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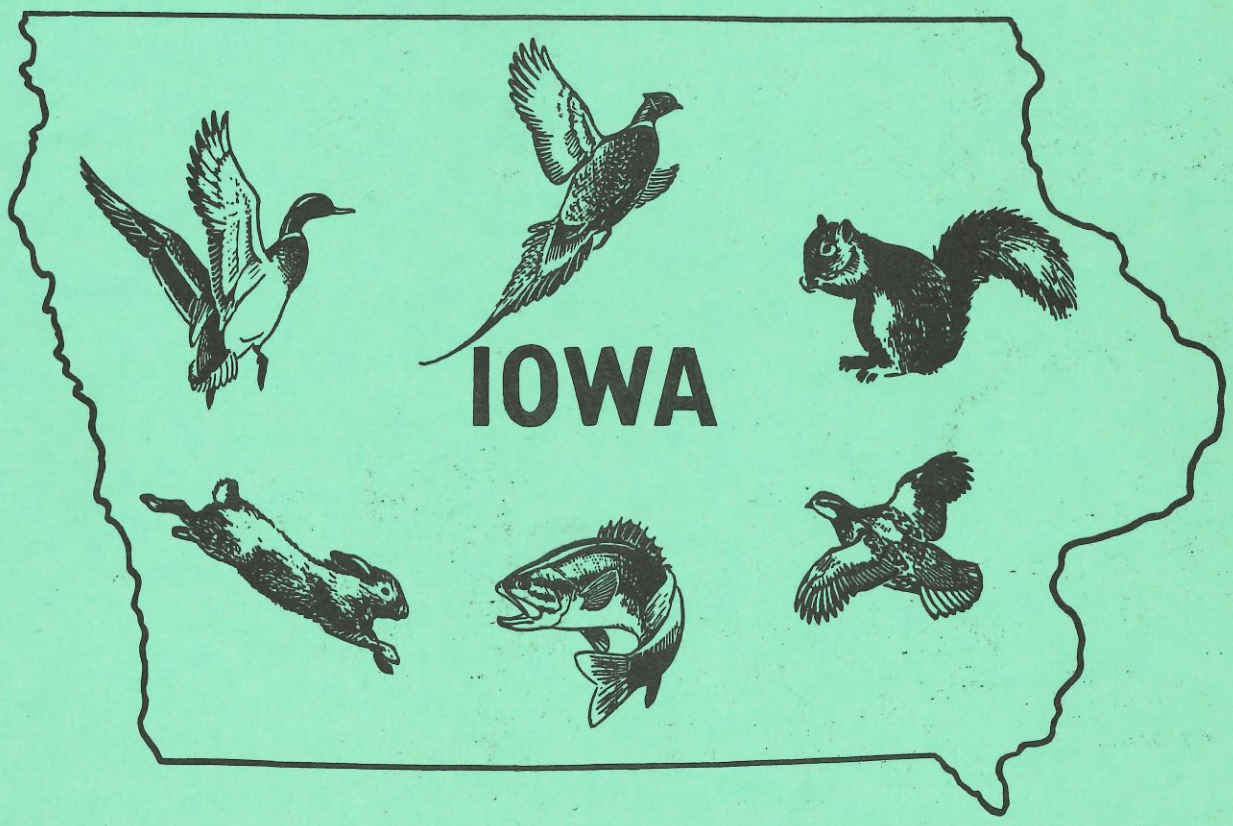
QUARTERLY BIOLOGY REPORTS



FISH AND GAME DIVISION — BIOLOGY SECTION

STATE CONSERVATION COMMISSION

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EVALUATION OF FARM GAME HABITAT AREAS - RICE LAKE UNIT

Richard C. Nomsen
Game Biologist

An evaluation program of existing Farm Game Habitat areas in the Rice Lake Game Management Unit was initiated in 1965. A total of 47 such areas was checked and evaluated in relation to pheasants and other small game. The size of areas varied from 1 to 6 acres with an average of 2 acres. A total of 90,390 shrubs and trees was planted, of which 29.5 per cent survived. Shrubs were the most numerous species and had the best survival rate. Survival of conifers was very poor - only 5.3 per cent. Nesting cover appeared to be very good on most areas although a few showed evidence of grazing. Most areas lacked adequate winter cover.

RESULTS OF THE 1965 PHEASANT HUNTER SURVEY

Richard C. Nomsen
Game Biologist

A random sample consisting of 5,000 names was drawn from the duplicate files of license sales following the 1965 season. Results were used to determine the number of pheasant hunters, the total number of birds killed and distribution of hunting pressure. The survey indicated that 80.1 per cent (220,275) of the 275,000 resident licensees hunted pheasants during the 51-day season. They bagged a total of 1,075,000 pheasant in 1965. There were 42,500 birds bagged by 6,000 non-resident hunters. Hunters in northwest Iowa shot an estimated 11,500 huns during the season.

RESULTS OF THE POSTAL CARD SURVEY FOR SQUIRREL, FOX, RACCOON, AND WOODCHUCK HUNTERS IN THE 1965-66 SEASON

Robert L. Phillips
Game Biologist

The results of a portion of the 1965-66 postal card survey are presented in this report. Of the hunters responding to this survey, 44 percent hunted squirrels, 15 percent hunted foxes and coyotes, and 6 percent hunted raccoons. The expanded data revealed a harvest of 1,236,400 squirrels, 88,330 foxes and coyotes, and 254,361 raccoons. Detailed information on hunter effort for each species is given. A discussion is presented on the validity of questionnaire data for calculating the annual harvest of foxes, coyotes and raccoons.

QUAIL STUDIES ON TWO AREAS IN SOUTHERN IOWA SHOW INCREASED POPULATIONS AND EARLY-SEASON HUNTING ACTIVITY

M. E. Stempel
Game Biologist

Gene Hlavka
Game Biologist

Two quail study areas are located in southern Iowa south of Highway 34. One area lies in Wapello County; the other, in Decatur and Wayne Counties. Population estimates are based on the number of coveys flushed, birds per covey and covey sign. Dogs are used in locating coveys. The 1965-66 winter estimate of 364 quail on both areas combined was 39 percent higher than the 1964-65 estimate. This increase was a result of successful reproduction and high survival during the following mild winter. The 1965 fall population on both areas combined was also higher than the 1964 fall population. Hunting activity reported by farmers was heaviest in November (53%); the lightest, in January (21%).

IOWA'S 1965 SEPTEMBER TEAL SEASON

Richard Bishop
Game Biologist

Iowa held an experimental teal season for the first time in September of 1965. A 9-day season was held from September 11th to the 19th. A total of 17,018 permits was issued, of which 68 per cent of the permit holders hunted. Iowa hunters killed 49,041 blue-winged teal and 5,203 green-winged teal with an average kill of 3.88 teal per active hunter. Iowa had the third highest teal kill in the Mississippi Flyway, and also experienced a 21 per cent crippling loss. Ninety-seven spy-blind observations were made during the season and revealed that 34 per cent of the parties violated the law. The illegal kill was 7,270 ducks; however, this is only a small per cent of the fall duck kill and is not significant. The teal season was considered highly successful.

ESTIMATIONS OF WINTER DEER POPULATIONS BY DIRECT CENSUS 1964-1966, WITH COMPARISONS TO STATISTICALLY DERIVED ESTIMATES

Keith D. Larson
Game Biologist

A winter deer population of 25,573 was reported by officers for 1965 and 28,482 were reported for 1966 This represents an increase from 1964 of 31.9% to 1966 and a 11.3% increase from 1965 to 1966. A fall population of 48,419 is indicated based on the average annual reproductive rate of 70 fawns: 100 adults. A lack of snow cover during the 1965-1966 period hampered sight records, and made it more difficult to estimate the herds. A good snow cover the preceding winter revealed an above average increase to the herd. A county-by-county examination of kill records, success rates and total mortality by the author lead to an estimate of 31,878.

WEST OKOBOJI LAKE WALLEYE STUDY - 1964-65

Terry Jennings
Fisheries Biologist

During the 1964 walleye spawning run, 469 adult walleyes 11.3 inches and over were marked with monel metal strap tags attached to the upper jaw. Electro-fishing gear aided in the capture of 86 per cent of the tagged fish. Of this total, 82.5 per cent were tagged at Pillsbury Point and 3.5 per cent were tagged at Pikes Point. The remaining 14 per cent of the walleyes were tagged following capture by gill nets.

Insufficient data were collected to make a valid population estimate. However, the 35 tags voluntarily returned indicated a minimum angler harvest of about 7.5 per cent. Movement of the tagged walleyes is also discussed.

A DESCRIPTION OF THE WAPSIPINICON RIVER DRAINAGE WITH REFERENCE TO THE FISHES OF THE PROPOSED CENTRAL CITY RESERVOIR

Robert Schacht
Fisheries Biologist

A pre-impoundment study of the Wapsipinicon River near Central City will be initiated in 1966 to measure the effects of a dam proposed by the Corps of Engineers. Presently the dam is only in the planning stage and it is not known when construction will begin. The paper discusses the drainage area of the Wapsie, land use, dams, precipitation, flow records, fish surveys, and creel census results. A list of fishes taken from Cleary's Annotated List of Fishes of the Wapsipinicon River is included, with expected changes noted.

MISSOURI RIVER OX-BOW LAKE FISHERY PART 2: WALLEYE AND SAUGER

Bill Welker
Fisheries Biologist

Walleye and sauger populations in five Missouri River ox-bow lakes were studied during 1961, 1963, and 1964 by the Iowa Conservation Commission, Nebraska Game, Forestation and Parks Commission, and the United States Fish and Wildlife Service. Three of the lakes are open to the river at their lower end. The remaining two lakes are separated from the river by levees. Walleye and sauger rank about third or fourth in abundance amoung all game fish in each lake. More sauger than walleye were caught at most lakes during all three surveys. Reproduction by either fish appears limited. In general, the limited growth data indicates the growth of both walleye and sauger does not differ greatly from the growth of walleye and sauger caught in the majority of other midwestern waters. Mean total lengths of both sauger and walleye were considerably larger in 1963 and 1964 in those lakes separated from the river than in those lakes open to the river Also, there was a significant lack of both walleye and sauger over 16 inches in those lakes open to the river when compared to the lakes separated from the river. This indicates possible movement into the river by the larger walleye and sauger from those lakes open to the river.

EVALUATION OF THE UTILIZATION OF I 1/2-INCH AND 3-INCH BAR MEASURE BUFFALO NETS ON DES MOINES RIVER

Gary L. Ackerman
Fisheries Biologist

Controlled management of rough fish populations on inland Iowa rivers is not feasible by utilizing either 3-inch or I 1/2-inch bar measure buffalo nets. The mechanics of fishing this gear was limited due to excessive flooding, which resulted in the 3-inch nets being inoperable 87 percent per unit of effort and I 1/2-inch nets being inoperable 5 percent per unit of effort.

The data indicated that production of 3-inch nets was low, but the large mesh size allowed for the escapement of game and sub-adult rough fish species. This gear demonstrated selectibility for rough fish species. A comparison based on percent by number of total production showed that smallmouth buffalo, carpsuckers, and carp composed 98.7 percent of the catch.

Production of I 1/2-inch buffalo nets was different. The catch per unit of effort was higher, but production was largely game species. Channel catfish composed 72.7 percent of the catch and carp and carpsucker composed 26.2 percent of the catch.

EVALUATION OF FARM GAME HABITAT AREAS - RICE LAKE UNIT

Richard C. Nomsen
Game Biologist

Introduction

Land use changes in Iowa during the past 20 years have caused a considerable change in wildlife habitat. These changes have been most pronounced on our more fertile soils and there is little doubt that the great reduction of wildlife cover has reduced populations of farm game such as the pheasant. Restoration of habitat on private lands was initiated soon after World War II by planting small areas with suitable cover plants and fencing to protect them from grazing. However, with the trend toward more intensive farming, to areas that were offered for development were more often than not unsuitable for any other farm management practice. Areas such as drainage ditch banks, gravel pits, wet lands along creeks and steep slopes in over-grazed pastures were good examples of tracts offered for the Farm Game Habitat program. Habitat improvement on such areas certainly has its limitations.

An evaluation program of existing Farm Game Habitat areas in the Rice Lake Game Management Unit was initiated in 1965. All such areas in the 8-county unit were to be checked and evaluated in relation to pheasants and other small game. A single page evaluation sheet was prepared for use in gathering data such as plant survival, nesting cover, winter cover and location in relation to existing wildlife habitat.

Results

Records of 64 plantings were obtained from the files at Rice Lake. Of this total, 7 were previously reported as inactive and 4 did not list the number and species of plants. One agreement listed two areas of 4 and 2 acres but when located, actually consisted of at least 40 acres of conifers. Of the remaining 52 areas, 47 were checked and five were not located.

Size

The size of areas varied from 1 to 6 acres with the average just under 2 acres (Table 1). Several others were listed as fence-row plantings and did not specify size.

Table 1. Size of Farm Game Habitat Areas in Rice Lake Unit

Acres	# of F G H Areas
1	15
1.5	7
2	10
3	6
4	3
5	0
6	1

Survival of Plants

The following data includes all plantings made from 1950 to 1964 that were checked or previously reported as being inactive. Only those areas listing the number and species planted were used.

A total of 90,390 shrubs and trees were planted of which 26,710 had survived for an average of 29.5 per cent survival. Survival on 18 areas was less than 25 per cent - on 15 others from 26-50 per cent of the plants lived. More than 50 per cent survival was recorded for the remaining 14 plots.

Species planted and survival of each are listed in Table 2. Shrubs were by far the most numerous species and had the best survival rate - an average of 35.2 per cent.

Multiflora rose was planted on 31 areas and 30.3 per cent of 55,025 plants survived. Survival was best in the southern tier of counties but in most cases did not provide a solid hedge. It appeared that group plantings in protected areas might furnish good escape cover. Honeysuckle was planted on 24 areas and several row plantings appeared to be complete. Dogwood seemed to do best in wet areas where honeysuckle and multiflora rose died out. Ninebark had good survival and furnished good cover where used in several adjacent rows. Most shrub row plantings could have been improved by early replacement of seedling shrubs within the border plantings.

Wild plum was used on 27 areas but survival was quite low. Group plantings provided much better cover than when planted in rows. This was also true of Russian Olive.

Survival of conifers was very poor (Table 2). This was quite disappointing due to the fact that nearly all areas checked could have used better quality winter cover. Red cedar was used on 3 areas and had the best survival. Austrian and Red Pine were each used on 14 areas and it appeared that Red Pine survived best in the plantings. Survival of Jack Pine was apparently close to zero - it was used on 6 areas. Survival of other species was limited to a few scattered individuals. Three cooperators complained that evergreens had been stolen for Christmas trees. One cooperator suggested that trees from a nearby planting had been removed and used elsewhere.

Nesting Cover

Nesting cover appeared to be very good on most (31) areas. Evidence of grazing was noticed on 7 areas. Fences, where needed, were in good condition with the exception of a couple that crossed creek beds.

Winter Cover

Areas were rated on winter cover needs for a normal winter. All areas would need extra cover for very severe blizzards. One-third were rated good but 5 of these were aided by

by volunteer growth - usually of willows in wet areas. Another 17 were rated average and 12 poor.

Location

Considering the type of area offered for development, location was rated good in 26 cases: 13 were average and 5 were poor. The need for such areas is quite evident in north-central Iowa.

Discussion

The artificial improvement of wildlife habitat by the development of Farm Game Habitat areas was started in Iowa soon after World War II. Land use changes during the war and since that time have caused a serious deterioration of wildlife habitat. Small tracts of land were accepted from cooperators for development. Because of the extreme variation of the areas offered, it was very difficult to classify and evaluate them. Each unit should be examined and evaluated in relation to the existing conditions in the immediate vicinity.

Areas should be chosen carefully, and only cooperators showing a sincere interest in wildlife and the hunting of wildlife should be included in the program. Cooperators should be informed that habitat restoration takes time and not be impatient as the area develops.

Safe winter cover should receive priority in north central Iowa. A clump of conifers protected by several rows of shrubs could form the primary development feature of most areas. This could be added to existing areas as well as planned for new ones. In some cases, a large thicket of shrubs would furnish the necessary protection.

Safe undisturbed nesting cover can be provided, as in the past, by fencing the area. Wherever stock is present, fencing appears to be very important.

Once an area is planted, periodic checks should be made to plant the necessary replacements and to renew the cooperator's interest. Sincere and interested cooperators deserve a top notch area - and one that shows results.

Farm Game Habitat areas will never replace the enormous loss of natural wildlife habitat in north central Iowa. However, word of a successful planting will soon get around to interested neighbors. They in turn might be interested enough to inquire about the program. A program such as this must be sold through individuals.

Table 2. Survival of Plants in Farm Game Habitat Areas in Rice Lake Game Management Unit

	Area	No. Planted	Survived	Percent Survival
Red Cedar	3	150	20	13.3%
Austrian Pine	14	4000	243	6.1%
Pond. Pine	4	250	3	1.2%
Red Pine	14	2865	310	10.8%
White Pine	4	850	50	5.9%
Jack Pine	6	3475	0	0
White Spruce	3	150	0	0
Douglas Fir	2	140	0	0
		11,880	626	5.3%
Russian Olive	12	3900	485	12.4%
Wild Plum	27	3700	652	17.6%
		7600	1137	15.0%
Dogwood	9	1450	628	43.3%
Honeysuckle	24	12,360	6755	54.7%
Ninebark	7	1675	875	52.2%
Caragana	1	400	0	0
Multiflora Rose	31	55,025	16,690	30.3%
		70,910	24,948	35.2%
GRAND TOTAL		90,390	26,711	29.5%

RESULTS OF THE 1965 PHEASANT HUNTER SURVEY

Richard C. Nomsen
Game Biologist

A random sample consisting of 5,000 names was drawn from the duplicate files of license sales following the 1965 season. Names were selected from each county according to the number of hunting and combination hunting-fishing licenses sold. This total also included 135 names drawn from the duplicate files of non-resident hunting license sales. A record card and letter of instructions were mailed to each person selected requesting information about the previous hunting season.

The 51-day season opened on November 13, and closed January 2, 1965 with shooting permitted from 8:30 a.m. to 4:00 p.m.. The daily bag limit was 2 cocks and the possession limit was 6 roosters.

A total of 2,142 cards was received from resident hunters which was 44 per cent of the sample mailed. There were 78 returns from nonresident hunters which was a 58 per cent response. Total license sales for 1965 consisted of 165,000 hunting, 110,500 combination and 6,500 non-resident licenses. The total licensed hunters decreased 9 per cent from the previous year.

Results of the survey indicated a substantial decrease in the statewide harvest of pheasants. Complete statewide statistics are given in Table 1 for both resident and non-resident hunters. These figures include only licensed hunters - no figures are available for persons hunting on their own land without a license, or those under 16 hunting with a licensed adult. It is believed that their omission would tend to balance any bias in the data obtained due to non-response and the possibility that hunting results were poorer for those that did not respond.

The total kill of cocks during the 1965 season was 1,117,500 which was 36 per cent less than in 1964. It must be noted that the seasons of 1963 and 1964 produced record kills in Iowa. The 1965 August roadside count had indicated a 39 per cent decline in the fall population. The statewide pheasant population was similar to that in 1959 when the hunter survey indicated a total kill of 1,070,000 roosters.

The survey also showed that more time was required to bag a rooster in 1965 (Table 2). In addition to the lower population, corn harvest was delayed about 2 weeks which made hunting more difficult. The delay in crop harvest was most noticeable in the northeast part of the pheasant range.

There were 21 per cent fewer hunting trips for pheasants reported in 1965. The average hunter made 5.0 trips during the season to bag 4.9 birds - nearly one bird per trip.

Seasonal hunting pressure was quite evenly distributed throughout the pheasant range with very little change from 1964 (Table 3). Northwest and north central Iowa supported 32.2 per cent of the hunting pressure and contributed 33.0 per cent of the kill. Although the 1965 counts in these two regions indicated a 55 per cent decrease, the harvest decreased only 37 per cent. There appeared to be a slight increase in hunting pressure in the southern

Table 1. Statewide Pheasant Hunting Statistics from the 1965 Postal Card Survey

	Resident	Non-Resident	Total
Statewide Bag - Pheasants	1,075,000	42,450	1,117,450
Total Hunting Hours	4,146,700	141,450	4,288,150
Total Hunting Trips	1,105,780	26,480	1,132,260
Number Hunting Pheasants	220,275	5,460	225,735
Per Cent Hunting Pheasants	80.1	91.0	80.5
Avg. No. Trips per Hunter	5.02	4.85	4.92
Avg. No. Gun Hours per hunter	18.83	25.91	18.89
Avg. No. Bagged per Hunter per Season	4.88	7.78	4.91
Avg. No. Bagged per Trip	0.97	1.60	1.00
Avg. No. Bagged per Gun Hour	0.26	0.30	0.26
Avg. No. Hours per Bird	3.86	3.33	3.83
Avg. No. Hours per Trip	3.75	5.35	3.82

Table 2. Summary of Statewide Hunting Success, Iowa, 1964 and 1965

	1964	1965
Resident Hunters		
Per Cent of Licensees Hunting Pheasants	87.5%	80.1%
Avg. No. of Hunting Trips	5.3	5.0
Avg. Season Kill Per Hunter	6.4	4.9
Hours per Pheasant Killed	3.0	3.8
Estimated Total No. of Pheasant Hunters	263,460	220,275
Estimated Total No. of Hunting Trips	1,401,600	1,105,800
Estimated Total No. of Pheasants Killed	1,673,000	1,075,000
Non-Resident Hunters		
Per Cent of Licensees Hunting Pheasants	93.7%	91.0%
Avg. No. of Hunting Trips	4.4	4.9
Avg. Season Kill per Hunter	8.2	7.8
Hours per Pheasant Killed	2.7	3.3
Estimated Total No. of Pheasant Hunters	7,825	5,460
Estimated Total No. of Hunting Trips	34,100	26,500
Estimated Total No. of Pheasants Killed	64,400	42,450

Table 3. Distribution of Hunting Pressure and Pheasant Kill by Agricultural Districts, Iowa, 1964 and 1965

	Percentage of Trips		Birds Killed	
	1964	1965	1964	1965
1. Northwest	16.8%	16.2%	295,400	186,600
2. North central	16.2%	16.0	283,200	178,800
3. Northeast	14.7	13.1	251,900	129,600
4. West central	14.2	14.5	255,400	166,500
5. Central	13.1	12.9	241,500	139,700
6. East Central	13.6	14.3	205,000	137,500
7. Southwest	6.8	7.8	125,100	108,400
8. South central	3.4	4.1	59,100	53,600
9. Southeast	1.2	1.1	20,800	16,800

range, however, the total harvest decreased slightly. Hunting pressure and total kill were quite even in all other areas.

More hunters reported shooting hungarian partridge in 1965. A total of 88 huns were reported killed by 34 hunters. Estimates from these limited samples showed that 11,500 huns were harvested in 1965 compared to 7,000 in 1964. Most birds were shot by pheasant hunters.

The selectees were also asked if and where they hunted opening weekend, and how many birds were bagged. Eighty-three per cent of the hunters indicated that they hunted during the first two days and each killed an average of 1.6 birds. Total kill on opening weekend represented 27 per cent of the season kill. With the exception of several high population counties hunting pressure was quite evenly distributed over the northern two-thirds of the state (Table 4). It was observed that opening weekend pressure was much lighter in the north central region in 1965 then in 1963 (questionnaire asked only for opening day results that year, but is assumed there would be no great difference between the two)

Table 4. Distribution of Hunting Pressure - Opening Weekend, 1965, and Comparison with Opening Day in 1963.

District	Per Cent of Hunting Pressure on Opening Weekend in 1965	Per Cent of Hunting Pressure on Opening Day in 1963
1. Northwest	13.5%	14.0%
2. North central	14.3%	17.4%
3. Northeast	14.1%	15.9%
4. West central	12.6%	11.2%
5. Central	15.5%	14.5%
6. East central	14.4%	14.5%
7. Southwest	9.5%	8.5%
8. South central	4.3%	3.2%
9. Southeast	1.8%	0.8%

RESULTS OF THE POSTAL CARD SURVEY FOR SQUIRREL, FOX, RACCOON, AND WOODCHUCK HUNTERS IN THE 1965-66 SEASON

Robert L. Phillips
Game Biologist

Introduction and Methods

This paper reports on one phase of the postal card survey of licensed Iowa hunters for the 1965-66 season. The methods used in this survey were essentially the same as described by Kline (1965). One additional method used this year was to check to see whether the early respondents gave a different response pattern than the later ones. This was used only for squirrel hunters because of the small sample of cards for the other species. In analyzing the data, the sample was split into three groups: 1) those cards returned the first 15 days after mailing 2) cards returned during the second 15-day period after mailing and 3) cards returned after the mailing of the second postcard for the fox, rabbit, and quail survey.

Results and Discussion

Response

Sales of resident and non-resident hunting and combination licenses totaled approximately 281,000 in 1965. Of the 5,000 cards sent out for the squirrel, pheasant and duck survey, 44 percent responded. On the fox, coyote and raccoon survey, there was a 33 percent response. Complete tabulation of data on four species appears in Table 1.

Squirrels

Of those reporting, 44 percent hunted squirrels. The expanded data indicates that 123,640 hunters spent 2,225,520 hours harvesting 1,236,400 squirrels in 1965. The hunting effort figures (Table 1) agree closely with the 1964-65 postal card survey data. Analyses of the data in three sampling groups revealed no significant differences in the response pattern of the early and late returns by hunters.

Foxes and Coyotes

Iowa fox and coyote hunters comprised 14.6 percent of the licensed resident hunters. This compares with 19.5 percent in 1964-65 and 17.6 percent in 1963-64. The drop in the number of fox and coyote hunters may possibly be attributed to the lack of snow during the winter months. Despite poor hunting conditions, the expanded data indicates a harvest of 88,330 foxes and coyotes in 959,585 hours of hunting.

There has consistently been a big gap between the total fox and coyote harvest as given by the postal card survey and the reported number of animals bountied in the state. The postal survey indicated 121,124 foxes were killed in the 1963-64 season and approximately 90,000 in 1964-65. The bounty records for these years however, do not indicate the harvest was actually this high. For instance, 55,357 foxes were bountied in 1963 and 48,930 in 1964.

These are estimated bounty figures because five counties did not pay bounties in these years. It is possible that some fox are killed which are not bountied, but it is doubtful that the number would fill the 30,000 to 40,000 gap. It is my belief there is some sort of sampling error inherent to the postal survey which causes an overestimated fox harvest. The method of calculating the average number of foxes killed per hunter is statistically sound. This figure (2.2 fox killed per hunter per year) was exactly the same for the 1963-64 and the 1965-66 seasons.

It is my opinion that the error in the postal survey comes from overestimating the percent of the total licensed hunters that participate in fox and coyote hunting. Possibly this group of hunters respond differently to the survey than the average hunter and consequently biases our estimates upwards. Although there is no available evidence, I doubt that as high as 20 percent of the hunting public are fox hunters. If this figure were around 10 percent, the postal survey harvest figure and the bounty records would more closely agree.

Raccoon

Raccoon hunters represented 6.2 percent of licensed hunters. The expanded data reveals 463,425 hours were expended in bagging 254,361 raccoons. Again, the total harvest for this species far exceeds a comparable record such as the fur buyer reports. I believe the raccoon hunter may be similar to the fox hunter in his response pattern. Possibly these hunters are proud of killing large numbers of raccoons and foxes and every individual of this type that gets a card responds to the survey.

Woodchuck

Woodchuck hunting is a relatively minor sport as compared to other species. This was the first year woodchuck were included on the postcard, this being done in order to gain some idea of the amount of such hunting that does take place in the state. Because of the small number of returned cards that contained woodchuck hunting data on them, the confidence limits on the figures presented in Table I would be rather wide, however it should be remembered that prior to this year there was no measure of the amount of woodchuck hunting, and the information presented is thus the best available at present.

Literature Cited

Kline, Paul D. 1965. Postal card surveys of squirrel, rabbit, fox, and coyote hunters for the 1964-65 season. Iowa Conservation Commission, Quarterly Biology Reports 14 (2): 44-49.

Table 1. Results of the postal card survey for squirrel, fox, coyote and raccoon, woodchuck, 1965-66 season.

Species	Percent of all Hunters Hunting Species	Statewide Bag	No. Hunting This Species	Total Hours Hunted	Total Hunting Trips Made
Squirrel	44	1,236,400	123,640	2,225,520	704,748
Raccoon	6	254,361	17,422	463,425	114,985
Fox and Coyote	15	88,330	40,150	959,585	277,035
Woodchuck	1	13,480	3,135	48,280	14,420

Species	Avg. Trips /Hunter/ Season	Avg. Hours/ Hunter/ Season	Avg. Hours/ /Hunter/ Trip	Avg. Bagged /Hunter/Trip	Avg. Bagged /Hunter/Trip	Avg. Hrs. to Bag One Animal	Avg. Bagged /Hunter/ Season
Squirrel							
1st Sample	5.8	17.9	3.1	1.7	0.54	1.8	9.7
2nd Sample	5.5	14.8	2.7	1.9	0.74	1.4	10.4
3rd Sample	5.3	20.4	3.8	2.1	0.53	1.9	10.9
Average	5.7	18.0	3.2	1.8	0.55	1.8	10.0
Raccoon	6.6	26.6	4.0	2.2	0.55	1.8	14.6
Fox & Coyote	6.9	23.9	3.5	0.3	0.09	10.9	2.2
Woodchuck	4.6	15.4	3.3	0.9	0.28	3.6	4.3

QUAIL STUDIES ON TWO AREAS IN SOUTHERN IOWA SHOW INCREASED POPULATIONS AND EARLY-SEASON HUNTING ACTIVITY

M. E. Stempel
Game Biologist

Gene Hlavka
Game Biologist

Introduction

Two quail study areas are located in southern Iowa south of Highway 34. One area lies in Wapello County; the other in Decatur and Wayne Counties. Data are gathered during the four seasons. Results of the intensive studies can be compared each year to statewide counts, and, in addition, this information will aid in determining the effects of drouth, flood and snow on quail. Some previously collected information is available on the Wapello Area. Since the Decatur-Wayne Area is the former Iowa State University quail study area, a backlog of information has been accumulated. Data on other game species are recorded, but only quail are discussed in this paper.

Decatur-Wayne Area

This 7,713-acre area is located in extreme south-central Iowa, about eight miles north of the Iowa-Missouri boundary. The fall and winter quail counts are conducted on the north part which contains 4,739 acres. Elder (1956) states the Decatur Area actually comprises parts of Clay and Jefferson Townships in western Wayne County in addition to parts of High Point and Woodland Townships in eastern Decatur County. The study area is drained primarily by Steele's Creek drainage ditch. Some level land is found in the bottomland adjoining Steele's Creek, but for the most part the terrain is sloping to hilly. Simonson (1941) states rolling to hilly uplands make up 64.6 percent of the total acreage of Decatur County and are distributed over all the townships. The soil was formed mainly from the Kansan glacier till, loess and alluvium. The soils are, in general, slightly to strongly acid. Herke (1957) pointed out that numerous small ponds were constructed in the county to provide water for livestock and to check erosion. There are still many gullies caused by erosion, and considerable erosion continues.

Wapello Area

This area is located in Adams, Green and Center Townships southwest of Ottumwa. Little Soap Creek drains this area. Bottomlands as well as ridgetops are in grain and hay. Slopes are in timber or brush. Soils are about 22 percent class I and about 50 percent class II and III. The remainder is adapted to timber and permanent pasture. Loess types of Grundy and Clinton silt loam predonimate (Brown, 1936). There is a tendency for soils to be somewhat acid.

Methods of Censusing

Biologists with the aid of dogs conduct the winter quail counts in late February and early March by locating coveys, counting birds in each covey and recording quail sign (droppings, roosts, tracks and feathers). Actual walking time of the census is recorded. Farmers are interviewed for their estimates of the number of coveys.

Whistling (calling) cock quail counts begin in May along a pre-selected 10-stop route through each study area. The number of quail and rabbits sighted on the routes and miles driven are recorded. The routes are repeated about every 2 weeks until September. Thus, the beginning, peak, end and extent of "Bobwhite" calling is noted. This pattern approximates production activity.

In October a field search is again made with the aid of dogs. Flushed birds are counted. Sign is recorded. The search is made at grain field edges and along cover lanes in the vicinity of grain fields. The farmer is also asked for his opinion of the number of coveys on the farm.

After each month of the hunting season, 10 farmers on each of both study areas are interviewed about hunting activity that occurred the preceeding month. Questions are asked about the number of parties and the number of hunters in the parties using the farm.

Results of Studies

Winter Studies

The 1965-66 winter was characterized by lack of snow in southern Iowa. Pleasant days were interspersed between cold periods. In February and March, 1966, 32 coveys containing 364 quail were estimated on both areas combined (Table 1). This was a 39 percent increase in quail numbers over 1965 even though no snow cover was present for censusing. The average covey size of those flushed was used as the estimate for the size of coveys located by sign only.

Spring and Summer Studies

Spring and summer, 1965 were moderate and favorable except for delayed arrival of warm weather and a short period of excessive late summer rainfall which flooded some lowlands. Roadside counts of calling quail began in May. There was a calling peak in June and July with a high rate of calling continuing into August (Table 2). Whistling ceased in September. On the Wapello Area some of the counts were made on days when the weather turned unfavorable, thus only five of the stops (listening points) were completed. These data were converted to comparable figures (increased to 10-stop estimates) and inserted into the table. The calling pattern indicated high production during the summer. Lack of quail sign in lowlands in late summer may have indicated a loss caused by flooding. During the summer roadside counts on both study areas only three quail were sighted while driving 280 miles. Thus one quail per 100 miles driven was observed.

Autumn Studies

In October, 1965, 53 coveys containing 854 quail were located on both areas (Table 3). It took 1.9 hours of walking to flush a covey. In October, 1964, 28 coveys containing 374 quail were found. The population increase was computed at 128 percent. As in the winter counts, the average covey size of those flushed was used as the best estimate of those found by sign only.

Hunting Activity

The 1965-66 quail season of 87 days commenced on November 6 and terminated on January 31. Hunting activity reported by farmers decreased as the season progressed (Table 4). The percent of total hunting activity varied from 53 percent in November to 21 percent in January with the remaining 26 percent in December. No attempt was made to estimate the number of quail bagged.

Summary

1. Two areas in southern Iowa (one in Wapello County, the other in Decatur and Wayne Counties) are used for intensive studies of quail and rabbits.

2. Quail counts are conducted by locating coveys with the aid of dogs, estimating the number of birds during the covey flush, and interpreting sign. In addition, roadside whistle counts were run.

3. The 1966 winter population increased 39 percent. Summer reproduction was good, winter weather mild and snow lacking.

4. The 1965 fall population increased 128 percent from the 1964 fall population.

5. The 1965 spring and summer whistling counts indicated an increase in adult males.

6. Summer calling counts in 1965 showed that calling activity was at a peak in late June and during July.

7. Most hunting activity which was reported by farmers occurred in November (53%), the least in January (21%) with the remaining 26 percent in December.

Table 1. Results of Winter Quail Counts on the Wapello and Decatur-Wayne Areas, 1965-66

	1965			1966*		
	Wapello Area	Decatur-Wayne Area	Both Areas Combined	Wapello Area	Decatur-Wayne Area	Both Areas Combined
No. of coveys located	9	11	20	22	10	32
Flush	5	7	12	2	10	12
Sign	4	4	8	20	0	20
No. of quail estimated	72	190	262	264	100	364
Flush	40	121	161	24	100	124
Sign	32	69	101	240	0	240
No. of hrs. spent walking	-	-	-	7.5	23	30.5
Hrs. per covey flush	-	-	-	3.7	2.3	2.5
Farmer estimate of no. of coveys	2	9	11	1	4	5

* No snow cover present

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Table 2. Quail heard and observed on the 10-stop routes through the Wapello and the Decatur-Wayne Areas, 1965.

	Wapello		Decatur-Wayne		Number seen
Date	No. Heard	No. Seen	No. Heard	No. Seen	Both Areas
May 11			9	0	0
19	15	0	4	2	2
31	34*	0			0
Jn. 9			18	0	0
11	50*	0			0
16			19	0	0
24	54	0			0
Jly. 12	40*	0			0
24	51	1			1
29			14	0	0
Aug. 2			6	0	0
19	18	0			0
29			0	0	0
Total					3

* These are estimates based on 5 stops (see text).
Total number of listening points, 130
" " " miles driven on the routes, 280
Total number of bobwhites seen, 3; which is about one per 100 miles.

Table 3. Results of Fall Quail Counts on the Wapello and Decatur-Wayne Areas, 1964-65

	1964			1965		
	Wapello Area	Decatur-Wayne Area	Both Areas Combined	Wapello Area	Decatur-Wayne Area	Both Areas Combined
No. of coveys located	12	16	28	29	24	53
Flush	7	12	19	7	19	26
Sign	5	4	9	22	5	27
No. of quail estimated	190	184	374	576	278	854
Flush	111	138	249	139	220	359
Sign	79	46	125	437	58	495
No. of hrs. spent walking	-	-	-	18	25.3	43.3
Hrs. per covey flush	-	-	-	2.6	1.3	1.9
Farmer estimate of no. of coveys	12	17	29	14	13	27

Table 4. Summarization of quail hunting activity reported by farmers during November December and January on ten farms on each of two areas, Wapello and Decatur-Wayne, 1965-66

	Wapello Area[a]		Decatur-Wayne Area[a]		Both Areas Combined		Percent of Total Hunting Activity on Both Areas Combined	
	No. of Parties	No. of Hunters[b]	No. of Parties	No. of Hunters	No. of Parties	No. of Hunters	Parties	Hunters
November	11	25	14	29	25	54	53	60
December	5	9	7	11	12	20	26	22
January	3	4	7	12	10	16	21	18
TOTALS	19	38	28	52	47	90	100	100

a Average farm size for Decatur Co., 249 ac.; for Wayne Co., 260 ac.; Annual Farm Census (1964) Iowa Crop and Livestock Reporting Service

b Calculated by using 2.3 hunters per party

IOWA'S 1965 SEPTEMBER TEAL SEASON

Richard Bishop
Game Biologist

Season Details

A special early teal season was held for the first time in the Mississippi and Central Flyways in 1965. The season framework allowed a 9-day season between September 1st and September 30th. Iowa chose September 11th through the 19th for its season dates. The limit was 4 teal daily, 8 in possession after the first day. Shooting hours were from sunrise to sunset. In order to participate in the teal season, a special permit had to be in the possession of the hunter. This permit was obtainable by filling out an application and sending it to the State Conservation Commission. All applications had to be received by July 31, and those applying by that time were all issued permits. A total of 17,018 permits were issued in Iowa. This represents 45 per cent of the total waterfowl hunters in the state. Of the 17,018 permits issued, only 68 per cent of the permits holders actually hunted teal Table 1 shows the number of permits issued in each county.

All states in the Central Flyway chose to have the season except Montana. All states in the Mississippi Flyway decided to hold the season except Alabama, Tennessee, and Wisconsin. Five states put restrictions on their season; such as Minnesota which limited the number of days in the season from 9 to 3. Each state that held the season had to complete spy-blind reports on hunters, without their knowledge, in order to detect the true extent of other ducks killed. The season was promoted primarily on the basis of the low harvest on teal due to their early migration. In the northern states, where the majority of teal are raised, hunters did not formerly get a chance at most of the teal because of their early southward movement. Teal have a higher population turnover rate and, coupled with the low hunting mortality, it was believed that a large number of teal could be harvested without harm to the population. This is another means of managing our decreasing waterfowl supply by species management.

Results

Iowa held the 9-day season with very favorable results. Early fall rains produced optimum water conditions on Iowa marshes and many fields, ponds and streams also offered refuge conditions to teal and other ducks.

Teal had gathered on northern Iowa marshes in good numbers prior to the opening of the season on September 11th. Ventura Marsh had around 1,000 blue-winged teal, Eagle Lake - 500, Myre Slough -400, Rice Lake - 2,000, Harmon Lake - 1,000, and Ingham High-Swan Lake Complex - 2,000 teal just prior to the opening of the season. Teal were concentrated in the northern part of the state with the southern portion having only a few birds. Opening day hunting was excellent in northern Iowa with most parties filling their limits. The second day of the season was rainy and a majority of the teal either moved south or dispersed to creeks, farm ponds, field ponds and areas of lower gunning pressure.

A majority of the hunters had a very good time and thought the teal season was a success; however, those that witnessed other ducks being shot at, and some killed, enlarged this picture

Table 1. COMPILATION OF 17,018 TEAL SEASON PERMITS BY COUNTY - IOWA 1965

COUNTY	NO. ISSUED	COUNTY	NO. ISSUED
Adair	22	Jasper	170
Adams	10	Jefferson	13
Allamakee	232	Johnson	287
Appanoose	60	Jones	75
Audubon	15	Keokuk	29
Benton	165	Kossuth	279
Black Hawk	772	Lee	287
Boone	107	Linn	886
Bremer	173	Louisa	115
Buchanan	100	Lucas	78
Buena Vista	160	Lyon	107
Butler	170	Madison	12
Calhoun	42	Mahaska	24
Carroll	114	Marion	40
Cass	109	Marshall	135
Cedar	52	Mills	152
Cerro Gordo	587	Mitchell	79
Cherokee	106	Monona	123
Chickasaw	119	Monroe	16
Clarke	19	Montgomery	61
Clay	283	Muscatine	368
Clayton	241	O'Brien	130
Clinton	479	Osceola	73
Crawford	74	Page	172
Dallas	84	Palo Alto	296
Davis	20	Plymouth	114
Decatur	23	Pocahontas	85
Delaware	71	Polk	1141
Des Moines	389	Pottawattamie	660
Dickinson	504	Poweshiek	42
Dubuque	306	Ringgold	19
Emmet	409	Sac	100
Fayette	91	Scott	630
Floyd	103	Shelby	68
Franklin	93	Sioux	73
Fremont	98	Story	238
Greene	89	Tama	101
Grundy	107	Taylor	24
Guthrie	61	Union	70
Hamilton	123	Van Buren	25
Hancock	249	Wapello	115

Table 1. COMPILATION OF 17,018 TEAL SEASON PERMITS BY COUNTY - IOWA 1965 (Cont.)

COUNTY	NO. ISSUED	COUNTY	NO. ISSUED
Hardin	125	Warren	61
Harrison	174	Washington	89
Henry	28	Wayne	8
Howard	49	Webster	370
Humboldt	100	Winnebago	135
Ida	41	Winneshiek	57
Iowa	136	Woodbury	355
Jackson	178	Worth	74
		Wright	223

OTHER STATES	NO. ISSUED
Colorado	1
Illinois	187
Louisiana	1
Minnesota	10
Nebraska	45
South Dakota	3
Wisconsin	140

to disastrous proportions. A large number of hunters, as well as non-hunters, believed the illegal kill was considerably greater than what occurred. An estimated illegal kill of 7,270 ducks in Iowa is actually a very low percentage of the actual fall duck kill in Iowa. The wood duck was the number one illegal duck killed, although the illegal kill of wood ducks only amounted to about to about 3 percent of the total wood duck kill in the 1964 season. The overall effect of the illegal kill was not significant. The data obtained from 97 spy-blind observations of hunters during this season are presented in Table II.

Data obtained from a Fish and Wildlife Service questionnaire sent to a 5 per cent sample of those hunters receiving teal permits revealed an estimated total kill (bagged birds plus crippling loss) in Iowa of 49,041 blue-winged teal and 5,203 green-winged teal. The total kill of teal includes a crippling loss of 21 per cent. The total blue-winged teal kill in the Mississippi Flyway was 483,864 blue-winged teal and 46,789 green-winged teal. Iowa had the third highest kill of teal in the Mississippi Flyway. Minnesota experienced the highest teal kill with Louisiana being second. Iowa hunters averaged 2.68 days of hunting per active hunter and bagged 3.88 teal per active hunter. Age and sex of the teal bagged is shown in Table III.

In view of the data taken from the 97 spy-blind observations made in Iowa, the special teal season appears to be a success. The majority of the hunters tried to shoot only teal and the illegal kill of ducks does not warrant extreme pessimism. We will always have a certain per cent of the hunters who do not abide by the laws and these are present no matter what type of season we have. The recent pressure put on the sportsman to correctly identify ducks has resulted in a greater interest in the correct identification of species. This, in the future, could reduce the illegal kill by better identification. Most hunters are eager to obey the law and go along with the season presented, and it seems very unrealistic to set seasons on the basis of a few poor sportsmen.

Summary

1. A nine-day special teal season was held in Iowa in 1965 from September 11th through the 19th.

2. A total of 17, 018 permits were issued, which represented 45 per cent of Iowa's waterfowl hunters. Sixty-eight per cent of the permit holders actually hunted teal.

3. Iowa hunters killed and crippled 49,041 blue-winged teal and 5,203 green-winged teal, with a crippling loss of 0.21 per cent.

4. Iowa had the third highest kill in the Mississippi Flyway with Minnesota being first.

5. Hunters averaged 2.68 days of hunting and bagged an average of 3.88 teal during the season.

6. Ninety-seven spy-blind observations were made in Iowa, revealing an illegal kill of 7,270 ducks with wood ducks being the number one duck in the illegal kill. Compared to the fall season kill, this illegal kill is insignificant.

7. In view of the data, the teal season appeared to be a big success.

Table 2. Spy-Blind Observation Data, 1965 Iowa Teal Season

No. Hunters	208
No. Parties observed	97
Ave. No. Hunters per Party	2.1
Length of Observations	228 hours
Man Hours of Observations	503
Teal Shot Down Directly	229
Teal that Sailed Down	47
Birds Bagged per Cripple	2.8 - Bag Check Data
No. Parties that did not Violate	64
No. Parties that Violated	33
Per cent that Violated	34%
Illegal Ducks Killed	23
Shots fired at Illegal Ducks	151
Shots Fired at Teal	1,076
No. Times Hunters Passed up Illegal Ducks	178
Per Cent of Opportunities that Hunters shot at Illegal Ducks	32%
Illegal Duck Kill per Man Hours	1 Duck/21.7 Man hours
No. times Hunters Shot at Illegal Ducks	84

Table 3. Blue Wing Teal Age and Sex From Poynette, Wisconsin October 4-9, 1965

Mississippi Flyway

State	AM	AF	IM	IF	UNKN
Minnesota	147	198	458	468	168
Wisconsin	---	---	---	---	---
Michigan	81	78	92	96	37
Iowa	166	176	406	428	78
Illinois	111	121	277	293	48
Indiana	61	49	133	146	23
Ohio	69	46	135	140	17
Missouri	30	52	210	191	26
Kentucky	41	31	75	72	5
Arkansas	17	14	48	43	12
Tennessee	---	---	---	---	--
Louisiana	132	44	91	80	80
Mississippi	18	12	19	17	1
Alabama	---	---	---	---	--

Central Flyway

Montana	--	--	--	--	--
North Dakota	89	154	875	768	154
South Dakota	222	260	925	856	260
Wyoming	33	31	194	150	42
Nebraska	153	91	528	400	117
Colorado	27	20	130	106	29
Kansas	77	90	292	239	50
New Mexico	16	34	133	100	13
Oklahoma	25	56	139	121	36
Texas	163	16	117	57	49

ESTIMATIONS OF WINTER DEER POPULATIONS BY DIRECT CENSUS 1964-1966, WITH COMPARISONS TO STATISTICALLY DERIVED ESTIMATES

Keith D. Larson
Game Biologist

Introduction

Since 1947, Conservation Officers have been asked to make an estimate of the deer population in the county or counties comprising their territories, and to delineate on county maps areas where deer are concentrated. This paper presents the results of their 1966 winter deer estimates. Estimations for each county have been made by the author using available data from 13 hunting seasons.

Techniques

Various means of making estimates are employed by the various Conservation Officers. Ordinarily the location of a winter herd is known by the officer. He may estimate its numbers by keeping daytime sight records, by spotlighting at night, by counting tracks crossing roads, or by a combination of these methods. Sportsmen contribute information as well. A county with a high deer population and rough terrain, however, is a different story. Direct census only reveals a small fraction of the deer that are there. Reference to kill figures and success rates is essential for a reasonable estimate to be developed in many counties.

The author has utilized essentially the same information available to the officers but with less emphasis on direct census to arrive at what he feels are reasonable estimates of deer populations in each county (Table I). If the state's deer herd continues to increase as it has in recent years, direct censusing will become an almost impossible task - in some counties it has already reached this point. It will then be necessary to estimate the total deer population by other means, and the use of types of surveys meant to give only an index to population trends will take on more importance. The effort to arrive at a "computed total deer population" this year is an initial attempt to begin moving in this direction.

Results

A winter deer population of 25,573 was reported by officers for 1965 and a population of 28,702 was reported for 1966. (Table I) His represents an increase from 1964 of 31.9% to 1966 and a 11.3% increase from 1965 to 1966. The numerical increase was 3,993 from 1964 to 1965 and was 3,129 from 1965 to 1966.

The author's estimate indicates a wintering herd of 31,878 deer, for 1966.

The average winter deer population for the preceding 5 years was 16,867, with a range of 13,101 to 21,580. The mean percentage annual increase for this period was 13.2%.

Iowa white-tails have an annual average reproductive rate of 70 fawns: 100 adults (Mustard, 1962). A 1966 fall population of 48, 793 is indicated based on this reproductive rate and the winter population estimates reported by the officers. A fall 1966 population

of 54,192 would be indicated if the author's estimate were projected.

Discussion

Conditions for aerial census of deer herds were excellent during the winter of 1964-1965 and about 10 per cent of the winter population estimate was counted. Adjustments were made in some estimates because of this opportunity provided by good snow cover for many weeks. This accounts for the greater than average increase for that season. The past winter afforded no opportunity for aerial counts. The estimates consequently would tend to be low as the ground was bare most of the winter, and ground counts were affected also. The deer didn't get together in herds as is normal, but remained spread out over much of their range of Iowa.

A reduction of kill of approximately 2,000 deer which occurred during the shotgun season because of poor weather conditions for traveling and hunting is not reflected in these estimates. If more accurate census methods were available, these deer would probably have appeared in the officer count. However the percent increase reported in the herd did not deviate from the mean percentage average increase of the past five years.

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Table 1. Estimations of Iowa Deer Populations, by County, 1964-1966.

County	Conservation Officer Estimate (Based on Direct Census) 1964	1965	1966	Per Cent change 65-66	Biology (Statist. Estimate based) Feb. '66
1. Adair**	231	296	400	35	375
2. Adams**	39	205	240	17	250
3. Allamakee**	750	750	1500	100	1350
4. Appanoose**	105	115	152	32	225
5. Audubon **	110	139	157	12	167
6. Benton ***	56	48	41	-15	100
7. Blackhawk***	150	95	190	100	65
8. Boone*	143	210	280	33	300
9. Bremer***	150	175	135	-23	263
10. Buchanan**	100	95	90	-5	110
11. Buena Vista*	44	53	54	2	81
12. Butler*	130	115	160	39	160
13. Calhoun*	25	29	24	-17	25
14. Carroll***	35	51	70	37	60
15. Cass**	250	290	373	28	385
16. Cedar**	155	120	135	13	129
17. Cerro Gordo*	250	25	20	-20	20
18. Cherokee***	149	208	183	-12	275
19. Chickasaw**	155	170	130	-24	190
20. Clarke**	305	450	500	11	400
21. Clay*	109	171	151	-12	245
22. Clayton**	730	984	1000	1	1350
23. Clinton**	193	235	156	-33	250
24. Crawford**	675	700	800	14	800
25. Dallas***	250	300	350	17	500
26. Davis**	108	203	245	21	200
27. Decatur**	600	800	650	-19	600
28. Delaware**	190	185	180	-3	175
29. Des Moines**	679	887	1050	18	1200
30. Dickinson*	66	30	30	0	83
31. Dubuque**	180	200	130	-35	200
32. Emmett*	103	112	94	-16	130
33. Fayette**	120	175	245	40	500
34. Floyd***	125	160	181	13	140
35. Franklin*	75	56	50	-11	50
36. Fremont**	131	96	131	36	120
37. Greene*	80	92	159	73	140
38. Grundy*	5	5	5	0	5
39. Guthrie**	589	830	1074	29	975
40. Hamilton*	111	111	130	17	145
41. Hancock*	28	98	105	7	80
42. Hardin*	110	110	125	14	190

County	Conservation Officer Estimate (Based on Direct Census) 1964	1965	1966	Per Cent change	Biology (Statist. Estimate based)
43. Harrison**	600	850	1000	18	965
44. Henry**	208	174	185	6	250
45. Howard**	173	172	150	-13	100
46. Humboldt*	149	67	85	27	60
47. Ida***	29	35	21	-40	60
48. Iowa***	120	135	130	-4	125
49. Jackson**	530	582	565	-3	700
50. Jasper***	200	310	200	-35	195
51. Jefferson**	236	107	130	21	165
52. Johnson***	110	140	130	-8	260
53. Jones**	350	325	220	-32	300
54. Keokuk**	100	167	260	55	135
55. Kossuth*	89	147	130	-12	100
56. Lee**	257	347	661	85	525
57. Linn**	175	195	240	23	230
58. Louisa**	110	105	144	37	200
59. Lucas**	585	964	1090	13	1000
60. Lyon***	360	265	255	-4	310
61. Madison**	350	400	470	18	575
62. Mahaska**	126	246	363	47	280
63. Marion**	128	140	375	167	375
64. Marshall*	62	79	75	-5	75
65. Mills**	333	404	510	26	500
66. Mitchell***	120	137	147	7	150
67. Monona**	1260	1300	1000	-23	1000
68. Monroe**	350	950	695	-27	950
69. Montgomery**	209	274	307	12	300
70. Muscatine**	120	105	120	14	150
71. O'Brien*	32	74	86	16	150
72. Osceola*	56	30	31	3	50
73. Page**	131	191	278	46	200
74. Palo Alto*	50	79	32	-60	120
75. Plymouth***	192	172	220	28	295
76. Pocahontas*	74	38	56	47	35
77. Polk***	130	185	170	-8	450
78. Pottawattamie**	1440	1442	1207	-16	1050
79. Poweshiek***	100	65	110	69	50
80. Ringgold**	78	101	265	162	300
81. Sac***	57	74	34	-54	90
82. Scott**	40	68	66	-3	100
83. Shelby**	490	496	500	1	625
84. Sioux***	112	174	174	0	280
85. Story*	51	29	34	17	75

County	Conservation Officer Estimate (Based on Direct Census) 1964	1965	1966	Per Cent change	Biology (Statist. Estimate based)
86. Tama*	74	80	51.	36	175
87. Taylor**	50	175	235	34	180
88. Union**	88	138	286	107	400
89. Van Buren**	115	307	350	14	350
90. Wapello**	221	340	650	91	350
91. Warren**	141	151	164	9	575
92. Washington**	303	166	255	54	275
93. Wayne**	135	327	375	15	250
94. Webster*	125	120	160	33	250
95. Winnebago*	65	76	95	25	160
96. Winneshiek**	702	580	580	0	950
97. Woodbury**	585	425	421	-1	800
98. Worth*	85	72	99	38	150
99. Wright*	55	96	184	91	100
TOTAL	21,580	25,573	28,702		31,878

WEST OKOBOJI LAKE WALLEYE STUDY - 1964-65

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Introduction

West Okoboji is a natural lake of glacial origin located in northwest Iowa. It is Iowa's second largest natural lake with a surface area of approximately 3,788 acres and a maximum depth of slightly over 130 feet. West Okoboji Lake is one of a chain of six natural lakes in Dickinson County. Fish with migrating tendencies have free passage to and from West Okoboji through a narrow waterway connecting it with East Okoboji.

In the past, the adult walleye population in West Okoboji has been studied very little with only one population estimate being made - 1955 (Rose, 1957). At that time 502 walleyes were tagged during the spring spawning run. A population estimate of 60,000 adult walleyes present at the start of the 1955 fishing season was based strictly on the number of tagged and untagged fish observed by the creel census clerk. During this study there were 111 tags voluntarily returned or a minimum angler exploitation rate of 22.1 per cent. It was also noted there was some movement of tagged walleyes from West Okoboji when 9 per cent of the voluntary returns came from East Okoboji. Also in connection with this study, a walleye population estimate was made in East Okoboji by using the tag and recapture method. It was noted there was considerably more movement of walleyes from this lake when 24 per cent of the 164 voluntary returns were taken from West Okoboji and 6 per cent were creeled from other lakes of the chain.

Declining catches of walleyes by anglers in recent years seemed to suggest that a population estimate should be made to determine if the lack of angling success reflected the lack of adult walleyes. Consequently, a walleye tagging study was initiated during the spring of 1964.

Capture and Marking

During the spring of 1964, serially numbered monel metal strap tags were placed over the maxillary and premaxillary of 469 adult walleyes which were captured and released in West Okoboji. The total length range of these fish was between 11.3 and 28.8 inches. Of this total, 403 walleyes were captured with the aid of electro-fishing gear, tagged and released at two locations, Pillsbury Point and Pikes Point. Pillsbury Point, which is about 1 mile from the connection of East and West Okoboji, yielded 386 walleyes (82.5 per cent of the total tags placed) and Pikes Point, near the north end of the lake, yeilded 17 walleyes (3.5 per cent). The remaining 66 fish (14 per cent) were captured through the use of gill nets. These fish were used for spawn-taking purposes before they were tagged and transported to Miller's Bay, on the west side of the lake, where they were released.

1964 and 1965 Recapture Data

Insufficient data was collected to make a valid population estimate of the adult walleyes present in the lake. However, the 35 voluntary tag returns, or a minimum angler exploitation rate of 7.5 per cent, does indicate that the walleyes are being harvested quite lightly. This figure (7.5 per cent) is quite small when compared with the 22.1 per cent minimum angler exploitation rate found by Rose (op. cit.) in his 1955 study or the 32.2 per cent minimum

harvest rate he found during the same period on East Okoboji. Moen (1962, 1963, and 1964) found minimum angler exploitation rates of 27, 33, and 33 per cent respectively during walleye studies on Spirit Lake (another lake of the Okoboji chain). During the 1961 Spirit Lake walleye study (Moen, op. cit.), it was found that voluntary tag returns were approximately 50 per cent below the actual number of tags taken from the lake by anglers. Assuming that was the case during the 1964 season on West Okoboji, then the actual exploitation rate would be about 15 per cent. When compared with the previously mentioned minimum harvest rates, the walleye population in West Okoboji was still harvested very lightly.

There is some migration of adult walleyes into other lakes of this chain since 6 per cent of the 1964 voluntary returns came from lakes other than West Okoboji. It might be noted that one tagged walleye was recaptured by an angler from Minnewashta Lake (a distance of nearly 3 miles from the tagging side) 15 days after it was placed. Another tagged walleye was recaptured during October from East Okoboji. Both of these fish were tagged and released at Pillsbury Point. During 1965 fishing season, 23 tags were voluntarily returned. Approximately 13 per cent of these tags were recaptured from East Okoboji. Two of the East Okoboji recaptures were creeled during May and the other was taken during July. One (1) West Okoboji tagged walleye was recaptured from Spirit Lake during May of 1965. There are several possible explanations as to how this walleye entered Spirit Lake. One remote possibility is that the fish entered the lake through a narrow channel which connects East Okoboji and Spirit during periods of high water. This means seems highly unlikely since there is a screen barrier at the Spirit Lake outlet end of the channel. Another explanation, and probably the most logical, is the walleye was taken during spring gill netting operations in East Okoboji and following "stripping" was placed into Spirit when returned to natural waters. The bulk of the walleyes used for hatchery purposes are taken from East Okoboji and Spirit Lakes. Even though an effort is made to return the walleyes to the lake from which they were captured, there is some mixing of fish during the hatchery process and not all are returned to their original lake.

Conclusions

Even though this study did not provide the desired information as to the number of adult walleyes in West Okoboji during 1964, it did indicate the declining creel catches for this species could be explained by the failure of anglers to adequately harvest the walleye population in the lake.

Apparently the migrating tendencies of walleyes tagged in West Okoboji during the spring spawning run is negligible and would not greatly bias a population estimate. However, an earlier study (Rose, op. cit.) indicated a large influx of walleyes into the lake from East Okoboji during the fishing season. Such a population increase of the species being studied could significantly influence a population estimate unless proper compensations were made. Therefore, the migrating tendencies of walleyes from East Okoboji should be studied in conjunction with a future walleye population estimate in West Okoboji.

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A DESCRIPTION OF THE WAPSIPINICON RIVER DRAINAGE WITH REFERENCE TO THE FISHES OF THE PROPOSED CENTRAL CITY RESERVOIR

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Introduction

The U.S. Army Corps of Engineers have proposed the erection of a dam at Central City, Iowa on the Wapsipinicon River. Construction of this dam will depend upon its economic feasibility which is presently under consideration.

Pre-impoundment studies of the fish population will be initiated in 1966 in order to measure effects created by the dam when it is built. These studies will be the basis for management of the fisheries resource in the future.

Description of the Drainage Area

The Wapsipinicon River rises in southeastern Mower County, Minnesota and flows 255 miles in a southeastward direction to enter the Mississippi River 12 miles below Clinton. The watershed drains 2,540 square miles, all but 10 of which are in Iowa. The drainage basin is narrow averaging 10 miles in width. The largest tributaries are Buffalo Creek, Little Wapsipinicon, Otter Creek, and Plum Creek. (1).

Dams

There are four lowhead dams located along the Wapsie. They are located at Independence, Central City, Anamosa, and Oxford Mills. The dam at Anamosa is the only one of the four still functioning as a source of hydroelectric power. The dam at Central City is a remnant of the original dam. It has degenerated to the point that it functions as a spillway. This dam is to be reconstructed by the Linn County Conservation Board with work to begin in 1966. (3).

Land Use

The watershed of the Wapsipinicon River is essentially agricultural with 95 per cent of the land area included in farm units. (2). Seventy five to eighty per cent of the farm land is under cultivation. Soyabean and corn are the major crops. Most of the remaining 20 to 25 per cent of the farm land is in pasture.

Precipitation

Climatological data for Iowa show the average annual precipitation to be just over 31 inches with northeastern Iowa receiving slightly more than 33 inches. June is the month of heaviest precipitation averaging nearly 5 inches. Months of lowest precipitation are December January, and February with an average of almost one inch. (2).

Flow Records

Flow records recorded at Independence between 1933 and 1965 show a maximum discharge of 21,500 cfs. recorded on June 14, 1947. (8) A minimum of 7 cfs. was recorded many times during 1933 and 1934. The average discharge for the 32 year period of record is 520 cfs.

Near the mouth of the Wapsi the maximum discharge of 26,000 cfs. occurred on June 27, 1944. During the same recording period a minimum daily discharge of 70 cfs. was recorded between January 17-24, 1940. The average discharge for 31 years was 1,341 cfs. (8)

Study Area

The study area begins below Independence and run downstream to Oxford Mills. The dam site is presently planned to be two miles above Central City and will impound water to Independence at flood pool level. Stations will be chosen above the proposed pool in Buchanan County, the pool in Buchanan and Linn Counties, and a region below the dam in Linn and Jones Counties.

Conservation Officer Interviews

Conservation Officers in the three county area were contacted to obtain further information on areas of good angling success for game fish. Crappie fishing was reported to be good at the Independence Mill Pond, at the Central City dam, and below the Anamosa dam. Smallmouth fishing was reported as good from Independence to Anamosa. Walleye fishing was reported good from Independence to Quasqueton, below the dam at Central City, and below the dam at Anamosa. Catfishing is good throughout the area.

Fish Surveys

Records of fishery surveys are available since 1949. These surveys were conducted with electro-fishing gear, baited mesh nets, and pound nets. A 230 Volt AC. generator was used in electro-fishing surveys. Three quarter inch bar mesh nets were used to sample catfish populations. Pound nets of one and one quarter inch bar mesh were used.

All stations surveyed with electro-fishing gear showed very high rough fish populations comprising over 92 per cent by numbers and over 95 per cent by weight (Table I). Excellent populations of catfish are known for the entire length of the Wapsie. Between 1949 and 1956 pound netting surveys were conducted at Central City. Sixty per cent of the catch were rough fish comprised mainly of carpsucker and redhorse (Table II). Forty per cent of the catch was made up of game fish most of which were crappies.

Creel Census

During their regular duties Conservation Officers contact fishermen and record the numbers of fish taken and the number of hours fished. (5) In the five year period of 1960 through 1964 officers contacted 2285 fishermen who caught 2838 fish at the rate of 0.69 fish per hour. Seventy - six per cent of the catch consisted of bullheads, channel catfish, crappies, and carp. Bullheads

amounted to 37 per cent of the catch, channel catfish 18 per cent, crappie 13 per cent and carp 8 per cent. The remaining 24 per cent were made up of sucker, large and smallmouth bass, bluegill, northern pike, white bass, and walleye in that order of importance.

Beginning in 1950 a voluntary creel census has been conducted with better than average fishermen reporting on post card report forms (6). During the period of 1962 through 1964 channel catfish comprised 50 per cent of the catch and crappies 32 per cent. For all species the catch rate varied from .99 to 1.22 fish per hour.

Reservoir Fish Populations

With the construction of the dam and the resulting change in habitat from a flowing stream to a reservoir condition, changes in the fish populations are to be expected. Some fish will increase in importance because of favorable conditions. Others will decline or disappear. Still others might remain equal in importance.

Channel catfish should continue in importance in the reservoir. Largemouth bass and crappie are expected to be of greater importance during the first years of the reservoir. Smallmouth bass will decline or disappear. Walleye will be of greatest importance in the dam tailwaters. Rough fish should continue to flourish.

A list of fishes of the Wapsipinicon River Drainage is included. The paper, An Annotated Check List of Fishes of the Wapsipinicon Drainage System in Iowa, has been modified to include changes to be expected in the reservoir (1).

TABLE 1. Per Cent by Numbers and Weight of Game and Rough Fish Taken By Electro-fishing Gear 1958-1965.

Station	Years Surveyed	% Game (numbers)	% Game (weight)	% Non-Game (numbers)	% Non-Game (weight)
Troy Mills*	1958,59, 60,62	5%	5%	95%	95%
Central City*	1958,59, 60,62,65	8%	5%	92%	95%
Anamosa**	1959,60 62,65	4%	TR	96%	99%
Anamosa *** Anamosa	1958,59, 60,62,65	2%	3%	98%	97%

* Above and below dam combined
** Above dam
*** Below dam

TABLE 2. Average Per Cent of Rough Fish and Game Fish Taken in Eight Years of Pound Netting at Central City (1949-1956).

Game Fish	Numbers Taken	Per Cent of Catch	Rough Fish	Number Taken	Per Cent of Catch
Crappie	412	26%	Quillback	463	30%
C. Catfish	149	9%	Redhorse	289	18%
Bluegill	38	2%	Carp	121	8%
N. Pike	16	1%	Other	60	4%
Other	20	2%		933	60%
	635	40%			

TABLE 3. A List of Fishes of the Wapsipinicon River Drainage System (from Cleary's Annotated List of the Wapsipinicon Drainage System in Iowa).

Common Name		Scientific Name
	Lepisosteidae	
*Longnose gar		Lepisosteus osseus (linnaeus)
*Shortnose gar		Lepisosteus platostomus Rafinesque
	Amiidae	
*Bowfin		Amia calva Linnaeus
	Salmonidae	
*Brown trout		Salmo trutta Linnaeus
*Rainbow trout		Salmo gairdneri Richardson
	Clupeidae	
*Gizzard shad		Dorosoma cepedianum (LeSueur)
	Umbridae	
*Central Mudminnow		Umbra limi (Kirtland)
	Esocidae	
Northern pike		Esox lucius Linnaeus
	Catostomidae	
Bigmouth buffalo		Ictiobus cyprinellus (Valenciennes)
Quillback		Carpiodes cyprinus (LeSueur)

River carpsucker		Carpiodes carpio (Rafinesque)
Highfin carpsucker		Carpiodes velifer "
Golden Redhorse		Moxostoma erythrurum "
Silver redhorse		Moxostoma anisurum "
Northern redhorse		Moxostoma macrolepidotum (LeSueur)
*Northern hog sucker		Hypentelium nigricans (LeSueur)
White sucker		Catostomus commersoni (Lacepede)
Carp		Cyprinus carpio Linnaeus
Golden Shiner		Notemigonus crysoleucas (Mitchill)
*Creek chub		Semotilus atromaculatus (Mitchill)
Horneyhead chub		Hybopsis biguttata (Kirtland)
*Silver chub		Hybopsis storeriana (Kirtland)
*Gravel chub		Hybopsis x-punctata Hubbs and Crowe
*Blacknose dace		Rhinichthys atratulus (Hermann)
Suckermouth minnow		Phenacobius mirabilis (Girard)
*Emerald shiner		Notropis atherinoides Rafinesque
Rosyface shiner		Notropis rubellus (Agassiz)
*Redfin shiner		Notropis umbratilis (Girard)
*River shiner		Notropis blennius (Girard)
Common shiner		Notropis cornutus (Mitchill)
Bigmouth shiner		Notropis dorsalis (Agassiz)
Spotfin shiner		Notropis spilopterus (Cope)
*Red shiner		Notropis lutrensis (Baird and Girard)
Sand shiner		Notropis stramineus (Cope)
*Mimic shiner		Notropis volucellus (Cope)
*Ozark shiner		Dionda nubila (Forbes)
Brassy minnow		Hybognathus hankinsoni Hubbs
*Bullhead minnow		Pimephales vigilax (Baird and Girard)
Bluntnose minnow		Pimephales notatus (Rafinesque)
Fathead minnow		Pimephales promelas Rafinesque
*Stoneroller		Campostoma anomalum (Rafinesque)
Silvery minnow		Hybognathus nuchalis Agassiz
	Ictaluridae	
Channel catfish		Ictalurus punctatus (Rafinesque)
Black bullhead		Ictalurus melas (Rafinesque)
Yellow bullhead		Ictalurus natalis (LeSueur)
Flathead catfish		Pilodictis olivaris (Rafinesque)
*Stonecat		Noturus flavus Rafinesque
	Cyprinodontidae	
*Blackstripe topminnow		Fundulus notatus (Rafinesque)
	Antherinidae	
*Brook silverside		Labidesthes sicculus (Cope)
	Serranidae	
*White bass		Roccus chrysops (Rafinesque)

Centrachidae	
*Smallmouth bass	Micropterus dolomieui Lacepede
Largemouth bass	Micropterus salmoides (Lacepede)
*Warmouth	Chaenobryttus gulosus (Cuvier)
Green sunfish	Lepomis cyanellus Rafinesque
*Pumpkinseed	Lepomis gibbosus (Linnaeus)
Bluegill	Lepomis macrochirus Rafinesque
Orangespotted sunfish	Lepomis humilis (Girard)
*Rock Bass	Ambloplites rupestris (Rafinesque)
White crappie	Pomoxis annularis Rafinesque
Black crappie	Pomoxis nigromaculatus (LeSueur)
Percidae	
Walleye	Stizostedion v. vitreum (Mitchill)
*Yellow perch	Perca flavescens (Mitchill)
*Blackside darter	Percina maculata (Girard)
*Slenderhead darter	Percina phoxocephala (Nelson)
*River darter	Percina shumardi (Girard)
*Western sand darter	Ammocrypta clara Jorden and Meek
Johnny darter	Etheostoma nigrum Rafinesque
*Banded darter	Etheostoma zonale (Cope)
* Iowa darter	Etheostoma exile (Girard)
*Rainbow darter	Etheostoma caeruleum Storer
*Fantail darter	Etheostoma flabellare Rafinesque
Gasterosteidae	
*Brook stickleback	Eucalia inconstans (Kirtland)

* Expected to be absent or of minor importance in the Central City Reservoir.

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MISSOURI RIVER OX-BOW LAKE FISHERY
PART 2: WALLEYE AND SAUGER

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Surveys of fish populations in five Missouri River ox-bow lakes have been conducted annually since 1963 by the Iowa Conservation Commission, Nebraska Game Forestation and Parks Commission and the United States Fish and Wildlife Service. A less intensive study was conducted on four of these lakes in 1961. This paper presents data collected from walleye and sauger caught during the 1961, 1963 and 1964 surveys.

The surface areas of these lakes range between 200 and 900 surface acres; however, four lakes each have at least 600 surface acres. Three of the lakes, Omadi, Decatur Bend and Snyder, are open to the Missouri River at their lower end. Their upper end is separated from the river by rock and pile levees. Decatur Lake is completely separated from the river by rock and pile levees. However, spring floods have damaged the levees, allowing the river to enter the lake during high water periods. Only one lake, Desoto, is completely separated from the river by earth levees. The levees contain two tubes which connect the river and lake and allow control of the lake water level. These tubes, however, are closed except for brief periods when the water level is being adjusted.

Rough fish, composed mainly of gizzard shad, numerically dominate the fish population in each lake. A previous Quarterly Biology Report (Vol. 16, No. 1) describes the fishery of these lakes in detail.

Walleye fry and fingerlings have been stocked annually in Desoto, beginning in 1962. Walleye fry were stocked in Snyder during 1962, stocked only in Desoto in 1963, and stocked in all lakes except Omadi during 1964.

The 1961 surveys at Decatur, Decatur Bend, Snyder and Desoto were conducted in September. Omadi was not surveyed in 1961. During 1963 and 1964, Desoto was surveyed in May and the remaining four lakes after mid-July.

The unit of effort during the 1963 and 1964 surveys did not vary greatly between lakes. A minimum of 18 gill nets, 8 frame nets, 2 trammel nets, and 16 seines were fished in each lake, each year. The nets were each fished approximately 12 hours. Seine hauls were conducted during both day and night along approximately 40 yards of shore. The unit of effort was considerably less at each lake during the 1961 survey. Fishing gear included frame nets, seines, trawl, and electro-fishing gear.

Abundance

The total number of walleye and sauger caught by nets and seines at each lake during the three surveys is shown in Table 1. Generally, more sauger than walleye were caught at each lake during all surveys. The exceptions were Decatur Lake during 1963 and Decatur Bend in 1964.

Table 1. Total walleye and sauger caught at five Missouri River ox-bow lakes during three surveys

Lake	Walleye			Sauger		
	1961	1963	1964	1961	1963	1964
Desoto	2	10	6	17	11	11
Decatur	-	26	19	16	24	21
Omadi	-	4	2	--	16	6
Snyder	27	2	-	95	184	5
Decatur Bend	-	9	9	13	22	3
Totals	29	51	36	141	257	46

Most of the walleye and sauger were caught with gill nets and frame nets. When data collected with an equal unit of effort (18 gill nets and 8 frame nets) are evaluated, a more valid comparison of abundance between lakes can be made (Table 2). More sauger than walleye were taken at each lake, both years. Over half of the sauger taken from all lakes in 1963 were from Snyder Lake. This cannot be explained. More sauger were also caught at Snyder in 1961 than at any other lake. In general, the number of walleye or sauger caught at each lake did not vary greatly between 1963 and 1964.

Table 2. Total number of walleye and sauger caught with 18 gill nets and 8 frame nets fish at each lake during 1963 and 1964

Lake	Walleye		Sauger	
	1963	1964	1963	1964
Desoto	6	4	11	9
Decatur	5	15	10	17
Omadi	1	-	6	3
Snyder	2	-	177	2
Decatur Bend	9	7	21	3
Totals	23	26	225	34

Among the game fish in these lakes, walleye and sauger probably rank about third or fourth in abundance, at least behind crappie and catfish.

Reproduction

The study of reproduction in these lakes is difficult since most lakes are subject to immigration of Missouri River fish during high water periods. Only one lake, Desoto, is not directly affected by spring flooding of the river. The levees at Desoto do contain two tubes which connect the lake and river, but any possible movement of river fish through these tubes into the lake is not considered great enough to affect the lake fish population.

Desoto was constructed in 1960 but walleye were not stocked until 1962. Undoubtedly, sexually mature walleye and sauger were present in the 7 1/2 mile long lake at the time it was separated from the new river channel. However, during the 1963 survey only three fish were caught which may have been from the 1961 year class of walleye. Also, no sauger less than 12 inches were taken during the 1963 survey. This indicates poor reproduction of walleye or sauger in those lakes separated from the river.

Since the stocking of walleye was conducted only in Desoto during 1963, data collected this same year from the other four lakes with trap nets and seines should show the relative abundance of young-of-the-year walleye even though some may have entered the lake from the river. This data is presented in table 3. Field identification to separate small sauger and walleye is sometimes difficult; therefore, the total walleye and/or sauger caught, which were less than eight inches long, were combined.

Table 3. Total number of walleye and/or sauger less than eight inches long caught with frame nets and seines in five Missouri River ox-bow lakes in 1963

Lake	Number of nets fished	Number of seine hauls	Number of walleye and/or sauger caught less than eight inches long
Desoto	8	23	4
Decatur	8	14	26
Omadi	8	18	16
Snyder	8	16	16
Decatur Bend	8	23	2
Totals	40	94	64

In addition to the approximate 96 hours frame nets were fished in each lake, a minimum of 14 seine hauls were conducted at each area. Considering the total effort used to catch these small fish, reproduction of either sauger or walleye in these lakes appears limited.

Growth

Due to difficulty in aging the sample of walleye and sauger scales, no detailed evaluation of growth was made. In general, however, there appears to be no major difference in the growth of these sauger or walleye from the growth of sauger and walleye caught in most other midwestern waters.

Possible Movement of Larger Fish From Lakes Into the River

There is evidence the larger walleye and sauger leave the lakes and enter the river from those lakes open to the river. Mean total lengths were considerably larger for both walleye and sauger caught in the two lakes separated from the river during both 1963 and 1964 than in the lakes open to the river (Table 4). Data recorded in Table 4 were collected from fish caught with gill nets. Since these nets were effective in catching most walleye and sauger over seven inches, they were the least selective gear used. It seems unlikely, therefore, that the difference in mean total lengths can be attributed to selectivity of fishing gear.

Table 4. Mean total length of walleye and sauger caught in 18 gill nets fished at each lake during 1963 and 1964

Lake	Walleye		Sauger	
	1963	1964	1963	1964
Desoto	20.3	12.0	17.5	21.2
Decatur	17.7	23.2	14.3	15.3
Omadi *	10.2	-	11.8	10.2
Snyder *	-	-	12.2	8.2
Decatur Bend *	10.4	11.9	11.2	9.6

* Lakes open to the river

Other evidence to support the theory that the larger fish move out of the lakes is the almost complete lack of walleye and sauger over 16 inches long from the sample caught during 1963 and 1964 in those lakes open to the river (Table 5).

Table 5. Total number of walleye and sauger over 16 inches caught in 18 gill nets fished during each of two surveys

Lake	Walleye		Sauger	
	1963	1964	1963	1964
Desoto	7	1	7	6
Decatur	7	11	-	2
Omadi *	-	-	-	-
Snyder*	-	-	6	-
Decatur Bend*	-	1	-	-

* Lakes open to the river

Only six sauger and one walleye over 16 inches were caught during both surveys from the three lakes open to the river. In contrast, 26 walleye and 15 sauger over 16 inches were taken from the two lakes separated from the river during the same surveys.

Summary

1. Walleye and sauger populations in five Missouri River ox-bow lakes were studied during 1961, 1963 and 1964 by the Iowa Conservation Commission, Nebraska, Game Forestation and Parks Commission, and the United States Fish and Wildlife Service.

2. Among the game fish in these lakes, walleye and sauger rank about third or fourth in abundance. More sauger than walleye were caught at most lakes during all three surveys.

3. Reproduction by either walleye or sauger appears limited.

4. In general, the limited growth data indicates the growth of both walleye and sauger does not differ greatly with the growth of walleye and sauger caught in the majority of other midwestern waters.

5. Evidence supporting the theory that the larger sauger and walleye enter the river from those lakes open to the river consists of: 1. mean total lengths of sauger and walleye were considerably larger in 1963 and 1964 in those lakes separated from the river than in those lakes open to the river and 2. there was a significant lack of both walleye and sauger over 16 inches long in those lakes open to the river when compared to those lakes separated from the river.

EVALUATION OF THE UTILIZATION OF 1 1/2-INCH AND 3-INCH BAR MEASURE BUFFALO NETS ON DES MOINES RIVER

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Introduction

A phase of fish population studies initiated in 1965 on the Des Moines River near the site of the future Red Rock Reservoir involved a commercial fishery netting study. This study was designed to evaluate and to compare the potential use of 1 1/2-inch and 3-inch bar measure buffalo nets for controlled management of rough fish populations.

The purposes of this paper was to report the species composition harvested and the rate of harvest of the species, and to determine whether buffalo nets are fishable gear on inland rivers, and if rough fish populations can be exploited to a appreciable degree by utilizing commercial gear.

Methods

Nets used in this study were approximately 15 feet in length and patterned after the Illinois River Style nets; i.e. they were two throat nets with the rear throat being "crowfoot style", mesh of one size, and equipped with tapered white oak wood hoops with a 3 1/2-foot front opening. Ten 3-inch and ten 1 1/2-inch buffalo nets were used.

Two buffalo nets, one of each mesh size, and seperated by 100 feet of tailline, were fished in comparable habitats for equal periods of time. Starting in May, these nets were fished on sand or gravel bars and along mud banks at depths not exceeding 10 feet. The purpose was to sample the spawning smallmouth buffalo population. During June, tandem nets were fished for spawning channel catfish and spawning flathead catfish, so the nets were fished along mud banks at shallower depths. During September-October, the nets were fished in a variety of habitats. Being baited with soyabean meal, a variety of species were caught.

Data recorded were: species caught, their number and weight, bait used, set location, date, and hours fished.

Results

Comparative production rates indicated that the catch per unit of effort was low for both mesh sizes (table 1). Since this is based on total hours fished and does not take into account whether or not the net was capable of catching fish, production results were severly depressed due to mechanical difficulties encountered fishing this gear in a dynamic river system. For example, flooding caused the collection of debris on web material, then sanding or pulled stakes resulting in the loss of nets. In short, 3-inch buffalo nets were inoperable 87 percent of the total time fished and 1 1/2-inch buffalo nets were inoperable 5 percent of the total time fished.

Basing production on a system of averages may tend to mislead the reader for 1 1/2-inch nets capable of catching quantities of channel catfish at a high rate. For example, a net caught 38 catfish per net day and 38 pounds per net day. Catch rates like this were common during the spawning run of channel catfish.

Table 1. Comparative production Rates of 1 1/2-inch and 3-inch Buffalo Nets, Des Moines River, 1965.

Gear	Net Days Fished	Production Sample	Weight	Fish/Net Day	Lbs/Net Day
3-inch	310 inoperable 45 operable 355 total	73	373	0.205	1.048
1 1/2-inch	52 inoperable 925 operable 977 total	1,029	1,562	1.053	1.599

Species composition data indicated that 3-inch buffalo net production was only rough fish species (Table 2). Selectibility was demonstrated by the high percentage of smallmouth buffalo, Ictiobus bubalus (Rafinesque), even though I believe their abundancies were low in the Des Moines River. This production occurred during their spawn in May. Bigmouth buffalo, Ictiobus cyprinellus (Valenciennes), were considered more abundant, but their production was limited due to the selectibility and method of using this gear. No black buffalo, Ictiobus niger (Rafiensque), were observed. Carpsuckers, Carpiodes sp., were considered the most abundant fish, but large numbers did not enter the sample due to their small size and their probable escapement. Carp, Cyprinus carpio (Linnaeus), being very abundant, did not enter the sample significantly until baiting techniques were employed. No game species entered the sample.

Table 2. Species Composition of 3-inch Buffalo Nets, Des Moines River, 1965

Species	Sample sz.	Wt. in lbs.	Mean Wt.	% of Wt.	% of Sample
Smallmouth buffalo	43	283	6.6	76.0	59.0
Bigmouth buffalo	1	6	6.0	1.6	1.3
Carp	14	71	5.0	19.1	19.2
Carpsucker	15	12	0.8	3.3	20.5
Channel catfish	0	--	---	---	---
Flathead catfish	0	--	---	---	---
TOTALS	73	372		100.0 %	100.0 %

Species composition data indicated that 1 1/2-inch buffalo net production was primarily channel catfish (Table 3). The small mesh size did not allow for escapement of this game species in excess of 12.0 inches in TL. Composing 26.2 percent of the catch, carp and carpsucker represented minor rough fish production when compared with game fish production; thus, 1 1/2-inch buffalo nets were considered inadequate for controlled management of rough fish populations.

Table 3. Species composition of 1 1/2-inch buffalo nets, Des Moines River, 1965

Species	Sample sz.	Wt. in Lbs.	Mean Wt.	% of Wt.	% of sample
Smallmouth buffalo	0	-	-	-	-
Bigmouth buffalo	4	9.5	2.37	.7	.4
Carp	126	376.9	2.98	24.1	12.2
Carpsucker	145	108.2	0.74	6.9	14.0
Channel catfish	748	1,053.1	1.40	67.4	72.7
Flathead catfish	6	14.0	2.33	.9	.7
TOTALS	1,029	1,561.7		100.0	100.0

Discussion

The potential use of 3-inch buffalo nets for controlling rough fish populations in the Des Moines River was considered infeasible if not impossible. The removal of a significant portion of rough fish populations by utilizing this gear was limited by several factors. The mechanics of fishing this gear was restrictive due to excessive flooding resulting in loss of gear or inoperable nets, and at low stages, transportation became difficult due to physical barriers.

Economic factors further limited these possibilities. The present commercial market value of carp, carpsucker, and various suckers was disregarded. The buffalo species only command sufficient commercial market value in order to support a commercial fishery based on rough fish as defined by present inland Iowa fishing regulations. But the high production cost and the relative low abundancies of buffalo species in the Des Moines River excluded all possibilities of establishing a commercial fishery.

Since channel catfish are designated as game species on inland streams and due to the high rate of harvest of this species utilizing 1 1/2-inch buffalo nets, the potential use of this gear for management of rough fish populations was considered impractical.