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NAME AND ADDRESS

THE CINNAMON TEAL (ANAS CYANOPTERA VIEILLLOT):
ITS LIFE HISTORY, ECOLOGY, AND MANAGEMENT

by

Howard E. Spencer, Jr.

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Wildlife Management

UTAH STATE AGRICULTURAL COLLEGE
Logan, Utah

1953

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TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS.	iii
INTRODUCTION.	1
REVIEW OF LITERATURE.	4
THE INVESTIGATION	6
Area of Investigation	6
Material and Methods	11
CHARACTERISTICS OF THE CINNAMON TEAL	14
Taxonomy	14
Description.	15
Distinction of Cinnamon and Blue-winged Teals	19
Hybridism	22
Sex and Age Ratios	28
Weights and Measurements	29
DISTRIBUTION	32
MIGRATION	36
General	36
Spring	36
Fall	38
BANDING ACTIVITIES AND RESULTS.	43
Summary of past banding data	43
Project Banding Operations ,	48
COURTSHIP AND PRENESTING ACTIVITIES	60
Courtship Behavior.	60
Other prenesting habits	66
TERRITORIALISM	70
THE NESTING SURVEY	73

	Page
Techniques	73
Phenology of the Breeding Season	77
Nest Site Selection	80
Interspersion of Nests	86
Nest Construction	88
Egg laying and Incubation	95
Nesting Mortality	101
Hatching	104
Embryo Dyeing	104
RENESTING	116
BROOD REARING	120
Cover Selection	120
Growth of the young	121
Brood Sizes	123
Juvenile Mortality	124
PREDATION	130
ESTIMATED PRODUCTION	132
HUNTING SEASON AND HARVEST	136
Utah Harvest	136
Continental Kill	142
FOOD HABITS	145
Food Habits in Utah	146
DISEASES AND PARASITES	154
Botulism	154
Lead Poisoning	156
Fowl Cholera	156
Parasites	157
MANAGEMENT PRACTICES AND RECOMMENDATIONS.	159
Predator Control	160
Water-level Control	161
Habitat Development	162
Disease Control	165
SUMMARY	167
LITERATURE CITED.	173
APPENDIX	

LIST OF FIGURES

Figure	Page
1. The Cinnamon Teal in nuptial plumage	i
2. Principal waterfowl areas included in the investigation	8
3. Map of Ogden Bay Refuge, Utah, showing vegetational cover and location of Special Study Area	10
4. Map of Special Study Area, Ogden Bay Refuge, and nest locations	12
5. Comparison of Cinnamon and Blue-winged Teals	24
6. Lachrymal bone characteristics of 3 species of North American Teals	25
7. A Cinnamon Teal-Blue-winged Teal hybrid . .	26
8. Map of main ranges of North American Cinnamon Teal	35
9. Three-year average of monthly Cinnamon Teal abundance on three Utah Refuges, 1949-1951	42
10. Map of band returns from Cinnamon Teal through 1948	47
11. Semi-permanent type waterfowl trap used during banding operations at Ogden Bay Utah	54
12. Three Redhead ducks just inside the trap entrance.	55
13. Schematic drawing of semi-permanent type trap used during study at Ogden Bay	56
14. Total out-of-State banding recoveries of Cinnamon Teal banded at Ogden Bay, Utah, July 1947-June 1952	59
15. A typical resting and courting ^t area favored by Cinnamon Teal, Ogden Bay Refuge, 1950 .	68

Figure		Page
16.	Ideal loafing spots adjacent to nesting cover for Cinnamon Teal at Ogden Bay.	69
17.	Sample nest history form used during the Cinnamon Teal investigation	75
18.	Phenology of Cinnamon Teal nesting at Ogden Bay 1950	79
19.	A well concealed Cinnamon Teal nest at Ogden Bay Refuge, 1950	81
20.	Two complete clutches of Cinnamon Teal eggs - 1 nest with an abundance of down and 1 with almost no down	82
21.	Preferred Cinnamon Teal nesting cover at Ogden Bay Refuge, 1950	83
22.	Cover types and Cinnamon Teal nest cover selection, Special Study Area, Ogden Bay Refuge, 1950	92
23.	Cinnamon Teal and Mallard nests 8 inches apart at Newstate Duck Club, Woods Cross, Utah, 1950	93
24.	An incubating Cinnamon Teal killed on her nest by a predator.	103
25.	Caliper devised for measuring eggs during the study	113
26.	Injecting Cinnamon Teal eggs with dye to color the young	114
27.	Sealing the hypodermic puncture with collodion after injecting Cinnamon Teal eggs with colored Dye	115
28.	An abnormal Cinnamon Teal egg compared with normal eggs of the same species and Canada Goose	116
29.	A Mallard drake showing color of the marking with airplane dope, for future identification in the field.	121
30.	Growth of Cinnamon Teal ducklings from the age of one to eight weeks	129
31.	Seasonal variation in the diet of the Cinnamon Teal	147

Figure		Page
32.	Diagram of device (Waterfowl Aspirator) used to extract ingested material from the gizzards of live ducks	151
33.	(A) The waterfowl aspirator in use. . . .	152
	(B) The collection bottle and a duck's gizzard contents extracted with the aspirator.	152

LIST OF TABLES

Table	Page
1. Bill measurements of Cinnamon and Blue-winged Teal	23
2. Sex Ratios of Cinnamon Teal	31
3. Population fluctuation of Cinnamon Teal . on 3 Utah State Refuges, 1949-1951. . . .	41
4. Migration of Cinnamon Teal from banding returns through 1948	45
5. Returns from Cinnamon Teal banded at Ogden Bay, Utah, 1947-1952	57
6. Summary of Cinnamon Teal nesting cover, Ogden Bay Refuge, Utah 1949	89
7. Cinnamon Teal nesting cover selection, Salt Lake Basin Utah, 1950	90
8. Vegetational composition of the Special Study Area and Cinnamon Teal nesting cover selection and preference	91
9. Variation in egg size of individual Cinnamon Teal clutches, Ogden Bay Refuge, 1949-1950	108
10. Summary of Cinnamon Teal nesting results, Ogden Bay Refuge, 1949.	109
11. Cinnamon Teal nesting data, Ogden Bay Refuge, 1950	110
12. Comparison of nesting success of various duck species on Special Study Area at Ogden Bay Refuge, 1950	111
13. Additional nesting data from Ogden Bay. . and Bear River Migratory Bird Refuges . .	112
14. Cinnamon Teal brood count data, Ogden Bay Refuge, 1949 and 1950	128

	Page
15. Breeding pair populations of Cinnamon Teal and other ducks on 3 Utah State Refuges, 1949-1952	135
16. Composition and numbers of Cinnamon Teal killed in the 1949 hunting season by weekly periods.	139
17. Sexed and aged samples of Cinnamon Teal killed on 3 Utah check areas, 1949-1951	140
18. The calculated kill of Cinnamon Teal on 3 Utah check areas and the computed Statewide kill, 1949-1951	141
19. Plant food of the Cinnamon Teal	146
20. Fall foods of 24 Cinnamon Teal from Ogden Bay Utah, 1950	151
21. Cinnamon Teal botulism losses at Ogden Bay Refuge, Utah, 1949-1951	158

Table 22.	Partial List of Birds and Mammals at Ogden Bay Migratory Birds Refuge	178
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Table 23.	Partial List of Common Plants at Ogden Bay Refuge, Utah.	182
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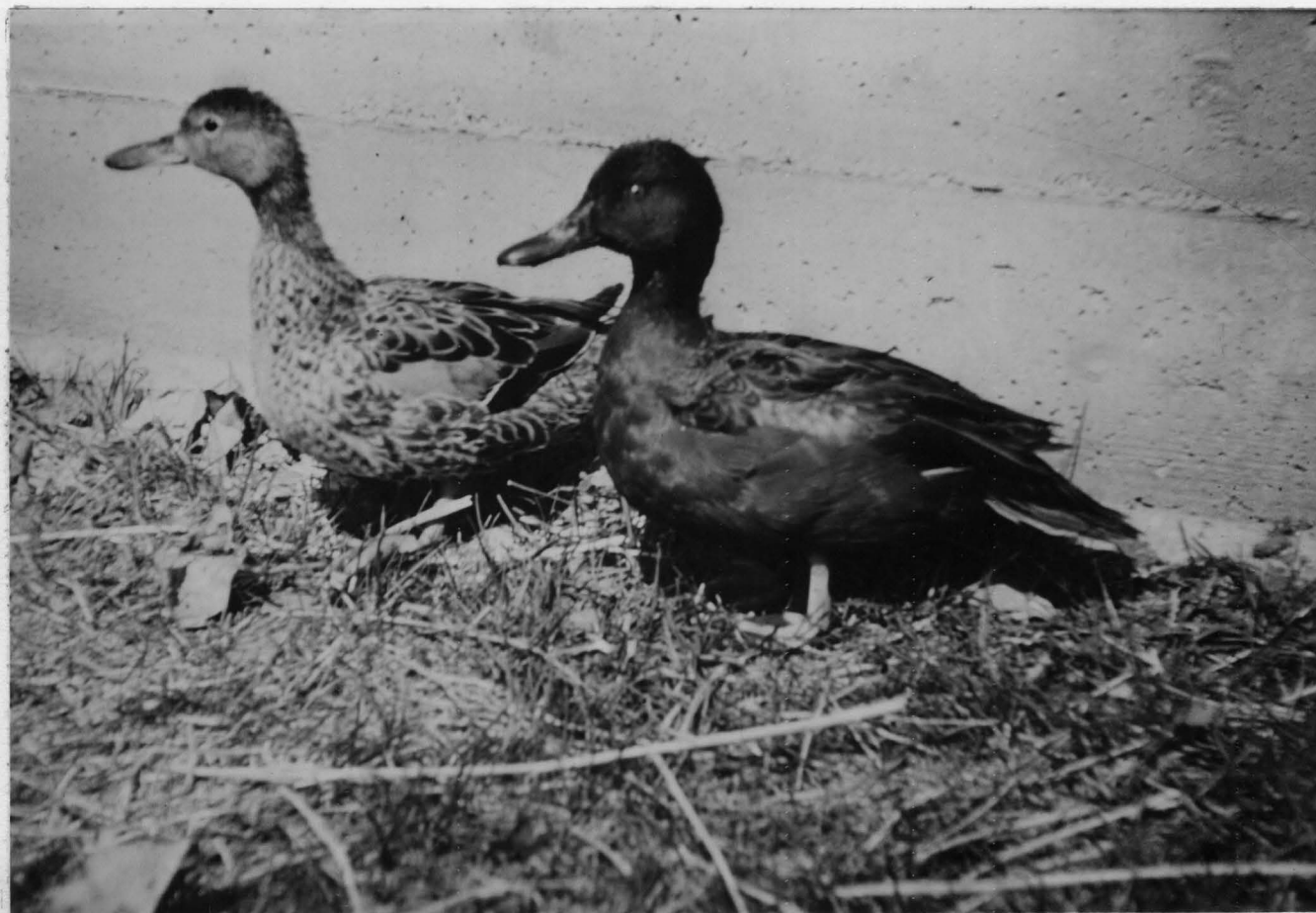


Figure 1. THE CINNAMON TEAL (Anas cyanoptera Vieillot)

NUPTIAL PLUMAGE

Female

Male

ACKNOWLEDGEMENTS

I am deeply indebted to many persons for assistance in this project.

Gratitude is expressed to the Utah State Fish and Game Department for financial assistance and for use of their lands for most of the field work. The guidance and constant encouragement of project director, Dr. Jessop B. Low, Leader, Utah Cooperative Wildlife Research Unit, were primary factors in the success of the project. For the close friendship, sound technical advice and assistance of Mr. Noland F. Nelson, Utah Waterfowl Project Leader, I am particularly grateful. Mr. Calvin Wilson, Curator, Tracey Aviary, Salt Lake City, Utah, unhesitatingly contributed the facilities of the Aviary and furnished counsel on many ornithological phases of the project. The friendship of Mr. Wilson and his family has meant much.

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Finally much gratitude is expressed to my wife, Marcy, for her assistance in preparation of the manuscript.

INTRODUCTION

It takes but a perusal of literature pertaining to waterfowl to realize the paucity of information regarding the Cinnamon Teal. The Redhead, Blue-winged Teal, and Canvasback have all been exhaustively studied by Low (1941), Bennett (1938), and Hochbaum (1944), respectively; and other species are now receiving attention from other workers. In order to help round out these studies of particular species, the writer undertook the project of a detailed study of the life history, ecology, and management of the Cinnamon Teal.

The project was directed and financed under the auspices of the Utah Cooperative Wildlife Research Unit at Utah State Agricultural College, Logan, Utah.

The study began as Project No. 112 in June 1949, and continued as such until September 1950, when the writer was recalled to active duty with the Armed Forces. Quarterly progress reports from June 1949 to September 1950 are published in the Quarterly Unit Reports. Work on the investigation reopened in January 1952 upon the writer's return and has been continuous until the present. Considerably more than a year has been spent in field research and the collection of data. Detailed nesting and harvest data for two years by the writer, plus several additional years' data collected by co-workers, have been included.

Whenever possible, for the sake of clarity, data are presented in graphs or tables. In addition, a number of photographs have been included to illustrate particular points or to supplement the general text.

Purpose

The principal purpose of the Cinnamon Teal study was to obtain a unified and rather comprehensive understanding of this particular bird, both from an ornithologist's and a waterfowl manager's point of view. This species has never received extensive study or treatment. Hence, the specific purpose of the present investigation is to add to existing knowledge of American waterfowl in order that the biology and biological requirements of the species may be more fully appreciated by sportsmen, managers, and students.

In pursuing this purpose the investigator sought the answers to such problems as important decimating factors, reproductive potential, the effect of various management practices, food habits, and migration characteristics. Even the matter of identifying this species from its relative, the Blue-winged Teal, under certain conditions, constituted a serious difficulty and therefore received special attention.

Scope

Although the investigation was generally restricted to the State of Utah, correspondence with fish and game departments of several western states was initiated to determine what workers had found in other sections of the bird's range.

Many of the data gathered are necessarily qualitative rather than quantitative and should be so regarded. The nesting survey and productivity observations received the most detailed and extensive work during the project period as it was felt that this phase was of paramount importance. In addition to the normal characteristics and habits of the species such special topics as disease and parasites received whatever added attention was possible.

REVIEW OF LITERATURE

Very little research to date has been concerned with the Cinnamon Teal. Most of what is currently known of this species has been gleaned piecemeal from studies by a number of biologists with varied objectives. Probably the most singularly comprehensive compilation of data is the work by Kortright (1943). His treatment is freely quoted throughout this thesis. The data on weights and measurements are largely from this source.

Jensen and Smith (1949) summarized banding data, and theirs plus subsequent data are included in the present work. Nord (1941) developed a waterfowl aspirator, a modification of which was used to some extent in studies of food habits made in the present investigation. Embryo dyeing techniques were developed by Evans (1951) and Hyers (1949); both of their techniques were experimented with during the investigation.

Nesting densities and cover selection for all waterfowl were extensively studied at the Bear River Migratory Bird Refuge by Williams and Marshall (1938). Their work covered a portion of the investigation area and included the Cinnamon Teal.

Wingfield (1951) and Odin (1951), working at Knudson's Marsh and Farmington Bay respectively, also included nesting

data on the Cinnamon. Abbot (1938) discovered the distinctive characteristics of the lachrymal bones of waterfowl but failed to include the Cinnamon. This approach to identification has been studied, and the results are included under the section on Identification.

The taxonomic position of the Cinnamon Teal was considered by Delacour and Mayr (1945) in their extensive treatment of the Anatidae. More recently, Snyder and Lumsden (1951) analysed variation found in both North and South American specimens. As a result of their findings they proposed the subdivision of the species into five races. The North American population is considered one race and the South American Cinnamon Teal are divided into four additional races. Their work has not yet been accepted by the American Ornithologists' Union Committee on Nomenclature, whose classification is followed in this treatment.

Mabbott (1920) made early investigations of the food habits of the Cinnamon Teal; and the epochal work of Martin, Zim, and Nelson (1951) summarized existing knowledge of the diet to date. The results of these studies are further discussed under "food habits."

THE INVESTIGATION

Area of Investigation

The project in Utah was statewide. Field work, however, was confined to areas on the east shore of the Great Salt Lake and to Cache Valley in Cache County. Thus the findings pertain specifically to the Great Basin and intermountain region of Utah. Most of the detailed field work was conducted at Ogden Bay Bird Refuge west of Ogden and near the town of Hooper, Utah. Information gathered at Ogden Bay was supplemented by additional data gathered at: (1) Farmington Bay State Migratory Bird Refuge, 20 miles south of Ogden Bay; (2) State Public Shooting Grounds, 10 miles west of Corine, Utah; and (3) the Bear River Migratory Bird Refuge west of Brigham City, Utah. Some data were also obtained from the lands of two private gun clubs, the Newstate Gun Club at Woods Cross, Utah, and the Bear River Gun Club at Brigham City.

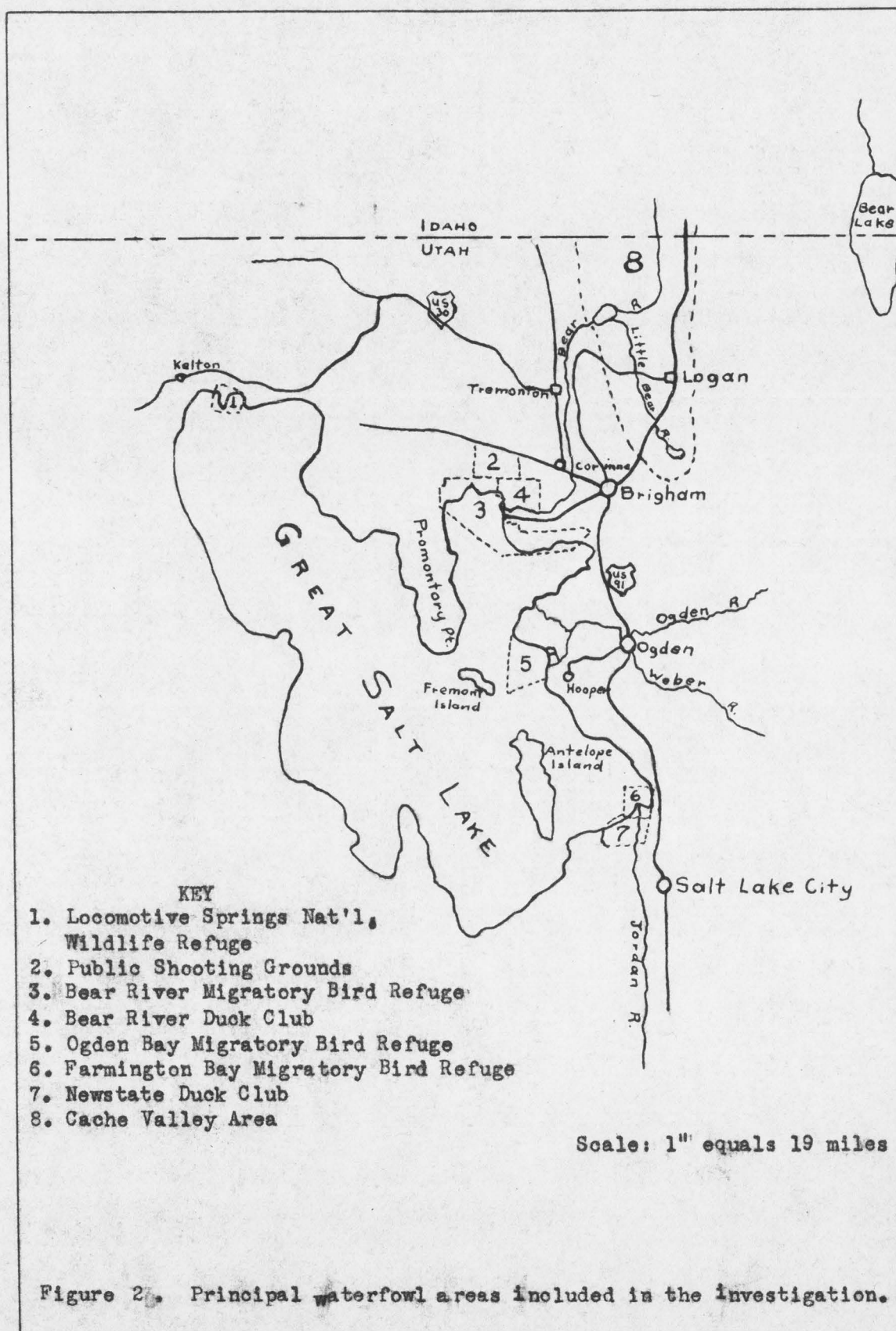
Description of Area. The area from Salt Lake City northward to the Idaho State line is a region of outstanding geologic interest. It is bounded on the east by the Wasatch Mountains and on the west by the shore of the Great Salt Lake.

The Great Salt Lake has been receding over the course of recent geologic time and in its recession has left a

gradually sloping alluvial plain between its shore and the Wasatch fault. The present distance between the mountains and actual lake shore varies from about 1 mile in the Farmington Bay region to approximately 20 miles at the outwash of Bear River Delta. The Wasatch front is characterized by numerous alluvial fans and cones of defunct streams. Four principal rivers have been instrumental in elevating the plain with large rich silt deposits. From south to north these rivers are, respectively; (1) the Jordan, which enters Salt Lake in the vicinity of Woods Cross; (2) the Weber and Ogden Rivers, which join and flow jointly into Salt Lake west of Ogden; and (3) the Bear River, which enters Salt Lake from the northeast near Brigham City.

As one goes west from the mountains across the Great Salt Lake Valley, he crosses successively the upland fruit growing belt, the bottomland farming belt, the bordering marshes, the barren alkali flats, and finally reaches the actual lake level. Where the rivers have pushed out their deltas and accompanying silt deposits, along with a supply of fresh water, the vegetation has been extended further and further westward into the Lake. On these extensive delta systems some of the finest waterfowl marshes in United States have been produced. This is the general nature of the area encompassed by the study.

Ogden Bay Refuge. Except for Cache Valley, the description of the Ogden Bay Refuge which follows applies largely to the other sections, where data were collected.



This Refuge was established in 1938 by the State of Utah to preserve and improve important waterfowl breeding and hunting grounds on the outer Weber River Delta and a portion of the eastern shore of the Great Salt Lake. The area includes 12,000 acres and consists of 3 units, 2 of which are completely enclosed by dikes that allow close water control. The water supply of the Refuge is drawn from two sources. The Weber River supplies Units I and II, while Unit III depends upon seepage springs and ground return from local farmland irrigation (figure 3).

Unit I was selected for intensive study; within this unit a smaller area of 357 acres was selected for quantitative phases of the work (figure 4). Both Unit I and the special study area were chosen because they represented a closely controlled area readily accessible for study. In addition, these areas present a diversity of well interspersed cover types. The nature and composition of these various types is discussed in the sections on nesting and brood rearing.

In general, on Ogden Bay as well as in the other Lakeshore areas, the vegetation follows a definite pattern of zonation and succession. When fresh water is supplied to an area of barren alkali flat and the salt content is diluted, Saltwort (Salicornia rubra) and Greasewood (Sarcobatus vermiculatus) become established. As dilution becomes greater and silt deposits are laid down, saltgrass (Distichlis stricta), alkali bulrush (Scirpus paludosus).

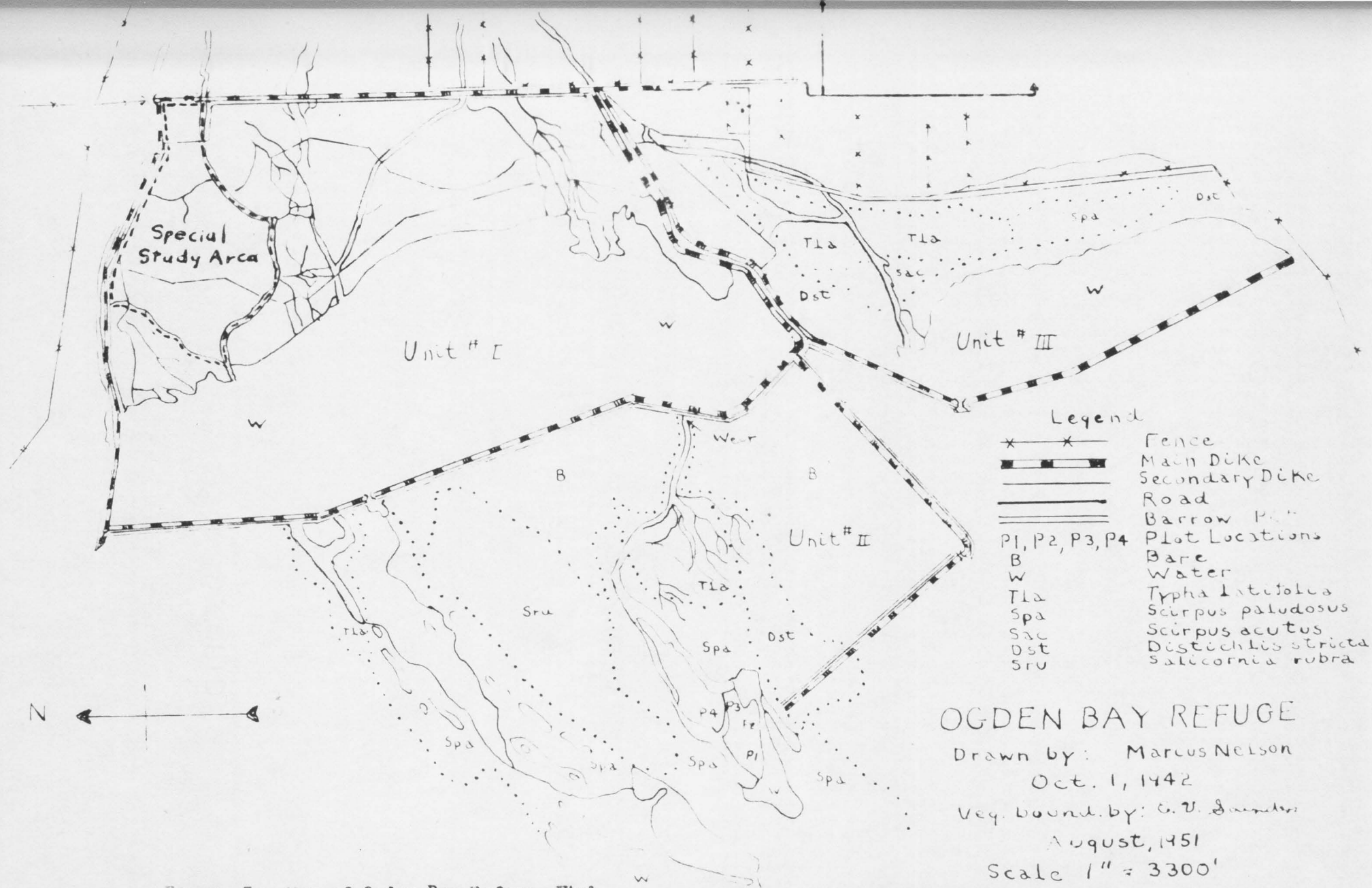


Figure 3. Map of Ogden Bay Refuge, Utah, showing vegetational cover and location of Special Study Area.

hardstem bulrush (Scirpus acutus) and other rushes (Juncus spp.) take over in approximately that order. Cattails (Typha spp.), forbs, and grasses (Graminae) invade and establish themselves in spots where drier natural levees, dikes, and channel banks are built of new or non-alkaline soils. This succession is especially obvious (figure 4) in the vegetational zonation as one moves away from an outwash channel through the Cattails into the Bulrush, thence to a belt of Saltgrass, a belt of saltwort and greasewood, and finally onto an expanse of barren, salty, mud flats where no plant life exists.

In the actual fresh water channels and impoundments, such submerged forms as Muskgrass (Chara spp.), Wigeon grass (Ruppia spp.), Coontail (Ceratophyllum spp.), and Pondweeds (Potamogeton spp.) quickly establish themselves. Sago Pondweed (Potamogeton pectinatus) is the most important submergent from the standpoints of both prevalence and value to waterfowl.

The soils for the most part consist of clays and sandy clays which in places are overtopped with loamy silt deposits. Most of the area is underlain with a hardpan layer varying in depth from about 3 feet to well over 20 feet.

Materials and Methods

Specific details of various techniques employed in particular phases of the study are discussed in detail in those sections pertaining directly to the facet of the investigation involved. In general, the writer relied

heavily upon personal observations in the field. Careful, copious notes were made and constantly referred to. An effort was made to make the degree of accuracy of all weights and measurements commensurate with the individual measurements in question. For example, nest distances were paced off, nest sizes were measured with a steel rule, eggs were measured in millimeters, and weights taken in grams. The nesting survey followed a pattern similar to that used by Williams and Marshall (1938) at Bear River in 1937. The renesting study employed the techniques used by Sowls (1949) at Delta, Manitoba. Census, sex ratios and similar data were gathered by standard methods.

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CHARACTERISTICS OF THE CINNAMON TEAL

Taxonomy

The committee on Nomenclature of the American Ornithologists' Union places the Cinnamon Teal taxonomically as follows:

Class Aves
 Subclass Neornithes
 Superorder Neognathae
 Order Anseriformes
 Suborder Anseres
 Family Anatidae
 Subfamily Anatinae
 Genus Anas
 Species cyanoptera Vieillot

The derivation of the scientific name is as follows: Anas from the Latin meaning duck, and cyanoptera from the Greek knanos, meaning blue and pteron, meaning wing.

It will be noted that the Cinnamon and not the Blue-winged Teal is scientifically named the "blue-wing duck."

Vernacular and Colloquial Names

<u>Name</u>	<u>Authority</u>
Bluewing	Kortright, F.H. 1943
Blue-winged Teal	"
Red-breasted Teal	"
Red Teal	"
River Teal	"
Silver Teal	"
La Sarcelle Cannelle	Taverner, P. A. 1937
South American Teal	Finley, W. L. 1936

The taxonomy stated above for the specific name is in a somewhat unsettled position. The forthcoming revision of the American Ornithologists' Union check list will probably describe the species as Anas cyanoptera V. (Cinnamon Teal), and Anas cyanoptera cyanoptera V. (lesser Cinnamon Teal).¹ Snyder and Lumsden's (1951) work further subdivides the species into five races. Their work may become accepted in the future.

Despite the excellence of the above work the writer questions the "splitting" for two reasons. (1) The number of specimens examined is small (114 for all of North and South America). The writer's observations of thousands of specimens have shown extreme variation within the species even in the limited area of Great Salt Lake Basin, Utah. (2) The species hybridizes in the wild, the incidence of which is unknown.

Delacour and Mayr (1945) do not recognize any subspecies of the Cinnamon Teal.

Description

Breeding Plumage, Adult Male. In nuptial plumage the adult male on the water has a bright cinnamon red appearance over most of his body. Closer inspection, however, shows that the long cinnamon flank feathers have been brought up and over a mottled brown wing that bears a chalky blue wing-patch extending over most of the lesser, middle, and greater

1. Personal communication with C. S. Robbins, U. S. Fish and Wildlife Service, date: April 22, 1952.

coverts. The tips of the greater covert bear a solid band of white. The speculum is irridescent green, and the tertials are strikingly long silky, and pointed, with alternating longitudinal strips of black, blue, fawn, and cinnamon. The under wing lining and axillars are silvery. The back rump, upper tail coverts, and tail are a dull mottled brown. The cinnamon of the breast and flanks shades into a darker gray brown on the posterior breast, belly and under tail coverts. The remainder of the plumage is bright cinnamon red. The bill is black, rimmed with lighter grey in some cases. The feet and legs are bright yellow with darker joints and greyish black webbing. The eye is crimson red blending into flecked yellow next to the black pupil.

Eclipse and Autumn Plumage. The moult into the eclipse plumage starts in late June in Utah and is largely complete by the third week in July. The males at this time closely resemble the females, but the red eye color and yellowish tarsus tend to be retained. Wing coloration remains the same throughout the year. Kortright (1943) states that the head, neck, and edges of the body feathers are rich cinnamon buff. This has not been noted in Utah.

It has been stated that the adult males begin the moult to winter or breeding plumage in September and complete the change by October or November (Bent 1951). In Utah no adult males in winter plumage have been observed during the fall. One adult male, shot the last week in November 1949, showed

no signs of the prenuptial moult. A few males (age unknown) were observed in mid-January in Box Elder County, Utah which had partially completed the moult into cinnamon dress. Specimens kept in captivity at the Salt Lake aviary have commonly completed the moult by mid-March.

The cinnamon feathers appear first on the breast and the moult continues in progressive stages until full breeding plumage has been assumed.

Adult Female. Kortright (1943) gives the following description, which is accurate except for very minor details and variations mentioned under Identification.

Head and neck greyish buffy white, streaked with dusky, darker on crown, a light dusky line from bill through eye; cheeks buffy white, and finely streaked; chin and throat, and area at base of bill, whitish; bill dusky and spotted at base; edges of both mandibles yellowish flesh color; eye dark greyish brown. Body. Back and rump, dark olive brown, feathers edged with pale buff, feathers of back with U-shaped buffy markings; scapulars same as back but with more pronounced buffy edging; chest and sides, brown, feathers broadly edged with buffy white; breast white¹ belly, whitish mottled with greyish brown; feet, dull yellowish with dark webs. Tail, dusky feathers narrowly edged with buff; upper coverts, olive brown, margined with buff, like back; under coverts, like breast. Wings, like those of male, except blue of lesser and middle coverts duller; greater coverts slaty tipped with white; speculum, dull blackish, glossed with green and narrowly tipped with white; tertials, brown, with lighter edgings."

Juveniles. As soon as they attain full juvenile plumage both sexes resemble the adult female except that

1. This is not to be interpreted as a true white but merely a light background color on close inspection. No white is visible to casual observation; the whole bird has a dusky mottled brown appearance.

the breast may be paler and more streaked than mottled. The wing characteristics and red eye color of the males will separate the sexes at about three months. The wing of the male is as in the adult male, with a solid white edging posterior to the blue wing patch. In the female it is correspondingly similar to the adult female with the white interrupted and separated from the blue by greyish black.

Downy Young. (For a description and pictures of downy young, see "Brood Rearing.")

Voice

The voice of the Cinnamon Teal is limited to a low-pitched, harsh, "karrrr karrrr karrrr" in the female, and a weak whistling, "peep" in the male.

DISTINCTION OF CINNAMON AND BLUE-WINGED TEALS

No difficulties are encountered in identification of the Cinnamon Teal except for occasional confusion with the Blue-winged Teal.

Wherever the ranges of these two species overlap waterfowl workers encounter difficulty in separating juveniles, adult females, and eclipsed adult males for census and nesting study purposes. In banding programs and the collection of harvest data the identification problem again arises. The adult males and juvenile males over 8 weeks old, in most cases, constitute no serious problem since they may be identified on a basis of eye color. The eyes of the Cinnamon Teal males begin to turn red at an age of about 7 weeks although some may take slightly longer. At 8 or 9 weeks this characteristic may be observed in the field with a pair of strong binoculars.

Adult females and juveniles of both sexes (less than 8 weeks) provide the real difficulty. Despite 2 years work on this problem the writer has no positive method of separating these 2 species in the above mentioned sex and age categories. However, the following observations may be of some value.

Various writers give bill measurements as criteria. The writer measured the length and breadth of the bills of 14 Blue-winged and Cinnamon Teals from Utah.

The length of the exposed culmen to the point, length of upper mandible, length of lower mandible, and maximum breadth on the chord were measured in millimeters. The only measurement which shows satisfactory freedom from overlap between the two species is the chord length of the exposed culmen. It would appear from data presented in Table 1, that any specimen with a culmen chord length over 48 millimeters is a Cinnamon Teal. Allan J. Duvall, U. S. Fish and Wildlife Service furnished the writer with the measurements shown in Part B Table 1. It is believed that the difference shown by Parts A & B of this Table result from different techniques of measuring the culmen. Mr. Duvall undoubtedly measured the chord length to the tip of the V or U shaped junction of the culmen with the skull. The writer measured the chord length to the tips of this junction which appeared to be a more clearly defined measurement, less subject to measuring errors and variation. Probably either method will yield similar results for identification. Additional data are needed to verify the validity of this criterion in identification also to separate juvenile birds of the two species.

Another character mentioned in some references is the shape of the feather tract at the junction of the culmen and fore-head. This is supposedly "V" shaped for the Blue-winged and "U" shaped for the Cinnamon. In checking this feature a number of hand reared birds were examined and the variation in one brood alone was sufficient to eliminate this from the

realm of usefulness.

In an effort to determine some differences between the Blue-winged and Cinnamon Teals, series of color photos were taken in order to compare them in various plumages, sexes, and ages (Figure 5). It was noted that, as a general rule, the blue wing coverts of the Blue-wing tend to have a slightly waxy tone whereas those of the Cinnamon are more chalky. No appreciable difference in color hue, intensity, or pattern of the juveniles or females of the two species was detected. Minor differences always could be attributed to individual variation and always were ruled out upon examination of additional specimens.

One characteristic which did appear of some value to one thoroughly familiar with the birds was the shape of the head. The typical Cinnamon appears to have a slightly more massive bill, sloping gradually to the crest somewhat similar to the Shoveller (Spatula clypeata). The typical Blue-wing on the other hand has a head of rather similar shape to the Gadwall (Anas strepera L.) with smaller bill and more abrupt forehead. There is much variation even in this character but at least specimens which show it clearly may be separated. For intermediate individuals it is of little value and is useless as a field mark.

The size and shape of lachrymal bones of several species were found by Abbot (1938) to be distinctive but he failed to include either the Cinnamon or Blue-winged Teals in his treatment. Figure 6 shows a photographic comparison of the left

lachrymal bones of the Green-winged Teal (Anas carolinensis), the Blue-winged Teal (Anas discors), and the Cinnamon Teal (Anas cyanoptera Vieillot). It may be seen from this figure that the lachrymal bones of all three species are of distinctive size and shape. The ventral lobe of the Cinnamon is less regular and more nearly vertical than that of the Blue-wing. Utilization of Abbot's (1938) technique of measuring the two long axes shows 17.5 X 11.0 mm for the Cinnamon Teal and 19.0 X 13.0 mm for the Blue-wing. The characteristics of the lachrymal bones appear to be the best identifying features yet discovered for separating these two species. Additional collections of various sex and age groups should be made to determine whether bone features hold true as would be expected. The utilization of the lachrymals is only of value for specimen identification.

Hybridism

Although extremely uncommon among wild Cinnamon Teal, hybrids are by no means unknown. DeClacour and Mayr (1945) state that the Blue-winged and Cinnamon Teals freely interbreed and that the stock soon becomes "hopelessly intermixes." It is assumed that this refers to birds in captivity.

The writer has been fortunate in being able to examine a preserved specimen at the Bear River Migratory Bird Refuge¹ which is obviously a hybrid male resulting from a Cinnamon Teal X Blue-winged Teal cross (Figure 7). No means of

1. Reported in Auk 65 (4)

Table 1 A. Bill measurements of Cinnamon and Blue-winged Teals.

A. Utah specimens¹

Cinnamon Teal				Blue-winged Teal			
Sex	Length Upper Mandible (mm)	Length Lower Mandible (mm)	Width (mm)	Sex	Length Upper Mandible (mm)	Length Lower Mandible (mm)	Width (mm)
M	51	50	19	M	46	43	18
M	51	48	19	M	47	46	18
M	50	46	18	M	47	46	19
M	50	50	17	M	45	43	18
F	50	48	18	F	45	45	19
F	49	46	18	F	46	43	18
F	51	47	18	M	46	46	18
Average	50.0	47.8	18.1		46.0	44.5	18.2
Range	49-51	46-50	17-19		43-47	42-46	18-19

1. All Utah specimens were adult birds.

B. Records furnished by Mr. Allan Duvall, U. S. Fish and Wildlife Service, Patuxent Research Refuge, Laurel, Maryland

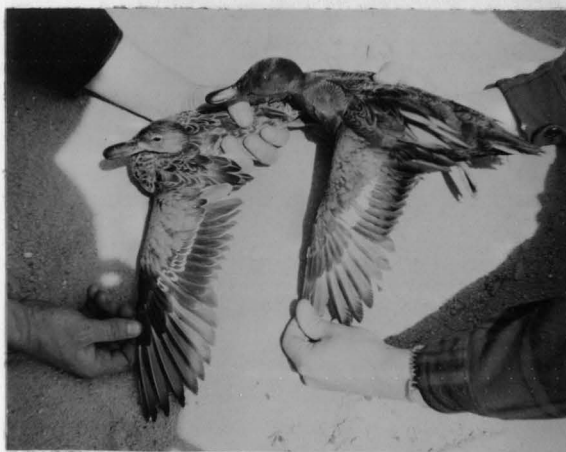
Measurements of Exposed Culmen.

Cinnamon Teal			Blue-winged Teal		
No. Specimens	Range (mm)	Average (mm)	No. Specimens	Range (mm)	Average (mm)
17 Females	41-46	43	26 Females	36.5 -41	38.7

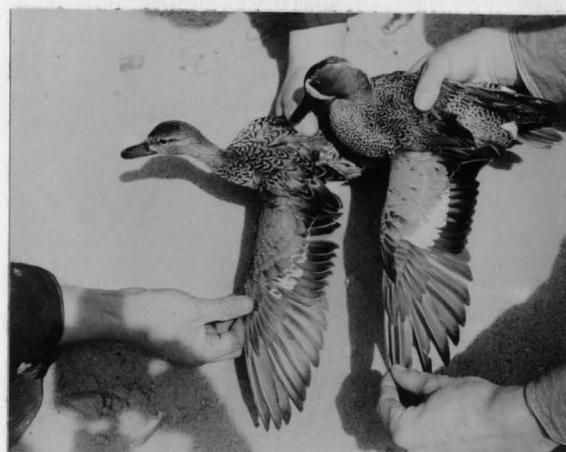
Robert S. Johnson

1900-1901

1901-1902



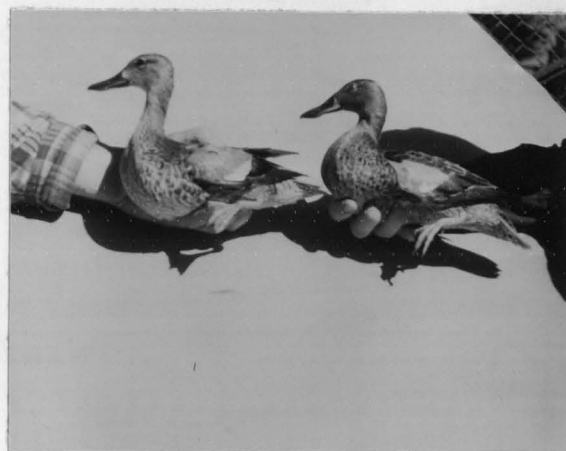
A. Cinnamon Teal - Nuptial Pl.
Female, left; Male, right



B. Blue-winged Teal - Nuptial Pl
Female, left; Male, right



C. Blue-winged and Cinnamon
Males. Nuptial Plumage



D. Blue-winged (L) and Cinnamon
(R) Males. Eclipse Plumage



E. Cinnamon (L) and Blue-wing
(R) Females. Nuptial Pl.



F. Blue-winged (L) and Cinnamon
(R) Females. Eclipse Pl.

Figure 5. Comparison of Cinnamon and Blue-winged Teals.

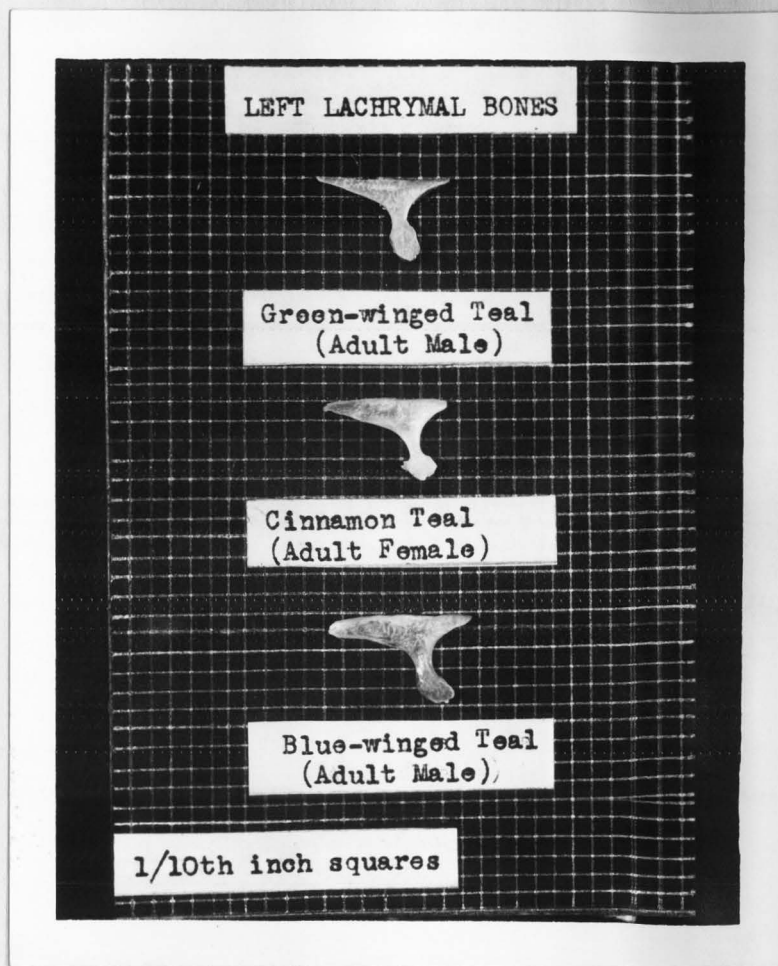


Figure 6. Lachrymal bone characteristics of three species of North American Teals.

Hardy Common Skirt
The following are the
names of the

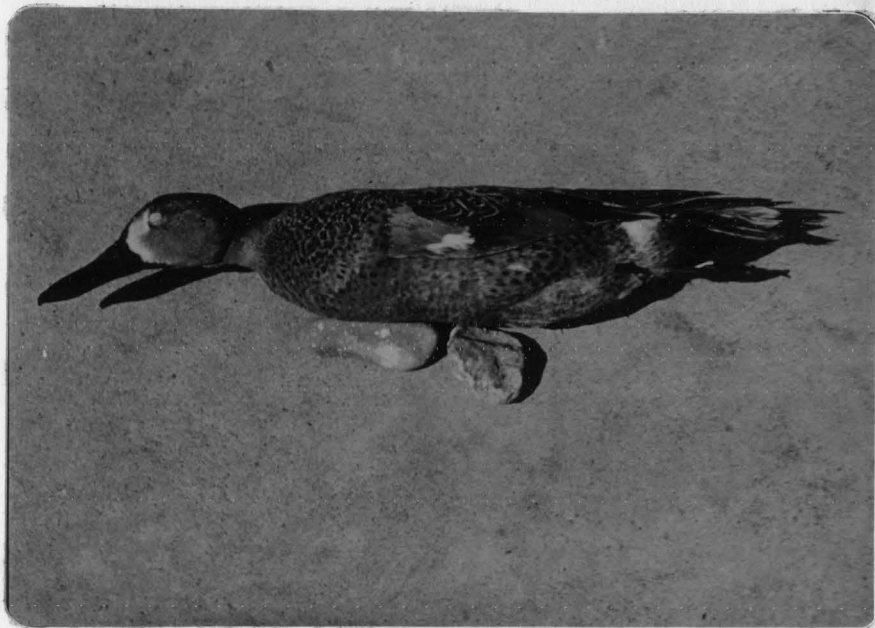


Figure 7. A Cinnamon Teal-Blue-winged Teal hybrid.

determining the sex of two parental species is known, however.

Bent (1951) describes an apparent hybrid male collected by Mr. Wm. G. Smith (1887) in Colorado. This specimen was similar to a Cinnamon male in breeding plumage; except that the head and facial crescent were distinctly Blue-wing.

Two other fairly reliable records of hybrids are known to the author. One was reported by Mr. Allen Smith, Flyway Biologist, Pacific Flyway, as a personal observation near Cayley, Alberta, Canada, about June 10, 1950. He noted this bird as a male hybrid of Cinnamon X Blue-wing origin. The head plumage was that of a Blue-wing male with characteristic white crescent; the body plumage was similar to a male Cinnamon.

The other apparent hybrid was observed by the writer at Ogden Bay Refuge, Hooper, Utah, on May 1, 1950. This bird, also a male, resembled a Cinnamon Drake with the exception of a distinct white facial crescent as borne by the Blue-wing. It was not possible to make positive observations of the presence or absence of the white flank patch borne by the Blue-wing. It is believed that this was lacking.

Several other observations of apparent Cinnamon X Blue-wing hybrids are known to the writer, but specific details are not obtainable. Generally they parallel those described above with the white facial crescent developed to a greater or lesser degree.

No instances of hybridism of the Cinnamon Teal with

species other than the closely related Blue-wing are known to the writer. It should be noted, however, that in Utah, where the breeding ranges of these two species overlap, the Blue-winged Teal constitutes less than 6 percent of the combined breeding population of Cinnamon and Blue-winged Teals. This probably to some extent accounts for the paucity of hybrids in this region. Furthermore, Mr. Calvin Wilson, Curator of the Tracey Aviary, relates that never in his long experience at the aviary has he noted a hybrid Cinnamon Teal, despite the fact that he maintains a considerable number of both breeding Blue-wing and Cinnamon Teals in close association.

Sex and Age Ratios

The value of Sex and Age Ratios as a tool in determining population dynamics for a single species of waterfowl on an area even as large as the State of Utah is still a moot question. As Freeman (1948) noted, samples large enough to be statistically significant of true ratios are extremely impractical if not nearly impossible to obtain at justifiable expense. Despite questionable value at present, a number of representative samples of both sex and age ratios for the Cinnamon Teal were collected and compiled during the investigation.

For purposes of the study all birds returning from the wintering grounds were considered as adults. The term "Immature" as used herein pertains to young birds of the season, from time of hatching until departure for the

wintering grounds. Sex and age ratios in Utah were collected during several phases of the investigation. From the time the locally breeding pairs arrived in spring migration until the males went into the post nuptial molt, sex ratios were obtained by observation during census work. As soon as the young were old enough to shift for themselves trapping and banding was initiated and both sex and age ratios determined by cloacal inspection. During the hunting season hunter bag checks also yielded sex and age data by the same method (See Harvest and Hunting Pressure).

In order to gain a more comprehensive picture of sex ratios (and age ratios where available) throughout the breeding range, data from the Pacific Flyway Reports for 1949 and 1950 have been assembled to supplement Utah Data (Tables 2 A & B)

Weights and Measurements

Kortright (1943) gives the following weights and measurements for the Cinnamon Teal.

Males : Length 15.3" to 17.0"; average (of 18) 16.0". Wingspread, 23.5" to 26.0"; average (of 10), 25.2". Weight, 10 oz to 1 lb 2 oz; average (of 13), 12.0 oz.

Females: Length 14.5" to 16.3"; average (of 10), 15.5". Wingspread 22.7" to 25.0"; average (of 5), 23.9". Weights, 10 oz. to 1 lb 2 oz; average (of 11), 12.5 oz.

These weights and measurements conformed closely to the few representative specimens weighed and measured in Utah. It was noted that birds taken during the hunting season were in better flesh than returning spring migrants. Few healthy

birds were weighed but it appears that the presence or absence of the fall fat layer probably accounts for between 4 and 6 oz. in the total weights of healthy adult birds.

Table 2. Sex ratios of Cinnamon Teal

(A) Utah samples from 1947 through 1951

Approx. Date	Ratio M/100 F	Size of Sample	
Aug. - Oct. 1947	123:100	143	Banding Data
Aug. - Oct. 1948	78:100	32	Banding Data
Aug. - Oct. 1949	103:100	69	Banding Data
Oct. - Dec. 1949	65:100	186	Hunter's Bag Checks
Apr. - June 1950	119:100	966	Census
Aug. - Oct. 1950	69:100	98	Banding Data
Oct. - Dec. 1951	80:100	117	Hunter's Bag Checks
Total	91:100	1611	

(B) Samples from banding in California

Previous to Dec. 1949	77:100	227	Banding Data
Jan. - Mar. 1950	71:100	29	Banding Data
Mar. 1950 - Jan. 1951	100:100	512	Banding Data
Total	83:100	768	
Total (A) + (B)	87:100	2379	

DISTRIBUTION

Bent (1951) gives the following information on distribution of the species.

Breeding range.--Western North America and southern South America. In North America east to western Montana (Missoula County), eastern Wyoming (Lake Como), southwestern Kansas (Meade County), and south central Texas (Bexar County). South to southwestern Texas (Marathon), northern Mexico (Chihuahua), and northern Lower California (San Rafael Valley). West to practically all the central valleys of California, central Oregon (Paulina Marsh), and northwestern Washington (Tacoma). North to southern British Columbia (Revelstoke, Okanogan and Chilliwack). In South America, from central Argentina (Buenos Aires) south to the Falkland Islands, and from the Straits of Magellan north in the Andes to central Peru (Santa Luzia).

Winter range.--Southwestern North America and central South America. In North America east to southern Texas (Brownsville). South to south central Mexico (Jalisco and Puebla) and perhaps farther; has occurred in Costa Rica. North to central California (Stockton, southern Arizona (Tucson), central New Mexico, and probably southwestern Texas. In South America south to central Patagonia (Senger River) and southern Chile (Chiloe Island). North to southern Brazil (Rio Grande de Sul), southern Paraguay, Bolivia (lake Titicaca), Peru (Corillos), and rarely to Ecuador (Quito) and Colombia (Bogota and Santa Marta). These latter records may have been stragglers from North America.

Casual records.--Has wandered on migrations as far east as Alberta (Edmonton, May 12, 1917), Manitoba (Oak Lake), Wisconsin (Lake Koshkonong, October 18, 1879, and October 9, 1891), Ohio (Licking County Reservoir, April 4, 1895), New York (Seneca Lake, about April 15, 1886), South Carolina (a somewhat doubtful record), Florida (Lake Iamonia and Key West), and Louisiana (Lake Pontchartrain)."

These distribution data coincide generally with Peter's (checklist).

Robbins¹ of the U. S. Fish and Wildlife Service, has furnished the writer with the following information from the forthcoming revision of the American Ornithologists' Union checklist:

"Anas cyanoptera VIEILLOT. Cinnamon Teal.

From southwestern Canada (east of the coastal mountains) and Wyoming south to California, New Mexico, Mexico, Panama and northern Columbia; and from central Chile, northern Argentina, Paraguay, Uruguay and southeastern Brazil to Patagonia and the Falkland Islands.

Anas cyanoptera cyanoptera VIEILLOT. Lesser Cinnamon Teal.

Breeds in two widely separated areas; in North America from southern British Columbia, western Saskatchewan (rarely), western Montana, eastern Wyoming and southwestern Kansas, south to the Central valleys of California, northern Baja California, Chihuahua, Jalisco, Tamaulipas, and central western Texas; casual in summer in Alberta, Wisconsin, Ohio, and New York. In South America from central Chile (Coquimbo), northern Argentina (Chaco), Paraguay, Uruguay, and Rio Grande do Sul, Brazil to Tierra del Fuego and the Falkland Islands.

Winters from central and southern California (sparingly), southern Arizona, central New Mexico south through western and central Mexico to Nicaragua, Costa Rica, Panama and northern Colombia from the Cauca Valley to Santa Marta; and in its South American breeding range except in the far south (extent of migrations in the Southern Hemisphere not as yet well known).

Rare or casual in Cuba, South Carolina, Florida, and Louisiana.

1. 1952 Personal communication with Mr. C. S. Robbins, Biologist, Distribution of Birds and Mammals, Branch of Wildlife Research, U. S. Fish and Wildlife, Washington, D. C. Dated April 12, 1952.

One record of a bird banded at Malheur, Oregon, taken in the Santa Marta region."

Robbins adds that "...this species is now recorded fairly regularly in winter in south Texas."

In addition to this information the writer has learned from Mr. Allen Smith¹ of the U. S. Fish and Wildlife Service, that the species is apparently increasing its northward breeding range. During the past several summers, Mr. Smith has observed, with increasing frequency, breeding pairs of Cinnamon Teal in southern Alberta, Canada. He believes the species to be presently a common breeder as far north as the Lethbridge and probably occasionally breeds north to Edmonton. The casual records of Bent(1951) are supplemented by Roberts (1936) who states that the Cinnamon Teal is casual or rare in Minnesota.

1. Personal discussions



Figure 8. Map of the main ranges of North American Cinnamon Teal.

MIGRATION

General

Several factors make it difficult to clearly define, describe, and delimit the migration of the Cinnamon Teal. As was pointed out in discussing distribution, much of the breeding range and the winter range overlap. Thus the migration may in some ways be considered a limited movement or shift from the more northern to the southerly parts of the same region. This statement must be qualified due to numerous banding data which indicate that rapid migrations over long distances frequently occur. Another difficulty encountered in studying these migration habits is the relatively small population size. The Cinnamon Teal population becomes "lost in the shuffle" in the literally millions of waterfowl which pass through Utah in both fall and spring. The height at which true migration is made, the size of migrating flocks, and many other characteristics are relatively unknown.

It is interesting to note, however, the chronological changes in census figures between the Farmington Bay Refuge and the Public Shooting Ground roughly 50 miles farther north (Table 3 and Figure 4.).

Spring

In discussing the spring migration of the Cinnamon, the

major effects of weather and habitat conditions must be emphasized. This species apparently requires open water and generally does not tolerate extremely low temperatures. Spring weather in Utah varies considerably from year to year and also varies greatly with regard to topography. Hence, migrating birds may be observed 2 weeks earlier in the northern Great Basin of Utah than 10 miles farther east in the Cache Valley at the same altitude and latitude.

In considering its North American range, Bent (1951) gives the following early arrival dates for spring migrants:

Nevada, Ash Meadows, March 18; Idaho, Grangeville, April 11; British Columbia, Chilliwack, April 22; Colorado, Beloit, March 23, Loveland, April 13, and Lay April 20; Missouri, Lake City, April 15; Nebraska, Omaha, April 10; Wyoming, Lake Como, May 5, Late date of departure: Lower California, Colnett, April 8.

During the present study there has been no month of the year in which Cinnamon Teal have not been observed in northern Utah. December and January may be considered the months of lowest population, though. In those months birds are few in number and are confined to a few isolated, sheltered areas of open water having abundant feed.

Observations appear to indicate that migrating Cinnamon Teal arrive in the Great Basin Area of Utah during the first week in March. The earliest arrival records at Ogden Bay for birds believed to be migrants was February 26, in 1950. Four birds were tallied on this date during a census of the area by Mr. Noland Nelson, refuge manager. The spring

migration tends to be gradual and largely dependent on weather. Populations were gradually increased to a peak about the third week in April after which there was a slight decline until only locally-breeding pairs remained. No instances of a sudden large influx of the species into an area have been noted by the writer. Bizeau, (1951), working at Gray's Lake in Idaho noted a spring arrival date of April 15.

No evidence was noted of a sex or age differential in the spring migration. All birds were courting upon arrival, and a considerable percentage were already paired. Sex ratios appeared well balanced at this time.

The size of migrating flocks, height, and speed of migration were extremely difficult to discern because of the gradual nature of the spring migration. Small flocks of from 10 to 20 birds commonly were observed at heights lower than 500 feet. No Cinnamon Teal were noted at heights appreciably above this limit. It is probable that small groups gradually work their way northward. No instances of night migration were noted during the study, but it may occur. The species appeared generally diurnal in habits.

Fall Migration

The fall migration of this species was as difficult as the spring migration to comprehend. Cinnamon Teal are essentially early fall migrants and the southward movement apparently began in early August in northern Utah. It

appeared to be characterized by a sex and age differential since the first migratory groups to appear were adult males which presumably gathered together following the eclipse molt. No sizable groups of Cinnamon Teal males were observed during the flightless period of the moult.

These groups of migrating males (usually less than 150) were observed until about mid-September. After this time very few groups of Cinnamon Teal were seen. Adult males after this date were rarely encountered in trapping operations or botulism studies. The hypothesis of a sex and age differential in fall migration was further substantiated by detailed hunter kill analysis in the fall of 1949. The Cinnamon Teal kill on three Utah State Refuges was recorded by date, sex, and age. These data showed, with one exception, that no adult males were killed after the first week of the hunting season (October 21)(Tables 17-19). Kill data further indicated that, on these same three refuges plus Bear River Migratory Bird Refuge, 86.5 percent of the total Cinnamon Teal kill occurred during the first week of the season (October 14-21). This apparently indicated that after mid-October the majority of the population had moved south. The only specimens killed later in the season were either juveniles or adult females. It is likely that these 2 latter categories depart from the breeding grounds about the same time and possibly in mixed associations constituting several broods of the year.

Table 3 (Cinnamon Teal Abundance) and Figure 9

illustrate population fluctuation for 3 years on 3 Utah areas. It will be noted that these census figures reach 2 peaks - 1 about mid-April during the spring migration followed by a slight decline to what may be considered approximately the locally breeding birds - and another higher peak in September, followed by a rapid reduction to mid-October as the birds move south.

This early migration date is reflected by observations and kill data in other states of the breeding range. Personal correspondence with the Fish and Game organizations of Wyoming, Washington, Colorado, Oregon, California, and Idaho all indicate that the majority of the Cinnamon Teal have departed prior to the hunting season.

Further information on migration routes and rates are presented in the section on banding.

Table 3. Population fluctuation of Cinnamon Teal on three Utah State Refuges, 1949-1951.

Date	Public Shtg Grds			Ogden Bay Ref.			Farm. Bay Ref.		
	1949	1950	1951	1949	1950	1951	1949	1950	1951
1/15	0	0	0	0	00	0	0	0	0
1/30	0	0	0	0	0	0	0	0	0
2/15	0	0	0	0	0	0	0	0	2
2/28	0	0	5	0	15	10	0	2	5
3/15	39	18	52	111	115	49	80	48	75
3/30	84	44	550	40	45	1267	64	27	250
4/15	64	1000	680	779	900	1644	1045	850	1250
4/30	291	900	675	812	675	2450	390	325	1275
5/15	54	350	185	796	650	642	114	300	287
5/30	97	300	175	764	630	694	292	275	272
6/15	165	300	98	850	725	752	290	394	310
6/30	125	250	178	1650	1225	1450	150	390	315
7/15	127	350	215	2500	1500	1220	125	108	375
7/30	330	730	616	2530	2200	2331	165	960	4200
8/15	375	700	550	2520	2227	3125	150	1255	3700
8/30	1250	625	530	3140	2250	2450	1420	1314	1755
9/15	1250	550	525	3100	2250	2675	1780	1300	1830
9/30	575	500	720	3500	2500	1400	1780	1300	1200
10/15	575	430	-- ¹	3300	3300	--	1780	1750	--
10/30	150	225	--	175	1200	--	650	550	--
11/15	0	65	--	45	350	--	114	225	--
11/30	0	5	--	15	425	--	25	220	--
12/15	0	2	--	0	210	--	0	18	--
12/30	0	2	--	0	15	--	0	2	--

1. Data not available.

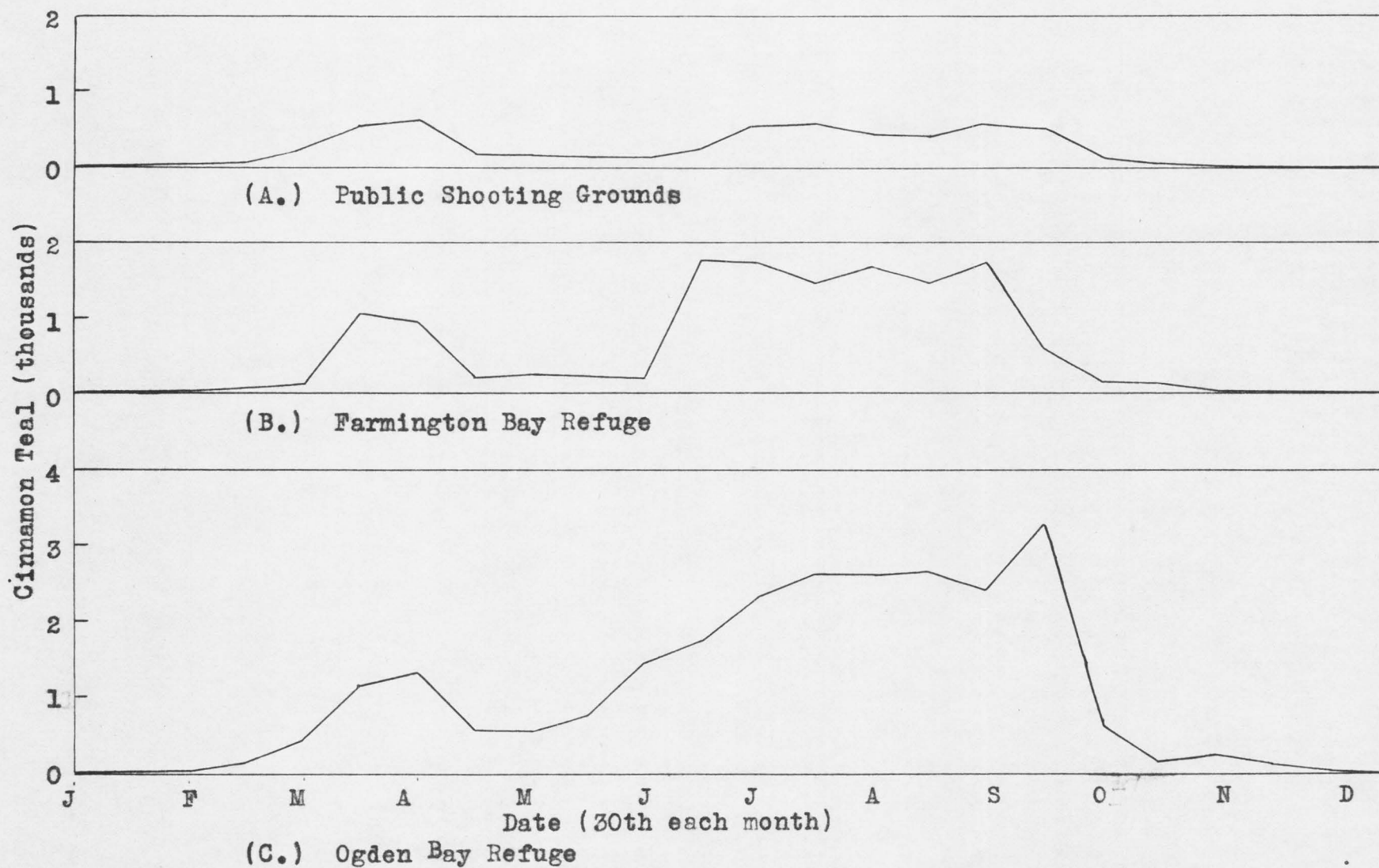


Figure 9. Three-year average of monthly Cinnamon Teal abundance on three Utah Refuges, 1949-1951. October 15 to December 30 - 2 yr. average only.

RESULTS OF BANDING ACTIVITIES

Summary of Past Banding Data

Jensen and Smith (1949) summarized the migration data for the Cinnamon Teal obtained through U. S. Fish and Wildlife Service banding programs through 1948. These authors pointed out that over a period of 32 years comparatively few (about 1000) Cinnamon Teal had been banded and only 138 recoveries received. With the exception of 1 Saskatchewan banded bird, all these bandings had been accomplished in California, Oregon, or Utah. Eighty-four (61 percent) of the 138 were direct recoveries¹ from birds banded on the breeding grounds. Only 3 of the known direct recoveries occurred east of the Continental Divide. Seventy-three percent of these direct recoveries were from areas within a 50 mile radius of the banding locality, which leaves only 22 direct recoveries far enough distant from the banding station to yield migration data of consequence. Figure 10. shows the more important returns up to 1948.

Jensen and Smith further hypothesize from these data that two migration patterns may exist. The first is a

1. A direct recovery is a bird recovered within the period of one migration, one-way. Thus summer-banded birds recovered prior to departing from the wintering grounds the following spring or winter and spring-banded birds recovered on the breeding grounds the following summer constitute direct recoveries. All others are considered indirect.

movement of Oregon and Utah populations southeast (probably through the intermountain valleys) into Mexico and South America. The California populations apparently move south through the central valley of California either remaining in the state or progressing southward to northern or central Mexico.

The second pattern indicated by direct recoveries is that a population segment of unknown size from the northeastern breeding range moves southwestward to central and southern California. This possibility is based on California recoveries of 4 Utah - banded birds and 1 Saskatchewan-banded bird.

The general conclusions reached were that fall and winter migrations were southeast for populations west of the Continental Divide and southwest for populations east of it. The reversal being true for the spring migration. Little importance is attached to transmountain migration.

Two rather unusual indirect recoveries of interest are cited. One Utah-banded bird was recovered in northeastern Montana, and 1 Kansas-banded bird was recovered in Wisconsin. These 2 returns probably indicate the characteristic of peripheral populations to radiate away from areas of the greatest density.

The returns considered by Jensen and Smith are shown in Table 4.

Table 4. Migration of Cinnamon Teal from banding returns through 1948. (Data from Jensen and Smith - 1949)

Summary of direct recoveries of Cinnamon Teal banded during summer or fall

<u>Place of Banding</u>	<u>Place of Recovery</u>	<u>Recoveries</u>
Oregon	Mexico	2
	California	1
	Utah	1
	Colombia	1
California	California	52
	Mexico	3
Saskatchewan	California	1
Utah	Utah	10
	Mexico	6
	California	4
	Texas	2
	Colorado	1

Summary of indirect recoveries of Cinnamon Teal banded during summer or fall

<u>Place of Banding</u>	<u>Place of Recovery</u>	<u>Recoveries</u>
California	California	25
	Mexico	5
	Utah	1
Oregon	California	2
	Mexico	1
Utah	Utah	2
	California	2
	Mexico	2
	Colorado	1
	Montana	1
Louisiana	Louisiana	1

Table 4 (conc.). Migration of Cinnamon Teal from banding returns through 1948. (Data from Jensen and Smith - 1949)

Summary of direct recoveries of Cinnamon Teal banded during winter or spring.

<u>Place of Banding</u>	<u>Place of Recovery</u>	<u>Recoveries</u>
California	California	2
Oregon	California	2

Summary of indirect recoveries of Cinnamon Teal banded during winter or spring

<u>Place of Banding</u>	<u>Place of Recovery</u>	<u>Recoveries</u>
California	California	2
	Mexico	2
	Nevada	1
Oregon	Oregon	1



Figure 10. Map of direct band returns for Cinnamon Test to 1948. (Data from Jensen and Smith, 1949.)

Project Banding Operations

General. Due to the scarcity of migration information on the Cinnamon Teal it was considered worthwhile to instigate a banding program in conjunction with the present project. This aspect was carried on concurrently with the general waterfowl banding project carried out by Noland Nelson, Utah Waterfowl Project Leader. Banding programs had been previously conducted at Ogden Bay Refuge and Public Shooting Grounds. These data, plus those collected during the writers' absence in 1951 are included to supplement data personally collected in 1949 and 1950.

Trapping Techniques. During the summer of 1949 semi-permanent traps (figures 11-13) were established as soon as the majority of juvenile birds were large enough to band. These traps were constructed by joining sections of 48" X 2" X 5" mesh, heavy gauge, welded wire fencing together with hog rings. An 18 inch strip of $\frac{1}{2}$ " mesh hardware cloth was wired flush with the lower edge around the inside to prevent the escape of Green-winged Teal through the mesh and also to prevent larger species from getting caught in the mesh in escape attempts. The top was loosely covered with 2' X 2" mesh fish-netting to prevent escape and injury. Entrance funnels were found to be most efficient when set at a width of 5 inches. Escape through the funnel was encountered less frequently when a small piece of the welded wire fencing was placed cross-wise about a foot inside the entrance as a baffle. This was held in place by tying to a pair of small

willow sticks. The traps were located in shallow water, usually not over 1 foot in depth, and anchored by means of several "U Type" steel fence posts. Two of these posts were placed at the trap exit facing each other and sufficiently far apart to hold a 12" X 1" board which acted as a sliding door through which birds were removed from the traps for banding. The trap set-up was completed by addition of chicken-wire wings supported by steel fence posts.

In placing the traps, an attempt was made to find a shallow channel mouth emptying into one of the impounded lakes. Waterfowl showed a strong tendency to feed from the lake shore up these channels particularly in the evening. Under these conditions the trap wings could be extended to both banks of the channel. This left birds moving up the channel the alternative of flying over or entering the trap. It was found that windy weather usually increased the catch. Probably this was due to birds attempting to leave the open water of the lakes. Traps were baited daily with about 5 quarts of grain. Corn, wheat and barley were all tried with success though wheat appeared to be the preferred bait. Baiting may be of dubious value on these breeding grounds since ample natural feed was available and many birds were taken in unbaited traps. However, it appeared that baiting did increase the size of the catch. Operation of these traps was simple, rapid, and effective. An effort was made to tend them daily before 10:00 A.M. to prevent excessive injury and drowning of birds caught during

the evening. To remove the birds, the crate was placed at the trap exit, the sliding doors of the crate and trap opened, the birds driven into the crate, and the doors closed. The crate thus could be carried to high ground for identification of birds as to sex, age, and species and subsequent banding.

Similar type traps were used on a temporary basis to take large concentrations of juvenile birds. These were not baited and birds were caught by driving them into the trap. Local Boy Scout Troops were found to be a source of eager, excellent and inexpensive labor for this work. The driving technique was found particularly effective in trapping Redheads, as many as 600 having been caught in a single drive.

In connection with nesting and brood rearing studies in 1950 a moderate amount of nest trapping of Cinnamon Teal was accomplished by means of a long handled net. These birds "sit close" and by marking the nest on previous visit they may be taken quite easily by this method. In fact the writer has caught incubating females with his hands. If it is not desired to break up the nest for study reasons, nest trapping should be delayed until late in incubation. Very little desertion (1 out of 11) occurred with this restriction.

Number of Birds Banded. Between the dates of July 15 and October 1, 1949 two semi-permanent traps were operated at Ogden Bay Refuge and temporary trapping conducted at both Ogden

Bay and Public Shooting Grounds. A total of 1705 ducks were banded during the season. An estimated 1100 of these were driven into the temporary traps as flightless juveniles. The majority of these were redheads and no Cinnamon Teal were taken in this manner. A total of 41 Cinnamon Teal were taken in the semi-permanent traps, classified, banded and subsequently released. There is a decided scarcity of adult males in the banding samples of this species at Ogden Bay. This probably is an indication of the eclipse moult being in progress and the subsequent change in daily habits of this sex and age and age. Observations do not lend credence to any trapping selectivity.

In the early spring of 1950 a trap was operated for about a month prior to the breeding season. Little success was encountered in taking Cinnamon Teal during this period, only one adult male and one adult female being taken. Later in the summer, 11 adult females were nest trapped and 84 juveniles were taken in semi-permanent traps. A total of 1016 ducks were trapped and banded during the season by methods similar to those used in 1949.

Returns. During the 5 year period from 1947 through 1951 inclusive, a total of 358 Cinnamon Teal were banded at Ogden Bay Refuge. From these have come: 10 first-year or direct returns, 3 were from within a 20 mile radius of the banding station, 1 was from the Pecos River in Texas, and the remainder were from an area about 100 miles square with Mexico City, Mexico, as the northeast corner.

The second-year return was from a bird shot at Ogden Bay November 11, 1951. This bird was banded September 10, 1949 on the same area.

The two of the third-year returns were from the above described area in Mexico.

Of the 5 years included 2 have yielded no returns - namely 1948, in which 32 Teal were banded, and 1951, when 44 were banded.

The obvious pattern indicated by these returns of Utah - banded birds is a principal wintering area southwest of Mexico City, Mexico. Migration would presumably be south through the intermountain valleys, possibly Texas, and on to the wintering ground. The species is recorded quite regularly in winter in south Texas. The return from Pecos River, Texas, came from a bird killed November 13. This bird may have been on its wintering ground or merely a transient. The indirect return from the vicinity of the banding station appears to denote a commonly reported tendency of waterfowl to return to the same general nesting grounds year after year.

Complete summaries of these returns are presented in table 5 and figure 14.

Details of one return from an immature female Cinnamon Teal banded at Ogden Bay July 31, 1947 are of unusual interest. This bird (Band No. 47-602097) was shot in the vicinity of Mexico City, Mexico on August 15, 1947 which leaves an elapsed time from the banding station to Mexico City

of only 15 days -- a remarkable record! This emphasizes the previously mentioned early migration date and give a minimum rate of 114 miles per day assuming that the bird flew air-line and utilized all 15 days in traveling. In actuality the rate of travel was probably considerably faster.



Figures 11. Semi-permanent type waterfowl trap used during banding operations at Ogden Bay, Utah.



Figure 12. Three Redhead ducks just inside the trap entrance.

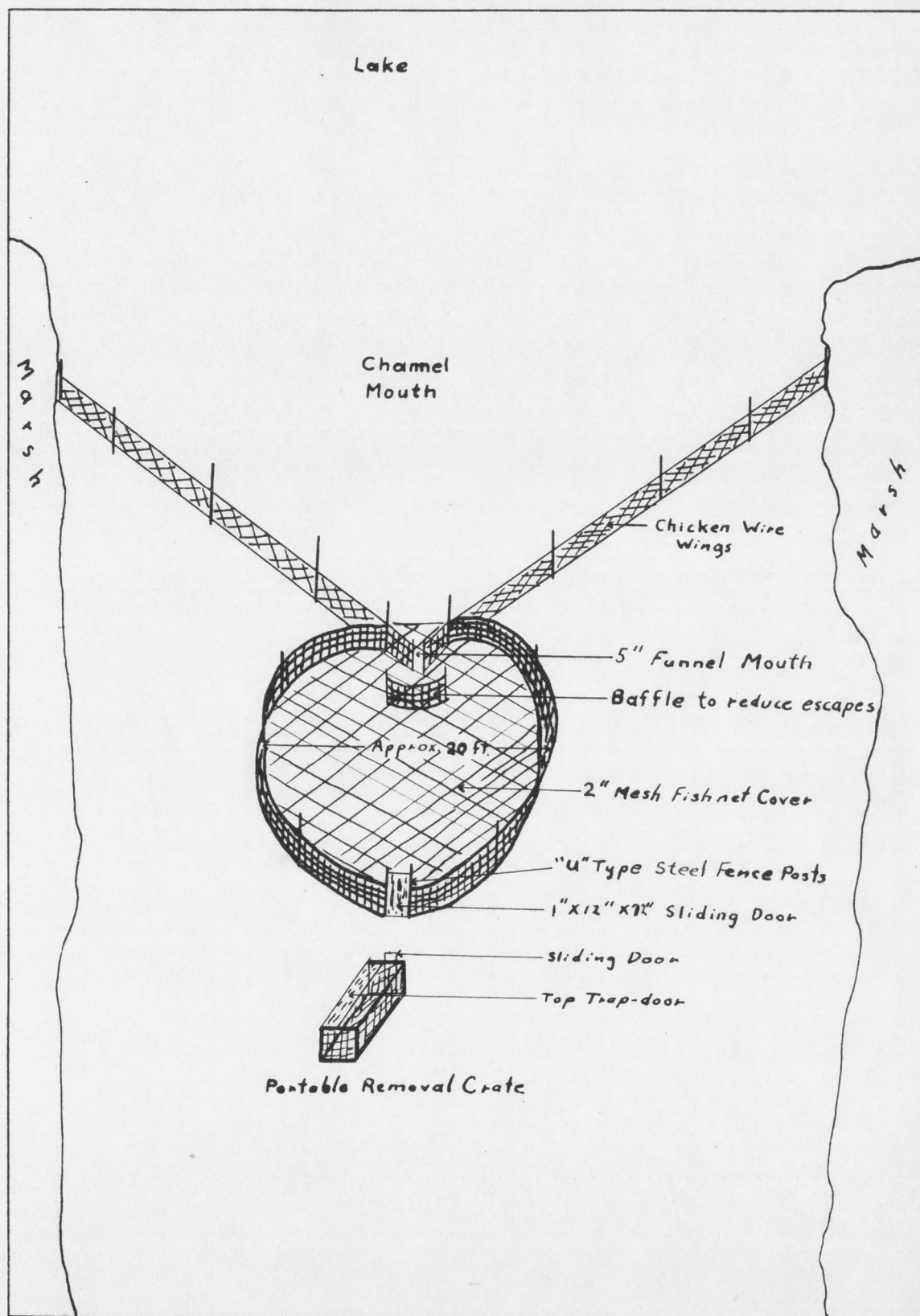


Figure 13. Schematic drawing of semi-permanent type Trap used during the study at Ogden Bay.

Table 5. Returns from Cinnamon Teal banded at Ogden Bay, Utah

1947 Banding - 143 birds banded - 8 returns to June 1952

1st Year Returns (Direct)

Band No.	Age	Sex	Date	Locality	Date	Cause
39-503709	Imm.	M	8/18/47	Farimore, Mex.	4/15/48	Found Dead
39-503721	Ad	F	8/21/47	Guasave, Mex.	3/ 9/48	Found Dead
39-503732	Imm.	M	8/24/47	Pecos R. Tex.	11/13/47	Shot
47-602097	Imm.	F	7/31/47	Mex. City, Mex.	8/15/47	Shot
47-602194	Imm.	F	8/ 8/47	Quimichis, Mex.	2/17/48	Found Dead
39-503806	Imm.	M	9/19/47	Bear R. Ref., Utah	11/ 9/47	Shot

2nd Year Returns (Indirect) - None

3rd Year Returns (Indirect)

39-503706	Imm.	M	8/16/47	Celestun, Mex.	Fall 49	Shot
47-602105	Imm.	M	8/ 1/47	Guaracha, Mex.	12/28/49	Shot

1948 Banding - 32 birds banded - no returns to June 1952

Table 5. (Conc.). Returns from Cinnamon Teal Banded at Ogden Bay, Utah.

1949 Banding - 41 birds banded - 2 returns to June 1952

1st Year Returns (Direct)

Band No.	Age	Sex	Date	Locality	Date	Cause
48-518603	Imm.	F	7/28/49	Querendaro, Mex.	3/6/50	Shot

2nd Year Returns (Indirect)

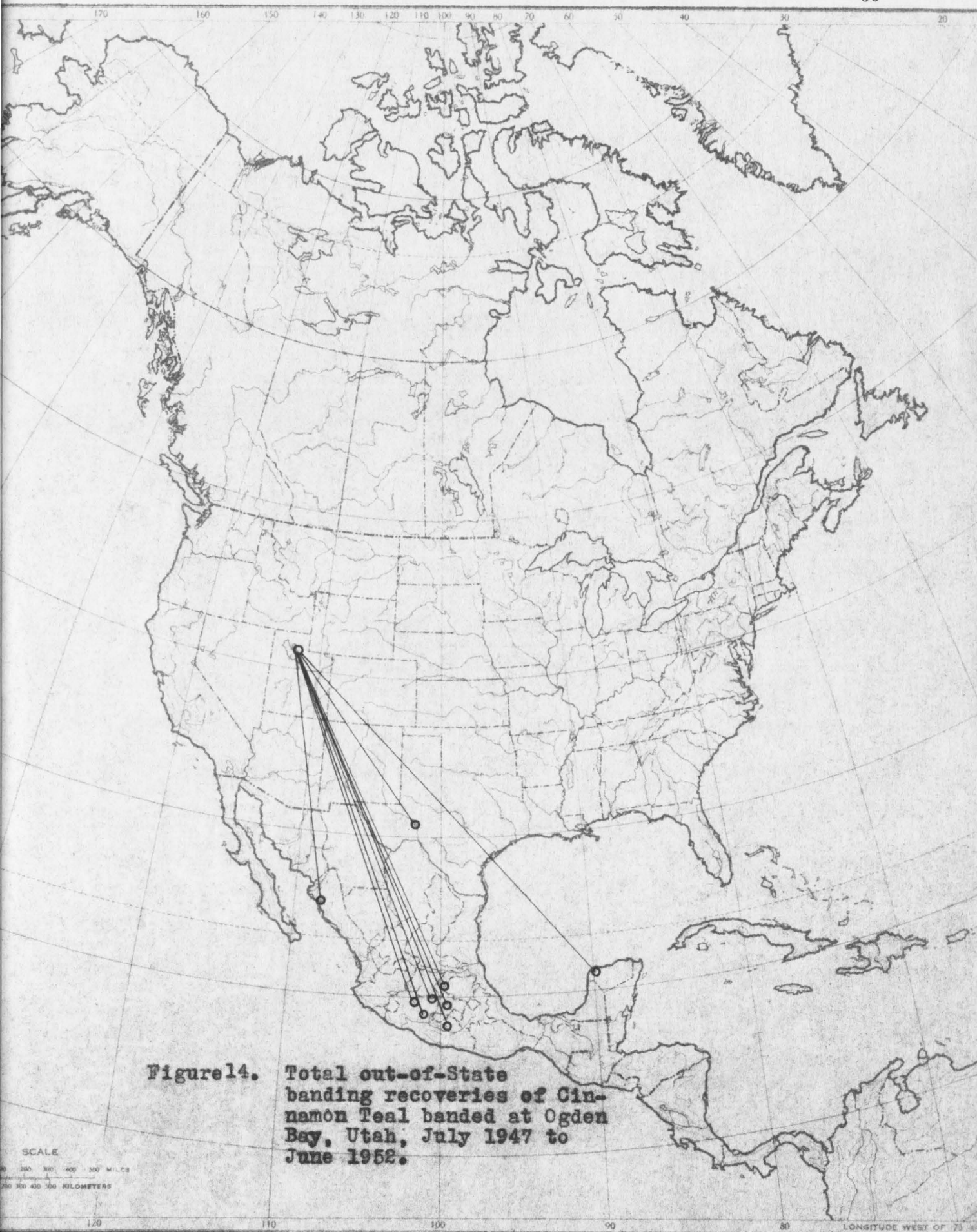
48-518631	Ad.	F	9/10/49	Ogden Bay, Utah	11/11/51	Shot
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1950 Banding - 98 birds banded - 3 returns to June 1952

1st Year Returns (Direct)

495-28142	Imm.	F	8/29/50	Tocumbo, Mich., Mex.	2/ ?/51	Shot
495-28150	Imm.	F	8/30/50	Ogden Bay, Utah	10/13/50	Shot
495-28169	Imm.	F	9/ 1/50	Ogden Bay, Utah	10/14/50	Shot

1951 Banding - 44 banded - no returns to June 1952



COURTSHIP AND PRENESTING ACTIVITIES

Courtship Behavior

Season. The exact date when true courtship of the Cinnamon Teal in Utah begins is not known by the writer. As Hochbaum (1944) points out, courtship displays in waterfowl may be observed under some conditions throughout the year. Waterfowl courtship may further be divided into the "pre-nuptial" courtship involved in the selection of mates and the "nuptial" courtship taking place subsequent to pairing. Bennett (1938) in studying the Blue-winged Teal, found that prenuptial courtship begins on the Mexican wintering grounds about January 1, and, that many Blue-wings were paired upon reaching Iowa about March 1.

Captive Cinnamon Teal at the Salt Lake Aviary commenced courtship in late February as the prenuptial moult neared conclusion. Wild birds observed wintering in Utah in January were not paired and not courting. It is believed that considerable courtship and mate selection is accomplished during the migration. When the spring migrants arrive in Utah in March a large percentage appears to be already paired. Nuptial courtship, however, continues until late June when the males seek seclusion for the eclipse moult. Prenuptial courtship is largely complete in Utah by May 1. No courtship displays have been

witnessed in any sex or age group after commencement of the eclipse moult or later in the fall prior to southward migration.

Daily Schedule. Courtship activities may occur at any time during the day. However, such activities are far more intense before 10:00 A.M. and after 4:00 P.M. No courtship was observed during the hours of darkness though it may quite probably be prevalent on moon light nights. Cool, cloudy weather tends to increase mid-day courtship.

Displays. Courtship displays of Cinnamon Teal may be classified into two categories - aerial and terrestrial. Aerial displays may be considered largely pre-nuptial and are usually characterized by two or more males in pursuit of a female. This is not always the rule, however, as a single pair has frequently been observed dashing over the marsh in flashing twisting flight. The females lead these flights and the male or males follow every move close on her flanks like wing men in a fighter plane formation. So closely is the female followed that not infrequently the observer may hear or see the strike of wings or body between the participants. These aerial antics vary constantly in altitude from a few feet to several hundred feet and may extend over several miles or only a few hundred yards. Early spring flights of this nature, occurring before definite mate selection has taken place, tend to be of longer duration, cover more ground and originate and terminate in well separated areas. As the breeding season nears

the peak, the opposite is true - the flights become shorter and more frequently originate and terminate from the same area. The vocal efforts of the Cinnamon are usually inconsequential and courtship does not render them more impressive. The best they can muster is a few short chattering squeaks - audible only at short range. Despite this lack of vocal powers, one cannot help but be impressed with the whistling wing and tortuous, agile, flight during these chases.

Terrestrial displays may take place on either water or land but are far more common and spectacular on the water. The most frequent and persistent courtship behavior is the bobbing and bowing of the head by the males. Depending on the season, this may consist of few perfunctory bobs by the male or later on, by nearly continuous, animated, bobbing by the male for an hour or more. In the advanced stages of courtship, and after mating, the female commonly responds with a few answering bobs. The bobbing and bowing is the only courtship activity that has been observed on the land.

Active, pre-nuptial courtship on the water usually involves two or more males and one female. This ratio also applies to larger groups of birds indulging in courtship. Often these three-bird units consist of a mated pair and an interloping male. In this situation the mated drake stays close to the hen driving the odd male away with short ferocious rushes whenever he approaches too closely. Bent (1951) describes a leap frog antic indulged in by courting Cinnamons. This was not noted during the present study.

although it was common for the odd drake in the above noted behavior to make a short flight to the far side of hen when chased by the preferred suitor. This always appeared to infuriate the mated male who would redouble his efforts to drive off the intruder. This process would be repeated time and again.

Defense tactics often become quite vigorous and are accompanied by much splashing and bobbing by both males. Despite the vigor of these displays the males rarely come into actual bodily contact and no physical injuries were ever observed. When male tussles persisted more than 5 or 10 minutes, the female usually tired of it all and flew off, whereupon both drakes would forget their differences and follow in rapid pursuit.

Odd drakes court much more ardently in the early spring than later on, when they limit their efforts to a few half-hearted attempts at approaching a female and occasional bowing. These displays are quickly and easily discouraged by the mated males who appear sure of their position. When in pursuit of the female, the male characteristically swims rapidly, neckout-stretched, and head low to the water. The females frequently make short flights of 10 to 20 yards and are followed in kind by the male and the chase resumes. Females have been observed to dive during courtship. When this occurs the male follows but usually the 2 come up several yards apart.

Selected excerpts of specific courtship observations

from the writers field notes follow:

June 24, 1949, 6:15 A.M. South Run Channel, Ogden Bay Refuge: Weather; warm and sunny.

Noted several pairs of Blue-wings and Cinnamons together. Two females with 1 Blue-wing drake. A Cinnamon drake singled out of these females and commenced courting- bobbing head and keeping her away from Blue-wings. Female gave occasional answering bobs but finally tried to fly back to Blue-wings. The Cinnamon drake prevented. Cinnamon drake apparently lost interest after about 10 minutes. (Can't identify Cinnamon - Blue-wing females side by side.).

April 13, 1950, 9:15 A.M. Ogden Bay: Weather; sunny and warm, 10 M.P.H. wind (S.E.). Area shallow alkali pond, estimated $\frac{1}{2}$ acre, fringed with Saltgrass and Saltwort.

When first observed, pond occupied by 2 pairs Cinnamon Teal, 1 pair Shovellers, 1 pair of Pin-Tails and several American Coots (Fulica americana) and Avocets (Recurvirostra americana). all feeding in harmony. A new pair of Cinnamons flew in and landed about 100 feet from other birds. New pair, led by drake, swam toward other pairs and within 2 or 2 minutes all but the Shovellers and the new Cinnamons had left the area. The new pair then began feeding - the Shovellers remaining undisturbed. Coots and Avocets were apparently ignored. (Question: Is this a case of territorialism during courtship?) No actual fighting and little courtship activity noted during the observation.

April 13, 1950, 1:30 P.M. Ogden Bay: Area; flooded Saltgrass flat.

A female Cinnamon accompanied by two males flew into the area. One male, evidently an interloper. Whenever the unmated drake got too close to the female (about 5 yds.) the mated drake would make a rush for the other with head lowered, neck extended and bill open. The bachelor drake would begin by swimming away then jump just as the other's bill was about to close on its tail. The lone drake would make a short flight to a spot about equidistant on the opposite side of the female. This performance repeated several times in about 15 minutes then all 3 took wing and departed together.

April 19, 1950, 10:00 A.M. Ogden Bay: Weather; warm and sunny; Area - cattail bordered borrow pit.

Four pairs of Cinnamon Teal in borrow pit. One pair ardently courting. Male harrassed and female would dive and come up 10-15 ft. away, whereupon male would fly to her. In 1 instance the drake apparently dove in pursuit. He reappeared in approximately the same spot however, while she came up about 20 ft. away. A pair of Gadwalls were also courting in the same area at the same time and were chasing about. This did not appear to bother the Teal.

April 19, 1950 11:00 A.M. Ogden Bay.

Observed 20 pairs of Cinnamons feeding on a small salt pond. Largest spring concentration noted to date.

Courtship Areas. Courtship activities were not found to be limited to any specific type of habitat. Most active courtship was performed on open water which ranged from borrow pits as narrow as 10 feet to large impounded lakes. When observed on large bodies of open water birds were usually within 50 yards of the shore. There appeared to be no rigid requirements by this species for courting areas.

Copulation. All copulation observed took place in the water and always represented the culmination of a short but vigorous chase. In treading the female, the male usually forced her completely under water. The struggle was always brief but intense. It usually lasted 10 to 15 seconds. During most of this time the participants were partially obscured by submersion and splashing water. The male was always superior during the act and grasped the hen at the nape of the neck with his bill. On completion of the act, the female normally swam a few feet, ruffled her feathers, and resumed intermittent feeding. The drake stretched,

gave a few wing flaps, and settled down to leisurely following his mate.

The treading of a hen by more than 1 drake has not been observed but may possibly occur, particularly early in the season.

Other Prenesting Habits

Daily Activities. In addition to the courtship behavior which occuppys much time the normal daily routines are carried on. The early morning hours and late afternoon are periods of feeding. The middle of the day is usually spent in loafing and sunning, or as the season progresses, looking for nesting sites. Pairs remain together throughout the day.

Resting Spots.

Resting spots may very likely be of considerable importance to this species. Resting or loafing spots as considered here to not necessarily include the rather specialized waiting sites utilized by males waiting upon nesting hens. Loafing spots are areas of resting, sunning, and perhaps some indifferent feeding (Figure 15 and 16). The use of various habitat types of this nature is considerably influenced by weather conditions. On warm, sunny, windless days much loafing is done on the water. Birds often are observed on small ponds sleeping, preening, or paddling slowly about sampling a bit of feed here and there. On cool blustery days, which so frequently characterize spring weather, the lee bands of dikes and channels are favorite spots. At Ogden Bay Refuge there are a number of small weed-covered

"secondary" diversion dikes. The south exposures of these are sought out by large numbers of Cinnamon Teal. The adjoining borrow pits provide feed and the warm banks are ideal for resting, being protected from the prevailing winds.



Figure 15. A typical resting and courting area favored by Cinnamon Teal. Ogden Bay Refuge. 1950.



Figure 16. Ideal loafing spots and waiting sites for territorial males, adjacent to nesting cover for Cinnamon Teal, Ogden Bay Refuge, 1950.

TERRITORIALISM

The term territory has been loosely used and abused by many students. Hochbaum's definition (1944) and concept is clear and shows keen insight into waterfowl behavior. His definition clarifies a territory as a "defended area". This definition is adhered to in the following discussion.

Territorialism in the Cinnamon Teal as in most waterfowl, is a seasonal behavior, characteristic of the breeding period. It is difficult to measure and evaluate its role on the nesting grounds. Observations indicate that this species does not establish a territory until selection of the nest site has been made. This was demonstrated by a behavior pattern noted in the Spring of 1950 at Ogden Bay. In the third week of April, 7 or 8 mated pairs were using a 300 foot strip of delta channel as loafing, feeding, and courting cover. Movement up and down this channel by the various pairs was unrestricted and resulted in no friction. No territories were in evidence. Females spent much time wandering about through the Saltgrass borders of the channel - to all appearance searching for nest sites. These females were usually followed by their drakes. Intensive search revealed no nests at this time. A day or 2 later, 1 pair had obviously established a territory which was being defended by the drake. Search at this time revealed a nest containing 2 eggs. The remaining pairs also commenced

nesting and established territories within a week.

Territories established by Cinnamon Teal appear to be small. Examples observed in Utah were rarely over 30 square yards in extent. A choice loafing spot was always included in the area defended by the waiting drake. Old muskrat houses, logs, and small points of land were selected frequently (Figure 16). The territory was constantly occupied by the drake whenever the hen was on the nest, and both spent considerable time together on the territory. It was not uncommon, however, for the pair to depart from the territory during the hours of feeding.

Defense of the territory was completely conducted by the male. If another pair of Cinnamon or a lone male entered the territory the resident male usually started to bob his head and bow as in courtship display. The interlopers frequently gave a few answering bobs and walked or swam away. If this preliminary exchange failed its purpose the territorial drake would make a short rush at the intruders. These established territories were not observed to be seriously contested by outsiders. Drakes were not observed to take wing in pursuit during defense actions. Little or no attention was paid to birds flying over or near the territory.

Nesting densities were high on Ogden Bay Refuge. This may be influential in reducing the size of territories, and the intensity with which they are defended. It was common to note an overlapping between territories of Cinnamon Teal

and other species, particularly Gadwalls and Mallards. With the possible exception of one instance noted in "Field Notes on Courtship", no examples of inter-specific strife were witnessed.

Territorial areas often included the nest site and have not been observed over 100 yards distant from it. No friction was noted between females, either of the same or different species. In fact, nests of Cinnamon Teal were found within 3 feet of each other and a Teal and Mallard nest only 8 inches apart.

THE NESTING SURVEY

Techniques

When field work began on this investigation in mid-June, 1949, at Ogden Bay Refuge, the nesting season was already well advanced. Because of this, the 1949 nesting survey was limited to locating as many nests as possible and following their history through to termination. Additional refinements were added in 1950 during which the complete breeding season was studied in the field.

Nest Location. During the early stages of the 1949 study it was soon discerned that the nature of the vegetational zonation of the study area precluded all but rare nests being found over 75 yards from water. It is within this strip along the shore-lines, dikes, ditches and channels that suitable nesting cover grows. Most nest-hunting efforts were confined within these limits.

Nests were located by walking a ziz-zig path along these strips making an effort to cover all ground carefully. Willow poles about 8 or 9 feet long were cut and trimmed to serve as nest markers. When a nest was found a willow was placed 5 paces from the nest on a bearing with a prominent mountain peak selected as a reference. In relocating the nest in future visits, the worker had merely to go to the marker, face the reference point and take 5 paces directly to the nest. The excellent concealment of many nests in

in dense cover made this a time saving technique. All markers were numbered with marking crayon and the nest given a similar number on the nest history form.

Pertinent data were recorded on individual nest history forms (Figure 17). An effort was made to revisit each nest a minimum of once a week until termination.

A majority of the nests were located by the writer working alone using the above technique. Two other methods, however, proved valuable. One consisted of utilizing the local Boy Scout Troop. Spread out in a line and followed by the writer with binoculars and notebook, these Scouts could and did find as many nests in half a day as 1 man could find in a week. They proved easy to manage and no known nest destruction or desertion was caused by their assistance. In the other method the writer's two-year old Springer Spaniel was used briefly in 1949. His ability at locating nests was uncanny and he was fairly well trained. The advanced season proved a serious factor, however, in that many hens were incubating and would sit extremely close. This dog worked up to a nest so rapidly that when coming on an incubating female the temptation proved too great and he would catch the hen. This happened 4 times in 4 hours and his use was discontinued. It was interesting to note that, of these 4 females caught by the dog and released unharmed, 3 Cinnamon held to the nest and brought off successful hatches. The third nest, a Mallard, was destroyed later by a skunk. It is believed by the writer

NEST HISTORY FORM

REFUGE Ogden Bay SPECIES Cin. Teal NO 1057
 Details of location: _____
Unit I, St. Area - S.E. Corner SW Δ

 FLAGGED: SOP
 Cover Type: Dsp
 Distance to, and nature of, nearest water: 10 ft - small
grassy ditch.
 Height above adjacent earth 1 inch or water _____

RECORD OF VISITS

Date	Eggs	Down	Concealment	Other Notes	Observer
6/13/50	5	Abund.	Good	-	H. Spencer
6/21/50	7	"	"	Hen dead see below	H. Spencer

Fate of Nest: Failed due to mink predation on
female

Comments: Pile of feathers 2 ft fr. nest. Carcass of
female 10 ft fr. nest - edge of ditch

Figure 17. Sample nest history form used during the Cinnamon Teal Investigation.

that few dogs with sufficient hunting instinct and scenting ability to be of value, could be trained to completely resist a female exploding in their face. For this reason the use of dogs should perhaps be confined to the earlier season before incubation is prevalent. Their ability to find nests is unquestionable and when used under the right conditions they can accomplish far more than a man.

Mapping. During the fall of 1949 field data for a large scale (1" = 150 ft.) cover map of the Special Study Area were collected. This area consisted of 357 acres of diversified marsh land. No up-to-date aerial photos were available. An original mapping technique was devised as follows.

The area was roughly sketched to scale from observation. This sketch was divided up into numbered rectangles roughly of the size that would be covered by an 8½" X 11" paper, mapped to final scale size. Sheets of 8½" X 11", 1/10" square graph paper were numbered to correspond with the index sketch. A base line was laid out across the center of the area from east to west and marked at 5 chain intervals by compass and pacing. Cruise lines and base line stations were plotted on the graph paper. The cover type lines and general land features were mapped as cruise lines were traversed. Two advantages were derived from this method. First, all type lines on adjacent cruise lines could be tied-in as work progressed in the field. This eliminated the "dangling" type lines which frequently create the office problem in other methods. Second, construction of the final map was much

simplified by butting all the field sheets together in proper sequence with scotch tape and tracing the final map to scale directly, by use of a light table. The map shown in figure 4 was produced by this method. It has proved quite accurate and adequate for uses of the present study.

Phenology of the Breeding Season

1949. Due to the late start of field work in 1949 a comprehensive picture of the breeding rhythm was not possible to obtain. Probably hatching neared its peak in mid-June. A total of 59 nests were studied during this season. The final nest terminated in desertion on August 10. It contained only infertile eggs. It is of interest to note that, on July 5, two broods of Cinnamon Teal were observed to be flying quite well. Since 6 weeks is the earliest probable flying age and estimating at least a month for total nest period, laying must have started by the third week in April. This was very likely one of the earliest hatches for 1949. The observation was made at Public Shooting Grounds in Box Elder County, Utah.

Bizeau (1951) making a nesting survey at Gray's Lake, Idaho this same year noted that the Cinnamon Teal was the latest nester of 9 duck species. He records the first hatching on June 12, the peak on June 25 and the last hatch on August 3.

1950. In 1950 the first egg was observed April 28. Hatching reached a peak on June 11 and terminated with a successful hatch on August 15. To portray these breeding

dynamics a graph was prepared on which 170 active nests were plotted over weekly periods (figure 18). Plotting the data by this method meant that each nest added weight to the curve throughout its duration. Thus a better picture of the entire season is presented than by plotting only hatching dates with few data. By correlating this graph with general observations of the nesting season the following deductions can be made. The gradually increasing rise of the curve to May 21 indicates a normal build up of nesting birds. This period was characterized by late, cold spring weather which inhibited vegetational development. Consequently, concealment of early nests was poor and predation heavy. Of the first 55 nests located, only 2 hatched successfully. High early nest failure resulted in alteration of the curve between May 21 and June 4. From this date the curve rose rapidly to a June 11, peak, which was brought about by increase of the breeding population plus, undoubtedly, the renesting of early failures. The secondary peak on June 25 is probably a result of late renesters. The drop of the curve after this date appears normal.

It was noted by all waterfowl workers in the area, during this season, that there was a great disparity in brood ages. Some broods were flying well, others were just hatching, and all in-between categories were evident. This was true to the extent that banding had to be delayed until much later than normally to eliminate breaking up young broods by trapping.

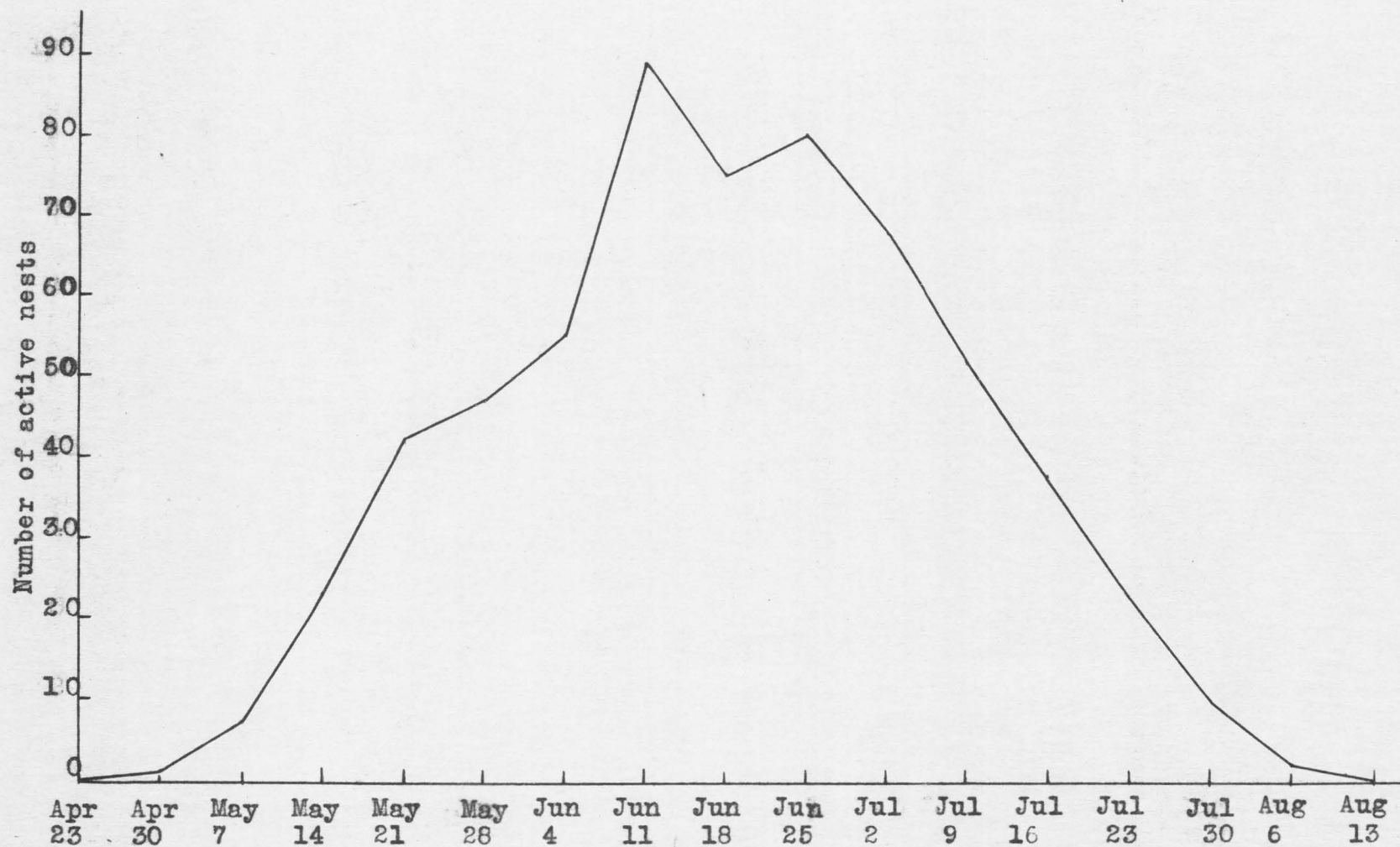


Figure 18. Phenology of Cinnamon Teal nesting at Ogden Bay Refuge, 1950.
(Based on number of active nests by weekly periods.)

Nest Site Selection

The actual selection of the nest site is performed by the females. Apparently the general area is selected on reconnaissance flights accompanied by the male. The exact spot is selected on foot and only after careful inspection of most of the area by the hen. The drake usually waddles along behind like a bored, house-hunting husband.

Cover Types. The importance of specific cover types for nesting can easily be over-emphasized. With regards to the Cinnamon Teal other habitat factors may be of greater influence in nest site selection than the actual species or nature of vegetation in which the nest is located. This is emphasized by the data presented below.

Nesting data collected at Ogden Bay Refuge in 1949 and based on 59 nests showed 54.2 percent of the nests located in saltgrass. This appeared to indicate a strong preference. Forbs¹ and a saltgrass-forb mixture were second in importance with 11.8 and 11.9 percent of nests respectively (table 6). No attempt was made to analyse the cover type percentages available on the overall area occupied by these nests.

In 1950, nesting cover data were collected on 169 nests at Ogden Bay, 117 nests at the Farmington Bay - Newstate Area² and 145 nests at Knudsen's Marsh, Box Elder County

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1. For actual composition of "forb" type see table 23. The terms forbs and weeds are used synonymously in this thesis.
 2. The writer is indebted to Clyde Odin and Billy Wingfield respectively for Farmington Bay and Knudsen's Marsh Data.



(A) Natural view of nest



(B) Nest exposed showing
clutch of 14 eggs.

Figure 19. A well concealed Cinnamon Teal nest at Ogden Bay Refuge, 1950.



Figure 20. Two complete clutches of Cinnamon Teal eggs - one nest with abundant down (upper), one almost no down (below).

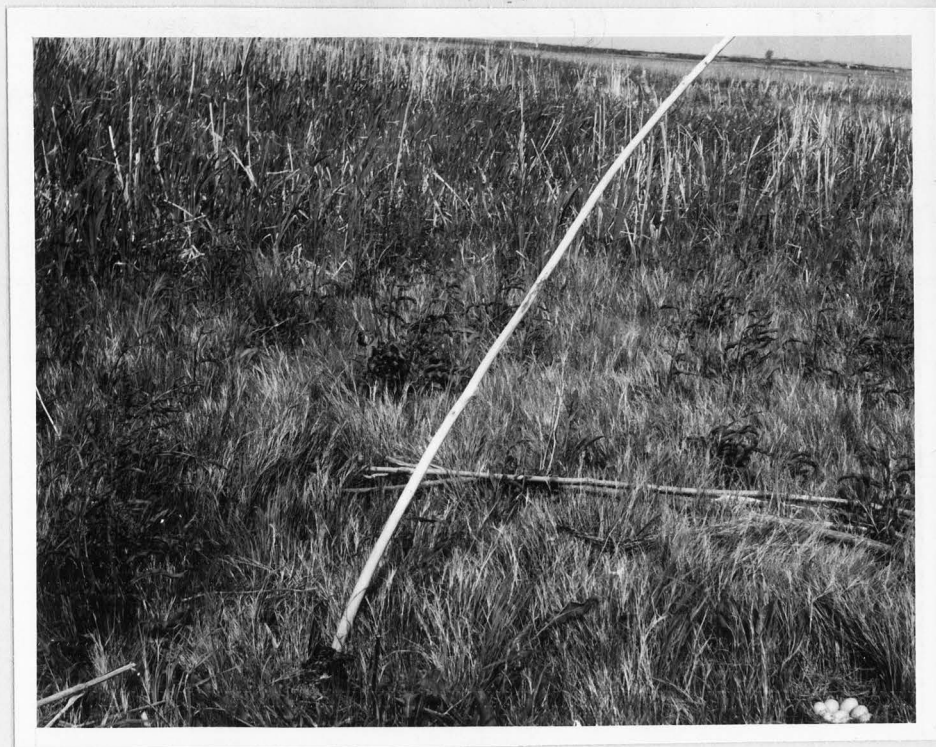


Figure 21. Preferred Cinnamon Teal nesting cover at Ogden Bay Refuge, 1950. Note saltgrass and forbs adjacent to tall, cattail brood-rearing cover.

(Table 7). Orden Bay data again showed the preference for saltgrass-nesting cover containing 91 or 53.9 percent of the nests. Forbs and saltgrass-forb mixtures contained another 20.7 percent. Data from the Farmington Bay Area further substantiated the popularity of saltgrass-cover type containing 94 or 80.6 percent of the nests. Forbs and saltgrass-for mixtures held an added 14 percent of the nests.

From the above data it might be concluded that saltgrass was of major importance for nesting for this species. This is probably true. However, in view of the Knudsen's Marsh data which showed 67 nests or 46.3 percent in Scirpus olneyi, 54 or 37.3 percent in Scirpus acutus, and none in saltgrass or mixtures thereof, additional criteria of nesting habitat must be sought. The characteristics of Knudsen's Marsh are of course an important clue. It is a small (400 acres), highly productive, wet marsh, grown almost entirely to dense bulrush stands. Saltgrass is present only in small amounts around the fringes. Water commonly stands ankle deep or more over most of the area. Normally the Cinnamon Teal is predominantly a dry-land nester. Other workers have indicated this. Williams and Marshall (1938) at Bear River found 50 percent of the Cinnamon nests in saltgrass. Bizeau (1951) noted 69 percent of 52 nests as being on land, against 31 percent in the marsh at Gray's Lake, Idaho. The unanswered question then is - why do Cinnamon Teal nest in such densities in

areas like Knudsen's Marsh since there is ample saltgrass cover in the Salt Lake Basin area to provide nest sites for many times the actual breeding population? Is it a lack of interspersed and "edge effect"? a population saturation point? or as Hochbaum (1944) suggests a lack of suitable "territories"? The writer is not prepared to offer a solution.

In conclusion of this section, one additional factor influencing data on nesting cover should be mentioned. In recording nest cover, it is common practice to note the specific nature of vegetation in which the nest is built. In cover mapping many small patches of a type may be too small to be of significance. Thus for example a 10 or 12 square-yard stand of spike rush containing a nest in a predominately saltgrass area may not show at all on a map. The importance of data of this nature may not be correctly emphasized if the actual data reflect a low percent of the total nests to be in these "trace" vegetational types. In an effort to evaluate the data at hand a preference index has been prepared for the special study area by dividing the percent of available cover types by the percent of nests found in each. It will be noted (Table 8) that trace types as spike rush (Eleocharis spp.) and sedges (Carex spp.) assume considerable importance when preference index is considered. Conversely saltgrass is drastically reduced. No attempt is made to evaluate the preference index as the sample is not large enough on which to base conclusions.

Other Habitat Factors. In addition to cover types several other factors appear to influence the selection and utilization of nesting sites. The proximity to water and suitable "territories" appears important. Nests were rarely found over 75 yards from the water and most were much closer. Water requirements, however, may be satisfied by narrow weed-filled ditches or a small slough of as little as 1/10 acre.

Another requirement which appeared important is the proximity of nesting cover to some form of tall dense vegetation which can be utilized as escape cover during brood rearing. Nests were found in extensive, pure stands of saltgrass where water was close. However, nesting density was always greater where such areas were broken up with stands of tall vegetation such as Typha, Scirpus or various forbs.

Interspersion of Nests

Including the Cinnamon Teal at least 10 species of ducks and the Canada Goose nest at Ogden Bay. These include: Green-wing Teal (Anas carolinensis), Blue-winged Teal (Anas discors), Gadwall (Anas strepera), Baldpate (Mareca americana), Mallard (Anas platyrhynchos), Pintail (Anas acuta tzitzihos), Shoveller (Spatula clypeata), Redhead (Aythya americana), and Ruddy Ducks (Oxyura jamaicensis rubida). Of these the Green-winged Teal and Baldpate are uncommon, usually totaling only 1 or 2 nests per season. The Blue-winged Teal nests

in small numbers and the remaining species are each represented by sizable breeding populations.

With the exception of Redheads and Ruddy Ducks breeding species at Ogden Bay are dry-land nesters. The Redhead and Ruddy commonly nest over water and the latter has never been recorded otherwise on this area. Variations among the dabblers occur, however, and nearly all have been found nesting over water. There appears to be complete freedom of interspersion between nests of different species and other individuals of the same species. A tenth-acre plot may contain as many as half a dozen nests representing 2 or 3 species. As many as three Cinnamon Teal nests within a 3 foot triangle of saltgrass have been observed. A Cinnamon Teal and a Mallard, nesting within 8 inches of each other, were observed (Figure 23). There was a free exchange of eggs in these 2 nests during incubation.

Though not colonial nesters in the sense that some sea birds (gulls, murres, etc.) are, the nesting ducks at Ogden Bay show no signs of incompatibility between females of the same species or different species in respect to nest sites. Territorialism is confined to that area defended by the drake, and even this does not extend to other species. In 1950 a total of 164 duck nests were observed on the special study area (figure 4). Taking the entire area of 357 acres into consideration, this represents a density of approximately 0.5 nests per acre. Cinnamon Teal nests numbered 65 on this area for a density of 0.18 nests per acre. If only

actual nesting cover were considered the density would undoubtedly exceed a nest per acre. No pattern of nest distribution was noted. Nest site selection appeared to be at random in regard both to other species and to the same species.

Nest Construction

The Cinnamon Teal commonly constructs a simple nest of whatever materials happen to be at hand. Usually this consists of dead grasses and plant stems. Fresh green growth is seldom used. In some cover types such as Eleocharis or Scirpus the hen often burrows in under dead growth of the previous years. This results in a nest completely hidden from above and all sides. This roof may be so dense that even when flushed from the nest the hen cannot break through it. In nests of this type the female usually sneaks into and out of the nest by tunnels under the vegetational mat.

In the more frequent locations in saltgrass cover, nests are built in a dense clump of the previous years growth. Nests are usually a small, shallow, bowl-shaped depression. As the clutch nears completion the size is increased, more materials are added and down is pulled for a lining. The amount of down in nests varies greatly. Very early and very late nests frequently have very little, even late in incubation. In average nests the quantity usually increases during early incubation until it sparsely lines the nest and forms a roll about 2 inches in diameter

Table 6. Summary of Cinnamon Teal Nesting Cover. 1949
Ogden Bay Refuge, Utah.

A. Cover Types (Based on
60 nests)

Cover Type	No. Nests	Percent
Dst	32	54.2
Dst & Fbs	7	11.8
Fbs	7	11.8
Spa	4	6.8
Dst & Lac	3	5.1
Sam & Hju	2	3.4
Eleoc	2	3.4
Eleco & Rum	1	1.7
Dst & Spa	1	1.7
Sol	1	1.7

B. Cover Height (based
on 32 nests)

Cover Ht. (inches)	No. Nests	Percent
12	5	16.1
13	6	19.4
14	11	35.5
15	4	12.8
16	3	9.7
17	2	6.5
17	1	3.2

C.

Degree Concealment	No. Nests	Percent
Excellent	18	30.5
Good	33	54.2
Fair	9	15.3
Poor	0	0

Legend

Dst - Distichilis stricta
 Fbs - Forbs
 Spa - Scirpus paludosus
 Lac - Lactuca sp.
 Sam - Scirpus americana
 Sol - Scirpus olneyi
 Hju - Hordeum jubatum
 Eleoc - Eleocharis sp.
 Rum - Rumex sp.

Table 7. Cinnamon Teal nesting cover selection, Salt Lake Basin, Utah, 1950

Cover Type	Farmington Bay Newstate Area		Ogden Bay		Knudsen's Marsh	
	No. Nests	Percent	No. Nests	Percent	No. Nests	Percent
<u>Distichilis stricta</u>	94	80.6	91	53.9		
<u>D. stricta</u> + <u>Scirpus paludosus</u>	3	2.7	3	1.8		
<u>D. stricta</u> + <u>Weeds</u>	12	10.4	17	10.1		
<u>D. stricta</u> + <u>Hordeum jubatum</u>			4	2.4		
<u>D. stricta</u> + <u>Carex spp.</u>			1	0.6		
<u>Forbs</u>	4	3.6	18	10.6		
<u>Bromus inermis</u>			3	1.8		
<u>Juncus balticus</u>			8	4.7		
<u>Eleocharis spp.</u>	1	0.9	6	3.2		
<u>Juncus balticus</u> + other			3	1.8		
<u>Eleocharis spp.</u> + other			1	0.6		
<u>Carex spp.</u> + other	2	1.8	7	4.0		
<u>Hordeum jubatum</u>			3	1.8		
<u>Scirpus olneyi</u>			2	1.2	67	46.3
<u>Scirpus paludosus</u>			1	0.6		
<u>S. acutus</u> + <u>S. olneyi</u>					12	8.2
<u>S. acutus</u>					54	37.3
<u>Scirpus acutus</u> + <u>Typha spp.</u>					12	8.2
<u>Typha spp.</u>	1					
Total	117		169		145	

Table 8. Vegetational composition of the Special Study Area and Cinnamon Teal nesting cover selection and reference¹

Cover Type	Cover Type Percent (a)	Percent of Nests (b)	Preference Index (b/a)
<u>Distichilis</u> spp.	33.30	52.3	1.57
Forbs ²	6.40	10.8	1.69
<u>Juncus</u> spp.	0.03	7.7	256.66
<u>Eleocharis</u> spp.	Trace ³	6.1	610.00
<u>Distichilis</u> + Forbs	4.30	6.1	1.41
<u>Carex</u> spp.	Trace	6.1	610.00
<u>Juncus</u> et.al	Trace	3.2	320.00
<u>Distichilis</u> spp. + <u>Hordeum</u> spp.	Trace	3.2	320.00
<u>Scirpus acutus</u>	Trace	1.5	150.00
<u>Hordeum</u> spp.	0.07	1.5	21.43
<u>Promus</u> spp.	0.03	1.5	50.00

1. Only types containing nests considered.

2. See appendix, table 23

3. 0.01 arbitrarily used in computing $\frac{b}{a}$

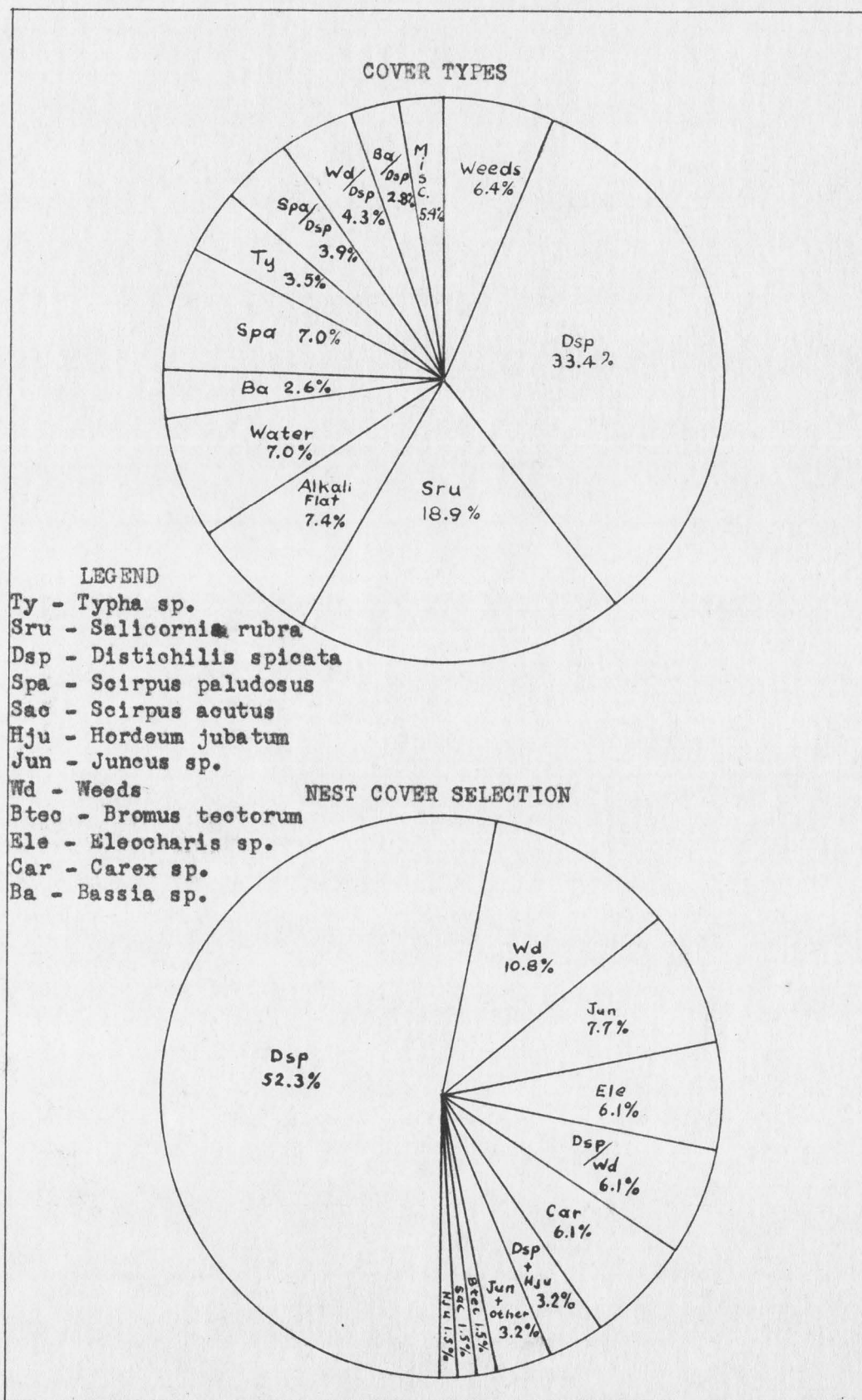
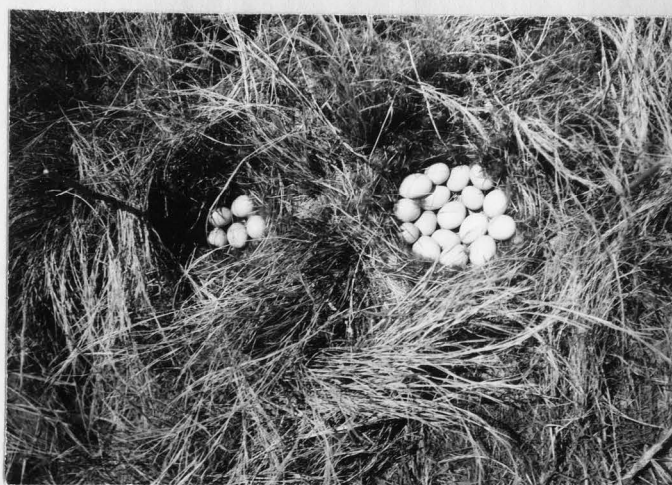


Figure 22. Cover types and Cinnamon Teal Nest Cover Selection, Special Study Area, Ogden Bay, 1950.



(A) Nests as discovered



(B) Nests 3 days later after a natural exchange of eggs (6 Teal eggs moved to Mallard nest by the females).

Figure 23. Cinnamon Teal and Mallard nests 8 inches apart, at Newstate Duck Club, Woods Cross, Utah, 1950. (Photo by C. R. Odin)

around the rim of the bowl. This roll of down is invariably used to cover the eggs when the female leaves the nest under natural conditions.

The size of the bowl does not vary appreciably with the size of the clutch. In nests containing exceptionally large clutches, eggs have been found double-decked when covered and left by the hen. Nests measured at Ogdan Bay showed an average bowl diameter of 7.25 inches with a range from 6.5 to 8.25 inches. Average depth was 2.75 inches with a range from 2.25 to 3.25 inches. With the exception of nests in dense mat-forming vegetation, the bowl bottom is usually formed by solid earth. This frequently results in flooding of precariously situated nests. It is unusual though not rare for the nest bowl to be raised by adding more material as water levels rise. The only instances of this observed, took place during a 2 inch rise over a weeks time. This was overcome by several females in the above manner. A sudden additional 4 inch rise the following week however proved too much and the nests were found flooded and deserted.

Another interesting response in nest building by a female was observed in a dense stand of Scirpus acutus. The nest was on a dense mat of dead growth. During the laying the nest was also used as a Redhead "dump" nest. Both Redhead and Teal eggs were being added daily but the Teal kept burying the Redhead eggs with layers of dead plant material, leaving her own on top. Competition finally proved too great and the Teal deserted leaving 5 eggs on top and 2 mixed in

with buried Redhead eggs. During the final inspection of this nests, thirty-two Redhead eggs were excavated from depths of 3 to 13 inches below the Teal eggs.

Conspicuous ramps leading down to the water, found in some waterfowl nests, have not been observed for the Cinnamon Teal.

Concealment of nests of this species is almost uniformly excellent regardless of cover types (table 6 and figure 19). This of course represents a "man's eye view" and is difficult to assess from the standpoint of predators. To illustrate this point - the writer several times had females flush between his legs from unseen nests during nest hunting. In fact 1 or 2 nests have been accidentally stepped on during the investigation.

Egg Laying and Incubation

Normally egg laying is associated with nest building, but early in the season eggs are occasionally deposited at random throughout the marsh. Seldom were more than 2 found together and these appeared to be a sort of false nest which was abandoned as soon as the true nest was begun. Sometimes it was difficult to determine whether a nest was false. Cinnamon Teal are particularly apt to desert these early nests and often on slight provocation.

Rate of Laying. Early in the season, egg laying may be somewhat irregular. The first 3 or 4 eggs of the clutch may be deposited at intervals of from 1 to 3 days. Usually after the fourth egg has been layed, deposition becomes

regular at the rate of one egg per day until the clutch has been completed. As the season progresses, all eggs of the clutch tend to be layed at this rate. No instances of more than 1 egg being layed in a 24 hour period have been observed.

Records at Ogden Bay indicate that laying activities are most frequent between the hours of 8:00 and 10:00 A.M. Most hens are to be found on the nest during this period, having fed during the early morning hours. Flushing the bird after this period usually reveals an egg added to the previous day's total. If undisturbed, the hen may remain on the nest for 1 to 2 hours, or she may join the drake on the territory for a bit of courtship, feeding or loafing. The later afternoon is usually devoted to feeding. The hen may return either to her nest or to the territory for the night.

Egg Size and Color. The eggs of the Cinnamon Teal observed in Utah may be universally described as pale pinkish buff in color. There has been noted a slight variation in the intensity of this color but the "pure white" eggs described by Kortright (1943) have not been recored in this area.

The size of 46 eggs from 6 different clutches varied from a maximum of 50.0 X 35 millimeters to 44.0 X 33.3 millimeters. The average was 46.4 X 34.6 millimeters (Table 9). Eggs were measured with callipers devised for the study (figure 25).

In observing at least 3000 Cinnamon Teal eggs over the two-year investigation period only 1 abnormal egg was found. This was extremely small, roughly the size of a robbin's egg (figure 28). Other than size it was normal though infertile.

Fertility. Complete data on egg fertility was not obtained. However, nearly all eggs found remaining in the nest after hatching were inspected to determine the cause of failure. Out of 1400 eggs on which records were kept in 1950 a total of only 35 were left in nests from which others hatched. Twenty-seven of these were infertile. This does not give a total fertility rate because unsuccessful nests were not inspected. Losses due to desertion, flooding, predators, etc., may have included infertile eggs. This figure does give a true picture of the actual reduction in production due to infertility however. This reduction is approximately 1.9 percent of the total eggs laid.

In order to determine approximate total fertility further computation can be made using the total number of Teal eggs in successful nests. This gives 27 infertile eggs out of 630 or 4.3 percent. Thus fertility would be computed as 95.7 percent. This does not take into consideration eggs stolen from successful nests by predators. Consequently actual fertility may be slightly higher or slightly lower.

There is a tendency toward more infertility in very late nests. This is probably due to departure of the drakes

for the eclipse moult.

Size of Clutch. Clutch size is affected by many factors including season, predation and parasitism by other ducks. The greatest number of eggs in a single clutch was 16 and the smallest 4. The average clutch size of 52 successful unparasitized nests in 1950 at Ogden Bay was 9.7 eggs (Table 11). On the same area in 1949 it was 9.6 in 22 successful unparasitized nests (Table 10).

A more useful figure is provided by the average clutch size of all successful nests regardless of predation or parasitism. For 104 such nests this is 8.9 eggs per clutch.

Both very early and very late nests usually show reduced clutch sizes. The larger clutches almost invariably are found in mid-season. The reason for the small early clutches is not known. Small late clutches probably represent renests and birds past the peak of physiological breeding condition.

Effects of Nest Parasitism. Nest parasitism has been discussed by several workers (Hochbaum 1944, Bennett 1938, etc.) The Redhead has become notorious for the habit of dropping its eggs in other birds' nests. As might be expected, parasitism of Cinnamon Teal nests in Utah is quite prevalent, since the Redhead is one of the important breeding species.

Quantitative studies of this habit were made during the investigation in relation to its effect on Teal production. Out of 59 nests in 1949, 17 or 29.8 percent were

parasitized by Redheads. No other species were noted parasitizing Teal nests that year. In 1950 out 170 nests 38 or 22.5 percent were parasitized. One of the latter was by a Shoveller, the remainder by Redheads. Bennett (1938) mentions the pheasant (Phasianus colchicus) as a parasitizer of Blue-winged Teal nests. Although pheasants nest in considerable numbers on the study area and their eggs were found in nests of other species of waterfowl, they did not occur in any Teal nests studied.

It is difficult to evaluate the effects of this parasitism. Clutch size and hatchability are two factors which should be indicative. The data at hand are too meager to constitute statistical significance but are presented for consideration. In 1949, 82.4 percent of 17 parasitized nests hatched. In 1950, 39.4 percent of 38 parasitized nests hatched. The hatching success for unparasitized nests for both years (179 nests) was 38.4 percent. Utilizing only the 1950 data which is probably a better criteria since the entire breeding season is considered, 36.8 percent of the parasitized nests hatched and 40.1 percent of the unparasitized. This represents a difference of 3.3 percent nest success in favor of the unparasitized condition. Furthermore, the clutch size for successful nests, was reduced by parasitism from an average of 9.7 to 8.3 eggs. Bennett (1938), studying the Blue-winged Teal, hypothesized that clutch size was controlled by nest size which was rather inflexible.. If this

were true for the Cinnamon Teal it would explain the reduction in clutch size commonly found in parasitized nests. It would not account for the exceptionally large clutch size (16 eggs) encountered in some unparasitized nests however.

Desertion, as affected by parasitism, is difficult to evaluate due to the interrelation of predation and the effects of man. Measurement of this factor was not attempted but observations indicate: (1) that parasitism does not affect the degree or amount of predation and: (2) desertion occurs more frequently in parasitized nests, other things being equal.

Incubation. Incubation is performed exclusively by the female. It usually commences within 24 hours after the final egg of the clutch has been deposited. The incubation period varies from 21 to 25 days.

The habits of the hen during this period are typical of most waterfowl. A majority of the time is spent sitting on the nest which is always approached and left by walking - sometimes as much as 75 yards. Incubating females have frequently been observed leaving the nest between 3:00 and 5:00 P.M. to drink and feed. Probably 2 hours is about the maximum time spent off the nest. As the incubation period nears completion the hen becomes progressively broody. When flushed at this time she seldom flies over a few yards and almost invariably feigns injury in an attempt to divert the worker. This performance is continued as long as anyone

is in the area.

Nesting Mortality

In Utah, nesting mortality is the most important decimating factor to the Cinnamon Teal population. A summation of its effects is shown by 2 year's data at Ogden Bay Refuge. Of 229 nests, on which complete histories were studied, 125 failed to hatch. In terms of eggs - 1,061 out of 1,860 failed, for a total of approximately 57.1 percent. Several factors are instrumental in causing this mortality.

Weather. Weather does not appear to cause direct nesting mortality. Its secondary effects, though delaying or enhancing spring vegetational growth and the creation of flood conditions, is important, however.

In 1949, after field work began on June 23, no nests were destroyed by flooding. That year was characterized by normal mild weather during the early nesting season and nesting cover was in good condition. Losses attributed to weather in 1949 were very small.

In 1950, spring weather was extremely cold with frequent storms. Several inches of snow fell in May. This had the effect of retarding plant growth considerably. The poor plant growth in turn resulted in many early nests being constructed in poor locations, extremely susceptible to predation. As an example, of the season's first 55 nests, only 2 terminated in successful hatches. The majority of this loss was through predation. Flooding during this season destroyed 4.5 percent of the total teal eggs.

Predation. Predators on the study area accounted for the heaviest nesting losses. In order of their importance, these consisted of: California Gulls (Larus californicus), Common Skunk (Mephitis mephitis), Mink (Mustela vison), Weasels (Mustela cicognani), Magpies (Pica pica hudsonia), Ravens (Corvus corax), and Duck Hawks (Falco peregrinus). No egg-consuming snakes have been observed on the area. Short-eared Owls (Asio flammeus flammeus) and Marsh Hawks (Circus hudsonius), though very common, were never noted as preying on waterfowl.

The California Gull proved to be the most serious predator. A colony of several thousands of this species nests annually on the area. It is difficult to determine what percentage of these birds develop the predation habit. Throughout the season a few gulls could always be observed hunting the marsh. The typical manner of predation was to fly low (10-30 ft.) over the marsh until a nest was spotted. Eggs were occasionally destroyed at the nest but more frequently an egg was carried off to some bare area for consumption. In some instances Gulls would return to the nest several times and in others only a single visit was made with 1 egg being stolen. Occasionally eggs were carried back to the colony entire, as evidenced by finding Cinnamon Teal eggs in gull nests. Due to the small size, Teal eggs were commonly carried off whole. The larger eggs of Mallards (Anas platyrhynchos platyrhynchos) and Redheads (Anthya americana) were more frequently consumed at the nest. Gulls destroyed

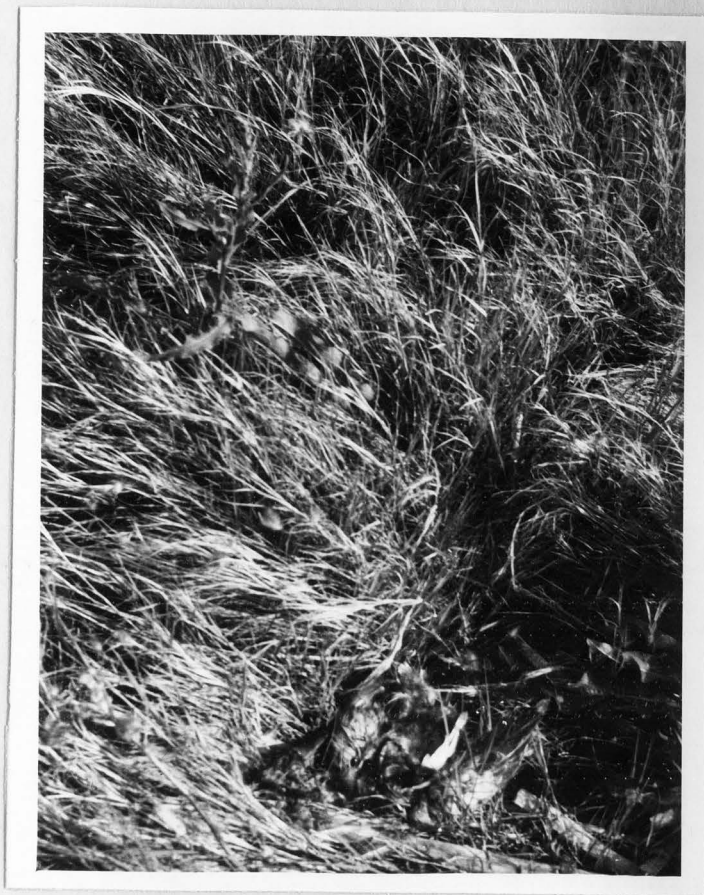


Figure 24. An incubating Cinnamon Teal killed on her nest by a predator, Ogden Bay Refuge, 1950.

at least 12.4 percent of the Cinnamon Teal eggs in 1949 (latter part of season only) and 33.9 percent of the eggs in 1950.

Skunk populations on the area were heavy and despite control efforts destroyed 3.4 percent of the eggs in 1949 and 8.8 percent in 1950.

Both years inclusive, six females were found killed on the nest by minks and weasels.

Magpie, Raven, and Duck Hawk populations were low, and individually accounted for well under 1.0 percent of the predation losses.

Desertion. Mortality through nest desertion is often related to other decimating factors such as disturbance by man, egg predation, and others. As an example, the question frequently arises regarding Cinnamon Teal nests as to whether 4 deserted eggs of a former clutch of 8 should be assessed as desertion or credited to the gulls which raided the nest originally and constituted the factor leading to desertion. Probably failure of the entire clutch should be attributed to gulls but during the present study only eggs remaining unhatched in terminated nests (except for flooding) were recorded as deserted.

In 1949, 12 nests or 20.3 percent failed because of desertion. The average clutch size in these nests was 6.1 eggs - considerably lower than the successful clutch size. In 1950, 7.5 percent of all Teal eggs were deserted.

Usually the nesting Cinnamon Teal will withstand

considerable disturbance by man without deserting her nest. This is particularly true during incubation. During the early laying period, however, desertion may be caused by a moderate amount of disturbance.

Hatching

The hatching characteristics of this species are similar to most dabbling ducks. Once pipping begins the remainder of the process is completed rapidly and the young leave the nest. In one closely observed clutch of 10 eggs, pipping was just beginning at 10:00 A.M. By 5:00 P.M. of the same day the hatch had been completed and the nest was vacated. Some instances were noted of eggs containing partially hatched dead embryos being abandoned in recently hatched nests. This seems to indicate that the female will not spend much time waiting for the delayed hatching of 1 or 2 eggs.

In determining nest success, the number of "skins" (egg membranes) and egg caps left in the nest were the most satisfactory evidence on which to base egg fates.

During the hatch, the female has never been observed to leave the nest voluntarily. If flushed at this time she acts extremely "broody", remains close by, and soon returns when the disturbing factor is removed.

Embryo Dyeing

General. At the time this phase of the project was undertaken the techniques for coloring young waterfowl by inoculation of eggs with dyes were just being developed.

Preliminary reports by Evans (1950) and Hyers (1949) were available to the writer. Both of these workers used slightly different techniques. Evans injected the embryo directly through the small end of the egg, and Hyers inoculated the air sac in the large end of the egg.

In connection with the present study it was felt that if the young Cinnamon Teal could be efficiently colored in this manner they would yield valuable data on specific broods as to post hatching survival and movements. An attempt was made to inoculate the eggs during the last week in incubation.

Techniques. Both of the described techniques were utilized on Cinnamon Teal. A total of only 5 clutches were found under suitable situations for the experiment and thus the data are meager though fairly indicative. The technique used by the writer closely paralleled those used by Evans and Hyers. Commercial food coloring dyes composed of 4 percent coat tar dye, 10 percent alcohol and 86 percent distilled water were used as coloring material. Three colors - red, green, and orange were used. Rubber stoppered serum bottles for dye, small bottles of alcohol and colloidion, and a 5 c.c. syringe with a one inch, 20 gauge hypodermic needle completed the equipment. The procedure used was to visit the nest during the last week in incubation, collect the eggs and remove them some distance for injection. The syringe and needle were sterilized by flushing in alcohol, 0.5 c.c. of dye injected, and the hole sealed

with commercial collodion. Eggs were subsequently returned to the nest and covered.

Results. Results of these experiments are presented in the brief nest histories below.

Nest No. 1 - Located July 5 -- 8 eggs; 2 stolen by gulls on July 25; July 26 - 6 eggs innoculated with red dye, 3 in large end, 3 in small end; July 31 - 3 eggs left in nest, 1 infertile, 1 injected large end, dead embryo; 1, small end, dead; 1 well colored duckling dead in nest, 1 weak hatched duckling died shortly, evidence of 1 successful hatch; female and single young nowhere in area and never observed later.

Nest No. 2. - Located June 30 - 8 eggs; July 17 1 egg stolen by gull; seven eggs injected green dye, 4 large end, 3 small end. July 31 - nest deserted, 6 eggs left all fertile, all dead. Appeared as though dye killed embryos. Seventh egg taken by gull.

Nest No. 3. - Located June 12. - 10 eggs; 4 eggs stolen by gulls as of June 28; 6 eggs injected orange dye on 6/28, 3 in each end. Deserted July 5, no hatch. Eggs all fertile - all dead.

Nest No. 4. Located June 12. - 13 eggs. Thirteen eggs injected red dye, July 6, 6 small end, 7 large end. (Embryos tapping when injected). Hatched 12 young July 8. One egg injected small end, fertile but failed to hatch. Brood never observed.

Nest No. 5. - Located June 19 - 12 eggs. Injected 6 eggs, red dye on 6/27, 3 in each end - embryos tapping when injected. Hatched 10 young June 28. One egg injected small end, fertile but failed to hatch and 1 uninoculated egg fertile, but failed to hatch. Brood never observed.

Summary. No data resulted for the purpose intended, i.e., post hatching mortality and movement. Some evaluation of the technique is possible, however. It was observed that immediately upon the injection of dye the egg shell assumed the color of the dye. This gave them a bizzare appearance

and it is felt this may have caused desertion in two nests. The two most successful clutches were both injected very late in incubation when the embryos had actually begun to tap through the shell. Weather during the experimental period was extremely hot and the chemical effect of the dye upon the embryos may have been increased thereby. Hatching success was apparently not influenced by selection of the large or small end of the egg for inoculation.

This is an interesting technique and worthy of additional research. However, it is the opinion of the writer that in order to produce worthwhile results the amount of time and effort necessary does not justify its use concurrently with other phases of a nesting survey. If it is used, it probably should be considered as a project in itself and at least one man's time should be devoted to this project alone.

Table 9. Variation in Egg Size of Individual Cinnamon Teal Clutches, Ogden Bay Bird Refuge, 1949-1950

Clutch No.	Average Size		No. Eggs
	Length (mm)	Breadth (mm)	
1	44.98	33.56	12
2	45.58	34.16	11
3	47.26	34.60	3
4	44.00	33.83	3
5	48.24	37.24	5
6	48.35	34.19	12
Total	46.40	34.59	46
Average Weight - 26.98 grams (11 eggs)			

Table 10. Summary of Cinnamon Teal Nesting Results, Ogden Bay Refuge, 1949

Item	Number	Percent
Total no. Cinnamon Teal nests	59	
Total no. eggs laid	460	
Total no. eggs hatched	265	57.5
Average clutch size	7.8	
Average hatch per nest (total nests)	4.5	
No. of successful nests	36	61.0
Average size of successful clutch	8.5	
Average hatch of successful clutch	7.4	
Average size unsuccessful clutch	6.6	
Total no. eggs in successful nests	306	
Total no. eggs in unsuccessful nests	154	
Percent hatch in successful nests		86.9
No. nests parasitized	17	28.8
No. nests parasitized and hatched	14	82.4
Average size parasitized clutches	6.9	
Average size of successful unparasitized clutch	9.6	
No. nests deserted	12	20.3
Average size deserted clutch	6.1	
No. deserted nests parasitized	1	
No. nests preyed on by gulls	11	18.6
No. nests destroyed by gulls	5	8.5
No. nests destroyed due to killing of female	4	6.8
Nests destroyed through other agencies	2	3.4

Table 11. (A) Cinnamon Teal Nest Data, Ogden Bay Refuge, 1950.

	No.	Percent
Total no. nests.	170	----
No. Successful nests	68	40.0
Average clutch size (overall).	8.3	----
Average clutch size successful nests	9.4	----
Average clutch size unsuccessful nests	7.5	----
Average clutch size successful parasitized nests	8.3	----
Average clutch size successful unparasitized nests	9.7	----
Average clutch size parasitized nests.	8.3	----
Average clutch size unparasitized nests.	8.3	----
No. parasitized nests.	38	22.4
No. unparasitized nests.	132	77.6
No. successful parasitized nests	15	39.5
No. successful unparasitized nests	53	40.1
Total teal eggs.	1400	----
No. teal eggs in successful nests.	630	45.0
Total no. eggs in teal nests (incl. other ducks	1508	----
Total no. eggs of other ducks.	108	----
No. eggs (overall) destroyed by skunks ¹	129	7.2
No. nests attached by gulls.	72	42.4
No. eggs (overall) destroyed by gulls ¹	537 ²	35.5

Table 11. (B) Cinnamon Teal Egg Fates³ Ogden Bay 1950

	No. eggs ⁴	%	Rh ⁵	Sh ⁶
Hatched	534	38.1	22	
Deserted	105	7.5	26	
Flooded	63	4.5	0	10
Destroyed by gulls	475	33.9	18	
Destroyed by skunks	123	8.8	1	
Left in nest	35	2.5	20	
Other fates	65	4.6	11	

1. Includes eggs remaining in nests and deserted due to predator attack.
2. Includes eggs of other ducks.
3. Nest fates cannot be accurately assigned in all cases since destruction maybe due to more than one factor - hence only eggs fates may be accurately designated.
4. Includes only teal eggs.
5. Eggs of Redheads laid in teal nests.
6. Shoveller eggs laid in teal nests.

Table 12. Comparison of nesting success of various duck species on Special Study Area at Ogden Bay Refuge, 1950¹

	Nests		Eggs ²		Egg Fates													
	No.	%	No.	%	Hatched		Deserted		Flooded		Dest'yd by Gulls		Dest'yd by Skunk		Left in Nest		Unk- nown	
					No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1.Cinnamon Teal	65	39.6	637	42.2	320	50.0	83	13.0	44	6.9	123	19.3	9	1.4	9	1.3	21	3.3
2.Mallard	37	22.6	307	20.4	169	55.0	25	8.1	4	1.3	90	29.3	12	3.9	7	2.3	0	0.0
3.Gadwall	29	17.7	283	18.8	257	90.8	6	0.2	0	0.0	6	2.1	0	0.0	14	4.9	0	0.0
4.Redhead	9	5.5	90	5.9	47	52.3	14	15.6	0	0.0	11	12.2	8	8.9	10	11.1	0	0.0
5.Pintail	13	7.9	99	6.6	58	58.6	2	2.1	0	0.0	23	23.2	0	0.0	16	16.2	0	0.0
6.Shoveller	10	6.1	82	5.5	59	47.6	0	0.0	0	0.0	27	32.9	14	17.7	2	2.4	0	0.0
7.Green-w Teal	1	0.6	10	0.7	10	100.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	164		1508		900	59.7	130	8.6	48	5.8	280	18.6	43	2.9	57	3.8	21	1.4

1. At least one pair of Baldpates and several pairs of Ruddys nested on the area but their nests were not discovered. The area also produced at least 50 young Canada Geese.

2. Includes eggs of other ducks.

Table 13. Additional nesting data from Ogden Bay and Bear River Migratory Bird Refuges¹

(A) Cinnamon Teal nesting success in 1951 at Ogden Bay Ref.

	Cinnamon Teal		All Ducks	
	No.	Percent	No.	Percent
Total nests	122	100	413	100
Nest successful	75	61.5	282	68.2
No. eggs	1215	100	3978	100
Eggs hatched	674	55.6	2370	60.0
Eggs left in nest	72	6.0	314	7.9
Eggs flooded	10	0.8	86	2.2
Eggs to gulls	273	22.5	712	18.0
Eggs to skunks	91	7.5	270	6.8
Unknown egg loss	29	2.4	91	2.3
Av. clutch	10.6	---	10.2	---
Av. hatch	9.0	---	8.4	---

(B) Yearly comparison of nests and eggs on sample plots at Bear River Migratory Bird Refuge.

	Cinnamon Teal		All Ducks	
	Nests	Eggs	Nests	Eggs
1947	51	327	343	2112
1948	61	433	325	2819
1949	95	782	388	3283
1950	123	521	462	2918
1951	96	653	434	3165

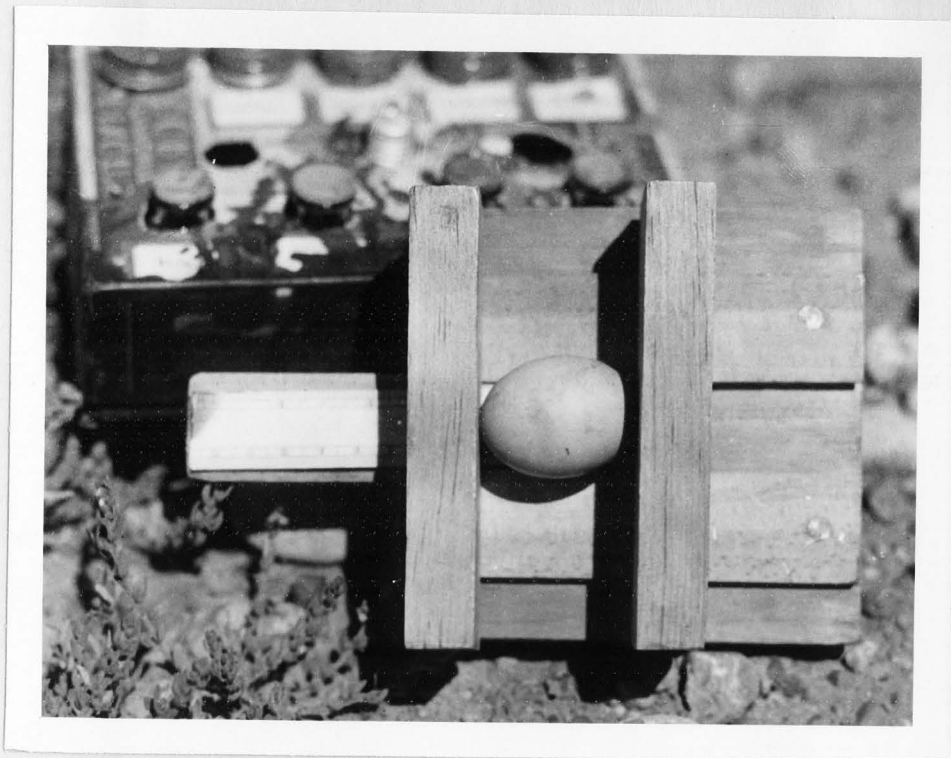


Figure 25. Caliper devised for measuring eggs during the study.



Figure 26. Injecting Cinnamon Teal eggs with dye to color the young.



Figure 27. Sealing the hypodermic puncture with collodion after injecting a Cinnamon Teal egg with colored dye.

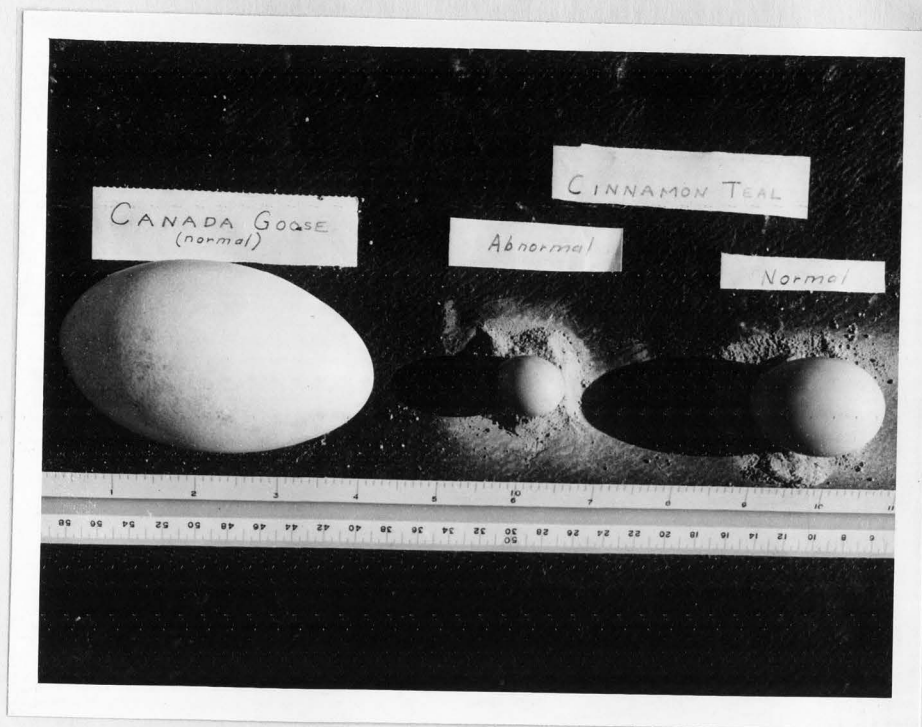


Figure 28. An abnormal Cinnamon Teal egg compared with normal eggs of the same species and of the Canada Goose.

RENESTING

Evaluation of the renesting habit in this species proved difficult. No reliable method for identifying re-nests in the field was determined. Other workers (Low 1941), Bennett (1938), and Sowls (1949) variously based identification of renests, (1) amount of down present, (2) clutch size, and (3) identification of marked females. The latter technique, used by Sowl at Delta, Manitoba, involves nest trapping and marking of females with the object of locating their second nests.

During the 1950 breeding season 15 nesting females were trapped on the nest by methods previously described. These hens were banded and marked for future field identification by application of a 2-inch band of colored airplane dope across the wings. "Testors" brand of dope proved very satisfactory and may be obtained in small handy bottles of various colors at most model airplane shops. The applications were made with ordinary cotton swabs. To mark the bird, the wing was stretched out and a liberal amount of dope swabbed on. The colored band dries in 2 or 3 minutes, during which time the wing should be held extended. The most satisfactory colors used on Cinnamon Teal were orange, red, yellow, and white. Any of these can be spotted readily with binoculars on flying birds at distances up to $\frac{1}{4}$ mile.

If birds are on the water, this distance is somewhat reduced.

Of the 15 birds marked by this method at Ogden Bay, 8 completed their nests naturally. The other 7 nests belonging to marked birds were collected and the area watched carefully for signs of renesting. Despite frequent diligent searches no renests of these marked females were located. Neither, on the otherhand, were any observations of broods accompanied by marked females noted. This lack of success points out the need for larger samples if studies of this nature are to yield desired data.

Although this phase of the investigation was inconclusive, it did result in some interesting observations which are indicative of nesting behavior. The most notable in this respect concerned the female on nest number 181. This nest was located on June 20 and contained a clutch of 10 eggs. Down was abundant and incubation was apparently in progress. The hen was trapped the following day (June 21) and marked for identification with a yellow strip across the left wing. On June 27 this bird was observed with a drake of the same species about $3/4$ miles from the nest. An immediate visit to her nest showed that it had been destroyed by a skunk. This pair was again seen in the same area on June 28 for the last time. A condition which makes this an unusual record is the lateness in the season at which this nest failed and the female's accompaniment by the drake. At this time most of the waiting drakes had departed for the eclipse moult and no drakes had been observed in the vicinity

of the previous nest. It appears that when a nest is broken up that the female almost immediately seeks a male. One wonders if a female may not mate with more than 1 male during the course of the season. Normally of course she could be presumed to remain with her original drake.

Other observations of marked birds were similar in nature and it was found that whenever an individual was recorded outside of a $\frac{1}{4}$ mile radius from the nest, subsequent checks showed that the nest had failed. It is logical to deduct from this that the daily range of nesting females rarely exceeds this distance ($\frac{1}{4}$ mile).

In view of the lack of concrete evidence on renesting it is hard to assess its importance in terms of annual production on the area in question. Since the nesting survey covered the entire season from start to finish in 1950, both original and renests were included. Very late nests, which were probably renests, did show a tendency for slightly reduced clutch sizes but the same was true of very early nests. Furthermore, Sowl's (1949) study showed that, for several species of waterfowl at Delta, clutch size is not a valid criteria of renests. The Cinnamon Teal study in Utah also indicated that the amount of nest down could not be utilized to identify renests of this species.

The proportion of the Teal population which does renest will vary from year to year depending upon the favorability of the season for successful completion of first nests. The phenology of breeding season may render a clue to the degree

of renesting for a particular season. If, as in 1949, hatching builds up rapidly to an early peak with very few late hatches it can be assumed that very little renesting was necessary. Should the opposite be true, and hatching spread out over the season, renesting could be considered extensive. The latter condition existed at Ogden Bay in 1950 for the Cinnamon Teal and several other duck species. As previously noted, broods of all ages for these species were noted throughout the summer. An exception to this were the Gadwalls (Anas streperus) which nested later than most and consequently encountered better conditions of cover and water levels for nesting than did the earlier species. Gadwalls had the highest nesting success of 6 species included in the nesting survey¹ (see table 12). In 1950, 90.8 percent of 283 Gadwall eggs recorded, hatched. The next highest species was the Pintail with a hatch of 58 percent of 99 eggs. Very little renesting of the Gadwall was apparent and the brood ages were much more uniform than their associates.

Further research into the effect of renesting upon annual production is needed.

1. ~~Green-winged Teal constituted a 7th species with only one nest which hatched 100 percent. Hatching data described above excludes this single nest.~~

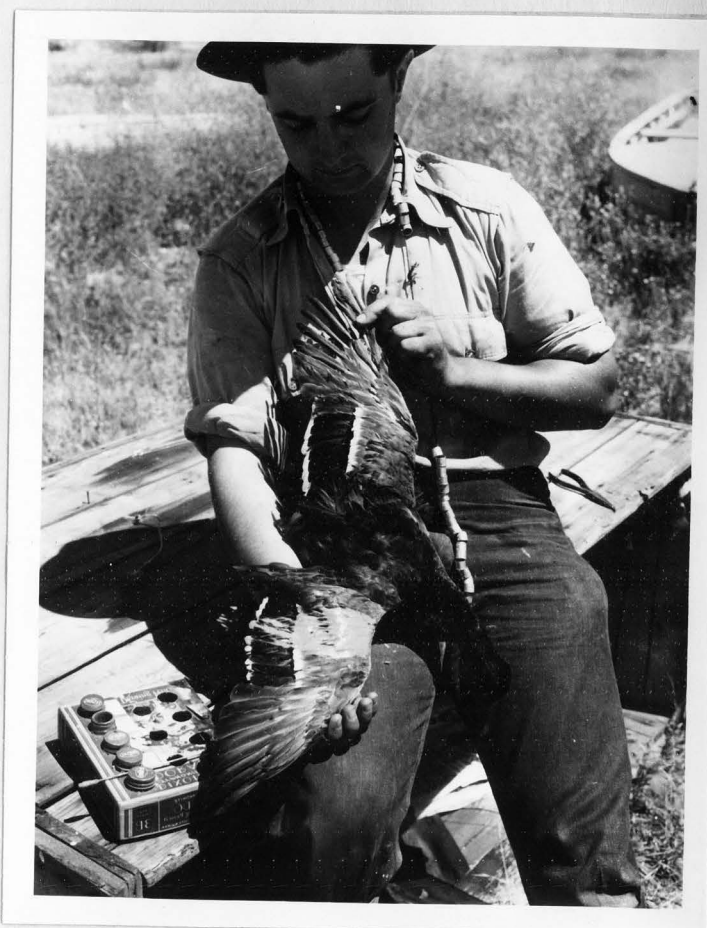


Figure 29. A Mallard duck showing color marking (right wing) with airplane dope, for future identification in the field.

BROOD REARING

Cover Selection

Once the young Teal have hatched the first action of the female is to lead them from the nest to a suitable area for rearing. It appears that good escape cover is the major requirement of the brood for the first few weeks. Food is everywhere abundant and is not a limiting factor in the selection of rearing cover. The preferred habitat on the Utah breeding grounds is a small ditch, borrow pit, or pond, filled with submergent plant foods and insect life, and surrounded by tall dense stands of emergent marsh vegetation. The many borrow pits and diversion ditches, as well as the excellent interspersions of cover types, on the Ogden Bay Study Area made it an ideal rearing area.

Favored brood rearing cover at Ogden Bay usually consisted of small ditches or borrow pits with sloping banks covered with dense stands of cattails, bulrushes, or weeds. Such waterways were commonly filled with growth of Sago Pondweed, Wigeongrass, Chara and other submergents.

Occasionally broods were observed along the heavily vegetated shores of large impounded water areas.

Broods may travel as much as a mile in 3 or 4 days along suitable waterways but they are far more apt to remain within a limited area of a few choice acres.

Interspersion of cover types cannot be over-emphasized in its importance to brood rearing. Good breeding habitat provides choice nesting sites in close proximity to rearing cover. Observations of nesting and brood rearing on some of the large expanses of Saltgrass marshes show that seldom is the brood size as large as where good interspersion is present. Broods have been seen traveling across large open areas to reach rearing cover but such movements almost assuredly result in higher mortality.

Growth of the Young

In order to obtain a more definite knowledge of growth and development of the young teal, 2 clutches of 12 eggs each were collected in 1950 and artificially hatched under Bantam Hens. Small bottomless coops were provided for each nest. Fourteen of the eggs hatched and 9 birds were raised to maturity on a diet of Duckweed (Lemma spp.) and commercial turkey mash. Studies of these captive reared birds yielded interesting data.

Several ducklings were weighed as soon as they had hatched and dried. The average weight for 5 was 18.2 grams as compared with an average egg weight (11 eggs) of 27.0 grams. Secondary sex ratio was exactly 1 to 1. Since the birds were reared artificially it was felt that weights subsequent to hatching would not be representative. However, photographs were taken of day-old ducklings and each week following photos were made to the age of 8 weeks. These photos were taken with $\frac{1}{4}$ " square, graph paper as a background.

This resulted in a good portrayal of growth as well as showing plumage development to a fair degree. Selected examples of these photos are presented in figure 28.

A brief description of the growth and plumage development is of interest. The day-old chicks are clothed in a yellow and brown natal down. The forehead, side of the head, and underparts are yellow in varying intensities. Yellow spots also appear on either side of the rump, the scapulars and wing edges. The back is a yellowish olive. The remainder of the body, head, and neck are brown. A prominent brown eye stripe is present and a small brown spot posterior to, and below the eye is characteristic. The first juvenile feathers are blackish brown and appear on the flanks and scapulars. At about 4 weeks of age the tail feathers are produced and the primaries have grown about $\frac{1}{2}$ inch beyond the quill. The speculum also begins to appear about this time and sex is distinguishable by the character of the white wing band. The belly becomes pale buff spotted with gray. The blue wing coverts are not yet noticeable. At 5 weeks the feet and tarsus have begun to fade from green to yellow. The eye in the males is still brown and traces of down remain at the nape of the neck, on the rump, and in the scapular region. At 6 weeks, feathering is very nearly complete, with only small traces of down remaining. The breast has become definitely spotted by this time. At the end of the seventh week the study birds were judged as fully feathered and probably capable of flight. The eye of

the males was fading from brown to red and traces of red pigment were appearing.

For more comprehensive descriptions of plumage patterns the reader is referred to Bent's (1951) treatment of this species.

Brood Sizes

Brood counts of Cinnamon Teal proved difficult to make under Utah conditions. The habits of the female were the instrumental in causing this. The Cinnamon Teal, typically one of the best waterfowl mothers on the marsh, was exceeded perhaps only by the Canada Goose (Branta canadensis). Teal keep their broods close to escape cover and at the first sign of disturbance the young disappear as if by magic while the female attempts to divert the observer by feigning injury.

Brood counts were attempted on foot, in canoe and from auto, along dyke lines. The most satisfactory method devised was to make the count of young (with binoculars) at long range from an auto driven by an assistant. This allows better counts, and once the young have been tallied a rapid approach for positive identification of the female can be made. In making the counts by other methods, it was rarely that the worker could be sure of having counted the entire brood.

During the 2 breeding seasons encompassed by the investigation, brood counts were made over the entire Ogden Bay Refuge a minimum of once a week. The counts yielded 28 brood records in 1949 and 51 in 1950. The 1949 average brood

sizes were found to drop from 10 young in broods 1 week old or less to 4.5 young at 8 weeks. The more useful age classifications of Classes I, II, and III were used in 1950 counts. The 1950 season showed a decrease in average brood size from 8.7 ducklings in Class I broods to 4.7 in Class III (Table 14). It may be stated in light of these data that the average size of the Cinnamon Teal broods to reach flying age was 4.5 in 1949 and 4.7 in 1950. These birds represent "actual production".

Juvenile Mortality

No positive information on juvenile mortality was revealed by the investigation. Never were any dead juveniles or identifiable remains thereof found on the rearing grounds. Predation by such species as minks, weasels, and gulls undoubtedly takes its toll. California Gulls frequently have been observed catching and eating live ducklings. Where large breeding populations of gulls are present in proximity with waterfowl areas such as at Ogden Bay and Farminston Bay Refuges they may very likely be an important cause in the reduction of brood sizes.

In the areas studied, weather was probably unimportant as a decimating factor of Teal broods. Presumably in areas suddenly modified during the rearing period by drought or floods this might cause serious losses.

Diseases and parasites may also enter the picture but the only serious item of this nature in Utah is an annual outbreak of botulism which kills young and old alike.

Normally this outbreak does not occur until late in the season after most immature birds have reached flying age. Further, areas on which such epidemics are most conspicuous are seldom good brood rearing areas. These 2 facts can only lead to the conclusion that botulism has little effect on brood sizes within the age period of discussion.

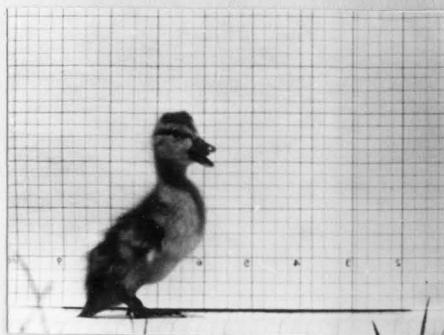
Table 14. Cinnamon teal brood count data, Ogden Bay Refuge
1949 and 1950.

(A) 1949

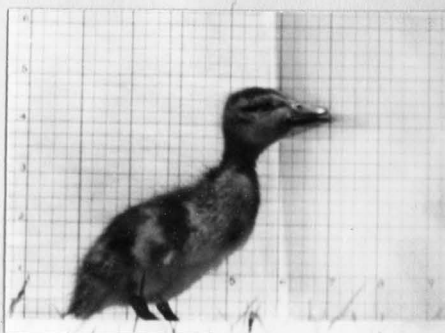
Age	No. Broods	Average Number in Brood
1 week	9	10.0
2 weeks	5	8.7
3 weeks	3	9.9
4 weeks	2	8.0
5 weeks	1	7.5
6 weeks	4	8.5
7 weeks	1	5.3
8 weeks	3	4.5

(B) 1950

Age	No. Broods	Average Number in Brood
Class I (less than 1/3 grown)	23	8.7
Class II (less than 2/3 grown)	17	6.6
Class III (over 2/3 grown)	11	4.7



1 Week



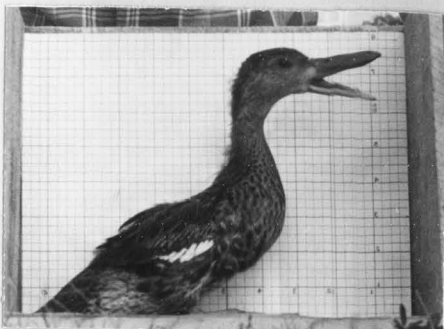
2 Weeks



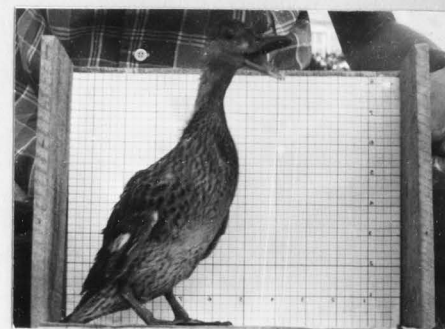
3 Weeks



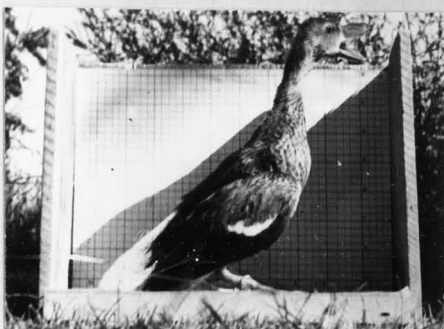
4 Weeks



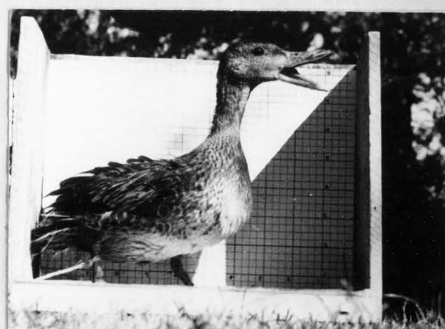
5 Weeks



6 Weeks



7 Weeks



8 Weeks

Figure 28. Growth of Cinnamon Teal ducklings from the age of 1 to 8 weeks.

PREDATION

With the possible exception of gulls and skunks predators upon Cinnamon Teal are not of serious consequence over Utah as a whole. On some localized areas, however, where attempts are being made to manage breeding waterfowl for maximum production, control of gulls and skunks may be beneficial. At Ogden Bay both of these predator species were prevalent in excessive numbers and the egg loss from their depredations materially reduced production of Cinnamon Teal. For example (combining the 1949 and 1950 data) these 2 nest predators destroyed a total of 777 teal eggs out of 1860 under observation.

By far the most serious predation loss of Cinnamon Teal is the egg destruction during nesting. However, predation undoubtedly accounts for many losses of young birds and even a few adults. Minks and weasels were present on the study area and during 2 seasons killed at least 10 females on or in the vicinity of the nest. The habits of incubating Teal apparently make them particularly susceptible to this type of predation.

Other predators present on the Study Area but in low populations included ravens, magpies, duck hawks, feral domestic dogs and cats, and in winter a rare coyote (Canis latrans) and several Bald Eagles (Haliaeetus leucocephalus).

The latter two of course did not have opportunity to prey on Cinnamon Teal. One badger (Taxidea taxus) was recorded on the area in 1949. Marsh Hawks (Circus hudsonius) and Short-eared Owls (Asio flammeus flammeus) were present during the breeding season in considerable numbers but were never observed to molest waterfowl. Another species not commonly considered a predator is the Black-crowned Night Heron (Nycticorax nycticorax hoactli). This species nests in considerable numbers at Ogden Bay and has been observed on 2 instances catching and eating young Coots. Undoubtedly, if the opportunity presented itself, they would just as readily consume a young teal. It is doubtful though if predation by this species ever assumes important proportions at Ogden Bay.

In summarizing predation on the Cinnamon Teal it may be safely stated that only egg predators are influential on the population as a whole. These vary in their detrimental effects from area to area. In some locations gulls are serious and on others crows, ravens, and magpies may cause important losses. The only important mammalian predator in this region is the skunk.

Predation upon birds past the flying age is relatively insignificant, though minks and weasels prey quite regularly on nesting females.

ESTIMATED PRODUCTION

An estimation of waterfowl production on a particular area is always difficult and of dubious validity. True production as considered here is interpreted as the number of juvenile birds which reach flying age following the breeding season. These may be considered as harvestable stock and an additional increment to the breeding population. Present tendencies in waterfowl management recognize the value of trends in production which are perhaps a better indication of nesting season success than actual estimate of numbers. It is important however to attempt some form of numerical estimates of a season's results in terms of new birds produced.

A composite method in general use and of accepted worth in making these estimates consists of: (a) censusing breeding pairs on any particular area, (b) determining nesting success through a nest survey, and (c) finding the average size of broods to reach flying age. When these data are known, production may theoretically be computed by multiplying the number of breeding pairs by the percent of successful nests, times the average size of Class III (2/3 grown or better) broods. On small areas of intensive study this method probably yields estimates of acceptable accuracy (plus or minus 20 percent error).

Use of this method for Ogden Bay Refuge for 1949 and 1950 produces the following results for Cinnamon Teal.

1949

Data: Estimated no. of breeding pairs (table 15)----- 337
 Percent of observed nests successful (table 10)-- 61
 Average Class III brood size (table 14)(young)--- 4.5¹

Computation: $337 \times 0.61 \times 4.5 = \underline{925 \text{ Teal produced}}$

1950

Data: Estimated no of breeding pairs (table 15)----- 350
 Percent of observed nests successful (table 11)-- 40
 Average Class III brood size (table 14)----- 4.5

Computation: $350 \times 0.4 \times 4.5 = \underline{630 \text{ Teal produced}}$

In considering the above figures it should be recalled that most juvenile Teal reach flying age by mid-August and even start migration late in the month. These estimates do not take into account the losses accruing from botulism which normally strikes during August and September.

In theory, production estimates could be made throughout the breeding range of the species by this method. The factors of time, space and available personnel however make certain modifications and assumptions necessary. In making such studies on areas as large as the State of Utah it becomes obvious that before even breeding pair counts or estimates can be made a thorough knowledge of breeding grounds within the State is necessary. This prerequisite knowledge is by no means complete for Utah.

1. This figure may vary from 4.5 to 6.0 but frequent observations elsewhere in the State seems to indicate that 4.5 young in Class III broods is fairly constant from area to area and year to year.

In relationship with other Utah waterfowl the Cinnamon Teal has been found to constitute between 20 and 25 percent of the breeding duck population on areas investigated during the study.

Table 15. Breeding pair populations¹ of Cinnamon Teal and other ducks on three Utah State Refuges, 1949 - 1952

Ogden Bay Refuge

	Year			
	1949	1950	1951	1952
Cinnamon Teal (no. pairs)	337	350	365	207
Percent Cin. T	18.0	19.8	19.5	11.2
Total pairs (all ducks)	1864	1771	1779	1844

Farmington Bay Refuge

Cinnamon Teal (no. pairs)	183	175	180	214
Percent Cin. T.	21.7	25.2	22.1	31.0
Total pairs (all ducks)	627	758	761	606

Public Shooting Grounds

Cinnamon Teal (No. pairs)	169	180	172	84
Percent Cin. T.	26.8	23.7	22.8	13.9
Total pairs (all ducks)	627	758	761	606

Total average percent of Cinnamon Teal - 21.3

1. Data for 1949 and 1950 collected during investigation. Data for 1951 from Pacific Flyway Report #15. Data 1952 unpub. from files of N. F. Nelson, Utah Fish and Game Dept.

THE HUNTING SEASON AND HARVEST

Utah Harvest

Wildfowling in Utah is a big business. Though duck or goose hunting occurs to some extent in nearly every county, by far the majority of the hunting pressure is in the northern sections of the state. The eastern side of the Great Salt Lake Valley is one of the great waterfowling areas of the nation. Approximately 200,000 ducks are killed annually by at least 30,000 hunters. In order to record and analyse this harvest, State waterfowl personnel operate checking stations at three locations, Farmington Bay, Ogden bay, and Public Shooting Grounds. Bear River Migratory Bird Refuge constitutes a fourth source of data. In addition to checking stations a card questionnaire kill survey is conducted immediately following the close of the season.

In addition to public hunting there is a considerable amount of gunning by private clubs. Many of the clubs have large holdings on some of the best waterfowl areas in the State. Shooting on the club grounds is principally from prepared blinds. On public marshes, temporary blinds, pass shooting, and jump shooting are the rule. Decoys of all descriptions are used but a relatively low percentage of hunters makes use of retrieving dogs.

In order to determine the amount of hunting pressure

upon the Cinnamon Teal, the writer assisted in the operation of checking stations during the 1949 season. All Teal appearing in hunters' bags were tallied as to sex and age. Checking stations were operated on all 3 areas on the opening day of the season and on every Sunday. In addition, they were operated so as to provide a sample of equal numbers of each week day throughout the season. On this basis the total kill was computed for each check area for the total season. Resulting data showed that 179 Cinnamon Teal were killed at Farmington Bay, 234 at Ogden Bay, and 73 at Public Shooting Grounds during the 1949 season. This amounted to 2.6 percent, 1.0 percent and 3.9 percent respectively of the total duck kill on these areas. Bear River Refuge produced a kill of 115 Teal or 1.1 percent of the total duck kill for this same season.

In addition to this kill on public lands the possibility of assessing the harvest on private clubs was investigated. It was found the records kept were so meager, and identification so dubious that they did not provide a reliable source of data. The Bear River Duck Club was an exception to this, and their records showed a kill of only 5 Cinnamon Teal for the season. Gunning on this club is highly selective, however, and the take was predominately Canvasbacks, Pintails, and Mallards.

In considering all hunters as a group there is little evidence to support any appreciable amount of shooting

selectivity as to species. On the other hand, the sportsmanship of many Utah hunters is far from sterling in character and the writer has often found 4 or 5 teal or shovellers pushed under a clump of vegetation near a blind. It appears to be a common practice with some hunters, if birds are plentiful, to keep shooting until a bag limit of the larger more desirable species has been completed. The crippling loss, as determined by check station questions, is estimated at 15 percent of the total duck kill or approximately 300 Cinnamon Teal per year.

In relation to the numbers produced and the kill of other species the Cinnamon Teal harvest has proved very small in Utah. On the combined check areas it averaged only 1.82 percent of the teal duck kill for the 3 years, 1949-1950 (table 18). The computed duck kill for the entire State is approximately 200,000 birds annually. Of these 200,000 birds approximately 3690 are Cinnamon Teal. Adding the estimated crippling loss of 300 gives a total Statewide estimated hunting removal of approximately 4,000 Cinnamon Teal.

The most significant reasons for the small kill are: (1.) the early migration date of the species; and (2) the magnitudes of other species which pour into Utah during migration and thereby greatly reduce the proportion of the Cinnamon Teal population.

Harvest data for the Cinnamon Teal in Utah is summarized in tables 16, 17, and 18.

Table 16. Composition and numbers of Cinnamon Teal killed in the 1949 hunting season by weekly periods.
(Sexed and aged sample only.)

(A) Ogdan Bay Refuge

	Teal kill by weekly periods (Oct. 14 - Dec. 2)							Total
	1	2	3	4	5	6	7	
Adult Males	6	-	-	-	-	-	-	6
Adult Females	12	-	1	-	-	-	-	13
Juv. Males	21	-	-	-	-	-	-	21
Juv. Females	21	-	1	-	-	-	1	23
Total	60	-	2	-	-	-	1	63

(B) Farmington Bay Refuge

Adult Males	11	-	-	-	-	-	1	12
Adult Females	18	-	-	-	3	1	1	23
Juv. Males	23	-	-	-	1	-	-	24
Juv. Females	29	-	1	-	-	-	1	31
Total	81	-	1	-	4	1	3	90

(C) Public Shooting Ground

Adult Males	7	-	-	-	-	-	-	7
Adult Females	-	-	-	-	-	-	-	-
Juv. Males	3	-	-	-	-	-	-	3
Juv. Females	2	-	-	-	-	-	-	2
Unclassified	21	-	-	-	-	-	-	21
Total	33	-	-	-	-	-	-	33

(D)

Bear River Migratory Bird Refuge (total kill)

Unclassified	86	6	4	9	4	3	3	115
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Table 17. Sexed and aged samples of Cinnamon Teal killed on three Utah check areas, 1949-1951

1949

	Males		Females		Sex Ratio	Age Ratio
	Adults	Juv.	Adults	Juv.	M/F	Ad/Juv
Ogden Bay	6	21	13	34	1:1.32	1:2.32
Farmington Bay	12	24	23	31	1:1.50	1:1.54
Public Shtg. Grds.	7	3	--	2	1:0.20	1:0.71
Total	25	48	36	56	1:1.00	1:1.52

1950

Ogden Bay	2	12	8	18	1:1.86	1:3.00
Farmington Bay	1	3	6	8	1:3.50	1:1.55
Public Shtg. Grds.	(Data Lacking)					
Total	3	15	14	26	1:2.28	1:2.28

1951

Ogden Bay	7	18	15	12	1:1.04	1:1.36
Farmington Bay	8	15	25	6	1:1.35	1:0.64
Public Shtg. Grds.	2	2	2	5	1:1.75	1:1.75
Total	17	35	42	23	1:1.38	1:1.25

Table 18. The calculated kill of Cinnamon Teal on three Utah check areas and the computed Statewide kill, 1949-1950

Total check area kill samples

Area		1949	1950	1951
Ogden Bay	All Ducks	6312	4515	6483
	No. Cin. Teal	63	61	153
	Percent Cin. Teal	1.0	1.4	1.7
Farmington Bay	All Ducks	3523	2027	4270
	No. Cin. Teal	90	19	54
	Percent Cin. Teal	2.6	1.0	1.3
Public Shtg. Grds.	All ducks	836	1551	933
	No. Cin. Teal	33	31	13
	Percent Cin. Teal	4.0	2.0	1.4

Calculated total kill on check areas

Ogden Bay	All Ducks	23,393	28,856	30,286
	Cin. Teal	234	400	515
Farmington Bay	All Ducks	6918	9424	12,523
	Cin. Teal	180	94	163
Public Shtg. Grds.	All Ducks	1866	3256	2290
	Cin. Teal	75	189	32

Computed Kill from check areas and percent of total kill from card survey¹

Statewide	All Ducks	144,857	182,201	209,468
	Cin. Teal	3660	2660	3060
Average		2.53%	1.46%	1.46%

1. Total kill calculated from card survey was: 345,064 ducks in 1949; 357,121 ducks in 1950; and 464,000 ducks in 1951.

The Continental Kill

The Cinnamon Teal kill in other parts of the United States seems to follow the same trend as Utah. Correspondence with California, Idaho, Wyoming, Oregon, Washington, Colorado and Texas Fish and Game Departments indicated that this species was relatively insignificant in the duck kill. Pertinent quotes from these letters are entered below for illustration.

Wyoming - ".....kill is very light due to fact that Cinnamon teal generally leave before our season opens." (L. Bagley, Game and Fish Com.)

Washington - ".... Cinnamon Teal in State of Washington represents only a fraction of a percent of the total State kill..... occurs only rarely in the hunter's bag." (R. Moreland, Research Supervisor, State Game Dept.)

Colorado - "Probably due to its early migration date, during the past two seasons we have not had a Cinnamon Teal recorded in the hunter's bag on two public shooting grounds in Colorado. An accurate record of kill by species is made on these two areas....it is quite apparent that the number of Cinnamon Teal killed in Colorado during the legal season is very low." (H. J. Figg, Dir. State Game Farm & Research Lab.)

Oregon - "Random bag checks on a state-wide basis showed no Cinnamon Teal kill in 1947 and 1949. In 1948 out of 2455 ducks checked was a Cinnamon. On the Summer Lake Game Management Area no kill of this species was recorded in 1947 or 1949. In 1948 ten out of 4,834 ducks were Cinnamon Teal. (W. B. Morse, Chief Small Game Biologist).

California - "Our kill studies and bag checks indicate that it (Cinnamon Teal) bears very little of the hunting pressure (Probably

California - less than 1%)... the majority of the (conc.) population apparently moves further south before the waterfowl hunting season opens (Gustine Gun Club Records, Merced Co. - Kill of Cinnamon Teal).

1945 - Cinnamon Teal = 233 total ducks = 8088
 1946 - Cinnamon Teal = 135 total ducks = 5320
 (J. E. Chatten, Actg. Chief, Bur. of Game Cons.)

Idaho - "....1/69 hunters checks, with no Cinnamon Teal being reported..checks taken local locker plants showed that out of 473 waterfowl in the first half and 2555 in the second half (1949 season), none were Cinnamon Teal...Cinnamon Teal forms only a very minor percent, if any, of the waterfowl kill in Idaho." (R. L. Salter, Waterfowl Biologist, Idaho Federal Aid).

Texas - In fact, the kill of the species is so low that we do not consider it any significance in comparison to other waterfowl species." (W. C. Glazener, Director, Div. of Wildlife Restoration).

In light of the above reports added to the Utah kill records the only conclusion possible is that the harvest of Cinnamon Teal in the United States is relatively small and the species bears only a very small proportion of the hunting pressure.

It appears that the Cinnamon Teal population must increase yearly between the time it leaves the Mexican wintering grounds and returns in the fall. Judging from reports of Mexican wintering areas (Bennett 1938) it is doubtful if the population is appreciably decimated by Mexican hunters. This leads to the ultimate conclusion that the species must be increasing somewhat. It is believed by the writer that this is probably the case but insufficient data are available to

make positive statements in this respect. Breeding ground counts indicate that it is at least holding its own in Utah and may be increasing northward (Smith¹). Martin, Zim and Nelson (1951) indicate that original Cinnamon Teal range has been reduced about 60 percent. The source of their information is not clear. If the species is increasing as hypothesized above perhaps some of the original range is in the process of reclamation.

1. Personal conversations with Allen Smith, U. S. Fish and Wildlife Service.

FOOD HABITS

General

Typically a "dabbling" duck, the Cinnamon Teal usually feeds in shallow water where its food may be reached without submerging. Not infrequently, it will also feed on dry land along the shores of ponds and on the banks of ditches, streams, and channels. Most bird books describe the species as feeding entirely on the surface or very shallow water. While this has been noted to be the case in wild birds, Cinnamon Teal at the Salt Lake Aviary were observed diving unhesitatingly as much as five feet deep to retrieve food thrown to them in deep water. Thus they are adept divers and quite capable of obtaining food in this manner. Undoubtedly, occasions also occur in the wild where the species would feed this way.

The composition of the Cinnamon's diet is approximately 4/5 vegetable and 1/5 animal matter (Kortright 1943) Bent (1951) quotes D. C. Mabbot's (1920) analysis of 41 gizzards for content. In order of importance these these specimens yielded the following data: Vegetable matter - sedges (Cyperaceae), 34.27%; pondweeds (Naiadaceae), 27.12%; grasses (Grammineae), 7.75%; smartweeds (Polygonaceae), 3.22%; mallows (Malvaceae), 1.87%; goosefoots (Chenopodiaceae), 0.75%; water milfoils (Haloragidaceae), 0.137%, and

miscellaneous 4.51%: animal matter - insects, 10.19%, mollusks, 8.09%; and miscellaneous, 1.26%.

The more recent work, "American Wildlife and Plants," by Martin, Zim, and Nelson (1951) list 10 important plant groups identified in examination of 59 Cinnamon Teal from North America and collected throughout the year (Table 19).

Table 19. Plant foods of the Cinnamon Teal (data extracted from Martin, Zim, and Nelson (1951)).

Plants	Part Utilized	Importance	Season of Use
Bulrush	seeds, veg.	***	Su, F, W
Pondweed	seeds, veg.	***	Sp, Su, F
Horned Pondweed	seeds	**	Su
Salt Grass	seeds	**	Sp, F
Sedge	seeds, veg	**	Su
Wigeon Grass	seeds	*	Su, F
Smartweed	seeds	*	F, Sp
Dock	seeds	*	Sp, Su
Spikerush	seeds	*	Su, F, W, Sp
Burreed, Duckweed,	-	-	-
Cyperus, Watermilfoil	-	-	-

In discussing animal food consumed by this species, these authors state that it consists of about 1/2 mollusks and 1/2 insects (figure 31). The former is comprised of both snails and bivalves, and the latter is made up of beetles, bugs, dragonfly and damselfly nymphs, and fly larvae.

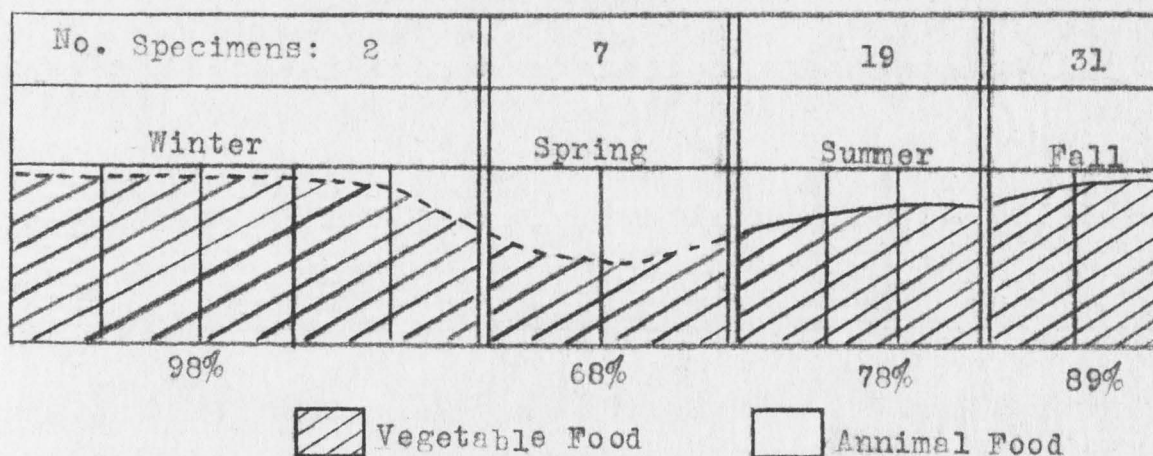


Figure 31. Seasonal variation in the diet of the Cinnamon Teal. (Modified from Martin, Zim, and Nelson, 1951.)

Food Habits in Utah

Observations of the food and feeding habits during the investigation show that this species does not differ greatly from most of the dabbling ducks. The characteristic of scooping up fine material from the water's surface and straining it through the lamellae is well developed, though not to the extent common to the Shoveller. This habit results in the ingestion of a larger percent of minute food particles than is noted in some of the larger pond ducks such as the Mallard or Pintail.

In investigating the habits of Utah Teal, 3 techniques were made use of. These are, (1) field observations, (2) use of an avian aspirator¹ (figures 32 & 33) and (3) examination and analysis of gizzard contents by volumetric displacement. Field observation of waterfowl food habits

1. Basically a "stomach pump" for birds, devised by W. H. Nord (1941)

are often difficult to discern accurately and consequently should always be verified by specimen analysis if possible. Data collected during the project are few for the spring and summer seasons. Two birds live-trapped in April and subjected to the aspirator showed gizzard contents consisting of about 75 percent sago pondweed (Potamogeton pectinatus) tubers and 25 percent grit. These are careful estimates rather than measurements since one cannot be certain that all food has been removed by the aspirator. These birds were wanted for other purposes and were released alive. Further experimentation should be conducted to determine the utility of this technique for food habits research. Actual observations of feeding birds followed by examination of the area indicate that sago pondweed, spikerush (Eleocharis spp.), smartweeds (Polygonum spp.) and salt grass (Distichlis stricta) are important spring foods. Similar records show the importance of such plant species as bulrushes (Scirpus paludosus, S. acutus, S. olneyi, and S. americanus), sago pondweed (seeds, tubers, and herbaceous parts), horned pondweed (Zanichellia palustris), smartweeds, duckweeds (Lemna spp.), widgeon grass (Ruppia spp.) and wild millet (Echinochloa crusgalli) as constituents of the summer diet. It is probable that the percentage of animal material consumed increases appreciably during this season. Particularly is this likely in the case of the young which everywhere would find an abundance of fly and mosquito larvae.

During the winter very few Cinnamon Teal remain in Utah and little information as to their diet is available. During the present study the only observation of value in this regard was a group of about 100 birds witnessed in mid-February in an extensive (approx. 3,000 acres), nearly pure, Scirpus olneyi marsh in Box Elder County. Little or no submergent vegetation was present. Although the possibility of buried tubers and rootstocks exists, it is believed that these birds were feeding largely on the bulrush seeds.

In order to determine fall food habits, a total of 24 gizzards were collected at Ogden Bay during October and November. These specimens were analyzed by the volumetric displacement method to the nearest 1/10 c.c. Material totaling less than 1/10 c.c. was listed as "Trace".

In considering the value of data yielded by these specimens, it should be pointed out that the population from which birds were collected was being subjected to heavy hunting pressure at the time. This hunting pressure in the Salt Lake Valley has the effect of driving waterfowl well out toward the actual lakeshore itself. Plant species in this belt of course are largely limited to salt tolerant plants. This may somewhat account for the high utilization of Scirpus paludosus and Distichilis stricta although observations throughout the year do indicate that these are preferred foods in addition to being 2 of the most abundant and accessible species.

Examination of the 24 specimens revealed the fall diet

to consist of 61.0 percent plant material 4.4 percent animal and 34.6 mineral (grit). Considering only food material this becomes 94.5 percent plant and 5.5 percent animal food. A total of 10 different plant foods were identified (table 20). Of these alkali bulrush and saltgrass were the most important both in frequency of occurrence and percent of total volume. Alkali bulrush occurred in 19 or 79 percent of the 24 gizzards and constituted 32.8 percent of the total volume of plant foods. Saltgrass ranked second with a frequency of 66.5 percent and 19.2 percent volume. Sago pondweed was third in importance with a frequency of 49.8 percent though volumetrically amounted to only 5.9 percent. Spikerush was fourth in frequency and volume with 29.1 percent and 3.2 percent respectively. Smartweeds and other bulrushes occurred in several specimens but these and remaining species were only found as traces. Plant debris, found in 8 cases amounted to 33.3 percent in volume. This category consisted very largely of chaff (i.e. seed husks, bracts, etc.) and the remainder can only be described as unidentified, finely divided, plant material. Animal food during this period amounted to 8.25 percent of the volume and was found in 50 percent of the specimens. This consisted of 23.5 percent beetles (Coleoptera), 41.2 percent snails (Gastropoda), animal debris (insect parts) 35.3 percent and a trace (3) of feathers. Grit was found in 23 gizzards and totaled 34.4 percent of the volume. No lead shot or other foreign material was encountered in this sample.

Table 20. Fall foods of 24 Cinnamon Teal from Ogden Bay Utah, 1950.

Food		Freq. No.	Occur %	Volume	
				Total (c.c)	Percent (X/1.31)
Vegetable					
Scirpus paludosus	Seeds	19	79.0	3.53	37.8
Distichilis, stricta	"	16	66.5	1.78	19.2
Potamogeton pectinatus	"	12	49.8	0.55	5.9
Fleocharis spp.	"	7	29.1	0.30	3.2
Polygonum spp.	"	6	24.9	0.05	0.5
Scirpus ocutus	"	5	20.8	Tr.	Tr.
A. americanus	"	1	4.2	Tr.	Tr.
Carex spp.	"	1	4.2	Tr.	Tr.
Plant debris	Husks Bracts Etc.	18	74.8	3.10	Tr.
Tot. Veg.		59.1%		9.31	99.9 + Tr.
Animal (X/0.85)					
Coleoptera	Entire	2	8.4	0.20	23.5
Gastropoda	"	8	33.3	0.35	41.2
Feathers	"	3	12.5	Tr	Tr.
Animal debris	Insect Parts	1	4.2	0.30	35.3
Tot. Animal		6.5%		.85	100.0 + Tr.
Mineral					
Grit	-	23	99.8	5.77	
Tot. Cont.-16.79 cc(measured). Computed Cont.-15.93 cc + 4 Tr					
Tot. Food - 10.16 cc = 91.75% plant; 8.25% animal.					

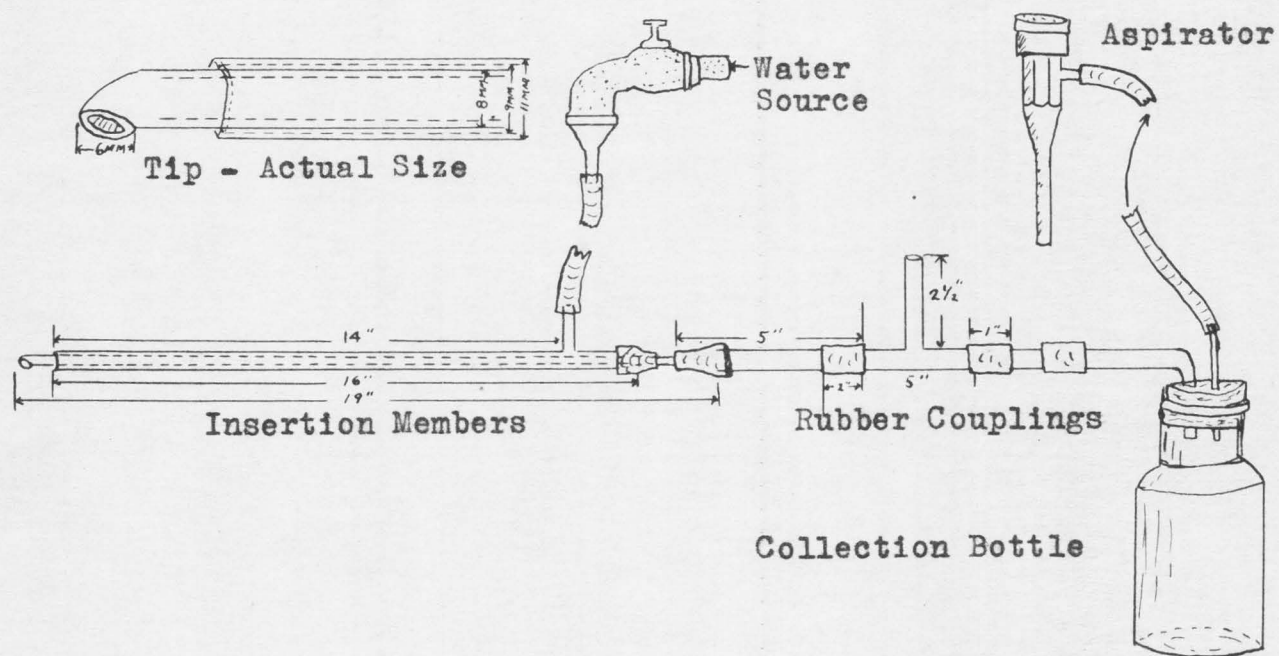


Figure 32. Diagram of device (Waterfowl Aspirator) used to extract ingested material from the gizzards of live ducks. (Modified from Nord - 1941.)



(A).

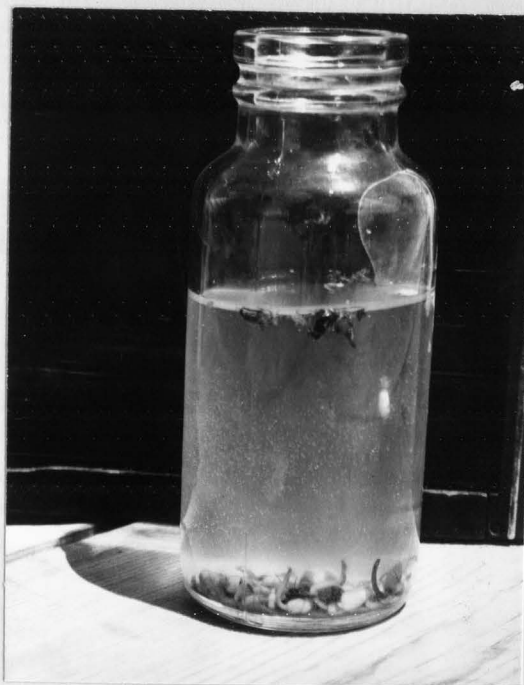


Figure 33. (A). The waterfowl aspirator in use.
(B). The collection bottle and gizzard contents
of a duck, extracted with the aspirator.

DISEASES AND PARASITES

Botulism

Botulism is by far the most serious decimating factor of waterfowl in Utah, exclusive of hunting. It takes a yearly toll from a few thousand to tens of thousands of waterfowl of all species. In conjunction with the botulism control work being conducted by the State, 2 years data on Cinnamon Teal losses by this disease were gathered during the investigation. Intensive studies were conducted at Ogden Bay Refuge and frequent counts were made at Farmington Bay and Public Shooting Grounds.

At Ogden Bay a careful watch was kept for the appearance of botulism. All affected birds were recorded and species, sex, and age noted whenever possible. As soon as the outbreak reached sizeable proportions daily pick-ups were started. Dead birds were collected by driving along the dikes with a truck and cruising the shorelines with an airboat. Counts were made in the marsh proper by workers on foot. These pick-ups and counts were continued until the week prior to the hunting season when a final count was made. The outbreak had largely spent itself by this time, extending roughly from July 27 to October 7 in 1949. With the exception of Bear River Refuge, which reported botulism losses slightly below normal during 1949, the 4 check areas showed losses somewhat higher than normal. Total known losses of ducks on

these areas were as follows: Public Shooting Grounds, 1830 birds.; Ogden Bay Refuge, 5,762 ducks; and Farmington Bay Refuge, 2,230.

Of 3,867 ducks collected and classified at Ogden Bay only 37 or slightly less than 1 percent were Cinnamon Teal. This is not a heavy loss but appears roughly proportional to other species on a percent composition of the population basis. The Cinnamon Teal abundance between August 16 and September 30 at Ogden Bay averaged 2.6 percent of the total waterfowl population. The average Teal abundance over this same period and area was 3,065 birds. Considering the tallied total of 5,762 ducks dead at Ogden Bay, the computed loss (1 percent on basis of sample) would be a total loss of 58 Cinnamon Teal at Ogden Bay due to botulism. On the basis of the average population over the period this would amount to 1.9 percent loss from the total Cinnamon population (tables 3 and 21).

The year 1949 selected as an example of botulism losses was not considered either unusually severe or remarkably light by experienced workers in the region. It shows approximately what may be expected in a normal year on the Salt Lake marshes and flats.

Elsewhere over its range botulism takes some toll. Though apparently fairly well controlled at present, the Tulare Lake Basin in California has had outbreaks of import in the past. From 1938 thru 1944 inclusive 14,740 sick ducks were picked up in this area. Of these birds only 277 or about 1.9 percent were Cinnamon Teal. Other outbreaks

undoubtedly occur which are of temporary local importance. Judging from data from the larger epidemics it is doubtful if these are materially influential on the continental Cinnamon Teal population.

Lead Poisoning

Few if any extensive research projects concerned with lead poisoning have included the Cinnamon Teal. Throughout the field work of the project a careful watch was kept for sick Cinnamon Teal. In 1949 eleven birds were picked up alive but sick. Field diagnosis of botulism in these birds was somewhat doubtful and they were subsequently examined for presence of lead by means of a fluroscope. Results were completely negative and the birds recovered in captivity in a pen provided with shade and fresh running water. This appears to verify the original diagnosis of botulism. Frazier (1949) working with birds from Bear River Refuge, this same season, found a relatively low occurrence of ingested lead for all species. He examined only 1 Cinnamon Teal and recorded negative results.

In view of the lack of more comprehensive data it can only be stated that lead poisoning is not known to be a serious decimating factor to Utah Cinnamon Teal populations.

Fowl Cholera

Recent epidemics of this disease in Texas waterfowl have been viewed with some apprehension by waterfowl workers in Utah. At least a portion of Utah Cinnamon Teal populations have been shown to migrate through this State and the

possibility of birds carrying the disease into Utah exists. To the writer's knowledge the disease has not been identified in Utah wildfowl to date.

It is interesting to note the results of Petride's and Bryant's (1951) studies of these Texas epidemics. Although they did not specifically mention the Cinnamon Teal they do point out that the smaller the species infected the more serious and lethal are the effects. In view of this fact, if fowl cholera does reach Utah it may be expected that the Cinnamon Teal will be among the more severely affected species.

Parasites

A large percentage of Utah Cinnamon Teal are infected to some degree with various parasites. Mallophagan lice are common but have never been observed in infestations of such severity as to reduce vitality as apparent from gross examination. Tapeworms are often found attached in the cloacal region but again have not appeared to significantly influence general health or condition. Leeches, though uncommon in healthy birds, are frequently a secondary cause of death of birds infected with botulism. They attach themselves within the nostrils, and swelling with ingested blood, block the nasal passages, thus causing suffocation.

The presence of the malarial-like diseases, caused by blood parasites such as Leucocytozoon, Haemoproteus, and Plasmodium, common in the Northeast has not been identified to the writer's knowledge in Utah. No examinations of

blood were made during the project. The principal vector, the Black Fly (Simuliidae) is not common in this region. In general, parasites of Utah waterfowl though common and varied have not been quantitatively studied in their effect on the population. Observations indicate however that they are secondary when compared with some of the other decimating factors. The cumulative effect of parasites on the Cinnamon Teal populations is unknown.

Table 21. Cinnamon Teal botulism losses at Ogden Bay Refuge, Utah, 1949 - 1951

	1949	1950	1951
Adult Males	11	1	3
Adult Females	5	-	3
Immature Males	9	3	8
Immature Females	3	2	10
Unclassified	9	-	7
Total	37	6	31
Percent of Av. Teal Population	1.2	0.7	0.8
Total Duck Losses	3687	875	3879
Approx. Av. Duck Population			176,120

MANAGEMENT PRACTICES AND RECOMMENDATIONS

The Cinnamon Teal appears to differ little if any from other dabbling ducks as to requirements for breeding grounds. The breeding range is limited chiefly to the U. S. and consequently we cannot rely on Canadian breeding areas to maintain the continued production of this species. The prime requisit in the propagation, natural or artificial, of any species is success during the reproductive season. For the Cinnamon Teal this success is dependent on the maintenance and provision of suitable and adequate breeding and brood rearing habitat.

When public areas are acquired and placed under plans calling for intensive management of waterfowl as the primary objective, they must be assiduously maintained and operated by qualified personnel if the public is to receive full value for funds expended. It is a penny-wise-pound-foolish program to spend tens of thousands of dollars in the development of an area and then economize by not providing adequate personnel and equipment to manage it.

In Utah waterfowl habitat may be roughly divided into 2 categories - controlled and uncontrolled. Controlled habitat may be considered as those areas in which water levels, and to a lesser extent vegetation composition is being managed for the production of waterfowl and muskrats.

This is comprised of waterfowl refuges and private duck clubs. Uncontrolled areas consist of vast expanses of public lands, where water management is not practical, and private holdings with alternative management objectives. To attempt to present any integrated management plan for the State would be presumptuous in the extreme as well as impractical. Furthermore, any management plan should consider all species rather than placing undue emphasis on a single species such as the Cinnamon Teal. On the other hand, although few Teal are harvested in Utah the latter is an important species from the standpoint of numbers (20-25 percent) on the breeding ground. As such it should be considered carefully in planning management of Utah breeding grounds. Aerial census of breeding populations accompanied by ground counts offer one solution toward overcoming time, space, and personnel problems involved in determining the size of the breeding population. Nesting surveys need increased scope and should be conducted on a sample basis over as many areas as possible. The same holds true for brood counts which follow. The cost of such an integrated program of large scale may be considered prohibitive in many instances and consequently recourse to trend studies on key or index areas will be necessary.

Predator Control

The Cinnamon Teal investigation in Utah has shown that in certain localized areas California Gulls and skunks may

cause material nesting failure. In other areas magpies, crows and ravens may produce like losses. If a nesting survey reveals important predation losses, or intensively managed areas develop excess predator populations, control may well be justified and imperative. Such conditions exist at Ogden Bay Refuge and the Farmington Bay-Newstate Club area. On both of these areas gull control is necessary. The most satisfactory method of control is debatable but in the writer's opinion the establishment of nesting colonies should be prevented and the population kept at least no higher than its present level. Skunk control should be continuous at Ogden Bay Refuge. Shooting, trapping, poisoning, and digging out dens have all proved moderately effective.

Some areas undoubtedly would benefit from magpie, crow, and raven control but in general each case should be judged on its own merit and no specific recommendations is further offered.

Water-level Control

For the Cinnamon Teal, water-level control is as important as it is for other waterfowl. The permanent level plan, with slight modifications in some instances, appears most satisfactory in Utah. Water supplies in Utah are critical with the exception of the spring flood period. Immediately following the spring floods extensive use of the water for irrigation of agricultural lands begins. In most instances waterfowl marshes will be forced to maintain

themselves with relatively small amounts of water not used in irrigation, or on the ground return of water already so used. On the marshes themselves the pattern of diversion of water is of major importance. Water supplies should be spread throughout the marsh areas by means of control structures, diversion cannals and ditches.

Water management is presently common on most private clubs and public refuges. There are, however, many small private areas plus a considerable amount of State and Federal land on which some form of development and water management would produce vastly increased yields of both waterfowl and muskrats. Such development on private lands will depend on better public education and relations. Perhaps financial assistance may be justified in some cases. The development of public lands will depend upon the results of land use surveys and the primary consideration of acquiring adequate funds.

Habitat Development

The management of cover and water are inseparable in the waterfowl marsh. An abundance of excellent native marsh plants can be produced in Utah marshes with proper water control. Many areas at present need more diversification and interspersion of cover if maximum production is to be attained. The numbers of breeding pairs which any marsh will accomodate has been shown by several workers (Hochbaun 1944 and Benett 1938) to be correlated almost directly with the amount of edge affect present. Saltgrass

has proven the most common nesting cover for Cinnamon Teal in most areas of Utah. However, good nesting density is not attained where Saltgrass areas are large, uninterrupted and far distant from good brood rearing cover. Williams and Marshall (1938) found a Cinnamon Teal nesting density of 0.17 nests per acre on a 3000 acre tract of nesting habitat at Bear River Refuge. The present study showed a density of 0.18 nest per acre on a very excellent area of 357 acres at Ogden Bay Refuge (Special Study Area). These data are of course exclusive of other species which would materially raise the density. It is believed that these figures represent nearly optimum limits which may be expected for the Cinnamon Teal in Utah.

Cattails (Typha spp.) are one of the less desirable waterfowl plants in Utah. The spread and development of this species is largely dependent on suitable water conditions. Management should be planned to control further extension of this species and numerous areas exist where its elimination to considerable extent would be beneficial.

Loafing spots are another important requirement of the Cinnamon Teal. The Territories of "waiting-males" always include some feature such as old log, muskrat house, boulder, sand bar, or even an open sunny ditch bank which is used for this purpose. The specific aspects of loafing spots are not severely restricted but their abundance and dispersion are definitely influential on the nesting density of any particular area.

Many private clubs in Utah are interested in improving their areas by the propagation of food plants. A word of caution should be tended to these clubs that careful studies of their lands are an economic saving in the long run. The buying and planting of various duck food may often constitute wasted money. To cite an example of this, in the summer of 1950 Noland F. Nelson, Utah Waterfowl Project Leader, and the writer visited a local club at the request of the owners. This club's improvement committee proposed a planting program of some magnitude. Their literature search had pointed out the excellence of Sago Pondweed as a food plant under their situation and the largest portion of their allotted funds were to be spent in the procurement and planting of this species from a Wisconsin source. The major fallacy in such a plan became apparent when inspection of the club lands revealed at least a thousand-acre stand of vigorous Sago Pondweed already growing on the club. Needless to say, the club members were somewhat non-plussed but the financial saving was considerable and the friendly advice and recommendations were received in a cooperative spirit by this group of sportsmen. Private organizations would do well to seek assistance from their Fish and Game Department in planning their management programs.

Another interesting habitat condition exists naturally at Ogden Bay Refuge which may be worthy of artificial development of some Utah areas. On the more or less uncontrolled portion of Unit II there are several hundreds of

acres of mud flats which are flooded with fresh water from the time of the spring run-off until about July 1. After this date they become dry and sun-baked. In normal years reduced irrigation demands and fall rains enable reflooding of these flats about October 1. During the spring flooded period a vast growth of both Sago Pondweed and Horned Pondweed (Zanichellia palustris) is produced. Through the summer dry period these plants lay dormant and untouched, but when fall flooding occurs they immediately become an important food supply for migrating birds. Hundreds of thousands of waterfowl are attracted by this tremendous food reserve suddenly made available.

Another factor which may in the future have a far reaching effect on Salt Lake Valley waterfowl is the drastic changes in water distribution attendant to large scale, Federal dam-building projects. One such program is the proposed multimillion dollar Weber Basin Project in the vicinity of Ogden, Utah. Though final results of this project may only be surmised it is notable that preliminary surveys have considered wildlife values and steps taken to assure the future of important breeding grounds at Ogden Bay Refuge.

Disease Control

Perhaps the greatest universal decimating agent of Utah's waterfowl is the occurrence of annual botulism epidemics. Research to date has revealed many facts about

this disease but as yet no practical solution has been produced that will eliminate it under Salt Lake Valley conditions. There is much need for a large scale, intensive, coordinated research program on this aspect of the problem. The removal of this 1 disease from Utah's marshes would, in the writer's opinion, accomplish more toward increasing production than most other management practices combined.

SUMMARY

1. The majority of the field work for the Cinnamon Teal investigation was conducted on three Utah State refuges. All refuges had controlled water levels. A special study area of 357 acres at Ogden Bay Refuge was selected for detailed study.
2. The Cinnamon Teal was found to possess good sporting qualities but was not particularly sought as a table bird due to its small size and only mediocre favor.
3. Field identification between females and young of the Cinnamon Teal and their counterparts among Blue-winged Teal is impossible. In Utah the Blue-winged Teal was found to constitute less than 6 percent of the combined Cinnamon Teal - Blue-winged Teal population. Hybridism occurs between these two species. Its frequency is unknown.
4. Migration to and from the wintering grounds occurs in small groups, probably in association with other species. One Cinnamon Teal averaged 114 miles per day over 1700 miles during the southward migration. The earliest spring migrants noted at Ogden Bay appeared on February 26. Most of the Cinnamon Teal have left Utah by October 20. A few individuals winter in northern Utah.
5. During a 5 year period, 358 Cinnamon Teal were banded at Ogden Bay Refuge. To June 1952, 3.9 percent of the

bands were recovered. These band returns indicate a principal wintering area for Utah Cinnamon Teal in the vicinity of Mexico City, Mexico.

6. The principal breeding grounds of the Cinnamon Teal is in the western United States. Records indicate that Utah and California are the two most important breeding areas. The Cinnamon Teal was found to make up approximately 20-25 percent of Utah's breeding waterfowl population.
7. Courtship and competition for mates was in evidence as soon as the first spring migrants appeared. Sex ratio samples of spring populations showed a slight preponderance of males. These ratios fluctuated from 106 to 115 males per 100 females. Territories were selected and defended by mated drakes. Territories of this species which were observed were commonly less than 1/10 acre in size and not over 100 yards distant from the nest.
8. Suitable loafing spots were a major requirement of the Cinnamon Teal during the breeding season. Old logs, muskrat houses, and ditch banks were selected by territorial drakes as waiting sites.
9. The females selected the nest site and built the nest. Most nests were constructed of dead vegetation from the immediate vicinity. Nests averaged $7\frac{1}{4}$ inches in diameter and $2\frac{3}{4}$ inches in depth. Nests were commonly situated from 0 to 3 inches above the ground.

10. The preferred nesting cover of Cinnamon Teal in Utah was found to be saltgrass or saltgrass in combination with other species. Fifty-four percent of the nests at Ogden Bay were situated in this cover type. The proximity of tall dense brood-rearing and escape cover was found to be important to reproductive success.
11. The average overall clutch size for Cinnamon Teal nests during two years at Ogden Bay was 8.05 eggs. Successful clutches averaged approximately one egg per nest more. Clutch size varied from 4 to 16 eggs. In Utah, the Redhead (Aythya americana) frequently deposits eggs in Cinnamon Teal nests. This parasitic habit reduced Cinnamon Teal average clutch size in successful nests from 9.7 to 8.3 eggs. At Ogden Bay 24 percent of 229 Cinnamon Teal nests were parasitized by Redheads. The hatching success of all eggs observed was 57.5 percent in 1949 and 38.1 percent in 1950. A computed 4.3 percent of all Teal eggs were infertile. Egg predation by California Gulls and skunks was a serious cause of loss at Ogden Bay. Other species such as magpies, crows, ravens, minks and weasels also preyed upon nests and incubating females.
12. Renesting study was very limited. A number of females were nest trapped and marked with colored airplane dope. A percentage of the nests of marked birds was collected and observations made in an effort to locate renests. No positive location of renests was possible and no

method of identifying natural renests was determined. The importance of the renesting habit in Cinnamon Teal was not measured.

13. Juvenile mortality causes proved difficult to determine. Numerous brood counts indicated a reduction in brood sizes from 8 or 9 young at hatching to 4.5 young reaching flying age. Probably predation was the most important mortality factor causing this loss, though diseases and parasites also caused mortality. Several clutches of eggs were injected with colored ^{dyes} dies in an effort to measure post-hatching mortality. Results were negative.
14. At Ogden Bay the production of Cinnamon Teal to reach flying age was estimated to be 925 young in 1949 and 630 young in 1950. No attempt was made to estimate Statewide production.
15. The kill of Cinnamon Teal during the hunting season was estimated at approximately 4000 birds annually. This includes an estimated 15 percent crippling loss. The Cinnamon Teal kill averages from 1.5 to 2.0 percent of the annual Utah duck harvest. There was little shooting selectivity by Utah hunters, and the Cinnamon Teal was often left in the field by unsportsmanlike hunters. The use of retrieving dogs was not extensive and should be encouraged as a means of reducing crippling loss.
16. Food habits studies of 26 Utah Cinnamon Teal collected during the fall months showed alkali bulrush, saltgrass,

and sago pondweed to be the most important foods.

Animal matter constituted 5.5 percent of ingested foods exclusive of grit.

17. With the exception of botulism very little research was made of diseases and parasites of Cinnamon Teal. In 1949 at Ogden Bay there was a botulism loss of 58 Cinnamon Teal. This was approximately 1.9 percent of of the average Cinnamon Teal population present during the epizootic. Fluoroscopic examination of 12 selected individuals revealed no evidence of lead poisoning. Lice, tapeworms, and leeches were common on many birds but were not estimated to be important mortality factors.
18. Though no specialized management practices appeared required by Cinnamon Teal the following research needs and management recommendations were brought out by the study.
 - a. Practical methods of botulism control should be determined.
 - b. The control and dispersion of water supplies and levels should be carefully maintained.
 - c. The interspersation of taller vegetational types with preferred saltgrass nesting cover produced higher nesting densities.
 - d. The number and distribution of suitable loafing spots was found important in establishing maximum numbers of breeding pairs. It may be feasible to construct loafing spots by anchoring old logs and debris brought into the marshes by spring floods.
 - e. Predator control was found definitely advisable on some areas.
 - f. Additional personnel and equipment was found

needed for the proper care and maintenance of important State waterfowl breeding areas.

- g. Future studies of the Cinnamon Teal should place emphasis on renesting, wintering grounds, parasites, and brood mortality causes.

LITERATURE CITED

- Abbot, C. E.
1938 The Skulls of Ducks. *Wilson Bul.* 50 (4):
249-253.
- Allee, W. C., et al.
1949 Principles of Animal Ecology. Philadelphia
W. B. Saunders Company.
- Anthony, H. E.
1928 Field Book of North American Mammals. 9th ed.
New York. G. P. Putnam's Sons.
- American Ornithologists' Union
1931 Checklist of North American Birds. 4th ed.
Lancaster, Pa. American Ornithologist
Union.
- 1944 Nineteenth Supplement to the American
Ornithologists' Union Check-list of North
American Birds. *Auk* 61 (3):441-464.
- 1945 Twentieth Supplement to the American
Ornithologists' Union Check-list of North
American Birds. *Auk* 62 (3):436-449.
- 1946 Twenty-first Supplement to the American
Ornithologists' Union Check-list of North
American Birds. *Auk* 63 (3):428-432.
- 1947 Twenty-second Supplement to the American
Ornithologists' Union Check-list of North
American Birds. *Auk* 64 (3):445-452
- 1949 Twenty-fourth Supplement to the American
Ornithologists' Union Check-list of North
American Birds. *Auk* 65 (3):281-285
- Bennett, L. J.
1938 The Blue-winged Teal, its ecology and
management. Collegiate Press, Inc. Ames,
Iowa.
- Bent, A. C.
1951 Life Histories of North American Wild Fowl,
Ducks, Geese and Swans. Vol. 1.- New York.
Dover Publications, Inc.

- Bizeau, E. G.
1951 Factors affecting waterfowl production at Gray's Lake, Idaho. (M.S. thesis unpublished). University of Idaho, Moscow, Idaho.
- Delacour, J., and E. Mayr
1945 The Family Anatidae. Wilson Bul. 57:3-55.
- Evans, D. C.
1951 A method of color marking young waterfowl. Journal of Wildlife Management 15 (1):101-103.
- Finley, W. L.
1940 Birds of America. New York, New York. Garden City Pub. Co. Inc.
- Frazier, H. H.
1949 A study of the incidence of lead shot in ducks by fluroscopy. Project 114, Utah Cooperative Wildlife Research Unit. Quarterly Report 3rd quarter 1949.
- Freeman, W. G.
1948 Sex and age ratios and sampling techniques of the hunter's bag of waterfowl in Great Salt Lake Valley, Utah 1946 & 1947. (M.S. thesis unpublishes). Utah State Agricultural college.
- Hochbaum, H. A.
1944 The Canvasback on a Praire Marsh. Washington, D. C. American Wildlife Institute.
- Holmgren, A. H.
1948 Handbook of the Vascular Plants of the Northern Wasatch. San Francisco, California. Lithotype Process Company.
- Hyers, R. D.
1949 Identification of ducklings by injection of eggs with dye. Project 115. Utah Cooperative Wildlife Research Unit. Quarterly Report 3rd quarter.
- Jensen, H. G. and A. H. Smith
1949 Migration of some N. A. waterfowl. Special Scientific Report (Wildlife) No. 1. Washington, D. C. U.S.D.I. Fish and Wildlife Service.
- Kortright, F. H.
1943 The Ducks, Geese and Swans of North America. American Wildlife Institute, Washington, D. C.

- Low, J. B.
1941 The ecology and management of the Redhead (*Nyroca americana*) in Iowa. PhD unpublished. Ames, Iowa. Iowa State College.
- Mabbot, D. C.
1920 Food habits of seven species of American shoal-water ducks. U.S.D.A. Bul. 862 December 30, 1920.
- Martin, A. C., Zim, H. S., and A. L. Nelson
1951 American Wildlife and Plants. New York. McGraw-Hill Book Company Inc.
- McLean, D. D.
1946 Duck Disease at Tulare Lake. California Fish and Game 32 (2) April 1946.
- Muenschner, C. W.
1944 Aquatic Plants of the United States. Ithaca, New York. Comstock Publishing Company, Inc.,
- Nelson, N. F.
1949 Pacific Flyway Reports for Utah. Pacific Flyway Reports numbers 7 and 8. U. S. Fish and Wildlife Service.

1950 Pacific Flyway Reports for Utah. Pacific Flyway Reports Numbers 9 - 12. U. S. Fish and Wildlife Service.

1951 Pacific Flyway Reports for Utah. Pacific Flyway Reports Numbers 13 - 16. U. S. Fish and Wildlife Service.

1952 Pacific Flyway Reports for Utah. Pacific Flyway Reports Numbers 17 and 18.
- Nord, W. H.
1941 A technique for removing lead from the gizzards of living waterfowl. Journal of Wildlife Management. 5(2):175-179.
- Odin, C. R.
1951 The effect of predation by California Gulls (*Larus californicus* Lawrence) on waterfowl production. M. S. thesis unpublished. Logan, Utah. Utah State Agricultural College.
- Peters, J. L.
1931 Check List of Birds of the World, Vol. 1.

- Peterson, R. T.
1941 A Field Guide to Western Birds. Boston, Massachusetts. Houghton Mifflin Company.
- Pretides, G. A., and C. R. Bryant
1951 An analysis of the 1949-1950 fowl cholera epidemic in Texas Panhandle waterfowl. Trans. 16th N. A. Wildlife Conf.
- Roberts, T. S.
1936 The Birds of Minnesota Vol 1. Minneapolis. Minnesota. Univ. of Minnesota Press.
- Snyder, L. L., and H. G. Lumsden
Variation in *Anas cyanoptera*. Occ. Papers. No. 10. Toronto, Ontario, Canada. Royal Ontario Museum of Zoology.
- Sowls, L. K.
1950 Techniques for waterfowl nesting studies. Trans. 15th N. A. Wildlife Conf.
- Taverner, P. A.
1949 Birds of Canada. Toronto, Ontario, Canada. Royal Ontario Museum of Zoology.
- Williams, C. S. and W. H. Marshall
1938 Duck nesting studies Bear River Migratory Bird Refuge, Utah, 1937. Journal of Wildlife Management 2(1):29-48.
- Wingfield, B. H.
1951 A waterfowl productivity study in Knudson Marsh, Salt Lake Valley, Utah. M.S. thesis - unpub. Logan, Utah. Utah State Agric. Col.
- Wilson, V. T. and J. B. Van den Akker
1948 A hybrid Cinnamon Teal - Blue-winged Teal at Bear River Migratory Bird Refuge, Utah. Auk 65 (4):316.

APPENDIX

Table 22. Partial list of birds and mammals observed at
Ogden Bay Bird Refuge, Utah

Common Name	Scientific Name
Loon, Common	<u>Gavia immer</u>
Grebe, Eared	<u>Colymbus nigricellus californicus</u>
Grebe, Western	<u>Aechmophorus occidentalis</u>
Grebe, Pied-billed	<u>Podilymbus podiceps podiceps</u>
Pelican, White	<u>Pelecanus erythrorhynchos</u>
Cormorant, Double-cres.	<u>Phalacrocorax auritus</u>
Heron, Treganza Gt. B.	<u>Ardea herodias treganzai</u>
Egret, Brewster	<u>Egretta thula brewsteri</u>
Heron, Black-crowned N.	<u>Nycticorax nycticorax hoactli</u>
Bittern, American	<u>Botaurus lentiginosus</u>
Ibis, White-faced Glos.	<u>Plegadis guarauna</u>
Swan, Whistling	<u>Cygnus columbianus</u>
Goose, Common Canada	<u>Branta canadensis</u>
Goose, Lesser Snow	<u>Chen h. hyperborea</u>
Mallard	<u>Anas P. platyrhynchos</u>
Pintail	<u>A. acuta tzitzihua</u>
Teal, Green-winged	<u>A. carolinense</u>
Teal, Blue-winged	<u>A. discors</u>
Teal, Cinnamon	<u>A. cyanoptera V.</u>
Shoveller	<u>Spatula clypeata</u>
Gadwall	<u>Anas streperus</u>
Baldpate	<u>Mareca americana</u>

Table 22 (cont.). Partial list of birds and mammals observed at Ogden Bay Bird Refuge, Utah

Common Name	Scientific Name
Redhead	<u>Aythya americana</u>
Duck, Ring-necked	<u>A. collaris</u>
Canvas-back	<u>A. vallisneria</u>
Duck, Lesser Scaup	<u>Aythya affinis</u>
Golden-eye, American	<u>Bucephala clangula americana</u>
Golden-eye, Barrow	<u>B. islandica</u>
Buffle-head	<u>B. albeola</u>
Old-squaw	<u>clangula hyemalis</u>
Duck, Ruddy	<u>Erismatura jamaicensis rubida</u>
Merganser, American	<u>Mergus merganser americanus</u>
Merganser, Red-breasted	<u>M. serrator</u>
Vulture, Turkey	<u>Cathartes aura</u>
Hawk, Sharp-shinned	<u>Accipiter velox</u>
Hawk, West. Red-tailed	<u>Buteo borealis calurus</u>
Hawk, Am. Rough-legged	<u>Buteo lagopus johannis</u>
Eagle, Golden	<u>Aquila chrysaetos canadensis</u>
Eagle, Bald	<u>Haliaeetus leucocephalis</u>
Hawk, Marsh	<u>Circus hudsonius</u>
Duck Hawk	<u>Falco peregrinus</u>
Hawk, Sparrow	<u>Falco sparverius</u>
Pheasant, Ring-necked	<u>Phasianus colchicus torquatus</u>
Rail, Sora	<u>Porzana Carolina</u>
Coot, American	<u>Fulica americana</u>
Plover, Black-bellied	<u>Squatarola squatarola</u>

Table 22 (cont.). Partial list of birds and mammals observed at Ogden Bay Bird Refuge, Utah

Common Name	Scientific Name
Killdeer	<u>Oxyechus vociferus vociferus</u>
Curlew, Long-billed	<u>Numenius americanus</u>
Godwit, Marbled	<u>Limosa fedoa</u>
Yellow-legs, Greater	<u>Totanus melanoleucus</u>
Sandpiper, W. Solitary	<u>Tringa solitaria cinnamomea</u>
Willet, Western	<u>Catoptrophorus semipalmatus inornatus</u>
Dowitcher, Inland	<u>Limnodromus griseus</u>
Snipe, Wilson	<u>Capella delicata</u>
Stilt, Black-necked	<u>Himantopus mexicanus</u>
Avocet	<u>Recurvirostra americana</u>
Phalarope, Wilson	<u>steganopus tricolor</u>
Gull, Ring-billed	<u>Larus delawarensis</u>
Gull, California	<u>L. californicus</u>
Gull, Franklin	<u>L. pipixcan</u>
Tern, Black	<u>Chlidonias nigra surinamensis</u>
Tern, Common	<u>Sterna h. hirundo</u>
Tern, Forster	<u>S. forsteri</u>
Dove, West'n Mourning	<u>Zenaidura macroura macrinella</u>
Owl, Short-eared	<u>Asio flammeus flammeus</u>
Lark, Horned	<u>Octocoris alpestris</u>
Swallow, Tree	<u>Iridoprocne bicolor</u>
Magpie, American	<u>Pica pica hudsonia</u>
Raven, American	<u>Corvus corax</u>
Wren, Western Marsh	<u>Telmatodytes palustris plesius</u>

Table 22 (conc.). Partial list of birds and mammals observed
at Ogden Bay Bird Refuge, Utah

Common Name	Scientific Name
Sparrow, English	<u>Passer d. domesticus</u>
Meadowlark, Western	<u>Sturnella neglecta</u>
Blackbird, Yel-headed	<u>Xanthocephalus Xanthocephalus</u>
Blackbird, Red-wing,	<u>Agelaius phoeniceus</u>
Sparrow, W. Vesper	<u>Poaecetes gramineus confinis</u>
Sparrow, W. Chipping	<u>Spizella passerina arizonae</u>

Table 23. Partial list of common plants at Ogdan Bay Refuge, Utah.

Common Name	Scientific Name
<u>Forbs (Weeds)</u>	
Ragweed	<u>Ambrosia elatior</u>
Wormweed	<u>A. biennis</u>
Salt Bush	<u>Atriplex hastata</u>
Sea Blite	<u>Bassia hyssopifolia</u>
Wild Mustard	<u>Brassica nigra</u>
Blackweed	<u>Dondia</u> spp.
Squawweed	<u>Grindelia squarrosa</u>
Sunflower	<u>Helianthus Nuttallii</u>
Marsh Elder	<u>Iva axillaris</u>
Wild Lettuce	<u>Lactuca scariola</u>
Waterhoarhound	<u>Lycopus asper</u>
Black Medick	<u>Medicago lupulina</u>
White Sweetclover	<u>Melilotus alba</u>
Catnip	<u>Nepeta cataria</u>
Fivefinger	<u>Potentilla anserina</u>
Yellow Senecio	<u>Senecio hydrophilus</u>
Stinging Nettle	<u>Urtica breweri</u>
Arrowgrass	<u>Trislochin maritima</u>
Cockebur	<u>Xanthium pennsylvanicum</u>
Dock	<u>Rumex maritimus</u>
Peppergrass	<u>Lepidium</u> spp.

Table 23 (cont.). Partial list of common plants at Ogden Bay Refuge, Utah.

<u>Common Name</u>	<u>Scientific Name</u>
<u>Emergent Aquatics</u>	
Alkali Bulrush	<u>Scirpus paludosus</u>
Tule	<u>S. acutus</u>
Olenyi's Bulrush	<u>S. Olneyi</u>
Shore Rush	<u>S. americanus</u>
Spike Rush	<u>Eleocharis</u> spp.
Sedge	<u>Carex</u> spp.
Rush	<u>Juncus balticus</u>
Burreed	<u>Sparganium erucarpum</u>
Arrowhead	<u>Sagittaria</u> spp.
Cattail	<u>Thpha latifolia</u>
Wild Millet	<u>Echiochloa crusgalli</u>
<u>Grasses</u>	
Marsh Cane	<u>Phragmites communis</u>
June Grass	<u>Bromus tectorum</u>
Saltergrass	<u>Distichilis stricta</u>
Foxtail Barley	<u>Hordeum jubatum</u>
<u>Submerged Aquatics</u>	
Duckweed	<u>Lemna minor</u>
Sago Pondweed	<u>Potamogeton pectinatus</u>
Widgeongrass	<u>Ruppia maritima</u>

Table 23 (conc.). Partial list of common plants at Ogden Bay
Refuge, Utah

<u>Common Name</u>	<u>Scientific Name</u>
<u>Submerged Aquatics</u>	
Muskgrass	<u>Chara spp.</u>
Coontail	<u>Ceratophyllum demersum</u>
Horned Pondweed	<u>Zannichellia palustris</u>
<u>Woody Plants</u>	
Poplar	<u>Populus spp.</u>
Willow	<u>Salix spp.</u>
Tamarisk	<u>Tamarix gallica</u>
Russian Olive	<u>Elaeagnus angustifolia</u>