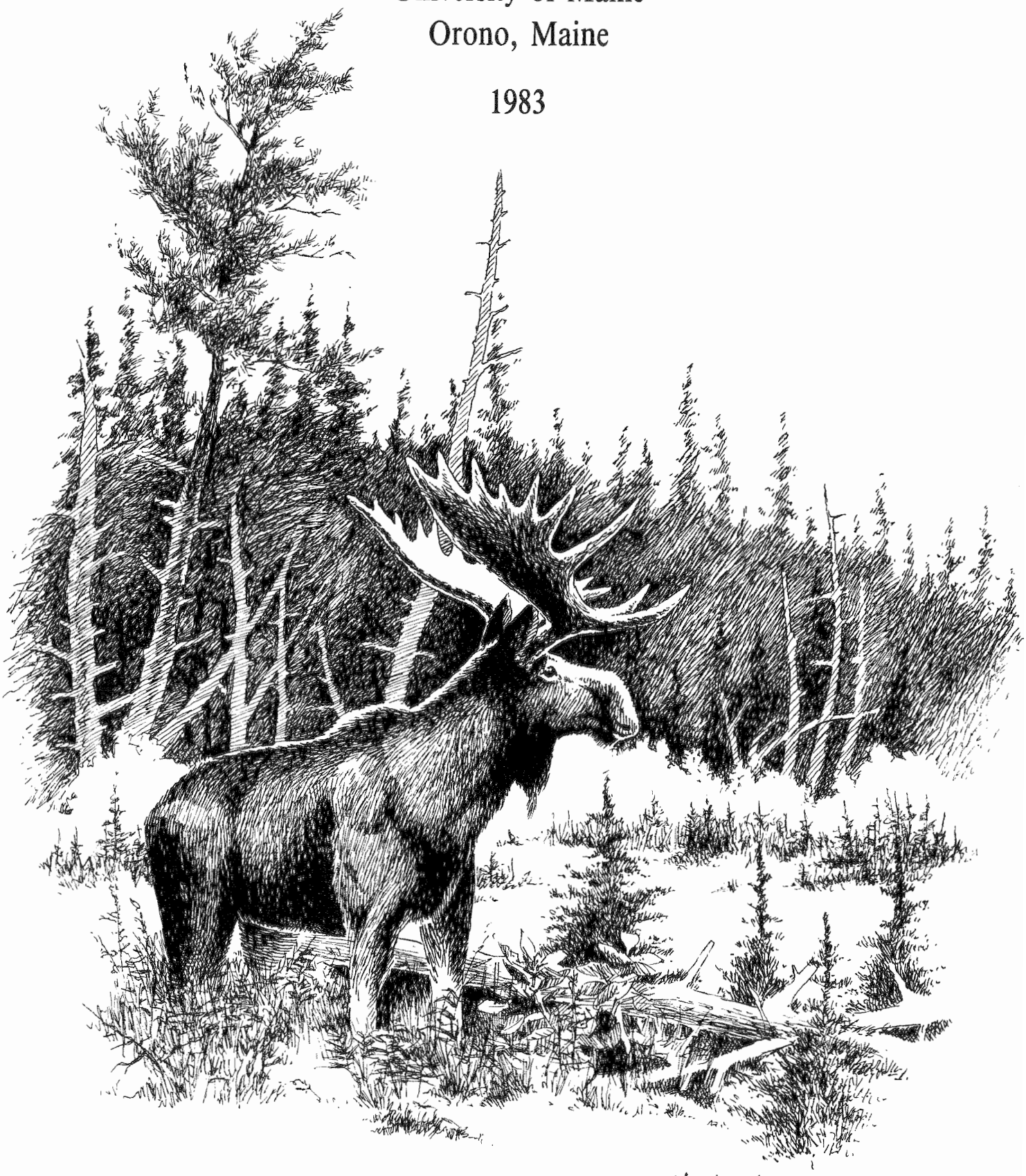
MAINE
COOPERATIVE WILDLIFE RESEARCH UNIT

University of Maine
Orono, Maine

1983



MAINE COOPERATIVE WILDLIFE RESEARCH UNIT
240 Nutting Hall
University of Maine
Orono, Maine 04469

COOPERATORS

MAINE DEPARTMENT OF INLAND FISHERIES AND WILDLIFE

UNIVERSITY OF MAINE

FISH AND WILDLIFE SERVICE, U.S. DEPARTMENT OF THE INTERIOR

WILDLIFE MANAGEMENT INSTITUTE

May 1982 - April 1983

Cover Designed by Mark A. McCollough

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PERSONNEL AND COOPERATORS (August 1983)

COORDINATING COMMITTEE

Maine Department of Inland Fisheries and Wildlife:
Glenn H. Manuel, Commissioner

University of Maine, Orono:
Ray B. Owen, Jr., Chairman, Wildlife Division, College of Forest Resources

U.S. Fish and Wildlife Service:
Reid Goforth, Supervisor, Cooperative Wildlife Research Units

Wildlife Management Institute:
Laurence R. Jahn, Vice President

WILDLIFE PERSONNEL

Unit Staff

John A. Bissonette, Acting Unit Leader, Associate Professor of Wildlife
John T. Major, Associate Scientist
Joyce A. Harrison, Wildlife Technician
Matthew A. Miller, Wildlife Technician
Dennis Kingman, Wildlife Technician
Fred DiBello, Wildlife Technician
Robert C. Burke, Wildlife Technician
John W. Ault III, Wildlife Technician
Maxine L. Horne, Unit Secretary

University and Associated Staff

Ray B. Owen, Jr., Chairman, Wildlife Division, College of Forest Resources and Professor of Wildlife
James R. Gilbert, Associate Professor of Wildlife
Chester F. Banasiak, Associate Research Professor of Wildlife
Patrick W. Brown, Assistant Professor of Wildlife
David M. Leslie, Assistant Professor of Wildlife
Jerry R. Longcore, Research Wildlife Biologist, USFWS
Hewlette S. Crawford, Jr., Research Wildlife Biologist, USFS
Charles S. Todd, Research Associate
Kathleen M. Wynne, Wildlife Technician
Lisa DeBruyckere, Wildlife Technician
Jody J. Jones, Research Associate
Janet McMahon, Research Associate
Jack Witham, Research Technician

Maine Department of Inland Fisheries and Wildlife

Glenn H. Manuel, Commissioner
Norman E. Trask, Deputy Commissioner
Robert W. Boettger, Chief, Wildlife Division
Lee E. Perry, Assistant Chief, Wildlife Division
Howard E. Spencer, Research Supervisor, Wildlife Division

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

GRADUATE STUDENTS

Name	Degree Candidacy	Support
Thomas A. Allan	Ph.D.	CFR; McIntire-Stennis
John R. Bashaw	M.S.	CFR; McIntire-Stennis
MaryEllen Chilelli	Ph.D.	MDIFW; MDC; MCWRU
W. Alan Crossley	M.S.	MDIFW; CFR; McIntire-Stennis
Catherine A. Elliott	Ph.D.	IPC; MDIFW
Donald P. Englehardt	M.S.	MDIFW; MCWRU
William J. Galbraith	M.S.	MDIFW: USFWS-MBHRL
Margaret A. Halpin	M.S.	MDIFW; MCWRU
Daniel J. Harrison	Ph.D.	MDIFW; MCWRU
Dennis G. Jorde	Ph.D.	MDIFW; USFWS-MBHRL; CFR; Hatch Act
John A. Litvaitis	Ph.D.	MDIFW; MCWRU
Mark A. McCollough	Ph.D.	USFWS; NWF; NC
Paul W. Rego	M.S.	MDIFW; MCWRU
Joyce Snyder	M.S.	MCWRU; Newfoundland Wildlife Div.; GSB: Can. Fed. Govt.
Sally Stockwell	M.S.	MDIFW; Wheelabrator Frye Inc.
Paul I. V. Strong	Ph.D.	MDIFW; MAS
Michael E. Thompson	M.S.	MDIFW; MCWRU; McIntire-Stennis

Graduate Students: Theses completed during current period.

Catherine A. Elliott	M.S.	IPC; MDIFW
Daniel J. Harrison	M.S.	MDIFW; MCWRU
Gary R. Lamb	M.S.	MDIFW; WMI; NRA: L.L. Bean, Inc.
John T. Major	Ph.D.	MDIFW; MCWRU
Arthur M. Soukkala	M.S.	CFR; McIntire-Stennis

Graduate Students developing research proposals and support:

Stephen Arthur	Ph.D.
Diane R. Eggeman	M.S.
William F. Harvey	M.S.
David J. Leptich	M.S.
Daniel G. McAuley	M.S.
Mary F. Small	M.S.

COLLABORATING AGENCIES AND ORGANIZATIONS

International Paper Company - IPC
L. L. Bean, Inc.
Maine Audubon Society = MAS
Maine Cooperative Fishery Research Unit = MCFRU
Maine Department of Conservation = MDC
Maine Department of Inland Fisheries and Wildlife = MDIFW
North American Wildlife Foundation-Delta Waterfowl Research Station = DWRS
National Rifle Association = NRA
Nature Conservancy = NC
National Marine Fisheries Service = NMFS
National Wildlife Federation = NWF
Society of Sigma Xi
University of Maine: Graduate Student Board = GSB
College of Forest Resources = CFR

U.S. Fish and Wildlife Service: Migratory Bird and Habitat Research Lab = MBHRL
Office of Migratory Bird Management = OMBM
U.S. Forest Service-Northeast Forest Experiment Station = NEFES
U.S. National Park Service = NPS
Wildlife Management Institute = WMI

PERSONNEL CHANGES

There have been several changes in personnel associated with the Unit during the past year. James Sherburne, Leader of the Maine Cooperative Wildlife Research Unit since 1979, left 1 May 1983 to accept reassignment to USFWS-Research in Washington, DC. Jim has been detailed to the USAID-African Bureau in the State Department. He will be responsible for developing cooperative conservation programs in African countries and maintaining liaison among the National Park Service, U.S. Fish and Wildlife Service, and USAID. John Bissonette, formerly Assistant Unit Leader, Maine Cooperative Wildlife Research Unit, has been named Acting Unit Leader. John Major, who recently completed a doctoral program with the Unit, has been appointed to the Wildlife Division faculty as Associate Scientist. His responsibilities include oversight of the furbearer research project with additional administrative duties involving Unit activities. Mark O'Donoghue, Wildlife Technician on the furbearer project, left the Unit 1 July 1983, for a position with the Peace Corps in Upper Volta, Africa. Dennis Kingman will be replacing Mark in the Cherryfield study area.

Malcolm Coulter retired 31 December 1982 from his position as Chairman of the Division of Wildlife, College of Forest Resources after many years of distinguished service. Ray Owen was selected to succeed Dr. Coulter as Chairman of the Wildlife Division. Patrick Brown (U. of Missouri) joined the Wildlife Faculty September 1982, and David Leslie (Oregon State) will be joining the staff August 1983.

Dr. Gregory Brown, formerly Head, Department of Forest Resources, University of Minnesota, has been chosen as Dean of the newly reorganized College of Forest Resources. Dr. Brown will assume his duties in August. Dr. Fred Knight, who served as Interim Dean of the College, will continue to serve as Associate Dean.

J. William Peppard recently retired from his position as Deputy Commissioner of the Maine Department of Inland Fisheries and Wildlife. Mr. Norman Trask has been selected as the new Deputy Commissioner. Howard Spencer, formerly Migratory Game Bird Project Leader with MDIFW, has been named as Research Supervisor, a newly created position.

WILDLIFE OF MAINE'S PEATLANDS

Investigator: S. S. Stockwell

Advisors: M. L. Hunter, Jr., Chairman
R. Davis
W. Glanz
J. Longcore

Cooperators/ Project Support: Maine Department of Inland Fisheries and Wildlife, Wheelabrator-Frye, Inc.

Objectives:
(1) To identify those species of birds, mammals, and reptiles and amphibians which inhabitat Maine's peatlands.
(2) To quantify the relative abundances of Maine peatland wildlife species in relation to peatland vegetation and hydrology.
(3) To determine whether large, commercially valuable peatlands differ in their value to wildlife from smaller non-commercially valuable peatlands.

Scope:

Peatlands are one of the last remaining undisturbed ecosystems in the northeast. Prior to this project, no extensive or intensive survey of the wildlife in Maine peatlands has been conducted. Thus we know very little about how important peatlands are to wildlife. Recently several commercial mining companies have expressed an interest in developing Maine's peatlands for a new source of energy for the state. Prior to issuing any mining permits, it is critical that we know what species depend on peatlands for their continued survival, if any, and whether certain species are restricted to particular types of sizes of peatlands.

Project Status:

The initial phase of this project involved an extensive survey of 27 Maine peatlands during the summer of 1982. One day was spent in each peatland recording bird densities and any signs or sightings of mammals and herpetofauna. Small mammal live-trapping was conducted at the three largest peatlands surveyed.

During the survey of 27 peatlands, 72 bird species, 16 mammal species, 2 reptile species, and 8 amphibians were identified. Birds were the most commonly observed wildlife, and included species of passerines, waterfowl, shorebirds, and raptors. The number of bird species recorded in clearcuts and forests of Maine is substantially less than 72. This preliminary information suggests that peatlands offer a greater diversity of habitats to wildlife species than many other ecosystems in Maine.

Avian species richness and densities varied in each of nine different plant communities. Species richness was greatest where pools were present on the peatland. Relative densities were calculated for each habitat using Emlen's transect technique, with the greatest density occurring in the lagg, where a diverse tree and shrub layer were present, and the lowest

density occurring in the "lawns", where there was very little vegetation diversity.

No rare or endangered bird species were seen on the peatlands. However, a few species are most commonly seen in this ecosystem type, and probably depend on peatlands to maintain their populations in Maine. Certain species were found at their southern limit in Maine's peatlands.

Signs of various large mammals were evident on the peatlands, and in 592 live-trap nights, 59 small mammals were captured, representing four species. No endangered or rare species were found, but the sample size was too small to determine whether rare small mammals might exist in peatlands.

Amphibians and reptiles were occasionally seen in the peatlands, including every species of frog and toad known to occur in the state. More direct methods of trapping need to be used to determine if there are rare amphibians in Maine peatlands.

Future Plans:

During the summers of 1983 and 1984, eight peatlands representing five different peatland types will be censured for birds. Comparisons of species richness and densities will be made between similar peatland types of different sizes, and between different peatland types.

Seven major plant communities in Maine's peatlands will be sampled for herpetofauna and small mammals using both drift fences and pit traps and Sherman live-traps. Relative densities for each habitat will be compared.

Several visits to four peatlands will be made during fall of 1983 and spring 1984 to look for migratory bird use of peatlands. Winter bird censuses and mammal snow-tracking will be conducted at these same four sites.

AQUATIC AND TERRESTRIAL RESOURCE INVESTIGATIONS OF ACID PRECIPITATION AND ASSOCIATED METALS

Investigator(s): J. R. Longcore, Maine Field Station, PWRC
K. L. Stromborg, PWRC
D. G. McAuley, PWRC
G. L. Hensler, PWRC

Cooperators/
Project Support: ECE Program PWRC Laurel MD,
ECE Program CNFRL Columbia MO

Objectives

(1) To measure and catalog pH and alkalinity of pond, marshes, and other wetland areas suitable for waterbird habitats.
(2) To map wetland vegetation and classify vulnerable and resistant wetlands according to the criteria of The National Wetlands Inventory.
(3) To document annual variability in waterbird abundance and productivity as acidification of wetlands increases or decreases and to intensify the measurement of ring-necked duck use and survival on wetlands of varying susceptibility to acidification.

Scope:

Acidification of lakes, ponds and other wetlands has reduced or eliminated some fish and aquatic invertebrate populations in some areas of the northeast. Most studies to date have been conducted on fish populations in high elevation lakes. Little is known of the effects that acidification might have on the avifauna that use these lakes and associated beaver flowage habitats. This study is designed to assess wetland avian productivity and habitat relationships within an area of high vulnerability (based on bedrock characteristics) to acidification.

Project Status:

In the first field season (May-July, 1982) we collected water chemistry data on two study areas--one with low acid-neutralizing capacity (ANC) and one with high ANC to test the hypothesis that bedrock characteristics can predict wetland pH and alkalinity. The frequency distributions of pH and alkalinity showed little overlap between high and low ANC areas thereby demonstrating that pH and alkalinity can be predicted from bedrock type.

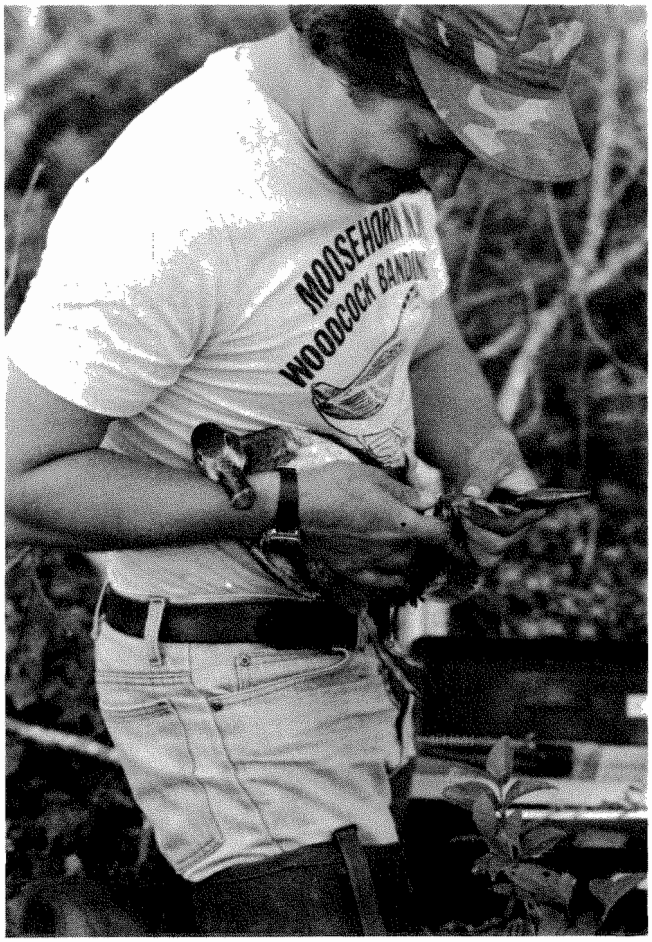
We collected field data on avian use of 32 low ANC wetlands, expending 523 hours of observation time during 409 visits to wetlands. Common loons (*Gavia immer*), common merganser (*Mergus merganser*), belted kingfisher (*Ceryle alcyon*) and common nighthawk (*Chordeiles minor*) were most frequently associated (33-67% of observations) with headwater wetlands, whereas the dabbling ducks, ring-necked duck (*Aythya collaris*), hooded merganser (*Mergus cucullatus*) and great blue heron (*Ardea herodias*) used downstream wetlands (81-97% of observations). Almost no use (5%) was made of headwater wetlands for brood rearing. The black duck (*Anas rubripes*), wood duck (*Aix sponsa*), ring-necked duck and hooded merganser produced 67% of the 80 broods observed and only 4 broods were produced on headwater wetlands.

We also collected eggs from 16 hooded merganser clutches to determine egg and shell minerals and correlate with ANC level at the site of collection.

Future Plans:

At least an additional field season will be used to obtain bird distribution and use data. More emphasis will be placed on the ring-necked duck to assess brood survival and food habitats of ducklings related to wetland pH and alkalinity. Hens will be trapped on the nest and fitted with nasal saddles and young ducklings of age Class I, II and III will be collected for food habitat analysis.

Bird use and distribution will be determined based on water chemistry and vegetational descriptions of wetlands.



BIOSPHERE RESERVE DATA--BIG BEND NATIONAL PARK, TEXAS

Investigator: J. W. Ault III

Supervisor: J. A. Bissonette

Cooperators/ Project Support. National Park Service: Big Bend National Park, Texas, MAB Program, Washington,DC, NPS Regional Office, Santa Fe, NM

Objectives:

(1) Compile an annotated bibliography of the archaeology, climate, terrestrial fauna, geology/paleonthology, history, soils, vegetation, human use/effects, and aquatic systems of Big Bend National Park, Texas and the northern Chihuahuan Desert.
(2) Assess, by discipline, the adequacy of the information base and its potential for providing accurate information for planning and decision making.
(3) Provide recommendations on future directions for policy decisions, research, and long-term ecological monitoring.

Scope:

Big Bend National Park, Texas, was designated a Biosphere Reserve by the U.S. Man and the Biosphere (MAB) Project Directorate as part of UNESCO MAB Project 8 in 1976. The objectives of the biosphere reserve system include: (1) promotion of the conservation of representative ecosystems as a means of preserving biological diversity, (2) provide sites for long-term research on the structure and function of ecosystems, (3) provide sites for monitoring environmental change, (4) provide sites for education and training, and (5) provide a multidisciplined data base to enable balanced decisions on resource management problems.

This project directly addresses the MAB objective of providing a multidisciplined data base. The 3 volume output will provide data on which future decisions regarding ecological studies and monitoring, as well as policy decisions, can be based.

Project Status:

Work on the project began in October 1982. Initial efforts were directed toward obtaining citations from numerous data bases from a computer based literature search at the University of Maine Fogler Library. Species keywords were used in the biological disciplines. Location keywords (e.g., Brewster County) were used for all disciplines. Approximately 1400 citations were obtained from a combination of the computer research and bibliographies provided by Big Bend National Park. More are added weekly.

A personal bibliographic computer program (FAMULUS) is being used to store, sort, and retrieve the citations. The program allows additions to be made to the data base so it can be kept current.

A meeting was held at Big Bend National Park from 24-28 January 1983. The purpose of the gathering was to discuss and clarify the objectives and methods of the project. Personnel from the Washington office, the regional office in Santa Fe, as well as many park employees were present. Data on physical facilities of the park were collected. The Park Service provided tours of the area.

Following the meeting, visits were made to approximately 40 scientists in Texas, New Mexico, and Arizona. An additional 56 scientists, working in or familiar with the northern Chihuahuan Desert, were contacted by mail.

More than 80 theses and dissertations have been identified as being "park specific" and have been ordered through interlibrary loan. One hundred fifteen abstracts to date have been written and input to the computer.

Future Plans:

Additional abstracts will be written and added to the FAMULUS data base. Preparations will be made for a workshop to take place at Big Bend National Park in October 1983. A questionnaire which will request input from scientists on long-term plans for the park will be developed and mailed. An analysis of the state of knowledge in each of the 9 disciplines will be prepared.

POST-FLEDGING ECOLOGY OF BALD EAGLES IN MAINE

Investigator: M. A. McCollough

Advisors: R. B. Owen, Jr., Chairman
J. A. Bissonette
M. L. Hunter, Jr.
W. E. Glanz
J. R. Gilbert

Cooperators/ Project Support: Maine Department of Inland Fisheries and Wildlife
U.S. Fish and Wildlife Service
National Wildlife Federation
The Nature Conservancy
Eagle Valley Environmentalists

Objectives:

(1) Describe post-fledging behavior of bald eagles in Cobscook Bay with emphasis on movements in relation to parent breeding areas, habitat use, and associated adult/juvenile relationships.
(2) Obtain information on juvenile eagle dispersal and movements and location of wintering areas in Maine.
(3) Investigate winter activity and habitat use of adult and immature eagles in Cobscook Bay.
(4) Evaluate artificial feeding of bald eagles during the winter as a technique to: (a) improve survival of juvenile and adult eagles, (b) provide a contaminant-free supplement of eagle diet in the winter, and (c) enhance subsequent nesting attempts of adult eagles.

Scope:

The Cobscook Bay bald eagle population is considered a nucleus for the recovery of viable populations in Maine. Highest nesting density, nesting success, and brood size are achieved in this area. Over the last five years, the Cobscook Bay eagle population increased to 12 pairs and fledged 53 eaglets; equivalent to 22% of the total annual bald eagle production in the northeastern U.S. A proposed oil refinery, tidal power projects, loss of habitat to land development, and recreational activity are potentially serious threats to the Cobscook eagles and therefore jeopardize the recovery of the statewide population.

This study will investigate fledgling eagle movements and behavior, adult-juvenile relationships, and wintering ecology of bald eagles in Cobscook Bay. Immature eagles will be radio-tagged to identify seasonal components of critical eagle habitat in Cobscook Bay and document daily movements and behavior. All eaglets in Maine will be color-banded to assist in investigation of movements, dispersal, and survivorship. Supplemental food will be provided at 4 major eagle wintering areas in an effort to improve survival of immature and adult eagles, provide a contaminant-free food source, and enhance subsequent nesting attempts of adult eagles.

Project Status:

In 1982, 6 fledgling eagles were radio-tagged at 5 nest sites in Cobscook Bay and were monitored from July to October. Over 1,500 relocations were made of radio-tagged eagles, their parents, and siblings. Data on perch tree characteristics, habitat use, and behavior were collected. Young eagles fledged between 11 July and 18 August. Five of 6 radio-tagged eagles dispersed from Cobscook Bay from 19 September to 21 October. One radio-tagged eagle remained in Cobscook Bay and were monitored until March. Winter habitat use and movements associated with the winter feeding stations were documented.

In the winter of 1982-83 the bald eagle winter feeding program was expanded to four eagle wintering areas: Cobscook, Frenchman, Penobscot, and Merrymeeting bays. Approximately 40,000 pounds of food (mostly deer, moose, livestock, poultry, and furbearer carcasses) were distributed to the feeding stations from October to March. At least 120 different eagles were observed at the feeding stations. The greatest response was in Cobscook Bay where 16 to 37 eagles, mostly immatures, used the feeding stations daily. Band numbers from 60 different eagles were obtained at the Cobscook Bay station while observing birds from a blind with an 80X telescope. Fifty-four eagles were from Maine, originally banded at 28 nest sites across the state. Of particular interest were 9 adult eagles banded from 1975-1978, including an adult eagle originally brought to Maine as part of an egg transplant program in 1975. Also resighted was an immature eagle from Upper Peninsula, Michigan, an immature eagle from Sault Ste. Marie, Ontario, and 4 immature eagles from Cape Breton Island, Nova Scotia.

In 1982, 48 of 56 eaglets produced in Maine were banded with individually coded color bands and band tags to investigate movements, dispersal and survival. During the winter of 1982-83, color-marked eagles were resighted in Maryland, Pennsylvania, Connecticut and Maine. In 1983, 60 of 62 eaglets produced in Maine were banded and color-marked. An additional 9 eaglets were banded in New Brunswick.

Future Plans:

During 1983, 5 fledging eagles will be radio-tagged in Cobscook Bay and subsequently monitored to identify the seasonal components of critical bald eagle habitat. The eagle winter feeding program will be continued at 4 major wintering areas. Research emphasis at feeding stations will document use of stations by eagles and obtain resightings of banded birds.

BOBCAT MOVEMENTS IN RELATION TO SNOWSHOE HARE DENSITY

Investigator: J. A. Litvaitis

Advisors: J. A. Bissonette, J. A. Sherburne, Co-chairmen
J. R. Gilbert
R. B. Owen, Jr.
G. L. Jacobson

Cooperators/ Project Support: Maine Department of Inland Fisheries and Wildlife, Maine Cooperative Wildlife Research Unit

Objectives:
(1) Examine bobcat movement patterns, including vegetative cover types used and territory size.
(2) Determine relative snowshoe hare density by cover type, season, and within bobcat territories.
(3) Examine bobcat habitat use in relation to snowshoe hare distribution and compare bobcat territory size to snowshoe hare density.

Scope:

Several factors are believed to influence territory size of bobcats, including habitat composition, intraspecific and interspecific relations, reproductive requirements and prey density. Among these factors, prey density has been suggested as a major determinant of bobcat territory size and population density. This project was initiated to examine the relationship of bobcat movements, territory size and the density of snowshoe hare, the major prey items of bobcat in Maine.

Project Status:

Three female bobcats were equipped with transmitters and released during this period bringing the total number of marked bobcats to 23. The transmitters on 4 bobcats marked during the previous period ceased transmission, presumably at the end of battery life. An adult female was killed by a hunter.

Home range maps of marked bobcats were partitioned into 25 ha cells (500 x 500 m) and the number of relocations within each cell were recorded. Transects were then run through 12 ranges and vegetation was sampled within the cells. Use of the cells by bobcats was evaluated. Preliminary results suggest that bobcats prefer areas with dense understories. These areas contain more snowshoe hare than areas having sparse understories.

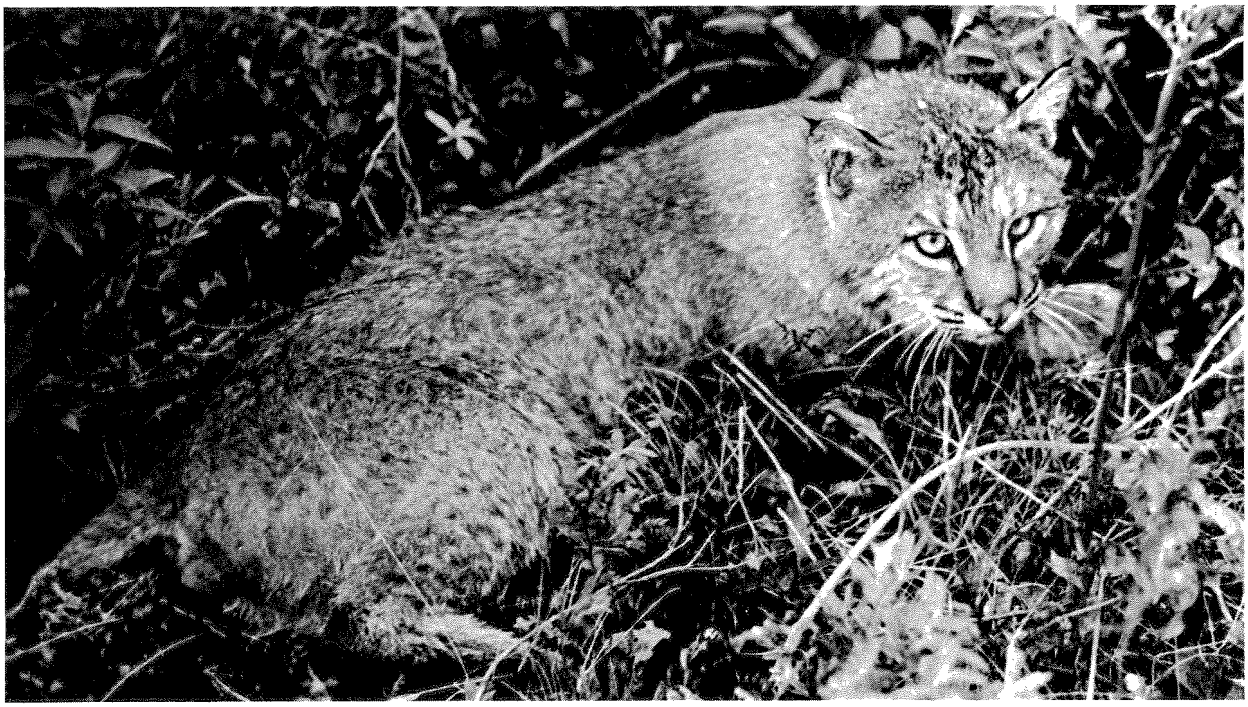
Bobcat feces were collected during this period in the Cherryfield area. Major prey included snowshoe hare, deer, and small mammals. A total of 48 bobcat carcasses were collected statewide during the 1982-83 season, increasing the sample from the last 3 seasons to 141. The occurrence of deer was down to 7% this season compared to 26 and 20% during the 1980-81 and 81-82 seasons. Snowshoe hare was the major prey during all years.

Mark/recapture censuses were conducted during the fall and spring in the Cherryfield and Pierce Pond study areas. Six hundred hare captures were recorded during this period. Counts of hare fecal pellets and snow tracks were made to examine habitat use. Four hares (2M:2F) were also equipped with transmitters to determine home range size and spatial arrangement. Mean home range size of male and female hare were 6.9 and 4.7 ha, respectively. Adjacent ranges overlapped substantially.

Browse use by hare was also investigated. Rhodora *(Rhododendron canadense)*, beaked hazelnut *(Corylus cornuta)*, witherod *(Viburnum cassinoides)* were consumed in large amounts in the Cherryfield area; whereas red spruce *(Picea rubens)*, white birch *(Betula papyrifera)* and red maple *(Acer rubrum)* were major browse species in the Pierce Pond area.

Future Plans:

Sampling of vegetation within bobcat home ranges will be completed. Collection of bobcat feces will continue and counts of hare fecal pellets will be made. The majority of field work will be completed by August 1983 and the projected completion date of this project is May 1984.



COYOTE SOCIAL ORGANIZATION, DISPERSAL, AND SPATIAL INTERACTIONS WITH RED FOXES IN EASTERN MAINE

Investigator: D. J. Harrison

Advisors: J. A. Bissonette, Chairman
J. A. Sherburne
J. R. Gilbert
W. E. Glanz
P. W. Brown

Cooperators/ Project Support: Maine Department of Inland Fisheries and Wildlife
Maine Cooperative Wildlife Research Unit

Objectives:
(1) Describe the social factors influencing coyote populations in eastern Maine, including territory size and composition, territorial stability, and the role of non-territorial individuals.
(2) Evaluate the timing of dispersal, the sex specific dispersal patterns, and the mortality of juvenile coyotes.
(3) Determine the effect of resident coyotes on the spatial distribution of red foxes.

Scope:

Recent studies indicate that social (Harrison 1983) and competitive interactions (Major 1983) significantly affect the structure of the predator community in Maine. This project was designed to assess the roles of coyote social behavior, juvenile coyote dispersal, and spatial relationships between coyotes and red foxes on canid populations.

Project Status:

Since the project began, 48 canids (38 coyotes, 10 red foxes) have been trapped, radio-collared, and released in eastern Maine. Over 4500 relocations of these animals have been coded and entered into computer storage. Mortality information has been obtained for 13 coyotes (7 trapped, 3 shot, 1 hit by automobile, 2 unknown), and 5 foxes (3 trapped, 1 shot, 1 unknown).

Dispersal movements of 25 juvenile coyotes were monitored during 1981-1983. Eighty-eight percent (22 of 25) dispersed during their 1st year of life. Of 3 individuals that did not disperse during their 1st year, 1 dispersed at 18 months of age, and 2 were still within their natal home range at 13 months of age when their transmitters expired.

Seven of 10 coyotes radioed at >1 year of age exhibited territoriality. Three individuals (1 yearling female, 2 adult males) were wanderers that traveled throughout several territories. One of the wandering adult males settled into a well defined territory 3 months after being captured.

Movements of foxes in relation to coyote territories were monitored to assess the role of interference competition on fox distribution. To date, no foxes have been relocated within the boundaries of coyote territories.

LANDSAT multi-spectral scanner imagery was used to classify habitats over a 15,000 km^2 area into 7 cover type categories with a resolution of 0.66 ha. The proportions of the cover types within coyote territories and fox home ranges will be compared to assess the role of habitat composition on the spatial distribution of foxes.

Future Plans:

Live-trapping and radio monitoring of canids will continue with emphasis on those individuals with overlaping and adjacent ranges. Fifteen additional juvenile coyotes will be equipped with radios during fall 1983 to monitor their dispersal. The projected date for project completion is August 1985.

WINTER HABITAT USE AND HISTORY OF RED FOX IN MAINE

Investigator: M. A. Halpin

Advisors: J. A. Bissonette, Chairman
W. A. Halteman
P. W. Brown
J. W. Peppard

Cooperators/
Project Support: Maine Department of Inland Fisheries and Wildlife
Maine Cooperative Wildlife Research Unit

Objectives:

(1) Examine winter habitat and resource use by red foxes in eastern Maine.
(2) Document historical distribution and occurrence of red foxes in Maine.

Scope:

Habitat characteristics and fox activities were examined along red fox snow trails in eastern Maine during 1982 and 1983 to investigate winter habitat use by the species. The distribution of observed fox activities among habitats will be evaluated relative to signs of food availability, social interactions, and snow conditions.

Sampled documents and records were examined and fur trappers were interviewed to collect historical information on the presence and distribution of red fox in Maine.

Project Status:

Field work was completed in March, 1983. One hundred and twenty-five km of fox trails were followed during two winter field seasons. Foxes traveled through all available habitats during both seasons, but the distribution of hunting and the use of food and prey resources differed between the two years. Snow accumulation was deeper in 1982, and 62 fox scats indicated that snowshoe hare was the most important food item during that winter. Fox scats (N=65) collected in the milder 1983 season contained a larger variety of food items and included larger proportions of small mammals and vegetative matter.

The timing of activities associated with breeding also differed between the two seasons. Initial den visitations by paired foxes were noted during February in 1983 but not until early March the preceding year.

Historical accounts indicate that red foxes occurred throughout the state during the past 300 years, though in varying abundances with time and location. Public sentiment toward the species has also varied during that period relative to recreation and sport, health, and agricultural interests.

Future Plans:

Complete analyses and write the thesis.

COYOTE/RED FOX INTERACTIONS IN MAINE

Investigator: D. B. Engelhardt

Advisors: J. A. Bissonette, Chairman
J. R. Gilbert
W. E. Glanz

Cooperators/
Project Support: Maine Department of Inland Fisheries and Wildlife
Maine Cooperative Wildlife Research Unit

Objectives:
(1) Examine the responses of coyotes and red foxes to the placement of scent marks within their home ranges.
(2) Describe the use by different species of large ungulate carcasses for food.
(3) Continue to collect long-term prey abundance and predator ecology data on the Pierce Pond study area.

Scope:

The rapid range expansion of the coyote into Maine has created some concern as to their effect on populations of other predators, including red fox. More information is needed about the interactions between sympatric individuals and their partitioning of food and space resources. Information will be obtained by monitoring the responses of free-ranging, radio transmittered coyotes and red foxes to the placement of fox and coyote scents within their home ranges and by observing the use of carcasses as a food source by different predators.

Project Status:

Small mammal trapping in 6 different cover types (2 replications in each type) was performed in October, 1982. Snow tracking to collect data on predator/prey use of different parts of the study area and to locate red fox home ranges took place in February, March and April of 1983. Direct observation of scavenger activity at two deer carcasses also were made during February and March. The first carcass was a coyote kill, located approximately 2 days after the deer's death. This carcass was observed for 20 hours. Except for avian scavengers (ravens, blue jays), no activity was seen. The second carcass was a road kill placed at a site near where an observation blind had been built. With the aid of a night vision scope, approximately 80 hours were spent observing this carcass. One coyote and one raccoon were observed feeding from it.

During May and June the movements of a female coyote and a female red fox were monitored on an intensive basis in connection with the performance of 2 experimental scent-marked trials. During these trials each animal's movements were followed by relocating them at 15-minute intervals on an 8-hours-on/8-off schedule. Approximately 1600 relocations were obtained on the two animals in this manner.

Future Plans:

During the summer of 1983 an additional 2-3 scent mark trials will be performed. Additional carcass observation and snow-tracking will take place during the winter of 1983-84.

FACTORS INFLUENCING HARVEST LEVELS OF FISHER IN EASTERN AND SOUTHCENTRAL MAINE

Investigator: P. W. Rego

Advisors: J. A. Bissonette, Chairman
W. A. Halteman
R. B. Owen, Jr.

Cooperators/
Project Support: Maine Cooperative Wildlife Research Unit,
Maine Department of Inland Fisheries and Wildlife

Objectives: To examine the relationship between levels and distribution of fisher harvests and (1) cover types (2) relative prey abundances and (3) demographic and condition parameters.

Scope:

A large difference in fisher densities exists between Wildlife Management Units (WMUs) 6 and 7 of southeastern Maine. Both WMUs were reoccupied by fisher following range expansion in the 1950's and 1960's. The Penobscot River separates WMUs 6 and 7 and appears to act as a barrier, slowing range expansion into WMU 6. Areas west of the Penobscot River (including WMU 7) have greater fisher densities than those to the east. This study examines factors which may influence the suitability of WMU 6 and 7 to support fisher.

Project Status:

Small mammal trapping was conducted at 16 locations during summer 1982; 8 locations in each of WMUs 6 and 7. Three trapping grids were established in separate cover types at each location. Feces of snowshoe hare, porcupine and white-tailed deer were counted on each trapping grid. Preliminary analysis suggests no difference in relative small mammal abundances between the two WMUs; 172 small mammals were captured in WMU 6, 157 in WMU 7.

Small mammal trapping areas were revisited during winter for snow track counts of prey species. Counts were made at only 12 of 16 locations because proper snow conditions were infrequent.

One hundred forty-three (143) fisher carcasses collected during the 1982 trapping season were analyzed. One hundred seven (107) originated from WMU 7, 13 from WMU 6, 12 from WMU 5, and 9 from WMU 4. The sample represents 27, 72 and 32% of the total fisher trapped in WMUs 5, 6 and 7, respectively. Sex, age, weight, condition indices and presence of porcupine quills were recorded for each carcass. Gastrointestinal tracts were removed and frozen. Contents of 24 tracts have been examined to date. There appears to be little difference in condition between fisher taken from WMU 7 versus those harvested from WMUs 5 and 6.

Live-trapping for fisher continued during fall-winter 1982, but was discontinued because of low success. One male fisher was radio-collared and released in WMU 6.

Land cover in WMUs 6 and 7 is being classified using LANDSAT imagery.

Future Plans:

Land cover classification will be completed. Data analysis will be completed and the thesis written. Target date for project completion is September 1983.

COYOTE USE OF DEER WINTERING AREAS--A COMPARISON OF A SEVERE AND MILD WINTER

Investigator: M. A. Miller

Advisors: J. A. Sherburne
J. A. Bissonette
J. T. Major

Cooperators/
Project Support: Maine Cooperative Wildlife Research Unit
Maine Department of Inland Fisheries and Wildlife

Objectives:

(1) To detect coyote response to winter concentrations of deer.
(2) To determine how winter severity affects coyote predation on deer.
(3) To detect seasonal and annual changes in food habits.
(4) To determine cause of death and predator utilization of winterkill deer.

Scope:

White-tailed deer is a major prey item of coyotes in Maine, especially during the winter. This project was initiated to study coyote predation on deer and will provide preliminary data for future coyote-deer studies. Several parameters were investigated: coyote summer and winter home ranges, Winter Severity Index (WSI), food habits through scat analysis, degree of yarding by deer, and causes of winter deer mortality.

Project Status:

Field work in the Pierce Pond study area was completed in April 1983. Summer and winter home ranges were determined by independent relocations collected 2-3 times a week. Three coyotes (1M:2F) were relocated during 1981-82 while 1 female was followed in 1982-83. The deer yards were mapped for the two winters from Land Use Regulation Commission (LURC) maps, aerial flights, and ground observations. This data is currently being analyzed to compare winter and summer home ranges of radio-collared coyotes.

To augment telemetry information, fifty-eight 500 m randomly-selected snow transects were run during the winter of 1982-83. Coyote, bobcat, fox, fisher, marten, otter, mink, deer, moose, and snowshoe hare tracks were counted using the line-intercept method. The sampling was stratified so that one-half the transects were in deer yards and the other half in non-deer yards. This data is currently being analyzed to determine if a correlation exists between the different predator and prey species in deer and non-deer yards.

WSI data was collected weekly on the study area. The winter of 1981-82 was the most severe while the 1982-83 winter was the least severe in the past decade.

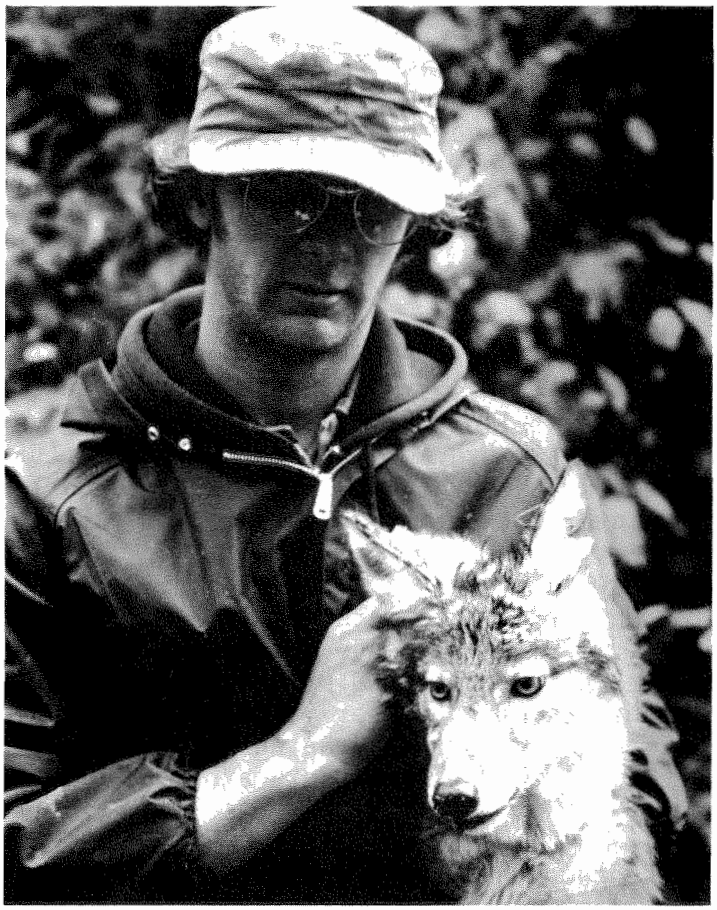
Approximately 600 scats were collected and analyzed for the two years. Raspberries, pin cherries, hare, and deer were the major food items during the summer months; while deer and hare were major winter food items. Deer occurred in over 50% of the scats during the severe winter and in 30% during the mild winter.

The degree of yarding for the two years will be determined from pellet counts on established plots in the Hayden Brook deer yard. This data will be obtained from Douglas Marston who is conducting a long-term habitat and deer use project in that area.

Twelve winterkill deer were found in 1981-82 and 3 the second winter. Mortality the first winter included 6 probable coyote kills, 1 old age, 1 splayed on ice, 1 starvation, and 3 unknowns. In the second winter I found 2 probable coyote kills and 1 positive coyote kill. One moose (poached) was also found in January 1983 and was fed on by coyote, bobcat, fisher, and raccoon until it was consumed by early April.

Future Plans:

Complete analysis and prepare a first draft report by July 31, 1983.



WINTER HABITAT USE, MORTALITY, AND SEASONAL MOVEMENTS OF WHITE-TAILED DEER IN WEST-CENTRAL MAINE

Investigator: M. E. Chilelli

Research Technician: R. C. Burke

Advisor: J. A. Bissonette, Chairman

Cooperators/ Project Support: Department of Inland Fisheries and Wildlife, College of Forest Resources and Maine Cooperative Wildlife Research Unit

Objectives:

(1) Determine the existing patterns of movement between summer range and winter yards.
(2) Determine the causes and circumstances underlying existing mortality patterns.
(3) Document how existing cutting patterns may influence deer activity and habitat use.

Scope:

It is generally believed that deer in the northern part of their range require cover for survival during winter. However, this apparent need for cover in primarily old growth, low elevation spruce-fir stands is in direct competition with the forest industry. This project is designed to determine the relationships between winter and summer habitats, and to document how forest cutting patterns may influence the use of these important habitats. In addition, with the recent colonization of Maine by coyotes and the subsequent concern for its effect on the state's deer herd, an attempt will be made to determine the importance predation has on existing mortality patterns.

Project Status:

This study commenced in January with initiation of the selection of suitable deer yard study sites. Deer yards located in the Pierce Pond study area, WMU 3, have been selected for examination. A well established predator project will be in progress in this area during this study. A literature review has been completed concerning the winter ecology and management of northern white-tailed deer. Presently, about 250 citations have been systematically organized and developed for computer compatability.

Future plans will involve selection and ordering of equipment, preparation for fall field work, and completion of final study proposal.

THE INFLUENCE OF FOREST HARVESTING ON PINE MARTEN IN NEWFOUNDLAND

Investigator: J. Snyder

Field Assistant: S. Perrin

Advisors: J. A. Bissonette, Chairman
P. W. Brown
D. B. Field
W. E. Glanz

Cooperators/
Project Support: Maine Cooperative Wildlife Research Unit
Newfoundland Wildlife Division, Canadian Federal Government

Objectives: To examine how forest harvesting influences marten densities and habitat use.

Scope:

Pine marten once ranged over most forested areas of Newfoundland; however, their present distribution appears to be restricted to isolated areas of mature forest in the western part of the province. It is likely that marten were never abundant; however they are now considered one of the rarest mammals in Newfoundland. Despite complete protection since 1934, neither marten numbers or their distribution has increased markedly.

Several factors, including limited prey base, low reproductive performance, and habitat destruction may be involved. Because large scale forest harvesting has been carried out on areas inhabitated by marten, this study addresses marten habitat requirements, with special emphasis on marten use of residual "islands" of uncut timber and various ages of regenerating clearcuts to aid in the formulation of management plans for marten.

Project Status:

A proposal has been completed and field work begun.

Future Plans:

Live-trapping and tagging of marten, and vegetation analysis are scheduled for summer, 1983. Snow-tracking is planned for the following winter. Field work should be complete by February 1984.

HARBOR SEAL POPULATIONS AND MARINE MAMMAL-FISHERIES INTERACTIONS IN NEW ENGLAND

Investigators: J. R. Gilbert
K. M. Wynne

Field Assistant: L. A. DeBruyckere

Cooperators/ Project Support: Northeast Fisheries Center, National Marine Fisheries Service

Objectives:

(1) To monitor seasonal distribution of harbor seals in Maine.
(2) To capture and monitor movements of adults and pups as a first step to identifying harbor seal range and population discreteness.
(3) To identify ledges used for pupping and note annual consistency in their use.
(4) To document interactions existing between commercial fisheries and marine mammal populations in New England.

Scope:

Conflicts between commercial fisheries and marine mammal populations include direct and indirect competition for commercially valuable fish species, entanglement of marine mammals, and damage to fishing gear. Such conflicts have intensified with increasing near-shore fishing pressure but have only recently been documented in New England. Because the number of harbor seals *(Phoca vitulina concolor)* on the Maine coast apparently doubled between 1973 and 1981, their population level, distribution, and discreteness have become a concern of several commercial fisheries.

Project Status:

Several aerial surveys were made to monitor seal numbers, distribution, and use of pupping ledges in the mid-coastal Maine study area. Harbor seals were tagged to monitor seasonal movements of individuals within and between bays. Two techniques were used successfully in 1982, resulting in the capture of 19 pups and a subadult (13M:7F). Eighteen pups were caught by hand after rushing or stalking them from the "blind side" of their haulout site. One pup and the subadult were entangled in a 150' gillnet which was set parallel to haulout sites by a speeding boat. The subadult, which also carried a radio pack, was resighted near Nantucket, Massachusetts four months after its capture in mid-coastal Maine.

In May and June 1983, 41 pups (30M:11F) were captured and tagged in mid-coastal Maine; 4 pups were equipped with fur-mounted radio packs. Tagged seals have been resighted within the bay of their captures 14 times; radioed seals have been relocated 11 times.

Marine mammal interactions with several commercial fisheries were investigated. The occurrence of incidental marine mammal entanglements and damage to bottom gillnets, lobster gear, and fish weirs were assessed

through phone interviews, and at sea surveys. The economic impact of codworm infestation (for which seals are a definitive host) on Maine groundfish packing plants was assessed. Potential interactions with the Atlantic salmon sportfishery were investigated through damage records provided by voluntary salmon check stations and Atlantic Salmon Commission creel censuses.

A small-take exemption to the Marine Mammal Protection Act was drafted to provide a legal means by which commercial fishermen can report interactions with marine mammals.

Future Plans:

Aerial surveys will continue through the year to monitor seasonal changes in seal distribution and movements of tagged and radioed seals. An estimate of annual productivity within the study area will be made from early summer counts of adults and pups.

At-sea and phone interviews of New England gillnetters will be conducted through the fall and winter.

HABITAT USE AND HOME RANGE CHARACTERISTICS OF MOOSE IN NORTHERN MAINE

Investigator: M. E. Thompson

Advisors: J. R. Gilbert, Chairman
J. A. Bissonette
M. D. Ashley

Cooperators/ Project Support: McIntire-Stennis; Maine Department of Inland Fisheries and Wildlife

Scope:

Early seral stage forest communities are important in maintaining moose populations at relatively high densities. In Maine, these habitats are largely the result of timber harvest practices. The currently high populations of moose found throughout much of northern Maine are a by-product of cutting operations during the past several decades. Because of the importance of moose for aesthetic and recreational values, it is important to determine more precisely the relationship between habitat components important to moose and logging operations.

This project is designed to assess seasonal moose habitat use and home range characteristics on two heavily logged areas in northern Maine. Radio-collared animals will be monitored seasonally using aerial and ground radio-tracking and direct observation. Habitat information of sites used by moose will be obtained from ground plots, forest-cover type maps, and remote sensing. Logging history will be determined from site characteristics and paper company records.

Project Status:

The proposal and literature review for this project have been completed. Fourteen moose with functional radio transmitters from a prior study by Alan Crossley are being monitored weekly.

Future Plans:

Field work will begin in June, up to 30 moose will be radio-collared using the boat and moose pole system. Telemetry data will be collected on all instrumented moose.

SUMMER POND USE BY MOOSE IN NORTHERN MAINE

Investigator: W. A. Crossley

Advisors: J. R. Gilbert, Chairman
M. L. McCormack
J. A. Bissonette

Cooperators/ Project Support: College of Forest Resources--McIntire-Stennis
Maine Department of Inland Fisheries and Wildlife

Objectives:
(1) To determine the optimal time seasonally and diurnally to conduct aerial summer pond surveys.
(2) To determine the effects of changing biomass and nutritional quality of aquatic vegetation on summer pond use.

Scope:

The purpose of the project is to identify the best time seasonally and diurnally to conduct aerial cow-calf surveys. The surveys are designed to provide information on calf production and cow:calf ratios. Time of arrival and departure, sex, and activities of moose are recorded during the summer to determine peak pond use times. Aquatic vegetation is sampled to test the effect of changing biomass and nutritional quality on the pond use activities of moose.

Project Status:

The objectives of this study were to determine the diurnal and seasonal patterns of summer pond use by moose *(Alces alces americana)*, particularly that of cows with calves; and to determine the seasonal effects of aquatic plant mineral composition on the pond use habits of moose. Moose were observed from fixed shore locations using binoculars or a 20X spotting scope during the summers of 1981 and 1982 in the Mooseleuk Lake area of northern Maine. Aquatic and terrestrial plants were grab sampled and sorted by species at biweekly intervals throughout the summer. Plants were oven-dried at 65°C for 48 hours, digested, and analyzed for 13 minerals using an inductively coupled argon plasma spectrograph. Crude protein was determined using a macro-Kjeldahl procedure. Moose were radio collared using a noose-pole and boat capture technique.

Over 1100 hours of observations were recorded. Of the 804 moose observed, 43.8% were bulls, 36.6% were cows not accompanied by calves, 15.4% were cows with calves, 1.6% were lone calves, and 2.6% were classified as unknown. A seasonal peak in pond use was observed for bulls and cows during the last 2 weeks of July in both years. Peak pond use by cow-calf groups occurred from late August to early September. Moose, in general, exhibited a diurnal peak in pond use during the early morning (0400-0859) and late evening (1700-2100). Mid-day periods (0900-1659) were used to a lesser extent. Bulls preferred the early morning period while cow-calf groups used all daylight periods proportionately. Analysis of 327 aquatic and 80 terrestrial plant samples suggests that sodium is the only potentially limiting mineral that is in greater supply in aquatic than terrestrial species. No relationship between the sodium phenology of aquatic plants and seasonal pond use by moose was observed. Six female moose were radio collared and located 476 times during the study. Collared cows exhibited a preference for aquatic areas during the summer. Aerial summer pond surveys, designed to assess cow-calf ratios, should be conducted in late August or early September. Moose, as an appreciative resource, are most visible to the public during the early mornings and late evenings of July. We suggest that the prolonged feeding by cows with calves is a result of the cows' greater dietary sodium requirement than that of bulls or barren cows.

A COMPARISON OF HABITAT USE BY SYMPATRIC POPULATIONS OF SPRUCE AND RUFFED GROUSE IN MAINE

Investigator: T. A. Allan

Advisors: M. L. Hunter, Jr.
R. B. Owen, Jr.
W. E. Glanz
P. W. Brown

Cooperators/ Project Support: College of Forest Resources--McIntire-Stennis
St. Regis Paper Company

Objectives:

(1) To describe the characteristics of habitats utilized by sympatric spruce and ruffed grouse.
(2) To measure ecological and spatial overlap in habitat use by spruce and ruffed grouse.

Scope:

Ruffed grouse and spruce grouse occur throughout Maine's forests. These forests include a great diversity of vegetation types resulting from geographic variability and past timber cuttings. This project is designed to describe the forest environments used by both species to evaluate the potential for modification of spruce and ruffed grouse habitats by future industrial forest management.

Project Status:

Field work was continued through the winter of 1982-83. To date 85 spruce grouse have been captured and banded in the Hancock County study area and 28 grouse (13M:15F) have been radio tagged. Over 600 daily observations have been made and "habitat sample plots" have been measured at 300 spruce grouse locations. Preliminary analysis indicates that spruce grouse are found at forested sites averaging greater than 90% conifer trees *(Picea, Abies,* and *Pinus)* with most trees less than 15 cm in diameter. Differences in habitat use by spruce grouse will be examined on the basis of sex, season and reproductive status.

Ruffed grouse densities in the conifer forests used by spruce grouse remain low. To date only 65 ruffed grouse sightings have been made. Spring density of drumming male ruffed grouse has been less than 1 drumming male/100 ha for the last 3 years. Ruffed grouse appear to be associated with the openings and edges of conifer forests and are found at sites of lower stand densities and more open canopy than spruce grouse. Ruffed grouse sites average only 58% conifer tree species and have a greater proportion of birch *(Betula)*, aspen *(Populus)*, and cherry *(Prunus)* trees than spruce grouse.

Future Plans:

Field work will be completed in August 1983 and preparation of dissertation will begin.

SONGBIRD SPECIES DIVERSITY IN RELATION TO THE STRUCTURE AND SIZE OF FOREST STANDS AND EDGES

Investigator: C. A. Elliott

Advisors: J. R. Gilbert, Chairman
P. W. Brown
W. E. Glanz
G. L. Jacobson
C. D. Webb

Cooperators/ Project Support: International Paper Company
Maine Department of Inland Fisheries and Wildlife

Objectives:

(1) To determine songbird species diversity (BSD) in habitat types varying in alpha (within stand) diversity.
(2) To determine the effect of stand size on BSD for each habitat type.
(3) To determine BSD in edge habitat varying in beta (between stand) diversity.
(4) To determine the effect of length of edge on BSD for each edge type.
(5) To determine the relationship between bird species composition of the edge zone and that of the adjoining habitats.
(6) To use the results of objectives 1-4 to quantify the relationship between alpha and beta diversity and gamma (landscape) diversity.
(7) To use the results of this study to predict the effect of forest management practices on habitat diversity (alpha, beta, and gamma) and BSD.

Scope:

Habitat diversity is an important concept in wildlife management, with each species having certain habitat requirements. Management for a diverse wildlife community means management for habitat diversity. Two major components of habitat diversity are vertical and horizontal structure. Combined, these produce landscape diversity.

Vertical structure, also termed "within-stand" or "alpha" diversity, is a function of the number of layers of vegetation present in a habitat and the variety and abundance of plant species present within and among layers. It is often measured as foliage height diversity (FHD).

Horizontal structure, also termed "between-stand" or "beta" diversity, is a function of the change in vertical structure between habitat types. The transition zone, or edge, has length, width, and vertical structure, may include characteristics of the adjoining habitats, may have unique characteristics, and may be the result of environmental gradients or man's activities.

"Landscape" or "gamma" diversity combines alpha and beta diversity and is a function of the interspersion, patchiness, size, and shape of habitat types. Management for habitat diversity is primarily concerned with maximizing gamma diversity.

This study will examine the relationship between habitat diversity at the alpha and beta levels and one group of species, songbirds.

As alpha diversity and stand size vary from low to high, the diversity of the songbird community will also vary. There is a point where, for a given alpha diversity (or FHD), any further increase in stand size will have little effect on bird species diversity (BSD). Similarily, for an edge of given beta diversity, as length of that edge increases there is, in theory, a point where any further increase in edge length will have little effect on BSD. Six stand and 6 edge types will be chosen to represent a range of alpha and beta values and censused for songbirds. By taking larger and larger portions of the area censused, species-area or species-length curves will be constructed for each value of alpha and beta. Each edge type will also be censused on transects across the edge to provide information on the composition of the bird community within the edge zone relative to the adjacent stands.

Dividing the vegetation into 9 layers (0-0.5, 0.5-1, 1-3, 3-5, 5-10, 10-15, 15-20, 20-25, 25+ meters), the composition and volume of foliage present in each layer will be determined in 10 by 10 m plots placed at 10-100 m intervals in stand and edge plots. FHD values will be calculated from these data and used to assess the homogeneity of the study areas.

A quantitative expression of gamma diversity will be developed from the results obtained from alpha and beta diversity values. All 3 levels of diversity are important in determining the overall diversity of an area, and together with information on stand composition and the spatial and temporal arrangement of different stand types can be used to assess

the effect of forest management practices on habitat diversity relative to BSD.

Project Status:

Two study areas, a hardwood stand and a clearcut, located near the town of Lincoln, Maine, were chosen for study in 1984. Plots of 40 ha (clearcut) and 64 ha (hardwood stand) were flagged at 25 m intervals on non-south transect lines placed 50 m apart. Songbirds were censused in June. Master maps, one for each species, have been compiled and will be used to define territories of individual singing males.

Vegetation analysis began in late June and will continue through the end of August.

Future Plans:

Data analysis, including calculation of BSD and FHD, will begin in the fall. Four additional stand plots (10-15 year-old regenerating cut, polestage softwood, polestage hardwood, mature softwood) and 6 edge plots (combinations of clearcut, young, pole, and mature hardwood and softwood) will be chosen for study in 1984 and 1985.

BIRD USE OF RIPARIAN HABITATS IN MAINE SPRUCE-FIR FORESTS

Investigator: J. R. Bashaw

Advisors: P. W. Brown
G. L. Jacobson
J. R. Gilbert

Cooperators/
Project
Support: College of Forest Resources--McIntire-Stennis

Objectives: (1) To determine if riparian habitats are more diverse in their vegetation than nearby spruce-fir forests.
(2) To determine if riparian habitats have greater species diversity in their avifauna than nearby spruce-fir forests.

Scope:

Timber stand management in riparian zones of the unorganized townships in Maine is conducted with little knowledge of the wildlife species present in such zones. This study will provide knowledge of wildlife-habitat relationships in riparian habitats that will be useful to the Land Use Regulation Commission in evaluating the potential influence of different land use practices in riparian areas.

Project Status:

Field work will begin on the Moosehorn National Wildlife Refuge in May 1983. Eight wetland areas have been selected for study.

NUTRITIONAL AND THERMODYNAMIC ASPECTS OF THE ECOLOGY OF BLACK DUCKS WINTERING IN MAINE

Investigator: D. G. Jorde

Advisors: R. B. Owen, Jr., Chairman
J. R. Gilbert
J. R. Longcore
M. R. Stokes
M. A. Vietti

Cooperators/ Project Support: Maine Department of Inland Fisheries and Wildlife
U.S. Fish and Wildlife Service, Migratory Bird and Habitat Research Laboratory
College of Forest Resources--Hatch Act Funds

Objectives:

(1) To determine if the microclimates of roost sites influence black duck use and energetics.
(2) To examine the nutrient content and true metabolizable energy of foods selected by wintering and staging black ducks.
(3) To determine the relationship between specific dynamic effect and thermoregulation.
(4) To develop an energy budget and energetics model of wintering and staging black ducks.

Scope:

This study will focus on winter survival of black ducks by examining several aspects of existence metabolism: the relationship between thermoregulation and the microclimates of roost sites, true metabolizable energy and nutrient content of winter foods, and specific dynamic effect (heat of digestion).

Project Status:

The second field season was conducted from December through March. Unusually warm weather continued through the winter and black ducks did not establish shoreline roost sites. Microclimate data at roost sites were not collected as planned. Instead, microclimates at 5 locations, representing roost sites used during the previous winter, were recorded and 29 non-random paired tests were conducted. Water temperatures and ice conditions at the Jordan River and Skillings River study areas were recorded daily.

Fifteen black ducks (9M:6F) were collected at foraging sites to determine food habits and carcass composition. Food was removed from the esophagus and gizzard, carcass structural measurements recorded, and the carcass frozen for laboratory analysis. Twelve marine invertebrates and 3 plants were represented in the diet of wintering black ducks.

Five females were fitted with transmitters and their habitat use and daily movements recorded. Three were killed by predators. Time budget activity and habitat use of flocks (85 flock scans) and individual birds (7 hr) were recorded. In order to monitor changes in winter body condition, 162 black ducks were banded and external measurements recorded in cooperation with the Maine Department of Inland Fisheries and Wildlife.

Samples of the more common invertebrates eaten by black ducks were collected and frozen for caloric and nutrient studies. *Gammarus* spp. were collected each month and laboratory analysis conducted, including determination of caloric content.

Future Plans:

Continue with microclimate, habitat selection, and behavioral studies in the field and physiological and nutritional studies in the laboratory.

THE USE AND IMPORTANCE OF TRADITIONAL SITES FOR COMMON LOONS IN MAINE

Investigator: P. I. V. Strong

Advisors: J. A. Bissonette, Chairman
W. E. Glanz
J. B. Dimond
M. L. Hunter, Jr.
J. A. Sherburne

Cooperators/ Project Support: Maine Department of Inland Fisheries and Wildlife
Maine Cooperative Wildlife Research Unit
Maine Audubon Society
Mr. Frank Voigt
Libby Sporting Camps
Mr. Joseph Sewall

Objectives:

(1) To determine the use and importance of traditional nest sites for loons in undisturbed areas.
(2) To determine the use and characteristics of brood rearing areas.
(3) To determine the use of migration and wintering areas by common loons in Maine.

Scope:

Increased development and recreational use of Maine lakes and ponds may adversely affect breeding populations of common loons. At the same time behavioral modifications by loons seem to be lessening the effects. This study is designed to look at potential conflicts between development and recreation, and reproductive success of common loons. The traditional use of territories, nesting sites, brood rearing areas, and feeding areas are being closely examined. Additionally, preliminary data on the use of Maine's lakes, ponds, and coastline during migration and winter are being collected.

Project Status:

The first summer field season was completed May-September 1982. Three remote and relatively undisturbed lakes in northern Maine were selected for study areas. Nests were located and monitored. Territory configuration and use was determined by plotting locations of loons on gridded maps of the lakes. Location mapping identified feeding and brood rearing areas. One hundred eighty-three 1-hour observation periods were completed for 15 territorial pairs.

Loons initiated 9 nests in 15 territories. Eggs were hatched from 7 nests. No renest attempts were found. Four chicks from 2 nests died soon after hatching. Five chicks were still alive in early September.

Summary statistics for the 1982 breeding season on the 3 lakes are: 15 territorial pairs, 9 nesting pairs, 15 eggs laid, 10 eggs hatched, and 5 chicks fledged. Three statistics are commonly used to compare loon productivity among lakes, regions, etc. Our figures for these are: 0.60 nesting pairs/territorial pair, 0.56 chicks fledged/nesting pair, and 0.33 chicks fledged/territorial pair.

Reports of large groups of loons migrating through the state were solicited from the public. I received 14 reports of groups of loons containing 20 or more birds. Some groups had more than 100 loons.

The first annual Maine winter loon census was conducted in February in cooperat-on with the Maine Audubon Society. Approximately 50 people counted 361 loons visible from the shoreline from Kittery to Cutler. Loons were seen throughout the area mostly in large groups or singly. Results of the total number and distribution were similar to those of the 1982 Christmas Bird Count.

Future Plans:

Summer field work will resume in May 1983. One lake will be added to the study area. Data collection will be much the same with 3-hour observation periods added to better define territories. Nest sites on one lake used in 1982 will be barricaded to prevent reuse of the same site. This experiment will be expanded to include more nest sites in 1984. Reports of groups of migrating and wintering loons will be solicited from the public using a variety of media. A second winter loon census will be conducted.

EARTHWORMS AVAILABLE TO WOODCOCK IN RELATION TO FOREST TYPE, SOIL, AND LAND-USE IN MAINE

Investigator: W. J. Galbraith

Advisors: R. B. Owen, Jr., Chairman
M. W. Coulter
G. L. Jacobson
R. A. Struchtemeyer

Cooperators/ Project Support: Maine Department of Inland Fisheries and Wildlife
U.S. Fish and Wildlife Service, Accelerated Research Program for Migratory Shore and Upland Game Birds

Objectives:
(1) To examine the relationship of forest type, soil characteristics, and history of agriculture on earthworm biomass available to woodcock in Maine.
(2) To develop a preliminary classification scheme to evaluate habitat potential for producing earthworms.

Scope:

Many life requisite variables must be integrated when evaluating habitat suitability for a particular wildlife species. Food availability, specifically earthworm biomass, may be a primary criterion to consider when evaluating habitat for woodcock. Although several floristically diverse communities can provide cover for woodcock, use of diurnal cover is positively correlated with earthworm abundance. Earthworms found in Maine forests are European-introduced species, and their distribution and abundance may still be related to abandoned agricultural areas, as well as to the habitat characteristics of the site. This study examines the relationship of forest, soil, and history of farming to earthworms available to woodcock in Maine.

Project Status:

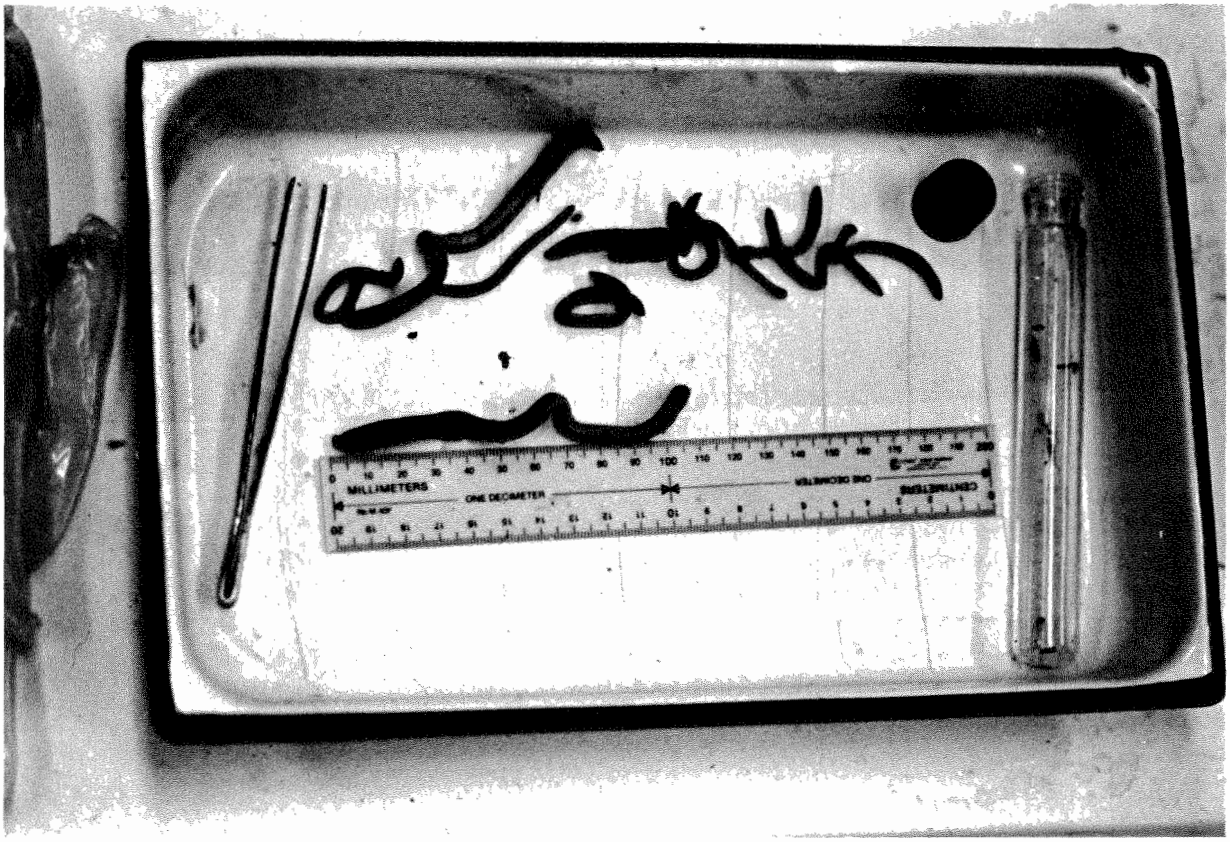
Earthworms (Oligochaeta, Lumbricidae) were collected from 4 study areas in central and eastern Maine during 3 seasonal sampling periods (May-June, July, Sept-Oct, 1982). Thirty-nine sites, representing 3 soil types, 4 forestry overstory types, on tilled and never-tilled land were sampled for earthworms using a chemical extraction technique. Habitat characteristics were recorded at each sample plot and a soil sample taken. Each site, consisting of 8 sample plots, were also characterized by forest overstory type, and soil drainage-textural class. Laboratory analyses of earthworm biomass and soil characteristics (pH, % soil separates, % organic material) are nearly completed. Required course work has been completed.

Future Plans:

Mean earthworm biomass will be compared among the 4 forest overstory types, 3 soil types, and on tilled vs never-tilled land. Earthworm biomass per m^2 at each sample plot will be regressed on the measured soil and vegetation parameters in an attempt to identify those habitat variables consistently associated with the availability of this primary woodcock food.

Results will be used to develop a preliminary classification scheme designed to evaluate habitat suitability for earthworms, which may then be incorporated into the HSI model for woodcock. Data analyses should be completed by August, 1983, with completion of the thesis expected in early fall.

Sampling for earthworms in another area of central Maine is currently being conducted to provide data with which to test the validity of the earthworm HSI model.



COMPLETED THESES AND REPORTS

INTEGRATION OF FOREST AND WILDLIFE MANAGEMENT ON INTERNATIONAL PAPER COMPANY'S NORTHERN EXPERIMENT FOREST

Investigator: C. A. Elliott

Advisors: M. W. Coulter, Co-chairman
C. F. Banasiak, Co-chairman
B. F. Hoffman
C. D. Webb

Cooperators/ Project Support: Maine Department of Inland Fisheries and Wildlife
International Paper Company

Objectives:
(1) To develop a decision making process, supported by a data base, with which the Northern Experiment Forest can be managed for wildlife, as well as timber, through the manipulation of habitat.
(2) To develop wildlife management prescriptions and a habitat diversity assessment procedure that can be used in forest management planning.
(3) To identify information gaps and areas requiring future research.

Scope:

Forest management affects wildlife by altering stand composition, structure, successional stage, and juxtaposition with other stand types. This study is the first phase of a project to integrate wildlife management into the forest management system. Use of habitat types by wildlife, wildlife management guidelines, and 3 methods of quantifying edge were developed to be used in management planning.

Project Status:

All requirements for the degree of Master of Science have been completed. An abstract of the thesis follows:

Abstract: This study was the first phase of a project to develop a system to integrate forest and wildlife management on International Paper Company's Northern Experiment Forest in Howland, Maine. A list of 123 birds and 38 mammals using the Forest was compiled from census data, sightings, sign, and the literature. The habitat requirements of each species were obtained from the literature and used to place each species in one of 6 guilds. A habitat type map was prepared based on stand maps and inventory data for the Forest. Use of the 44 habitat types recognized was tabulated and used to calculate an index of sensitivity to habitat change for each wildlife species. This information can be used in forest management planning to predict species changes with forest management and succession. The information for individual species was summarized for each guild to provide more general information on chances in the wildlife community with changes in structure and diversity of the Forest.

International Paper Company's objective for wildlife is to maintain habitat for a diversity of species. Management of the forest to maintain a diversity of habitats is necessary to meet this objective. Edge was chosen as an easily applied indicator of habitat diversity and was quantified using 3 methods: (1) total edge length, (2) an edge-area ratio, and (3) an edge quality rating. These values were calculated for the Forest and used to suggest management goals for increasing habitat diversity.

General recommendations for size and shape of clearcuts, residual stands, and connecting corridors, temporal and spatial arrangement of cuts, treatment of snags and dead and down material, and management of riparian areas and forest openings were made to address other aspects of habitat management for wildlife.

DENNING ECOLOGY, MOVEMENTS, AND DISPERSAL OF COYOTES IN EASTERN MAINE

Investigator: D. J. Harrison

Advisors: J. R. Gilbert, Chairman
M. W. Coulter
W. E. Glanz
J. A. Sherburne

Cooperators/
Project Support: Maine Department of Inland Fisheries and Wildlife
Maine Cooperative Wildlife Research Unit

Objectives:
(1) Describe the denning ecology, family interactions and interfamily spacing of coyotes.
(2) Assess the movements and mortality of juvenile coyotes.
(3) Compare the food habits of pup and adult coyotes during different stages of pup development.

Project Status:

All requirements for the degree of Master of Science (Wildlife Management) were completed in February 1983. An abstract of the thesis follows:

Abstract: Denning ecology, family associations and movements of 16 (4 adult, 12 juvenile) coyotes *(Canis latrans)* from 4 family groups were studied in eastern Maine from May 1981 through April 1982. Pups from 6 to 24 weeks of age were equipped with radio collars with compressible foam inserts. Monitoring of collared animals resulted in 2,760 radio locations.

Coyote families used several dens when pups were <10 weeks of age. Den entrances (N=7) were all oriented towards the south. Two pair of adult coyotes relocated their pups to new den sites on 9 occasions. The mean distance between den sites was 1.3 km. Pups 10-25 weeks old centered their activity around rendezvous sites.

Radio fixes of adult coyotes were <500 m from den entrances 55% of the time during nursing (May) and 54% during weaning (June and July). For 2 females with pups, distances traveled between consecutive independent relocations increased from nursing to weaning and from weaning to pup independence (August-April). Percent use of overall home ranges by females increased from 16% during nursing, to 63% during weaning, and 76% during pup independence.

For pups, home range sizes, mean distances traveled between independent relocations, and distances from den and rendezvous sites increased with age.

Coyote families centered their activity within a common territory that was adjacent to but discrete from those territories of neighboring groups. Prior to dispersal, the overall home ranges of juveniles were similar in size and position to those of their parents. Territory sizes of 3 coyote families known to contain pups ranged from 71-76 km^2. The size and position of three family territories were similar to those observed

during the year previous to this study. Seventy-three percent (8 of 11) of juveniles dispersed during their first year. In each of 3 families, 1 pup remained within the family territory until at least 1 year of age.

Food habits of pups and adults were compared from May 1981 through October 1981. Blueberried *(Vaccinium angustifolium)* occurred most frequently (68%) in coyote droppings. White-tailed deer *(Odocoileus virginianus)* was the most commonly occurring animal (43%), followed by snowshoe hare *(Lepus americanus)* (29%) and small mammals (Cricetidae, Soricidae, Zapodidae) (21%). Deer was the primary food of pups prior to their independence, and deer occurred in a higher percentage of pup droppings than adult droppings during June and July. Pups consumed hare more frequently than adults during July and August. Small mammals composed a smaller percentage of the diet of pups than adults during July.

ECOLOGY AND INTERSPECIFIC RELATIONSHIPS OF COYOTES, BOBCATS, AND RED FOXES IN WESTERN MAINE

Investigator: J. T. Major

Advisors: J. A. Sherburne, Chairman
M. W. Coulter
J. R. Gilbert
W. E. Glanz

Cooperators/
Project Support: Maine Department of Inland Fisheries and Wildlife
Maine Cooperative Wildlife Research Unit

Objectives:

(1) Document food habits and habitat utilization by bobcats, coyotes, and red foxes.
(2) Compare the utilization of these resources among the three species with special reference to competitive interactions and mechanisms by which competition is reduced.

Project Status:

All requirements for the degree of Doctor of Philosophy (in Forest Resources) were completed in 1983. An abstract of the dissertation follows:

Abstract: Interspecific relationships among coyotes *(Canis latrans)*, bobcats *(Lynx rufus)*, and red foxes *(Vulpes fulva)* were examined in western Maine between 1979-82. Habitat selection, spatial relationships, and activity patterns were determined through radio-telemetry of 9 coyotes, 10 bobcats, and 4 foxes. Similarity in niche parameters between pairs of furbearer species was compared using overlap indices.

During winter, radio-collared bobcats and coyotes selected forest stands of predominantly coniferous overstory, while radioed foxes avoided this type and selected hardwood dominated stands. Snowtracking of both radio-collared and other individuals indicated that bobcats and foxes used stands characterized by softwood regeneration more than did coyotes. Coyotes and foxes used roads and open areas extensively for travel and demarcation of territory boundaries whereas bobcats made little use of these areas. Overlap indices for the 3 species indicated that habitat selection during all seasons was least similar between coyotes and foxes.

Home range sizes averaged 43.3 km^2 for coyotes, 19.9 km^2 for foxes, and 138.6 km^2 for male bobcats. A female bobcat had a home range of 27.5 km^2. Home ranges of bobcats overlapped those of coyotes both spatially and temporally. Fox home ranges abutted but did not overlap coyote home ranges. Simultaneously monitored coyotes, bobcats, and foxes occupying adjacent or overlapping ranges maintained separation distances that did not differ from random ($p>0.05$), except that members of social groups tended to aggregate. Coyotes, bobcats, and foxes exhibited variable activity patterns, with no definite diel patterns.

Snowshoe hare *(Lepus americanus)* were abundant and ranked 1st or 2nd in frequency of occurrence during all seasons for all species from analysis of 826 scats. White-tailed deer *(Odocoileus virginianus)* also ranked 1st or 2nd in frequency of occurrence in 3 of 4 seasons for coyotes and bobcats, but occurred in <15% of seasonal fox diets. The occurrence of deer in furbearer diets was related to the severity of the particular winter. Small mammals (Cricetidae, Soricidae, Zapodidae) occurred frequently in the fox diet, but occurred rarely in bobcat and coyote diets. The canids ate fruits and berries in summer and fall, whereas bobcats were carnivorous year-round. The least dietary overlap was between coyotes and foxes during all seasons except summer, when bobcats and foxes had the least similar diet.

Interference competition was inferred from spatial segregation between coyotes and foxes on the study area. There was no evidence that competitive relationships existed between bobcats and red foxes. Although coyote and bobcat use of food and habitat overlapped, no supporting data for interference competition was obtained for these species.

THE EFFECTS OF TRAPPING ON MARTEN POPULATIONS IN MAINE

Investigator: A. M. Soukkala

Advisors: J. R. Gilbert, Chairman
M. W. Coulter
G. L. Jacobson

Cooperators/
Project
Support: College of Forest Resources--McIntire-Stennis

Objectives:
(1) To examine the interrelationships of harvest distribution, sex ratio, age structure and forest coverage within and between groups of townships.
(2) To estimate the sex ratio, age structure and minimum density of marten in a heavily trapped area from live-trapping data.
(3) To examine the relationships between trapping pressure and access roads.

Scope:

The harvest of marten in Maine has increased from 152 tagged marten in 1973 to over 5,000 in 1981. This study was designed to examine the harvest characteristics and the effects of exploitation on a local marten population. Carcasses were collected from trappers during the 1980 and 1981 trapping seasons to examine the sex ratio and age structure of the harvest. Date and township trapped were also recorded for each carcass. Cementum annuli were used to estimate the age of marten. A study area consisting of parts of 4 townships was chosen to represent a heavily exploited area. Marten were live-trapped and a premolar extracted to study the sex ratio, age structure, and density of this population.

Project Status:

All requirements for the degree of Master of Science (Wildlife Management) have been completed. An abstract of the thesis follows:

Abstract: The main objective of this study was to determine the effects of trapping on marten populations in Maine. Additional objectives were to estimate marten harvest rates, determine the relative vulnerability of various sex and age groups to trapping, and examine the influence of timber cutting practices on trapping pressure.

Between March and October, 1980, 107 marten from a heavily trapped population were livetrapped, tagged, and released. Thirty-four tagged marten were harvested during the 1981 trapping season. The sex and age composition of marten harvests were determined from 1,585 carcasses collected in 1980-81.

Males were more vulnerable to livetrapping than females and they also sustained greater mortality during the fall trapping season. In heavily trapped populations, the relative abundance of males has been decreased. Younger and relatively fewer males were trapped in townships with greater marten harvests, and more adult females than adult males were livetrapped from a population previously subjected to heavy fur-trapping pressure. Harvest rates of marten were estimated from tag recoveries. Additional estimates of juvenile harvest rates were obtained based on a gradual decrease in the percent males of juveniles trapped through the trapping season. Potential causes for the estimates to vary from actual harvest rates are discussed. Modeling the female population with a modified Leslie matrix predicted that current harvest rates may be causing a decline in some local marten populations. In addition to the effects on marten habitat suitability noted by other authors, timber cutting practices may intensify trapping pressure in local areas by providing increased access to trappers.

HOME RANGE AND HABITAT USE OF FEMALE BLACK BEARS IN NORTHERN MAINE

Investigator: G. R. Lamb

Advisors: J. A. Sherburne, Chairman
C. F. Banasiak
G. L. Jacobson

Cooperators/ Project Support: Maine Department of Inland Fisheries and Wildlife, L. L. Bean, Inc., Wildlife Management Institute, National Rifle Association

Objectives:
(1) To determine if differences exist in home range size for adult female black bears in heavily and lightly exploited populations.
(2) To describe habitat utilization by female black bears with major emphasis on highly exploited populations.

Scope:

Home range and habitat utilization data were collected using radio telemetry equipment. During summer 1980, bears were captured and fitted with radio transmitter collars. During winter 1980-81, dens were visited and biological and habitat data were collected. Bears were monitored regularly during 1981 from den emergence in April to denning in September and October.

Project Status:

All requirements for the degree of Master of Science (Wildlife Management) have been completed. An abstract of the thesis follows:

Abstract: A radio-telemetry study of home range and habitat use of female black bears *(Ursus americanus)* were conducted in an area of northern Maine. The study area (Spectacle Pond) had a lightly hunted bear population with extensive logging and limited recreation being the major land use activities. Data from 5 bears showed softwood and hardwood types were avoided when tests of use vs. availability were made for the entire study area. Examination of use vs. availability of cover types within the home ranges of these bears showed softwood-hardwood and mixedwood types were preferred. Average home range for the bears was 2,469 ha (range 1,755-3,999 ha). Extensive summer and early fall movements were observed and bears denned earlier than usual in 1981 in response to a poor beechnut crop.

SCIENTIFIC AND TECHNICAL PRESENTATIONS

Bissonette, J. A. 1982. Peccary behavior and its relation to ecology. Presented to an undergraduate class at the University of Vermont, Burlington. Dec., 1982.

Bissonette, J. A. 1982. Wildlife and forest practices: A Maine perspective. Presented to an undergraduate silviculture class at the University of Vermont, Burlington. Dec., 1982.

Bissonette, J. A. 1983. The units of natural selection: Individual vs. group selection. Presented at a Lecture Series in Evolution held at Unity College, ME. Feb., 1983.

Bissonette, J. A. 1983. Determinants of density of Chihuahuan desert peccaries. Presented to the Massachusetts Chapter of The Wildlife Society at the University of Massachusetts, Amherst. Feb., 1983.

Crossley, W. A. May 1983. Summer pond use by moose in northern Maine. Poster presented at 40th N.E. Fish and Wildlife Conf., Mt. Snow, VT.

Crossley, W. A., and J. R. Gilbert. May 1983. Home range and habitat use of female moose in northern Maine. Abstract presented at 40th N.E. Fish and Wildl. Conf., Mt. Snow, VT.

Galbraith, W. J. Earthworms available to woodcock in relation to forest type, soil characteristics, and land use in Maine. Presented at the U.M.O. Wildlife Seminar Series, and at the 1983 Northeast Graduate Wildlife Conference, University of New Hampshire, Durham.

Halpin, M. A. Current research on winter habitat use by red fox in eastern Maine. Presented at the 1983 Northeast Graduate Wildlife Conference, University of New Hampshire, Durham and U.M.O. Wildlife Seminar Series.

Halpin, M. A. May 1983. Winter habitat use by red fox in eastern Maine. Poster presented at 40th N.E. Fish and Wildl. Conf., Mt. Snow, VT.

Harrison, D. J., and J. A. Harrison. May 1983. Denning ecology, movements, and dispersal of coyotes in eastern Maine. Abstract of paper presented at 40th N.E. Fish and Wildl. Conf., Mt. Snow, VT.

Harrison, D. J. Denning ecology, movements, and dispersal of coyotes in Maine. Presented to Maine Dept. of Inland Fisheries and Wildlife Personnel, August 1982 and U.M.O. Wildlife Seminar Series, March 1983.

Litvaitis, J. A., and J. A. Sherburne. May 1983. Snowshoe hare browse use in Maine. Poster presented at 40th N.E. Fish and Wildl. Conf., Mt. Snow, VT.

Litvaitis, J. A. Coyote-deer relationships in southwestern Oklahoma. Presented at the Environmental Seminar Series, Unity College, ME.

Litvaitis, J. A. Bobcat movements in relation to snowshoe hare density. Presented to Wildlife Management and Wildlife Ecology classes at University of New Hampshire and to University of Massachusetts Student Chapter of The Wildlife Society.

Litvaitis, J. A. Methods used in studying carnivore food habits. Presented to Wildlife Biology class, U.M.O.

Litvaitis, J. A., J. T. Major, and J. A. Sherburne. A status report: Bobcat movements in relation to snowshoe hare density. Presented at the International Cat Symposium, Texas A&I University, Kingsville, TX. Oct. 1982.

Major, J. T. Effects of forestry practices on furbearers. Maine Audubon Society Conference on Wildlife Issues in Maine, Augusta. Oct. 1982.

Major, J. T., and D. J. Harrison. Coyote ecology in Maine--an update. Presented to Maine Chapter of The Wildlife Society, Brewer. April 1983.

Major, J. T., and J. A. Sherburne. Ecology and interspecific relationships between coyotes and red foxes in Maine. Masters of the Foxhounds Association Annual Meeting, New York City. January 1983.

Major, J. T., J. A. Sherburne, J. A. Litvaitis, and D. J. Harrison. Resource use by and interspecific relations between bobcats and other large mammalian predators in Maine. Presented at International Cat Symposium, Texas A&I University, Kingsville, TX. Oct. 1982.

McCollough, M. A. Winter feeding of bald eagles in Maine. Presented at Eagle Valley Environmentalists Bald Eagle Days, Rochester, NY. August 1982.

O'Donoghue, M. May 1983. Seasonal habitat use by snowshoe hare in eastern Maine. Abstract presented at 40th N.E. Fish and Wildlife Conf., Mt. Snow, VT.

Soukkala, A. May 1983. Effects of trapping on marten population structure in Maine. Abstract presented at 40th N.E. Fish and Wildlife Conf., Mt. Snow, VT.

PUBLIC PRESENTATIONS/EXTENSION ACTIVITIES

Bissonette, J. A. Maine wildlife. Program presented to 3-4-5 grade classes at Asa Adams Elementary School, Orono.

Bissonette, J. A. Presented introduction to and showed film "Red deer of Rhum" to U.M.O. Chapter of TWS.

Halpin, M. A. Winter ecology of foxes. Presented to the Union River Chapter of Maine Trappers Association, Ellsworth.

Harrison, D. J. Coyote/furbearer research and ecology. Presented to:
Northern Coastal Chapter, Maine Trappers Association
Union River Chapter, Maine Trappers Association, January 1983
Aroostook Chapter, Maine Trappers Association, April 1983
Eastbrook Rod and Gun Club, Nov. 1982
Veazie Salmon Club, Feb. 1983
Calais Rod and Gun Club, May 1983

Lamb, G. R. Maine black bear research. Northern Coastal Chapter MTA.

Litvaitis, J. A. Bobcat research in Maine. Presented to:
Narraguagus Regional High School Ecology Class
Union River Chapter of Maine Trappers Association

Major, J. T. Furbearer ecology and research in Maine. Presented to:
Central Maine Chapter, Maine Trappers Association, Palmyra
Ellsworth High School Biology Class
Winterport Lions Club
Penobscot Chapter, Maine Trappers Association, Kenduskeag
North New Portland Lions Club

McCollough, M. A. Eagle Program. Presented to:
Penobscot Conservation Club
Schoodic Audubon

O'Donoghue, M. Coyote research and ecology. Presented to:
Calais Rod and Gun Club, Calais

Soukkala, A. M. Marten--natural history and current research. Presented to:
Northern Coastal Chapter, Maine Trappers Association, Belfast
Central Maine Chapter, Maine Trappers Association, Palmyra

Strong, P.I.V., J. A. Sherburne, and J. A. Bissonette took part in the filming by Wild Kingdom of the Loon Project. The finished film called "Call of the Loon" will be aired in Nov./Dec. 1983.

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Bissonette, J. A. 1982. Ecology and social behavior of the collared peccary in Big Bend National Park, Texas. NPS Sci. Monogr. Ser. No. 16. 85pp.

Bissonette, J. A. 1982. Collared peccary. Ch. 42:841-850 in J. A. Chapman and G. E. Feldhamer (eds.). Wild mammals of North America. Johns Hopkins Univ. Press, Baltimore. 1147pp.

Bissonette, J. A. (ed.). 1982. Deer winter habitat management. Misc. Publ. 679, Univ. Maine Agric. Exp. Stn., Orono. 93pp.

Crossley, W. A. 1983. With camera and binoculars. Maine Fish and Wildlife 25(1):4-5.

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Litvaitis, J. A., J. A. Sherburne, M. O'Donoghue, and D. May. 1982. Cannibalism by a free-ranging bobcat, Felis rufus. Canadian Field-Naturalist 96:476-477.

Litvaitis, J. A., and R. P. Tebbets. 1982. Mark-recapture estimates of a population. Pages 89-94 in Introduction of forest resources lab manual. College of Forest Resources, Univ. of Maine. 129pp.

Litvaitis, J. A. 1982. Bobcat research at Cooperative Wildlife Research Units. 6pp. Mimeo.

Major, J. T. 1982. Maine Cooperative Wildlife Research Unit--Learning, teaching, serving. Maine Fish and Wildlife Magazine 24(4):19-22.

Major, J. T., and J. H. Hunt. 1983. Habitat suitability index model: bobcat. Report to the Maine Department of Inland Fisheries and Wildlife. 12pp.

Major, J. T., and E. R. Kleban. 1983. FAMULUS users guide. Univ. of Maine Computing and Data Processing Services Document 025-1. 20pp.

Steventon, J. D., and J. T. Major. 1982. Marten use of habitat in a commercially clear-cut forest. J. Wildl. Manage. 46:175-182.

Stockwell, S. S., and M. L. Hunter, Jr. 1983. A description of the wildlife in 27 Maine peatlands. Report to the Maine Department of Inland Fisheries and Wildlife. 144pp.

Sherburne, J. A. (ed.). 1983. Wildlife populations utilizing right-of-way habitats along Interstate 95 in northern Maine. Final Rept. Tech. Paper 83-5, Materials and Research Division of Maine Depart. Transportation, Bangor. 28pp.

Sherburne, J. A. 1983. Interstate highway construction in Maine may create favorable habitats for some wildlife species. Res. Info. Bull. 83-25:1.

Sherburne, J. A. 1983. Riparian habitats important for furbearing predators in Maine. Res. Info. Bull. 83-21:1.

In Press

Batcheller, G. R., J. A. Bissonette, and M. W. Smith. (in press). Towards reducing pecan losses to blue jays in Oklahoma. Wildl. Soc. Bull.

Jorde, D. G., G. L. Krapu, and R. P. Crawford. (in press). Feeding ecology of mallards wintering in Nebraska. J. Wildl. Manage.

Krapu, G. L., A. T. Kleft, and D. G. Jorde. (in press). The relationship between mallard reproduction and spring water conditions. Auk.

Litvaitis, J. A., C. L. Stevens, and W. W. Mautz. (in press). Age, sex, and weight of bobcats in relation to winter diet. J. Wildl. Manage.

Major, J. T., and J. A. Sherburne. (in press). Furbearer ecology of Maine. Maine Agric. Exp. Sta. Annual Rep.

O'Donoghue, M. 1983. Seasonal habitat selection by snowshoe hare in eastern Maine. Trans. 40th N.E. Fish and Wildl. Conf., Mt. Snow, VT. (in press).

Ockenfels, R. A., and J. A. Bissonette. (in press). Activity levels of white-tailed deer in Cross Timbers habitat. S.E. Assoc. F. & G. Comm. Proceedings, Jacksonville, FL.

In Preparation

Ault, J. W. and J. A. Bissonette. Quantitative estimate of barn owl nesting habitat. In prep. for Ecol. Monogr.

Strong, P. I. V., and J. A. Bissonette. Ecology of beaver in southwestern riparian ecosystems. In prep. for Wildl. Monogr.

Bissonette, J. A. Account of collared peccary. In prep. for J. Mammal. (Mammalian Species).

Major, J. T., and J. A. Sherburne. Ecology and interspecific relationships of coyotes, bobcats, and red foxes in western Maine. In prep. for Wildl. Monogr.

Major, J. T., J. D. Steventon, J. A. Sherburne, and G. J. Matula. Ecology of sympatric red foxes and coyotes in northwestern Maine. In prep. for Can. J. Zool.

Major, J. T. The eastern coyote. In prep. for Maine Audubon Environment.

Caturano, S. L., and J. A. Sherburne. Habitat and home range use by coyotes in eastern Maine. Submitted to J. Wildl. Manage.

Harrison, D. J., and J. A. Harrison. Denning ecology, movements, and dispersal of coyotes in eastern Maine. In prep. (abstract presented at 40th N.E. Fish and Wildl. Conf.).

Harrison, D. J., and J. A. Harrison. Food habits of reproductive eastern coyotes and their known aged pups. In review, J. Wildl. Manage.

Litvaitis, J. A., M. O'Donoghue, M. Miller, and J. A. Sherburne. An evaluation of trapping efforts to captive bobcats, coyotes, and red foxes. Accepted for presentation at First Eastern Animal Damage Control Conf., Sept. 1983.

Miller, M. Relationships between coyotes and deer in western Maine--a pilot study. In prep.

Theses

Caturano, S. L. 1983. Habitat and home range use by coyotes in eastern Maine. M.S. Thesis, Univ. of Maine, Orono. 28pp.

Elliott, C. A. 1982. Integrating forest and wildlife management on International Paper Company's Northern Experiment Forest. M.S. Thesis, Univ. of Maine, Orono. 65pp.

Harrison, D. J. 1983. Denning ecology, movements, and dispersal of coyotes in eastern Maine. M.S. Thesis, Univ. of Maine, Orono. 48pp.

Lamb, G. R. 1983. Home range and habitat use of female black bears in northern Maine. M.S. Thesis, Univ. of Maine, Orono. 26pp.

Major, J. T. 1983. Ecology and interspecific relationships of coyotes, bobcats, and red foxes in western Maine. Ph.D. Dissertation, Univ. of Maine, Orono. 64pp.

Theses in Preparation

Halpin, M. Winter ecology of red fox and historical account of red fox in Maine. M.S. Thesis requiring major editing by Unit Leader.

Rego, P. Factors influencing harvest levels of fisher. M.S. Thesis requiring major editing by Unit Leader.