

File copy

MAINE COOPERATIVE WILDLIFE RESEARCH UNIT

University of Maine

Orono, Maine

QUARTERLY REPORT

January-March, 1971

Cooperating Agencies

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

NOT FOR PUBLICATION

TABLE OF CONTENTS

	PAGE
WILDLIFE STAFF	3
RESEARCH PROJECTS	4
BIG GAME	
Mobility of Deer in Three Western Maine Winter Yards (Financed by Maine Federal Aid in Wildlife Restoration Funds)	4
Effects of Three Cover Conditions on Behavior and Physiology of Penned White-tailed Deer (Financed by Maine Federal Aid in Wildlife Restoration Funds)	8
Effects of Fertilization on Nutrient Content of Deer Browse and Forest Vegetation in a Recently-cut Area (Financed by McIntire-Stennis Funds)	8
UPLAND GAME	
Ecology of the Ruffed Grouse in Maine (Financed by Unit)	9
WATERFOWL	
Distribution of Eider Populations in Coastal Maine (Financed by Unit and Bureau of Sport Fisheries and Wildlife)	10
Establishing and Increasing Local Breeding Populations of Wood Ducks by Relocating Active Nests (Financed by Maine Federal Aid in Wildlife Restoration Funds)	11
OTHER PROJECTS	
The Effects of DDT on Robin Reproduction in Northern Maine Forests (Financed by Food and Drug Administration)	11
Incidence of Occurrence of <u>Pneumostrongylus tenuis</u> in Potential Intermediate Hosts Collected from Various Ecological Regions in Maine (Financed by Maine Federal Aid in Wildlife Restoration Funds)	13
Environmental Studies on the Lower Penobscot River (Financed by the Ford Foundation)	14
CURRENT PROJECTS NOT REPORTED THIS QUARTER	14
COOPERATION, EDUCATIONAL WORK AND MISCELLANEOUS ACTIVITIES	14
PERSONNEL CHANGES	16
PUBLICATIONS AND THESES	16

WILDLIFE STAFF

Howard L. Mendall, Unit Leader and Professor of Wildlife Resources
 Voit B. Richens, Assistant Unit Leader and Assistant Professor of Wildlife Resources
 Malcolm W. Coulter, Associate Director for Wildlife, School of Forest Resources
 and Professor of Wildlife Resources
 Sanford D. Schemnitz, Associate Professor of Wildlife Resources
 Ray B. Owen, Jr., Assistant Professor of Wildlife Resources
 Frederick F. Gilbert, Assistant Professor of Wildlife Resources

Unit Collaborators - Personnel from 15 University departments or State and Federal agencies are actively collaborating with the Unit. Individuals assisting with projects that are currently reported upon are listed in connection with the appropriate project summary.

Graduate Assistants: David H. Abell
 Myrtle C. Bateman
 David E. Capen
 R. Daniel Dunford
 Roy D. Hugie
 David M. Knupp
 James M. Ramakka
 William F. Reid, Jr.
 William Sarbello

Graduate Fellows: J. George Gleich
 John F. Moroney

NSF Trainee: Gary C. White

Graduate Students: Chester F. Banasiak
 William R. Whitman

Unit Secretary: Maxine L. Horne

Unit Coordinating Committee

George W. Bucknam, Commissioner, Maine Department of Inland Fisheries and Game
 Albert D. Nutting, Director, School of Forest Resources
 Howard L. Mendall, Unit Leader

RESEARCH PROJECTSBIG GAMEMobility of Deer in Three Western Maine Winter Yards

- Objectives: (1) To relate indices of deer mobility in snow in yard and non-yard areas to food, cover, snow, and weather.
- (2) To determine the boundaries of the yards during the study period and relate any changes in yard boundaries to food, cover, snow characteristics, and weather.
- (3) To test the feasibility of using track-trail relationships as indices of deer mobility in snow.

Assignment: Roy D. Hugie, Graduate Assistant

Thesis Advisor: Voit B. Richens, Assistant Unit Leader

Consultants: Malcolm W. Coulter, Professor, Wildlife Resources
 Frederick F. Gilbert, Assistant Professor, Wildlife Resources
 Marshall D. Ashley, Assistant Professor, Forest Resources

Data in this report were obtained during the period of December to mid-April, and is a seasonal summary of the study.

Heavy snowfall, wind and long periods of extremely low temperature in the Flagstaff Lake study area, made this a hazardous winter for deer. Weather data taken from the four major cover types have been summarized in Table 1 and snowfall, snow accumulation, and mean deer sinking depth in Table 2.

Most observations of deer, their trails and tracks, were made on days free of snowfall and with relatively mild weather conditions but some observations were also obtained during stormy periods. A total of 56 days was spent by Hugie in the yarding areas and observations were recorded on nearly all phases of deer mobility; hundreds of tracks and trails were studied and more than 140 deer observed. Travel in and near yards was by snowshoes and snowmobile. Over 1100 miles were driven along established snowmobile routes during this winter period while an average of 2-4 miles were walked each day.

Yarding Periods

Concentration began early in December and progressed throughout the month near the Black Brook and Hayden yards. Twenty-six inches of snow fell on December 24-25, causing the deer to resort to trails. Moderate confinement developed by mid-January and by January 30, deer were active primarily in softwood growth near Black Brook, Hayden Brook, and Dead River. Confinement continued through February and the first two weeks of March. By March 17-19, a hard sun-rain crust developed, enabling deer to maintain and extend their trail system through portions of the non-yard area; the number of tracks also greatly increased.

Periodic snowstorms during late March and April, thaws, a deep snow-pack, and cold windy weather have made travel and feeding conditions alternately good and poor for deer this winter. Since March 20, there has been progressively less activity in the yards and more in nearby areas. By mid-April, deer were well into the dispersal period, but slushy, deep snow (30 inches in the open) inhibited travel onto the mountains.

Food and Cover

Foraging for food did not appear critical until the third week of January. During late January and early February, deer made use of "feeding loops." These are main trails on which deer could leave the yard and travel through a non-yard food area, returning to the yard without doubling back over the same trail. Such trails varied from 1/8-1 mile in length. Trails and/or tracks branched from a feeding loop and either "dead-ended" or circled to reunite with the main trail.

By late January, preferred browse within the yard was not available and deer began to use spruce, fir, pine, and alder. Observations during the confinement period showed extensive use of the edges of softwood stands. These edges had the advantage of food, cover, and concealment.

Often yards were in rather sparse stands near cut-over patches which contained good to excellent deer browse. Multiple deer beds were found in small patches (less than 1/4 acre) of softwoods within mixedwood stands. During mid-January, single beds were found under the canopy of individual fir and spruce trees.

Snow and Topography

The snowfall this year was nearly double the annual average of 115 inches as recorded by Maine Central Power Company at nearby Long Falls Dam. Snow conditions from late December to late February were not conducive to deer mobility (see October-December, 1970 Quarterly Report). However, deer often foraged in areas adjacent to yards when there was a 22-32 inch snow pack. When deer consistently sank to their chests, 22 inches, they traveled more on trails and confined their activity to yards.

From hoof prints and observing actual travel, it appeared likely that steep inclines, over 45°, had two trail types. Downhill trails followed the fall line but uphill trails were oblique. Several observations showed that deer sought topographical depressions, i.e., ditches, washes, and small ravines, when traveling up inclines. When deer sinking depth exceeded leg length, deer usually reacted to steep banks, brush piles, open water, logs, and thickets by going around them. The edges of lakes, brooks, and rivers were heavily traveled during times of adverse travel conditions.

Yard Changes

Both Hayden Brook and Black Brook yards had several centers of deer activity. These centers varied in size and were sometimes not connected to each other by tracks or trails for 2-3 weeks at a time. As snow and weather conditions changed some of these activity centers were vacated and

new ones established. Yards were smallest from January 20, to March 10. Usually, it took from 2-3 days for deer to re-open trails leading from yards. When a strong crust developed, deer abandoned some softwood areas and moved to west-facing mixedwood cover. Yard areas approximately doubled in size from March 10 to March 20.

Use of Snowmobile Trails

Deer made extensive use of snowmobile trails; feeding from these trails occurred within 10-15 yards of the trail. When available, deer used snowmobile and snowshoe trails to travel from one part of the yard to another. When deer were approached they took full advantage of man-made trails to escape; they usually walked or ran toward Hugie to reach a snowmobile trail instead of escaping directly away. Groups of deer were observed to remain in single file on snowmobile trails regardless of trail width.

Deer that met a snowmobile trail at right angles often followed it for 15-100 yards or more and then continued traveling in their original direction. Use of 2-3 continuous miles of snowmobile trail by deer was common in the Hayden Brook yard. Limited deer use of non-yard areas was sometimes facilitated by making snowmobile trails into them.

Track-Trail Index

Observations showed that the track-trail ratio was a reliable index of mobility only when counts were made throughout the yard and at least three days after snowstorms of 6 inches or more. The track-trail ratio did not produce an accurate mobility index if counts were made exclusively in areas connecting yard segments, food areas, or on frequently traveled snowshoe or snowmobile routes.

Seven major trails were "flagged" with surveyors tape. These trails and sites will be checked for reuse next winter.

Plans for next quarter: A dead deer search will be conducted in the Hayden Brook, Black Brook, and Grand Falls yards as soon as conditions permit. This past winter's data will be summarized and examined more fully.

Table 1. Cumulative miles of wind and weekly minimum and maximum air temperatures, averaged by month, in four vegetation cover types.

Month	Cover Type	Miles of Wind	Temperature (F°)	
			Av. Min.	Av. Max.
*February	Mixedwood	450	-14.7	29.7
	Hardwood	476	-15.2	33.2
	Open	567	-20.8	37.2
	Softwood	196	-18.0	31.0
March	Mixedwood	1259	.8	39.6
	Hardwood	817	.4	38.4
	Open	1024	-5.0	41.4
	Softwood	381	-4.6	32.8
April (to 15th)	Mixedwood	377	10.0	54.6
	Hardwood	415	9.0	50.3
	Open	553	11.0	53.3
	Softwood	185	7.0	43.0

* This is for the entire month; the figures for the first half only were given in the October-December Quarterly Report.

Table 2. Snowfall, mean snow depth, and mean deer sinking depth in the open cover type at the end of each month.

Explanation	Dec.	Jan.	Feb.	Mar.	Apr.
Total Snowfall	84.0	20.3	35.7	37.1	15.6 ¹
Mean Snow Depth	32.7	32.9	47.8	46.0	-
Mean Deer Sinking Depth	27.0	24.0	19.0	10.3	-

¹To April 17.

Effects of Three Cover Conditions on Behavior and Physiology of
Penned White-tailed Deer

- Objectives: (1) To relate differences on behavior of deer penned under three different cover conditions to environmental conditions.
- (2) To determine if certain physiological parameters indicate a difference among deer penned under three different cover conditions.

Assignment: Myrtle C. Bateman, Graduate Assistant

Thesis Advisor: Frederick F. Gilbert, Assistant Professor, Wildlife Resources

Consultants: David C. O'Meara, Associate Professor, Animal Biology
Voit B. Richens, Assistant Unit Leader

Behavior observations were terminated March 27. Deer from one complete experimental replicate were sacrificed on March 29, 30, 31, and April 1. Blood samples were collected before death and the hematocrit, hemoglobin, and plasma protein determined within 48 hours. Blood smears were made in the field and in the laboratory for later study. Immediately after death, the deer were weighed and the thymus, spleen, and adrenals were collected, weighed, and fixed for histological examination.

Plans for next quarter: Behavior data will be computer-analyzed and histological examination of the preserved organs completed.

Effects of Fertilization on Nutrient Content of Deer Browse and Forest
Vegetation in a Recently-cut Area

- Objectives: (1) To measure seasonal nutrient content of selected browse species subjected to different fertilization treatments.
- (2) To measure effects of fertilization on forest composition and growth during the season in which fertilizer is applied.

Assignment: David H. Abell, Graduate Assistant

Thesis Advisors: Sanford D. Schemnitz, Associate Professor, Wildlife Resources
Frederick F. Gilbert, Assistant Professor, Wildlife Resources

Consultants: Charles E. Schomaker, Associate Professor, Forest Resources
Roland A. Struchtemeyer, Professor, Plant and Soil Sciences

Activities this quarter consisted of establishing plots on the Sebec study area and determining the abundance of collectable browse on each plot. Twenty-four plots (60 x 150 feet) were established in a block design allowing

for three replications of fertilizer application. Twenty-foot buffer strips were established between plots to prevent overlap of fertilizer treatments. Treatments of the plots were selected and will include nitrogen (N) only, phosphorus (P) only, potassium (K) only and mixed treatments of NP, NK, PK and NPK. One plot in each block will not be treated and will serve as a control.

Plant cover was examined on the plots and it was decided that red maple, balsam fir, sugar maple, aspen, and beaked hazelnut will be collected for pre-fertilization nutrient analyses. It was recognized that three replications would not be possible for all species chosen, as sugar maple, aspen, and beaked hazelnut were conspicuously absent from several of the plots. Pre-fertilization collection was delayed because of deep snow on the study area.

Plans for next quarter: Browse samples will be obtained from plots for nutrient analyses, prior to treatment. Plots will be fertilized, and following treatment, plant reproduction and species composition will be studied on each plot.

UPLAND GAME

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, Associate Professor, Wildlife Resources

Consultant: Robert Wade, Moosehorn National Wildlife Refuge

An analysis was made of data from ruffed grouse summer trapping and brood observations at both units of the Moosehorn National Wildlife Refuge for the period 1964-1970. Based on back-dating of a sample of 606 immature grouse, 29% of the total were hatched during the week of June 13-19. Two-thirds (66.7%) of the hatch occurred during the 3-week period of May 30-June 19. There was little difference between years in the peak week of hatching. Observations on trapped grouse and on broods showed a similar hatching pattern. This is about 2 weeks later than the peak hatching dates reported by Bump, et al. (1947) in his New York grouse study.

Literature Cited:

Bump, G., R. W. Darrow, F. C. Edminister, W. E. Crissey. 1947. The ruffed grouse life history, propagation, management. N.Y. Conserv. Dept. 915 pp.

Plans for next quarter: Ruffed grouse drumming site vegetation analysis will be completed.

WATERFOWLDistribution of Eider Populations in Coastal Maine

- Objectives: (1) To conduct aerial breeding ground inventories biennially, and to maintain a current classification of the important nesting islands.
- (2) To determine the abundance and subspecific composition of fall and winter populations.

Assignment: Howard L. Mendall, Unit Leader
William Snow, Game Management Agent, Bureau of Sport Fisheries and Wildlife

Consultant: Rex Tice, Division of Management and Enforcement, Bureau of Sport Fisheries and Wildlife

Eider specimens obtained during the fall and winter were classified as to subspecies and were kept for plumage study. The latter is being conducted by Graduate Assistant Bateman. In addition, stomach analyses of a portion of the specimens were made by Graduate Assistant Sarbello.

The general collection areas and identification is given in the following listing:

Area	American Eider	Northern Eider	Intermediate	Total Birds Examined
Western Maine (Scarboro-Saco R.)	23	--	--	23
Central Maine (Muscongus & Penobscot Bays)	51	1	2	54
Eastern Maine (Washington Co.)	29	1	2	32
Total	103	2	4	109

The proportion of northern eiders was very low this season, but, as pointed out in the last quarterly report, the total sample this season was smaller than a year ago because of adverse weather conditions.

Plans for next quarter: Inactive.

Establishing and Increasing Local Breeding Populations of Wood Ducks by
Relocating Active Nests

Objective: To establish new breeding populations of wood ducks by moving hens and their recently hatched broods to areas with no wood duck production.

Assignment: David E. Capen, Graduate Assistant

Thesis Advisor: Malcolm W. Coulter, Professor, Wildlife Resources

Consultants: J. William Peppard, Migratory Bird Research Leader,
Maine Dept. of Inland Fisheries and Game
Fred Hurley, Regional Biologist, Maine Dept. of
Inland Fisheries and Game

Nest box erection and maintenance was completed on the areas where hens and their broods were successfully released during the 1970 breeding season. These nest boxes will be checked carefully this year to determine if some of the released birds return to nest.

Areas from which active nests will be removed during the 1971 season were selected in cooperation with Fred Hurley and Jim Dorso of the Department of Inland Fisheries and Game. Nest box maintenance has been completed on these areas.

Plans for next quarter: Intensive nest box checks will begin in April followed by nest relocation during May and June. If time permits, a small number of hooded merganser and goldeneye nests will be moved using the method which was developed for wood ducks last season.

OTHER PROJECTS

The Effects of DDT on Robin Reproduction in Northern Maine Forests

- Objectives: (1) To compare clutch size, egg shell thickness, and nesting mortality in sprayed and non-sprayed areas.
(2) To compare DDT concentrations in eggs, young, and adult robins in sprayed and non-sprayed areas.

Assignment: David M. Knupp, Graduate Assistant

Thesis Advisor: Ray B. Owen, Jr., Assistant Professor, Wildlife Resources

Consultants: Marshall D. Ashley, Assistant Professor, Forest Resources
John B. Dimond, Professor, Entomology
Frederick F. Gilbert, Assistant Professor, Wildlife
Resources

This study is part of a broad ecological project with the goal of examining the sublethal effects of DDT in the environment. Vast forested

areas of northern Maine have been sprayed aerially with DDT at 1 lb/acre for control of the spruce budworm during 1958, 1960, 1961, 1963, 1964, and 1967. Overlap of sprayings from year to year has resulted in a mosaic of areas having received different total amounts of DDT. Earlier studies in these treated areas have shown that DDT persists beyond 9 years in some animals and that some organisms reflect quite well the spray history involved (Dimond, 1970). The scope of the main project will be to determine the effects, if any, of these persistent residues upon the population dynamics of crayfish, salamanders, and robins.

The summer of 1970 was spent in preliminary field work. General study areas were chosen that had been sprayed and that contained crayfish, salamanders, and robins. These areas were classified according to their spray history as follows: (1) control (no spray), (2) light (one spray), and (3) heavy (three sprays). Soil, earthworms, small mammals, crayfish, salamanders, and robins were collected for subsequent residue analyses. The salamander and crayfish studies will be conducted by Chester Banasiak and William Reid respectively. Reports of these studies will be given in the next quarterly report.

Six sampling areas for the robin study have been chosen consisting of two control, two light, and two heavy spray plots. Each sampling area centers on a 3 mile length of woods road since the distribution of robins in the spruce-fir forest of northern Maine depends greatly upon clearings provided by roads, streams, and cuttings. These woods roads are currently being marked at 0.1 mile intervals to facilitate singing-male censuses.

Literature Cited

Dimond, J. D. et al. 1970. DDT residues in robins and earthworms associated with contaminated forest soils. *Can. Entomol.*, 102(9):1123-1130.

Plans for next quarter: The spring and summer of 1971 will include collecting clutch size and nesting mortality data for each sampling area. Eggs, young, and adult robins will be collected throughout the summer for residue analyses to give an indication of DDT levels during that period. The shells of these eggs and eggshell fragments from nests will be measured for thickness.

Incidence of Occurrence of *Pneumostrongylus tenuis* in Potential Intermediate Hosts Collected from Various Ecological Regions in Maine

- Objectives: (1) To determine the distribution of gastropods in representative areas of different moose and deer densities.
- (2) To determine numbers of various stages of *P. tenuis* larvae in the different species of gastropods collected.
- (3) To evaluate possible correlations between moose and deer densities and incidence of *P. tenuis*.

Assignment: J. George Gleich, Graduate Fellow

Thesis Advisor: Frederick F. Gilbert, Assistant Professor, Wildlife Resources

Consultants: Marshall D. Ashley, Assistant Professor, Forest Resources
Kenneth W. Allen, Professor and Chairman, Dept. of Zoology
Roy C. Anderson, Professor, Univ. of Guelph, Ontario

This is a new study initiated during the quarter. Gastropods can act as intermediate hosts in the life cycle of *P. tenuis*, and it is assumed that deer and moose become infected by accidentally ingesting gastropods carrying infective larvae (LanKester and Anderson, 1968). Cerebrospinal nematodiasis, caused by *P. tenuis*, is generally non-pathogenic to white-tailed deer, but highly so to moose. Distribution of suitable gastropod vectors, and occurrence of *P. tenuis* larvae in such vectors, has not been extensively studied in Maine. Snails and slugs will be collected in various cover types in areas of different moose and deer density and examined for *P. tenuis* larvae. Moose and deer from these areas will be examined, as available, for *P. tenuis* infection. Aquatic snails, which have not been shown to be important in transmission of *P. tenuis*, will also be collected and examined.

During the present quarter, seven study areas were chosen throughout central Maine. These areas all contain winter deer concentrations which may serve as "infection centers" for moose during late spring and early summer. A literature review is in progress.

Literature Cited

LanKester, M. W., and R. C. Anderson. 1968. Gastropods as intermediate hosts of *Pneumostrongylus tenuis* Dougherty of White-Tailed Deer. *Can. J. Zoology*, 46:373-383.

Plans for next quarter: The study areas will be cover-typed and sampling methods will be determined and initiated. Gastropod collection, vegetation analysis, assessment of moose and deer use and density, and laboratory analysis of gastropods will begin.

Environmental Studies on the Lower Penobscot River

Assignment: John F. Moroney, Graduate Fellow
Gary C. White, NSF Trainee

Thesis Advisors: Malcolm W. Coulter, Professor, Wildlife Resources
Ray B. Owen, Jr. Assistant Professor, Wildlife Resources

Consultants: Richard H. Storch, Associate Professor, Entomology
Robert L. Vadas, Assistant Professor, Botany, and
Assistant Professor, Zoology
Franklin E. Woodard, Associate Professor, Civil Engineering

Moroney and White continued reviewing literature concerning the Penobscot River and the sampling of aquatic communities. Also, meetings were held with representatives of the Darling Center for Research, Teaching and Service, Dr. John Dearborn, Associate Professor of Zoology, Dr. Robert Vadas, Assistant Professor of Botany and Zoology, and Dr. Richard Storch, Associate Professor of Entomology, to discuss sampling methods.

Plans for next quarter: Moroney and White plan to accomplish preliminary sampling of the river so that an overall sampling scheme can be developed.

CURRENT PROJECTS NOT REPORTED THIS QUARTER

Importance of Snow Support in the Welfare and Survival of Wintering Deer in Western Maine - V. B. Richens
Breeding Season Studies of Male American Woodcock, Part I - J. M. Ramakka
Breeding Season Studies of Male American Woodcock, Part II - S. D. Schemnitz
Summer Behavior of American Woodcock - R. D. Dunford
Woodcock Nocturnal Habitat Utilization in Relation to Sex, Age, and Molt - R. B. Owen, Jr.
Waterfowl Distribution and Breeding Ecology - H. L. Mendall
Ecology and Behavior of the Fisher - M. W. Coulter
Factors Affecting Summer Flight Behavior of White-tailed Deer on Isle au Haut - S. D. Schemnitz
Annual Production and Factors Influencing Nesting Success of the American Eider - H. L. Mendall
Renesting of the American Eider in Penobscot Bay Colonies - W. Sarbello

COOPERATION, EDUCATIONAL WORK AND MISCELLANEOUS ACTIVITIES

Coulter served as Director for the Seventh Annual Warden Training School which concluded with graduation ceremonies March 26. The 8-week course included 12 wardens and 1 Baxter State Park Ranger. The Game Biology course was taught by Coulter. J. William Peppard, State Migratory Bird Research Leader, Dr. J. F. Witter, Professor of Animal Pathology and Schemnitz lectured and conducted laboratory sessions when Coulter was away. Richens taught the course in plant identification.

Schemnitz, Owen, Gilbert, and 7 graduate students attended the 3rd annual Wildlife Seminar held jointly with Atlantic Provinces Universities. This year's meeting was at Acadia University, Wolfville, Nova Scotia, March 18-20. The meeting featured field trips and research reviews. This seminar was financed in part by the New England-Atlantic Provinces Quebec Center.

Schemnitz and 14 wildlife students, members of the Maine Student Chapter Wildlife Society hosted the 2nd Annual Eastern Student Conclave, at Remington Farms, Chestertown, Maryland, March 26-28. Activities included field trips and a student Wildlife Bowl and simulation games. Mr. Philip Barske, Wildlife Management Institute, was the main banquet speaker.

Coulter, Mendall and Owen presented written statements to the Environmental Improvement Commission for use in the Sears Island Oil Refinery hearing in late March.

Gilbert attended the annual meeting of the Canadian Society of Wildlife and Fishery Biologists in Montreal, Quebec, January 6-8. He also attended the North American Moose Conference in Saskatoon, Saskatchewan February 4-5. He presented a paper entitled "The Clinical Signs of Moose Sickness in Maine Moose" and chaired a session on moose pathology.

Gilbert was a discussion leader at the Third Maine Environmental Congress in Portland on March 26 on the subject "Logging Practices and Wildlife Values."

Richens and Dr. Charles E. Shomaker of Forest Resources attended the Snow and Ice Symposium held at Iowa State University February 11-12.

The annual University of Maine Open House was held March 28-31 and April 1-3. Richens was chairman and Mendall vice-chairman of the program "Our Wildlife Resources in Modern Times," held in the Forest Resources Building on Tuesday, March 30. The program consisted of an outstanding film on wetland habitat management, an endangered wildlife species, management of an upland game bird and red fox ecology. Each film was introduced by a brief explanation of its portrayal of current conservation problems. About 175 people attended.

Coulter, Mendall and Graduate Assistant Capen attended the North American Wildlife and Natural Resources Conference in Portland, Oregon, March 5-9. Coulter participated, as Regional Representative, in several days of Wildlife Council meetings. Mendall participated in the annual Unit Leaders' meetings and also the meeting of the Atlantic Flyway Council.

The Unit Coordinating Committee held its winter meeting in Augusta on March 25. Present were Commissioner Bucknam, Director Nutting, Game Division Chief Spencer and Unit Leader Mendall.

A number of museum specimens were acquired for the wildlife collection from the Portland Society of Natural History. Some of these have considerable historical as well as educational value as they date back to early ornithological collections in Maine. These were obtained through the courtesy of Richard Anderson, Associate Director of the Portland Society.

Several public speaking engagements were given to sportsmen's, civic and educational groups during the quarter by the staff.

PERSONNEL CHANGES

Two new graduate students began their programs this quarter for advanced degrees at the University of Maine. They are:

Chester F. Banasiak - B.S., 1948, Michigan State College, Lansing;
M.S., 1952, University of Massachusetts, Amherst.

William F. Reid, Jr. - B. A., 1960, Bowdoin College, Brunswick, Maine;
M.S., 1970, University of Maine, Orono.

Both students are Ph.D. candidates. Banasiak is a former deer project leader of the State Game Division and Reid was previously fisheries biologist with the State Fisheries Division.

PUBLICATIONS AND THESES

Balinga, V. S. 1971. A comparative study of selected public conservation areas in Northeastern North America. M.S. Thesis, Univ. of Maine, Orono. Unpublished. 143 pp.

Gilbert, F. F. and V. B. Richens. 1971. Winter weather and the white-tail. Maine Fish and Game, Vol. XIII, No. 1, pp. 2-3.

Schemnitz, S. D. and D. Allan. 1971. Flatpea--new plant for wildlife. Soil Conservation, 36(8):185-186.

May 17, 1971

File Copy

MAINE COOPERATIVE WILDLIFE RESEARCH UNIT

University of Maine

Orono, Maine

QUARTERLY REPORT

April-June, 1971

Cooperating Agencies

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

NOT FOR PUBLICATION

TABLE OF CONTENTS

	PAGE
WILDLIFE STAFF	3
RESEARCH PROJECTS	4
UPLAND GAME	
Breeding Season Studies of Male American Woodcock (Financed by Bureau of Sport Fisheries and Wildlife)	4
Summer Behavior of American Woodcock (Financed by Upland Webless Migratory Bird Funds [State of Maine])	5
WATERFOWL	
Annual Production and Factors Influencing Nesting Success of the American Eider (Financed by Unit)	7
OTHER PROJECTS	
Environmental Studies on the Lower Penobscot River (Financed by the Ford Foundation)	8
Incidence of Occurrence of <u>Pneumostrongylus tenuis</u> in Potential Intermediate Hosts Collected from Various Ecological Regions in Maine (Financed by Maine Federal Aid in Wildlife Restoration Funds)	8
CURRENT PROJECTS NOT REPORTED THIS QUARTER	9
COOPERATION, EDUCATIONAL WORK AND MISCELLANEOUS ACTIVITIES	9
PERSONNEL CHANGES	10
PUBLICATIONS AND THESES	10

WILDLIFE STAFF

Howard L. Mendall, Unit Leader and Professor of Wildlife Resources
 Voit B. Richens, Assistant Unit Leader and Assistant Professor of Wildlife Resources
 Malcolm W. Coulter, Associate Director for Wildlife, School of Forest Resources
 and Professor of Wildlife Resources
 Sanford D. Schemnitz, Associate Professor of Wildlife Resources
 Ray B. Owen, Jr., Assistant Professor of Wildlife Resources
 Frederick F. Gilbert, Assistant Professor of Wildlife Resources
 Donald A. Hammer, Assistant Professor of Wildlife Resources (1 year appointment)

Unit Collaborators - Personnel from University departments and State and Federal Agencies are actively collaborating with the Unit. Individuals assisting with projects that are currently reported upon are listed in connection with the appropriate project summary.

Graduate Assistants: David H. Abell
 Myrtle C. Bateman
 David E. Capen
 R. Daniel Dunford
 Roy D. Hugie
 David M. Knupp
 James M. Ramakka
 William F. Reid, Jr.
 William Sarbello

Graduate Fellows: J. George Gleich
 John F. Moroney

NSF Trainee: Gary C. White

Graduate Students: Chester F. Banasiak
 William R. Whitman

Unit Secretary: Maxine L. Horne

Unit Coordinating Committee

George W. Bucknam, Commissioner, Maine Department of Inland Fisheries and Game
 Albert D. Nutting, Director, School of Forest Resources
 Howard L. Mendall, Unit Leader

RESEARCH PROJECTSUPLAND GAMEBreeding Season Studies of Male American Woodcock

- Objectives: (1) To study the fidelity and continuity of use of singing fields by observation of individually-marked, male woodcock.
- (2) To observe any daily changes in woodcock courtship activity that may occur on several fields in the same general area.

Assignment: James M. Ramakka, Graduate Assistant

Thesis Advisor: Sanford D. Schemnitz, Associate Professor, Wildlife Resources

Consultants: Howard L. Mendall, Unit Leader
 Malcolm W. Coulter, Professor, Wildlife Resources
 Ray B. Owen, Jr., Assistant Professor, Wildlife Resources
 William B. Krohn, Research Biologist, Bureau of Sport Fisheries and Wildlife

Field work began April 20 and was completed on May 28. William B. Krohn, Research Biologist, Bureau of Sport Fisheries and Wildlife, assisted with much of the field work. Six courting male woodcock, one subadult and five adults, were marked with radio transmitters weighing 4.3 g each. The movements of these birds were followed for an average of 8 days each; during this time all but one flew to a singing field at least once. Two males flew to only one field and three males flew to two different fields on different nights. Two of the marked males definitely peented on the singing fields, but, unlike radio-marked males observed during the previous spring, none of the marked birds made courtship flights on the singing fields. Only one observation of a territorial conflict involving a marked male was made and during this encounter a marked male was driven from a singing field by an unmarked male.

The times of 27 flights from diurnal cover to the singing field were recorded. Average flight time was 26 minutes after sunset and the average distance flown from diurnal cover to the singing field was 430 meters. There was no significant difference between the flight times or distances of birds marked this year and those marked in the spring of 1970 (t test, $P > 0.01$).

Ten observations were made of marked males at dawn. The evidence suggests that they remained on the singing fields throughout the night, then returned to the diurnal cover about 35 minutes before sunrise.

The five radio-marked males which flew to singing fields used an average of three different types of diurnal cover during the time that they were monitored. Usually one cover type was occupied more often than the others. As found during the previous spring, the mixedwood cover type was most often used by the marked birds.

The activities of the males marked this spring gave further indications that marking and handling upsets the birds' normal courtship behavior. One male never left his diurnal cover after being marked, but when flushed by an observer, the bird flew strongly. Most marked males which did fly to singing fields did not make courtship flights. A comparison of the times that radio-marked and unmarked males flew to the fields in the same area, revealed that marked males flew to the singing fields significantly later than unmarked ones ($P < 0.01$).

Plans for next quarter: The thesis will be completed and an oral examination will be taken on August 9.

Summer Behavior of American Woodcock

- Objectives: (1) To determine summer movements of woodcock with special emphasis on birds hatched during the current year.
 (2) to investigate woodcock behavior, such as times of feeding and resting, while on summer fields and in diurnal cover.
 (3) To measure vegetation characteristics of diurnal cover.

Assignment: R. Daniel Dunford

Thesis Advisor: Ray B. Owen, Jr., Assistant Professor, Wildlife Resources

Consultants: Malcolm W. Coulter, Professor, Wildlife Resources
 Sanford D. Schemnitz, Associate Professor, Wildlife Resources
 Gene W. Farthing, Jr., Assistant Professor, Psychology
 William B. Krohn, Research Biologist, Bureau of Sport
 Fisheries and Wildlife
 J. William Peppard, Migratory Bird Research Leader,
 Department of Inland Fisheries and Game

Graduate Assistant Dunford completed his thesis during the quarter and received his M.S. degree in June. The summary is as follows:

The summer behavior of American woodcock was studied in central Maine during the summers of 1969 and 1970. Fifteen hatching-year woodcock were equipped with radios during the study period to obtain information on movements and daily activity. In addition, information was also gathered on flight times, predation, disturbance factors due to human interference, and on the general characteristics of diurnal cover sites. The specific objectives of the study were: (1) to determine the summer movements of hatching-year woodcock; and (2) to investigate temporal patterns of woodcock behavior, such as feeding and resting while on summer fields and in diurnal cover.

1. A gradual build-up of woodcock using summer fields for reasons other than courtship began about the third week in June. This build-up of summer field use begins at about the same time that young birds in Maine would be beginning normal summer activities.

2. Radio-tagged woodcock were active throughout the day. Activity was recorded during 318 of 488 five-minute periods throughout three woodcock-days of monitoring.

3. Radio-equipped woodcock utilized second growth-hardwood cover, alder, hardwood-conifer, and conifer cover as diurnal sites. Diurnal areas averaged 15 m from major breaks in the canopy such as fields, roads or rivers.

4. Monitored birds used an average of three diurnal areas during a 12-day period. Usually one cover area received considerably more use than any of the others.

5. One to 6 percent of the movements to and from nocturnal fields were accomplished by walking. Flights similar to those observed during spring courtship were frequently observed during the summer. It was not uncommon for woodcock to land on a field, remain for a few minutes, and fly again to a new field.

6. Evening flights of radio-tagged birds averaged from 20 to 27 minutes after sunset, depending on cloud cover. Morning flights averaged about 42 minutes before sunrise.

7. The crepuscular movement distances of radio-tagged woodcock between diurnal covers and nocturnal areas averaged 340 m. There was no difference between the average movement distance of hatching-year male and female birds.

8. Very little activity occurred when birds were monitored at night. Limited data suggest that the open fields are used as roosting areas.

9. Radio-tagged woodcock used a variety of nocturnal sites including fields, bogs, powerlines, highway medians, woods roads and forest clearings. Fields were occupied considerably more often than any of the other types.

10. Birds used an average of three nocturnal areas during 11 nights of monitoring. Each bird seemed to prefer one of their fields more than any of the others. Human disturbance may affect the pattern of use of nocturnal and diurnal locations.

11. There was no apparent difference in the behavior of male and female radio-tagged woodcock in relation to summer field usage.

12. Radio-tagged birds appeared on most fields within an area of approximately 193 ha. surrounding the main banding field during the study period.

13. Environmental changes or interference may cause seasonal differences in nocturnal or diurnal habitat use.

14. Three of the 15 birds selected for study were killed by predators.

WATERFOWLAnnual Production and Factors Influencing Nesting Success of the American Eider

Objectives: To determine production and factors related to eider nesting success in breeding colonies of Penobscot Bay.

Assignment: Howard L. Mendall, Leader

Seasonal work on the islands of the Rockland study area was begun in mid-May. A very retarded phenology this spring resulted in the latest dates of nest initiation that have been recorded during the Unit's eider studies. Nevertheless, the peak of nesting occurred at near average dates and was only slightly later than in 1970. Assistance during nesting studies was given by Professors Coulter and Richens, Graduate Assistant Sarbello, U.S. Game Management Agent Snow, and Mendall's wife.

Population estimates on the 5 islands of the Muscle Ridge area indicated about a 15-20 percent decrease in breeding birds from 1970. Whether this is a result of the fowl cholera outbreak of a year ago is uncertain. It may be only coincidental, but the percentage decline is approximately the same as the estimated loss of nesting females from cholera in this same general area (see Unit Quarterly Report, April-June, 1970).

On the basis of limited comparative data, nest success of the Penobscot Bay colonies is substantially higher than last year. The period when eider nests are most vulnerable to gull predation apparently occurred after maximum aggressiveness by black-backed gulls and before that of herring gulls. The seasonal chronology of the three species definitely favored the eider this year.

Because of last year's serious outbreak of fowl cholera, special monitoring was carried out on those islands in Penobscot and Muscongus Bays where the heaviest losses had been found. William Snow, U.S. Game Management Agent, assisted in these checks. Virtually no dead birds were found on any of the islands west of Rockland and there appeared to be no carry-over of the disease. One bird found on Fishermans Island, a site of heavy loss in 1970, had all outward symptoms of fowl cholera but laboratory cultures by the Pathology Laboratory at the University of Maine were negative.

One exception to the foregoing was noted. At Mouse Island, on the Islesboro study area, Graduate Assistant Sarbello found about twenty dead birds with gross symptoms of fowl cholera. The disease was confirmed in two specimens sent to the Pathology Laboratory for autopsy. Fortunately, mortality occurred near the end of the nesting season and affected only a minor proportion of the nesting population. Few losses were noted on any of the other islands of Sarbello's study area.

Plans for next quarter: To conclude the season's studies.

OTHER PROJECTSEnvironmental Studies on the Lower Penobscot River

Assignment: John F. Moroney, Graduate Fellow
Gary C. White, NSF Trainee

Thesis Advisors: Malcolm W. Coulter, Professor, Wildlife Resources
Ray B. Owen, Jr., Assistant Professor, Wildlife Resources

Consultants: Richard H. Storch, Associate Professor, Entomology
Robert L. Vadas, Assistant Professor, Botany and
Assistant Professor, Zoology
Franklin E. Woodard, Associate Professor, Civil Engineering

A week was spent becoming familiar with the fresh water portion of the study area. Coulter accompanied Moroney and White on two trips in the estuarine portion of the river. Also, Fred Hartman of the Pennsylvania Game Commission, who worked in the estuary from 1958-1960 on winter habitat of black ducks, met with Moroney and White.

Following initial reconnaissance, a broad inventory of major community types in the estuary was begun to familiarize the project assignees with the plants and animals. Artificial substrates consisting of wire baskets of two different sizes filled with cobbles are being experimented with in the fresh water portions as a method of collecting invertebrates in a lotic habitat. Moroney is mapping emergent vegetation to determine plant community types in the estuarine portion of the river. White is taking preliminary bottom samples from four selected estuarine coves and counting the macroinvertebrates in each sample by species. Two undergraduate students have been hired to help with the samples.

Plans for next quarter: Moroney plans to finish mapping the vegetation and begin extensive qualitative sampling of bottom macroinvertebrates. White plans to begin intensive quantitative sampling of bottom macroinvertebrates in the four coves. Use of artificial substrates in the freshwater portion will continue.

Incidence of Occurrence of *Pneumostrongylus tenuis* in Potential Intermediate Hosts Collected from Various Ecological Regions in Maine

- Objectives: (1) To determine the distribution of gastropods in representative areas of different moose and deer densities.
(2) To determine the number of *P. tenuis* larvae in different species of gastropods collected.
(3) To evaluate possible correlations between moose and deer densities and incidence of *P. tenuis*.

Assignment: J. George Gleich, Graduate Fellow

Thesis Advisor: Frederick F. Gilbert, Assistant Professor, Wildlife Resources

Consultants: Marshall D. Ashley, Assistant Professor, Forest Resources
Kenneth W. Allen, Professor and Chairman, Dept. of Zoology
Roy C. Anderson, Professor, Dept. of Zoology, Univ. of
Guelph, Ontario

During the present quarter 30 pieces of corrugated cardboard (22 x 28 inches) were placed in each of the seven study areas. The gastropod "traps" were placed in different cover types in proportion to the percentage of the entire study area occupied by that cover type. Data on the vegetation under and over the "traps" was recorded. Collection of gastropods was initiated in June and an intensive search of the vegetation and litter under the "traps" was made. The first collection cycle produced approximately 400 gastropods, half snails and half slugs. About 12 species of snails and five species of slugs were identified and laboratory examination of gastropods for P. tenuis was begun.

Plans for next quarter: Collections will continue as will laboratory examination of gastropods for P. tenuis larvae. Results will be compiled and writing of the thesis will be started.

CURRENT PROJECTS NOT REPORTED THIS QUARTER

Importance of Snow Support in the Welfare and Survival of Wintering Deer in Western Maine - V. B. Richens
 Breeding Season Studies of Male American Woodcock, Part II - S. D. Schemnitz
 Woodcock Nocturnal Habitat Utilization in Relation to Sex, Age, and Molt - R. B. Owen, Jr.
 Waterfowl Distribution and Breeding Ecology - H. L. Mendall
 Ecology and Behavior of the Fisher - M. W. Coulter
 Factors Affecting Summer Flight Behavior of White-tailed Deer on Isle au Haut - S. D. Schemnitz
 Renesting of the American Eider in Penobscot Bay Colonies - W. Sarbello
 Mobility of Deer in Three Western Maine Winter Yards - R. D. Hugie
 Effects of Three Cover Conditions on Behavior and Physiology of Penned White-tailed Deer - M. C. Bateman
 Effects of Fertilization on Nutrient Content of Deer Browse and Forest Vegetation in a Recently-cut Area - D. H. Abell
 Ecology of the Ruffed Grouse in Maine - S. D. Schemnitz
 Distribution of Eider Populations in Coastal Maine - H. L. Mendall
 The Effects of DDT on Robin Reproduction in Northern Maine - D. M. Knupp

COOPERATION, EDUCATIONAL WORK AND MISCELLANEOUS ACTIVITIES

The Northeast Fish and Wildlife Conference (N.E. Section, The Wildlife Society) was held in Portland, Maine, May 23-26. Richens, Owen, Coulter, Mendall and Schemnitz of the staff and most wildlife graduate students attended. Coulter reported to the N.E. Section business meeting as regional representative of The Wildlife Society. Undergraduate Audrey Magoun was presented the P. F. English Award for the outstanding senior wildlife student of the N.E. Section.

The annual wildlife-forestry summer camp was held at Princeton, Maine, June 5-July 16. Owen, Hammer and Graduate Assistants Hugie and Dunford instructed wildlife courses. Richens gave a lecture on fire ecology in relation to wildlife management to the combined forestry-wildlife class.

Nicholas J. Holler, Head, Cooperative Wildlife Research Units, visited University and Unit personnel June 23-25. Mendall and Richens accompanied Holler in a visit to the coastal waterfowl study areas.

Gilbert attended a meeting on deer management at Dorset, Ontario, May 27-28. Maine, New York and Michigan each were invited to send a biologist to participate in the discussion of the deer program by the Ontario Department of Lands and Forests.

Graduate Fellow Moroney and N.S.F. Trainee White attended an international symposium on river ecology and the impact of man on rivers at Amherst, Massachusetts, June 20-23. Financial aid for this travel was provided by Massachusetts Continuing Education Division of University of Massachusetts.

Coulter attended meetings of the Association of State College and University and Forest Research Organizations at Amherst, Massachusetts during late May.

PERSONNEL CHANGES

Albert D. Nutting retired in June as Director of the School of Forest Resources. As a long-time member of the Unit Coordinating Committee, he did much to further the wildlife program. The Unit personnel are grateful for his interest and help and extend best wishes to him. Professor Edwin Giddings is acting as Director of the School prior to the arrival next spring of the new Director, Dr. Fred Knight, currently in the Department of Forestry, University of Michigan.

Schemnitz took sabbatical leave for the year in Florida; during that time he will study the ecology of the impact of road networks upon the vegetation and ecology of parts of the Everglades. Schemnitz will return to Orono July 1972.

Dr. Donald A. Hammer, a recent graduate of Utah State University, received a 1-year appointment to the wildlife staff, as a replacement for Schemnitz.

Graduate Assistant Dunford completed his work toward an M.S. degree in June and is now working for the Florida Game and Fresh Water Fish Commission at Vero Beach.

PUBLICATIONS AND THESES

Dunford, R. D. 1971. The summer behavior of American woodcock in central Maine. M.S. Thesis, University of Maine, Orono. Unpubl. 98 pp.

July 30, 1971

file
copy

MAINE COOPERATIVE WILDLIFE RESEARCH UNIT

University of Maine

Orono, Maine

QUARTERLY REPORT

July-September, 1971

Cooperating Agencies

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

NOT FOR PUBLICATION

TABLE OF CONTENTS

	PAGE
WILDLIFE STAFF	3
RESEARCH PROJECTS	4
BIG GAME	
Effects of Fertilization on Nutrient Contents of Deer Browse and Forest Vegetation in a Recently-cut Area (Financed by McIntire-Stennis Funds)	4
UPLAND GAME	
Breeding Season Behavior of Radio-equipped Male Woodcock (Financed by Bureau of Sport Fisheries and Wildlife)	5
WATERFOWL	
Establishing and Increasing Local Breeding Populations of Wood Ducks by Relocating Active Nests (Financed by Maine Federal Aid in Wildlife Restoration Funds)	6
Reneesting of the American Eider in Penobscot Bay Colonies (Financed by Unit)	7
OTHER PROJECTS	
The Effects of DDT on Robin Reproduction in Northern Maine Forests (Financed by Food and Drug Administration)	9
Effects of DDT on Red-backed Salamanders in Northern Maine (Financed by Food and Drug Administration)	11
The Ecology and Population Dynamics of the Crayfish (<u>Cambarus bartoni</u>) in Northern Maine (Financed by Food and Drug Administration)	14
Environmental Studies on the Lower Penobscot River (I and II) (Financed by the Ford Foundation)	16
Investigation of Aquatic Gastropods in Maine for Occurrence of <u>Pneumostromylus tenuis</u> (Financed by Maine Federal Aid in Wildlife Restoration Funds)	17
CURRENT PROJECTS NOT REPORTED THIS QUARTER	18
COOPERATION, EDUCATIONAL WORK AND MISCELLANEOUS ACTIVITIES	18
PERSONNEL CHANGES	19
PUBLICATIONS AND THESES	19

WILDLIFE STAFF

Howard L. Mendall, Unit Leader and Professor of Wildlife Resources
 Voit B. Richens, Assistant Unit Leader and Assistant Professor of Wildlife Resources
 Malcolm W. Coulter, Associate Director for Wildlife, School of Forest Resources
 and Professor of Wildlife Resources
 S. D. Schemnitz, Associate Professor of Wildlife Resources (on leave until 7/1/72)
 Ray B. Owen, Jr., Assistant Professor of Wildlife Resources
 Frederick F. Gilbert, Assistant Professor of Wildlife Resources
 Donald A. Hammer, Assistant Professor of Wildlife Resources (1 year appointment)

Unit Collaborators - Personnel from many University departments as well as State,
 Federal and private organizations are actively collaborating with the Unit.
 Individuals assisting with projects that are currently reported upon are
 listed in connection with the appropriate project summary.

Graduate Assistants: David H. Abell
 Chester F. Banasiak (Ph.D. Program)
 Myrtle C. Bateman
 William Crenshaw
 Roy D. Hugie
 James Kienzler (Ph.D. Program)
 David M. Knupp
 Jeffrey Kropp
 John F. Moroney
 James M. Ramakka
 William F. Reid, Jr. (Ph.D. Program)
 William Sarbello
 Gary C. White

Graduate Fellow: Katherine Little

N.S.F. Trainee: James Wakeley

Graduate Students: James Barnes
 David Capen
 J. George Gleich
 Barbara McKean (Trustee Scholarship)
 Mark Mowatt
 William R. Whitman (Ph.D. Program)

Unit Secretary: Maxine L. Horne

Unit Coordinating Committee

George W. Bucknam, Commissioner, Maine Department of Inland Fisheries and Game
 Edwin L. Giddings, Acting Director, School of Forest Resources
 Howard L. Mendall, Unit Leader

RESEARCH PROJECTSBIG GAMEEffects of Fertilization on Nutrient Content of Deer
Browse and Forest Vegetation in a Recently-cut Area

- Objectives: (1) To measure seasonal nutrient content of selected browse species subjected to different fertilization treatments.
 (2) To measure effects of fertilization on forest composition and growth during the season in which fertilizer is applied.

Assignment: David H. Abell, Graduate Assistant

Thesis Advisors: Sanford D. Schemnitz, Associate Professor, Wildlife Resources
 Frederick F. Gilbert, Assistant Professor, Wildlife Resources

Consultants: Charles E. Schomaker, Associate Professor, Forest Resources
 Roland A. Struchtemeyer, Professor, Plant and Soil Sciences

The forested plots were fertilized in June with the treatment outlined in the Unit Quarterly Report of January-March, 1971. Each element was applied at the rate of 150 lbs/acre. Hand application on subdivisions of the larger fertilization plots proved to be an easy method for obtaining an even distribution of the fertilizer.

Segmented belt transects, one lengthwise of each fertilization plot, were established following fertilization. Data collected from each transect included canopy coverage, slash presence, density of tree seedlings by height class and percent coverage of tree seedlings and shrubs, and herb density by height class. An attempt will be made to characterize each treatment series with these data to determine vegetational composition on the study area during the year.

Twigs and foliage of browse was collected in August for nutrient analyses from the following species: red maple (Acer rubrum), sugar maple (Acer saccharum), beaked hazelnut (Corylus cornuta), quaking aspen (Populus tremuloides), and balsam fir (Abies balsamea). Three herbaceous species, bracken fern (Pteridium aquilinum), wild lily-of-the-valley (Maianthemum canadense), and wild sarsaparilla (Aralia nudicaulis), were also collected. Spectrographic analyses for eleven elements and Kjeldahl analysis for nitrogen is presently under way to determine nutrient levels in this vegetation.

Plans for next quarter: Course work and nutrient analyses of the vegetation collected in August will continue. Post-fertilization soil samples will be collected and a 100% tally will be made of the woody vegetation present on the fertilization plots.

UPLAND GAMEBreeding Season Behavior of Radio-equipped Male Woodcock

- Objectives: (1) To study the fidelity and continuity of use of singing fields by observation of individually-marked, male woodcock.
- (2) To observe any daily changes in woodcock courtship activity that may occur on several fields in the same general area.

Assignment: James M. Ramakka, Graduate Assistant

Thesis Advisor: Sanford D. Schemnitz, Associate Professor, Wildlife Resources

Consultants: Howard L. Mendall, Unit Leader
 Malcolm W. Coulter, Professor, Wildlife Resources
 Ray B. Owen, Jr., Assistant Professor, Wildlife Resources
 William B. Krohn, Research Biologist, Bureau of Sport Fisheries and Wildlife

An abstract of Ramakka's thesis follows:

The breeding season behavior of American woodcock was studied during April and May of 1970 and 1971. Miniature radio transmitters were attached to 15 male woodcock. The data from these birds were examined to learn more about the fidelity of males to singing fields and to obtain information about the activities of males immediately prior to the evening courtship period.

Radio-equipped males showed a high fidelity to a single singing field. Twelve males used an average of two fields each during a 9-day period. However, one field was always used more often than any other. Evening flights between the diurnal cover and the singing field averaged 564 m.

Mixed hardwood-softwood stands were most often used for diurnal covers by marked males. These birds confined their activities to a small area in the cover and often returned to the same diurnal cover on several consecutive days.

Males carrying transmitters flew to singing fields later than unmarked males and made fewer courtship flights than unmarked birds. On several occasions marked males were chased from singing fields by unmarked males, or else remained silent while unmarked males performed on the fields.

Attaching radio transmitters to courting males affected their behavior on the singing grounds. Three males never flew from the diurnal cover after being marked. Marked males which did fly to singing fields showed reduced courtship activity. Most marked males either peented on the singing fields without making courtship flights or else remained silent on the fields. During this study only four marked males were observed making courtship flights.

WATERFOWLEstablishing and Increasing Local Breeding Populations of Wood Ducks by
Relocating Active Nests

Objective: To establish new breeding populations of wood ducks by moving hens and their recently hatched broods to areas with no wood duck production.

Assignment: David E. Capen, Graduate Student

Thesis Advisor: Malcolm W. Coulter, Professor, Wildlife Resources

Consultant: J. William Peppard, Migratory Bird Research Leader, Maine Department of Inland Fisheries and Game

This report covers work done during the entire field season, April through July.

Based upon the results of nest box relocations during 1970 (summarized in Unit Quarterly Report for July-September, 1970), it was decided that in 1971 a special release box should be constructed to transport and liberate the broods. The advantages of the box were that the hen and the young could see out as soon as the front was opened, and that if the female left the box without calling the young, they could emerge on their own with little difficulty. Outside dimensions of the box were 12 inches on all sides. The front had a circular exit 3 inches in diameter which was located within 3 inches of the bottom; this was covered by a hinged flap which could be opened from a distance.

Eight wood duck broods and their females were moved during the 1971 season. The first 7 relocations were considered successful at the time of release; the 8th was uncertain. A move was regarded as successful if a hen left the site of a release box with her brood and exhibited behavior which seemed to indicate that the young were of primary importance. The last female to be released showed some inclination for the brood, but seemed to respond more to the new surroundings.

Briefly, the most desirable procedure for moving the broods was as follows. The nest box containing the female and her recently hatched young was approached by canoe during the early morning hours, about 30 minutes after daylight. The female was taken from the nest, wing-clipped and placed in the release box. Next, the ducklings were removed individually, web-tagged, and returned to the hen. After being transported by car to the new area, the release box containing the ducks was fixed to a post which had been placed in shallow water about 50 yards from shore. The box was opened about 30 minutes after the ducks were last disturbed, and the females usually emerged 8-10 minutes later.

Six of the wood duck broods were released on a single study area; this marsh was observed frequently throughout June and July, and bait traps were set in July. Five of the 6 broods were positively recognized, and all were attended by the appropriate females. Twenty-five class-IIb juveniles were caught in traps and marked with Fish and Wildlife Service leg bands. They were identified by web tags and represented portions of at least 4 different broods. These captures and additional observations indicated excellent survival among the released broods.

In addition to the wood duck transplants, 4 broods of hooded mergansers and 1 brood of goldeneyes were moved to new areas. The method of relocation was the same as that described for wood ducks. Three of the merganser releases were considered successful although the behavior of the females seemed to be less predictable than with wood ducks. The goldeneye hen and 1 merganser hen died before being released. The deaths were unexplained but likely resulted from either stress or excessive heat.

Plans for next quarter: The entire quarter will be devoted to writing the thesis.

Renesting of the American Eider in Penobscot Bay Colonies

Objective:: To determine the extent to which eiders renest following the loss of initial clutches.

Assignment: William Sarbello, Graduate Assistant

Thesis Advisor: Howard L. Mendall, Unit Leader

Field work began on April 21 and terminated on July 22. Considerable assistance was received from Professors Mendall and Richens. In addition, occasional help in the field was provided by Professors Schemnitz and Hammer, Graduate Assistants Capen and White, and White's wife. Professor Coulter made helpful suggestions on capture techniques.

A total of 125 nesting eiders were handled. Twenty-three (18.4%) had been banded in previous years. The bands on 6 of these (first tagged in 1964-1966) were worn and were replaced. Clutches were taken from 111 banded hens. Two of these birds subsequently died during a fowl cholera outbreak in late June. Sixteen (14.7%) of the remaining 109 hens were found to renest. The frequencies of renesting, as divided into 2 banding categories, were 27.3% (6 of 22) for returns, and 11.5% (10 of 87) for newly banded hens. The mean age of the returns is assumed to be older than that of the newly banded hens. The returns had all nested at least once before, while the newly banded group doubtlessly included some young birds nesting for the first time.

A breakdown of data by islands is presented in Table 1. The renesting column refers to the birds banded on a given island that renested within the entire study area and not necessarily on that island. Two of the Mouse Island captures renested on other islands.

Hens were captured with long-handled nets and with automatic drop-door nest traps as in past studies. In addition, funnels were devised for the present study to catch hens nesting under artificial shelters. These funnels were made of plastic-covered weldwire and were cut to size for each shelter. The funnels were stapled directly to the shelter and anchored into the dirt. Once a reliable method of anchoring was developed, the funnels were efficient; they worked best when set in the afternoon and checked the following morning. The main disadvantage of the funnels was the time required to cut and fit them to the individual shelter.

Early in the season natural cover was sparse, and most hens were netted or trapped under the shelters. Females made increasing use of natural cover as the season progressed, and capture methods shifted to automatic nest traps and, to a lesser extent, hand-netting. A summary of numbers captured by each method is given in Table 2. Hens recaptured were caught by all 3 methods, and apparently did not become either funnel- or trap-shy.

Some eiders had colored leg bands attached or were marked with paint so that they might be recognized as individuals. Butyrate dope was used for paint marking as in most past waterfowl color-marking studies. Drying was facilitated through the use of a car defroster gun powered by a motorcycle battery. Only 6 sightings were made on 4 of the 24 paint-marked hens and only 1 renest was found through the observation of a colored bird. The paint marks apparently did not hinder renesting, as 10 of the 16 renesters were color-marked. Marks were recognizable at a distance, however, in only 2 of these 10 renesters. None of the 27 birds given additional colored leg bands were observed at a distance. This can be attributed in part to a lack of opportunities for observing birds with a spotting scope. Also the paint colors used (orange and white), or the intensity of application, do not appear to permit individual identification as well with eiders as with other ducks studied.

There was a minor outbreak of fowl cholera on Mouse Island during the latter part of the nesting season. Since it occurred in late June, only a small proportion of the nesting population was affected. Twenty-four dead hens were found, most of which had gross appearances of fowl cholera; 2 specimens sent for necropsy to the University of Maine Pathology laboratory were positive for fowl cholera. Seven of the dead hens were banded. Unfortunately, 3 of these were renesting experiment birds, one of which was renesting when stricken. Pools of stagnant water on the islands, a logical source of bacterial transmission, were disinfected as soon as the outbreak was suspected.

Plans for next quarter: Work will continue on the establishment of a set of known-age embryos from the egg samples saved. Clutches of collected eggs will then be backdated to determine the dates of the start of laying and the start of incubation. Renesting intervals will be calculated and analyzed with respect to the stage of incubation at the time of nest loss.

Table 1. Eider Renesting Data by Island.

Island		Total	Eligible for Renesting	Number Renesting	% Renesting
Mouse Island	New Bandings	39	33	4	12.1
	Returns	10	9	4	44.4
	Total	49	42	8	19.0
Goose Island	New Bandings	16	11	3	27.3
	Returns	5	5	1	20.0
	Total	21	16	4	25.0
Robinson Rock	New Bandings	35	33	2	6.1
	Returns	8	8	1	12.5
	Total	43	41	3	7.3
E. Goose Rock	New Bandings	12	10	1	10.0
	Returns	0	0	0	--
	Total	12	10	1	10.0

Table 2. Catch of Eiders by Island and Method

Island	Number of Eiders Caught by			Total Capture
	Funnel	Net	Trap	
Mouse Island	12	17	20	49
Goose Island	5	8	8	21
Robinson Rock	12	9	22	43
East Goose Rock	--*	1	11	12
Total	29	35	61	125

* There are no nest shelters on East Goose Rock.

OTHER PROJECTS

The Effects of DDT on Robin Reproduction in Northern Maine Forests

- Objectives: (1) To compare clutch size, egg shell thickness, and nestling mortality on sprayed and non-sprayed areas.
 (2) To compare DDT concentrations in eggs, young, and adult robins in sprayed and non-sprayed areas.

Assignment: David M. Knupp, Graduate Assistant

Thesis Advisor: Ray B. Owen, Jr., Assistant Professor, Wildlife Resources

Consultants: Marshall D. Ashley, Assistant Professor, Forest Resources
 John B. Dimond, Professor, Entomology
 Frederick F. Gilbert, Assistant Professor, Wildlife Resources

The last two quarters in the field have been used for collecting data. Initially, robins were collected as soon as resident birds arrived so that a base-line level of DDT being carried north might be established. The remainder of the season was spent locating nests and gathering data concerning habitat and site selection. The areas that had received one spraying were eliminated from the study to cut down on observer traveling time. A total of 68 active nests were found within the remaining study areas as described in the Unit Quarterly Report for January-March, 1971.

Although some nests were found through the location of singing males, the most productive method was to search the area intensively. Even with this method, a maximum of only 1 nest/man-day was found. Nests were visited about every 3 days and their contents recorded. A sectioned aluminum pruning pole with a mirror attached to one end was used to see into nests; this minimized disturbance of the birds. After the outcome of the clutch was known, habitat and site-selection data were recorded. Nestlings were banded at 7-8 days of age if they were readily accessible. A total of 25 birds were banded. Nestlings that died or fell from nests were collected for analysis as were eggs that failed to hatch.

Losses to predation were higher than expected. Of those nests found in an active state, 40-50% of the eggs and/or young were lost to predators. Therefore, collections of adults, young, and eggs were held to a minimum with the major emphasis of the study being placed on hatchability and nestling survival. Five females with their clutches, and 1 female with her brood were collected outside actual study areas, but with the same spray histories. A total of 83 birds and 25 eggs were collected throughout the field season.

The only observed predation was of a raven on robin nestlings; it killed and carried away the entire brood. The nest had not been previously found by the investigator, so human disturbance was not a factor in the loss. Eggs in three nests were lost to avian predators and the evidence indicates that the predator was small since the eggs were neatly picked open and not removed from the nest. Generally, ravaged nests were not disturbed other than having their contents removed.

Some site selection data have been analyzed. The average height of nests above ground in conifers was 4.0 ± 0.33 ($\bar{x} + SE$) meters and the average height in deciduous trees was 7.1 ± 0.85 meters. The means are significantly different at the .95 level. Table 1 summarizes the species of trees that nests were found in and the average heights of the nests ~~(nest dimensions)~~ ^{above ground.}

Table 1. Site Selection (by tree species) by Nesting Robins

Tree Species	Number of Nests	Nest Dimension	
		Ht. (Inches)	(Meters)
Balsam Fir (<u>Abies balsamea</u>)	18	3.9	
Red Spruce (<u>Picea rubens</u>)	9	4.2	
White Birch (<u>Betula papyrifera</u>)	6	6.3	
Yellow Birch (<u>Betula lutea</u>)	5	8.6	
White Spruce (<u>Picea glauca</u>)	5	4.3	
Sugar Maple (<u>Acer saccharum</u>)	4	9.6	
Beech (<u>Fagus grandifolia</u>)	4	5.5	
Hemlock (<u>Tsuga canadensis</u>)	1	5.0	
Willow (<u>Salix</u> spp.)	1	1.5	
White Cedar (<u>Thuja occidentalis</u>)	1	1.5	
Ash (<u>Fraxinus</u> spp.)	1	5.0	

Plans for next quarter: The samples collected will be processed for DDT residues. Eggshell thickness will be measured and the analyses of this quarter's data will continue.

Effects of DDT on Red-backed Salamanders in Northern Maine

- Objectives: (1) To compare population parameters of red-backed salamanders in DDT sprayed and non-sprayed areas.
 (2) To contribute to the knowledge of the life history and ecology of the red-backed salamander in northern Maine.

Assignment: Chester F. Banasiak, Graduate Assistant

Thesis Advisors: John B. Dimond, Professor, Entomology
 Ray B. Owen, Jr., Assistant Professor, Wildlife Resources

Consultants: Carter Gibbs, Project Leader, N.E. Forest Experiment Station, Graduate Faculty Lecturer
 Frederick F. Gilbert, Assistant Professor, Wildlife Resources
 Richard W. Hatch, Associate Professor, Zoology

Initial collections of the red-backed salamander (Plethodon cinereus) and information on reproduction were previously carried out during the summer of 1970. The present report will discuss activities, progress and preliminary findings from June 1 to September 30. During that period approximately 45 days were spent in the field.

This salamander is one of several animal species being studied for DDT contamination in Aroostook County. The spray history is contained in the Unit Quarterly Report for January-March, 1971, in conjunction with the robin study. Previous studies (Dimond, et al., 1968; Dimond, et al., 1970) indicate that the salamander and other vertebrate and invertebrate species carry residues associated with DDT-contaminated forest soils which reflect the past spray history. This study will attempt to gain a more complete understanding of red-backed salamander populations and ecology under conditions of DDT contamination.

Four general areas of study were selected on the basis of spray history, occurrence of salamanders, and access (Table 1). Mapping and measuring of all ground objects (logs, branches, rocks, etc.) capable of harboring salamanders was completed on 1 of 3 25 x 25-meter plots.

Preliminary sampling to obtain estimates of relative salamander numbers were conducted on each of the general study areas. Alternate half-hour periods were spent in searching time-plots of 1 meter width for salamanders by turning over ground objects, and by tearing apart decaying logs and stumps. Preliminary findings are given in Table 2.

Approximately 150 salamanders were collected for sex, length and weight determinations from each area; these were preserved in 70% alcohol and will be measured during the non-field season.

Reproduction Data

In all, 89 clutches, approximately equally distributed among the 4 areas, were collected. Mean clutch size was 6.2 eggs. When combined with data collected in 1970, the total of 168 clutches averages 6.3 eggs/clutch (Table 3).

Hatching-success measures were obtained from rearing of eggs in the laboratory. Eggs and attending females were placed in covered plastic containers on wet, partially-decayed wood fragments collected from logs used as nesting sites. Storage temperatures while in transit to Orono were kept between 15-21°C by use of styrofoam coolers. Incubation was continued at a temperature of 20°C maintained in a Perceival Model E-54 environmental chamber.

Hatching of clutches incubated in the laboratory began August 10 and was complete by August 28. Because eggs from clutches were presumably eaten, two measures of hatching success were computed. One is based on total eggs collected while the other is the number of eggs remaining available for hatching. Of the 544 eggs incubated, 417 or about 77% hatched; based on the 447 eggs remaining available, hatching success amounted to 93%. Differences among areas were relatively minor. Hatching success of available eggs ranged from about 92-96% for clutches attended by females. For small numbers of eggs incubated without attending females, hatches of available eggs varied from 78-100% among areas.

Survival of larvae likewise was high. Approximately 95% of larvae survived during a minimum 3-week, post-hatch period. A point of interest regarding behavior is evident in the Greenlaw and Beaver area data. Extremes in egg eating and cannibalism of young occurred in these 2 areas. Part of the difference in behavior can be attributed to greater stress or opportunity associated with pairing of clutches and females in the same container. Ninety per cent of Greenlaw broods were paired in contrast to 63% for Beaver area broods. Additional examination of data is required for a more detailed comparison of oophagy and cannibalism among paired and solitary brooding females.

All but one of 77 attending females survived the stress of collection, storage, transportation, and incubation. The one loss was attributable to desiccation upon escape from its container.

Rearing in Laboratory

In mid-September the stock of 475 salamanders was randomly reduced to 6 adults and 12 or 13 young from each area and an effort made to maintain that population. House fly maggots were reared and successfully fed to both adults and young. Optimum food required is unknown, but adults appear to have gained weight on an average of 6 maggots/day while the young have visibly grown, after a months feeding, on 2-3 small maggots/day.

Housing of the animals continued the same as during incubation. Either 3 adults or 6 or 7 young are housed/covered plastic tray (125 x 170 x 58 mm) in which bedding consists of chunky pieces of decaying wood taken from nest-site logs.

No mortality of adults has occurred during the elapsed month since reduction of the population and mortality among young of the year has not been evident.

Literature Cited:

Dimond, J. B., R. E. Kadunce, A. S. Getchell and J. A. Blease. 1968. Persistence of DDT residues in red-backed salamanders in a natural environment. Bull. Environmental Contamination Tox., 3:194-202.

Dimond, J. B., G. Y. Belyea, R. E. Kadunce, A. S. Getchell and J. A. Blease. 1970. DDT residues in robins and earthworms associated with contaminated forest soils. Can. Entomol. 102(9):1123-1130.

Plans for next quarter: Coding and punching for computer compilation and analysis of data will be initiated. Specimens collected will be measured and weighed. Rearing of salamander population in captivity will continue.

Table 1. Areas, Township Location, Spray History and DDT Residues in Parts/Million found in Resident Salamanders in 1970.

Area	Location	DDT Application (Years Treated)	PPM Residues
Greenlaw Mountain	T12R7 WELS	None	.020
Weeks Brook	T11R8 WELS	None	.080
Beaver Brook	T14R5 WELS	3	.440
Sterling Brook	T12R7 WELS	2	.150

Table 2. Relative Red-backed Salamander Abundance Based on $\frac{1}{2}$ -hr. Search Plots

Item	Control			Spray			Total of all Areas
	Greenlaw Mountain	Weeks Brook	Total	Beaver Brook	Sterling Brook	Total	
	<u>Lifting Objects</u>						
Number of Plots	6	3	9	9	6	15	24
Salamanders Found	10	2	12	11	10	21	33
*M ² of Surface							
Uncovered	9.63	4.69	14.32	11.50	6.63	18.13	32.45
Salamanders/m ²	1.04	0.43	0.84	0.96	1.51	1.16	1.02
Salamanders/hr.	3.3	1.3	2.7	2.4	3.3	2.8	2.8
	<u>Tearing Apart Logs, etc.</u>						
Number of Plots	6	3	9	7	4	11	20
Salamanders Found	12	9	21	15	3	18	39
**M ³ Searched	1.29	0.52	1.81	0.94	0.44	1.38	3.19
Salamanders/m ³	9.3	17.4	11.6	16.0	6.76	13.0	12.2
Salamanders/hr.	4.0	6.0	4.7	4.2	1.5	3.3	3.9

*M² = Square Meters.

**M³ = Cubic Meters.

Table 3. Comparison of Annual Red-backed Salamander (Plethodon cinereus) Clutch Size, 1970 and 1971

Year	Control			Spray			All Areas		
	Number	Mean	S.E.	Number	Mean	S.E.	Number	Mean	S.E.
1970	40	6.62	+ 0.40	39	6.31	+ 0.35	79	6.47	+ 0.27
1971	45	6.04	+ 0.29	44	6.30	+ 0.21	89	6.18	+ 0.18
1970 & 1971	85	6.32	+ 0.24	83	6.30	+ 0.20	168	6.32	+ 0.16

The Ecology and Population Dynamics of the Crayfish (Cambarus bartoni) in Northern Maine

- Objectives: (1) To determine the habitats occupied by and the life history of C. bartoni in northern Maine.
 (2) To investigate the role of C. bartoni as consumer, prey, host, and competitor.
 (3) To determine and compare the population dynamics and productivity of this species in four streams.
 (4) To investigate the possible effects the DDT spraying has had upon these populations.

Assignment: William F. Reid, Jr.

Thesis Advisor: John B. Dimond, Professor, Entomology

Consultants: Ray B. Owen, Jr., Assistant Professor, Wildlife Resources
 William L. Soule, Jr., Assistant Professor, Mathematics
 Ronald B. Davis, Associate Professor, Botany and Geological Sciences
 Richard W. Gregory, Assistant Professor, Zoology

Sampling was begun in June to determine the species of crayfish present and their distribution in the Fish River Lake area of northern Maine. Four streams--2 in DDT sprayed and 2 in unsprayed areas--containing crayfish populations were selected for intensive study and comparison. Crayfish were collected throughout the summer to obtain information on life history events and population levels. Selected chemical and physical parameters of the 4 streams were periodically measured for descriptive and comparative purposes.

Preliminary sampling indicated that trap captures are biased by sex, size, age, and molt condition because of differential behavior associated with various life history events. Hand sampling by overturning rocks and digging into the substrate appeared to be the least biased method of capture but might be selective for size, particularly when visibility is poor. This method results in considerable short-term alteration of the habitat.

Two species of crayfish, C. bartoni and Orconectes virilis, were found in the study area. C. bartoni appears to be the dominant crayfish in cold streams with a rubble substrate, over a soft bottom. O. virilis occupies warmer lentic and lotic habitats with a variety of substrates. The two species occur together in at least one river. C. bartoni occurs in many streams within the spray area while O. virilis is found in few. For this reason, and because little information is available on O. virilis in the literature, the former species was chosen as the principal one to be investigated.

During the past summer over 2,000 C. bartoni and over 350 O. virilis were collected. The majority of which were released. Some, however, were preserved for anatomical study, age and growth work, ovarian egg counts, and stomach analysis. Others were frozen for subsequent residue analysis and some were kept in aquaria in an attempt to develop rearing techniques.

Most oviferous and young-bearing female C. bartoni were found in August and early September but some were also captured during June and July, indicating an extended reproductive season. Females appear to become sexually mature at about 26-27 mm carapace length (CL) while males mature at 24-25 mm CL. The number of eggs affixed to the pleopods (abdominal swimmeretts) appears to be an increasing linear function of the oviferous female CL. The relationship between the number of young on the pleopods and female CL appears similar when plotted but exhibits more scatter.

Free-living crayfish collected ranged in CL from about 6-41 mm and in weight from 0.1 to over 19 g. The CL-weight relationship is curvilinear and appears to be the same for males and females. Sex ratios were 50:50 for most samples. Length frequency plots were multimodal with considerable overlap of modal groups.

Population estimates using mark-recapture techniques exhibited large variances. Difficulties included biased trapping of too short a duration, inadequacy of blocking seines to effectively isolate stream sections, and poor visibility because of high water during hand sampling.

The only actual observation of predation was of that by a brook trout (Salvelinus fontinalis) upon a small, newly released, marked C. bartoni. Generally, however, the secretive habits of the smaller crayfish and the armament of the larger individuals would appear to limit predation. Most mortality appeared associated with molting and old age.

Unidentified branchiobdellids (leech-like commensals on gills of crayfish) were frequently found upon C. bartoni but never upon O. virilis, even when the two species were taken from the same locations. Branchiobdellid specimens were collected for identification.

Plans for next quarter:

1. Collect C. bartoni for rearing in laboratory.
2. Develop a modified scheme for determining population structures and densities.
3. Identify branchiobdellids.
4. Check mark retention, determine molt categories, and measure growth increments of laboratory specimens.

Environmental Studies on the Lower Penobscot River (I)

Objective: To establish a biological base by qualitative sampling of benthic macroinvertebrates in tidal and non-tidal areas.

Assignment: John F. Moroney, Graduate Assistant

Thesis Advisors: Malcolm W. Coulter, Professor, Wildlife Resources
Ray B. Owen, Jr., Assistant Professor, Wildlife Resources

Consultants: Richard H. Storch, Associate Professor, Entomology
Robert L. Vadas, Assistant Professor, Botany and Assistant
Professor, Zoology
Franklin E. Woodard, Associate Professor, Civil Engineering

Qualitative sampling of the benthos in the tidal and non-tidal portions of the study area and mapping of the emergent vegetation in the tidal area was completed.

Artificial substrates consisting of rock-filled boxes constructed with $\frac{1}{2}$ -inch mesh hardware cloth were placed in the non-tidal area to sample 3 fast-water and 3 slow-water communities. Each of the 6 stations consisted of 9 substrates. The substrates were left in place for 1 month and removed over a 2-day period. Each substrate was transported to the laboratory in plastic buckets where the organisms were removed by washing into a $\frac{1}{2}$ -mm screen. The organisms were preserved in Bouin's solution for further sorting and identification.

In the tidal area, qualitative sampling was conducted at 10 locations. Two locations in the upper reaches of the tidal area were sampled with artificial substrates in the manner described above. The other 8 locations were sampled by 10 random grabs with a Ponar grab sampler. All samples were taken over a 4-day period, sieved with a 1-mm screen and preserved in the field with a 5-10% formalin solution for further sorting and identification in the laboratory.

Plans for next quarter: The sorting of all samples is to be completed and identification and analyses of the results will be initiated.

Environmental Studies on the Lower Penobscot River (II)

Objective: To establish a biological base by quantitative sampling of benthic macroinvertebrates in four coves in the Penobscot Estuary.

Assignment: Gary White, Graduate Assistant

Thesis Advisors: Malcolm W. Coulter, Professor, Wildlife Resources
Ray B. Owen, Jr., Assistant Professor, Wildlife Resources

Plans for next quarter: Nematode slides as well as type specimens of all snail species will be sent off for positive identification. Initial organization and analysis of data will begin.

CURRENT PROJECTS NOT REPORTED THIS QUARTER

Mobility of Deer in Three Western Maine Winter Yards - R. D. Hugie
 Woodcock Nocturnal Habitat Utilization in Relation to Sex, Age, and Molt -
 R. B. Owen, Jr.
 Ecology of the Ruffed Grouse in Maine - S. D. Schemnitz
 Waterfowl Distribution and Breeding Ecology - H. L. Mendall
 Ecology and Behavior of the Fisher - M. W. Coulter
 Factors Affecting Summer Flight Behavior of White-tailed Deer on Isle au Haut -
 S. D. Schemnitz
 Effects of Three Cover Conditions on Behavior and Physiological Responses
 on Pinned White-tailed Deer - Myrtle C. Bateman
 Annual Production and Factors Influencing Nesting Success of the American
 Eider - H. L. Mendall
 Importance of Snow Support in the Welfare and Survival of Wintering Deer
 in Western Maine - V. B. Richens
 Breeding Season Studies of Male American Woodcock - S. D. Schemnitz
 Distribution of Eider Populations in Coastal Maine - H. L. Mendall

COOPERATION, EDUCATIONAL WORK AND MISCELLANEOUS ACTIVITIES

Mendall participated in the annual meeting of the Maine Waterfowl Council in Augusta on August 19. He conferred in Fredericton, New Brunswick September 28 and 29 with personnel of the Provincial Fish and Wildlife Branch and of the University of New Brunswick on migratory game bird problems of mutual interest to Maine and New Brunswick.

Gilbert attended the N.E. Deer Study Group meeting in Montpelier, Vermont August 29-September 1.

The Maine Department of Inland Fisheries and Game named and dedicated a new state game management area September 23 in honor of Unit Leader Mendall. This area will eventually include 1,400 acres and consists of the tidal borders of Marsh Stream, a tributary of the Penobscot River, in Frankfort and Prospect. The primary benefit will be to waterfowl. It was purchased from Federal Aid to Wildlife Restoration Funds, Maine Fish and Game funds, donations from interested individuals and contributions from the Maine Audubon Society and Penobscot Valley Conservation Association.

Coulter attended the Wildlife Society Council meeting in Denver, Colorado, July 24-25.

Owen, Coulter and Hammer participated in the Northeast Wildlife Teachers Meeting in Fredericton, New Brunswick, August 16, 17.

PERSONNEL CHANGES

Effective September 24, George Bucknam retired as Commissioner of Inland Fisheries and Game. His successor has not yet been appointed. The Unit Staff is very appreciative of Mr. Bucknam's interest and assistance to the Unit program during his 17 years as Deputy Commissioner and his recent tenure as Commissioner. Best wishes are extended to him in retirement.

Eight new graduate students began their programs this quarter for advanced degrees at the University of Maine. They are as follows:

James B. Barnes - B.S., 1971, University of Vermont, Burlington.
 William J. Crenshaw - B.S., 1971, University of Tennessee, Knoxville.
 James M. Kienzler - B.S., 1969, University of Maryland, College Park;
 M.S. 1971, West Virginia University, Morgantown. [Mr. Kienzler
 is working toward a Ph.D. degree.]
 Jeffery R. Kropp - B.S., 1971, Dartmouth College, Hanover, New Hampshire.
 Katherine J. Little - B.S., 1971, Swarthmore College, Swarthmore,
 Pennsylvania.
 Barbara W. McKean - B.Sc., 1970, B. Ed., 1971, Dalhousie University,
 Halifax, Nova Scotia.
 Mark R. Mowatt - B.Sc., 1971, Acadia University, Wolfville, Nova Scotia.
 James S. Wakeley - B.A., 1971, University of California, Santa Barbara.

Graduate Assistant James M. Ramakka received an M.S. degree in Wildlife Management in August and is now living in New York.

PUBLICATIONS AND THESES

Ramakka, James M. 1971. Breeding Season Behavior of Radio-equipped Male Woodcock. M.S. Thesis, University of Maine, Orono. Unpub. 59 pp.

Reid, William F., Jr. 1971. New Forage Food for Fish? - Crayfish Study. Maine Fish and Game, Vol. XIII, No. 3, pp. 8-9.

November 9, 1971

File Copy

MAINE COOPERATIVE WILDLIFE RESEARCH UNIT

University of Maine

Orono, Maine

QUARTERLY REPORT

October-December, 1971

Cooperating Agencies

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

NOT FOR PUBLICATION

TABLE OF CONTENTS

	PAGE
WILDLIFE STAFF	3
RESEARCH PROJECTS	4
WATERFOWL	
Distribution of Eider Populations in Coastal Maine (Financed by Unit and Bureau of Sport Fisheries and Wildlife)	4
Renesting of the American Eider in Penobscot Bay Colonies (Financed by Unit)	5
OTHER PROJECTS	
The Effects of DDT on Robin Reproduction in Northern Maine Forests (Financed by Food and Drug Administration)	6
Effects of DDT on Red-backed Salamanders in Northern Maine (Financed by Food and Drug Administration)	6
The Ecology and Population Dynamics of the Crayfish (<u>Cambarus bartoni</u>) in Northern Maine (Financed by Food and Drug Administration)	7
Environmental Studies on the Lower Penobscot River (I and II). (Financed by the Ford Foundation)	8
Incidence of Occurrence of <u>Pneumostrongylus tenuis</u> in Potential Intermediate Hosts Collected from Various Ecological Regions in Maine (Financed by Maine Federal Aid in Wildlife Restoration Funds)	9
CURRENT PROJECTS NOT REPORTED THIS QUARTER	9
COOPERATION, EDUCATIONAL WORK AND MISCELLANEOUS ACTIVITIES	9
PUBLICATIONS AND THESES	10

WILDLIFE STAFF

Howard L. Mendall, Unit Leader and Professor of Wildlife Resources
 Voit B. Richens, Assistant Unit Leader and Assistant Professor of Wildlife Resources
 Malcolm W. Coulter, Associate Director for Wildlife, School of Forest Resources and Professor of Wildlife Resources
 S. D. Schemnitz, Associate Professor of Wildlife Resources (on leave until 7/1/77)
 R. B. Owen, Jr., Assistant Professor of Wildlife Resources
 Frederick F. Gilbert, Assistant Professor of Wildlife Resources
 Donald A. Hammer, Assistant Professor of Wildlife Resources (1 year appointment)

Unit Collaborators - Personnel from many University departments as well as State, Federal and private organizations are actively collaborating with the Unit. Individuals assisting with projects that are currently reported upon are listed in connection with the appropriate project summary.

Graduate Assistants: David H. Abell
 Chester F. Banasiak (Ph.D. Program)
 Myrtle C. Bateman
 William Crenshaw
 Roy D. Hugie
 James Kienzler (Ph.D. Program)
 David M. Knupp
 Jeffrey Kropp
 John F. Moroney
 William F. Reid, Jr. (Ph.D. Program)
 William Sarbello
 Gary C. White

Graduate Fellow: Katherine Little

N.S.F. Trainee: James Wakeley

Graduate Students: James Barnes
 David E. Capen
 J. George Gleich
 Barbara McKean (Trustee Scholarship)
 Mark Mowatt
 William R. Whitman (Ph.D. Program)

Unit Secretary: Maxine L. Horne

Unit Coordinating Committee

Maynard F. Marsh, Commissioner, Maine Department of Inland Fisheries and Game
 Edwin L. Giddings, Acting Director, School of Forest Resources
 Howard L. Mendall, Unit Leader

RESEARCH PROJECTSWATERFOWLDistribution of Eider Populations in Coastal Maine

- Objectives: (1) To conduct aerial breeding ground inventories; to maintain a current classification of the important nesting islands, and to establish priorities for agency acquisition.
- (2) To determine the abundance and subspecific composition of fall and winter populations.

Assignment: Howard L. Mendall, Unit Leader
 William D. Snow, Game Management Agent, Bureau of Sport Fisheries and Wildlife

Consultant: Rex C. Tice, Division of Management and Enforcement,
 Bureau of Sport Fisheries and Wildlife

Eider specimens were obtained during the fall and winter hunting season as in recent years. These were for purposes of sex, age and subspecies determinations from the harvest. In addition to hunter contacts by Snow and Mendall, the number of specimens available for study was supplemented through the cooperation of the following individuals who contacted hunters in their respective localities: Richard Anderson of Portland, Alfred Teel of Rockland and John Maines of Brewer.

A total of 328 eiders were examined and these were well distributed along the Maine coast. Subspecies determination is given in Table 1.

Table 1. Examination of Maine Eider Duck Specimens in the Fall and Winter of 1971-72 (Nov. 1 - Jan. 8).

Area	American ^{1/} Eider	Northern ^{2/} Eider	Intermediate ^{3/}	Total Eiders Examined
Western Maine (Casco Bay-Saco River)	115	--	2	117
Central Maine (Penobscot & Muscongus bays)	73	1	1	75
East-central Maine (Off Mt. Desert I.)	61	1	2	64
Eastern Maine (Jonesport-Schoodic)	69	2	1	72
Totals	318	4	6	328

^{1/}*S. m. dresseri.*

^{2/}*S. m. borealis.*

^{3/}Probable hybrids of the American and northern eiders.

As was the case a year ago, the proportion of northern eiders killed was very low. The same is true of intermediates--birds that probably are crosses between northern (S. m. borealis) and American (S. m. dresseri) eiders. Only specimens obtained during the last 2/3 of the hunting season were used in the subspecies tabulation, because September and October flocks would not be expected to contain northern eiders.

Plans for next quarter: Inactive.

Renesting of the American Eider in Penobscot Bay Colonies

Objective: To determine the extent to which eiders reneest following the loss of initial clutches.

Assignment: William Sarbello, Graduate Assistant

Thesis Advisor: Howard L. Mendall, Unit Leader

A set of known-age embryos was established from clutches observed during laying and subsequently collected at differing stages of incubation. These embryos will be kept as a permanent reference collection. They are being used as a base to age embryos collected from unknown-age clutches. These are being backdated to determine the dates of the start of incubation and the start of laying.

Nearly two-thirds of the clutches contained more than one age-class of embryo. Usually one embryo was found to be about one day younger than the rest of the clutch; although clutches with a greater differential in age-classes were also found. When more than one age-class was present the oldest was used for backdating, unless there was an obvious anomaly.

There are several possible causes for the age differences among embryos in the same clutch. It may be that incubation often begins before the last egg is laid as some authors have believed. Large discrepancies in age probably represent laying by more than one female and nest consolidations. It is also possible that the first eggs laid may begin to develop slightly from the heat of the hen since she spends an increasing amount of time on the nest during the final portion of the laying period.

Plans for next quarter: Aging of embryos and back-calculating the dates of the start of laying and the start of incubation will be completed. All nesting data will be analyzed, and writing of the thesis will be started.

OTHER PROJECTSThe Effects of DDT on Robin Reproduction in Northern Maine Forests

- Objectives: (1) To compare clutch size, egg shell thickness, and nestling mortality on sprayed and non-sprayed areas.
 (2) To compare DDT concentrations in eggs, young, and adult robins in sprayed and non-sprayed areas.

Assignment: David M. Knupp, Graduate Assistant

Thesis Advisor: Ray B. Owen, Jr., Assistant Professor, Wildlife Resources

Consultants: Stanley Getchell, Associate Professor of Chemistry
 John Blease, Research Associate, Maine Agriculture
 Experiment Station
 John B. Dimond, Professor of Entomology

During this quarter all of the robins and eggs that were collected in the 1971 field season were prepared for pesticide residue determinations. DDT residues are being detected by gas chromatography at this time and results will be available next quarter.

Plans for next quarter: The data will be analyzed and the writing of a thesis will be initiated.

Effects of DDT on Red-backed Salamanders in Northern Maine

- Objectives: (1) To compare population parameters of red-backed salamanders in DDT sprayed and non-sprayed areas.
 (2) To contribute to the knowledge of the life history and ecology of the red-backed salamander in northern Maine.

Assignment: Chester F. Banasiak, Graduate Assistant

Thesis Advisors: John B. Dimond, Professor of Entomology
 Ray B. Owen, Jr., Assistant Professor of Wildlife Resources

Consultants: Carter Gibbs, Project Leader, N.E. Forest Experiment
 Station, and Graduate Faculty Lecturer
 Frederick F. Gilbert, Assistant Professor, Wildlife Resources
 Richard W. Hatch, Associate Professor, Zoology

Primary emphasis during the quarter was placed on the rearing of the captive salamanders. All of the 24 adult females, originally collected in July 1971, survived through the quarter. Of the 50 young retained (hatched in the laboratory in late August) 30 survived to the end of the year. Surviving young varied considerably in size; snout-vent lengths ranged from 12 to 19 mm. and weights varied from 0.03 to 0.20 g. Adult snout-vent lengths varied from 41 to 52 mm and weights ranged from 1.22 to 2.10 g at the end of the quarter.

Measurement of specimens from summer collections and processing of related data continued through the quarter. In addition, plans for subjecting the surviving captive population to contrasting photoperiods and DDT-contaminated food levels were initiated.

Plans for next quarter: Data processing and rearing of salamanders will continue. Experimentation with photoperiod adjustments and DDT-contaminated food will be initiated.

The Ecology and Population Dynamics of the Crayfish *Cambarus bartoni* in Northern Maine

- Objectives:
- (1) To determine the habitats occupied by and the life history of *C. bartoni* in northern Maine.
 - (2) To investigate the role of *C. bartoni* as consumer, prey, host, and competitor.
 - (3) To determine and compare the population dynamics and productivity of this species in four streams.
 - (4) To investigate the possible effects DDT spraying has had upon these populations.

Assignment: William F. Reid, Jr.

Thesis Advisor: John B. Dimond, Professor, Entomology

Consultants: Ray B. Owen, Jr., Assistant Professor, Wildlife Resources
 William L. Soule, Jr., Assistant Professor, Mathematics
 Ronald B. Davis, Associate Professor, Botany and Geological Sciences
 Richard W. Gregory, Assistant Professor, Zoology
 Marshall D. Ashley, Assistant Professor, Forest Resources

Rearing problems resulted in the loss of a laboratory population of *C. bartoni*. Additional specimens of both species were collected and are being successfully maintained in aquaria within an environmental chamber. A laboratory stream model suitable for use within the chamber is being investigated.

Observations of aquaria and in the field suggest that *C. bartoni* burrows more deeply and becomes inactive when water temperatures reach approximately 6° to 10°C. *Orconectes virilis* also apparently becomes less active but does not dig burrows or become as immobile as does *C. bartoni*.

A modified sampling scheme for determining population structures and densities has been developed for field testing. This scheme consists of a mark-recapture procedure involving two different methods of capture and enclosure of the sampling area.

Plans for next quarter: Data collection will be continued.

Environmental Studies on the Lower Penobscot River (I)

Objective: To establish a biological base by qualitative sampling of benthic macroinvertebrates in tidal and non-tidal areas.

Assignment: John F. Moroney, Graduate Assistant

Thesis Advisors: Malcolm W. Coulter, Professor, Wildlife Resources
Ray B. Owen, Jr., Assistant Professor, Wildlife Resources

Consultants: Richard H. Storch, Associate Professor, Entomology
Robert L. Vadas, Assistant Professor, Botany and Assistant
Professor, Zoology
Franklin E. Woodard, Associate Professor, Civil Engineering

Sorting of estuarine and freshwater benthic samples and identification of species encountered was completed. Preliminary analyses of the freshwater data show that diversity of benthic organisms differs in a downstream direction as well as across the stream, from major sources of pollution.

More species were found in the "clean water" control stations and in the east and mid-channel downstream stations when pollution-intolerant species predominated. There were few types of organisms in the west channel and these were species tolerant of pollution. This indicates that there is a very definite channeling of pollutants along the west bank of the river.

Plans for next quarter: Analysis of the data is to be completed and compilation of the final report is to be initiated.

Environmental Studies on the Lower Penobscot River (II)

Objective: To establish a biological base by quantitative sampling of benthic macroinvertebrates in four coves in the Penobscot Estuary.

Assignment: Gary White, Graduate Assistant

Thesis Advisors: Malcolm W. Coulter, Professor, Wildlife Resources
Ray B. Owen, Jr., Assistant Professor, Wildlife Resources

Consultants: Richard H. Storch, Associate Professor, Entomology
Robert L. Vadas, Assistant Professor, Botany and Assistant
Professor, Zoology
Franklin E. Woodard, Associate Professor, Civil Engineering

The sorting of organisms in the 320 samples taken last August and the counting of individuals of each species in samples was completed.

Plans for next quarter: To verify the identifications of organisms, complete the analysis of data and begin writing the thesis.

Incidence of Occurrence of *Pneumostrongylus tenuis* in Potential Intermediate
Hosts Collected from Various Ecological Regions in Maine

Assignment: J. G. Gleich, Graduate Student

Thesis Advisor: Frederick F. Gilbert, Assistant Professor, Wildlife
Resources

Consultants: Marshall D. Ashley, Assistant Professor, Forest Resources
Kenneth W. Allen, Professor and Chairman, Zoology
Roy C. Anderson, Professor, Zoology, Univ. of Guelph,
Ontario

Gastropod collection, laboratory examination of gastropods for nematodes and vegetative characterization of the seven study areas was completed. Compilation of gastropod and vegetation data was begun.

Nematode specimens were prepared and sent to Dr. Anderson and slug specimens to Dr. J. B. Burch (Museum of Zoology, Ann Arbor, Michigan) for positive identification.

Plans for next quarter: Compilation of data and identification of plants, slugs and nematodes will be completed. Writing of the thesis will be initiated.

CURRENT PROJECTS NOT REPORTED THIS QUARTER

Mobility of Deer in Three Western Maine Winter Yards - R. D. Hugie
Woodcock Nocturnal Habitat Utilization in Relation to Sex, Age, and Molt -
R. B. Owen, Jr.
Ecology of the Ruffed Grouse in Maine - S. D. Schemnitz
Waterfowl Distribution and Breeding Ecology - H. L. Mendall
Ecology and Behavior of the Fisher - M. W. Coulter
Factors Affecting Summer Flight Behavior of White-tailed Deer on Isle au Haut -
S. D. Schemnitz
Effects of Three Cover Conditions on Behavior and Physiological Responses
on Penned White-tailed Deer - Myrtle C. Bateman
Annual Production and Factors Influencing Nesting Success of the American
Eider - H. L. Mendall
Importance of Snow Support in the Welfare and Survival of Wintering Deer
in Western Maine - V. B. Richens
Breeding Season Studies of Male American Woodcock - S. D. Schemnitz
Investigation of Aquatic Gastropods in Maine for Occurrence of *Pneumostrongylus
tenuis* - M. R. Mowatt

COOPERATION, EDUCATIONAL WORK AND MISCELLANEOUS ACTIVITIES

Coulter, representing The Wildlife Society, served as a member of the re-accreditation team of the Society of American Foresters, visiting the School of Forest Resources and Wildlife, University of Florida during late October. While in Florida Coulter spent 2 days in the Everglades and at

National and State wildlife refuges with Dr. Sanford Schemnitz. Schemnitz is on leave from the University of Maine and is stationed at Fort Lauderdale working for the Florida Game and Fresh Water Fish Commission.

Coulter attended a 2-day Wildlife Society Council meeting in Omaha, Nebraska during early December.

Gilbert chaired the annual meeting of the Atlantic Chapter of the Canadian Society of Wildlife and Fishery Biologists in Greenville, Maine, October 14-16. This was the first time this organization had ever met outside of Canada. Coulter served as panel discussion leader for a session of the meeting. The theme for the panel was "How can the fishery and wildlife biologists best take an active role with respect to environmental problems."

Coulter was invited by the New England Natural Resources Center to serve on a steering committee to develop a Forest Land Use Policy symposium for New England. The initial meeting of the steering committee was held in Boston during November.

Owen attended the Fourth American Woodcock Workshop at Higgins Lake, Michigan, October 13-15 and presented a paper, "Studies of Radio-equipped Woodcock in Maine."

Hammer presented a paper, "Ecological Relations of Waterfowl and Snapping Turtle Populations," at the 33rd Midwest Wildlife Conference, December 12-15, at Omaha, Nebraska.

PUBLICATIONS AND THESES

Coulter, M. W. 1971. A Review - The Wolf: The Ecology and Behavior of an Endangered Species. By L. David Mech. The Natural History Press, Garden City, New York. 1970. 384 pp. \$9.95. In J. Wildl. Mgmt., 35(4):861-862.

Hammer, D. A. 1971. Reproductive Behavior of the Common Snapping Turtle. Canad. Herp. Quart., 1(4):9-13.

Wright, P. L. and M. W. Coulter. 1971. Reproduction and growth in Maine Fishers. In Readings in Mammalogy, Monograph No. 2, Univ. of Kansas Museum of Natural History, Lawrence, Kansas. pp. 230-247. (Published from original article in Journal of Wildlife Management. 1967. 31(1):70-87.

February 24, 1972