A PRELIMINARY STUDY OF THE ECOLOGY OF THE NATIVE WILD DUCKS OF IOWA

BY

Logan J. Bennett

A Thesis Submitted to the Graduate Faculty
for the Degree of

MASTER OF SCIENCE

Major Subject Zoology

Iowa State College

1932

TABLE OF CONTENTS

ACKNOWLEDGMENTS

The writer feels greatly indebted to Professor J. E. Guthrie, Dr. Carl J. Drake, and Dr. Paul L. Errington for guidance and criticism in the accomplishment of this work; to the State Conservation Commission, the State Fish and Game Department and the Ruthven Shooting Club for their hearty support; and to every member of the department of Zoology and Entomology whose interests and cooperation has made possible this study. In addition, the writer desires to give special mention to Mr. J. N. Darling of Des Moines for his active interest in wild life conservation in Iowa and especially for the gift of funds to Iowa State College for the prosecution of these studies.

INTRODUCTION

This study of waterfowl (June 19 to October 15, 1932) was made north of Ruthven, Iowa, in the vicinity of Lost Island Lake, Brown Slough, the Outlet, Mud Lake, Trumbull Lake, and Round Lake. The main objective of this work was to get data on nesting sites, predators, life history, and other information that may be of use in improving the nesting and rearing grounds of our waterfowl. The following description will give some idea as to the terrain of the country. (Figure I.)

Lost Island Lake (Palo Alto County) is located two and one-half miles north of Ruthven. The lake is one and one-half miles wide and two and one-half miles long, with an average depth of ten feet. The surface of the lake is devoid of any such vegetation as would afford protection to ducklings. During the fall and spring migrations the lake is used as a resting place by waterfowl.

Mud Lake (Clay County) is one quarter of a mile northwest of Lost Island Lake. It has a width of a quarter of a mile with a length of one and one-half miles and an average depth of about three feet. The surface of the lake is almost completely grown over with American Bulrushes (Scirpus validus), Flagroot (Acorus sp.), Tall Marsh Grass (Spartina michauxiana),

and Bur-reed (Sparganium eurycarpum). This growth rises from one to three feet above the surface of the water, making the lake an ideal rearing ground.

Off the north and east shores of Mud Lake are five hundred acres of natural meadow, marshes, and sloughs. Abundant vegetation over this area furnishes excellent nesting cover.

Brown Slough (Palo Alto County) is a marsh-like lake located one-half mile east of Lost Island Lake. It is one-quarter of a mile wide and one-half of a mile in length. About two feet of water cover this area the greater part of the year. The vegetation is similar to that of Mud Lake.

Trumbull Lake (Clay County) is one-half of a mile west of Mud Lake. The lake is one-half mile wide by two miles long, with an average depth of five feet. There is little cover on this lake for the rearing of ducks.

Between Mud Lake and Trumbull Lake there is a slough of about one hundred acres having water from eight to ten inches deep during the nesting season. It has a high value as rearing ground on account of dense growths of Tall Marsh Grass and Flagroot.

Round Lake is a state game refuge located one hundred yards from the southwest shore of Trumbull Lake. The lake is three-quarters of a mile wide and one mile long. There is little open water on this lake as it is grown over with Tall Marsh Grass, American Bulrush, Flagroot, and Bur-reed.

The Outlet is a marshy slough that drains from Lost Island Lake into the Little Sioux River. The sloughs, marshes, and natural meadow that comprise this area cover almost a thousand acres. About one-half of this land is covered with water from four to ten inches deep during the nesting and rearing season. The entire region has an abundant growth of Tall Marsh Grass, Flagroot, several species of Arrow-head (Sagittaria), American Bulrush, Bluegrass (Poa), White Vervain (Verbena urticifolia), Hoary Vervain (Verbena stricta), and many other weeds that make good nesting cover.

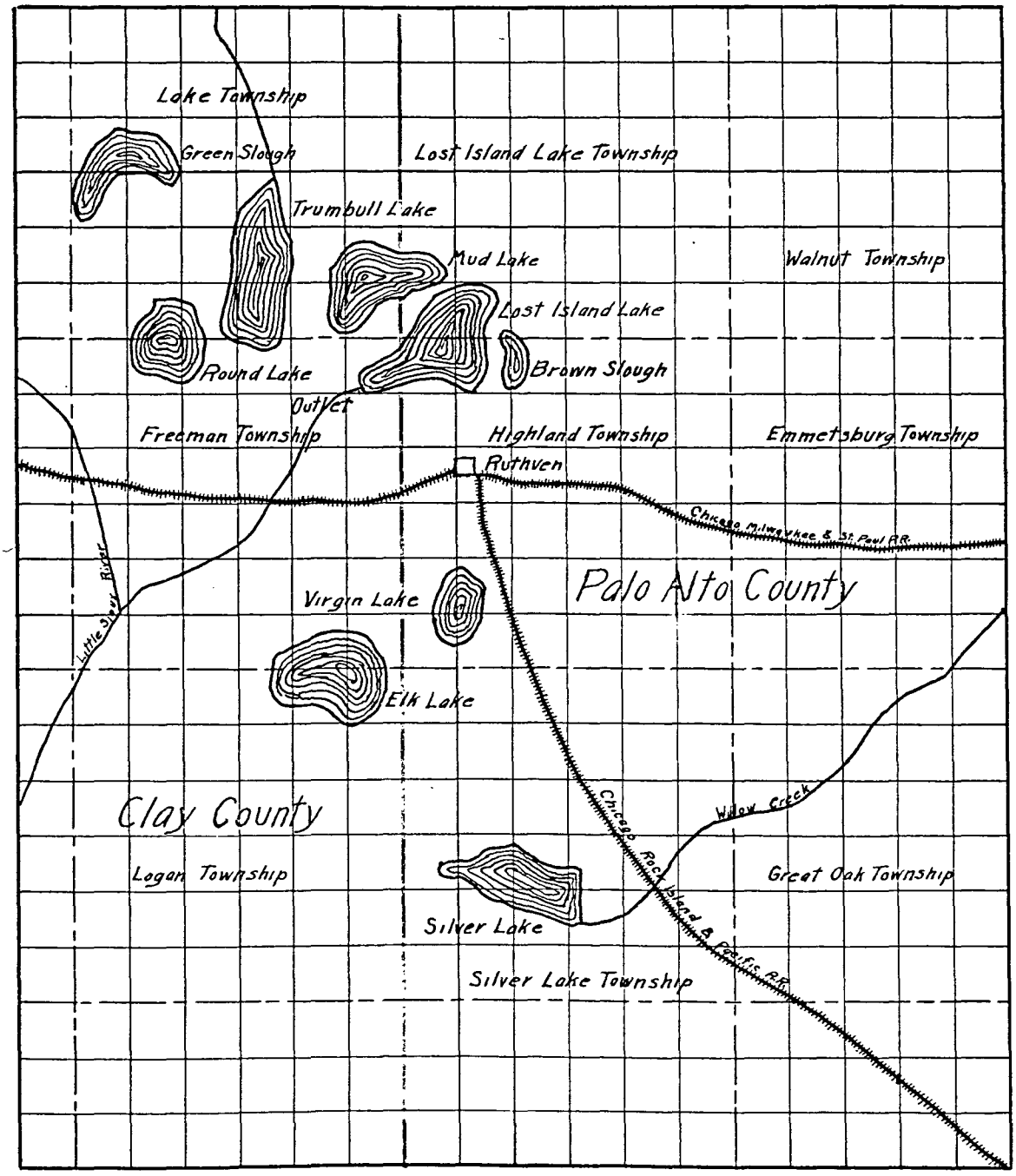

Fig. I. Lakes in the Vicinity of Ruthven, Iowa.

LOCATION OF NESTS

The primary purpose of this study was to obtain data on nesting sites of native wild ducks in order to determine what constitutes nesting grounds. Especial attention was paid to the distance of nests from water, elevation, and type of cover where found.

Data were obtained on thirty-one Blue-winged Teal, Querquedula discors (Linnaeus), nests, thirty Mallard, Anas platyrhynchos platyrhynchos (Linnaeus), nests, and one Shoveller, Spatula clypeata (Linnaeus), nest. A description of each nesting site of the three is given as in the above order in tables I, II, and III.

Table I

Blue-winged Teal Nests

Nest No.	Date Found	No. Eggs	Location	Cover (Vegetation) Type	Cover (Vegetation) Height	Distance from water	Elevation	Fate of nest
1	June 22	8	knoll	Bluegrass and Hoary Vervain	12 in.	150 yards	9 ft.	complete hatch
2	June 23	7	knoll	Bluegrass and Hoary Vervain	10 in.	20 yards	15 ft.	complete hatch
3	June 24	11	knoll	Bluegrass and Hoary Vervain	10 in.	200 yards	25 ft.	complete hatch
4	June 25	10	marsh	Tall Marsh Grass	36 in.	40 yards	3 in.	complete hatch
5	June 25	8	knoll	Bluegrass, Hoary Vervain and White Vervain	12 in.	325 yards	25 ft.	complete hatch

The following nests had either hatched or been destroyed before these observations began.

6			small hill	Bluegrass, Hoary Vervain and White Vervain	10 in.	120 yards	20 ft.	not known
7			slope of marshy pond	Bluegrass and Flagroot	10 in.	15 yards	3 in.	not known
8			marsh	Tall Marsh Grass	36 in.	75 yards	5 in.	Destroyed by mowing June 17
9			marsh	Tall Marsh Grass	36 in.	75 yards	5 in.	" "
10			marsh	Tall Marsh Grass	36 in.	75 yards	5 in.	" "
11			marsh	Tall Marsh Grass	36 in.	75 yards	5 in.	" "
12			marsh	Tall Marsh Grass	36 in.	75 yards	5 in.	" "
13			marsh	Tall Marsh Grass	36 in.	75 yards	7 in.	" "
14			marsh	Tall Marsh Grass	36 in.	75 yards	7 in.	" "
15			marsh	Tall Marsh Grass	36 in.	75 yards	5 in.	" "
16			marsh	Tall Marsh Grass	36 in.	75 yards	12 in.	" "
17			marsh	Tall Marsh Grass	36 in.	75 yards	12 in.	" "
18			marsh	Tall Marsh Grass	36 in.	75 yards	10 in.	" "
19			marsh	Tall Marsh Grass	36 in.	75 yards	8 in.	" "
20			knoll	Bluegrass	12 in.	125 yards	12 ft.	not known
21			meadow	Bluegrass Hoary Vervain	10 in.	21 yards	3 ft.	" "
22			marshy land	Bluegrass	10 in.	10 ft.	12 in.	" "

		small hill	Bluegrass, Hoary Vervain and White Vervain	10 in.	120 yards	20 ft.	not known
7		slope of marshy pond	Bluegrass and Flagroot	10 in.	15 yards	3 in.	not known
8		marsh	Tall Marsh Grass	36 in.	75 yards	5 in.	Destroyed by mowing June 17
9		marsh	Tall Marsh Grass	36 in.	75 yards	5 in.	" "
10		marsh	Tall Marsh Grass	36 in.	75 yards	5 in.	" "
11		marsh	Tall Marsh Grass	36 in.	75 yards	5 in.	" "
12		marsh	Tall Marsh Grass	36 in.	75 yards	5 in.	" "
13		marsh	Tall Marsh Grass	36 in.	75 yards	7 in.	" "
14		marsh	Tall Marsh Grass	36 in.	75 yards	7 in.	" "
15		marsh	Tall Marsh Grass	36 in.	75 yards	5 in.	" "
16		marsh	Tall Marsh Grass	36 in.	75 yards	12 in.	" "
17		marsh	Tall Marsh Grass	36 in.	75 yards	12 in.	" "
18		marsh	Tall Marsh Grass	36 in.	75 yards	10 in.	" "
19		marsh	Tall Marsh Grass	36 in.	75 yards	8 in.	" "
20		knoll	Bluegrass	12 in.	125 yards	12 ft.	not known
21		meadow	Bluegrass Hoary Vervain	10 in.	21 yards	3 ft.	" "
22		marshy land	Bluegrass Hoary Vervain	10 in.	10 ft.	12 in.	" "
23		marshy land	Bluegrass Hoary Vervain	12 in.	4 yards	12 in.	" "
24		damp slough	Bluegrass Hoary Vervain	10 in.	10 ft.	8 in.	" "
25		meadow	Bluegrass	10 in.	400 yards	24 in.	" "
26		meadow	Bluegrass Hoary Vervain	10 in.	440 yards	24 in.	" "
27		meadow	Bluegrass Hoary Vervain	10 in.	22 yards	12 in.	" "
28		meadow	Bluegrass Hoary Vervain	10 in.	20 yards	12 in.	" "
29		meadow	Bluegrass Hoary Vervain White Vervain	10 in.	20 yards	12 in.	Tramped by cattle
30		alfalfa field	Alfalfa	12 in.	75 yards	15 ft.	not known
31		muskrat house	Bulrushes Flagroot	24 in.	2 ft.	24 in.	complete hatch

Table II

Mallard Duck Nests

Nest No.	Date found	No. eggs	Location	Cover (Vegetation) Type	Height	Distance from water	Elevation	Fate of nest	Remarks
1	June 21	9	marsh	Tall Marsh Grass	36 in.	85 yds.	5 in.	complete hatch	
2	June 21	13	meadow	Bluegrass and Hoary Vervain	8 in.	28 yds.	20 ft.	complete hatch	poor cover
3	June 22	9	knoll	Bluegrass, Hoary Vervain and White Vervain	12 in.	30 yds.	6 ft.	complete hatch	
4	June 22	9	marsh	Tall Marsh Grass	18 in.	25 yds.	18 in.	complete hatch	
5	June 24	9	marsh	Tall Marsh Grass	36 in.	150 yds.	3 in.	complete hatch	very damp
6	June 24	11	marsh	Tall Marsh Grass	24 in.	25 yds.	14 in.	complete hatch	
7	June 24	8	meadow	Bluegrass and Hoary Vervain	10 in.	300 yds.	18 in.	complete hatch	
8	June 24	7	knoll	Bluegrass and Western Wheat Grass	18 in.	75 yds.	36 in.	complete hatch	
9	June 25	8	dry marsh	Bluegrass	10 in.	125 yds.	10 in.	complete hatch	

The following nests had either hatched or been destroyed before these observations began.

10			meadow	Bluegrass, Western Wheat Grass and White Vervain	10 in.	35 yds.	18 in.	trampled by cattle	
11			meadow	Bluegrass, Western Wheat Grass and White Vervain	10 in.	25 yds.	15 in.	not known	
12			meadow	Bluegrass, Western Wheat Grass and White Vervain	10 in.	20 yds.	10 in.	not known	
13			marsh	Tall Marsh Grass	12 in.	80 yds.	8 in.	not known	
14			marsh	Tall Marsh Grass and Bluegrass	15 in.	20 yds.	10 in.	not known	
15			alfalfa field	Alfalfa	12 in.	125 yds.	12 in.	complete hatch	
16			last year's	weeds and fallen cornstalks	15 in.	150 yds.	20 ft.	destroyed by plowing	

11			meadow	Bluegrass, Western Wheat Grass and White Vervain	10 in.	25 yds.	15 in.	not known	
12			meadow	Bluegrass, Western Wheat Grass and White Vervain	10 in.	20 yds.	10 in.	not known	
13			marsh	Tall Marsh Grass	12 in.	80 yds.	8 in.	not known	
14			marsh	Tall Marsh Grass and Bluegrass	15 in.	20 yds.	10 in.	not known	
15			alfalfa field	Alfalfa	12 in.	125 yds.	12 in.	complete hatch	
16			last year's cornfield	weeds and fallen cornstalks	15 in.	150 yds.	20 ft.	destroyed by plowing	
17			under fallen oak limb	weeds and fallen oak twigs	3 in.	15 ft.	15 in.	destroyed by predator	very poor cover
18			meadow	Bluegrass, Hoary Vervain and White Vervain	10 in.	20 yds.	2 in.	not known	would have been flooded with little more rainfall
19			marsh	Tall Marsh Grass	24 in.	300 yds.	6 in.	not known	
20			meadow	Bluegrass, White Vervain and Hoary Vervain	10 in.	25 yds.	4 in.	not known	
21			marsh	Tall Marsh Grass	36 in.	60 yds.	5 in.	destroyed by mowing June 17	
22			marsh	Tall Marsh Grass	36 in.	60 yds.	5 in.	" "	
23			marsh	Tall Marsh Grass	36 in.	65 yds.	4 in.	" "	
24			marsh	Tall Marsh Grass	36 in.	55yds.	4 in.	" "	
25			marsh	Tall Marsh Grass	36 in.	60 yds.	4 in.	" "	
26			marsh	Tall Marsh Grass	36 in.	60 yds.	4 in.	" "	
27			marsh	Tall Marsh Grass	36 in.	60 yds.	4 in.	" "	
28			marsh	Tall Marsh Grass	36 in.	50 yds.	4 in.	" "	
29			marsh	Tall Marsh Grass	36 in.	70 yds.	6 in.	" "	
30			meadow-like marsh on top of bog	Tall Marsh Grass	14 in.	10 yds.	12 in.	not known	

Table III

Shoveller Nest
(Nest had hatched before it was found)

Nest No.	Date found	No. eggs	Location	Cover (Vegetation) Type	Cover (Vegetation) Height	Distance from water	Elevation	Fate of nest
1		5	meadow-like marsh	Bluegrass and Hoary Vervain	12 in.	5 yards	8 in.	complete hatch

CONCLUSIONS AS TO NESTING SITES

Blue-winged Teal.

The average distance from water was ninety-three and six-tenths yards. The greatest distance from water was four hundred and forty yards while the shortest distance was two and five-tenths yards.

The elevation of the Blue-winged Teal nests averaged much higher than those of the Mallard nests. Vegetation on the slopes was found to be not nearly so rank as where the Mallard nests were found.

The types of cover for the nests were as follows: fourteen in Tall Marsh Grass; eight in bluegrass and Hoary Vervain; three in bluegrass, Hoary Vervain, and White Vervain; two in bluegrass; one in bluegrass and Flagroot; one in sweet clover; one in alfalfa; and one on a muskrat house.

From the above data one may suspect that Tall Marsh Grass offers ideal nesting cover, but definite conclusions can not be reached until a greater number of nests have been studied.

Mallard.

The nest farthest from water was three hundred and ten yards, though there is reason to believe that if good natural cover were unlimited nests would occur much farther away. The nearest to water was five yards, and the average distance

was seventy-three and six-tenths yards. In all cases the nests were so located that the cover and terrain offered good protection both for the nest and the migration of the young to the rearing grounds.

The types of cover for the nests were as follows: eighteen were built in Tall Marsh Grass; nine in bluegrass, Hoary Vervain, and White Vervain; one in alfalfa; one in weeds and oak twigs; and one in corn stubble and weeds. From the above data one is led to believe that the best types of cover are Tall Marsh Grass and Bluegrass, Hoary Vervain, and White Vervain.

Nest sites were so well drained as a rule that it is doubtful if many Mallard nests are flooded in a year of normal rainfall. On the other hand, two were observed in situations where a slight rise of water level would have endangered them, and much of the territory in which nests were commonly located has been submerged in abnormally rainy seasons. Whether or not the ducks build their nests in more protected locations under such circumstances, I can not say at this time.

Shoveller.

A nest was located five feet from water in a slough just north of Trumbull Lake. It was built on a tuft of bog eight inches above the water level. Vegetation surrounding the nest was bluegrass and Hoary Vervain twelve inches high.

The data are given on this nest merely to give the read-

er some idea as to where Shoveller nests might be found. No conclusions could be made on data from a single nest.

DESTRUCTION OF DUCK NESTS

Farmers reported to me the loss of fifteen duck nests by the trampling of cattle. Eleven of these were of Mallards, and the remaining four were those of Blue-winged Teal. Undoubtedly many more nests were destroyed by the same means but were unobserved.

Early in the nesting season several packs of mongrel dogs destroyed their share of duck nests as well as the nests of other game and non-game birds. After the eggs had hatched and the young ducks had migrated to water, there was little chance for dogs to harm them.

Cats were comparatively few in the area north of Ruthven, and as yet I have no data as to their status as waterfowl enemies.

Skunks were fairly numerous in that territory, but I was unable to secure any information with regard to their nest-destroying activities, if any.

During the summer I observed some mink signs, but the animals were scarce, and I obtained no data bearing upon their relation to ducks.

June 25 I observed fourteen Marsh Hawks within a radius of four miles of Mud Lake. Apparently these hawks do not molest the ducks in any way. In a number of cases I saw them fly over ducks of all ages and not once were the ducks seen

to become alarmed because of their presence. Intensive studies of Marsh Hawk food habits are planned for next year, however, contemporaneous with the waterfowl rearing period.

Crows seemed to lead the field in the destruction of duck nests. Once a nest was located by a crow, it was sure to be broken up. I saw many of them sitting on fence posts in the nesting areas, constantly watching for a duck to get up off her nest. A farmer told me of flushing a Mallard off a nest on his way to lunch and when returning an hour later found two crows taking the last of seven eggs. Within the small stands of timber on some of the lakes I found the remains of many duck eggs that had been carried there by crows. Despite the conspicuousness of crow damage, nevertheless, we are far from being in a position to say how serious an enemy to wild ducks the species actually is. Nor will we be in a position until we have quantitative as well as qualitative data on nest mortality factors.

On June 17 a tract of twenty-five acres of Tall Marsh Grass was cut for packing purposes in the Outlet of Lost Island Lake, and as a result of which twenty-one duck nests were destroyed. Twelve were of Blue-winged Teal and the rest were of Mallard.

From the data now in possession it appears that crows destroyed more nests than all the rest of the inimical agencies combined. Trampling by stock caused some damage to the

duck nesting activities. Losses through mowing may be locally heavy but need to be evaluated quantitatively.

DUCK LIFE

In this study of duck life the writer will begin with the nesting season as it was at the time he began making observations.

The nesting ducks upon the approach of danger became tense and crouched close upon the nest. In several instances the writer walked within five feet of occupied nests, and still the female did not move. However, when a water spaniel dog was used for the locating of nests, the ducks would flush when the dog came within twenty feet. This surely proved that they had a greater fear of dogs than they did of man. On all occasions when the incubating birds flushed from nests they displayed neither protective nor resistive behavior. Flushed, the duck usually made a circle and then flew to a slough or marsh near by. When leaving the nest she took directly to the air.

The density of vegetation surrounding the nests prevented accurate observations as to the length of time that the young remained after hatching. On the basis of data at hand, the new broods left the nests within twenty-four hours. Peril to the ducklings must be relatively great during the migration from the nest to water, especially where the nests are a half mile or more from rearing grounds.

After the ducklings reached the rearing waters, their

dangers were greatly reduced. The rearing waters as those of Round Lake, Mud Lake, and numerous sloughs may be adjudged ideal, with Tall Marsh Grass, Flagroot, and Bulrushes extending from one to three feet above the surface of the water. In such a place the ducklings were never taken to open water until they were learning to fly. To observe the ducklings in such cover, one had to wade through this mass of vegetation to catch what glimpses he could as they swam out of his way.

The mother ducks employed different tactics when they had young instead of eggs to care for. If a duck with ducklings was approached, she flew in a crippled manner in the opposite direction from the ducklings. If one remained near the ducklings, she circled over them low, quacking softly, in response to which they kept perfectly quiet. If one continued to remain, she soon had them swimming away in very close formation, swimming in unison, the color of their down and feathers blending into the vegetation. The actions of both the Mallard and Blue-winged Teal ducks were much the same in this respect.

As soon as breeding had taken place and nesting had started, the drakes congregated in small flocks on the numerous ponds, sloughs, and marshes. Many were seen late in the evening on different bodies of open water. During the day they were usually concealed in the marsh cover. Blue-winged Teal drakes seemed to gather in larger flocks than did the

Mallard drakes. Rarely were more than three Mallard drakes in one group. In several cases between twelve and eighteen Teal drakes were flushed in one flock. The drakes were commonly found in ponds, sloughs, and marshes near the nesting or brooding females.

Feeding of both the ducks and drakes was usually done late in the evening and early in the morning. Much greater numbers were observed flying to and from the feeding grounds just before dark than at other times. By observing the horizon through binoculars in the early stages of darkness, one saw large numbers of ducks flying. On stormy days a number of drakes and a few females were observed flying to more quiet and protected waters.

The ducklings were kept in close cover until they could fly with ease. The first of this season's ducks were observed on the wing early the morning of July 25. From August 15 on, large numbers were seen flying or attempting to fly early in the morning. I could not say whether the ducks were flying to feeding grounds or were merely getting exercise in preparation for their flight south.

Toward the latter part of September there seemed to be some unrest among the duck population, preliminary to migration. This was made apparent by the increase in the size of the flocks and the tendency for them to group together on the larger bodies of open water.

At noon on October 1 the shooting season opened. For the first forty-five minutes of shooting the ducks of all species were in utmost confusion. Especially were the young ducks easy victims for the hunters. The Blue-winged Teal were the last of the species present to find safety by "climbing". The ducks flew out over the surrounding country and remained at high altitudes until evening when they returned to the marshes and sloughs to seek cover for the night.

Soon after the closing of the first day the greater part of the ducks learned that Round Lake and Virgin Lake were game refuges. Shooting was permitted up to the water's edge on these lakes and it took the ducks several days to learn to leave and return at high altitudes. It was very interesting to watch the flocks come into the lake two and three hundred yards high in order to foil the hunters along the water's edge. Of course a few stragglers became unwary and passed over within gunshot range. On stormy days when the visibility was poor the ducks had to fly low, and it was at times such as this that large numbers were killed by hunters.

There seemed to be a tendency for the greater part of the ducks to wait until after sundown to leave the lakes to fly and feed. Several evenings after darkness had fallen observations were made on a flight of Mallard ducks. The birds were observed against the horizon, and the flight took place in about twenty minutes. One evening approximately

six hundred and fifty ducks were counted that passed directly overhead, and at the same time the flight was equally concentrated a quarter of a mile on both sides.

The ducks returned from their feeding grounds or flights some time in the early hours of the morning.

October 24 the Mallards and Pintails began feeding in corn fields. By this date large fields had been picked by mechanical corn pickers. These machines laid the cornstalks to the ground and at the same time shelled out and scattered much grain to be found easily by hungry birds appreciative of a chance to fill up quickly. Most of the feeding in such fields was done within an hour after sunrise and from sundown until dark; in stormy weather, throughout the day.

Considerable data on shooting were gathered in an attempt to evaluate the direct human pressure upon waterfowl during the hunting season. These data are not sufficiently complete to include here.

DUCKS NATIVE TO THIS REGION

Blue-winged Teal, Querquedula discors (Linnaeus).

This species was the most abundant of all the ducks in that particular part of the state. Large numbers were observed on all nesting and rearing grounds.

Mallard, Anas platyrhynchos platyrhynchos (Linnaeus).

Next to the Blue-winged Teal this much hunted duck was the most abundant. Its presence was noted in large numbers throughout the area.

Pintail, Dafila acuta tzitzihoa (Vieillot).

Although this duck was not nearly so abundant as the above species, it was seen on almost all of the lakes and marshes.

Shoveller, Spatula clypeata (Linnaeus).

Data were obtained on only one nest, but many young were reared locally.

Wood Duck, Aix sponsa (Linnaeus).

This beautiful duck was present in small numbers, and probably some nesting took place.

Ruddy, Erismatura jamaicensis rubida (Wilson).

The Ruddy duck was seen throughout the summer, but in all cases they were adults; if young were reared, they escaped

my observation.

Bald Pate, Mareca americana (Gmelin).

During the summer two adult individuals of this species were observed.

Hooded Merganser, Lophodytes cucullatus (Linnaeus)

One adult drake and one female with a brood of four were observed on two occasions during the summer.

Redhead, Nyroca americana (Eyton).

On August 15 four two-thirds grown Redheads were seen on Lost Island Lake. They had undoubtedly been reared in that area.

Lesser Scaup, Nyroca affinis (Eyton).

A small flock of twelve adults was observed throughout the summer on a small slough, but apparently no young were produced.

Black Duck, Anas rubripes tristis (Brewster).

No observations were made on this duck, but it undoubtedly nested in small numbers.

Gadwall, Chaulelasmus streperus (Linnaeus).

This duck like the Black duck doubtless nested in that part of the state in small numbers. Several adults were noted, but no young.

PRODUCTIVITY OF NORTHWESTERN IOWA AS A WILD DUCK BREEDING AREA

Though I am fully aware of the extreme difficulty of making a reasonably accurate estimate of the breeding duck population of the four counties (Clay, Palo Alto, Emmet, Dickinson) in which the major part of my studies were conducted, it may be of some utility to list the best figures I have been able to compile. The totals were arrived at through careful calculations and are not to be mistaken for mere guesswork.

	Adult ducks at beginning of breeding season	Young ducks reared	Total
Blue-winged Teal	10,000	25,000	35,000
Mallard	9,000	21,000	30,000
Pintail	1,500	5,000	6,500
Shoveller	300	800	1,100
Wood Duck	25	60	85
Ruddy	65	?	65
Bald Pate	Not known	Not known	
Hooded Merganser	8	20	28
Redhead	10	15	25
Lesser Scaup	25	?	25
Black Duck	Not known	Not known	
Gadwall	Not known	Not known	
	20,933	51,895	72,828

CONCLUSION

Five months studies have made it indeed evident to me that if we expect our ducks to withstand future shooting seasons we will have to pay attention to their breeding requirements as well as to legal restrictions on taking them.

The most imperative need at present is the restoration of native cover to the land surrounding what lakes and sloughs we have. At present practically all land adjacent to our duck waters is cultivated or heavily pastured, and is thus rendered practically useless for nesting, irrespective of how suitable for the birds conditions may be otherwise. The best example of such a condition is found at Round Lake, a state game refuge. The cover of the lake is ideal for the rearing of ducks, but the land surrounding it is over-pastured by cattle, sheep, and hogs. This past season I doubt if one nest could be found for every twenty-five acres. Ducks that were reared upon this lake must have migrated to it from quite a distance. The same condition as was noted on Round Lake will hold true for the majority of lakes in the vicinity of Ruthven, Iowa.

From my observations I have come to the conclusion that at least as much native land should surround a small or medium-sized body of water as the area of the water itself. Perhaps cooperation with farmers and land owners could be

attained by which livestock could be kept off such lands until the ducks are through nesting.

Certain predators such as crows and dogs may be of sufficient local importance to justify reasonable repression during the nesting season, but ill-judged and indiscriminate campaigns against hawks, owls, and carnivores are by all means to be avoided. In general, stress should be laid upon reducing predator losses through improvement of waterfowl breeding environment instead of applying unnecessary pressure upon predacious species themselves.

Miscellaneous factors as the destruction of duck foods by droughts, fluctuating water levels, carp, etc. may have their greater or less bearing upon the productivity of given areas. All in all, the problem of waterfowl management is predominantly ecological and must be approached from that standpoint if the results of our endeavors are to be of greatest significance to conservation. A combined technique of sound environmental manipulation and control of shooting seems to offer about the only slavation for many species of native game birds.

LITERATURE CONSULTED

(1) American Ornithologist's Union.
1931 A. O. U. check-list of North American birds. American Ornithologist's Union, Lancaster, Pa.

(2) Bailey, B. H.
1906 200 wild birds of Iowa. Audubon Nature Publication, Cedar Rapids, Iowa.

(3) Bailey, B. H.
1918 The raptorial birds of Iowa. Iowa Geological Survey, Bulletin No. 6, Des Moines, Iowa.

(4) Baird, S. F.
1860 The birds of North America. J. B. Lippincott and Co., Philadelphia, Pa.

(5) Barrows, W. B.
1912 Michigan bird life. Michigan Agricultural College, Lansing, Mich.

(6) Davie, O.
1889 Nests and eggs of North American birds. Hann and Adair Co., Columbus, Ohio.

(7) Eaton, E. H.
1914 Birds of New York. New York State Museum, Memoir 12, Albany, New York.

(8) Forbush, E. H.
1916 History of the game birds, wild-fowl, and shore birds of Massachusetts and adjacent states. Massachusetts State Board of Agriculture, Boston.

(9) Forbush, E. H.
1925 Birds of Massachusetts and other New England States. Berwick and Smith Co., Norwood, Mass.

(10) Hartley, G. I.
1922 The importance of bird life. The Century Co., New York.

(11) Hudson, W. H.
1921 British birds. Longmans, Green, and Co., London and New York.

(12) Knowlton, F. H.
1909 Birds of the world. H. Holt and Co., New York.

(13) Mabbott, D. C.
1920 Food habits of seven species of American shoal-water ducks. U. S. Dept. Agr. Bul. No. 862.

(14) McAtee, W. L.
1914 Five important wild-duck foods. U. S. Dept. Agr. Bul. No. 58.

(15) McAtee, W. L.
1918 Food habits of the Mallard ducks of the United States. U. S. Dept. Agr. Bul. No. 720.

(16) Oberholser, H. C.
1917 The great plains waterfowl breeding grounds and their protection. Department of Agriculture Yearbook 1917:197-204.

(17) Oberholser, H. C. and McAtee, W. L.
1920 Waterfowl and their food plants in the sandhill region of Nebraska. U. S. Dept. Agr. Bul. No. 794.

(18) Phillips, J. C.
1928 Wild birds introduced or transplanted in North America. U. S. Dept. Agr. Tech. Bul. No. 61.

(19) Phillips, J. C. and Lincoln, F. C.
1930 American waterfowl. Houghton Mifflin Co., Boston and New York.

(20) Reed, C. A.
1904 North American birds eggs. Doubleday, Page and Co., New York.

(21) Rowan, W.
1931 The riddle of migration. The Williams and Wilkins Co., Baltimore.

(22) Thomson, J. A.
1923 The biology of birds. The Macmillan Co., New York.

(23) United States Congress: Senate. Special committee on conservation of wild life resources.
1932 Migratory waterfowl shortage. Hearings before the special committee on conservation of wild life resources United States Senate on the protection and preservation of migratory waterfowl in the United States.

(24) Wetmore, A.
1915 Mortality among waterfowl around Great Salt Lake, Utah. U. S. Dept. Agr. Bul. No. 217.