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MAINE COOPERATIVE WILDLIFE RESEARCH UNIT

University of Maine

Orono, Maine

QUARTERLY REPORT

January-March, 1966

Cooperating Agencies

Maine Department of Inland Fisheries and Game
Wildlife Management Institute
University of Maine
U. S. Bureau of Sport Fisheries and Wildlife

NOT FOR PUBLICATION

The quarterly reports are usually statements of progress. The data presented often are incomplete and the conclusions reached may not be final. Consequently, permission to publish any of the information contained herein is withheld pending authorization from the Research Unit

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Unit Personnel

Leader - Howard L. Mendall

Assistant Leaders - Malcolm W. Coulter(*)
Sanford D. Schemnitz(*)

University Representative - Albert D. Nutting, Director, School of Forestry

Collaborators(**) - John Gill, Maine Dept. Inland Fisheries & Game
J. William Peppard, Maine Dept. Inland Fisheries & Game
Kenneth Anderson, Maine Dept. Inland Fisheries & Game
Howard E. Spencer, Maine Dept. Inland Fisheries & Game
Alfred O. Gross, Professor Emeritus, Bowdoin College
Wesley Jones, Moosehorn National Wildlife Refuge
Eldon Clark, Moosehorn National Wildlife Refuge
David O'Meara, Associate Professor of Animal Biology
J. Franklin Witter, Head, Dept. of Animal Pathology
Thomas J. Corcoran, School of Forestry
Harold E. Young, School of Forestry
Harold Hubler, Superintendent, Acadia National Park
Roy W. Stamey, Park Ranger, Acadia National Park
Carl Gruener, Div. Mgmt. & Enforce., U.S. Bur. Sport Fish.
& Wildlife
Rex Tice Div. Mgmt. & Enforce., U.S. Bur. Sport Fish. &
Wildlife
Owen Seelye, Div. Mgmt. & Enforce., U.S. Bur. Sport Fish.
& Wildlife
Harold Gausman, Professor of Soil Chemistry

Graduate Assistants - John C. Baird
Jerry S. Choate
Stephen H. Clark
Ronald D. Klataske
Charles H. Lobdell
F. Loy McLaughlin
Vaughn D. Rasar
Larry J. Roop

Graduate Student - Lawrence S. Barden

Secretary - Maxine L. Horne

(*) Professors Coulter and Schemnitz serve half time on the Unit program and half time on the teaching staff of the School of Forestry.

(**) Collaborators change periodically. This list includes only those who are directly cooperating or assisting in current Unit studies.

Unit Coordinating Committee

Ronald T. Speers, Commissioner, Maine Dept. Inland Fisheries & Game
Albert D. Nutting, Director, School of Forestry
Howard L. Mendall, Unit Leader

MAINE COOPERATIVE WILDLIFE RESEARCH UNIT

Quarterly Report

January-March, 1966

RESEARCH PROJECTS

FUR ANIMALS

Ecology and Behavior of the Fisher

- Objectives: (1) To study patterns of range expansion, food habits and habitat preferences of fisher.
 (2) To study behavior patterns of the animal.
 (3) To evaluate the current role of the fisher in its new status as a major component of the carnivorous fauna of Maine.

Assignment: Malcolm W. Coulter, Assistant Leader

A preliminary draft of the manuscript was completed during the quarter.

Plans for next quarter: To complete the final manuscript.

WATERFOWL

(a) Waterfowl Distribution and Breeding Ecology

Objectives: To obtain data on factors influencing distribution and migration of waterfowl in Maine and to determine population densities of the important breeding species, especially the black duck and ring-necked duck, under varying habitat conditions.

Assignment: Howard L. Mendall, Leader

Inactive during the quarter.

Plans for next quarter: Breeding censuses will be obtained on the most representative of the Unit's study areas. Work on this sub-project will be curtailed this year because of the expanded coastal studies.

(b) Renesting and Homing Study

Objectives: To study renesting behavior and the degree of migrational homing exhibited by waterfowl, primarily the black duck, mallard and the ring-necked duck.

Assignment: Malcolm W. Coulter, Assistant Leader
 (Vermont phase conducted jointly with William Miller, former Waterfowl Project Leader, Vermont Fish and Game Service)

Inactive during the quarter.

Plans for next quarter: It is hoped that work on the manuscript can be resumed during the latter part of the quarter.

(c) Waterfowl Hunter Bag Checks

Objectives: To determine hunter success, crippling loss, and species, sex and age composition of the kill.

Assignment: Howard L. Mendall, Leader

Inactive during the quarter.

Plans for next quarter: Inactive.

(d) Breeding Biology of the American Eider in Penobscot Bay, Maine

Objectives: To determine breeding success, and factors influencing productivity, within selected eider colonies on the Maine coast.

Assignment: Jerry S. Choate, Graduate Assistant

Thesis adviser: H. L. Mendall, Leader

Consultant: Dr. A. O. Gross, Professor Emeritus of Ornithology,
Bowdoin College

Choate completed his Master's thesis and this was accepted by the Graduate School. The thesis summary is as follows:

The breeding biology of the American eider (Somateria mollissima dresseri) was studied during the spring and summer of 1964 and 1965, on five small (one quarter to four acres) islands in West Penobscot Bay, Waldo County, Maine. Principal objectives were to determine nesting density and production, and the factors influencing production; also, to devise ways for measuring annual production under habitat conditions of the Maine coast.

Nests were marked with wooden stakes and were observed once a week until they either hatched or failed. A limited number of observations of inter-specific behavior of nesting eiders and gulls was made from a blind. After the nesting season, brood surveys were carried out by boat. Cover maps of the nesting islands were made.

Pertinent data were recorded on tabulating cards and were tallied with the aid of an IBM Card Sorting Machine. Standard statistical tests were used where feasible to evaluate the significance of the data.

The following conclusions resulted from the investigation:

1. Nesting chronology was similar in both 1964 and 1965. Nesting began the third week of April and reached a peak the third week of May. Few nests were initiated after mid-July. The latest hatch occurred the first week of August.

2. Cow parsnip was the cover type most often selected by nesting eiders, but changes in cover use during the nesting season suggested that the birds selected the most favorable cover available at the time of nest construction. There was a tendency for nests to be concentrated near the boundary (edge) of two cover types.

3. Measured nesting density for an island ranged from 3.8 nests per 1000 sq. ft. to 8.9 nests per 1000 sq. ft. With a greater amount of edge per unit of area on an island the nesting density, in general, was greater. A positive correlation existed between eider nest densities and number of nesting gulls per unit of area.

4. Average size of 617 complete clutches was 3.8. Mean clutch size for a given island was reduced when nest predation increased. There were no significant changes in average clutch size throughout either breeding season.

5. In contrast to the expressed beliefs of several previous workers, that the incubation period of the eider is 28 days, the average period for 11 clutches in this study was only 26 days. Evidence from 18 other clutches whose exact incubation periods were not known suggested that the period may often be less than 26 days.

6. Nesting success on the study area was 39 percent in 1964 and 36 percent in 1965. Total production in 1964 was 713 young, or 1.3 young hatched per nesting attempt. In 1965, 557 young were hatched, or 1.2 per nesting attempt.

7. Predation by gulls was responsible for the greatest number of egg losses, but some eggs were also lost because of infertility, abandonment by the female, and overexposure to extremes in temperature. There was evidence that eiders re-nested on the study area, but re-nesting did not greatly compensate for the high rate of nest predation.

8. Nests in shrubs and cow parsnip had relatively high success while those in grass and nightshade were much less successful. The barrier to gulls provided by dense shrubs apparently protected the nests from extensive predation. Concealment provided by cow parsnip reduced predation, while lack of concealment of grass and nightshade allowed more predation.

9. In 1964, success of nests initiated early in the season was high and then dropped as the season progressed. The following year success increased gradually in nests initiated up to late May after which it declined. Nesting success was not influenced by differences in nest densities.

10. In 1964, partial predation, as contrasted to complete destruction, occurred in 13 percent of all nests while in 1965, part of the eggs were taken by predators in nine percent of the nests. There was an inverse relationship in the ratio of gulls per nesting eider on a given island and nesting success of the eiders on that island.

11. Human disturbance was indirectly responsible for lowered nesting success. Whenever a person stopped at an island many gulls and eiders flushed from their nests. The gulls invariably returned before the eiders and destroyed many eggs of the latter. In addition, eggs were sometimes overexposed to extremes in temperature when the female eiders were kept off the nests for up to three hours.

12. At least 57, or 12 percent, of 461 nesting attempts in 1965 were on sites that had been used in 1964. Some nests were also utilized more than once in the same year. In 1964, 16 sites were used twice, and one was used three times. Corresponding figures for 1965 were 34 nests occupied twice and two occupied three times.

13. Rechecks of terminated nests showed that their fate could be determined with a reasonable degree of accuracy up to at least six weeks after termination. Since human visitors on nesting islands often induce excessive egg predation, this has potential value as a method for calculating nesting success without undue disturbance of incubating birds.

14. Average brood size was 9.5 young with a range of one to 30 young per brood. Broods were usually combined, presumably for protection from avian predation. Most combination probably took place during the Class I stage. In contrast to some other studies, there appeared to be very little predation of young eiders by gulls. Human disturbance was indirectly responsible for that which was observed.

15. No evidence of disease or parasites was found in juvenile eiders, but it is suspected that these are often important mortality factors. There was no evidence that adverse weather caused any juvenile mortality.

16. Two recommendations for management are: (1) prevention of excessive human disturbance, and (2) control or reduction of the resident gull population.

17. Several recommendations for future study were made. Among the more important ones are: (1) renesting and the extent to which it compensates for loss of initial clutches; (2) a determination of sex ratios, particularly an index of adult drakes to nesting hens as an aid in breeding censuses; (3) gull-eider relationships and their effect on nesting success and densities; (4) mortality of juvenile eiders; and (5) experimental management, including habitat manipulation and creation of artificial nest sites.

N O T E: This is a completed segment of the Unit's eider duck project. The current studies have been divided into the following sub-projects:

(1) Ecology and Experimental Management of the American Eider in Penobscot Bay,

Maine

Objectives: To study the breeding ecology of the American eider with particular reference to predation and other factors limiting production; and to devise and test management and inventory techniques that might be reliable with a minimum of disturbance to the eiders.

Assignment: Stephen H. Clark, Graduate Assistant

Thesis Adviser: Howard L. Mendall, Leader

This is, in part, a continuation of the study conducted by former Graduate Assistant Choate during the summers of 1964 and 1965. This dealt primarily with breeding success at the Islesboro study area.

Work during the current quarter consisted of a review of available literature, design of sampling surveys to measure breeding success, and checking and repairing field equipment.

Plans for next quarter: To begin study on selected islands in Penobscot Bay. Field work during this period will include:

1. Ground checks in conjunction with aerial census work that is to be carried out during late April and May (see sub-project 4).

2. Intensive nesting studies, to further determine relationships between gulls and eiders. In particular, chronology of gull and eider nesting peaks, density of nesting cover, territoriality exhibited by gulls and its effect on eiders, and other factors influencing nest predation will be closely studied.

3. Study of management techniques and their effect on eider production. This will entail experimental gull control in selected areas and construction of eider nest shelters.

(2) Renesting and Homing

Objectives: To study renesting behavior and the degree of migrational homing exhibited by the American eider.

Assignment: Malcolm W. Coulter, Assistant Leader

Little work on this sub-project is scheduled until the spring of 1967, but some exploratory efforts will be made this season to test various methods of capturing birds for banding and marking.

(3) Annual Production and Factors Influencing Nesting Success

Objectives: To determine annual production and factors related to nesting success in breeding colonies of the Mussel Ridge Channel of Penobscot Bay.

Assignment: Howard L. Mendall, Leader

This is a general study of basic ecology, designed especially to permit comparisons with the more detailed investigation of Graduate Assistant Clark. It is being carried out on a complex of islands, southwest of the Islesboro study area, where both the habitat and disturbance factors are considerably different.

(4) Distribution of Eider Populations in Coastal Maine

- Objectives:
- (1) To locate the principal breeding colonies along the Maine coast.
 - (2) To develop a satisfactory technique for aerial breeding ground inventory.
 - (3) To determine the abundance and subspecific composition of fall and winter populations.

Assignment: Howard L. Mendall, Leader
 Owen Seelye, Game Management Agent, U. S. Bureau of Sport
 Fisheries and Wildlife

Consultants: Rex Tice, Division of Management and Enforcement, U.S.
 Bureau of Sport Fisheries and Wildlife
 Carl Gruener, Division of Management and Enforcement, U.S.
 Bureau of Sport Fisheries and Wildlife
 Howard E. Spencer, Waterfowl Biologist, Maine Dept. of
 Inland Fisheries and Game

This sub-project is being conducted jointly by the Unit and the Division of Management and Enforcement, of the Boston Regional Office. Carl Gruener is serving as Regional Office coordinator. Owen Seelye has been assigned to work with Unit personnel on both the aerial reconnaissance and the subsequent ground checks by boat. One of the major objectives of this study is to develop a satisfactory technique of aerial breeding ground inventory by a count of drakes at the beginning of the nesting season. Its success will depend on establishment of a ratio (on a basis of sample islands) of mature drakes/nesting females. Establishment of such a ratio is one of the objectives of the basic studies of Clark and Mendall. An important criterion of the inventory is that flights be low enough to count drakes yet high enough to avoid flushing hens from their nests. Unattended eider nests are usually immediately destroyed by the less wary gulls.

As an initial step two flights are to be made along the entire Maine coast in one of the Fish and Wildlife Service planes at approximately the following dates: April 15-23 and May 18-25.

Fall flights similar to those of 1965 are contemplated to determine fall and winter concentrations. Through the collection of specimens and field bag checks of hunters at selected areas, it is hoped to obtain data as to the proportion of northern (S. m. borealis) and American (S. m. dresseri) eiders available to hunters during the open season. This phase of the study is not being confined to Maine, and Regional Office personnel will obtain data throughout the northeastern states.

WOODCOCK

Woodcock Population Studies

Objectives: To conduct annual censuses and to obtain related ecological data on the Unit's permanent census routes in Maine.

Assignment: Howard L. Mendall, Leader
 Sanford D. Schemnitz, Assistant Leader

Inactive during the quarter.

Plans for next quarter: Annual censuses will be conducted on the Unit's permanent routes. Schemnitz, aided by Graduate Assistant Klataske, will conduct banding and marking studies of males on singing grounds. Objectives are to determine regularity in singing ground use and within-season shifts in grounds.

RUFFED GROUSEEcology of the Ruffed Grouse in Maine

- Objectives: (1) To study population dynamics of harvested and unharvested grouse populations; and to compare mortality rates of resident non-migratory species (grouse) and migratory species (woodcock) on the same area.
- (2) To determine cover preferences and use of forest clearings by adults and broods in spring and summer.
- (3) To study the causes of juvenile mortality and measure the incidence of blood parasites.

Assignment: Sanford D. Schemnitz, Assistant Leader

Consultants: Eldon Clark, Refuge Biologist
Wesley Jones, Refuge Manager

Grouse banding data for 1965 were coded for IBM analysis. This was carried out in cooperation with Eldon Clark, Biologist of the Moosehorn National Wildlife Refuge.

Plans for next quarter: Drumming grouse censuses, location of new drumming sites, and male grouse trapping will be conducted at the Moosehorn National Wildlife Refuge.

BIG GAME(a) Ecological Relationships of White-tailed Deer and Vegetation at AcadiaNational Park

Assignment: M. W. Coulter and S. D. Schemnitz, Assistant Leaders
F. Loy McLaughlin, Graduate Assistant

Consultants: Harold E. Young, School of Forestry
Paul G. Favour, Chief Naturalist, Acadia National Park
Roy W. Stamey, Park Ranger, Acadia National Park
J. Franklin Witter, Department of Animal Pathology

- Objectives: (1) To develop a sound statistical design for study of the influence of the deer herd upon the vegetation.
- (2) To measure the influence of the current deer herd upon vegetation.
- (3) To assist Park personnel in exploring and developing methods to census deer, and to study deer movements; also to develop ways for deer to be readily seen by the public.

McLaughlin devoted much time during the quarter to this project. A forest type map of Acadia National Park was completed, which was followed by a pre-sample of the vegetation. Upon completion of the pre-sample, a browse survey was designed using the forest type map as a foundation for the stratified

sampling. The browse survey was initiated during the last of March, with the following objectives: (1) to show the proportion of browsed to unbrowsed twigs for each of the key species, (2) to compare the relative amount of available browse among forest types.

Several deer yards and concentration areas were visited during February. Average degree of browsing, number of deer beds, snow depth and crust hardness, and other points of interest, were recorded.

During the herd reduction program, described in the October-December report, 147 deer were removed from the Park. Ninety-two were females and 55 were males. Fifty-five fawns and 63 does ($1\frac{1}{2}$ years and older) were taken, or a fawn to doe ratio of .87. The following tables show the number of deer killed by age classes and seasonal ratios:

Deer Killed by Age Classes

Age (Years)	$\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{2}$	$6\frac{1}{2}+$
Male	26	4	12	7	3	2	0
Females	29	18	15	6	11	6	5

Seasonal Sex Ratios

Month	Males	Females	Percent Females
November	22	30	58
December	0	2	100
January	8	20	71
February	22	29	57
March	3	11	78
Total	55	92	63

The average weights are given in the following table by age classes:

Average Weights (Pounds)

Age (Years)	$\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}+$
Males	45 (19)*	77 (2)	113 (15)
Females	44 (20)	66 (19)	76 (31)

*The number in parenthesis denotes the number of deer on which the average is based.

A total of 65 sets of ovaries were collected; with some of these it was possible to obtain the developing fetuses. None of the female fawns showed evidence of pregnancy. Whether or not they ovulated cannot be determined until the ovaries have been examined in detail. All deer that were $1\frac{1}{2}$ years and older which had fetuses large enough to be detected by the unaided eye were carrying two fetuses.

Two deer which were in a weakened condition and unable to walk when shot were taken to the Department of Animal Pathology. It was determined that one of these, which was more than ten years old, was suffering from starvation and old age. The other deer, a yearling, was also suffering from malnutrition.

Plans for next quarter: Continue intensive browse survey and analyze resulting data.

(b) Influences of Known Populations of Deer Upon Forest Vegetation

- Objectives: (1) To measure the influence of a known population of deer upon forest vegetation.
 (2) To develop and test more adequate deer census methods than those currently available.

Assignment: Sanford D. Schemnitz, Assistant Leader

Consultants: Malcolm W. Coulter, Assistant Leader
 J. Franklin Witter, Department of Animal Pathology

Inactive during the quarter.

Plans for next quarter: Finish control plot analysis adjacent to deer exclosure. Release deer at Outer Heron Island. Reconnaissance of additional islands in Penobscot Bay area.

(c) Pilot Radio-Tracking Studies of White-tailed Deer

- Objectives: To test the efficiency and accuracy of telemetry equipment on semi-tame deer within fenced enclosures on the University Forest.

Assignment: Sanford D. Schemnitz, Assistant Leader

Assistant: Thomas Allen, Undergraduate Wildlife Science student

Successful tranquilization of a penned adult female deer (approximately 110 lbs.) was achieved by feeding 2 grams of tranimul (Hoffman-LaRoche Company, Nutley, New Jersey). The powdered drug was mixed with apple juice and placed within a cored apple. The core was then replaced. The deer appeared stupified $1\frac{1}{2}$ hours after dosage and was readily approached and handled. A collar bearing a transmitter was removed and replaced without alarm reaction or escape attempts by the deer. Six hours after drug administration, she was in a standing position. Although she seemed more alert, the deer was approached by two people and readily handled without eliciting a fear response. After 18 hours this deer showed some sluggishness, but ran when approached and stayed with the penned herd. The effect of the drug was completely worn off 36 hours after administration.

By contrast, a 1 gram dosage fed in an apple to a 1½ year adult male (approximately 110 lbs.) yielded no visible effects.

Plans for next quarter: Periodically test solar-battery transmitter.

(d) The Ecology of the Deer Population on Isle au Haut, Maine

- Objectives: (1) To determine the number of deer on Isle au Haut.
 (2) To evaluate the existing habitat conditions and measure the influence of the deer upon their environment.
 (3) To determine the carrying capacity for this particular habitat with regard to adequate forest regeneration.

Assignment: John C. Baird, Graduate Assistant

Thesis Adviser: S. D. Schemnitz, Assistant Leader

Consultants: J. William Peppard, Regional Biologist, Dept. Inland Fisheries and Game
 Harold Hubler, Former Superintendent, Acadia National Park
 Harold E. Young, School of Forestry

A preliminary draft of the thesis was prepared during the quarter.

Plans for next quarter: To complete the thesis.

(e) Ecology of White-tailed Deer in a Low Harvest Area of Eastern Maine

- Objectives: (1) To determine the causes of the low deer kill in a block of 21 townships in Hancock and Washington counties.
 (2) To relate these findings to area management suggestions.

Assignment: Larry J. Roop, Graduate Assistant

Thesis Adviser: Sanford D. Schemnitz, Assistant Leader

Consultants: J. William Peppard, Regional Biologist, Dept. Inland Fisheries and Game
 John Gill, Game Biologist, Dept. Inland Fisheries & Game
 Harold Young, School of Forestry

Snow depths of up to 34 inches by mid-winter on the study area forced deer to use winter yards. This permitted aerial reconnaissance of concentration areas. The winter was relatively mild, however, with rapid melting and frequent crusting of the snows, and the deer were concentrated for only short periods.

By the end of the quarter the ground survey was nearing completion and eight of the ten selected yards had been checked. In addition to a more general survey to determine yard use and condition, systematic sampling of milacre plots throughout the yards is being used to obtain comparative figures on browse density, composition, and utilization. Also, random samples of twigs from key browse species in the yards are being taken for nutritional analysis.

The number of yards sampled is small for the size of the study area. This has become evident in view of the great variability in the yards thus far checked. However, when analysis of sampling data is completed, differences between the two areas may be found that would merit further investigation. One difference, which proved to be a problem in aerial spotting of the deer yards, was the number of moose in the low-kill area. No moose were located in the periphery, but eight moose yards were found within the low-kill townships, two of which were at first mistaken for deer yards. In addition, two deer yards checked in the wildland towns that make up the low deer kill area were also frequented by moose.

Plans for the next quarter: State questionnaire files from the past five years will be sorted for information pertaining to the study area. Further analysis of data from the deer kill and hunting pressure sampling will be undertaken and statistical tests will be applied.

SALT MARSH ECOLOGY

Factors Affecting the Production of *Ruppia* and Macroinvertebrates in a Salt Marsh

- Objectives:
- (1) To determine factors which affect the production of widgeon grass, *Ruppia maritima*.
 - (2) To further investigate the effects of plugged ditches upon production of *Ruppia* and on populations of macroinvertebrates.
 - (3) To further investigate the effects of plugged ditches on mosquito reproduction.

Assignment: Vaughn Rasar, Graduate Assistant

Thesis Adviser: M. W. Coulter, Assistant Leader

Consultants: Kenneth Anderson, Regional Biologist, Dept. Inland Fisheries and Game
Harold Gausman, Professor Soil Chemistry

During the quarter the project outline was completed and experimental designs were chosen for the various aspects of the study. Dr. George Cooper, Professor of Botany and Dr. Harold Gausman helped in this regard.

Snails from bottom samples were sorted, counted, oven-dried and weighed. Soil analysis of the ditches was completed by the University Soil Testing Service. These samples were analyzed for phosphorus, potassium, calcium, magnesium and percentage of salt. Both wet and dry pH of the soil was recorded.

Additional seeds of *Ruppia* were collected in the field. Germination of scarified ditch and pothole seeds has been started and the results will be given in the next quarterly report.

Plans for next quarter:

1. Conduct the spring snail and soil sampling.

2. Mulch pothold seeds in both the ditch and pothole environment in preparation for the germination of these seeds.

3. Transplant Ruppia to potholes devoid of this plant.

4. Test germination of pothole seeds in soil already containing Ruppia growth and in soil lacking it.

5. Survey areas in the upper portion of the Weskeag Marsh for installation of additional impoundments.

OUTDOOR RECREATION

Socio-Economic Characteristics of Maine Sportsmen

- Objectives:
- (1) To identify and analyse those social, psychological, and economic variables which motivate sportsmen to hunt and fish.
 - (2) To identify and analyse the reactions of the consumer to rules and regulations, administration and policy, and the opportunities for sport in Maine.
 - (3) To identify and analyse the expenditures incurred by sportsmen in pursuit of hunting and/or fishing.
 - (4) To compare the above information for Maine to the northeastern states in general.

Assignment: Charles H. Lobdell, Graduate Assistant

Thesis Adviser: M. W. Coulter, Assistant Leader

Consultants: Thomas J. Corcoran, Forest Economist, School of Forestry
 Sanford D. Schemnitz, Assistant Leader
 John Gill, Game Biologist, Maine Department Inland Fisheries and Game

Activities during the quarter included the following: (1) the regional questionnaire was pre-tested and subjected to critical review on the basis of obvious problems experienced by the respondents to the pre-test; (2) the regional committee met in New York City; (3) the survey designed specifically for Maine was revised several times and is presently being reviewed by the consultants; (4) 2,500 names were drawn from hunting and fishing license stubs in the files of the Maine Department of Inland Fisheries and Game; (5) a system for coding the information yielded by questionnaire returns was developed and is presently being reviewed by the consultants prior to distribution to the regional committee; (6) cover letters for the first and second follow-up mailings were drafted and distributed to the members of the regional committee for approval; and (7) miscellaneous activities in preparation for the April 15, 1966, mailing were completed.

The New York conference of the regional committee was for the specific purpose of reviewing the results of the pre-test. Lobdell attended from Maine. Certain questions were obviously troublesome to respondents and these were either deleted or rephrased.

A 40 percent return from the pre-test was projected to 78 percent with two follow-up requests by Dr. Richard McNeil of Cornell University. With a few of the initial objectionable features removed, a significant shortening, and an attractive format and cover, it is expected that at least a 70 percent return will be obtained after three mailings.

The survey designed specifically for Maine was constructed so that the data could be compared with that from the regional study. The controls of both are identical in content, position, and phrasing. This schedule is designed to determine the factors affecting preferences for various recreational activities as opposed to hunting and fishing.

A mailing list of 2,500 names was drawn randomly from hunting and fishing license sales stubs in the files of the Maine Department of Inland Fisheries and Game. One thousand five hundred will be used for the regional study population and 1,000 will be used for the state population. Both populations have been checked against license sales data and both are representative of the universe of Maine sportsmen. All preparations prior to the mailing of the regional survey have been completed.

Plans for next quarter: Conduct the survey. The initial mailing, April 15, 1966, will be followed by two follow-up mailings at three week intervals.

COOPERATIONAL, EDUCATIONAL WORK AND MISCELLANEOUS ACTIVITIES

Unit personnel participated in the 10-week training school for state game wardens. Details of scheduling were handled by Coulter who also taught game biology. Schemnitz taught the course in plant identification. Mendall and several of the graduate assistants handled occasional laboratory sections.

Mendall attended the Bureau of Sport Fisheries and Wildlife conference of Region V employees in Boston January 10-13.

Staff members of the Unit participated in the Northeast Fish and Wildlife Conference in Boston January 16-19. Mendall was awarded the John Pearce Memorial Award by the Northeast Section of the Wildlife Society for his accomplishments in waterfowl research. Coulter was elected Chairman of the Northeast Section for 1966. He was Vice-chairman last year. Schemnitz served as Co-chairman of two of the technical programs, the bird session and the professional wildlife teaching group.

Mendall, Coulter and Schemnitz attended the annual Unit Leaders' meetings and the North American Wildlife and Natural Resources Conference in Pittsburgh, Pennsylvania, March 11-16.

Schemnitz was Chairman of the wildlife program on March 29 of the 59th annual University of Maine Farm and Home Week. Graduate Assistant Roop was one of the main speakers on this program. He presented an illustrated lecture on the moose.

Schemnitz gave two lectures at the State Science Forum for high school students held at the University of Maine, March 28.

Graduate Assistant Rasar presented a wildlife demonstration-lecture at a conservation workshop of Boy Scouts held in Portland, March 24. This meeting was sponsored jointly by the Scouts and the Portland Society of Natural History.

PERSONNEL CHANGES

Two new graduate assistants joined the Unit at the beginning of the spring semester. Stephen Clark received a B.S. degree in wildlife management, graduating in February with highest distinction. His thesis study will be on the eider duck. Ronald Klataske is a January graduate of Kansas State University with a B.S. degree in zoology--majoring in wildlife biology. His thesis project will deal with the white-tailed deer.

PUBLICATIONS

Choate, Jerry S.

1965. Breeding Biology of the American Eider in Penobscot Bay, Maine. (Unpublished) M.S. Thesis, University of Maine, Orono. 173 pp.

Respectfully submitted,



Howard L. Mendall, Leader
Maine Cooperative Wildlife
Research Unit

April 8, 1966

MAINE COOPERATIVE WILDLIFE RESEARCH UNIT

University of Maine

Orono, Maine

QUARTERLY REPORT

April-June, 1966

Cooperating Agencies

Maine Department of Inland Fisheries and Game
Wildlife Management Institute
University of Maine
U. S. Bureau of Sport Fisheries and Wildlife

NOT FOR PUBLICATION

The quarterly reports are usually statements of progress. The data presented often are incomplete and the conclusions reached may not be final. Consequently, permission to publish any of the information contained herein is withheld pending authorization from the Research Unit.

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Unit Personnel

Leader - Howard L. Mendall

Assistant Leaders - Malcolm W. Coulter (*)
Sanford D. Schemnitz(*)

University Representative - Albert D. Nutting, Director, School of Forestry

Collaborators(**) - John Gill, Maine Dept. Inland Fisheries & Game
J. William Peppard, Maine Dept. Inland Fisheries & Game
Kenneth Anderson, Maine Dept. Inland Fisheries & Game
Howard E. Spencer, Maine Dept. Inland Fisheries & Game
Harold Gausman, Professor of Soil Chemistry
Wesley Jones, Moosehorn National Wildlife Refuge
Eldon Clark, Moosehorn National Wildlife Refuge
David O'Meara, Associate Professor of Animal Biology
J. Franklin Witter, Head, Dept. of Animal Pathology
Thomas J. Corcoran, School of Forestry
Harold E. Young, School of Forestry
Ralph Griffin, School of Forestry
Stephan L. Finner, Assistant Professor of Sociology
Franklin L. Roberts, Dept. of Zoology
Roy W. Stamey, Park Ranger, Acadia National Park
Paul Favour, Acadia National Park
Carl Gruener, Div. Mgmt. & Enforce., U. S. Bur. Sport
Fisheries and Wildlife
Rex Tice, Div. of Mgmt. & Enforce., U. S. Bur. Sport
Fisheries and Wildlife
Owen Seelye, Div. Mgmt. & Enforce., U. S. Bur. Sport
Fisheries and Wildlife

Graduate Assistants - John C. Baird
Stephen H. Clark
Ronald D. Klataske
Charles H. Lobdell
F. Loy McLaughlin
Vaughn D. Rasar
Larry J. Roop

Graduate Student - Lawrence S. Barden

Secretary - Maxine L. Horne

(*) Professors Coulter and Schemnitz serve half time on the Unit program and half time on the teaching staff of the School of Forestry.

(**) Collaborators change periodically. This list includes only those who are directly cooperating or assistant in current Unit studies.

Unit Coordinating Committee

Ronald T. Speers, Commissioner, Maine Depart. Inland Fisheries & Game
Albert D. Nutting, Director, School of Forestry
Howard L. Mendall, Unit Leader

Quarterly Report

April-June, 1966

RESEARCH PROJECTSFUR ANIMALSEcology and Behavior of the Fisher

- Objectives: (1) To study patterns of range expansion, food habits and habitat preferences of fisher.
- (2) To study behavior patterns of the animal.
- (3) To evaluate the current role of the fisher in its new status as a major component of the carnivorous fauna of Maine.

Assignment: Malcolm W. Coulter, Assistant Leader

Part of the fisher data was used for a thesis accepted at Syracuse during May 1966. Coulter was awarded the degree of Doctor of Philosophy at the June Commencement. This was through the Department of Forest Zoology, Syracuse State University College of Forestry. The thesis abstract follows:

Winter field studies were conducted from 1950-1966, penned animals observed during 1963-1966 and 376 specimens examined in the laboratory. Range in Maine doubled to approximately 25,000 square miles from 1950-1966. Rates of dispersal varied from 5 to 9 miles per year; penetration into one region was slowed markedly by a broad river. Populations of fishers exceeded 1 per square mile in some areas, but such densities were believed temporary. Wild fishers were solitary, primarily nocturnal and decidedly terrestrial during winter. Unfused cranial sutures were characteristic of juveniles. Color variations between age classes, sexes and seasons were noted. Molting occurred during late summer. Females bred the first year, and whelping extended from late February to April. The kits, averaging three per female, are altricial; eyes of two captives opened on day 53 and nursing continued into the fourth month. The female and litter separate before late November. Leading foods from 242 specimens were, varying here, porcupine, white-tailed deer (carrion), small birds, shrews, mice and squirrels. Porcupines were killed by an attack to the head. Quills were present in the body tissues of 127 of 365 fishers examined. Diseases were uncommon; parasitism was frequent. New host records for a cestode (*Taenia* sp.) and a trematode (*Alaria* sp.) were established. Females predominated in catches when trapping pressure was high; males were taken more frequently during late winter. Practical management is limited to administrative control of trapping. The wisdom of restocking fishers without thorough evaluation of objectives, land use patterns, human attitudes, and prospects for control by fur-trappers in any area is questioned. The maintenance of fisher populations high enough to control porcupine numbers effectively is probably biologically impossible, and in many areas not compatible with some other human uses.

Plans for next quarter:

1. A joint manuscript on growth and reproduction in Maine fishers by P. L. Wright of the Montana Unit and Coulter will be completed and submitted

for possible publication.

2. A paper on fisher food habits based on the material submitted in part of the thesis will be prepared for publication.

WATERFOWL

(a) Waterfowl Distribution and Breeding Ecology

Objectives: To obtain data on factors influencing distribution and migration of waterfowl in Maine and to determine population densities of the important breeding species, especially the black duck and ring-necked duck, under varying habitat conditions.

Assignment: Howard L. Mendall, Leader

The 1966 waterfowl breeding ground studies in northern, eastern and central Maine were carried out. Mendall was assisted in breeding pair counts by State Regional Biologist J. William Peppard, by Graduate Assistant Vaughn Rasar, and by John M. Dudley of Calais, Maine.

This is the 28th consecutive year of these studies. Techniques were the same as in recent years and have been described in earlier reports. In 1966, however, coverage was considerably reduced, as was the case a year ago, due to man-power limitations and expansion of the Unit's coastal studies. Data are primarily confined to initial populations based on breeding pair estimates, and, hence, are directly comparable only with 1965.

Weather and General Breeding Conditions

Mild weather during late March and early April resulted in an early spring break-up. Waterfowl migration was earlier and much less prolonged in comparison with 1965. This was followed by a long period of sub-normal temperatures that lasted until well into the second half of May. As a result, the seasonal chronology appeared to be retarded, both from 1965 and the long-term average. However, nesting consisted of two peaks for all early breeding species--a few birds nested at earlier than average dates, with the majority considerably later. This tendency was not as noticeable with the normally late breeding species such as the ring-necked duck and blue-winged teal.

A precipitation deficiency continues to exist throughout Maine but is far less serious than a year ago. Water levels in most areas have been only slightly below normal throughout the breeding season. Moreover, extensive and heavy showers thus far in July appear to have insured reasonably good brood rearing conditions for the balance of the summer.

Breeding Populations

Breeding pair counts ordinarily are determined from 13 study areas which have proven fairly reliable indicators for northern, eastern and central Maine. Data for the two most numerous species--the black duck and ring-necked duck--have appeared especially valid. For other species much less reliability is placed on the information. Because of the reduced coverage as explained, data were obtained from only 9 of the areas in 1965 and from 10 in 1966.

Results of the studies showed a 16 percent decrease in initial breeding populations of black ducks and an 11 percent increase in ring-necked ducks. This follows a similar trend recorded in 1965 except the black duck decrease this year is slightly greater and the ring-neck increase is slightly less.

With the wood duck, goldeneye, blue-winged teal and green-winged teal, too few data were obtained to warrant percentage tabulations. No major change in the status of these species is indicated this year in comparison with 1965.

Conclusions

1. Breeding populations of black ducks were decreased on Unit study areas in 1966 from those of a year ago. The ring-necked duck showed a slight increase. Other species appear little changed from 1965. This is the second consecutive year of a similar trend.

2. Brood rearing conditions are believed to be improved this year in comparison with 1965, because of greater amounts and a more even distribution of precipitation throughout the spring and summer.

Plans for next quarter: Largely inactive although a few brood checks will be made during August.

(b) Renesting and Homing Study

Objectives: To study renesting behavior and the degree of migrational homing exhibited by waterfowl, primarily the black duck, mallard and the ring-necked duck.

Assignment: Malcolm W. Coulter, Assistant Leader
(Vermont phase conducted jointly with William Miller, former Waterfowl Project Leader, Vermont Fish and Game Service)

A draft of the manuscript was completed and submitted to the Vermont cooperators for approval.

Plans for next quarter: To complete the manuscript.

(c) Waterfowl Hunter Bag Checks

Objectives: To determine hunter success, crippling loss, and species, sex and age composition of the kill.

Assignment: Howard L. Mendall, Leader

Inactive during the quarter.

Plans for next quarter: Inactive.

(d) Eider Duck Ecology and Management(1) Ecology and Experimental Management of the American Eider in Penobscot Bay, Maine

Objectives: To study the breeding ecology of the American eider with particular reference to predation and other factors limiting production; and to devise and test management and inventory techniques that might be reliable with a minimum of disturbance to the eiders.

Assignment: Stephen H. Clark, Graduate Assistant

Thesis Adviser: Howard L. Mendall, Leader

Consultants: Harold Young, School of Forestry
Ralph Griffin, School of Forestry

Field work on this study was begun April 9. Prior to nesting by the ducks, 24 experimental nest shelters were constructed in order to test their feasibility in reducing gull predation and increasing eider production in sparsely utilized cover. Sixteen shelters were built with rough lumber and varied in length from 18 inches to 5 feet and in width from 18 inches to 2 feet. Average height was approximately 10 inches. All shelters were placed on level ground or on slight slopes in grass cover infrequently used in the two previous years.

During the nesting season, 12 nests were initiated in 8 of these shelters and 5 hatched successfully; all of the remaining nests were destroyed by gulls. Successful nests were located in those shelters that were at least 3 feet long by 2 feet wide. Eight additional shelters were built with flat stone slabs. Only two nests were initiated in these, of which one hatched successfully. Thus, it seems apparent that artificial shelters could have some value in management of the eider, but clearly further experimentation is necessary.

Experimental gull control and analysis of its effect on the nesting eider populations was initiated May 14. Several techniques were used. On Mouse Island an area exhibiting a variety of cover types and a moderate gull population was demarcated and all gull eggs within the area were removed at 3 week intervals. On Robinson Rock, eggs were treated with formaldehyde-oil emulsion spray to prolong incubation and prevent hatching. Both islands were checked once a week and treated every third week.

On the Mouse Island experimental area, a total of 33 black-backed gull nests and 10 herring gull nests were initiated and destroyed in the period May 14-July 10. Of these 12 black-backed gulls and 5 herring gulls re-nested on the area within three weeks; the remaining gulls apparently abandoned their territories. Their nests were also robbed before they could hatch, and only one herring gull nest was reactivated after this treatment.

The results of this procedure on the nesting eider population is at present unclear, but data collected thus far indicate that the technique was not effective in reducing predation. Of 137 eider nests completed during this period, only 44 (32 percent) have been successful.

On Robinson Rock a total of 18 black-backed gull nests and 127 herring gull nests were initiated. A small number (14) were either destroyed by predation or were missed in spray operations. Of the 131 that were sprayed only 6, three of each species, hatched.

The majority of nests in which the treatment was effective were abandoned near or shortly after the end of the normal incubation period, but in some instances eggs were incubated up to 6 weeks. It is apparent that the technique was highly effective in reducing gull production, but there is some possibility that eider nest predation may actually have increased. To date 168 eider nests have been initiated on this island but only 35 or 21 percent have been successful.

No conclusions have been made pending more thorough analysis of the data, and a correlation with gull-eider behavior data obtained during the spring. On three islands--Flat Island, Goose Island, and East Goose Rock--the breeding ecology of gulls and eiders was studied in detail. Nesting data for both have been recorded on a weekly basis; currently 292 eider nests and 350 gull nests have been completed or are nearing completion on these islands. Objectives of this phase are to determine the relationships between predation and nesting chronology, character and density of the resident gull population, and relationship of nest success to vegetative development and density. Numerous observations of the birds from a blind were made. Graduate Assistant McLaughlin helped a great deal in this phase of the work. In addition, Graduate Assistant Roop obtained behavior data on eider-tern relationships on an island near Mouse Island where a tern colony also has a small population of eiders.

The final phase of the 1966 field work which is now in progress involves testing of a sample design to determine nesting concentrations and overall production on a series of breeding islands. It is planned to take a random sample of approximately 250 circular plots of varying radii; information will be analyzed at the University Computer Center to determine optimum size and number of plots needed for this type of a production study under conditions found in Penobscot Bay. This work will be completed in early August.

Plans for next quarter: To complete field work, analyze the data, and prepare a seasonal report.

(2) Renesting and Homing

Objectives: To study renesting behavior and the degree of migrational homing exhibited by the American eider.

Assignment: Malcolm W. Coulter, Assistant Leader

A trip was made during June to further test techniques for capturing nesting eiders. Owen Sealye, Game Management Agent, Bureau of Sport Fisheries and Wildlife provided a boat and assisted during the work.

A small number of eiders were captured on experimental trials during 1964 and 1965 with fish netting draped over the cover or across trails to the nests, and also with the hoop net trap activated by a cord. This year three new traps were constructed similar to the automatic nest trap developed by Weller (1960. J. Wildl. Mgmt., 21(4):456-458). Eiders entered these traps readily.

Based upon the trials conducted during the past two years, three methods seems effective for catching nesting hens: (1) hoop net nest trap (2) cover and trail nets and (3) the Weller-type trap. The latter has several advantages. A series of these traps will be constructed for use next year with certain modifications that are needed on rocky islands. It is also anticipated that a square, folding model may be more convenient to transport in boats offshore than the conventional, rigid circular model.

Since eiders often leave their nests whenever people approach the islands, the automatic trap seems to offer the best technique. However, the problem of capturing nesting hens is not as difficult as that of causing high predation to nests as a result of human disturbance on the islands. It will be essential that study islands for this phase of eider work be selected where low densities of birds are nesting in good concealing cover.

Plans for next quarter: Inactive.

(3) Annual Production and Factors Influencing Nesting Success

Objectives: To determine annual production and factors related to nesting success in breeding colonies of the Mussel Ridge Channel of Penobscot Bay.

Assignment: Howard L. Mendall, Leader

Five islands near Rockland, in the Mussel Ridge Channel, were studied by Mendall in 1965 and again this year to permit comparisons with the more basic data being obtained from the Islesboro study area (see sub-project 1). Cover conditions and the degree of human disturbance are much different on the two areas even though they are less than 20 miles apart.

Field work on the Mussel Ridge islands was initiated by Mendall May 22 and has continued intermittently since. Mrs. Emma Mendall assisted considerably in the search for and subsequent rechecking of the nests. A total of 527 nests were located and marked. This was 90 more than were found in 1965. In 23 instances, the females were nest-trapped and banded. The birds were caught by long handled nets during normal nest checking and caused no disturbance to other eiders; hence little or no gull predation resulted.

Overall populations on the 5 islands was somewhat greater than a year ago, showing a substantial increase on 2, a slight increase on 1, and a slight decrease on 2. Hatching success to date (mid-July), is proving better than that of 1965 but varies considerably between islands, from a low of about 40 percent to a high of 80 percent. The latter figure is high for any waterfowl species and especially so for the eider. It occurred on Tommy Island and is directly attributable to exceedingly dense raspberry cover and freedom from human disturbance. This high success is all the more impressive because Tommy Island has one of the largest gull populations of any of the study islands.

The situation on Fisherman's Island was very interesting this year in view of the poor production there in 1965. This island, which has one of Penobscot Bay's largest eider colonies, had a hatching success of only 27 percent a year ago. The birds were repeatedly disturbed by sheep pastured there and by human visitors. This year, with excellent cooperation from

Maurice Duncan of Rockland, the owner of the island, there are no sheep present and visits by sight-seers and bird watchers were largely discouraged. Hatching success thus far of 196 nests (an additional 40 still are to be rechecked) is noticeably better than in 1965.

Nesting chronology has been retarded this year. A few nests were initiated earlier than usual but the majority were later. For most eiders nesting was evidently delayed by the long period of sub-normal temperatures and snow of late April and early May. Earliest recorded hatching was May 22 at Tommy Island. By mid-July all nesting had apparently been concluded there. It was nearly over at the other islands. The only known nests still being incubated were 2 at Garden Island, 1 at Seal Island, 1 at Oak Island, and 6 at Fisherman's Island.

Plans for next quarter: To complete field checks and begin tabulation of the season's data for computation by IBM card sorter.

(4) Distribution of Eider Populations in Coastal Maine

- Objectives: (1) To locate the principal breeding colonies along the Maine coast.
 (2) To develop a satisfactory technique for aerial breeding ground inventory.
 (3) To determine the abundance and subspecific composition of fall and winter populations.

Assignment: Howard L. Mendall, Leader
 Owen Seelye, Game Management Agent. U. S. Bureau of Sport Fisheries and Wildlife

Consultants: Rex Tice, Division of Management and Enforcement, U. S. Bureau of Sport Fisheries and Wildlife
 Carl Gruener, Division of Management and Enforcement, U. S. Bureau of Sport Fisheries and Wildlife
 Howard E. Spencer, Waterfowl Biologist, Maine Dept. of Inland Fisheries and Game

Field work was initiated during April on this new project, which is being conducted jointly by the Unit and the Division of Management and Enforcement of the Boston Regional Office.

The first aerial reconnaissance was completed April 19 with 5 consecutive days of flying, totaling about 26 hours. Practically the entire Maine coast from Cape Porpoise to West Quoddy Head was covered. More than 300 islands and ledges were examined, including all off-shore islands. The Bureau's Cessna 180 plane was piloted by Agent William Snow. Unit Leader Mendall was observer on all flights and also obtained a series of photographs to correlate with visual estimates. Game Management Agent Seelye (who arranged the flight plan) and Agent Donald Blais alternated as a second observer.

More than 26,000 eiders were recorded on the flights. Heaviest concentrations were in Penobscot, Jericho, Bluehill and Frenchman's Bays. This is roughly the central and east-central portion of the coast.

Sex ratios were recorded on a sampling basis (nearly 5,500 records) and showed close to a 50:50 distribution, although there was a slight excess of females. There was an almost exact 50:50 ratio in western Maine but a less balanced ratio in eastern Maine. At the latter, seasonal chronology was less advanced and there was less evidence of pairing. Moreover, the majority of sub-adult males were found east of Penobscot Bay.

The second series of flights were interrupted slightly by fog but were carried out on May 18, 21 and 22, totaling $15\frac{1}{2}$ hours of flying time. The same plane, again piloted by Snow, was used. Mendall was observer on all flights. Agent Bruce Parker alternated with Seelye as second observer. The flight plan was essentially the same as in April except that it was reduced somewhat in scope. Many areas covered during the early flights were subsequently considered as of valueless habitat to eiders and hence eliminated for future consideration.

Approximately 22,000 eiders were recorded during the May flights. Considering that many females were laying or incubating at that time, and were not tallied, the two sets of data appear in very close agreement. It should be pointed out that upon approaching an island, if it was apparent that eiders of either sex were in nesting cover, the plane was veered away to refrain from flushing the females and inducing gull predation.

Distribution of the birds followed a pattern similar to that of April. Sub-adult males, however, were much more concentrated in a relatively small portion of the coast east of Penobscot Bay.

A third flight in the Cessna was made June 21 by Agent Snow, with Carl Gruener, Regional Supervisor of Management and Enforcement as observer. This flight was primarily for the purpose of locating molting male concentrations and was confined to the outer portions of the bays and the offshore islands. Approximately 8,500 birds were recorded. The largest concentrations of males were off the Washington County coast, which is considerably east of the center of breeding abundance in Maine.

From May 24 to June 25, Agent Seelye conducted ground appraisals of many of the islands determined by the air surveys as being actual or potential breeding areas. During much of this time he was assisted by a University of Maine wildlife undergraduate student, Patrick Corr. A total of 68 islands were checked. Most of these were in the western and central portions of the coast.

The aerial data have not yet been completely analyzed; also, it would be premature to attempt a correlation of sex ratios with total populations on the basis of one year's results. Nevertheless, it seems safe to state that a very conservative estimate of Maine's breeding eider population would be about 12,000 pairs. This is substantially higher than hitherto believed.

Plans for next quarter: To complete the analysis of aerial survey data, including the visual and photographic sex ratio comparisons.

WOODCOCKWoodcock Population Studies

Objectives: To conduct annual censuses and to obtain related ecological data on the Unit's permanent census routes in Maine.

Assignment: Howard L. Mendall, Leader
Sanford D. Schemnitz, Assistant Leader

The annual woodcock censuses were conducted by Mendall and Schemnitz on the routes in northeastern Maine that are covered by Unit personnel. A decrease of 17 percent was recorded in comparison with 1965 results. The decline occurred largely on two routes, one being the normally highly productive Greenbush area. Data from four additional routes actually showed a slight increase. Censusing was very difficult this year because of stormy, cold and windy weather that prevailed during late April and early May.

Plans for next quarter: Inactive.

RUFFED GROUSEEcology of the Ruffed Grouse in Maine

- Objectives: (1) To study population dynamics of harvested and unharvested grouse populations; and to compare mortality rates of resident non-migratory species (grouse) and migratory species (woodcock) on the same area.
- (2) To determine cover preferences and use of forest clearings by adults and broods in spring and summer.
- (3) To study the causes of juvenile mortality and measure the incidence of blood parasites.

Assignment: Sanford D. Schemnitz, Assistant Leader

Consultants: Eldon Clark, Refuge Biologist
Wesley Jones, Refuge Manager
David O'Meara, Associate Professor of Animal Biology

Drumming grouse censuses were made at both the Baring and Edmunds Units of the Moosehorn Refuge. The counts were lower on both Units and seem to be indicative of a decreased grouse population level.

Two male grouse were trapped and banded with conventional mirror traps. One was recaptured at the same log for the third consecutive year. Fifteen drumming sites were located and evaluated. Two additional drumming sites were found in the town of Crawford with the aid of Warden Jack McPhee.

A similar grouse courtship study was undertaken on the 1700-acre University Forest at Orono for the second consecutive year with the assistance of Paul Nickerson an undergraduate wildlife student. Fifteen active drumming sites were located and three male grouse were mirror trapped.

The IBM tally sheets on ruffed grouse trapping have been received from William Goudy of the staff of the Migratory Bird Population Station, U. S.

Bureau of Sport Fisheries and Wildlife, and are being analyzed.

Plans for next quarter: Co-ordinate summer ruffed grouse trapping with shorebird type drift traps at the Moosehorn Refuge.

BIG GAME

(a) Ecological Relationships of White-tailed Deer and Vegetation at Acadia National Park

Assignment: M. W. Coulter and S. D. Schemnitz, Assistant Leaders
F. Loy McLaughlin, Graduate Assistant

Consultants: Harold E. Young, School of Forestry
Paul G. Favour, Chief Naturalist, Acadia National Park
Roy W. Stamey, Park Ranger, Acadia National Park
J. Franklin Witter, Department of Animal Pathology
Franklin L. Roberts, Dept. of Zoology

Objectives: (1) To develop a sound statistical design for study of the influence of the deer herd upon the vegetation.
(2) To measure the influence of the current deer herd upon vegetation.
(3) To assist Park personnel in exploring and developing methods to census deer, and to study deer movements; also to develop ways for deer to be readily seen by the public.

The intensive browse survey conducted by McLaughlin and described in the previous quarterly report was completed by the first week in May. Seven hundred and twenty sample plots were taken with the aid of four other graduate assistants, who contributed considerable time to the project. A total of 42 man-days were needed to complete the survey. Data from the survey are being tabulated for computer analysis.

Plans for next quarter: Errors in the type map which were discovered during the course of the browse survey will be corrected. Ovaries collected during the herd reduction program will be examined.

(b) Influences of Known Populations of Deer Upon Forest Vegetation

Objectives: (1) To measure the influence of a known population of deer upon forest vegetation.
(2) To develop and test more adequate deer census methods than those currently available.

Assignment: Sanford D. Schemnitz, Assistant Leader

Consultants: Malcolm W. Coulter, Assistant Leader
J. Franklin Witter, Department of Animal Pathology

One field day was spent along with Graduate Assistant Klataske and former Graduate Assistant Choate at Outer Heron Island working on the deer exclosures. Part of this sub-project has been assigned to Klataske as a thesis topic.

Plans for next quarter: Finish control plot analysis and release deer at Outer Heron Island. Reconnaissance to be made of an additional island in Penobscot Bay area.

(c) Pilot Radio-Tracking Studies of White-tailed Deer

Objectives: To test the efficiency and accuracy of telemetry equipment on semi-tame deer within fenced enclosures on the University Forest.

Assignment: Sanford D. Schemnitz, Assistant Leader

Assistant: Thomas Allen, Undergraduate Wildlife Science student

Powdered tranimul at doses of 2 grams per 100 pound deer allowed successful tranquilization. This gave better results than the recommended dosage 2.5 mg/5 cc of liquid tranimul. The drug was injected with a cap-chur gun on two adult females. The deer exhibited no reaction after being injected.

Plans were made and equipment ordered for an expandable type collar fitted with a transmitter for use on a male deer.

Plans for next quarter: Construct and test additional experimental collars and telemetry equipment.

(d) The Ecology of the Deer Population on Isle au Haut, Maine

Objectives: (1) To determine the number of deer on Isle au Haut.
 (2) To evaluate the existing habitat conditions and measure the influence of the deer upon their environment.
 (3) To determine the carrying capacity for this particular habitat with regard to adequate forest regeneration.

Assignment: John C. Baird, Graduate Assistant

Thesis Adviser: S. D. Schemnitz, Assistant Leader

Consultants: J. William Peppard, Regional Biologist, Dept. Inland Fisheries and Game
 Harold Hubler, Former Superintendent, Acadia National Park
 Harold E. Young, School of Forestry

The thesis was completed and accepted by the University of Maine Graduate School. Baird received the degree of Master of Science at the June Commencement. He has accepted a wildlife teaching position on the staff of the Forest Ranger School at Fredericton, New Brunswick. The summary is as follows:

An introductory study was conducted from September, 1964 to December, 1965 on Isle au Haut, Maine, an area of distinctly heavy utilization by an apparently high density of deer. The objectives were to determine the number of deer on the island, to evaluate the existing habitat conditions, and to measure the influence of the deer upon the environment.

Strip censuses, deer drives, and direct aerial counts were employed to determine the size of the deer population. Overstory vegetation, understory tree species, and understory shrubs comprised the three categories considered

in the evaluation of the existing habitat. These strata were measured by the Bitterlich point sampling, Shafer twig-count, and clip and weigh methods, respectively.

The following conclusions resulted from the investigation:

1. Isle au Haut has a present deer population between 250 and 300 animals, based on the Hayne strip census method.
2. Areas censused by deer drives were not representative, and, thus, deer densities determined for these areas do not apply to the entire island.
3. Direct aerial counts of the white-tailed deer are not feasible in regions of coniferous vegetation similar to Isle au Haut.
4. Serious habitat deterioration has resulted from a density of approximately one deer per 25 acres. A continuation of the present density will prolong the detrimental effects on both the deer and the vegetation.
5. The total amount of preferred browse was less than seven pounds per acre for the entire island. Red spruce, white spruce, and poor quality shrubs composed 96 percent of the 1,334 pounds of available browse calculated per acre.
6. Deer subsisted to a large extent on food sources other than woody vegetation. A detailed study of the role of supplementary foods, especially marine algae, in the diet of the deer is necessary to better evaluate deer-vegetation relationships.
7. Specific information should be gathered by direct examination of deer in order to assess the effect of a deteriorated habitat upon the animals.

(e) The Ecology of the Deer Population on Isle au Haut, Maine

- Objectives: (1) To develop and test deer census techniques with particular emphasis on strip census methods, and to study the influence of deer distribution and cover type usage on census techniques.
- (2) To appraise the physical condition of a sample of the deer herd by capturing deer at Isle au Haut, and to collect information on the herd's sex and age composition.

Assignment: Ronald D. Klataske, Graduate Assistant

Thesis Adviser: Sanford D. Schemnitz, Assistant Leader

Consultants: Malcolm W. Coulter, Assistant Leader
 John Gill, Game Biologist, Dept. Inland Fisheries and Game
 Harold Young, School of Forestry

This is a new project, although to a large extent it is a continuation of the Master's study of former Graduate Assistant Baird. During the quarter emphasis was placed on development of precise objectives, methods and work outlines and a review of pertinent deer literature.

Several trips were made to the Isle au Haut study area. The initial weekend trip involved a general reconnaissance of the island, and morning and evening counts of deer along the road. This was made with Dr. Schemnitz and former Graduate Assistant, John Baird. Checks were made on the condition of the strip census lines used by Baird and additional lines planned; a reconnaissance was made of the deer drive areas, and possible sites for deer trapping activities were located.

Deer will be counted on the seven strip census lines, which cross the island at $\frac{1}{2}$ mile intervals, each month until November 1967. The lines will be walked morning and evening for two days near the middle of each month. The results will be used to determine the influence of season on the number, and sex and age composition, of deer counted by this method. In addition to the perpendicular and direct distances now recorded with respect to the deer's location on strip census counts, two new measurements will be taken which are based on the "visual distance." This is the maximum distance that a deer can still be seen and identified as such, before it disappears from sight. Distances from this location to the observer and to the census line will be measured; estimates will be calculated on this basis and compared to the other estimates obtained during the study. Several additional techniques are being planned which will be described in subsequent reports.

In order to appraise the physical condition of the deer, it is expected that several will be captured with portable box traps and studied during the fall months. Information such as age, weight, antler development, and hind foot length will be recorded for each deer. The animals will be marked and released for re-observation.

Plans for next quarter: Complete the marking of the census lines, and begin systematic field observations.

(f) Ecology of White-tailed Deer in a Low Harvest Area of Eastern Maine

- Objectives: (1) To determine the causes of the low deer kill in a block of 21 townships in Hancock and Washington counties.
 (2) To relate these findings to area management suggestions.

Assignment: Larry J. Roop, Graduate Assistant

Thesis Adviser: Sanford D. Schemnitz, Assistant Leader

Consultants: J. William Peppard, Regional Biologist, Dept. Inland Fisheries and Game
 John Gill, Game Biologist, Dept. Inland Fisheries and Game
 Harold Young, School of Forestry

The deer yard survey was completed for this season early in the quarter. Plans are currently being made for computer analysis of information from a state postal hunter survey. State Game Biologist John Gill will assist and coordinate this work.

At the beginning of the yard survey, aerial flights with Regional Biologist Peppard and Warden Pilots Later and Stinson were made to locate deer concentration areas during optimum snow conditions. Five townships with the lowest deer harvest per square mile of the low-kill area were chosen

to compare with five townships with the highest kill per square mile of the peripheral area. Yards were chosen that were nearest the center of the selected townships when possible. Four of the five yards from both areas were subjected to intensive browse sampling with a modified Aldous-Krefting 1/100 acre plot method. Foliage density and degree of browsing were determined to the nearest ten percent in each plot. The number of plots in each yard varied with respect to the size and variability of the yard, and all important deer food species or species basic to the forest type (such as red spruce) were included in the sampling. All ten yards were subjected to general appraisal and cruising to evaluate yard condition and past use. Browse samples from plants being utilized by deer were taken in eight of the yards for chemical analysis or a comparison of nutritional composition.

A total of 391-1/100 acre plots, or an average of 49 plots per yard, were taken during the survey. Chemical analysis of the browse samples from the yards has been completed by the Agricultural Experiment Station, University of Maine. The analysis report shows the percentages of moisture, protein, fat, fiber, ash, and NFE (nitrogen free extract), but of these the percentage of protein on a dry basis is most important. The average values of percentage protein for the different species is nearly the same for both areas. Preliminary tabulations of the browse survey results show a wide variation in the species composition, amount of utilization, and amount of browse available. Analysis is not fully completed, but it is apparent that consumption is well in excess of production in some of the yards of both areas. Only one yard, however, in Township 42MD, was considered as severely overbrowsed.

Plans for next quarter: Tabulate 1965 deer registration data for the study area townships; extract information from past years of the State postal survey to compute hunter effort per deer harvested; prepare plans for the fall field work.

SALT MARSH ECOLOGY

Factors Affecting the Production of *Ruppia* and Macroinvertebrates in a Salt Marsh

- Objectives:
- (1) To determine factors which affect the production of widgeon grass, *Ruppia maritima*.
 - (2) To further investigate the effects of plugged ditches upon production of *Ruppia* and on populations of macroinvertebrates.
 - (3) To further investigate the effects of plugged ditches on mosquito reproduction.

Assignment: Vaughn Rasar, Graduate Assistant

Thesis Adviser: M. W. Coulter, Assistant Leader

Consultants: Kenneth Anderson, Regional Biologist, Dept. Inland Fisheries and Game

Harold Gausman, Professor of Soil Chemistry

During the quarter, several aspects of the study were initiated. Included was spring sampling of snails and collection of soil samples from the impounded and control ditches. A total of ten areas, including three potholes, containing

small Ruppia seedlings were mulched early in the spring, and another 10 adjacent areas served as controls. It is felt through past field observation that water currents resulting from wind action seriously damages Ruppia seedlings in the soft pothole bottoms.

Pothole seeds have been mulched in the three treatment ditches. Fifty seeds were planted per ditch in two groups of 25. Six experimental ditches of the nine were mulched with seed. Two ditches for the same treatment are represented in this experiment.

Ruppia seedlings were taken from two potholes in the marsh and transplanted to four potholes containing this growth and into four potholes where the plant was lacking.

Experiments to test the germination of Ruppia seeds in pothole soil already having this plant and in such soil lacking this growth was conducted in the laboratory in early spring. The experiment was conducted twice. Soil analysis for the second trial has not been completed by the soil testing laboratory. There appears to be a distinct difference in the total soluble salts of the two groups of soil. Potholes with Ruppia appear to have higher total soluble salts.

This experiment will be conducted again in the fall. In the first trial it could not be affirmed that seeds which did germinate were not already present in the soil. In the second trial, elevated temperatures in the greenhouse allowed water temperatures to reach as high as 33°C. Setchell (1924) reports that successful germination readily takes place at the temperature range 10°-18°C.

Selection of areas for impoundment in the upper elevations of the marsh have been reviewed. Small holes have been dug at potential impoundment construction sites to see if there is adequate ground water supply. Areas are being staked for size and shape and construction is planned to start soon.

Plans for next quarter:

1. Analyze snail samples and conduct fall sampling.
2. Collection of Ruppia seeds in preparation for additional germination tests.
3. Map the distribution of Ruppia on the study area.
4. Continue to collect physical and chemical data in experimental ditches and potholes containing transplants.

OUTDOOR RECREATION

Socio-Economic Characteristics of Maine Sportsmen

Objectives: (1) To identify and analyze those social, psychological, and economic variables which motivate sportsmen to hunt and fish.

- (2) To identify and analyze the reactions of the consumer to rules and regulations, administration and policy, and the opportunities for sport in Maine.
- (3) To identify and analyze the expenditures incurred by sportsmen in pursuit of hunting and/or fishing.
- (4) To compare the above information for Maine to the northeastern states in general.

Assignment: Charles H. Lobdell, Graduate Assistant

Thesis Adviser: M. W. Coulter, Assistant Leader

Consultants: Thomas J. Corcoran, Forest Economist, School of Forestry
 Sanford D. Schemnitz, Assistant Leader
 John Gill, Game Biologist, Maine Dept. Inland Fisheries and Game
 Stephan L. Finmer, Assistant Professor of Sociology

Activities during the quarter included the following: (1) three mailings of the regional questionnaire and state questionnaire were completed, and (2) a system of coding the data from the questionnaires was revised and approved at a conference of the technical committee at Hartford, Connecticut. Lobdell attended from Maine. After three mailings, the response rate is over 70 percent on both the state and regional surveys. This is in line with the projection from the pre-test of an 80 percent overall return.

Plans for next quarter:

1. Coding the data for entry on IBM cards.
2. Sampling of nonrespondents by post-card surveys and telephone interviews.
3. Developing a system of data analysis.

COOPERATIONAL, EDUCATIONAL WORK AND MISCELLANEOUS ACTIVITIES

Schemnitz attended the two-week NSF Summer Institute at the University of Michigan on "Remote Sensing of the Environment," June 19-July 2.

Coulter, Schemnitz and Mendall attended the departmental workshop of the Maine Department of Inland Fisheries and Game held at the University June 9-10. Several internationally known conservationists presented papers at a recreation panel. These included C. R. Gutermuth of the Wildlife Management Institute, Will Johns of the National Wildlife Federation, George Davis of the Bureau of Outdoor Recreation, and Richard Griffith, Regional Director of the Bureau of Sport Fisheries and Wildlife. Featured speaker at the banquet was Dr. Ira N. Gabrielson of the Wildlife Management Institute.

Mendall spent two days during June with Austin Reed, Quebec waterfowl biologist, visiting islands in the lower St. Lawrence River having high nesting densities of black ducks and eiders. He was given an excellent demonstration of the effectiveness of a helicopter in black duck nest and brood surveys in expansive Spartina and sedge-meadow marshes.

Schemnitz taught the one-week ecology course for wildlife majors at the forestry summer camp in Princeton. Coulter took the forestry and wildlife students on a day-long inspection of upland game habitat and development on the Moosehorn National Wildlife Refuge.

Coulter participated in several conferences devoted to planning details of the new forestry-wildlife building. Also, as Chairman of the Northeast Section of the Wildlife Society, he made a trip to Quebec City in ~~June~~^{April} to assist in formulating plans for the 1967 Northeastern Conference to be held there in February.

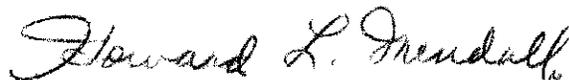
PUBLICATIONS

Baird, John C. 1966. Some Ecological Aspects of the White-tailed Deer on Isle au Haut, Maine. (Unpublished) M.S. Thesis, Univ. of Maine, Orono, 114 pp.

Coulter, Malcolm W. 1966. Ecology and Management of Fishers in Maine. (Unpublished) PhD Thesis, State College of Forestry at Syracuse Univ., Syracuse, N. Y. 183 pp.

Mendall and Coulter contributed Chapter 4, Game Resources, to the publication OUTDOOR RECREATION IN MAINE, recently released. This published report to the Governor's Advisory Council on Outdoor Recreation, was prepared by a study team through contract with the University Department of Agricultural Business and Economics and the Agricultural Experiment Station. The Unit's collaboration consisted of 7 pages of text and 9 distribution maps.

Respectfully submitted,



Howard L. Mendall, Leader
Maine Cooperative Wildlife
Research Unit

July 29, 1966

Unit
File

MAINE COOPERATIVE WILDLIFE RESEARCH UNIT

University of Maine

Orono, Maine

QUARTERLY REPORT

July-September, 1966

Cooperating Agencies

Maine Department of Inland Fisheries and Game
Wildlife Management Institute
University of Maine
U. S. Bureau of Sport Fisheries and Wildlife

NOT FOR PUBLICATION

The quarterly reports are usually statements of progress. The data presented often are incomplete and the conclusions reached may not be final. Consequently, permission to publish any of the information contained herein is withheld pending authorization from the Research Unit.

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Unit Personnel

Leader - Howard L. Mendall

Assistant Leaders - Malcolm W. Coulter (*)
Sanford D. Schemnitz (*)

University Representative - Albert D. Nutting, Director, School of Forestry

Collaborators (**) - John Gill, Maine Dept. Inland Fisheries & Game
J. William Peppard, Maine Dept. Inland Fisheries & Game
Kenneth Anderson, Maine Dept. Inland Fisheries & Game
Howard E. Spencer, Maine Dept. Inland Fisheries & Game
Harold Gausman, Professor of Soil Chemistry
David O'Meara, Associate Professor of Animal Biology
J. Franklin Witter, Head, Dept. of Animal Pathology
Thomas J. Corcoran, School of Forestry
Harold E. Young, School of Forestry
Ralph Griffin, School of Forestry
Stephen L. Finner, Assistant Professor of Sociology
George R. Cooper, Dept. of Botany
Eldon Clark, Moosehorn National Wildlife Refuge
Roy W. Stamey, Park Ranger, Acadia National Park
Paul Favour, Acadia National Park
Carl Gruener, Div. Mgmt. & Enforce., U. S. Bur. Sport
Fisheries and Wildlife
Rex Tice, Div. of Mgmt. & Enforce., U. S. Bur. Sport
Fisheries and Wildlife
Owen Seelye, Div. Mgmt. & Enforce., U. S. Bur. Sport
Fisheries and Wildlife

Graduate Assistants - Stephen H. Clark
Ronald D. Klataske
Charles H. Lobdell
F. Loy McLaughlin
Vaughn D. Rasar
Larry J. Roop

Graduate Student - Lawrence S. Barden

Secretary - Maxine L. Horne

(*) Professors Coulter and Schemnitz serve half time on the Unit program and half time on the teaching staff of the School of Forestry.

(**) Collaborators change periodically. This list includes only those who are directly cooperating or assisting in current Unit studies.

Unit Coordinating Committee

Ronald T. Speers, Commissioner, Maine Dept. Inland Fisheries & Game
Albert D. Nutting, Director, School of Forestry
Howard L. Mendall, Unit Leader

MAINE COOPERATIVE WILDLIFE RESEARCH UNIT

Quarterly Report

July-September, 1966

RESEARCH PROJECTSFUR ANIMALSEcology and Behavior of the Fisher

- Objectives: (1) To study patterns of range expansion, food habits and habitat preferences of fisher.
 (2) To study behavior patterns of the animal.
 (3) To evaluate the current role of the fisher in its new status as a major component of the carnivorous fauna of Maine.

Assignment: Malcolm W. Coulter, Assistant Leader

The final draft of a manuscript entitled "Growth and Reproduction in Maine Fishers" was prepared jointly by Coulter and P. L. Wright of the Montana Unit. It has been accepted for publication in the January 1967 issue of the Journal of Wildlife Management.

Plans for next quarter: Inactive.

WATERFOWL(a) Waterfowl Distribution and Breeding Ecology

- Objectives: To obtain data on factors influencing distribution and migration of waterfowl in Maine and to determine population densities of the important breeding species, especially the black duck and ring-necked duck, under varying habitat conditions.

Assignment: Howard L. Mendall, Leader

A few population checks were made during late summer on Unit study areas. No changes were indicated from conclusions previously reported that breeding populations of black ducks in Maine were decreased from those of a year ago.

Plans for next quarter: Data on fall flights will be obtained in connection with activities under sub-project (c).

(b) Renesting and Homing Study

Objectives: To study renesting behavior and the degree of migrational homing exhibited by waterfowl, primarily the black duck, mallard and the ring-necked duck.

Assignment: Malcolm W. Coulter, Assistant Leader
(Vermont phase conducted jointly with William Miller, former Waterfowl Project Leader, Vermont Fish and Game Service)

The final draft was prepared of the joint manuscript by Coulter and W. R. Miller entitled "Nesting and Renesting among Black Ducks, Mallards and Ring-necked Ducks." This has been accepted for publication as a P-R financed bulletin of the Vermont Fish and Game Service. It will be 60+ printed pages in length.

Plans for next quarter: Inactive.

(c) Waterfowl Hunter Bag Checks

Objectives: To determine hunter success, crippling loss, and species, sex and age composition of the kill.

Assignment: Howard L. Mendall, Leader

Inactive during the quarter.

Plans for next quarter: Limited field bag checks will be made, primarily during the early part of the season and during the special black duck coastal season that opens December 15.

(d) Eider Duck Ecology and Management(1) Ecology and Experimental Management of the American Eider in Penobscot Bay, Maine

Objectives: (1) To study the breeding ecology of the American eider with particular reference to predation and other factors limiting production.
(2) To devise and test management and inventory techniques that might be reliable with a minimum of disturbance to nesting eiders.

Assignment: Stephen H. Clark, Graduate Assistant

Thesis Adviser: Howard L. Mendall, Leader

Consultant: Harold Young, School of Forestry

All field work for the 1966 season was completed and the data were coded preliminary to statistical analysis.

Field work during July involved conclusion of intensive nesting studies on Flat Island, Goose Island, Little Bermuda Island and East Goose Rock, and the experimental management studies conducted on Mouse Island and Robinson Rock. In addition, production estimated by circular sample plots (described in the April-June Quarterly Report) was attempted on all nesting islands in the Islesboro area; also several of those in the Mussel Ridge Channel study area (Garden, Seal and Tommy islands). These were supplemented by data from Hardhead, Barred, Colt's Head, and Grass Ledge islands in the vicinity of North Haven, southeast of Islesboro. On each island sampled, circular plots of varying diameter were located on sample lines with compass and steel tape. Plots were assigned a cover type classification based on composition of the nesting cover and all nests recorded. Although nest fate could usually be determined, it proved impossible to estimate hatching success by membrane counts as these were often blown away or carried away by the gulls. However, if the subsequent statistical analysis indicates that this technique would be feasible in terms of man-hours and accuracy for estimating nesting densities and nesting success, a figure for average clutch size based upon a limited number of records could then be applied to the total number of successful nests per unit area.

Other work during the quarter involved observations from a blind of gull and eider behavior and interactions during the late stages of nesting. A little experimental trapping and marking of nesting females was undertaken. Fourteen hens were captured and marked with combinations of orange and white airplane dope in an attempt to determine the effectiveness of the method in tracing movements on the study area. Only 3 of these birds were observed after marking. It is believed that the method would be much more useful in determining eider movements if conducted during earlier stages of nesting. Trapping was done with the modified Weller traps described by Coulter in the April-June, 1966 Quarterly Report of the Unit.

Plans for next quarter: To analyze the season's data.

(2) Renesting and Homing

Objectives: To study renesting behavior and the degree of migrational homing exhibited by the American eider.

Assignment: Malcolm W. Coulter, Assistant Leader

Inactive during the quarter.

Plans for next quarter: Inactive.

(3) Annual Production and Factors Influencing Nesting Success

Objectives: To determine annual production and factors related to nesting success in breeding colonies of the Mussel Ridge Channel of Penobscot Bay.

Assignment: Howard L. Mendall, Leader

The seasonal field work was terminated during August.

Plans for next quarter: To tabulate and code the data for computation by IBM card sorter.

(4) Distribution of Eider Populations in Coastal Maine

- Objectives: (1) To locate the principal breeding colonies along the Maine coast.
 (2) To develop a satisfactory technique for aerial breeding ground inventory.
 (3) To determine the abundance and subspecific composition of fall and winter populations.

Assignment: Howard L. Mendall, Leader
 Owen Seelye, Game Management Agent, U. S. Bureau of Sport Fisheries and Wildlife

Consultants: Rex Tice, Division of Management and Enforcement, U. S. Bureau of Sport Fisheries and Wildlife
 Carl Gruener, Division of Management and Enforcement, U. S. Bureau of Sport Fisheries and Wildlife
 Howard E. Spencer, Waterfowl Biologist, Maine Dept. of Inland Fisheries and Game

Analysis of the spring aerial survey data was completed. A summary report of the 1966 studies, with recommendations for 1967, was submitted to the Regional Office.

Plans for next quarter: Bureau and Unit personnel will make as many hunter contacts as possible during the sea duck hunting season to examine specimens and obtain data on the extent of eider duck hunting in New England.

WOODCOCK

Woodcock Population Studies

Objectives: To conduct annual censuses and to obtain related ecological data on the Unit's permanent census routes in Maine.

Assignment: Howard L. Mendall, Leader
 Sanford D. Schemnitz, Assistant Leader

Inactive during the quarter.

Plans for next quarter: Inactive.

RUFFED GROUSEEcology of the Ruffed Grouse in Maine

- Objectives: (1) To study population dynamics of harvested and unharvested grouse populations; and to compare mortality rates of resident non-migratory species (grouse) and migratory species (woodcock) on the same area.
- (2) To determine cover preferences and use of forest clearings by adults and broods in spring and summer.
- (3) To study the causes of juvenile mortality and measure the incidence of blood parasites.

Assignment: Sanford D. Schemnitz, Assistant Leader

Consultants: Eldon Clark, Refuge Biologist
David O'Meara, Associate Professor of Animal Biology

For the third consecutive season the production of ruffed grouse in eastern Maine appeared low. An especially heavy decline in trapping success was noted at Edmunds. Only 4 broods were observed by the permanent and summer wildlife staff traveling over the network of roads on the Refuge. The weather conditions in general were dry although rainfall was more substantial than a year ago.

Table 1. Trap Catch, Excluding Recaptures, of Ruffed Grouse at the Moosehorn National Wildlife Refuge.

Unit	1964	1965	1966
Edmunds	64	42	8
Baring	33	57	43

Only one of the grouse banded in 1965 was recaptured in the 1966 trapping operation. This was an adult female first captured on July 10, 1965 with 4 young 4 weeks old. This same grouse was retaken this year on July 21 with 2 young 3-4 weeks old. The distance between trap sites was about 100 yards.

Four direct recoveries have been made of ruffed grouse (2 each as roadkills and hunter harvest) in 1965 and 1966. All of these were on or adjacent to the Moosehorn Refuge and represent movements of $\frac{1}{2}$ mile or less.

For the second consecutive summer spruce grouse were observed at the Edmunds Unit. Four were caught with dip nets and banded. Two broods of 6 and 5 young (3 weeks of age) were taken on July 7 and 8. One adult male was also observed at close range at the Baring Unit by a summer student. All 5 observations of spruce grouse were made in dense spruce-fir vegetation.

In contrast to 1965 when nearly all grouse handled were parasitized by ecto-parasites, this year ticks (Haemaphysalis leporis palustris) and other ecto-parasites were uncommon. Blood smears were collected in 1966 from ruffed and spruce grouse for blood parasite analysis. Graduate Assistant Klataske is

assisting with the blood smear examination. A preliminary analysis of a sample of slides has shown that 75 percent of the birds carried Leucocytozoon.

Plans for next quarter: To continue data analysis of summer banding records; and check drumming sites at Moosehorn for fall activity.

BIG GAME

(a) Ecological Relationships of White-tailed Deer and Vegetation at Acadia National Park

Assignment: M. W. Coulter and S. D. Schemnitz, Assistant Leaders
F. Loy McLaughlin, Graduate Assistant

Consultants: Harold E. Young, School of Forestry
Paul G. Favour, Chief Naturalist, Acadia National Park
Roy W. Stamey, Park Ranger, Acadia National Park
J. Franklin Witter, Department of Animal Pathology
J. William Peppard, Game Biologist, Maine Dept. Inland Fisheries and Game
John Gill, Leader, Deer Research, Maine Dept. Inland Fisheries and Game

Objectives: (1) To develop a sound statistical design for study of the influence of the deer herd upon the vegetation.
(2) To measure the influence of the current deer herd upon vegetation.
(3) To assist Park personnel in exploring and developing methods to census deer, and to study deer movements; also to develop ways for deer to be readily seen by the public.

Browse Survey

This report, prepared by McLaughlin, is a preliminary summary of computer-analyzed data obtained from a browse survey. It was based on 720 plots in 18 cover types involving 11 key species. The survey was described in detail in the January-March, 1966 Quarterly Report.

Northern white cedar, the species of major consideration, occurred on a small percentage of the plots, but, in those types where found, it was usually browsed more heavily than the other highly palatable species. However, the available cedar was not browsed more than 35 percent in any of the cover types sampled. Striped maple, red maple, paper birch, witherod, and sweet fern occurred on a high proportion of the plots but rarely were these species browsed more than 50 percent. As anticipated, there was more white cedar in the softwood and mixed softwood cover types than in the hardwood types. The highly palatable hardwood species occurred approximately as frequently as the undesirable species in the hardwood and mixed hardwood stands. There was considerable difference in browsing pressure on the "preferred" species between cover types. In conclusion, there was more available browse on the Park than was anticipated prior to the survey.

Reproductive Tracts

Examination of the reproductive tracts of 37 pregnant deer collected between January 3, 1966, and March 8, 1966, disclosed an embryo-doe ratio of 1.17 for yearling does and 1.55 for adults (21/2+). Ovary analysis of these same reproductive tracts revealed a ratio of embryos:100 corpora lutea of 100 for yearlings and 84.6 for adults. In addition, 11 corpora lutea were counted in the ovaries of seven other adult deer shot between November 11, 1965 and January 31, 1966, which were carrying no embryos.

Five corpora albicans were counted in twelve yearlings. This indicates that approximately 40 percent of the fawns ovulated, although all fawn reproductive tracts examined were barren of embryos. However, fawns breed later than adults and thus it would be difficult in this study to detect pregnant fawns, since the herd reduction program ceased during the first week of March.

Breeding dates were determined by aging embryos. The breeding intensity reached a peak during the last week in November at which time 62.1 percent of the deer bred.

Considerable assistance with population analyses and reproductive tract examinations was kindly provided by several of the technical personnel of the New York Conservation Department, especially C. W. Severinghaus, Stuart Free, and William Hesselton.

Type Map

Further checks of the cover type map were made from the air with an airplane supplied by the Maine Department of Inland Fisheries and Game. No major errors were discovered.

Plans for next quarter: The same information that was obtained last year during the herd reduction program will be collected again this year. In addition, the lower jaws will be collected to facilitate aging the Park deer since abnormal tooth wear has been detected in these deer. Data analysis concerning the browse survey and the deer population will be continued.

(b) Influences of Known Populations of Deer Upon Forest Vegetation

- Objectives: (1) To measure the influence of a known population of deer upon forest vegetation.
 (2) To develop and test more adequate deer census methods than those currently available.

Assignment: Sanford D. Schemnitz, Assistant Leader

Consultants: Malcolm W. Coulter, Assistant Leader
 J. Franklin Witter, Department of Animal Pathology

At the suggestion of the Game Division, Maine Department of Inland Fisheries and Game, the release of two deer at Outer Heron Island has been delayed until the 1966 hunting season ends in December. This will help to

prevent molestation of the deer by hunters. It is planned for the island to be posted against future deer hunting as a game management area with the authorization of the Commissioner of Inland Fisheries and Game.

Plans for next quarter: Release deer at Outer Heron Island.

(c) Pilot Radio-Tracking Studies of White-tailed Deer

Objectives: To test the efficiency and accuracy of telemetry equipment on semi-tame deer within fenced enclosures on the University Forest.

Assignment: Sanford D. Schemnitz, Assistant Leader

Assistant: Thomas Allen, Undergraduate Wildlife Science student

Improvements were made in solar-powered transmitters. Wires were coated to avoid corrosion. An expandable collar made of 2 sheets of plastic 1/16" in thickness, and 2½" wide, constructed to surround a flexible steel band 7/8" wide imbedded in the plastic. These sheets of plastic were glued and rivetted together. This collar will allow neck expansion on bucks during the fall rutting season.

The antlers were removed from 2 adult males housed at the deer pen to avoid hazard to students feeding the animals during the rutting season. Two Michigan-type double-door deer traps were built to facilitate handling the animals.

Plans for next quarter: Continue to test various modifications of experimental transmitters.

(d) An Evaluation of Deer Census Techniques, and the Physical Condition of Deer on Isle au Haut

- Objectives:
- (1) To develop and test deer census techniques with particular emphasis on strip census methods.
 - (2) To study the influence of deer distribution and cover type usage on census techniques.
 - (3) To determine the physical condition and sex and age composition of the deer herd at Isle au Haut.

Assignment: Ronald D. Klataske, Graduate Assistant

Thesis Adviser: Sanford D. Schemnitz, Assistant Leader

Consultants: Paul Favour, Acadia National Park
 John Gill, Maine Dept. Inland Fisheries and Game
 J. Franklin Witter, Head, Dept. of Animal Pathology
 Malcolm W. Coulter, Assistant Leader

Seventeen deer were captured during the initial six nights of trapping in September, using nine clover type box traps, loaned by Henry Laramie of

the New Hampshire Fish and Game Department.

Captured deer are stretched out and their front and hind legs are tied to eye bolts along a 10-foot aluminum pole. In this position the deer are almost helpless, and can be marked, measured, and weighed easily. They are weighed by placing them on a 6-foot by 2½-foot stretcher, which is then suspended from a portable tripod with scale attached.

Estimated ages are obtained with the aid of a jaw restraining device. A loop of surgical tubing is placed around the snout and another around the jaw. Each loop contains a collar snap. When the mouth is pulled open the snaps can be attached to hooks near the ends of a 20-inch board. The teeth can then be readily observed for aging. A more refined device involving a lever is now being developed.

Deer are being marked with numbered collar flaps and with ear streamers similar to those described by Harper and Lightfoot (1966. J. Wildl. Mgmt., 30(3):461-466). By using various colors, as well as numbers and letters on the collars and streamers, individual deer can be recognized in the field. Red collar flaps are placed on females and yellow flaps on males.

Four complete strip census counts of deer on the island were conducted during mid-July, three during mid-August, and three during mid-September. Each census involved walking seven lines, totaling about 18 miles in length, which cross the island at ½ mile intervals. A total of 138 deer observations were made during these counts. The average perpendicular flushing distance was 90.1 feet, and the average direct flushing distance was calculated to be 137.7 feet. Therefore, the mean population estimate for the 6,575 acre island using the King method was 150 deer. Using the Webb method the population estimate was 228 deer.

The current year's fawn crop appeared to be small. Only 9 fawns were counted on the census lines, while 58 adult females were recorded. Likewise, adult females appeared to be more abundant than males. Twenty-one males and 58 females were recorded. However, males with small antlers may have been considered females, in some instances.

Plans for next quarter: Continue strip census counts, conduct roadside counts of marked and unmarked deer, and continue trapping and marking operations.

(e) Ecology of White-tailed Deer in a Low Harvest Area of Eastern Maine

- Objectives: (1) To determine the causes of the low deer kill in a block of 21 townships in Hancock and Washington counties.
 (2) To relate these findings to area management suggestions.

Assignment: Larry J. Roop, Graduate Assistant

Thesis Adviser: Sanford D. Schemnitz, Assistant Leader

Consultants: J. William Peppard, Dept. Inland Fisheries and Game
 John Gill, Dept. Inland Fisheries and Game
 Harold Young, School of Forestry,

A preliminary analysis was made of the postal hunter survey from the past six years' data collected by the Maine Department of Inland Fisheries and game. A sample of 1,428 questionnaires was drawn for the 49 townships included in the study area. By use of two, three, and four-way comparisons of such aspects as hunter success, resident (in-state or out-of-state), and days hunted, it was shown that there was little or no difference in these characteristics. As with the number of deer killed in each township, the number of questionnaires returned from different townships varied greatly within the two areas. However, the average number of questionnaires per township, 2.1 in the low-kill area and 6.7 for the periphery, showed a distinctive difference. If the proportion of questionnaire returns is representative of the actual distribution of hunters, this might be interpreted as meaning that the ratio of hunters in the low-kill area to the periphery would be 1:3.2. This ratio is exactly proportional to the deer kill within the two groups of townships.

There were 1,179 deer registered for the entire study area during the 1965 hunting season, 205 of which were from the low kill area. Data for this study were obtained from 164 of these deer by state game biologists and students from the University of Maine. The average deer killed per town was 10.3 for the low-kill area and 33.6 for the periphery. Stated on a kill per square mile basis, this would be .35 and 1.10 respectively. The ratio of fawns per 100 does was .59 and .68 for the two areas, which is comparable to results from other forest interior sections. The percent of deer killed by non-residents was 34.6 in the low-kill area and 40.3 for the periphery, which corresponds with 35.0 percent for the entire southeastern section of the State.

Plans for next quarter: Checks will be undertaken again this year at deer registration stations and hunter camps to obtain sex, age, weight, and measurements of the deer from the study area. Two or three aerial flights will be made on Saturdays to obtain an index of hunter distribution by vehicle counts. In addition, the traffic flow will be measured on gravelled logging roads leading into the area through the use of counters to be put out by the State Highway Commission. Interviews with successful hunters will be used to supplement information from other sources.

SALT MARSH ECOLOGY

Factors Affecting the Production of *Ruppia* and Macroinvertebrates in a Salt Marsh

- Objectives:
- (1) To determine factors which affect the production of widgeon grass, *Ruppia maritima*.
 - (2) To further investigate the effects of plugged ditches upon production of *Ruppia* and on populations of macroinvertebrates.
 - (3) To further investigate the effects of plugged ditches on mosquito reproduction.

Assignment: Vaughn Rasar, Graduate Assistant

Thesis Adviser: M. W. Coulter, Assistant Leader

Consultants: Kenneth Anderson, Regional Biologist, Dept. Inland Fisheries
and Game

George Cooper, Professor of Botany

Harold Gausman, Professor of Soil Chemistry

Field studies completed during the quarter included:

1. Weekly measurements of temperature, salinity, and pH in selected potholes and all experimental ditches.
2. Turbidity readings were taken twice for each experimental ditch.
3. The influence of mulching upon the establishment of widgeon grass seedlings was tested.
4. The influence of baffles to reduce wave action and improve the establishment of widgeon grass was tested.
5. Widgeon grass plants were transferred to potholes lacking this species and to ditches to determine if the plants would survive in these environments.
6. Potholes and ditches were inspected twice for presence or absence of water and widgeon grass growth.
7. The phenology of the disappearance and reappearance of widgeon grass as related to water fluctuation and algae blooms was mapped and described for 273 potholes and 35 ditches.
8. Mosquito production was studied by sampling as well as from frequent observation.
9. Fall sampling of snails in all experimental ditches was completed.
10. A simplified technique was developed for separating snails from mud samples. An average of 26 minutes was required to separate one sample.
11. More than 1700 widgeon grass seeds were collected in preparation for greenhouse germination tests.

Some of the highlights resulting from the above work are discussed as follows:

Establishment of widgeon grass using mulch and baffles

Observations made throughout the summer indicates that small widgeon grass seedlings are susceptible to being uprooted by wave action caused by wind, especially in soft bottom areas. Baffles installed in a large open pothole proved to successfully reduce wave action and consequently improve widgeon grass growth. Results of mulching in some areas with marsh hay did not yield reliable results because (1) areas were mulched after the seedlings had already appeared (2) failure to locate all the mulched areas in direct exposure to prevailing winds and (3) settling of algae over widgeon grass growth after rain storms. Areas protected from wave action by baffles produced luxuriant

growths of widgeon grass, but areas adjacent to the baffles at points where no protection was offered revealed either an absence or reduced growth of the plant.

It is likely that baffles would be more feasible and reliable for protecting stands of widgeon grass in large open potholes. Reasons are: (1) waves are actually reduced whereas mulching only provides an aid to anchoring the seedlings; (2) baffles would not have to be replaced annually as would mulch.

Transplanting

Transplants in potholes lacking widgeon grass did not survive, whereas only one seedling out of 40 failed to survive in potholes supporting widgeon grass. Comparisons between these areas show: (1) a highly significant difference in temperature (temperatures are an average of 5.5°C higher in potholes lacking the growth), (2) potholes supporting widgeon grass are an average of 8 inches deep and potholes lacking the growth are an average of 4 inches deep, (3) salinities and total soluble salts are slightly higher in potholes without widgeon grass growth.

Transplanting in the experimental ditches can be summarized by the following table:

Response of Transplanted Widgeon Grass

Impoundment	Ditch	Number of Plants			Vegetative Growth
		Survived	Flowered	Fruited	
8-inch	A	1	4	5	5 grams
	C	2	31	12	--
16-inch	B	10	112	37	163 grams
	D	9	33	5	--
Control	E	2	1	0	Small stands 1 gram
	*E ₂	2	0	1	Small stands 1 gram

*E₂ is not an experimental ditch but is the same as a control ditch.

Low survival in the 8-inch impoundments does not necessarily mean poor response of the widgeon grass at this depth of water. Eight-inch impoundments do not hold a full 8 inches of water due to a ditch gradient and sedimentation behind these impoundments since their installation in the spring of 1964. In some cases, the plants were exposed to only a few inches of water or to "trickles" during low tides. Survival of plants in control ditches was primarily due to transplants located in depressions in the ditch where water was not completely drained during low tides.

Phenology of widgeon grass growth

Germination of widgeon grass on the Weskeag Marsh started approximately May 5, 1966. By May 13th seedlings were 1-2 inches tall and a week later

growths had reached 3 to 4 inches. Algae blooms were noticeable, especially around the edges of the potholes by June 4. At this time, there was an apparent difference in the growths of widgeon grass within and outside of algae blooms. Widgeon grass was much more profuse within algae blooms, averaging approximately 10-12 inches in height. Plants outside of algae blooms still remained 3-4 inches tall and appeared to have changed very little since the May 13 observation. Much flowering and fruiting of widgeon grass occurred throughout the marsh from June 14 and into the fall.

The distribution of widgeon grass on the lower portion of the Weskeag Marsh was mapped between July 4 to 15. This was at a time when much of the marsh was very dry and indicated those areas which are capable of retaining water during extreme dry periods; it also illustrated the effect of water evaporation and drying on the survival of the plant. The following table summarizes the results:

Type of Area	Total	Areas with Widgeon Grass	Areas with Widgeon Grass which Dried	Percentage of Total Areas with Widgeon Grass which Dried
Pothole	273	86	40	46.5
Ditch	35	10	10	20.0

The above summarization indicates the importance of evaporation and drying of potholes as an ecological factor affecting the abundance of widgeon grass. Many of the potholes which dried up were less than 10 inches deep and most were much shallower than this.

Algae blooms appeared to have a beneficial effect on initial establishment of widgeon grass. As the summer progressed, however, algae growths finally matted all widgeon grass until none could be seen unless the algae mats were pulled back. Peak algae growths on the Weskeag appeared in early July. Heavy rain storms ultimately sank much of the algae during July but several potholes throughout the marsh still retained heavy blooms. These were later floated off the potholes by spring tides. Sinking algae covered up much of widgeon grass growth that ordinarily would have been available to waterfowl and algae which floated out of the potholes by spring tides was observed to have carried entangled stems and leaves of the widgeon grass with it. The latter, however, is believed of little significance.

Mosquito production

Mosquito production on the Weskeag Marsh was not observed to any great extent until June 20, 1966, at which time several mosquito larvae (Aedes sollicitans) were noted throughout the marsh in small depressions 2-5 feet in diameter. Hatching of mosquito larvae was observed to be most successful when periods of dry weather were followed by spring tides or heavy rains. An interesting observation was made on July 27 when mosquito larvae were found in abundant numbers in cow tracks on the edge of the marsh after a spring tide. An estimate of over 50 wigglers per cow track was made. This is an important factor in increasing mosquito numbers on the marsh. The presence of mummichogs (Fundulus heteroclitus) is a deterrent to mosquito production as previously pointed out.

Fall snail sampling

Fall collections of snails has been completed. The usual six sampling stations were chosen by use of a table of random numbers. An additional four samples were taken from locations selected so as to allow a series of sampling points as close to each other as possible. The additional samples were taken to aid in interpreting the distribution of snails. Bottom substrate characters were recorded for comparisons with the actual snail numbers at the various sampling points.

A promising technique for sorting out the small snails from the marsh mud has been developed. The use of a shampoo head sprayer connected to a sink faucet has been used to differentially float out light trash (stems, roots and silt) by placing the sample in a white porcelain pan. With increase experience and refinement of the technique, the method allowed mud sample to be cleaned in an average of slightly over six minutes. Sorting out the snails from the remaining material in the porcelain pan requires approximately 10-20 minutes per sample depending on the numbers in each sample.

More than 1700 widgeon grass seeds were collected and sorted from the current year's growth in preparation for greenhouse germination tests. An additional area supporting widgeon grass was screened with 1-inch cord mesh approximately one foot above the water surface. This was done to protect the growth from feeding waterfowl in case additional seeds are required or the others are not viable.

Plans for next quarter:

1. Conduct temperature experiments on the respiration of widgeon grass.
2. Conduct greenhouse germination and growth experiments using four controlled temperature levels.
3. Complete sorting of snails and analyze the data.
4. Conduct scarification of widgeon grass seed by use of chemicals.
5. Collect some waterfowl from the Weskeag Marsh for food habits studies.

OUTDOOR RECREATIONSocio-Economic Characteristics of Maine Sportsmen

- Objectives: (1) To identify and analyze those social, psychological and economic variables which affect participation in sport hunting and fishing.
- (2) To project demand for hunting and/or fishing in Maine.

Assignment: Charles H. Lobdell, Graduate Assistant

Thesis Adviser: M. W. Coulter, Assistant Leader

Consultants: Thomas J. Corcoran, Forest Economist, School of Forestry
 Sanford D. Schemnitz, Assistant Leader
 Stephen L. Finner, Assistant Professor of Sociology
 John D. Gill, Game Biologist, Maine Dept. Inland Fisheries
 and Game

Activities during the quarter included the following: (1) 685 state questionnaires and 1,022 regional questionnaires were coded and the results were entered onto IBM cards; (2) a post card survey was mailed to all non-respondents; (3) a system of data analysis was proposed and submitted to the chairman of the technical committee for consideration and review; and (4) a meeting of the regional committee was attended in New York City to review the year's progress and to consider various types of data analysis.

The coding of the questionnaires was greatly facilitated by the cooperation of Charles Milmime and Arthur Wimble, Graduate Assistants in Forest Economics; and by Lobdell's wife. Their cooperation reduced the estimated coding time from 20 weeks to six.

A system of data analysis was developed during the quarter. Basically, a summary analysis will be performed using two-way and three-way tables, with appropriate statistical tests. Primary relationships to be contrasted include: age, license type, residence, education, rural or urban youth background, occupation, amount of leisure time, total years' hunting/fishing, and sex; in relation to number of trips afield in 1965 (regional analysis) and sport preference (state analysis).

Licenses of the non-respondents from the postal survey were drawn from the files of the Maine Department of Inland Fisheries and Game to determine the age composition of the non-respondent population. In theory, if there is no statistically significant difference in the age composition of the respondent and non-respondent populations, the relationships involving age may be generalized from the respondent to non-respondent population.

Plans for next quarter:

1. Analyze the data from both the state and regional surveys.
2. Compare the respondent and non-respondent populations.
3. Initiate writing of thesis.

SPECIAL STUDY

During September, 1961 Unit personnel sampled a tidal cove where it was expected that pollution from a new tannery would be dumped; also an adjacent area which was not likely to be affected. Emphasis was placed on determining the abundance of invertebrate organisms important as waterfowl food.

The area now has been receiving effluent from the tannery for approximately 5 years. During the last of the current quarter, Unit personnel began re-sampling this area and the adjacent control area. Early results suggest striking changes during the 5 year period. A detailed report of this study will be given in the next Unit Quarterly Report. Graduate Assistant Clark took charge

of this fall's sampling, with help from other graduate assistants, under Coulter's overall supervision.

COOPERATIONAL, EDUCATIONAL WORK AND MISCELLANEOUS ACTIVITIES

Dr. Lee Yeager, of the Washington Office, in charge of Cooperative Wildlife Research Units, spent the week of September 12 in an official inspection of the Maine Unit. Most of the period was devoted to field inspection of the Unit's coastal studies in Knox County and upland study areas of Washington County. Informal conferences were held with Fish and Game personnel in Augusta; also with personnel of the Moosehorn National Wildlife Refuge at Calais and Bureau of Commercial Fisheries at the Boothbay Harbor Laboratory. In Orono, Dr. Yeager met with University wildlife staff and graduate students for a two-hour seminar, at which State regional biologist Peppard also took part. Mendall accompanied Dr. Yeager throughout the week and Coulter participated much of the time.

Coulter and Schemnitz gave several lectures to students enrolled in the first Junior Forester's Institute in Maine, sponsored in cooperation with Scientists of Tomorrow. Introductory lectures to the 80 high school students from 10 states included wildlife ecology, wildlife management, and lectures and discussions on the opportunities in wildlife conservation.

Considerable time was devoted by Coulter to final plans for the new Forestry-Wildlife building. It is expected that bids will be let sometime during November.

The wildlife staff devoted several days to discussion and revision of undergraduate as well as graduate programs. Course content, requirements, needs in supporting areas and other aspects were studied and recommendations made to the Director, School of Forestry.

Schemnitz, Klataske, Roop, and McLaughlin participated in the Northeast Deer Group meetings August 24-26 at Durham, New Hampshire.

Schemnitz conferred with Professor Frank Beyer, K. Hendrn of the Maine Forest Service, and Mrs. Evans of the Bangor Garden Club on the management of Prentiss Woods, near Bangor High School, as a nature center and an ecological study area for high school biology students.

Coulter, Schemnitz, Mendall, Clark and Rasar attended portions of the 3-day training session on wetland ecology for Game Division personnel. This was a field training school conducted in August by Francis Uhler of the Patuxent Research Center.

Mendall participated in the annual meeting of the Maine Waterfowl Council held in Augusta in August.

Respectfully submitted,

Howard L. Mendall
Howard L. Mendall, Leader
Maine Cooperative Wildlife
Research Unit

November 15, 1966

Unit Copy

MAINE COOPERATIVE WILDLIFE RESEARCH UNIT

University of Maine

Orono, Maine

QUARTERLY REPORT

October-December, 1966

Cooperating Agencies

Maine Department of Inland Fisheries and Game
Wildlife Management Institute
University of Maine
U. S. Bureau of Sport Fisheries and Wildlife

NOT FOR PUBLICATION

The quarterly reports are usually statements of progress. The data presented often are incomplete and the conclusions reached may not be final. Consequently, permission to publish any of the information contained herein is withheld pending authorization from the Research Unit.

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Unit Personnel

Leader - Howard L. Mendall

Assistant Leaders - Malcolm W. Coulter (*)
Sanford D. Schemnitz (*)

University Representative - Albert D. Nutting, Director, School of Forestry

Collaborators(**) - John Gill, Maine Dept. Inland Fisheries & Game
J. William Peppard, Maine Dept. Inland Fisheries & Game
Kenneth Anderson, Maine Dept. Inland Fisheries & Game
Howard E. Spencer, Maine Dept. Inland Fisheries & Game
Harold Gausman, Professor of Soil Chemistry
J. Franklin Witter, Head, Dept. of Animal Pathology
David O'Meara, Associate Professor of Animal Biology
Thomas J. Corcoran, School of Forestry
Harold E. Young, School of Forestry
Ralph Griffin, School of Forestry
Stephen L. Finner, Assistant Professor of Sociology
George R. Cooper, Dept. of Botany
Gerald Dube, University Computer Center
Eldon Clark, Moosehorn National Wildlife Refuge
Roy W. Stamey, Park Ranger, Acadia National Park
Paul Favour, Chief Naturalist, Acadia National Park
Carl Gruener, Div. Mgmt. & Enforce., U. S. Bur. Sport
Fisheries and Wildlife
Rex Tice, Div. of Mgmt. & Enforce., U.S. Bur. Sport
Fisheries and Wildlife
Owen Seelye, Div. Mgmt. & Enforce., U. S. Bur. Sport
Fisheries and Wildlife

Graduate Assistants - Stephen H. Clark
Ronald D. Klataske
Charles H. Lobdell
F. Loy McLaughlin
Vaughn D. Rasar
Larry J. Roop

Graduate Student - Lawrence S. Barden

Secretary - Maxine L. Horne

(*) Professors Coulter and Schemnitz serve half time on the Unit program and half time on the teaching staff of the School of Forestry.

(**)Collaborators change periodically. This list includes only those who are directly cooperating or assistant in current Unit studies.

Unit Coordinating Committee

Ronald T. Speers, Commissioner, Maine Dept. Inland Fisheries & Game
Albert D. Nutting, Director, School of Forestry
Howard L. Mendall, Unit Leader

MAINE COOPERATIVE WILDLIFE RESEARCH UNIT

Quarterly Report

October-December, 1966

RESEARCH PROJECTS

FUR ANIMALS

Ecology and Behavior of the Fisher

- Objectives: (1) To study patterns of range expansion, food habits and habitat preferences of fisher.
 (2) To study behavior patterns of the animal.
 (3) To evaluate the current role of the fisher in its new status as a major component of the carnivorous fauna of Maine.

Assignment: Malcolm W. Coulter, Assistant Leader

Inactive during the quarter.

Plans for next quarter: Inactive.

WATERFOWL

(a) Waterfowl Distribution and Breeding Ecology

- Objectives: To obtain data on factors influencing distribution and migration of waterfowl in Maine and to determine population densities of the important breeding species, especially the black duck and ring-necked duck, under varying habitat conditions.

Assignment: Howard L. Mendall, Leader

Data on fall flights were gathered in connection with work on sub-project (c).

Plans for next quarter: Inactive.

(b) Renesting and Homing

- Objectives: To study renesting behavior and the degree of migrational homing exhibited by waterfowl, primarily the black duck, mallard and the ring-necked duck.

Assignment: Malcolm W. Coulter, Assistant Leader
 (Vermont phase conducted jointly with William Miller, former Waterfowl Project Leader, Vermont Fish and Game Service)

Inactive during the quarter.

Plans for next quarter: To make final manuscript revisions following comments by technical reviewers and submit the material to the printer. As pointed out previously, this is to be published as a bulletin of the Vermont Fish and Game Service.

(c) Waterfowl Hunter Bag Checks

Objectives: To determine hunter success, crippling loss, and species, sex and age composition of the kill.

Assignment: Howard L. Mendall, Leader

Unit staff and graduate assistants conducted hunter bag checks on the opening day and second Saturday of the regular season, and on several days of the special black duck season. In addition staff members conducted checks intermittently throughout the fall.

The number of hunters afield on opening day appeared below average. Hunting success averaged somewhat below that of 1965, but there was considerable variation by areas. During the balance of October and the first of November, waterfowl populations were very low and hunting activity declined rapidly. Conditions improved gradually through November, especially on the coast. But, on the whole, the season must be considered as rather mediocre.

Very mild weather prevailed during the first two weeks of the experimental black duck season which opened December 15. Hunting pressure on areas checked by Unit personnel exceeded what had been expected. Many small coastal bays and tidal streams, normally iced over by mid-December, were open, and hunters took full advantage of this. Black duck populations, disappointingly low in October and much of November, had noticeably increased. During field checks, more gunners were observed on several week days of the experimental season than were noted on most Saturdays of the regular hunting period on the coast.

Shooting success was higher than during the regular season even allowing for the additional bird legally permitted in the bag. It should be emphasized, however, that Unit studies were of necessity restricted to a relatively small portion of the coast, primarily Waldo and western Hancock counties. These observations may not be representative of Maine's coast as a whole. Several reports from western and west-central Maine indicate that, by comparison, hunting pressure as well as shooting success was lower.

The latter part of the season on the Unit check areas was of little consequence. Very few hunters were afield and shooting success declined. Colder, and more normal, weather sealed off many of the coves and tidal streams. Also many hunters apparently did not obtain the necessary new State license after December 31.

Plans for next quarter: Inactive.

(d) Eider Duck Ecology and Management(1) Ecology and Experimental Management of the American Eider in Penobscot Bay, Maine

- Objectives: (1) To study the breeding ecology of the American eider with particular reference to predation and other factors limiting production.
- (2) To devise and test management and inventory techniques that might be reliable with a minimum of disturbance to nesting eiders.

Assignment: Stephen H. Clark, Graduate Assistant

Thesis Adviser: Howard L. Mendall, Leader

Consultants: Harold Young, School of Forestry
Gerald Dube, University Computer Center

During the quarter the following phases of the project were completed:

1. Data from the experimental management areas on Mouse Island and Robinson Rock were summarized in final form and analyzed statistically.
2. Cover type acreages for Flat and Little Bermuda islands were measured and nesting density and hatching success by cover type was determined. Statistical tests were made on the Flat Island data.
3. Gull and eider nesting data from Flat, Little Bermuda, Goose, and East Goose Rock islands were coded and punched on IBM cards.
4. Sorting of the tabulated data needed for various statistical tests was done using an IBM electronic sorting machine. A preliminary statistical analysis was made with considerable help from Graduate Assistant Lobdell.
5. Sampling data for nest density and production estimates were analyzed. The necessary sampling intensities required to achieve predetermined accuracy levels under varying cover types were calculated.

Results

Experimental management procedures that were applied to Mouse Island and Robinson Rock were outlined in the April-June Quarterly Report.

(A) On Mouse Island, evidence indicates that induced renesting by gulls was confined to the experimental area. Of 23 breeding pairs of black-backed gulls (Larus marinus) nesting prior to May 16, 18 are known or suspected to have renested in the immediate vicinity of their first nest. This was also true for 7 of 15 herring gulls (Larus argentatus). Both species usually abandoned the area upon failure of their second nesting attempt.

The eider production for each cover type in the gull control area was calculated, and hatching success was compared by type to Choate's 1965 data for this island. In all types, percentage of successful nests was lower in 1966 but the difference was not statistically significant.

It was concluded that the overall effect of the control experiments was to free the gulls from incubation and parental responsibilities at a time when nesting eiders were most vulnerable to predation. Therefore, gull nest destruction on eider islands is not recommended for management purposes.

(B) Analysis of the Robinson Rock data revealed that the majority of the gulls abandoned oil-sprayed nests near the end of the normal incubation period. However, the incubation of a number of breeding pairs was extended several weeks. No large scale abandonment of the area occurred, and few renests were found.

A comparison of 1966 eider hatching success on Robinson Rock with data reported by Choate for 1964 is given below:

Year	Hatched	Failed	Total	Percent Success
1966	44	138	182	24
1964	33	85	118	28

This difference in the proportion of successful nests was not found to be significant. Nevertheless, the effect of the gull control measures on eider production is believed to have been detrimental.

The second phase of the field work was concerned with eider nesting ecology and factors limiting optimum production. Nesting data for the islands used is given below:

Island	Hatched	Destroyed	Abandoned	Unknown	Percent	
					Hatched	Total
Goose	16	85	0	2	15.5	103
East Goose	27	38	4	1	38.6	70
Flat	56	15	12	1	61.7	84
Little Bermuda	11	0	7	0	61.0	18
Totals	110	138	23	4	40.6	275

The data were arranged in two-way tables and tested for significance using chi-square. In each test, nest success was compared for the following variables:

1. Islands**
2. Week of nest initiation**
3. Week of fate**
4. Cover type**
5. Clutch size (complete nests)**
6. Degree of side cover**
7. Minimum overhead concealment (N.S.)
8. Minimum side concealment*
9. Maximum overhead concealment (N.S.)
10. Maximum side concealment (N.S.)

11. Distance into heavy cover**
12. Proximity to eider nests*
13. Proximity to herring gull nests*
14. Proximity to black-backed gulls nests**
15. Proximity to gull perching areas*
16. Numbers of eiders nesting within 10'*
17. Number of gulls nesting within 15' (N.S.)

*Significant (P = 0.05)

**Highly significant (P = 0.01)

(N.S.) Not significant (P < 0.05)

This phase of the analysis is incomplete. Results thus far indicate that eiders on Flat and Little Bermuda islands had a significantly higher nesting success (61.7 percent and 61.0 percent, respectively) than eiders on Goose Island and East Goose Rock. Also, nesting success declined as the season progressed. A significant difference was also found between certain cover types; nests initiated in shrub cover were more successful than nests initiated in types offering less cover and concealment, such as grass.

To test the relationship of gull nesting chronology to eider nest destruction, gull nest initiation and hatching data for Goose Island and East Goose Rock were compared to eider nest predation peaks. A strong positive correlation was found between numbers of herring gulls in their early stages of incubation and predation on eiders, as well as between numbers of hatched black-backed gull nests and eider losses to predation. This is believed due to the fact that, following hatching of their nests, black-backed gulls exhibit progressively less territoriality, and hence less harassment to the herring gulls. The latter, therefore, have increased opportunities to prey upon eiders.

The sampling data for nesting density and production estimates were analyzed. Islands and procedures used were given in the July-September Quarterly Report. On each island, 3 basic cover types were recognized:

1. Shrub growths (bayberry, rose, raspberry) or heavy umbelliferous growth (cow parsnip); provides good to excellent nest cover and/or concealment.
2. Grass; provides some side concealment but little or no cover.
3. Miscellaneous herbs; provide practically no cover or concealment until late in the season.

A total of 170 plots were taken in the presample. Using these data, the number of plots needed to estimate nesting densities and production by type with predefined sampling errors and probability levels was calculated. Results of the analysis indicated that the same level of sampling accuracy could be attained with fewer plots if data from all types were combined. It is believed that the technique would prove feasible for estimating nest density and production if the acreage of eider nesting cover for the region in question were known.

Plans for next quarter:

1. To continue analysis of the 1966 data.

- 2. To complete a literature review.
- 3. To plan the 1967 field work.

(2) Renesting and Homing

Objectives: To study renesting behavior and the degree of migrational homing exhibited by the American eider.

Assignment: Malcolm W. Coulter, Assistant Leader

Inactive during the quarter.

Plans for next quarter: Inactive.

(3) Annual Production and Factors Influencing Nesting Success

Objectives: To determine annual production and factors related to nesting success in breeding colonies of the Mussel Ridge Channel of Penobscot Bay.

Assignment: Howard L. Mendall, Leader

The 1966 data were coded and punched on cards for computation by IBM electronic card sorter.

Plans for next quarter: To analyze the tabulated data.

(4) Distribution of Eider Populations in Coastal Maine

- Objectives:
- (1) To locate the principal breeding colonies along the Maine coast.
 - (2) To develop a satisfactory technique for aerial breeding ground inventory.
 - (3) To determine the abundance and subspecific composition of fall and winter populations.

Assignment: Howard L. Mendall, Leader
Owen Seelye, Game Management Agent, U. S. Bureau of Sport Fisheries and Wildlife

Consultants: Rex Tice, Division of Management and Enforcement, U.S. Bureau of Sport Fisheries and Wildlife
Carl Gruener, Division of Management and Enforcement, U.S. Bureau of Sport Fisheries and Wildlife
Howard E. Spencer, Waterfowl Biologist, Maine Dept. of Inland Fisheries and Game

Unit personnel and Federal Game Management agents of the New England States contacted a number of sea duck hunters and arranged to examine specimens

for sub-species determination; also to obtain specimens for Unit study and for the Migratory Bird Population Station. Graduate Assistant Rasar is conducting a plumage study of all eiders obtained.

Plans for next quarter: To continue examination of specimens.

WOODCOCK

Woodcock Population Studies

Objectives: To conduct annual censuses and to obtain related ecological data on the Unit's permanent census routes in Maine.

Assignment: Howard L. Mendall, Leader
Sanford D. Schemnitz, Assistant Leader

Inactive during the quarter.

Plans for next quarter: Inactive.

RUFFED GROUSE

Ecology of the Ruffed Grouse in Maine

- Objectives:
- (1) To study population dynamics of harvested and unharvested grouse populations; and to compare mortality rates of resident non-migratory species (grouse) and migratory species (woodcock) on the same area.
 - (2) To determine cover preferences and use of forest clearings by adults and broods in spring and summer.
 - (3) To study the causes of juvenile mortality and measure the incidence of blood parasites.

Assignment: Sanford D. Schemnitz, Assistant Leader

Consultants: Eldon Clark, Refuge Biologist
David O'Meara, Associate Professor of Animal Biology

A check was made in November of known grouse drumming sites at both the Moosehorn National Wildlife Refuge and the University Forest. Evidence, through droppings, feathers or of the birds themselves, was found of recent occupation by grouse assumed to be males on 10 of 23 sites used last spring.

One recovery of a banded male grouse was obtained December 15, 1966 as a roadkill. It had been banded May 2, 1966 on a drumming log in the University Forest. This grouse was recovered 0.3 miles from its drumming site. This localized movement corresponded to similar findings for telemetered male ruffed grouse studied at Cloquet, Minnesota.

Plans for next quarter: Detailed analysis of grouse banding data will be made using an electronic card sorter and IBM 1620 computer in consultation with Eldon Clark, Refuge Biologist.

BIG GAME(a) Ecological Relationships of White-tailed Deer and Vegetation at Acadia National Park

Assignment: M. W. Coulter and S. D. Schemnitz, Assistant Leaders
F. Loy McLaughlin, Graduate Assistant

Consultants: Harold E. Young, School of Forestry
Paul G. Favour, Chief Naturalist, Acadia National Park
Roy W. Stamey, Park Ranger, Acadia National Park
J. Franklin Witter, Department of Animal Pathology
J. William Peppard, Game Biologist, Maine Dept. Inland Fisheries and Game
John Gill, Leader, Deer Research, Maine Dept. Inland Fisheries and Game

- Objectives: (1) To develop a sound statistical design for study of the influence of the deer herd upon the vegetation.
(2) To measure the influence of the current deer herd upon vegetation.
(3) To assist Park personnel in exploring and developing methods to census deer, and to study deer movements; also to develop ways for deer to be readily seen by the public.

McLaughlin completed a detailed analysis of the browse survey which was described in the January-March, 1966 Quarterly Report. Eleven key species were chosen for sampling on the basis of relative abundance and palatability. These indicator species are believed to offer a representative example of range conditions on the Park. They are white cedar, striped maple, red maple, paper birch, witherod, red oak, juniper, lambkill (sheep laurel), sumac, sweet fern, and balsam fir.

Based on availability and utilization, white cedar, striped maple, and sweet fern were three of the more important deer foods of the plant species sampled. On the other hand, balsam fir and lambkill rated high in availability but low in utilization.

Plans for next quarter: Data from deer killed during the herd reduction program on the Park will be analyzed. A preliminary draft of the thesis will be completed.

(b) Influences of Known Populations of Deer Upon Forest Vegetation

- Objectives: (1) To measure the influence of a known population of deer upon forest vegetation.
(2) To develop and test more adequate deer census methods than those currently available.

Assignment: Sanford D. Schemnitz, Assistant Leader

Consultants: Malcolm W. Coulter, Assistant Leader
J. Franklin Witter, Department of Animal Pathology

On December 19, a 1½-year-old female equipped with a solar powered transmitter (Channel 9 151 megacycles) was taken to Outer Heron Island on the Inland Fisheries and Game patrol boat piloted by Deane Jordan. The deer was released without incident. Four days later a 3½-year-old male was also transported to the island. This animal plunged into the water after the transmitter collar had been attached and swam for a few minutes before it could be driven ashore. Fortunately the transmitter and solar cell had been thoroughly waterproofed with potting compound and wrapped with electrical tape. A directional signal was received on the patrol boat from both deer on the island verifying that the transmitters were functioning.

Plans for next quarter: A trip will be made to Outer Heron Island to check on the deer and the performance of the telemetry equipment.

(c) Pilot Radio-Tracking Studies of White-tailed Deer

Objectives: To test the efficiency and accuracy of telemetry equipment on semi-tame deer within fenced enclosures on the University Forest.

Assignment: Sanford D. Schemnitz, Assistant Leader

Assistant: Thomas Allen, Undergraduate student

A test bench system has been built to measure the efficiency of the solar battery pack as a recharge circuit for the transmitter. Thus, the circuit and its components can be measured under various light intensities and temperature conditions and modified for improved performance.

Plans for next quarter: Continue to test telemetry equipment on penned deer.

(d) Evaluation of Deer Census Techniques, and the Physical Condition of Deer on Isle au Haut

Objectives: (1) To develop and test deer census techniques with particular emphasis on strip census methods.
 (2) To study the influence of deer distribution and cover type usage on census techniques.
 (3) To determine the physical condition and sex and age composition of the deer herd at Isle au Haut.

Assignment: Ronald D. Klataske, Graduate Assistant

Thesis Adviser: Sanford D. Schemnitz, Assistant Leader

Consultants: Paul Favour, Chief Naturalist, Acadia National Park
 John Gill, Maine Dept. Inland Fisheries and Game
 J. Franklin Witter, Head, Dept. of Animal Pathology
 Malcolm W. Coulter, Assistant Leader

Thirty-nine different deer have been captured to date since trapping operations were initiated in September. In addition, more than 35 recaptures have been made. Apples have been successfully used for bait in the clover-type

box traps. A few deer have entered the traps repeatedly and one has been captured 10 times.

Measurements made on captured deer include hind foot length, shoulder height, girth, total length, antler and teat measurements. The weight is obtained by placing them on a 6-foot by 2½-foot stretcher, which is then suspended from a portable tripod with scale attached. Preliminary results indicate that the deer are smaller in size and stature than the deer on the mainland.

Deer are being marked with numbered collar flaps and with colored ear streamers. Numerous observations of marked deer have been made. The residents of the island have helped greatly in this respect, and have observed over 20 of the marked deer. Most observations, like recaptures, have been within ½ mile of the initial capture location.

The jaw restraining device, described in the last Quarterly Report, has been improved with the addition of a lever which is used to pull the deer's mouth wide open. Using this device the teeth can be easily examined with the aid of a flashlight.

Five complete strip census counts of deer on the island were conducted during the quarter. The number of animals seen was slightly lower than previously reported for July, August and September.

Plans for next quarter: Continue strip census counts, conduct deer drives and track counts, and continue trapping and marking operations.

(e) Ecology of White-tailed Deer in a Low Harvest Area of Eastern Maine

- Objectives: (1) To determine the causes of the low deer kill in a block of 21 townships in Hancock and Washington counties.
 (2) To relate these findings to area management suggestions.

Assignment: Larry J. Roop, Graduate Assistant

Thesis Adviser: Sanford D. Schemnitz, Assistant Leader

Consultants: J. William Peppard, Dept. Inland Fisheries and Game
 John Gill, Dept. Inland Fisheries and Game
 Harold Young, School of Forestry

Heavy rains and flooding during the first week (November 1-6) of the 1966 hunting season delayed the arrival of many deer hunters. Stagnant air masses caused mild, humid weather throughout much of the remaining season; only a few hunters were active in the vicinity of the study area during the last three hunting days when the first good tracking snow prevailed. These adverse hunting conditions were reflected in the comparatively low deer kill and the low number of hunters.

Of the deer examined by students at registration stations and by the writer at camps and homes, 139 were from the 50 study-area townships. To this number will be added data from the deer examined by state biologists.

In addition to the measurements obtained last season, body length, shoulder height, and girth were taken from the deer this year to further aid in determining any differences in animals from within the two areas.

Data from 1,036 deer from the study area townships were obtained by state biologists between 1958 and 1964. This information has already been put on computer cards. It will be analyzed, with the deer checked during this study, by linear regression and discriminant function tests to determine possible variations between the low-yield and perimeter areas.

Fifteen traffic counters were maintained by State Highway Commission employee Gene Huff during the week of November 7-11. These counters, to sample hunter penetration into more remote sections, were adjacent to paved highways on gravel roads leading into the study area and at ten mile intervals. Aerial flights and road counts were carried on again this season as in 1965 to gain supplemental information on hunter penetration. A summary of the two aerial flights is as follows:

	Total Miles	Vehicles per Mile	Avg. Distance from Blacktop	% Vehicles at Camps	% Vehicles Trucks and Jeeps
Low-kill Area:					
Nov. 5	90	0.6	10.3	34.0	34.0
Dec. 1	100	0.4	6.2	12.0	50.6
Perimeter Area:					
Nov. 5	70	1.0	4.1	24.2	36.0
Dec. 1	60	0.4	3.6	37.9	63.0

The decrease in average distance from a blacktop road and increase in percentage of trucks and jeeps as shown in the second sampling was due in part to deteriorating conditions of the gravel roads as the season progressed. Also, a decrease in the percentage of camp hunters in the low-kill area reflects the unfavorable access conditions to these areas late in the season.

Plans for next quarter: Data analysis will be continued and thesis writing will be initiated.

SALT MARSH ECOLOGY

Factors Affecting the Production of *Ruppia* and Macroinvertebrates in a Salt Marsh

- Objectives:
- (1) To determine factors which affect the production of widgeon grass, *Ruppia maritima*.
 - (2) To further investigate the effects of plugged ditches upon production of *Ruppia* and on populations of macroinvertebrates.
 - (3) To further investigate the effects of plugged ditches on mosquito reproduction.

Assignment: Vaughn Rasar, Graduate Assistant

Thesis Adviser: M. W. Coulter, Assistant Leader

Consultants: Kenneth Anderson, Regional Biologist, Dept. Inland Fisheries
and Game
George Cooper, Professor of Botany
Harold Gausman, Professor of Soil Chemistry

Experimentation with the survival of widgeon grass seedlings during the summer field work has indicated that temperature may be critical for the production of the plant. To help evaluate this influence, a controlled temperature experiment was initiated in the University greenhouse in early November. Both germination and growth tests were conducted at temperatures 85, 75, 65, and 55 degrees F. Germination and growth over a 17-day period is summarized as follows:

Widgeon Grass Germination				
Temperature	55	65	75	85
No. Seeds Germinated	90	121	129	117
Percent Germination	45	60.5	64	58.5
Average Height of Plants	23mm	70mm	105mm	65mm

The proportion of seeds that germinated was greater ($P = .05$) at the 75° treatment than that from the other treatments. A growth experiment using rootstock was started November 25, 1966. These plants have been allowed to flower and fruit. This test is still in progress and all measurements are not complete. However, preliminary results indicate that widgeon grass growth is best in the 75°F water.

Snail counts from the 1966 fall sampling in the impounded and control ditches were carried out during the quarter. Although the statistical analysis is not complete, it is apparent that there has been a noticeable increase in the number of snails in both control and experimental ditches.

Plans for next quarter:

1. Interpretation of snail sampling data.
2. Conduct respiration experiment with widgeon grass seedlings.
3. Begin thesis writing.

OUTDOOR RECREATION

Socio-Economic Characteristics of Maine Sportsmen

- Objectives: (1) To identify and analyze those social, psychological and economic variables which affect participation in sport hunting and fishing.
- (2) To project demand for hunting and/or fishing in Maine.

Assignment: Charles H. Lobdell, Graduate Assistant

Thesis Adviser: M. W. Coulter, Assistant Leader

Consultants: Thomas J. Corcoran, Forest Economist, School of Forestry
 Sanford D. Schemnitz, Assistant Leader
 Stephen L. Finner, Assistant Professor of Sociology
 John D. Gill, Game Biologist, Maine Dept. Inland Fisheries
 and Game

During the quarter the following progress was made: (1) a detailed thesis outline was drafted and approved; (2) the age distribution, state of residence, license type, education, and rates of participation in hunting and/or fishing were determined for the non-respondent population; and (3) a plan for the statistical testing of the regional and state survey data was formulated and approved. Data analysis for both surveys is in progress.

Plans for next quarter:

1. Compare respondent and non-respondent population for similarity.
2. Interpret the data from both surveys.
3. Continue writing of thesis.

SPECIAL STUDY

The Influence of Industrial Wastes Upon Invertebrates in a Tidal Bay

It was pointed out in the July-September Quarterly Report that a special study had been conducted on the effects of pollution upon the invertebrates of a tidal bay. This project was organized by Coulter and was carried out by Graduate Assistant Clark with help from the other Unit graduate assistants. The data have now been analyzed.

An initial study by Unit personnel had been made during 1961 in two salt water coves constituting part of the Skillings River in the town of Hancock, Hancock County, Maine. Both areas were unpolluted in 1961, but it was anticipated that industrial wastes would soon be discharged into Kilkenny Cove. There appeared to be no similar threat to nearby Partridge Cove; therefore, the latter area was considered as a control to compare possible changes in the abundance of invertebrates in the area to be polluted. Field procedures involved screening 110 bottom samples (9 x 9 x 7") and counting the numbers of the various kinds of invertebrates.

The second survey was made during the fall of 1966. Wastes from the tannery had been discharged into Kilkenny Stream since 1961. A comparison of the two surveys is given in the following table:

Numbers of Organisms Found in Kilkenny Cove and Nearby Control Area, 1961
and 1966.

Invertebrate	Number of Organisms				Statistical Test Chi-square Value
	Kilkenny Cove 1961	Kilkenny Cove 1966	Control 1961	Control 1966	
<u>Macoma</u>	286	0	104	150	233.86**
<u>Mya</u>	86	1	110	53	32.95**
<u>Mytilus</u>	483	35	1	1	5.78*
<u>Nereis</u>	65	78	6	21	5.04*
<u>Clymenella</u>	57	22	1	14	27.04**
Gastropods	18	1	1	4	13.41**
<u>Glycera</u>	11	14	1	13	5.72*

*Significant at P = .05.

**Significant at P = .01.

A statistically significant decrease in the abundance of *Macoma* clams, blue mussels and snails was evident in the polluted area. Although there was a decrease in soft-shell clams (a species of commercial importance in Maine) in both areas, the decline was striking in the polluted cove. The above species, with the exception of the soft-shell clam, are important foods for waterfowl. The *Macoma* clam, virtually absent after pollution, is probably the most important food for some species of ducks along the eastern Maine coast.

As of the autumn of 1966, waste materials from the tannery had accumulated in layers over extensive areas of the mudflats at places almost one mile from the discharge pipe. Residues consisted of shredded leather and fats in various stages of degradation. Odors from the area are noticeable and intertidal vegetation is becoming coated with layers of residue. Beds of eelgrass, also important to waterfowl, are not yet showing visible effects from the pollutants.

Information gathered to date suggests that if the pollution continues at the levels of the past four years, the following results are likely:

1. Further decrease of organisms important to waterfowl.
2. Gradual enlargement of the area influenced by pollution.
3. Possible adverse effect on eelgrass, also an important waterfowl food.
4. A gradual decline of use of the area by waterfowl.
5. Continued build up of odor and surface scum, rendering the area unpleasant for waterfowl hunting or any other kind of recreational use.

Although this investigation has been limited to a few organisms and has been directed primarily toward indirect effects on migratory birds, the importance of ecological changes to many other forms of life and human interests is recognized. The results from the Unit study were presented at a hearing

held by the Water Improvement Commission to consider reclassification of the waters in the area.

COOPERATIONAL, EDUCATIONAL WORK AND MISCELLANEOUS ACTIVITIES

Unit personnel provided technical assistance, upon request, to several members of the State Department of Inland Fisheries and Game during the quarter.

The Unit is cooperating with the Refuge Division of the U. S. Bureau of Sport Fisheries and Wildlife in the detailed analysis of woodcock banding on the Moosehorn Refuge. This study is being conducted by Refuge Biologist Eldon Clark. He has been provided with office space at the Unit, and arrangements made for use of the facilities of the University Computer Center. Schemnitz, Coulter and Mendall are cooperating in an advisory capacity and Graduate Assistant Lobdell is assisting Clark with the statistical analysis.

Respectfully submitted,



Howard L. Mendall, Leader
Maine Cooperative Wildlife
Research Unit

February 7, 1967