950: Harlan and Speaker, 1956: Johnson, 1961). Eschmeyer and Johnson believe most walleye spawning occurrs in water 30 inches deep or less.

Using these guidelines, much of the west shoreline of Spirit Lake qualifies as preferred walleye spawning habitat. This area consists of an interspersion of rocks ranging in diameter from about 8 inches to one-inch or less. When the water level of the lake is at crest elevation, the rocky area extends to about the 6 ft contour.

Gill net catch statistics, personal observation,and egg collection data indicate much of the natural walleye reproduction in Spirit Lake occurs along the west shoreline. For this reason, it is assumed reliable data as to success of natural reproduction could be obtained by sampling in this area. Of course, spawning also occurs at other locations around the lake, but, gill net catch records and data collected by electro-fishing indicates ideal spawning habitats are utilized extensively by male walleyes and only occasionally by females.

The State of Iowa owns approximately 1.3 miles of this lake's western shoreline. It is located about midway between the north and south lake shores. Since bottom composition is representative of the entire western shoreline and access to the lake is unrestricted, three

$\frac{1}{2}$-inch diameter steel rod was covered on four sides by screenwire. Use of the quadrate required only placement of it so that no eggs could escape from or enter the enclosure. After quadrate placement, a 6 inch diameter rubber plunger was used to loosen the walleye eggs from the lake bottom. Current created by vigorous vertical stirring movement of the plunger carried eggs and other debris from the bottom toward the lake surface. Eggs and other debris were removed from inside the quadrate with a dipnet covered with screenwire. It was impossible to collect all of the eggs from a quadrate placement, however loss of eggs appeared to be minor. Judgement of the collector was used to determine when to stop collecting from a placement. A sample from one sampling site consisted of all eggs collected from several quadrate placements. Water depths from which egg samples were taken ranged between 8 inches and 30 inches.

Eggs and other collected debris were transported to the laboratory where the eggs were removed from the debris with forceps. Live and dead eggs were separated and counted with the aid of a binocular microscope.

During the first four years of study, eggs were collected and counted the same day. Olson (1966) reported that he preserved walleye eggs in 10% formaldehyde solution and had no difficulty distinguishing live and dead eggs. During 1968 and 1969 eggs collected for this study were preserved in formaldehyde and counted at a later time. This author encountered no difficulties distinguishing between live and dead preserved eggs.

ESTIMATED NATURAL REPRODUCTION

Normally Spirit Lake walleye spawning is completed within two to three weeks. Thus, hatching of the eggs does not occur instantaneously, but it is spread over several days. Because of this, it is difficult to accurately estimate fry production. During this study, the last sampling occurred when all live eggs collected were either eyed or pre-eyed. To estimate fry production, it was assumed these eggs would hatch. A pre-eyed egg was characterized by eyes of the embryo were not visible except under magnification. Johnson (1961) also used eggs that were found in these two developmental stages as indicators of fry production. Based on personal observation of walleye eggs incubated at the Spirit Lake Fish Hatchery, little mortality occurs during late stages of development. It is possible conditions other than those occurring in a hatchery could cause increased mortality of naturally spawned eggs, but considering the length of time between pre-eying and hatching, it is doubtful that mortality would be significant.

It is clearly evident (Table 1) the number of walleye eggs recovered in Spirit Lake fluctuates widely from year to year. Maximum egg density ranged between 561.4 eggs per square ft in 1966 and 0.39 eggs per square ft in 1969. Maximum egg density does not represent the maximum density of eggs in a single quadrate placement. It is the

It is also evident (Table 1) annual walleye reproductive success in Spirit Lake fluctuates widely. Best success occurred in 1965 when an estimated 0.61 fry were hatched per square ft. The next best success was in 1966 when 0.19 fry were hatched per square ft. Poorest reproduction occurred in 1969 when 0.01 eggs hatched per square ft. All but the 1965 estimate is considerably less than Johnson's (1961) minimum estimate. His estimate of fry production in some Minnesota lakes ranged between 269.36 per square ft and 0.46 square ft.

Per cent survival of naturally spawned walleye eggs was calculated by dividing the number of live eggs collected per square ft during the last sampling by the maximum egg density per square ft for that year. Estimated egg survival fluctuated widely, between 34.4% in 1968 and 0.03% in 1966. It averaged 10.9% for the 6 year period. Johnson (1961) reported egg survival rates between 0.6% and 35.7%.

Per cent of survival in itself does not mean much to total reproductive success. However, when used in conjunction with egg density, it is more meaningful. For example best reproductive success occurred in 1965 when the maximum density was only 2.2 eggs per square foot. But, 27% of these eggs hatched. The greatest potential for high reproductive success occurred in 1966 when about 561 eggs per square foot were observed. The potential was lost when only 0.03% of these eggs hatched. On the other hand, during 1968 and 1969 when egg densities were very low, high or low egg survival rates would not have noticeably changed fry production.

DISCUSSION

This study indicates that walleye reproductive success in Spirit Lake is poor, especially when compared with those reported in northern Minnesota Lakes. During only one year (1965) of this 6 year study did the number of fry produced approach significant importance.

During the first four years of study, egg densities were sufficient to provide good fry production. Except for 1965 when 27% of the eggs spawned survived, poor survival of eggs limited reproductive success. During 1968 and 1969 egg densities probably limited reproductive success. With a low density of eggs such as observed the last two years of this study, very high survival would not have noticeably changed fry production.

It is indicated from this study that during most years reproductive success in Spirit Lake is limited by poor egg survival during incubation. It is also necessary further study into factors limiting egg survival could be a benefit to walleye management in Spirit Lake.

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Olson, D. E.
1966. Physical characteristics of fertilized and unfertilized walleye eggs during early stages of development. Minnesota Fisheries Invest. Department of Conserv. No. 4: 31-38.

Table 1. Density of naturally spawned walleye eggs along west shore of Spirit Lake and estimates of n
fry produced per square foot of sampled area

Item	1964	1965	1966	1967	1968
Maximum egg density	28.4	2.24	561.4	7.3	0.43
Total sampled area at last sampling	145	72	54	63	108
Total eggs collected at last sampling	55	161	572	18	46
Total live eggs at last sampling	2	44	10	2	16
Estimated number of fry produced	0.02	0.61	0.19	0.03	0.15
Estimated per cent of egg survival	0.06	27.0	0.03	0.43	34.4

AN ANNOTATED LIST OF FISHES OF THE FLOYD RIVER DRAINAGE

Don Kline
Fisheries Biologist

The fishes of the Floyd River Drainage are part of Iowa's natural resources and knowledge of their present distribution is necessary for continued management of this fishery.

Meek (1894) and State Conservation Commission biologists, (Harlan and Speaker, 1956, Harrison, unpublished data and Harrison and Speaker 1954) sampled the Floyd River fishes and reported their relative abundance.

The purpose of this study is to continue this inventory and examine previous results for comparison. This paper contains notes on 5 families and 19 species of fishes. The present work had added four new species to the list of species found in the Floyd River Drainage. It failed to account for 23 species collected by earlier workers.

I wish to thank Larry Gepner for his capable help in the field and laboratory.

DESCRIPTION OF STUDY AREA

The area covered by this study encompasses the Floyd and West Branch Floyd River Drainages (Figure 1). The Floyd River flows southeasterly and has a drainage area of 921 square miles (Larimer, 1957). The West Branch Floyd River flows south and drains 281 square miles.

The Floyd River starts in northwestern O'Brien County, passes through Sioux and Plymouth Counties and flows into the Missouri River at Sioux City, Iowa in northwest Woodbury County. The West Branch Floyd River rises in northeast Sioux County and flows to the middle of Plymouth County and confluences with the Floyd River near Merrill, Iowa.

Sioux City, Le Mars, Sioux Center, Orange City, Alton and Sheldon are major cities in the Floyd and West Branch Floyd River watersheds.

The soils of the region are derived from two sources. Missouri River loess deposits from the majority (95%) of the soil, with the remainder contributed by the Wisconsin Glacial deposits. However, glacial material forms 90 per cent of the streams bottom type because the rivers have eroded the loess.

The topography of the region changes from gently undulating upstream to sharply

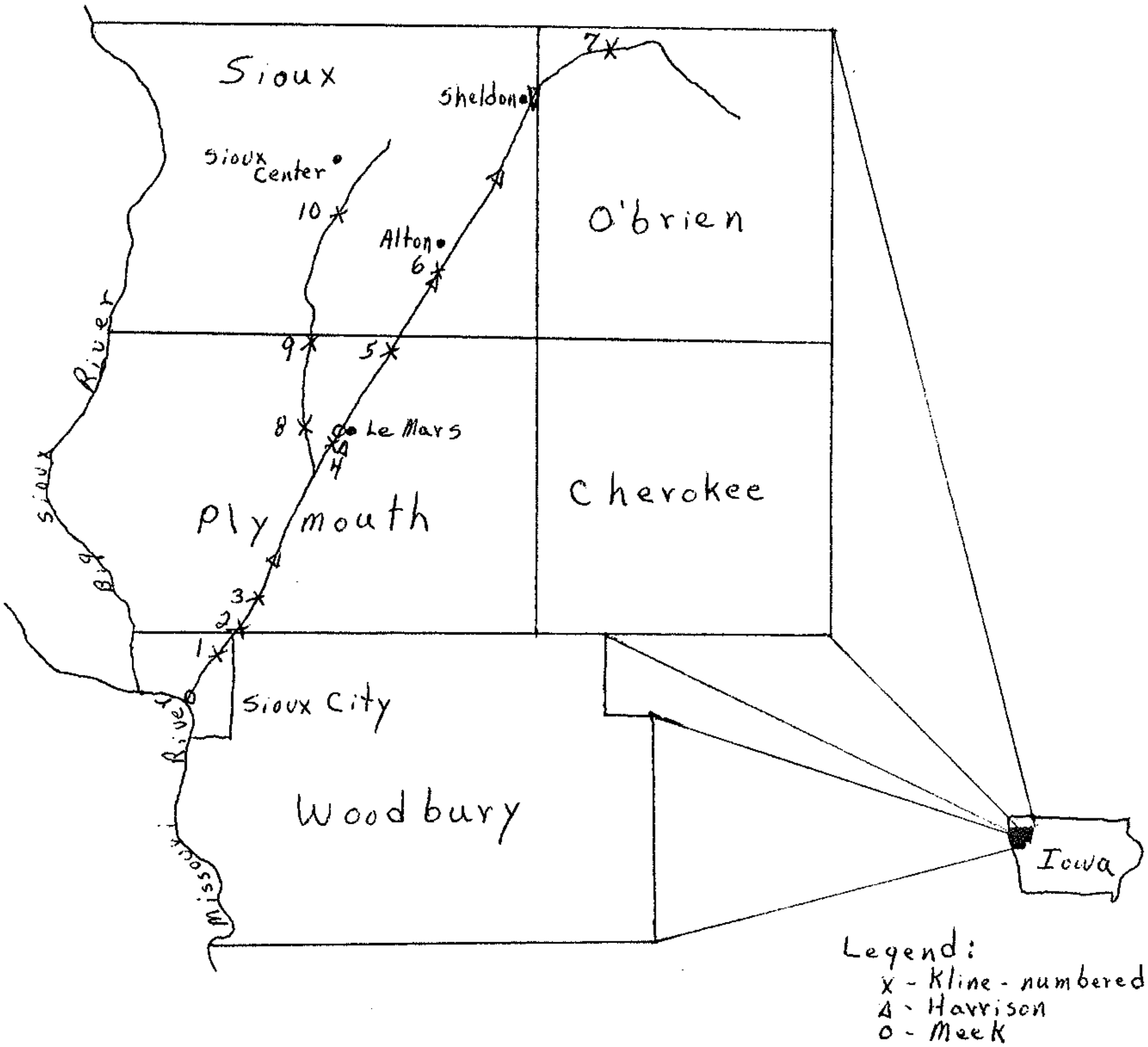

Figure 1. A sketch showing present sampling stations along the Floyd and West Branch Floyd River in relation to two previous workers.

station 3 follows an almost straight path from near Sheldon, Iowa with few sharp bends or cut banks. There are numerous pool areas and rapids, but few drifts or fallen trees.

Water flow records taken just north of Sioux City show a difference of approximately 71,500 cfs. No flow has been recorded in the upper reaches of the Floyd River and the West Branch Floyd River might be considered intermittent above Struble, Iowa (Table 1).

PROCEDURES

Hoop nets, siene and Pro-Nox Fish (rotenone) were used to capture fish in the Floyd River Drainage.

Hoop nets were set at four stations in the lower reaches of the river. Hoop nets with 2 throats, 24 inches in diameter and 3/4 inch bar mesh were baited with cheese and fished for approximately 48 hours. No hoop nets were placed in the river above Le Mars, Iowa because there was not sufficient water to cover the nets except at flood stage.

Table 1. Water flow records for 2 stations on the Floyd River and 1 on the West Branch Floyd River

Town	Records	Mean discharge	Maximum flow	Minimum flow
James	1934-1968	170 cfs	71,500 cfs ('53)	1 cfs ('36 and '59)
Alton	1955-1968	32.1 cfs	12,200 cfs ('62)	No flow at times ('56, '58-59, '65, '68)
Struble	1955-1968	23.1 cfs	8,060 ('62) cfs	No flow for many days ('56-69, '61, '63-69)

Seine hauls were made at 3 stations on the Floyd River and 3 stations on the West Branch. The siene was 35 feet long, 6 feet wide with $\frac{1}{4}$ inch bar mesh. Siene hauls were directed at each habitat and did not have preset length or width.

Pro-Nox fish (rotenone) was used at 2 stations on the Floyd River and 1 station of the West Branch. A $\frac{1}{4}$ inch bar mesh block net (75 feet long) was hung on reinforcing bars across the downstreamend of the desired sample station. Pro-Nox fish was mixed in a bucket with water and poured across the upstream end of the sample station. Additional dosages of mixed Pro-Nox fish were put along the edges in the upper quarter of the station and indicated each station was sampled with very little undesired kill. The block net was left across the stream for one-half hour.

All fish collected were preserved in 10% formalin and returned to the laboratory for positive species identification and enumeration. Representive samples of each species have been kept in a permanent collection.

After the collections were made the station were inspected for physical and ecological characteristics. Field notes were taken on a standardized form with space available for additional notes on fish species or other fauna. Color slide pictures were taken of each station.

Fish species were classified as rare, common, or abundant using the following combination of critieria:

	Specimens		Stations
Rare	1 or 2	at	1 or 2
Common	several	at	2 or 3
Abundant	many	at	3 or more well separated.

STATIONS

Fish samples were taken from 7 stations along the Floyd River and 3 stations along the West Branch Floyd River. The following is a list of the stations, describing their physical and ecological characteristics. The stations are listed from 2 to 10 starting at the station nearest the mouth and continuing up the Floyd River and then the West Branch. The County, Range and Township numbers are given first, then the exact location by section. Six additional characteristics are bottom type, current - swift or slow and presence of backwaters or pools, depth - deepest, gear, vegetation - presence and type, shore - bank type and principal cover.

Station 1. Woodbury (97), Highway 75 bridge, northeast edge Sioux City, Iowa.
Bottom - sand.
Current - swift
Depth - to 4 feet.
Gear - hoop net, cheese bait, 13 August 1969.
Vegetation - none

Station 3. Plymouth, (75), T-90N R-46W Sec. 29 SW corner.
Bottom - sand with silt deposits along banks.
Current - swift.
Depth- to 26 feet.
Gear - hoop net, cheese bait, 13 August 1969.
Vegetation - none
Shore - farmed with grass protective belt.

Station 4. Plymouth (75), T-92N R-45W Sec. 31 North border.
Bottom - hard mud and gravel.
Current- swift with two backwaters.
Depth- to 45 feet.
Gear - 1 siene haul 3 June, rotenone 10 June and hoop net 13 August 1969.
Vegetation - none.
Shore -farmed with grass protective belt.

Station 5. Plymouth (75), T-93N R-44W Sec. 18 northeast corner.
Bottom - gravel and sand with silt along banks.
Current - swift with one backwater.
Depth - to 45 feet.
Gear - 2 siene hauls 3 June 1969.
Vegetation - filtimentous algae.
Shore - farmed downstream, pastured upstream not protected.

Station 6. Sioux (84), T-95N R-44W Sec. 36 west border.
Bottom - hard sand.
Current - swift with slow areas along banks.
Depth - to 4 feet.
Gear - 3 siene hauls 4 June 1969.
Vegetation - filamentous algae
Shore - farmed with grass protective belt.

Station 7. O'Brien (71), T-97N R-42W Sec. 10 southwest corner.
Bottom - gravel.
Current - swift.
Depth - to 2 feet.
Gear - rotenone 9 June 1969.
Vegetation - filamentous algae, arrowhead and grasses.
Shore - farmed with grass protective belt and pastured downstream.

West Branch Floyd River

Station 9. Sioux (84), T-94N R-45W Sec. 32 southeast corner.
Bottom - sand and hard mud.
Current - swift with slow area along banks.
Gear - 3 siene hauls 4 June 1969.
Vegetation - filamentous algae (sparse).
Shore - pastured with protective belt.

Station 10. Sioux (84), T-96N R-44W Sec. 31 northwest corner.
Bottom - soft mud.
Current - slow
Gear - 2 siene hauls 4 June 1969.
Vegetation - filamentous algae (sparse).
Shore - farmed, well protected with grasses.

ANNOTATED LIST OF SPECIES

This list contains 19 species of fishes from 5 families. Meek (1894) reported 9 families and 35 species of fishes. Commission biologists reported 5 families and 16 species of fishes.

Notes contained in this list give the relative abundance, station (s), records of previous workers and a description of the habitat if the species was new to the list or more details were needed than given in the station description.

Catostomidae
(Sucker Family)

Carpiodes carpio (Rafinesque). River carpsucker. Rare. One specimen was taken at station 4 with siene over sand and marble sized gravel in still water area at the head of a gravel bar. This species has not been reported in the Floyd River Drainage by previous workers.

Moxostoma aureolum (LeSueur). Northern redhorse. Rare. Two specimens were caught one each at stations 1 and 3. Meek found this species at Sioux City and Le Mars, but it was not collected by Commission Biologists.

Catostomus commersoni (Lacepede). White sucker. Rare. Two specimens were taken one each at stations 1 and 7. This species was found by Meek at Sioux City and Le Mars and reported abundant by Commission Biologists.

Cyprinidae
(Minnow Family)

Campostoma anomalum (Rafinesque). Stoneroller. Rare. This species was found only at station 7 where it was abundant. The channel was narrow with a gravel bottom and large mats of filamentous algae were found in quiet water and trailing from clumps of grass. Meek found this species at Sioux City and Le Mars, but Commission Biologists found it in abundance near the vicinity of this collection.

Semotilus atromaculatus (Mitchill). Creek chub. Common. This species was found in both the Floyd and West Branch Floyd Rivers where it showed a preference for the clearer upstream habitat. It was abundant at station 7 on the Floyd River. Meek found it at Sioux City and Le Mars and Commission Biologists reported it abundant.

Pimephales promelas (Rafinesque). Fathead minnow. Abundant. This species is the most abundant and widely distributed fish in the Floyd River watershed. Three siene hauls at station 9 on the West Branch Floyd River captured more than 500 fatheads. Many locations produced over 200 fatheads. Meek found this species and Commission Biologists reported it abundant in all collections.

Notropis cornutus (Mitchill). Common shiner. Rare. Common shiners were taken only at station 7 on the Floyd River where it was abundant. This species has an ecological preference for clear water (Harlan and Speaker, 1956) and its presence in the extreme upper portion of the river may be the result of increased silt pollution in the lower reaches. Meek found this species at Sioux City and Le Mars. Commission Biologist found it rare above Sioux City, but abundant at Le Mars and above.

Notropis lutrensis (Baird and Girard). Red shiner. Common. The red shiner was found only in the upstream portion of the Floyd River Watershed at stations 6, 9 and 10. Meek collected it at Sioux City and Le Mars. Commission Biologists reported it common inonly one location near the vicinity of station 6. This species also prefers clear water.

Notropis deliciosus ssp. (Cope). Sand shiner. Abundant. This species was found in large numbers throughout the watershed. Commission Biologists reported this species rare below and common to abundant above Alton, Iowa.

Notropis Dorsalis (Agassiz). Bigmouth shiner. Abundant. The bigmouth shiner was the second most widely distributed species in the Floyd River Watershed. Meek found this species at Sioux City and Le Mars. Commission Biologists found it abundant in most collections.

Ictaluridae
(Catfish Family)

Ictalurus melas (Rafinesque). Black bullhead. Common. Black bullheads were taken at stations 1, 5 and 6. Habitat suitable for black bullheads extends to the Plymouth-Sioux County line. Meek found this species at Le Mars. Commission biologists reported it common to abundant throughout the Floyd River.

Noturus gyrinus (Mitchill). Tadpole madtom. Rare. One specimen was taken with a siene at station 10 on the West Branch Floyd River. The siene haul was made in a pool area with a soft mud bottom. Meek reported this species at Sioux City and Le Mars, but it was not taken by Commission Biologists.

Noturus exilis (Nelson). Slender madtom. Rare. One specimen was taken at station 7 on the Floyd River. This station was characterized by clear, swift water flowing over a gravel bottom. This species was not taken by earlier workers.

Centrarchidae
(Sunfish Family)

Pomoxis annularis (Rafinesque). White crappie. Rare. White crappie were taken in hoop nets at stations 1 and 3. This species was not taken by earlier workers.

Lepomis humilis (Girard). Orangespotted sunfish. Common. Orangespotted sunfish were taken at widely scattered stations (3,7 and 8) on the Floyd and West Branch Floyd River. Meek reported this species at Sioux City and Le Mars. Commission Biologists found it rare near Sheldon and Alton, Iowa.

Percidae
(Perch Family)

Stizostedion canadense (Smith). Sauger. Rare. One specimen was taken at station 3 using rotenone. Meek reported the sauger at Sioux City and Le Mars, but Commission Biologists did not take them.

Etheostoma higrum (Rafinesque). Johnny darter. Rare. Johnny darters were taken at stations 7 and 8 on the Floyd and West Branch Floyd Rivers using rotenone. These stations differ ecologically and station 8 would not have been considered darter habitat. Johnny darters were abundant at station 7 where 14 individuals were captured. Meek found them at Sioux City and Le Mars. It was reported common by Commission Biologists throughout the watershed.

DISCUSSION

The present study, although not complete, sampled the entire Floyd River Drainage using three different sampling techniques. Earlier workers used only the siene and did not sample the West Branch Floyd River.

River carpsucker, white crappie, channel catfish and slender madtom were added to the list of fishes of the Floyd River Drainage. Channel catfish and white crappie were taken with hoop nets in the lower reaches, while slender madtom and river carpsucker were taken with rotenone and siene, respectively.

The Floyd River must have looked entirely different to Meek in 1894 and the fauna was much richer. Meek captured 36 species at 2 stations while Commission Biologists reported only 16 species at 5 stations and I captured 19 species at 10 stations. The fishes of the Floyd River drainage have probably been effected by a decrease in the amount of desirable habitat and deterioration of water quality, because of increased agricultural practices and the growth of towns without adequate sewage treatment plants.

I consider rotenone an effective sampling technique, but because it must be applied to the whole stream section, sampling specific habitats was difficult. The siene was the best method for sampling individual habitats if the bottom was smooth and without snags.

Minnows were found at all stations where sampling technique would allow and the rivers could produce a large number of minnows for bait purposes. Fishing for channel catfish and bullheads could be productive upstream to the Plymouth - Sioux County line on the Floyd River.

This was a pilot study used to test techniques and equipment and acquaint me with their use. Similar studies will be made on streams tributary to the Missouri River in western Iowa.

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PRELIMINARY RESULTS OF SLIME DISTRIBUTION

STUDIES ON THE MISSISSIPPI RIVER

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Growth of the bacterial slime, Sphaerotilus natans, is one of the results of major pollution problem in the upper Mississippi River. Sphaerotilus thrives on nutrients discharged from grain processing plants, sewage treatment plants and industries which manufacture various types of paper and fiber board products. As a result, vast areas of the river are presently in a state of pollution.

The present study was undertaken to learn more about seasonal distribution and density of slime growths and to establish background data which can be used to determine effects of forthcoming waste treatment improvements.

STUDY AREA

The "Dubuque slime bed" was chosen as the study area. It is located in pool 12 extending downstream from the city of Dubuque. During winter months it has been known to extend as far as Bellevue, 21 miles below the Dubuque Municipal sewage treatment plant. Although this bed is not as extensive as some of those found elsewhere, it is a suitable example close to our headquarters. Dubuque has also made steps toward converting from primary to secondary waste treatment in the near future. Hence, a before and after comparison can be obtained.

METHODS

Sphaerotilus generally grows on a substrate which continually sloughs off in the current. There is considerable drifting of sloughed particles. Techniques developed to measure the bed involve catching and measuring a sample of drifting material by suspending a trap approximately one ft above the bottom for a constant time period. Traps used in this study are one-half inch mesh hardware cloth cylinders, 18 meshes long and 22 meshes in circumference.

At the conclusion of each sampling period slime traps are picked up, drained of excess water and weighed to the nearest one-quarter ounce. They are then cleaned thoroughly and weighed again for tare.

Sampling stations are located at intervals of one mile near Dubuque. These intervals increase farther downstream. Samples have been collected monthly beginning 24 June, 1969.

RESULTS

Preliminary sampling results are presented in Table 1. River mile 577.6 one-quarter mile below the Dubuque sewage treatment plant discharge, is the uppermost sampling station at which slime was observed. Slime was most abundant at this point and deminished progressively downstream to the upper end of Nine Mile Island (river mile 574.3). An increase in slime was noted within two side channels which separate the island from the main shore. Lesser amounts were observed on the channel side and below the island system. No slime was found on the Illinois side of the channel.

Sphaerotilus was not collected in significant quantities below river mile 571.1. At this point, slime could only be found at the edge of the navigation channel. Sphaerotilus probably occurred in the navigation channel for some distance beyond this station, but barge traffic made sampling impractical.

DISCUSSION

Slime density and distribution are dependant on several factors. First, density is probably controlled by availability of the proper nutrients. Distribution is determined by temperature, current patternand stream velocity. Temperature affects metabolic rate and determines the time a nutrient travels before being metabolized. Current affects rate of sloughing and distance the particles may drift. Current velocity also affects quantitative trap results. This was a major factor in variation of collections at time of low river discharge vs. high discharge and collections near shore vs near the main channel.

High water temperatures and relatively low flow prevailed during the months sampled and probably represent minimum distribution of the Dubuque slime bed.

Table 1. Results of slime traps set for 24-hour intervals in the Dubuque slime bed

Station description		Date of sample	6/24/69**	7/25/69**	9/4/69	9/30/6
		River discharge (cfs)	40,500	48,000	29,000	24,000
River mile	Location*	Temperature (F)	70°	80°	76°	64°
578.6	20 yds. from shore		0.25	0.50	0.00	0.00
577.6	20 yds. from shore		7.25	16.00	7.75	7.75
577.5	20 yds. from shore (Illinois side)		0.50			
576.6	20 yds. from shore				7.25	6.00
575.6	20 yds. from shore		3.75	13.50	1.75	0.00
574.6	20 yds. from shore		0.25	1.00	0.50	0.50
574.6	Near edge of navigation channel		3.25	10.75	2.00	1.00
574.0	Shawndasse Slough (west side)			1.50	0.50	1.00
574.0	Shawndasse Slough (mid-channel)		2.50			
574.0	Shawndasse Slough (east side)			4.50	3.50	2.00
574.0	Molo Slough (mid-channel)		0.25	7.00	5.50	0.50
574.0	20 yds from shore		2.25	0.50	2.00	0.00
573.0	Center of cut which joins Shawndasse and Molo Sloughs					

Table 1. (continued)

Station description		6/24/69	7/25/69	9/4/69	9/30/69
572.0	Molo Slough (west side)		0.50		
572.0	Molo Slough (center of channel)	2.00		(T)	0.50
572.0	Molo Slough (east side)		3.00		
572.0	20 yds from shore	0.00	0.00	0.00	0.50
571.1	20 yds. from shore	0.25	0.50	(T)	
571.1	40 yds. from shore		0.50		
571.1	60 yds. from shore		1.25	0.25	0.00
571.1	20 yds. from shore (Illinois side)		0.25		
566.5	20 yds. from shore	0.00			

* All locations of stations described above are on the Iowa side of the river unless otherwise noted.
** Most samples collected on June 24 and July 25 included from 0.25 to 0.50 ounces of root hair, leaves and insect larvae.

MOVEMENT AND HOME RANGE OF DEER AS DETERMINED BY RADIO-TRACKING
(A working plan for Iowa Project)

Lee Gladfelter
Game Biologist

INTRODUCTION

A full understanding of the ecology of any animal includes knowing the animal's movement patterns both for basic scientific reasons and for its significance in practical management. Because the movements of animals are frequently difficult to observe under natural conditions, most data have been collected by indirect methods such as trapping and marking, automatic marking devices, and the study of animal signs. Biotelemetry, or more specifically radio-tracing, is a new procedure for collecting information about an animal from a distance with a minimal amount of disturbance to that animal. At the present, this new technique of study is in the embryonic stage of development and will undoubtedly see many advances in the next few years. Nevertheless, there can be a great amount of ecological data collected with the techniques and equipment currently being used. The first step is the understanding that radio-tracking is not an "armchair" approach to conducting a research project but that it will require a great effort in collecting useable data and in analyzing and intrepreting the results.

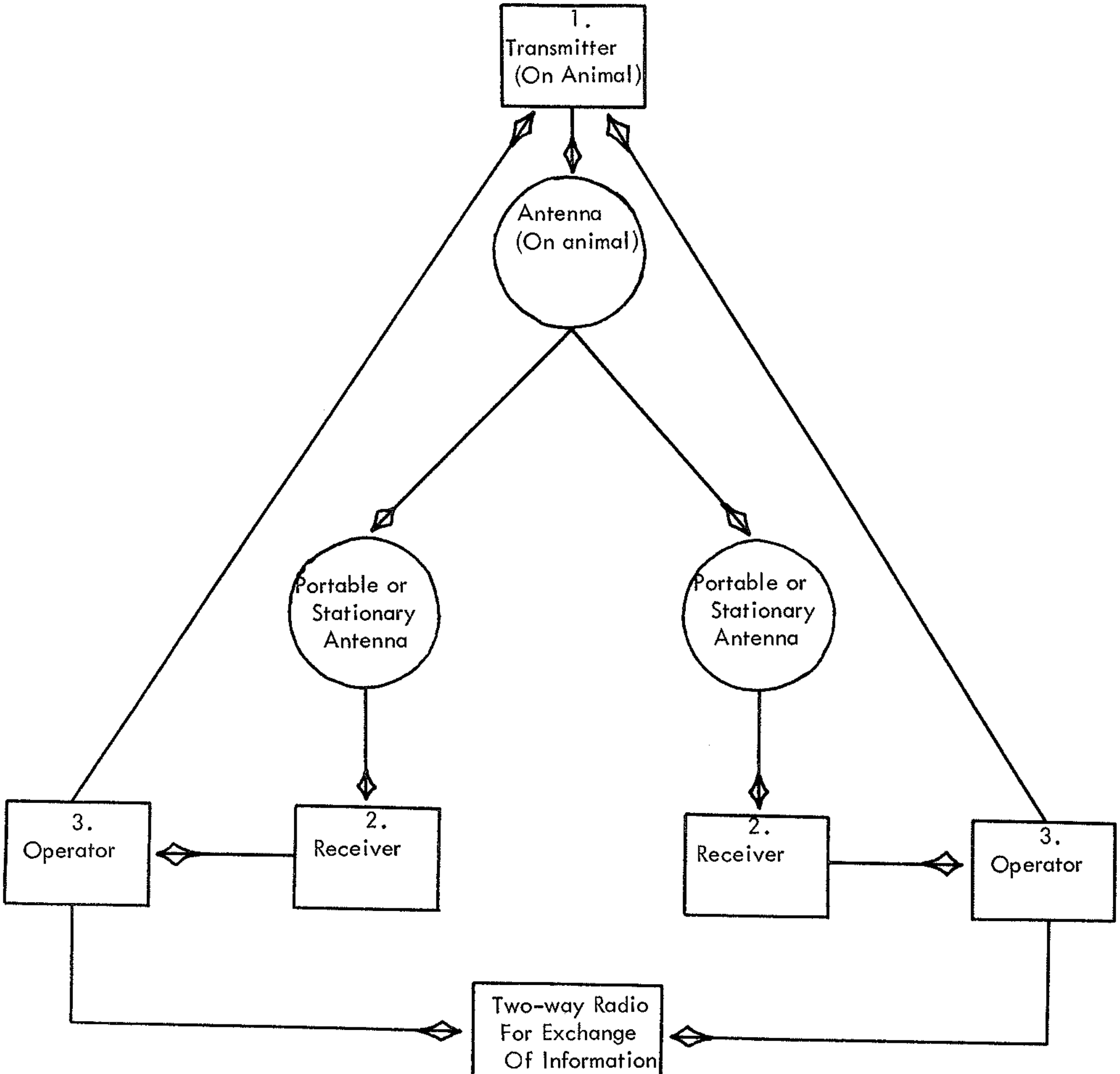
A radio-tracking system is composed of: 1, a transmitter which is placed on a captured animal and transmits a radio signal by means of an enclosed antenna; 2, receiving antenna which intercepts the signal and indicates the direction of the signal; 3, a receiver which collects the signal from the antenna and transfers it to the operator as an audible tone. The operator records the signal directions from two or more antenna stations and locates the animal by triangulation. Triangulation is the process of extending lines on a map corresponding to the compass bearings from each antenna station. The point at which these lines cross markes the location of the animal. The relationship of these components to locating an animal is shown in Figure 1.

There are great amounts of information available on movements of white-tailed deer in other parts of the country. This material can be used for comparisons but cannot be applied directly to deer in Iowa. There is need for the movement - ecology study of deer in Iowa including the relationships involved with specific environmental factors and the effects of large areas of cropland upon habitat requirements.

OBJECTIVES

The objectives of the project are: 1) To evaluate radio-tracking procedure and equipment

Figure 1. Diagram of the relationship between radio-tracking components and the location of animals



JUSTIFICATION OF PROJECT

Capturing, equipping, and monitoring deer with radio transmitters will provide biological data on longevity, disease, physical condition, herd composition and activities, breeding behavior, care of young, activity periods, food habits, and many other aspects of deer biology. One of the primary objectives of the project will be to study deer movements and home range, which will be important in evaluating present census techniques in Iowa and providing basic information for testing new techniques. The fact that the study will be conducted in the proposed Saylorville Reservoir area may be important to the future comparison of deer beharior in a changing habitat around large reservoirs. The need for more precise information on crop damage attributed to deer is emphasized by a question such as, "From how far away do depredating animals travel?" Another question concerning steps to be taken if reduction of a localized deer population becomes necessary is, "Over how wide an area must such a reduction be made?" As the deer herd in Iowa continues to grow, this deer - crop relationship becomes more important. The proposed study will try to evaluate the use of crops, such as corn, for feeding areas and protective cover.

The equipment cost of the proposed 2½-year project will be around $3,000. This may seem like an extreme expenditure for one project, but radio telemetry equipment is expensive and the type of data obtained from these techniques cannot be satisfactorily obtained in any other way. If the cost of the project is reduced to the cost per "unit of information" and compared to other studies, radio telemetry is actually inexpensive. This cost per "unit of information" may only be a few cents since thousands of animal locations can be plotted annually for each animal. With other deer movement studies such as trapping, marking, and releasing, only 10 - 15 observations may be made of one animal in a year. In some cases only one observation is made and that is when the animal is killed and a tag is returned. This type of information may cost from $5.00 - $10.00 per unit and still have no practical value since the observations are too widely separated to give any indication of home range or amount of daily or seasonal movement.

Colorado (Plenzlow, 1968), in an attempt to compare radio - tracking projects, developed a questionnaire concerning the type, amount, quality and methods of collecting big-game telemetry data. This questionnaire was mailed to 45 individuals and agencies during 1967 to determine status of other telemetry projects. Of 45 agencies contacted, 9 returned information on big game projects, 7 reported on various species other than American big game, 13 stated they were not involved with telemetry and 16 did not respond to the questionnaire. When asked the question, " Does the biological data gathered justify the expense of your program?" 5 of the 9 states reporting on big-game projects stated "Yes" while the remaining 4 states said they had not been conducting their projects long enough to answer this question.

PREVIOUS AND CURRENT WORK

White-tailed deer in southern portions of their range are not generally thought to have extensive seasonal movements (Schilling 1938; Hahn and Taylor, 1950; Progulske and Baskett, 1958). Alexander (1968) and Ellisor (1969) found that in Texas the average movement of whitetails was less than 1.5 miles. However, in more northern and mountainous regions, seasonal movements are common and sometimes pronounced. In Minnesota, Carlsen and Farmes (1957) found that deer in two different areas averaged movements of 5.1 miles and 9.7 miles. Severinghaus and Cheatum (1956) stated that in parts of Montana it was not uncommon for white-tailed deer to move from 10 to 20 miles.

The recent development and use of radio-tracking has enabled many investigators to closely monitor the seasonal and daily movements of white-tailed deer. Heezen and Tester (1967) found daily ranges of deer in Minnesota varied from less than ½-section, where the animals moved in a circular or zig-zag pattern, to straight - line movements of 2½ miles in linear-shaped home ranges. Marchinton and Jeter (1966) found that the minimum home range of deer in Florida and Alabama was 147 to 243 acres.

All radio-tracking techniques have certain limitations and restrictions which must be considered in the analysis of tracking data. Cochran and Lord (1963), Verts (1963), and Heezen and Tester (op. cit.) all describe the limitations in accuracy of radio locations while Marshall and Kupa (1963) and Slade et al. (1965) investigated the magnitude of the errors encountered. The accuracy of a location bearing using radio-tracking has been reported to range from $\pm 0.5^{\circ}$ with an automatic tracking station to $\pm 12^{\circ}$ with a portable unit. When using triangulation to locate an animal, this error must be doubled because two simultaneous bearings are being taken on each animal. However, the accuracy is not important in some aspects of movement studies when the radio location is primarily used to allow the investigator to approach close enough to visually observe the movements of the animals.

PROPOSED PROCEDURE

The proposed project will be conducted in three primary phases as follows:

1. Preparation and testing (5-8 mo.): The first step will be to determine the equipment requirements of the project and place an order to a commercial electronics company for the transmitters, receivers and antennas. This equipment will have to be built to set specifications and will probably take 3-6 months to deliver. During this waiting period a more complete literature review will be conducted of movement and telemetry studies. A ground and map reconnaissance will be

equipment capabilities using several penned deer. This period will also be a training period for equipment operators and will focus on the ability to determine animal behavior (resting, walking, running) from variations in the sound of the transmitter signal. From 2 to 4 semi-permanent, 30 foot antenna towers will also be constructed. These towers will be placed on high bluffs and will be used for location of animals by triangulation.

2. Collection of radio-tracking data (18 mo.): The first difficult part of this phase of the project will be to capture and equip 3 - 6 wild deer with transmitters. Capture methods will include baited Clover traps and drugs (succinylcholine chloride) injected by a syringe projectile fired from a powder charged, Palmer Cap-Chur gun. The most important phase of the project begins with the monitoring of radio signals from transmittered deer. The accuracy of the equipment will be constantly checked by locating a stationary animal by triangulation and then visually plotting the animal's location. Since the diel (entire 24 - hour period) movements of deer will be studied, some animals will be continually monitored for 24 hour periods. To obtain general movement patterns and habitat preferences animal locations will be plotted every 4 - 8 hours each day. There will also be some periods when locations are not made. Data will be recorded on special data cards (Figure 2). Climatological data will be collected and compared to animal movements. Daily maximum - minimum temperatures, average wind velocity, and barometric pressure will be collected on the study area while amount of precipitation, hours of precipitation, relative humidity, nebulosity on a 1-10 scale, daily snow depth, and hours of moonlight between sunset and sunrise will be furnished by the U. S. Weather Bureau Station in Des Moines. During the period of active research, modification of techniques or replacement of equipment will take place as necessary. Also progress reports on the project will be prepared as required.

Figure 2. Field data card for radio-tracking project

Date ______________	File No. ______________
Time ______________	Temperature ______________
Observer ______________	Wind Velocity ______________
Frequency ______________	Cloud Cover ______________
Location ______________	Rain or Snow ______________
Bearing	Comments

3. Compilation of data (4 mo.): All of the radio location and climatological data obtained during the study period will be analyzed and statistically evaluated with the aid of a computer. The area (in acres) of the home range of each deer will be ascertained by connecting all perimeter points or locations. (Figure 3). The study area will be divided into 6.4 - acre squares to aid in the determination of the center of activity. The number of daily animal locations falling into each square will be recorded with the center of activity being denoted by those squares containing the greatest number of locations (Figure 4). This system will also indicate habitat preferences since the vegetative composition of each square will be recorded and a comparison of habitat use to time of day and season of year will be made. Telemetry equipment and techniques will be reviewed along with the movement and home range data and a final report will be compiled on the project. At this time, plans will be made to either continue with the proposed project or transfer the equipment for use in a new study.

APPARATUS AND MATERIAL NEEDED

When working with radio transmitters a Federal Communications Commission license is required. An application on FCC form 440 will be completed before equipment is ordered. The specialized electronic equipment needed for the project is as follows:

1. Transmitters: The transmitters will be ordered from Davidson Electronics Company in Minneapolis, Minnesota. The transmitter components, batteries, and loop antenna will be encased in a waterproof acrylic substance. The total weight of the deer collar will be around 26 ounces and will have an estimated battery life of 10 months. The range of the transmitter will be 1 - 3 miles, but is very dependent on terrain, type of vegetation, height of antenna, atmospheric conditions, etc. The frequency of the transmitter will be in the 53 Mc range with a 20 kc spacing between units to distinguish each animal. This frequency range was chosen because it does allow fair penetration of land features and vegetation, reduces possibility of "bounce" or reflection of signal, is not within the citizen's band, and does not require a large antenna to provide good reception of signal. Both a pulsating and continuous wave signal will be tested to see which allows for most rapid signal recognition and which best indicates the movements of the animal. The pulsating signal should also increase the battery life of the transmitter.

2. Receiver: The receiver is probably the most important piece of radio-tracking equipment and the most expensive. The receiver will be a crystal controlled tracking receiver made specifically for game tracking by Markusen Electronic Specialities of Esko, Minnesota. It will contain 12 preset channels that can be used in tracking up to 12 different animals. One of the components of the receiver is an audio filter that can be switched in to give extra sharp selectivity and better signal - to - noise ratio. A meter is incorporated into

Figure 3. An example of determining home range by connecting lines drawn to perimeter location points.

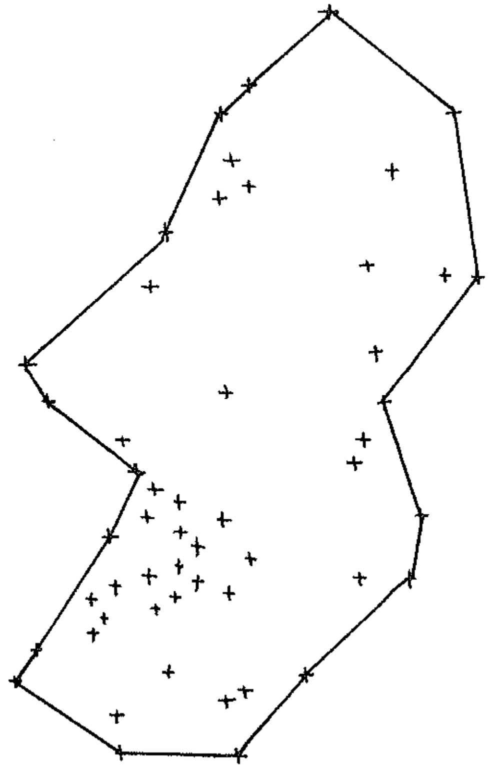
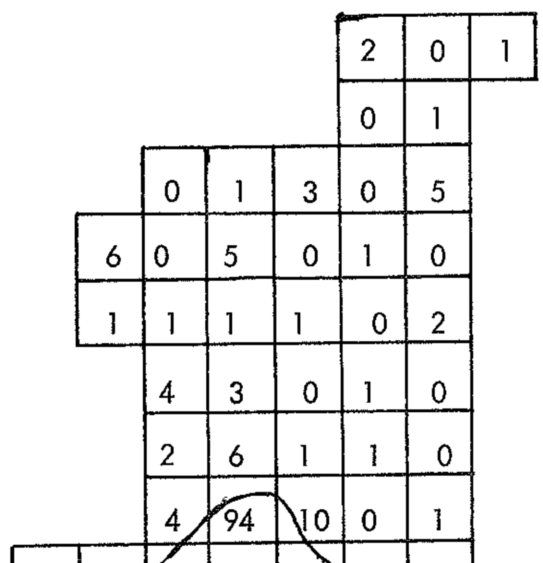


Figure 4. An example of determining center of activity by using number of locations in each 6.4 acre plot.



last 50 to 100 hours. A rechargeable nickle-cadmium battery can also be used. Headphones, necessary to eliminate outside noises, and a portable directional loop antenna are included with the receiver. One disadvantage to the receiver is that the efficiency of the transistors deteriorates at low temperatures. The receivers will be used in near zero weather so insulated carrying cases will be made for them. Handwarmers could also be used as a source of heat to maintain the efficiency of the system. The transmitters should not experience this difficulty since the body warmth of the animal and the insulating qualities of the encasing material should provide heat for normal operating efficiency.

3. Antennas: In addition to the hand held portable loop antenna that is furnished with the receiver, at least three "temporary directional antennas" (IDA) will be constructed. These will be 4-5 element Yagi antennas placed on 30 foot masts. They will be located at strategic positions around the study area and will have antenna wire leads that plug into the receiver. The TDA's will give a sharper bearing and greater range than the hand held antenna. The TDA's will be portable so that they can be moved around as the need arises and will be placed about $\frac{1}{4}$ - $\frac{1}{2}$ mile apart. The 30-foot mast for each antenna will be free to rotate so that the antenna can be turned in the direction of the signal, allowing the operator to record a bearing from a compass rosette attached to the antenna mast.

4. Two-way radios: A set of two-way radios will be purchased to allow the operators of each receiver - antenna station to transfer information of animal movements to each other. They will also be used for communications when one operator leaves an antenna station to visually locate an animal using the handheld portable antenna and receiver.

5. Equipment Costs:

Fiscal Year 1970

Quantity	Item	Total Cost
6	Deer transmitters ($85.00 ea.)	$510.00
2	Receivers, 12 channel ($531.00 ea.)	$1062.00
3	Yagi antennas ($49.50 ea.)	$148.50
3	30-foot towers ($25.00 ea.)	75.00
2	Portable two-way radios ($43.00 ea.)	86.00
1	Nickel - cadmium battery recharger	27.50

Fiscal Year 1971

Quantity	Item	Total Cost
4	Deer transmitters ($85.00 ea.)	$340.00
-	Data processing service	unknown
-	Cap-Chur gun projectiles, charges, drug, etc	65.00
-	Miscellaneous repairs and equipment replacement	300.00
	Total	$705.00

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CANADA GOOSE BANDING TRIP
Cape Churchill, Manitoba

Ron Andrews
Game Biologist

Dave Schafer, Assistant Area Manager, Missouri Department of Conservation, Trimble Wildlife Area and Harold Burgess, Refuge Manager, Squaw Creek NWR, picked me up in southwest Iowa on the morning of July 20 and we began our long trek northward. Our destination was Cape Churchill, Manitoba. Our mission was to assist Allan Pakulak of the Manitoba Game Branch in his Canada goose drive banding operations on the tundra lakes of Cape Churchill.

Burgess was going to La Perousa Bay on Cape Churchill to supervise the Queen's University (Kingston, Ontario) study group. Since 1968 the study group has been studying the genetic relations of the blue and white color phases of the blue goose in the La Perousa colony. Their camp was located about 23 miles east of Churchill. This was about half way between Churchill and Pakulak's camp on the Cape. Their banding operations netted them about 2,000 blue and snow geese of which 650 geese (mostly goslings) were leg banded and web tagged.

Our trip was initiated through the Mississippi Flyway Council's interest in knowing where the breeding grounds of the geese that use Swan Lake, Missouri are located. The Flyway Council is sponsoring a portion of Pakulak's work on the Cape. Pakulak is currently enrolled at North Dakota State University and his work at Churchill is part of his requirements for his Ph D. The states of Iowa, Missouri, and Minnesota are "footing" the majority of the money supplied by the Flyway Council. Missouri and Iowa are also providing one man each for the nest searching in June and one each for banding in late July and early August.

With the recent declines in duck populations, particularly the mallard waterfowl hunters are becoming increasingly interested in goose hunting, particularly for Canada geese as they are considered trophy birds. The Flyway Council and the states involved desire to maintain maximum goose hunting opportunites for the hunter but because of increased demand the council considers it necessary to build the Swan Lake post-hunting season goose flock from 123,000 to 200,000 within the next few years. Hopefully the biologists involved will be able to predict the fall flight and its magnitude once we better understand the nesting ecology, food habits, nutritive requirements, weather, and the mortality factors from the nest until the young bird gains flight. Pakulak hopes to determine if the nesting habitat available to the Canada geese in the area of the Cape is being used to its potential and if not how much can it be increased before stress, predation, and other factors become prevalent.

stopped at Winnipeg, and we spent the third day there making the appropriate reservations for points northward.

We decided the Delta Waterfowl Research Station on the southern tip of Lake Manitoba would be a worthwhile stop so we visited there on the fourth day. Al Hochbaum cordially greeted us and his youngest son, Peter, showed us around the area and discussed the various projects with which they are involved.

The Delta Waterfowl Station is a privately supported institution with contributions channeled through the North America Wildlife Foundation. Its overall objectives are two -- the production of well-trained waterfowl biologists and an increase of knowledge which may be useful to the management of waterfowl. Since its beginning in the 1930's, over 60 biologists have gained advanced degrees via Delta Research Station and some 20 major wildlife universities across North America, including Iowa State University. Over 150 scientific papers and three books based on Delta Investigations (Lyle Sowl's Prairie Ducks, H. Albert Hochbaum's The Canvasback on a Prairie Marsh and Travels and Traditions of Waterfowl) have had a marked influence on waterfowl management and policy throughout the continent. The Delta station houses one of the most extensive libraries on waterfowl biology and management in the world. Our visit at the Delta was one of the most interesting episodes of our journey northward. Incidentally, Pakulak is receiving some assistance from Delta for his Canada goose study at Churchill.

On Thursday, July 24 we arrived at La Pas, Manitoba. This was as far as we would go via automobile. Our reservations were confirmed with Trans Air, the Canadian Airlines of the north. Their motto is "If you don't care, fly Trans Air". However, what they lacked in convenience and plushness was more than made up by the good looking stewardess aboard. After a 13-hour lay over in Thompson we finally arrived at fog shrouded Churchill about 1:00 a.m., July 26 very eager to get down to the purpose of our journey. Bearded and looking like a northern bushman, Pakulak flew us to his camp on the Cape that morning. He indicated he would be back, weather permitting, in about 3 days.

Although camped about 45 miles out in the bush we had all the comforts of home. A quonset insulated tent was the roof over our heads and we had a refrigerator, cooking and heating stoves and enough supplies to last a month or longer if necessary. Because of a polar bear encounter at the camp last year we had an eight-foot high woven wire fence around our camp with two electric battery wires attached to use if a bear was in the area. We were equipped with two British 303 Enfield rifles and plenty of shells as a last resort. These were carried with us when we explored the bush. A good attitude of Pakulak's is if you are going to live out in the bush you might as well be as comfortable and safe as possible.

Brunswick who had assisted Pakulak during his spring nesting studies. McCarthy's assignment during the banding period was chief cook and bottle washer.

Pakulak and Schmidt were scheduled to make fix-winged brood survey flights for the next three days so during that time we made ourselves at home taking several hikes and exploring the tundra. Foggy, rainy weather set in and there we waited for nearly a week hoping that tomorrow would be the day that banding operations would begin.

Finally on August 2nd the helicopter returned to camp with all stations go for banding. They had banded approximately 27 geese near Churchill that morning.

Materials and Procedures

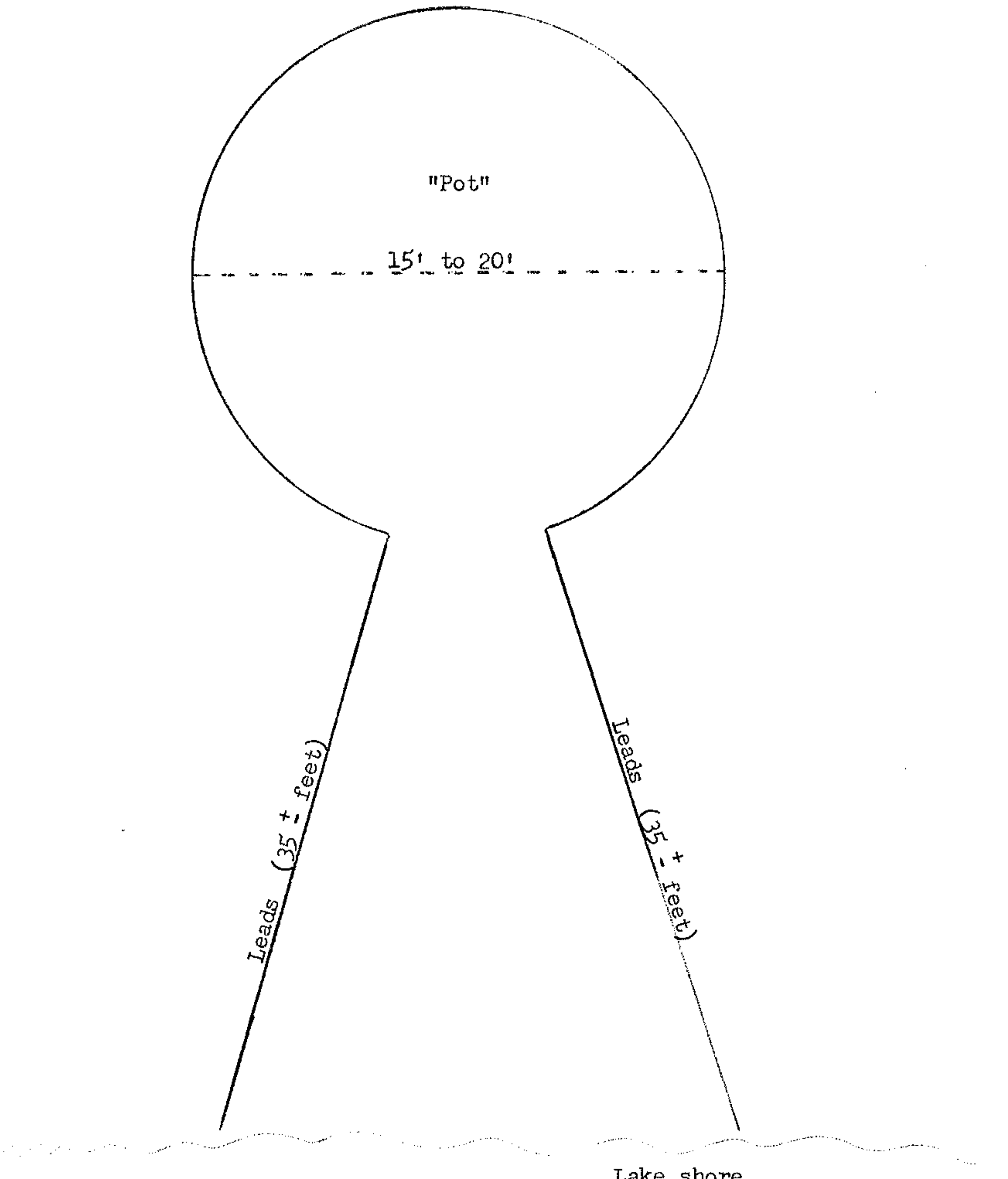
We split into two, 2-man crews - Schmidt and Schafer, and Pakulak and myself. From the fix-winged surveys of the previous week Pakulak had closely determined where the larger concentrations of geese were located. The pilot and two men would fly to the north end of the chain of lakes where the birds were previously located. When a suitable number of geese was sighted, we would pick out an area on shore to set up our trap. Preferably our trap location would be set up in an area with a gradual shoreline. The "chopper" would hover over the geese in the lake keeping them in a close knit flock. The two fellows would hurriedly set up the trap. The faster the trap was set up the better. It took us approximately 10 minutes to set up each drive trap site. We used a 50-foot circular trap (pot) consisting of chicken wire with 6-foot aluminum rods woven through it. Two 50-foot plastic net leads also with 6-foot rods woven through them were set in a funnel-like throat from the "pot" to the lake shore (Figure 1). Both the trap and the leads were staked down and once this was done the two fellows would head for the nearest cover and wait for the "chopper" to drive the birds into the trap. Quick action and efficiency were necessary because of the costly helicopter flying time.

Once the geese were in the trap the pilot would pick up the other two men and bring them to the site. There the four of us would age, sex, band and release the birds that were captured.

Eighteen trap sites were set up in an area extending from the Owl River some 100 miles southeast of Churchill to the Little Seal River nearly 35 miles northwest of Churchill. The majority of the geese were caught on inland tundra lakes; however, two sites were set up at the mouth of the Seal and Little Seal Rivers and well over 100 birds were caught.

Results

Approximately 1,060 birds were captured in our traps. A total of 937 geese was


"Pot"
15' to 20'
Leads (35 ± feet)
Leads (35 ± feet)
Lake shore

the majority were apparently nonbreeding adults. Because of rainy, foggy weather and thus nearly a week's delay in banding, many of the flocks of molting non-breeders had attained flight. Had these birds been incapable of flight we probably could have banded 300 more geese. However, the Flyway and the Manitoba Province wanted the emphasis placed on local birds, so everyone was well satisfied with the banding operations.

During the previous summer a total of 723 geese was banded, including 509 adults and 214 young. Table 2 gives a breakdown of the 1968 hunting season recoveries of bands placed on Canada geese at Cape Churchill during the summer of 1968. Although the number of recoveries is very small, it would appear that Missouri does harvest a large portion of the geese that nest on the Cape. However, we must be cautious of the differential band reporting rate from the breeding grounds to the wintering grounds.

Discussion

For many years the majority of goose banding that has been done has taken place on the wintering grounds. The information obtained from birds recovered has been helpful in determining migration routes and mortality of a particular flock of birds. The gap that occurred in the information from wintering ground banding was, "where are the birds that use a particular area produced?" In order to fill this gap, banding operations have to take place on the nesting and breeding grounds. In recent years several banding projects have been conducted on the nesting grounds of geese across the arctic and sub-arctic. In this way direct migratory routes, direct mortality, wintering areas, and nesting and breeding areas of a particular flock can be determined. Also by working with geese on their nesting grounds a more exact picture of yearly reproduction can be determined, and by late summer biologists may be able to predict the fall flights and their magnitude. When this can be done, hunting seasons and limits could be set accordingly.

Pakulak indicated that he thought production was good this year, but in comparison with the previous 2 years it would appear that at least two definite peaks of nesting occurred. The winter of 1968-69 was mild and fairly dry as far as arctic weather standards are concerned. Spring came early and some nesting was initiated early by some pairs. A 10-inch snowfall on June 10 delayed nesting activities of other pairs and consequently nesting and hatching took place over a much longer period. Pakulak indicated that the nesting period was 63 days during 1969 indicating the success of the early nesters as compared to those nesting successfully after the June snowstorm.

There has been some discussion and questions regarding the fact that it is likely that the birds that use Swan Lake, Missouri do not all come from the Cape Churchill area. The Flyway Council is interested in the possibility of expanding banding operations inland be unwise to "scuttle" or place less emphasis on Cape Churchill banding for at least another year. Another year would make an intensive 3-year banding and study program of the area and I feel that three years of data are necessary before any conclusions can be made on the Cape Churchill goose flock. Another large sample of banded birds would be helpful in establishing a life table for this particular flock.

Banding operations inland will be more costly than those in the Cape. If the Council and the states involved are willing to put more money and manpower into expansion of banding, then I would recommend some inland banding next year and be quite envious of the personnel making this adventure to the interior.

The most appalling thing I noted during our journey was the quickness with which the North is being changed and inhabited. Recent mineral surveys indicate that large quantities of oil, nickel, possibly uranium and other minerals are present under the permafrost of the far north. Modern day helicopters and light fixed-winged craft have given man and his modern day technology easy access to this country.

In ecologial terms the northern wilderness is a fragile place where each life form is linked to the others in a tenuous chain. As oil and mining encampments are established, the once untouched wilderness will become surrounded by mounds of diesel drums and whole acres will be awash with sewage and garbage. Debris, organic or inorganic, takes far longer to decompose in the Arctic than in warmer areas. Food wastes will last for months, paper will last for years, wood scraps will last decades, and metal and plastic will be almost immortal in this cold dry climate.

Caterpillar tractor treads have and will leave hundreds of miles of trails across the fragile tundra that will take 40 years to grow back to normal, if ever. A single "cat trail" cut in can erode into a permanent ditch and a chasm blocking natural drainage of the tundra and disturbing the balance of local wildlife in many ways. Pipelines, docks, gravel mining for airstrips and trails will greatly alter the migratory habits of many of the northern fish and wildlife species. Just how great a disturbance this will have on the balance of wildlife, ecologists can only guess at now. What was once believed to be the inconquerable last frontier of the north will vastly be altered within the next 15 years.

Late on August 9th we departed from Churchill via train to La Pas. We arrived in La Pas August 10th and left for Winnipeg early the next morning. Our route to Winnipeg took us through the Minnedosa Prairie pothole country of southwest Manitoba. This is one area where canvasback reproduction has deteriorated so drastically since 1964. In 1964 a research biologist tabulated 7 broods of canvasback per mile. In 1968 only one brood per two miles was found. However, with last summer's drought-breaking rains biologists at Rochester. Raveling has and will be neck banding these birds to follow their behavior patterns, migration routes, and mortality to Rochester and other wintering areas.

We visited the Manitoba Game Branch Office and discussed the Churchill banding and its future with Gene Bossemier, chief biologist for Manitoba. Enroute home we visited the Northern Prairie Waterfowl Research Station at Jamestown, North Dakota and Sand Lake NWR in South Dakota. All stops were quite interesting and educational and the entire trip was most enjoyable and interesting.

Table 1. Canada geese banded at Cape Churchill, Manitoba, August, 1969

Date	IM	IF	IU	Total immatures	AM	AF	AU	Total adults	Grand total
8-2-69	16	17		33	23	15		38	71
8-3-69	91	92		183	58	54	1	113	296
8-4-69	23	22		45	43	45		88	133
8-5-69	50	45	1	96	80	77		157	253
8-7-69*	5	4		9					9
8-8-69	11	7		18	3	5		8	26
8-9-69	59	53	—	112	16	21	—	37	149
Totals	255	250	1	496	223	217	1	441	937**

* These 9 birds were run down on foot from a group of 14 young.

** Approximately 110 foreign birds (birds banded elsewhere or in previous years) were also captured. About 20 birds previously banded a few days before were also retrapped.

Table 2. 1968 hunting season recoveries of bands placed on Canada geese at Cape Churchill in 1968*

	Adult	Young	Total
Total Banded	509	214	723
Recoveries			
Manitoba	2	1	3
Minnesota	5		5
Iowa	1	2	3
Missouri	8	9	17
Louisiana		1	1
	16	13	29

* Compiled by the Manitoba Game Branch on July 30th, 1969

IOWA'S LATE SUMMER PHEASANT POPULATION - 1969

Richard C. Nomsen
Game Biologist

INTRODUCTION

The August roadside pheasant count is the primary source of information on the status of the pre-hunting season pheasant population. There were 174 routes checked by Conservation Officers, Game Section personnel and Biologists in 1969. A preliminary indication of reproductive success is also obtained from pheasant broods reported on July rabbit and quail routes.

Pheasants experienced a long, rough winter in Iowa. The adverse winter weather conditions caused above normal mortality in the northwest region of our pheasant range. Temperatures for April averaged 1-3 degrees above normal and were near normal for the month of May. Melting snow and frequent rains kept fields wet which delayed field work. Only 20 percent of the oats was planted by April 20 compared to the average of 75-80 percent. June was a cool, cloudy and wet month which caused a delay in hay mowing.

RESULTS AND DISCUSSION

Birds Per Mile

There were 7,910 pheasants sighted on the 174 routes (5,220) miles censused, for an average of 1.52 birds per mile (Table 1). This count showed a decrease of 14 percent from the 1.76 birds per mile reported in 1968.

Changes recorded in the various regions showed considerable variation. The southern region reported a 9 percent increase while the results obtained in northwest Iowa indicated a 45 percent decrease. A 31 percent decrease was recorded in the southwest region but the population figure remained high for the state. Results of the roadside survey indicated no change in the central region and slight decreases in north central and eastern Iowa.

Broods Per 30-Mile Count

There were 1,034 broods sighted on 174 routes for an average of 5.9 broods per 30-mile count compared to 6.5 broods per count in 1968. Decreases were recorded in the western third of the state but more broods were reported elsewhere in the pheasant range.

Average Brood Size

The statewide average brood size for 1969 was 5.8 chicks per brood (Table 3). The largest broods were reported in north central Iowa.

Young per Hen

Pheasant reproductive success improved again this year. The young per hen index for 1969 was 5.0 compared to 4.5 young per hen in 1968 and 3.5 in 1967. Reproductive success was above the state average in the north central, east and south regions. Production appeared to improve in northwest Iowa compared to 1968 but was below average for this year. The young per hen index in southwest Iowa was below the state average and also indicated a lower rate of production than in 1968.

Hatching Date Distribution

The hatching dates of 1,027 broods were determined from age information recorded on the survey forms. The peak hatching period occurred during June 1-20 which was similar to 1968 (Table 4). This information was quite surprising when one compares general weather conditions for the past two years. Early spring weather seemed to be much more favorable in 1968 which would indicate a better production year. Wet field conditions in 1969 apparently were very misleading. Actually, the average temperature for April, 1969 was 51.1^{o} compared to 51.5^{o} in 1968. The average temperature for May was also near normal but frequent rains delayed planting of crops.

Pheasant Broods Sighted on Quail and Rabbit Counts

Pheasant broods sighted along rabbit and quail survey routes were recorded and used as indicators of hatching success (Table 5). Statewide, there were 5.4 broods reported per 100 miles in 1969 compared to 6.5 broods per 100 miles in 1968.

SUMMARY

1. Pheasants experienced a long, rough winter in Iowa. The adverse winter weather conditions caused above normal mortality in the northwest region of our pheasant range.

2. Temperatures for April averaged 1-3 degrees above normal and were near normal for May. Melting snow and frequent rains delayed field work.

3. A total of 174 routes was checked in 1969 - observers recorded an average of 1.52

5. Reproductive success appeared to be good to excellent in the eastern two-thirds of Iowa - slightly below average in the western third of the pheasant range. Results of this survey indicated much better production than was expected. Apparently, nesting activity began on schedule even though wet fields delayed field work.

Table 1. Results of the 1969 August roadside pheasant counts, and comparison with 1968 results

Region of state	No. of counts	No. miles driven	Total no. birds sighted	Birds per mile	1968 birds per mile	% Change from 1968
Northwest	30	900	631	0.70	1.28	-45%
North Central	27	810	1493	1.84	2.00	-8%
Southwest	22	660	1501	2.27	3.31	-31%
Central	28	840	1539	1.83	1.85	same
East	31	930	1493	1.61	1.72	-6%
South	36	1080	1253	1.16	1.06	+9%
STATEWIDE	174	5220	7910	1.52	1.76	-14%

Table 2. Comparison of number of broods sighted on August roadside pheasant counts in 1969 and 1968

Region of state	No. broods sighted	Broods per 30 mile count	No. broods sighted 1968	1968 broods per count	% Change in broods
Northwest	74	2.5	138	4.8	-48%
North central	171	6.3	170	6.5	-3%
Southwest	201	9.1	287	12.5	-27%
Central	208	7.4	196	7.0	+6%
East	211	6.8	223	6.2	+10%
South	169	4.7	167	4.2	+12%
STATEWIDE	1034	5.9	1181	6.5	-9%

Table 3. Data from 1969 August roadside pheasant count

Region of state	No. of cocks	No. of hens	Sex Ratio Index M:F	Hens without Brood	Hens with brood	% Hens with brood	No. of chicks	N yo per
Northwest	111	99	1:0.9	46	53	53.5%	421	4
North Central	133	225	1·2.0	72	153	68.0%	1135	5
Southwest	132	247	1:1.9	84	163	66.0%	1122	4
Central	145	238	1:1.6	82	156	65.6%	1156	4
East	113	214	1:1.9	52	162	75.7%	1166	5
South	111	177	1:1.6	48	129	72.9%	965	5
STATEWIDE	745	1200	1:1.6	384	816	68.0%	5965	5

Table 4. Distribution of the 1969 Iowa pheasant hatch by regions and statewide for 1968-69 (figures giv
percentages by 10-day periods)

Date of Hatch		Northwest	North Central	Southwest	Central	East	South	STA
May	1-10	-	-	-	-	-	-	
	11-20	-	2.0	-	1.8	6.5	.5	
	21-31	13.7	4.3	7.4	7.7	10.8	8.5	
June	1-10	20.5	16.3	38.3	24.0	32.9	39.7	2
	11-20	45.2	38.1	15.4	29.3	21.6	17.6	2
	21-30	9.6	27.1	20.4	19.2	13.5	17.0	1
July	1-10	10.9	8.7	12.4	11.5	9.2	9.0	1
	11-20	-	3.8	4.4	5.8	4.8	4.5	
	21-31	-	-	.9	.9	.5	2.8	
Aug.	1-10	-	-	-	-	-	-	
	11-20	-	-	-	-	-	-	
No. Broods in Sample		73	184	201	208	185	176	1

Table 5. Pheasant broods observed on 1969 mid-July rabbit roadside survey and quail whistling counts

Region of State	Rabbit Survey No. Miles	Rabbit Survey No. Broods	Rabbit Survey Broods per 100 Miles	Quail Survey No. Miles	Quail Survey No. Broods	Quail Survey Broods per 100 Miles	Combined 196[illegible] No. Miles	Combined No. Broods	Combined Bro[illegible] 100[illegible]
Northwest	450	23	5.1	130	4	3.1	580	27	[illegible]
North Central	420	31	7.4	120	4	3.3	540	35	[illegible]
Southwest	390	20	5.1	110	10	9.1	500	30	[illegible]
Central	450	25	5.6	160	7	4.4	610	32	[illegible]
East	450	23	5.1	160	9	5.6	610	32	[illegible]
South	570	23	4.0	200	17	8.5	770	40	[illegible]
STATEWIDE	2730	145	5.3	880	51	5.8	3610	196	[illegible]

RESULTS OF THE 1968-69 TRAPPER QUESTIONNAIRE AND FUR BUYERS REPORTS

Ron Andrews
Game Biologist

Iowa is one of the leading states in fur production. Nearly a million dollars worth of fur is harvested in Iowa each year. To properly manage this fur resource we must have good information to assess the annual harvest.

Prior to 1966, fur buyer reports were the only measure of Iowa's fur harvest. In 1966-67, a trapper questionnaire was initiated to compare fur dealer harvest reports with trapper reports. Commission personnel generally feel that fur dealer report totals are not entirely satisfactory because of incomplete returns, inaccurate recording, and other inherent biases.

METHODS

A 30 percent sample of licensed trappers is drawn from the duplicate file of trapping licenses. Approximately 2,000 of 6,477 licensed Iowa trappers were contacted in 1969 after the long haired trapping season closed. Sampling was stratified according to the number of licenses sold in each county.

Each cooperator is mailed an instruction letter and card at the close of the trapping season. Trappers are asked to record the number of each of the 12 listed furbearers they trapped during the season, whether their furs were sold in or out-of-state, and the average price they received for their furs (see Figure 1).

Fifteen percent of the total licensed trappers returned 982 cards for a response of 49 percent of those sampled.

The trapper questionnaire indicated that 90.0 percent of the trappers caught muskrats, 71.1 percent trapped raccoon and 62.9 percent trapped mink. The number of muskrat trappers were down about 10 percent from last year while raccoon trappers increased nearly 5 percent over the previous year (Andrews, 1968). The number of mink trappers increased nearly twofold over last year. These figures do not necessarily reflect the true number of trappers pursuing a particular species as in some instances animals are caught incidental to trapping others, and in other cases individuals may have attempted to capture a particular species but were unsuccessful. The twofold increase in mink trappers might be reflective of the increased pelt price paid for natural mink.

Furbearer harvest data is presented in Table 1 with comparative figures from the pre-

All species showed substantial gains in fur value over the previous season. Raccoon and fox pelt prices nearly doubled over the previous season (see Table 4). The supply of fur harvested and the demand for fur in Europe as well as the fashion trends generally determines the annual increase or decrease in fur value.

DISCUSSION

The most significant result of the survey is the discrepancy that exists between total harvest figures computed from the trapper questionnaire and those from the fur dealer reports (Table 3). This is particularly evident for some species, especially when taking into account the fur buyer's purchase of pelts of some species taken by hunters -- fox and raccoon primarily. The 15 percent sample of Iowa trappers should produce reasonable harvest figures. If there is any bias in the data because of trappers who caught the most fur being more likely to send back the postcard, this should be offset by the fact that non-licensed trappers (primarily farmers and farm boys) were not sampled (Phillips, 1967). However, their catch is believed small in comparison to that of licensed trappers.

The low harvest figures as indicated by the fur dealers reports are likely a result of poor record keeping by the dealers reporting their fur purchases. Also 7 dealers did not report their purchases and this may alter the harvest figures slightly. However, these are probably dealers who purchase little or no fur, or at least not enough to significantly narrow the gap between the trapper questionnaire data and the fur dealer data.

According to the questionnaire, less than 20 percent of Iowa harvested furs are sold to out-of-state dealers. If we consider all these factors together, the gap between harvest figures is somewhat more explainable. The important thing is that trend information is readily obtainable from either survey, with the trapper questionnaire probably being more reliable.

It is also interesting to note how the harvest of each species is closely correlated with increases or decreases in pelt prices (Table 4). These prices are not necessarily a reflection of the true price received by Iowa trappers because they are computed from the averages of a few of the larger fur dealers purchase furs from smaller ones. Because of the middle man involved, the prices are probably slightly above what the trapper actually received. However, yearly trends in prices are shown. It would appear from the figures in Table 4 that 1968-69 fur prices were higher than they had been for several years. Total fur value was nearly $1,355,000. This is double the 1967-68 fur value and higher than it has been since the early 1960's.

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Figure 1. Iowa Trapping Record, 1968 - 69 Season (Postcard form sent to trappers)

County (s) Trapped ______________________________

Species	Total Number Trapped	Number sold to Iowa fur buyer	Average Price Received	Number sold to out-of-state buyers	Average price received
Muskrat					
Mink					
Raccoon					
Beaver					
Red Fox					
Gray Fox					
Coyote					
Opossum					
Civet					
Skunk					
Badger					
Weasel					

Table 1. Results of 1968-69 Iowa Trapper Questionnaire, With a Comparison of the 1967-68 Results

Species	Percent reporting trapping this species		No. reported trapped		Avg. catch/ trappers		expa
	1967-68	1968-69	1967-68	1968-69	1967-68	1968-69	1967-68
Muskrat	99.9	90.0	66,202	72,694	69.0	88.6	421,430
Mink	29.7	62.9	3,376	4,120	3.5	6.5	16,337
Raccoon	65.6	71.1	7,320	10,680	7.6	14.8	40,761
Beaver	27.1	22.9	1,846	1,617	1.9	6.9	12,196
Red Fox	22.6	33.3	1,931	3,737	2.0	11.5	12,145
Gray Fox	4.5	10.6	97	116	1.1	.2	608
Coyote	3.2	4.4	144	184	1.5	4.4	822
Opossum	26.6	29.4	920	1,578	1.0	5.4	4,368
Civet	4.5	3.8	80	67	.8	1.6	414
Skunk	13.9	41.6	459	456	.5	3.7	1,656
Badger	3.0	4.4	42	88	.4	1.8	149
Weasel		.9		14		1.4	
						Total pelts -	510,886

* In 1967-68, 1,045 trappers responded while in 1968-69, 982 trappers reported their take.

Table 2. Furs Purchased from Iowa Trappers as Reported by Iowa Fur Dealers in 1968-69 Season*

Species	Number Purchased	Percent change from 1967-68	Avg. price per pelt	To
Muskrat	232,133	-9	$ .92	$213,
Mink	12,974	-10	11.44	148,
Raccoon	128,228	+59	4.62	592,
Beaver	5,221	-34	14.41	75,
Red Fox	27,661	+153	10.39	287,
Gray Fox	729	+79	2.62	1,
Coyote	4,922	+508	5.94	29,
Opossum	6,413	+165	.64	4,
Civet	308	-31	1.06	
Skunk	1,290	+38	1.83	2,
Badger	287	+26	2.25	
Weasel	47	-42	.52	
Total Pelts	420,213	+14	Total value	$1,355,

* A total of 115 of 122 licensed dealers reporting.

Table 3. A Comparison of the Total Fur Harvest for 12 Major Species for the 1968-69 Season as Indicated by
Reports and the Trapper Questionnaire

Species	No. pelts reported bought by Iowa fur buyers*	No. reported sold to Iowa fur buyers by trappers**	No. reported sold to out-of-state fur buyers by trappers**	Total repor Iowa
Muskrats	232,133	466,422	138,027	604,
Mink	12,974	24,037	2,421	26,
Raccoon	128,228	61,628	6,526	68,
Beaver	5,221	9,491	735	10,
Red Fox	27,661	21,063	3,812	24,
Gray Fox	729	137	0	
Coyote	4,922	1,183	71	1,
Opossum	6,413	10,282	514	10,
Civet	308	394	0	
Skunk	1,290	9,930	0	9,
Badger	287	513	0	
Weasel	47	82	0	
Total pelts	420,213	605,162	152,106	757,

* From fur buyers reports (includes pelts taken by hunting for some species)

** Computed from trapper questionnaire

Table 4. A Four Year Comparison of the Average Price Paid per Pelt, 1965-66, 1966-67, 1967-68, 1968-69

Species	1965-66	1966-67	1967-68	1968-69
Raccoon	$2.17	$2.47	$2.63	$4.62
Opossum	.28	.40	.36	.64
Muskrat	.98	1.32	.70	.92
Mink	7.84	7.83	8.08	11.44
Civet	1.66	2.56	1.37	1.06
Skunk	.88	.91	.95	1.83
Badger	1.16	1.90	1.90	2.25
Red Fox	3.02	5.80	4.12	10.39
Gray Fox	1.30	1.39	1.52	2.62
Weasel	.40	.43	.25	.52
Coyote	1.50	4.22	1.95	5.94
Beaver	8.44	8.07	10.80	14.41

* Average price paid/pelt was computed by averaging the prices paid by some of the larger fur dealers.

AGE COMPOSITION OF THE 1969 DEER HERD

Paul D. Kline
Game Biologist

Age data has been collected annually starting in 1953 when we held our first modern shotgun season for deer. Through the years this data has been used variously to demonstrate the high productivity of the deer herd and to prove the apparent high turnover in population components (scarcity of older age classes).

In 1968 the state was divided into four Zones for shotgun hunters. Since hunters were assigned to specific Zones it was possible to make separate collections for comparison of age data by Zones. Also, comparisons could be made with 1967 data.

Construction of life tables has permitted insight into the welfare and effect of hunting on Iowa's deer herd.

METHODS

Biology and game management personnel were asked to visit locker plants after the shotgun deer season to examine harvested deer. These personnel recorded ages of deer they encountered and collected lower jaws in most cases. The jaws were labelled with license numbers of hunters who bagged the deer. All jaw bones and recorded data were submitted to the Biology Section for data analysis.

By using license numbers and from information provided by Data Processing, State Comptroller's Office, it was possible to determine Zones where deer had been harvested. Zonal delineation has been presented in Kline, 1969, for the 1968 season and in Kline, 1968, for the 1967 season.

The data was worded into life tables for the state and for each of the four Zones. Contingency tables using Chi-square were used to test the significance of differences in data from the various Zones and for comparing 1967 and 1968 data.

RESULTS

From the bag of 12,941 legal gun kills in 1968 (Kline, 1969) jaws were collected from 1,589. Four hundred and three were from Zone 1, 644 from Zone 2, 197 from Zone 3, and 301 from Zone 4. The remainder (44) were from unknown locations. All were aged in the laboratory.

by the percentage of fawns (45.9) in the population. This can be interpreted to mean 54.1 adult deer (bucks and does) produce 45.9 fawns annually. This converts to 84.8 percent annual production. The death rate for 1967 (Kline, 1968b) was 60.6 percent. Mean expectation of life ranged from 1.52 years for fawns to 0.95 years for 4½ year old deer in 1968.

The death rate for deer from Zone 1 (Table 2) was 57.7 percent. Mean expectation of life ranged from 1.51 years for fawns to 0.83 years for 5½ year-olds. For Zone 2 (Table 3) the death rate was 52.9 percent and mean expectation of life varied from 1.57 years for fawns to 0.90 years for 7½ year-olds. Death rate for Zone 3 (Table 4) was 57.6 percent. Mean expectation of life ranged from 1.48 years for fawns to 0.83 years for 5½ year-olds. For Zone 4 (Table 5) the death rate was 59.2 percent, and mean expectation of life varied from 1.46 years for fawns to 0.69 years for 5½ year-olds.

Differences in age structure between the Zones (Table 6) was apparent only between Zones 2 and 4 and between Zones 3 and 4. However, these differences were not statistically significant. Differences were found between 1967 and 1968 age structure. These were significant at the 0.02 level of confidence. It would appear that the major portion of this change in age structure of the deer herd between 1967 and 1968 occurred in Zone 4 (Table 7).

Table 8 shows age composition of the deer herd for 1953, 1954 through 1962, 1968, and 1968. It is apparent that the herd at present is composed of more young and fewer old deer than in 1953 and 1954-62.

DISCUSSION

It is noteworthy that no significant differences in age structure were found between Zones in 1968. There was a difference between southeast and south central (Zone 2) and northwest and north central (Zone 4) areas in 1967. Perhaps our continued restrictions on hunting in Zone 4 has begun to pay off with less mortality and increased expectation of life. More likely it is a combination of increased mortality in southern Iowa and decreased mortality in northern Iowa through hunting pressure.

Hunting certainly has been the responsible agent for change in age structure from 1953 to 1968. We now have a much larger percentage of young and fewer old deer than in 1953. Our herd is not only younger, but, also, healthier and more productive. The only disadvantage is the fact that there is less chance of bagging trophy sized bucks than in 1953.

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Results of Iowa's first deer season in recent years. Proc. Iowa Acad. Sci. 61) 615-630.

Table 1. Life Table based on Deer Aged in 1968, Statewide

Age Class	Number Dead	Deaths per 1,000	Number Survivors per 1,000	Death Rate per 1,000	Mean Number Alive between Age Classes	Mean Expectation of Life
Fawn	730	460	1,000	460	770.0	1.52
1½	415	261	540	483	409.5	1.38
2½	253	159	279	570	199.5	1.21
3½	106	67	120	558	86.5	1.14
4½	60	38	53	717	34.0	0.95
5½	15	9	15	600	10.5	1.10
6½	6	4	6	667	4.0	1.00
7½	2	1	2	500	1.5	1.00
8½	2	1	1	1,000	0.5	0.50

Table 2. Life Table based on Deer from Zone 1.

Age Class	Number Dead	Deaths per 1,000	Number Survivors per 1,000	Death Rate per 1,000	Mean Number Alive between Age Classes	Mean Expectation of Life
Fawn	180	447	1,000	447	776.5	1.51
1½	113	280	553	506	413.0	1.32
2½	65	161	273	590	192.5	1.17
3½	25	62	112	554	81.0	1.13
4½	14	35	50	700	32.5	0.90

Table 3. Life Table based on Deer from Zone 2

Age Class	Number Dead	Deaths per 1,000	Number Survivors per 1,000	Death Rate per 1,000	Mean Number Alive between Age Classes	Mean Expectation of Life
Fawn	292	453	1,000	453	773.5	1.57
1½	160	248	547	453	423.0	1.46
2½	106	165	299	552	216.5	1.26
3½	50	78	134	582	95.0	1.20
4½	26	40	56	714	36.0	1.18
5½	4	6	16	375	13.0	1.88
6½	3	5	10	500	12.5	1.70
7½	2	3	5	600	3.5	0.90
8½	1	2	2	1,000	1.0	0.50

Table 4. Life Table based on Deer from Zone 3

Age Class	Number Dead	Deaths per 1,000	Number Survivors per 1,000	Death Rate per 1,000	Mean Number Alive between Age Classes	Mean Expectation of Life
Fawn	94	477	1,000	477	761.5	1.48
1½	54	274	523	524	386.0	1.36
2½	23	117	249	470	190.5	1.32
3½	16	81	132	614	91.5	1.04
4½	7	36	51	706	33.0	0.89

Table 5. Life Table based on Deer from Zone 4

Age Class	Number Dead	Deaths per 1,000	Number Survivors per 1,000	Death Rate per 1,000	Mean Number Alive between Age Classes	Mean Expectation of Life
Fawn	142	472	1,000	472	764.0	1.46
$1\frac{1}{2}$	79	263	528	498	396.5	1.33
$2\frac{1}{2}$	51	169	265	638	180.5	1.15
$3\frac{1}{2}$	12	40	96	417	76.0	1.28
$4\frac{1}{2}$	12	40	56	714	36.0	0.84
$5\frac{1}{2}$	4	13	16	813	9.5	0.69
$6\frac{1}{2}$	1	3	3	1,000	1.5	0.50

Table 6. Results of Contingency Tables used to Test Significance of Difference in Age Structure of Deer from 1968 Zones

Zonal Comparison	Chi-square	D. F.	0.50 Value	0.05 Value
1 with 2	2.0689	5	4,351	------
1 with 3	2.7933	4	3.357	------
1 with 4	2.2685	5	4,351	------
2 with 3	2.9018	4	3,357	------
2 with 4	4.8362	5	4,351	11.070
3 with 4	6.1529	4	3,357	9.488

Table 7. Results of Contingency Tables used to Test Significance of Differences in Age Structure from 1967 and 1968

Zonal Comparison 1968	1967	Chi-square	D. F.	0.50 Value	0.05 Value	0.02 Value
Statewide	Statewide	13.3901	5	4.351	11.070	13.388
1	1	3.5815	4	3.357	9.488	------
2	2 & 3	1.6897	5	4.351	------	------
3	4 & 5	1.6818	4	3.357	------	------
4	6	12.1217	4	3.357	9.488	11.668

Table 8. Comparison of Age Composition of Deer Herds for 1953[1], 1954-62[2], 1967, and 1968

Age Class	Percent of Total Sample			
	1953	1954-62	1967	1968
Fawn	30.0	41.7	41.0	45.9
1½	21.3	25.5	32.0	26.1
2½	23.5	18.1	15.0	15.9
3½	12.9	8.9	7.5	6.7
4½	8.4	3.7	3.6	3.8
5½ and older	3.9	2.1	0.9	1.6

1 from Sanderson and Speaker, 1954.

2 from Kline, 1965.

RESULTS OF 1969 RABBIT SURVEYS IN IOWA

Gene Hlavka
Game Biologist

INTRODUCTION

The July rabbit roadside counts were conducted in 1969 for the 20th consecutive year. Since 1959 this survey has been conducted with only slight modifications. Conservation Officer, Biology and Game Section personnel conduct the rabbit counts from July 10 to 20. In 1968 all routes were standardized as 30-mile routes. Starting at sunrise, observers drive 20-25 mph and record the number of rabbits sighted and, in addition, the number of quail, Hungarian partridge, and pheasant broods sighted along the routes. Although this July rabbit survey was developed to obtain an index of abundance to the cottontail population, jackrabbits were also surveyed starting in 1958.

Rabbit age was recorded as adult or juvenile on the basis of size alone. Age ratios and the fall population index were computed from this data. Data obtained for other game sighted on the rabbit surveys was submitted to biologists assigned to the various species. Similar data on rabbits obtained from quail and pheasant surveys are documented in this paper.

RESULTS

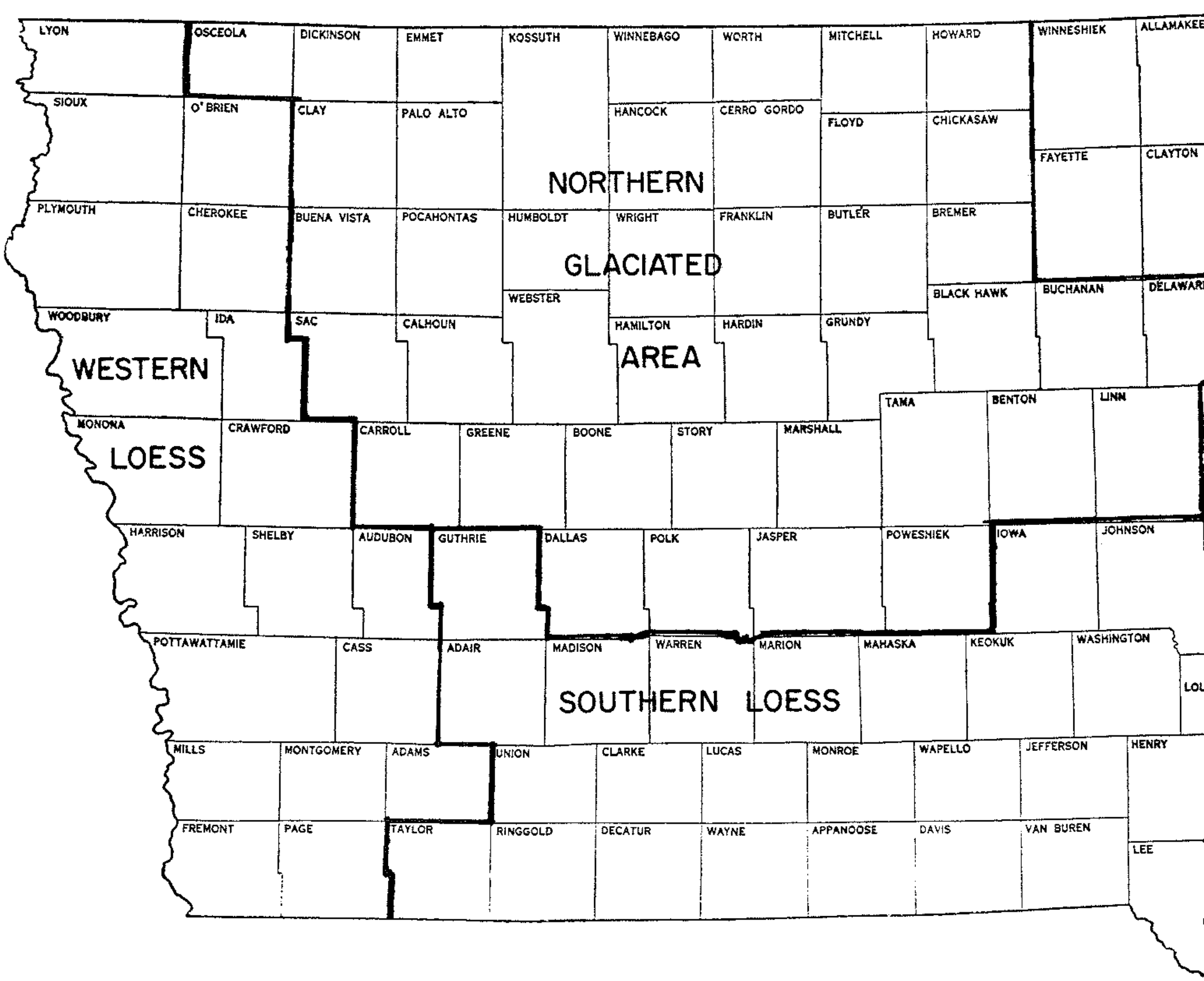
Ninety three routes were surveyed this summer. The statewide index of abundance to the cottontail population for 1969 was 4.24 cottontails sighted per 10 miles, which was down 33 percent from the 6.36 index of 1968 (Table 1). The 1969 statewide index is down 16 percent from the 19-year average, 4.24 vs 5.07 (Table 2). The four years from 1951-54, 1956 and 1962 had lower indexes than the 1969 index.

Cottontails again are most abundant in the Southern Loess area (Figure 1) which has a 1969 index of 7.48 (Table 2). This index is down 22 percent from the 1968 index of 9.62 but only 6 percent from the 19-year average. The Western Loess area is second in importance as far as cottontails are concerned. The 1969 index of 5.08 is 39 percent below the 1968 index of 8.31 but slightly below the 19-year average of 5.83.

The Northern Glaciated area showed a 50 percent decline --- 2.16 in 1969 vs 4.31 in 1968. The 1969 index is 42 percent below the 19-year average. The Eastern area is the only area with an index above the 19-year average --- a gain of 29 percent.

The statewide juveniles-per-adult cottontail ratio for 1969 was 1.93 (Table 3).

Figure 1. Regions of state used for analysis of rabbit survey data



Rabbits are also counted on the July quail whistling survey and the August roadside pheasant survey. On the July quail whistling survey the statewide index dropped 35 percent --- 4.53 in 1969 vs 6.99 in 1968 (Table 4). On the August roadside pheasant survey the statewide index declined 16 percent --- 2.20 in 1969 vs 2.63 in 1968 (Table 5). The quail and pheasant surveys substantiated the previous indication that the best cottontail populations are in the Southern Loess area.

The spring pheasant surveys indicated that statewide our rabbit brood stock was down 42 percent --- 1.72 in 1969 vs 2.99 in 1968 (Table 6). The greatest decline from the 1968 brood stock occurred in the Northern Glaciated area (65 percent): the least decline (18 percent), in the Eastern area.

Jackrabbits are also counted on the preceding four surveys. The statewide jackrabbit index obtained from the July rabbit survey dropped 55 percent--- 0.05 jackrabbits sighted per 10 miles in 1969 vs 0.11 in 1968 (Table 1). In the primary jackrabbit range this decline was 63 percent --- 0.07 in 1969 vs 0.16 in 1968. The 1969 jackrabbit brood stock, as indicated by the spring pheasant surveys, declined 62 percent from that of last year. The jackrabbit decline figures may not be very accurate because none of the surveys is designed especially for jackrabbits.

DISCUSSION

Winter and spring weather in 1969 was just too adverse for rabbits. A good supply of rabbits was not on hand to greet the spring. The rabbits also did not fully recover during the production season. This was especially true in northern Iowa.

At the end of February the winter season was the coldest and snowiest in 4 years, the iciest in at least 16 years and one of the cloudiest of record. March was cold and dry. Only thrice in the 20th century had March been appreciably colder. April temperatures were near normal. But crop planting was delayed by melting snow and wet fields. May was unusually cloudy and yet with near seasonal precipitation and temperatures. June was the coolest June since 1945 and was outstanding for extensive cloudiness, low evaporation and wetness. July was rainy, humid and cloudy (Climatological Data - Iowa, for months concerned).

Weather is the chief factor that affects the short-term trends in population levels of small game animals. With the type of winter and spring weather experienced in 1969, it is not surprising that the population level of rabbits declined.

SUMMARY

Spring pheasant survey, cottontails down 42 percent.

Quail whistling survey, cottontails down 35 percent.

July rabbit survey, cottontails down 33 percent.

August pheasant survey, cottontails down 16 percent.

4. The fall population index indicated a 32 percent decline in the cottontail rate of production.

5. Winter and spring weather of 1969 was unusually adverse for rabbits.

Table 2. Comparison of rabbit indexes of abundance for 20 years, 1950-69, expressed as cottontails sighted per 10 miles

Year	Northern Glaciated	Western Loess	Southern Loess	Eastern	STATEWIDE
1950	3.87	4.75	6.83	2.22	4.29
1951	3.37	6.69	5.68	2.13	3.92
1952	3.70	6.74	6.14	1.78	4.18
1953	2.70	4.26	4.23	3.33	3.31
1954	2.97	3.90	4.55	2.36	3.35
1955	4.60	3.55	6.03	5.31	4.96
1956	3.06	3.51	5.99	4.44	4.07
1957	3.32	4.72	7.59	4.79	4.87
1958	4.68	8.76	12.95	4.65	6.86
1959	4.36	7.92	10.46	4.66	6.33
1960	4.62	5.07	5.41	1.80	4.56
1961	4.25	6.12	6.58	2.19	4.79
1962	2.94	3.53	6.67	1.80	3.88
1963	4.19	5.27	10.17	3.87	5.61
1964	4.79	6.95	11.27	4.18	6.69
1965	3.95	5.11	11.59	4.31	6.05
1966	4.09	6.92	10.12	3.94	6.07
1967	3.96	8.67	9.86	3.87	6.11
1968	4.31	8.31	9.62	4.84	6.36
19-yr. avg.	3.72	5.83	7.99	3.50	5.07
1969	2.16	5.08	7.48	4.50	4.24

Table 3. Age ratios of cottontails sighted during July survey, 1969

Area	No. of adults	No. of juveniles	Juveniles per adult 1969	Juveniles per adult 1968
Northern Glaciated	113	166	1.47	1.75
Western Loess	69	129	1.87	1.13
Southern Loess	164	352	2.15	2.30
Eastern	57	132	2.32	2.16
STATEWIDE	403	779	1.93	1.85

Table 4. Rabbit indexes of abundance obtained from July quail whistling survey, 1969

Area	No. of miles	Cottontails sighted	Cottontails per 10 miles 1969	Cottontails per 10 miles 1968	Jacks sighted	Jacks per 10 miles 1969	Jacks per 10 miles 1968
Northern Glaciated	390	109	2.79	4.31	5	0.13	0.10
Western Loess	120	59	4.92	8.92	1	0.08	0.00
Southern Loess	230	156	6.78	12.00	0	0.00	0.00
Eastern	140	75	5.36	4.31	0	0.00	0.00
STATEWIDE	880	399	4.53	6.99	6	0.07	0.10

Table 5. Rabbit indexes of abundance obtained from August roadside pheasant survey, 1969

Area	No. of miles	Cottontails sighted	Cottontails per 10 miles 1969	Cottontails per 10 miles 1968	Jacks sighted	Jacks per 10 miles 1969	Jacks per 10 miles 1968
Northern Glaciated	2,310	192	0.83	1.31	44	0.19	0.20
Western Loess	780	153	1.96	3.11	8	0.10	0.06
Southern Loess	1,320	637	4.83	5.20	0	0.00	0.00
Eastern	720	148	2.06	1.46	1	0.01	0.01
STATEWIDE	5,130	1,130	2.20	2.63	53	0.10	0.10

Table 6. Rabbit indexes of abundance obtained from spring pheasant surveys, 1969

Area	No. of miles	Cottontails sighted	Cottontails per 10 miles 1969	Cottontails per 10 miles 1968	Jacks sighted	Jacks per 10 miles 1969	Jacks per 10 miles 1968
Northern Glaciated	1,602	123	0.77	2.23	21	0.13	0.44
Western Loess	503	93	1.85	3.79	8	0.16	0.06
Southern Loess	1,100	360	3.27	4.50	0	0.00	0.05
Eastern	540	68	1.26	1.53	0	0.00	0.02
STATEWIDE	3,745	644	1.72	2.99	29	0.08	0.21