

BIOLOGICAL INVENTORY OF ACADIA NATIONAL PARK
AND U.S. NAVY LANDS
ON THE SCHOODIC PENINSULA, MAINE

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EXECUTIVE SUMMARY

The goal of this biological inventory project was to provide Navy and National Park Service (NPS) managers with preliminary resource information on the vascular flora, vertebrate fauna, and forest communities of Schoodic Peninsula. The proximity of Navy and NPS lands on the Schoodic Peninsula presented a unique opportunity to cooperatively assess the natural resources and formulate management strategies. Prior to this study, NPS and Navy managers lacked basic biological information for these lands. The inventory was funded through a grant from the Department of Defense Legacy 2000 program to match funding and technical support from the NPS and College of the Atlantic (COA).

Roughly 500 hectares (ha) were included in the study area and were comprised of 250 ha of Navy lands on Corea Heath and Big Moose Island and 250 ha of NPS lands on Big Moose Island and Schoodic Peninsula. Corea Heath is recognized as a Maine Critical Area and is one of the southern-most and largest coastal raised peatlands in North America. The jack pine (*Pinus banksiana*) woodlands that border Corea Heath and are found on Big Moose Island and Schoodic Peninsula are registered as Maine Critical Areas, who have documented these forest communities as biologically important in Maine.

Objectives of this inventory were to 1) develop species lists of vascular plants and terrestrial vertebrates; 2) identify federal or state-listed endangered or threatened species and Maine species of management concern; 3) identify non-native species and evaluate the extent of intrusion for the most invasive species; and 4) quantitatively characterize the forest communities.

We inventoried amphibians and reptiles using different survey, trapping, and artificial shelter methods that included visual encounter day and night searches (95 hours), auditory night searches (12 hours), night driving (14 hours), straight-line drift fences with pitfall traps (1464 trap nights), pitfall traps without drift fences (45 trap nights), snake traps (548 trap nights), turtle traps (6 trap nights), and artificial shelters (170 shelter nights). We observed or captured 128 herptiles representing nine species. All nine species were present in Corea Heath, eight species were found on Acadia National Park (ANP) lands on Schoodic Peninsula, and four species were located on Big Moose Island. No federal or state-listed species of herptiles were encountered. However, the late start in beginning our field work limited our opportunity to match field inventory activities with emergence periods for potential species in all habitats. Additional inventory efforts are needed to augment our preliminary efforts.

A total of 31 mammal species were recorded using different trapping and searching methods. We set live-traps 3090 trap periods and pitfall traps 1464 trap periods. We captured 153 individuals representing 15 species of small mammals. All trap mortalities of small mammals were collected as voucher specimens. Electrophoretic assay of salivary amylase was conducted on all deer mice and white-footed mice to confirm taxonomic identifications. We identified sixteen species by direct observation and during ground searches for animal

sign. A complete list of the species can be found in the mammal chapter. We identified 25 mammal species from the Schoodic Head study site, 21 species from the Big Moose Island study site, and 18 species from the Corea Heath study site. No federally listed mammals were noted in the study area. We collected a bat from the Schoodic Head study site and Dr. William Glanz (University of Maine) identified the individual as a northern long-eared bat (*Myotis septentrionalis*), which is a Maine-listed mammal of special concern. Additional information on the presence, population size, distribution in the state, and ecology of this and all species of bats are needed to determine management status and conservation efforts in Maine. We also verified the presence of the white-footed mouse in the study area, which is not a federal or Maine-listed species, but confirms information on the northeast range limit of this species. Additional efforts should focus on the presence and distribution of the meadow vole, water shrew, woodland jumping mouse, northern flying squirrel, and all furbearers in the study area. The work would further define the presence and distribution of the more common species in all study sites.

Twenty 0.01 ha plots were randomly established at Corea Heath and Big Moose Island to quantitatively describe forest communities. We used detrended correspondence analysis of tree basal area to identify five distinct forest communities. These forest communities are the maritime spruce and fir forest community, jack pine woodland forest community, northern white cedar seepage forest community, early successional forest community, and pitch pine woodland forest community. At Corea Heath, jack pine woodland and early successional forest communities were the most prevalent with small patches of pure maritime spruce and fir and pitch pine woodland forest communities. At Big Moose Island, the maritime spruce and fir forest community was the most prevalent forest community with small patches of jack pine woodland and northern white cedar seepage forest communities. Forest communities were densely stocked and relatively young and even in age. The largest stand of old growth was located south of Frazer Creek on ANP lands on Schoodic Peninsula. We recommend additional research on old growth (i.e., age) forest communities of coastal forest communities.

We identified 442 vascular plant species including seven varieties and subspecies. The species are listed in Table 10. No federally listed plant species were found. A total of 10 Maine-listed species were verified and include three state endangered species (*Bartonia paniculata*, *Carex adusta*, and *Calamagrostis pickeringii*), one state threatened species (*Carex echinata*), two state special concern species (*Carex wiegandii* and *Montia fontana*), and four state watch list species (*Arethusa bulbosa*, *Iris setosa* var. *canadensis*, *Rubus chamaemorus*, and *Sagina nodosa* spp. *nodosa*). *Dryopteris fragrans*, is another State species of special concern that has been reported from the Schoodic Head study site, but we did not attempt to relocate this species because of its location on coastal cliffs. We identified seven of the state-listed species from Corea Heath study site, seven species from the Schoodic Head study site, and three species from the Big Moose Island study site. We identified 75 non-native species and none are known as highly invasive and threaten native plant communities. Because the investigation was funded for only one field season, our field work focused on

selected microhabitats within each study site. Additional surveys are needed throughout the study sites to complete a more thorough assessment of vascular plants in the study area.

To facilitate additional inventory or monitoring efforts, we surveyed the locations of all trapping areas and forest plots using global positioning system (GPS) technology. These data are stored on disc at ANP (Division of Natural Resources) and with Naval Security Guard Authority, Winter Harbor (NSGA-WH).

MANAGEMENT RECOMMENDATIONS

The following list provides a general overview of recommendations. Specific details for each recommendation are provided in the chapters of this report.

Amphibians and reptiles

- * Conduct additional surveys of herptiles using various methods scheduled to correspond with emergence time periods.
- * Support research of herptiles in coastal wetland habitats.

Mammals

- * Conduct additional mammal trapping and searches, focusing on species not verified in the initial inventory.
- * Determine presence of bat species and habitat use of coastal areas.
- * Conduct monitoring surveys of selected mammal species every several years.

Forest communities

- * Encourage research investigating old growth characteristics of all forest communities, especially northern white cedar, pitch pine, and jack pine.
- * Discourage projects that allow disturbance of forest communities.
- * Conduct forest community assessments every 20 years to reevaluate forest community health and threats.

Vascular flora

- * Conduct additional field searches throughout the growing season to complement out inventory of the vascular flora. Focus on wetlands, especially non-forested wetlands and coastal shorelines.
- * Participate in partnerships to enhance protection of rare plants in the region.
- * Monitor rare plant populations to ensure their protection and track the status of these populations and habitats.
- * Cooperate with state and other federal agencies to inventory and manage non-native species in the study area and throughout the Schoodic Peninsula.

Additional recommendations

- * Develop and implement a monitoring plan of Maine-listed plant species found in the study area and periodic review of the resources and ecological processes of the Corea Heath Critical Area.
- * Continue monitoring breeding bird populations.
- * Initiate inventories of bryophytes and invertebrates, with special emphasis on federal and Maine-listed species.
- * Protect the scenic integrity of the peninsula.

ACKNOWLEDGEMENTS

We thank the Navy, especially the Department of Defense Legacy 2000 program, for making this inventory a reality. Navy personnel at the Winter Harbor Naval Security Group Activity were helpful and cooperative as we conducted our field surveys and their patience was appreciated. Special thanks go to CTA1(SW) Guy Beckwith for scheduling escorts for our field work and to Mr. Jim Miller, Environmental Specialist, for his assistance and guidance throughout all stages of this inventory. David Manski and other staff members at Acadia National Park provided encouragement and support throughout this project and we thank them for their assistance. We also thank the following individuals for technical assistance throughout this project: Dr. Bill Kilpatrick of the University of Vermont for salivary amylase analysis of *Peromyscus* specimens, Dr. Craig Greene of College of the Atlantic and Linda Gregory of Acadia National Park for assistance with field work and plant identifications, Dr. Bill Patterson of University of Massachusetts at Amherst for assistance and advice on forestry methods, Dr. Steve Ressel of College of the Atlantic and his students for assistance with amphibian field work, and Danny Mitchell for taking the time to teach us how to attract and identify carnivores using scent and bait stations. Bill Weidner, Acadia National Park Schoodic Ranger, relayed historical and current fauna sightings to us throughout the summer and we appreciate his time and assistance.

INTRODUCTION

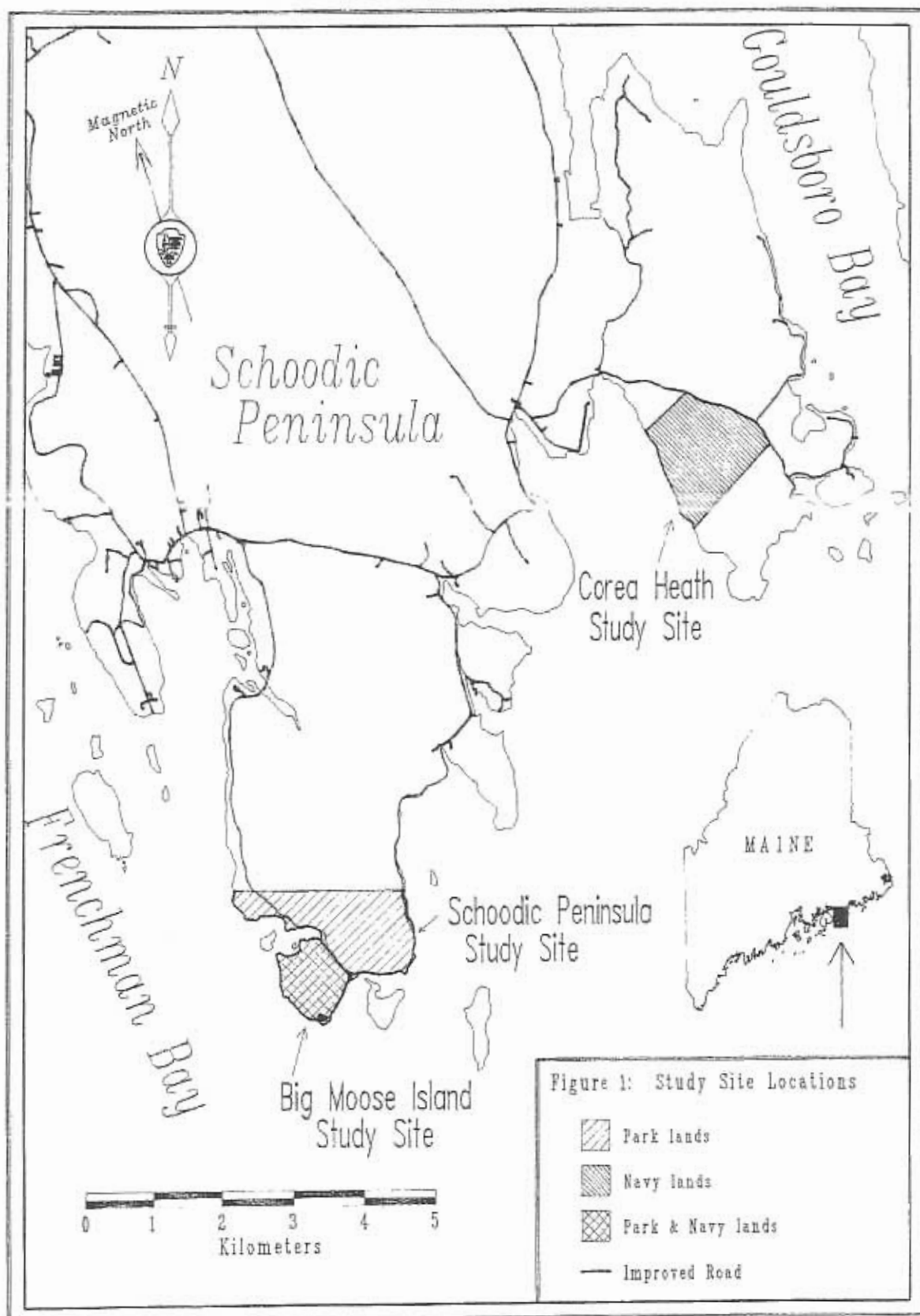
One of the most difficult problems facing natural resource managers is the lack of resource inventories for the areas they manage. Resource inventories identify basic biological information and establish the standards to measure population (Heyer et al. 1994) or environmental changes (Lichens 1987) and assess land use and recreational effects. Information from resource inventories are fundamental to understanding the intricacies of biological diversity (Heyer et al. 1994, Wilson 1988) and are a necessary component for successful management of natural resources and lands (Goldsmith 1991, Johnson et al. 1984, Likens 1989, van Riper et al. 1990, Williams 1994).

Extensive scientific work has been conducted in and adjacent to Acadia National Park (ANP) on Mount Desert Island (MDI) since the late 1800's (Greene et al. 1992). Contrasting to this richness is the lack of scientific information about the resources on Schoodic Peninsula including National Park Service (NPS) and Department of Defense-Navy (Navy) lands, which are two of the largest landowners. The proximity of Navy and NPS lands on Schoodic Peninsula (Figure 1) presented a unique opportunity to cooperatively assess the natural resources administered by ANP and Naval Security Group Activity-Winter Harbor (NSGA-WH). Recognizing this opportunity, the NPS and the Navy entered into an interagency understanding to conduct natural resources inventories through cooperative efforts. The NSGA-WH and ANP identified and proposed a preliminary biological inventory for the summer of 1994. The inventory was implemented when NSGA-WH received funding assistance from the Department of Defense Legacy 2000 Resource Management program to match funding and technical support from ANP and the College of the Atlantic (COA). Results from the inventory establish biological information databases for NSGA-WH and ANP, enabling managers to make informed and cooperative management decisions about resources and lands under their jurisdiction.

The specific objectives of our inventory project were:

- Develop species lists of vascular plants and terrestrial vertebrates in the major community types.
- Identify federal and Maine-listed endangered or threatened species and species of management concern for the taxa being inventoried.
- Identify non-native species found during field investigations and evaluate the extent of intrusion for the most invasive species.
- Quantitatively characterize the forest communities.

To meet these objectives, we conducted field inventories for the presence of vascular plants, terrestrial mammals, and herptiles within the major community types. We also described forest communities by conducting quantitative measurements. During the inventory we



attempted to verify the presence or absence of federal and Maine endangered and threatened species and Maine species of special concern (Appendix 1) as identified by the Maine Department of Inland Fisheries and Wildlife (MDIF&W)(1994) and Maine Natural Areas Program (1994b).

Our report is organized by chapters beginning with a description of the study area by study site and a general overview of the climate for the study area. The following chapters describe taxa surveyed during the inventory. These chapters describe historic information on the taxa within or near the study area, the methods used to conduct and analyze the field data, the taxa identified and the effort expended to collect these data, the identification of all federal and Maine-listed endangered species, general descriptions of the species identified in the study sites with the exception of the 340 species of vascular plants, a discussion of the inventory methods and results, and recommendations for additional inventories, research, and management programs.

STUDY AREA

Our study area was located on Schoodic Peninsula, Maine, between Frenchman and Gouldsboro Bays (Figure 1). The study area is comprised of Navy and NPS lands in three study sites: Navy lands at Corea Heath; Big Moose Island, which includes both ANP and Navy lands; and a small area of ANP lands on the southern tip of Schoodic Peninsula that is adjacent to Big Moose Island and identified as the Schoodic Head study site.

Corea Heath

The Navy administers the 191.4 ha Corea Heath study site (Figure 2), which is located west of Route 195 in the village of Corea, Town of Gouldsboro. One large antenna and several smaller ones, visible from many areas on the peninsula, are present on the property. Two roads branch west off of Route 195 and enter the heath. One is abandoned and the other provides access to Navy facilities. Areas disturbed by previous human activities are visible in the center of the peatland.

The 112 ha Corea Heath is one of the southern-most and largest coastal raised peatlands in North America (Maine Natural Areas Program 1994a). Coastal raised peatlands are a rare peatland type in North America and are distinguished by an elevated peat layer that lies above the water table (Worley 1981). The elevated condition is apparently responsible for the concentric arc patterns of peatland vegetation, which is a rare phenomenon (Worley 1981). These raised vegetative mats create unique habitats dominated by the grass-like lawns of *Scirpus cespitosus*. Another distinguishing feature is the peatland's border of jack pine forest stands, which represent one of only two peatlands in the state known to provide this unique environment for jack pine communities (Worley 1980). The Maine Critical Areas Program (Maine Natural Heritage Program 1994a) identified this peatland as a critical habitat because of its unique ecological character and assemblage of plants.

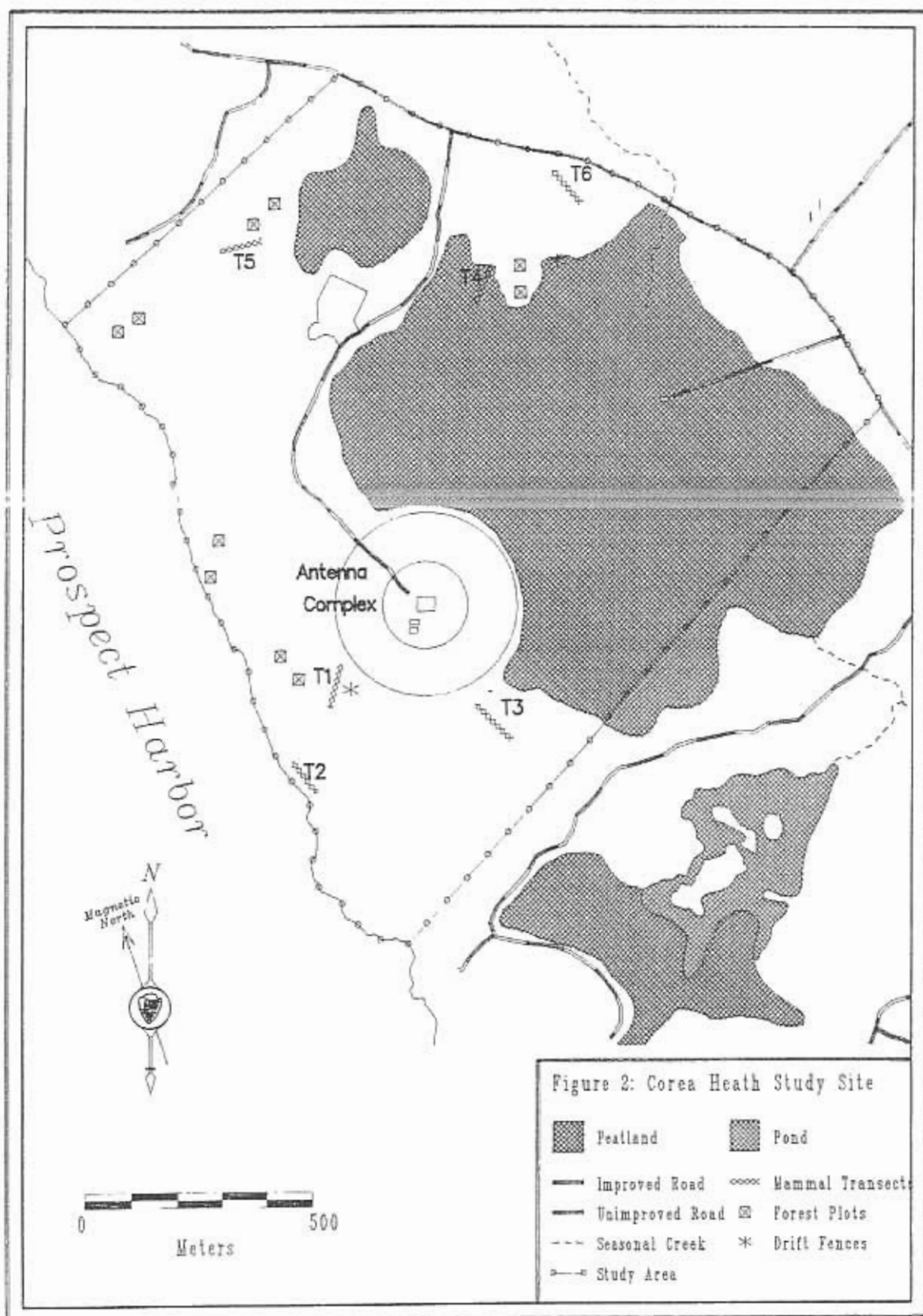


Figure 2: Corea Heath Study Site

Big Moose Island

Big Moose Island (Figure 3) was once an island adjacent to the southern-most tip of the peninsula. A paved road was built over a brackish marsh, which had divided the island and mainland, and joins the paved road known as the Schoodic Loop Road. The Schoodic Loop Road parallels the west, south, and east shoreline of the southern tip of Schoodic Peninsula. We selected the Schoodic Loop Road as the boundary between the Big Moose Island study site and the Schoodic Head study site.

Both NPS and Navy lands are present on Big Moose Island. The Department of the Interior transferred 10.5 ha of land to the Navy in 1935 and an additional 61.5 ha in 1947. In 1977, 33 ha of land were transferred from the Navy back to the Department of the Interior. Presently, the Navy administers approximately 40 ha of the island with no salt water frontage. Remaining lands on Big Moose Island are administered by ANP.

The Navy operated a series of communication antennas on the property until the mid-1960's when a new facility was constructed at Corea Heath. The site is used for Navy administrative operations and these facilities (e.g., administrative and maintenance buildings, medical complex, indoor and outdoor recreation areas, and a recreational campground) are connected by a network of paved and unpaved roads. The support cables and cement foundation blocks remain on site and are scattered throughout Navy lands and the island. Although the area around the tower sites are recovering, we imagine that the areas around the towers and throughout the island have been disturbed several times in the last fifty years. We did locate a few small tracts along the eastern and western sides of the island that were vegetated with older-aged forests and were apparently not disturbed with the placement and removal of the towers.

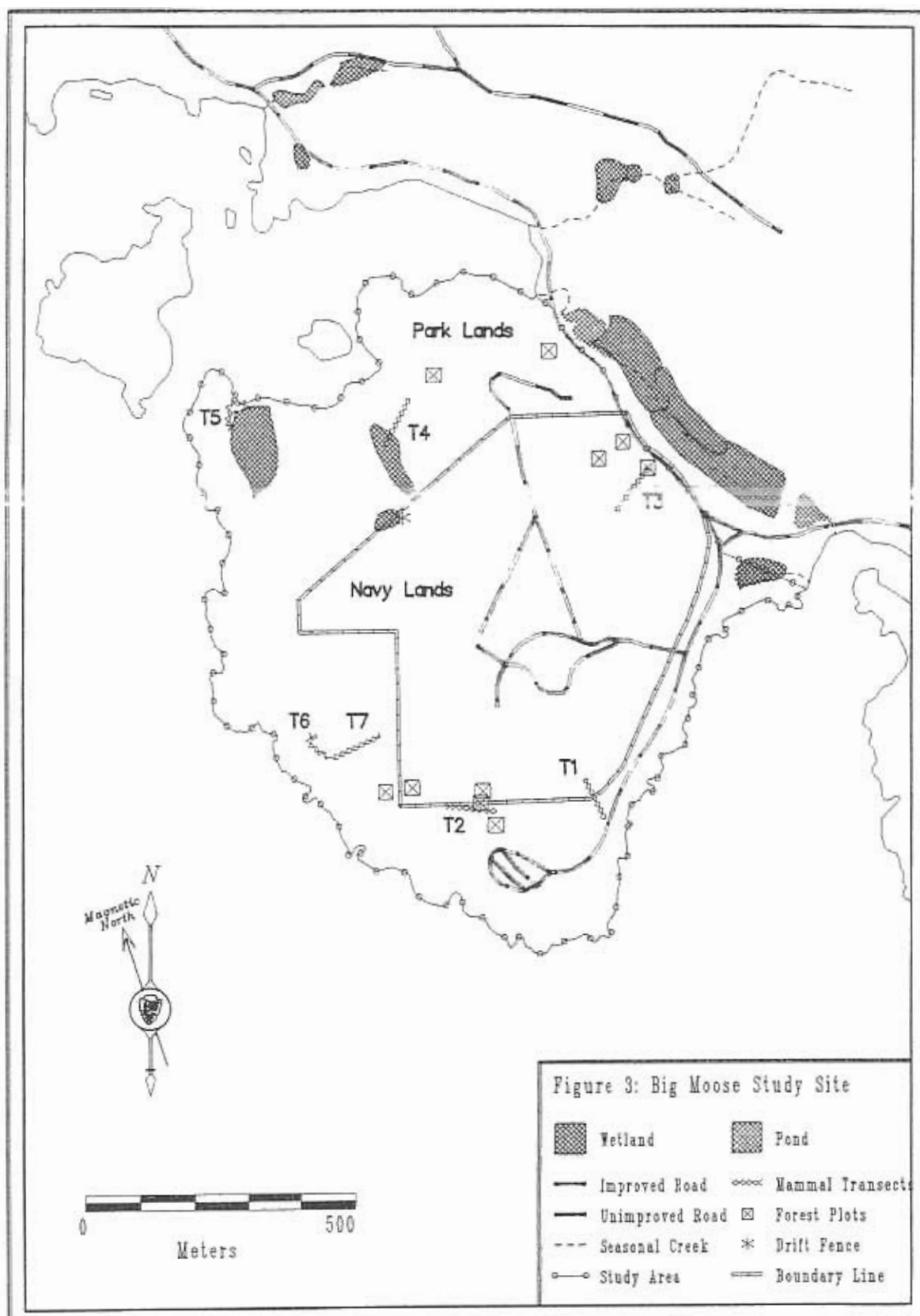
Spruce-fir stands are the dominant forest community with small stands of jack pine on the southern tip of the island. Small seasonal and permanent freshwater wetlands are scattered throughout the area. Streams are small and seasonal.

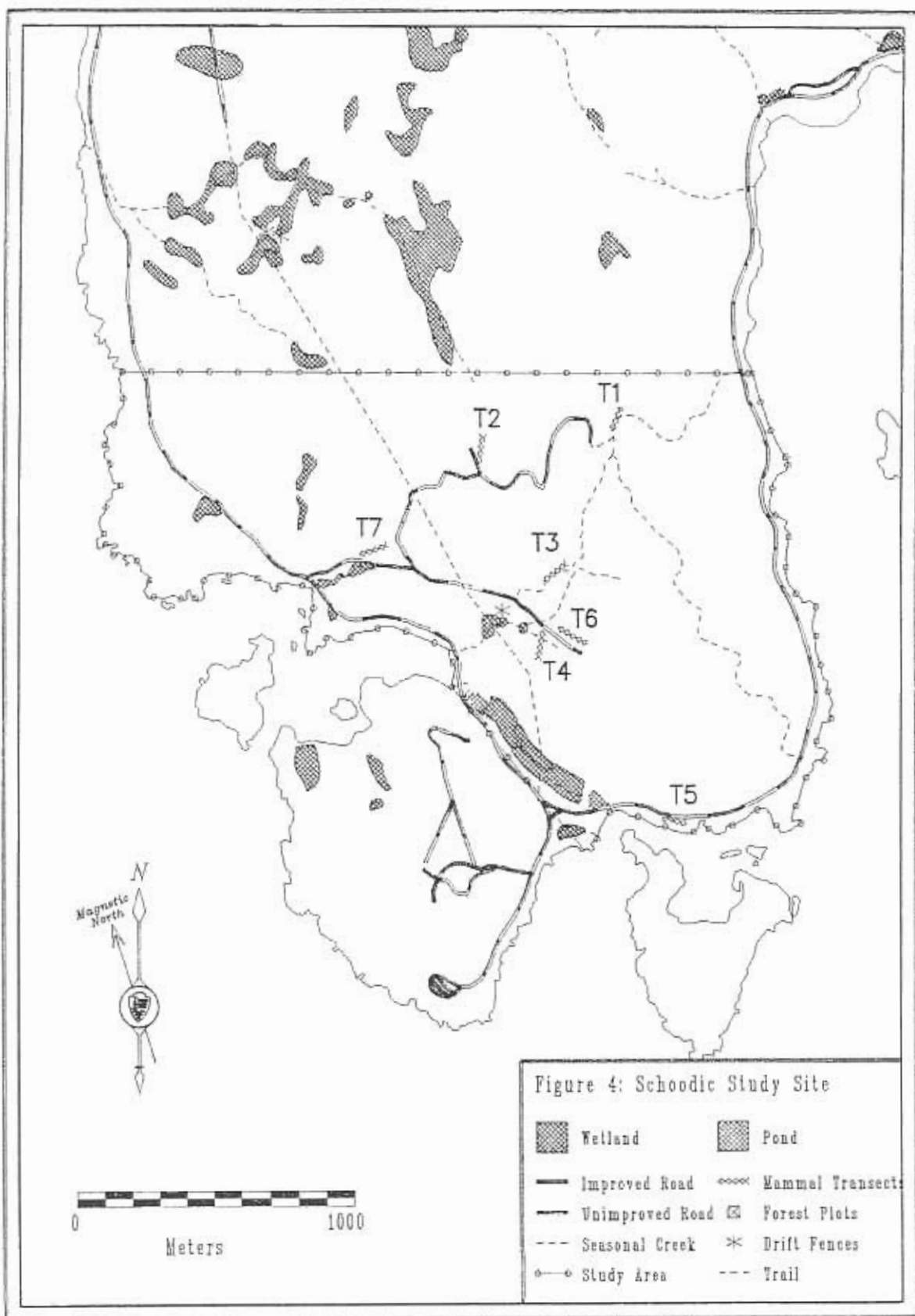
Schoodic Head Study Site

Lands administered by the NPS on the Schoodic peninsula (Figure 4) encompass roughly 800 ha. We surveyed the southern 250 ha because of the ecological associations with Big Moose Island. A east-west line drawn through the summit of Schoodic Head delineates the northern boundary of this study site. Some limited field work was conducted in specific wetland habitats north of the study site boundary.

Spruce-fir stands are the dominant forest community with small stands of jack pine on the eastern, western, and southern flanks of Schoodic Head. Numerous freshwater bogs, swamps, and seasonal water courses are scattered throughout the study site with a few permanent streams.

The Schoodic Loop Road parallels the entire coastline of Schoodic peninsula and one unimproved road branches from the Schoodic Loop Road to enter the interior of the study





site. This unimproved road provides access to the ANP's ranger station and Schoodic Head, which are open during the snow-free months. A north to south electrical powerline traverses the length of the peninsula supplying power to the Navy base on Big Moose Island. ANP maintains a summer ranger station and residence, a picnic area, two parking lots associated with vista vantage points, and a few low-maintenance trails. The remaining acreage, which is a majority of the total ANP acreage on Schoodic Peninsula, is managed to maintain the components and processes of a natural evolving ecosystem (Acadia National Park 1992).

CLIMATE

Schoodic Peninsula has a cool, moist, maritime climate. Temperatures range from a high of 35°C in summer to a low of -20°C in the winter. The mean annual precipitation is 120 cm with snowfall averaging 1.5 m. High relative humidity values and the cooling effect of cold ocean water mimic conditions of a more northern or arctic region and an environment suitable for arctic plants (Hill 1919).

AMPHIBIANS AND REPTILES

HISTORIC INFORMATION

No inventories or studies of the amphibians or reptiles (collectively known as herptiles) from the Schoodic Peninsula had been conducted (Greene et al. 1992) before our inventory. The only herptile reported in The Atlas of the Amphibians and Reptiles of Maine (Hunter et al. 1992) from the Schoodic Peninsula is a common garter snake (*Thamnophis sirtalis*).

METHODS

We used different inventory techniques (Heyer et al. 1994) to survey amphibians and reptiles. These techniques included visual encounter day and night searches, auditory night searches, night driving, straight-line drift fences with pitfall traps (Heyer et al. 1994), pitfall traps without drift fences (Call 1986), snake and turtle funnel traps, and artificial shelters (Fitch 1987, 1992). The day and night searches were conducted in all major habitat types.

Searches

We concentrated visual encounter searches in microhabitats frequented by specific species during day and nighttime periods to verify presence (Heyer et al. 1994). We conducted the searches by looking for and recording amphibian adults or eggs masses. During daytime periods, we conducted visual encounter searches as we walked through suitable habitats. Our searches involved modest habitat disturbance such as breaking apart rotten logs or looking under debris. We also searched ground surfaces and other likely habitats while conducting other inventory work, although this effort was not quantified. Our nighttime searches concentrated on locating amphibians in wetland habitats using visual encounter searches and listening for calls. Auditory searches involved listening and counting calling male frogs along designated wetland routes. Both day and night searches were conducted intermittently from mid-spring into mid-summer. To quantify our efforts, we recorded the number of person hours spent searching in each study site.

We used the night driving technique (Heyer et al. 1994), which is a method that counts mobile amphibians as they cross roads. We conducted this technique by slowly driving roads in the study area on warm rainy nights and stopped to identify and count all amphibians encountered crossing the road.

Trapping

We used straight-line drift fences with pitfall traps to capture herptiles (Vogt and Hine 1982, Heyer et al. 1994). Fences were placed in or adjacent to wetlands from May 19 through July 1, 1994. We constructed drift fences of polyethylene plastic that measured 15 meters (m) long by 50 centimeters (cm) high and were supported by wooden stakes every 3 m. The

lower edge of the plastic was buried approximately 10 cm into the ground to prevent animals from passing underneath the fence. Each pitfall trap was made from a No. 10 metal can (15.5 cm diameter x 17.5 cm deep), located adjacent to the drift fence every 5 m and buried in the ground until the lip of the can was flush with the ground (Voight and Hine 1982). At sites with deeper soils, pitfall traps were doubled in depth by joining two No. 10 metal cans (35 cm deep), which were sealed at the joint with silicone and covered with duck tape. We made anti-escape funnels from margarine bowls with the bottom removed and fitted these in the top of each pitfall trap to decrease escape opportunities. We filled and maintained pitfalls traps with 3 cm of water to drown mammal predators. We checked the traps every other day. We used Heyer's et al. (1994) description of one open trap during a full trapping period to determine the total number of trap periods.

We set pitfall traps without drift fences to complement our efforts to survey small mammals, however these traps occasionally captured amphibians. The pitfalls traps were constructed using No. 10 metal cans fitted with an anti-escape funnel as previously described. These traps were baited for mammals using a mixture of rolled oats, raisins, peanut butter, paraffin, and suet (Calhoun 1959) and water was not placed in the bottom. We checked the traps every other day. We used the Hever et al. (1994) definition in recording and summarizing trap periods for the study sites.

We placed snake funnel traps at the ends of drift fences, which we constructed using a design described by Hall (1967). These traps capture species that follow the fence and negotiate their way past the pitfall traps (Heyer et al. 1994) to the end of the fence, where the individual enters the trap and is unable to find the funnel opening. The traps were constructed of a one-pound coffee can (14 cm tall x 10 cm diameter) with the open end fitted with an inverted anti-escape funnel formed from 0.3 cm mesh hardware cloth. These traps were checked every other day as we checked the drift fence pitfall traps. We defined a funnel trap period as the time interval from the time the funnel trap was opened until the trap was monitored and was believed to have remained open or unobstructed during that period.

We made artificial shelters from 3 ml. black polyethylene plastic (2.5 m x 3 m) to attract snakes (John Albright, Maine State Planning Office, pers. comm.). We located the shelters in suitable snake habitat [e.g., rock piles and grassy areas (Hunter et al. 1992)] with no bait. We defined a shelter period as a shelter that remained undisturbed from the time it was set until it was monitored. We monitored the shelters every other day.

In July we set two turtle hoop-traps (i.e., four hoops, 0.5 m in diameter) in appropriate ponds within the study area. We anchored the traps with wooden stakes and used sardines for bait. We defined a trap period as one trap that remained open from the time it was set until it was monitored. We examined the hoop-traps every other day.

Identifications and Voucher Specimens

We used field guides by Conant and Collins (1991), Hunter et al. (1992), Hunter (1984), Tynning (1990), and Tyler (1994) for species identification and to determine the habitats to search for targeted species. We used cassette tapes (Elliot 1992) to identify frog and toad calls.

We collected herptiles killed on the roads and mortalities from traps as voucher specimens. We also included photographs of live specimens in the voucher collection. Voucher specimens are stored with the Natural Resources Division, Acadia National Park, Bar Harbor, Maine.

RESULTS

We conducted day searches for 36 hours, night searches for 59 hours, and drove roads in the study sites a total of 14 hours searching for herptiles (Table 1). We complemented these techniques by setting drift fences with adjacent traps a total of 1464 trap periods and traps without a drift fence for 45 trap periods. We opened snake funnel traps a total of 584 trap periods and set black plastic shelters a total of 170 shelter periods. We opened turtle hoop traps a total of 6 trap nights. We summarized trapping effort by capture or survey method for each study site in Table 2. Amphibians collected for voucher specimens are listed in Appendix 2.

We found nine herptile species (Table 3) in the study area. We recorded nine species of herptiles in the Corea Heath study site, eight species from Schoodic Head study site, and four species from the Big Moose Island study site. No federal or Maine-listed species were identified in the study area.

We found eight species and a total of 31 individuals conducting the daytime visual encounter searches. We found four species and a total of 19 individuals during the nighttime searches. Our night road searches recorded three species and the highest number (14) of spotted salamanders (*Ambystoma maculatum*). Our use of drift fences with adjacent pitfall traps were successful in trapping two frog and two salamander species and the highest capture rates of the techniques that we used for redback salamanders (35) (*Plethodon cinereus*) and wood frogs (*Rana sylvatica*) (16). Trapping with pitfall traps without adjacent drift fences resulted in only two captures of redback salamanders. We captured one redbelly snake (*Storeria occipitomaculata*) under an artificial shelter and the smooth green (*Opheodrys vernalis*) and common garter snakes (*Thamnophis sirtalis*) were located during daytime visual encounter searches. No turtles were captured in our hoop-traps or observed during any search efforts.

In addition to the federal and Maine-listed threatened and endangered species, we searched for and did not find any of the Maine-listed species of special concern, which are the four-toed (*Hemidactylium scutatum*) and spring (*Gyrinophilus porphyriticus*) salamanders and the

leopard frog (*Rana pipiens*). We were unable to find the dusky (*Desmognathus fuscus*), and two-lined (*Eurycea bislineata*) salamanders, which are brook salamanders reported by Albright (1986) and Hunter et al. (1992) to be locally common in Maine. We also searched, but were unable to verify the blue-spotted (*Ambystoma laterale*) and four-toed (*Hemidactylium scutatum*) salamanders in the study area. We found eggs in a wetland on Big Moose Island that matched descriptions of the blue-spotted salamander, but were unable to verify the species because we did not observe any adults and collecting for future identifications was not practical.

SPECIES DESCRIPTIONS

Herptile species found in the study area represent two of the three amphibian orders and one of the two reptile orders. The following descriptions present information about these species and their taxonomic classification.

Amphibians

CAUDATA. The salamanders.

Ambystomatidae. The spotted salamanders.

One of the first herptile species to emerge after winter is the spotted salamander. The spotted salamander's breeding season begins in early spring and lasts one to two weeks. The adult salamanders then abandon the eggs and the breeding pools and retreat to their moist burrows in the soil. Our night searches and driving in early spring on the Schoodic Loop Road resulted in numerous sightings of individuals crossing the roads and in the interior wetlands. Although we found spotted salamander egg masses in most small pools in all three study sites, we did not observe adults in either the Big Moose Island or Corea Heath study sites.

Salamandridae.

The eastern newt, *Notophthalmus viridescens*, undergoes three distinct stages throughout its life cycle: the aquatic larval stage, followed by the terrestrial juvenile stage (commonly known as the red eft stage), and finally the aquatic adult stage (Hunter et al. 1992). These salamanders are most often sighted under rocks, logs, or other fallen debris during the red eft stage of their lives. We observed two red efts in the Schoodic Head study site and captured two others in a drift fence at the Corea Heath study site. Although we did not find this species in the Big Moose Island study site, the habitat is suitable for this species.

Plethodontidae.

Redback salamanders are reportedly the most abundant amphibian species found in Maine (Hunter et al. 1992). We found this species to be the most abundant amphibian captured in pitfall traps associated with drift fences in the dry forested area on the seaward side of Corea Heath. However, we did not locate any redback salamanders in the Big Moose Island study site despite hours of specifically searching for this species. Our observations of redback salamanders were scattered in the Schoodic Head study site and we did not locate any areas where they were abundant.

SALIENTIA. The frogs.

Hylidae.

Spring peepers, *Pseudacris crucifer*, are difficult to see because of their small size and coloration, but their presence is unmistakable because of their loud and continuous vocalization during spring and early summer evenings. We heard these frogs from mid-April to mid-summer in many wet areas in all three study sites. One peeper was captured in the drift fence at Corea Heath and others were observed during spring night driving and visual encounter searches in the Schoodic Head study site.

Ranidae.

Rana clamitans, the green frog, is an anuran that always remains in close proximity to the water. There was no sign of the green frog in Big Moose Island study site, but many were heard at both the Corea Heath and Schoodic Head study sites. At the Corea Heath study site, we observed many green frogs in small pools adjacent to the antenna and other buildings and in the pools scattered throughout the heath.

The wood frog breeds in small pools in early spring. These frogs are terrestrial and live in moist cool woods. We heard and observed this species in many wetlands along the power lines on Schoodic Peninsula and in bogs adjacent to the Schoodic Loop Road. We captured several in a drift fence in a wet forested area and observed others in grassy areas in the Big Moose Island study site. In the Corea Heath study site we captured wood frogs in the drift fence adjacent to the antenna.

Reptiles

SERPENTES. The snakes.

Colubridae.

A common species of snake in this area is the smooth green snake. These snakes can be difficult to spot because their green coloration, which enables them to blend into the surrounding grasses. We found this species twice near the antenna and near the weather station in the Schoodic Head study site.

The redbelly snake is a small passive snake that is relatively common in Maine (Hunter et al. 1992). We located this species only at the Corea Heath study site. We found one individual dead on the main paved road that provides access to the antenna area and another under an artificial snake shelter located on a sandy and rocky area near the large antenna.

The common garter snake, which is reported to be the most common snake in Maine (Hunter et al 1992), was frequently observed in all study sites. Two subspecies are commonly found in Maine, the eastern garter snake and the maritime garter snake (*T. s. pallidulus*). Although the eastern garter snake was observed in all study sites, we only observed the maritime garter snake in the Big Moose Island and Schoodic Head study sites.

DISCUSSION

We identified nine herptile species expected in coastal Maine habitats. The nine species were not equally represented at all study sites. No federal or state-listed species nor Maine species of special concern (Maine Dept. of Inland Fisheries & Wildlife 1994) were found in the study area.

We were also unable to document the presence of some species that we expected to find that are known from areas adjacent to or near (i.e., islands) the study area. These are the wood, painted, and snapping turtles; the blue-spotted, four-toed, dusky, two-lined, and spring salamanders; and the northern leopard frog. Additional search efforts are needed to determine whether these species are present in the study area.

The diversity of species that we identified in the inventory illustrates the effectiveness of using a variety of sampling approaches to inventory herptiles. By using different methods we were able to overcome the short sampling periods by maximizing sampling intensity in suitable habitats. We found that day searches were the most successful technique in identifying herptile species, however the method results in habitat destruction to locate some species. Pitfall traps with drift fences had the highest capture rates for redback salamanders and wood frogs. Night surveys discovered concentration areas of salamanders, especially

yellow-spotted, and wood and green frogs. Although, artificial shelters have been used successfully by other inventory and research efforts (Fitch 1987), shelters were not particularly effective in our study area. Snake funnel traps were not effective and may suggest avoidance, poor trap design, or the need for a more frequent trap monitoring schedule.

Emergence for breeding is often directly related to specific short-term weather events (Heyer et al. 1994) in some species of amphibians and reptiles (i.e., turtles) and sampling efforts that miss these windows of herptile activity (i.e., explosive breeders) may have difficulty in documenting these species (Fitch 1992, Heyer et al. 1994). The late start (i.e., mid-April) limited our habitat reconnaissance before conducting field searches (late April) and preparing an adequate number of trap sites (mid-May) in suitable habitats. Concurrent inventory efforts (i.e., flora searches, small mammal trapping, and forest investigations, etc.) limited our search coverage to selected habitats and for shorter periods than would have been optimum given the taxa to be inventoried and the distance between study sites. This approach may have contributed to our missing important phenological stages or animal activity periods within each of the study sites. Additional personnel or multi-year funding would have allowed more habitats to be searched and an opportunities to conduct searches and trapping throughout animal activity periods.

Cool summer temperatures and harsh cold winters may explain the scattered distribution of herptofauna between and within all study sites. These climatic conditions also may delay or change key breeding periods from those of mainland populations and make the scheduling of trapping and searches difficult to predict in coastal areas.

RECOMMENDATIONS

Based on our findings and familiarity with the species and study sites, we recommend another year of sampling to complete a baseline inventory for the study area. To meet this objective, we recommend day and night searches be conducted during all emergent periods and employ additional drift fences in suitable habitats throughout the spring, early summer, and fall activity periods. Each sampling effort would be conducted for longer periods and employ additional personnel. We also would conduct fall sampling surveys using appropriate techniques to capture fall-breeding amphibians species.

We recommend that a monitoring program be developed that tracks the diversity and distribution of herptile fauna in the study area. The objectives of a monitoring program should support local management needs and cooperate with state and regional amphibian conservation programs.

All scientifically valid amphibian and reptile research activities should be supported to better understand herptiles and their relationship to their environment. Research efforts that address species ecology and habitat relationships, suitable methods to monitor population

trends and population size, and determine threats would be of specific value for conservation efforts. We recommend the following efforts.

Follow-up Inventory

- * Determine the presence of spring and fall-breeding terrestrial salamanders (i.e., yellow-spotted, four-toed, and blue-spotted salamanders, etc.) in each study site.
- * Determine the presence and emergence period of snakes in all study sites.
- * Determine the presence and emergence period of turtles in the study area, with special emphasis in the Big Moose Island and Schoodic Head study sites.
- * Determine if stream salamanders are present in Schoodic head study site.
- * Determine the presence of summer breeding frogs (i.e., green, northern leopard, pickerel, spotted-tree, and bull frogs) with the emphasis on locating the presence and distribution of any populations of spotted tree and northern leopard frogs.
- * Determine if the American toad (*Bufo americanus*) in the study area.

Long-term Monitoring and Research

- * Establish an amphibian monitoring program that tracks the distribution of amphibian species in the study area.
- * Support and cooperate with all research efforts assessing amphibian and reptile ecology and the relationship of these species to coastal wetlands and environments.
- * Cooperate with state and federal agencies managing the collection of species for commercial operations.
- * Discourage the harvesting of any species in the study area until information on population dynamics are known.
- * Enforce speed limits to reduce accidents between herptiles and vehicles as they cross roads to breed from the early spring to early summer. Educating and encouraging workers and residents to be sensitive about these active herptile periods will contribute to the conservation of these species.

Table 1 Herptile searching effort¹ by study site, Schoodic Peninsula, 1994.

INVENTORY METHOD	SURVEY PERIOD	TOTAL SEARCH HOURS per study site		
		Big Moose Island	Corea Heath	Schoodic Peninsula
Day Search	4/22-6/14	8	8	20
Night Search	4/28-6/14	5	24	30
Road Cruising	5/1-6/14	1	3	30

¹ Hours represent the effort spent conducting searches and compiling data.

Table 2. Herptile trapping periods¹ by study site, Schoodic Peninsula, 1994

INVENTORY METHOD	SURVEY PERIOD	TOTAL TRAP PERIODS per study site		
		Corea Heath	Schoodic Peninsula	Big Moose Island
Drift Fence Pitfalls ²	5/19-7/1	496	672	296
Pitfall w/out Fence)	7/5-21	21	0	24
Snake Funnel Traps ³	6/13-7/1	248	336	0
Turtle Hoop Traps ⁴	7/15-20	0	6	0
Black Plastic Shelter ⁵	6/13-7/1	80	60	30

¹ Trap period was defined as the period beginning from the time the trap, pitfall, artificial cover was set or opened until the time it was monitored by inventory personnel. The period was at least 12 hours and possibly as long as 48 hours.

² A pitfall trap was counted if the trap contained one captured animal, had evidence that an animal had been trapped and escaped, or had trapped an animal that had been eaten.

³ One funnel trap was counted if the trap contained a captured animal, had evidence that an animal had been trapped and escaped, or had trapped an animal that had been eaten.

⁴ One hoop trap was counted if the trap contained a captured turtle, or had evidence that an animal had been trapped and escaped, or had evidence that an animal had been trapped and became prey to animal predator.

⁵ A shelter trap was counted if it was available to snakes or other herptiles or contained a herptile during one trap period.

Table 3. Herptiles¹ observed or captured in each of the study sites, Schoodic Peninsula, 1994.

SPECIES	STUDY SITES		
	Big Moose Island	Corea Heath	Schoodic Peninsula
<i>Ambystoma maculatum</i> spotted salamander	X	X	X
<i>Notophthalmus viridescens</i> red-spotted newt		X	X
<i>Plethodon cinereus</i> redback salamander		X	X
<i>Pseudacris crucifer</i> spring peeper	X	X	X
<i>Rana clamor</i> green frog		X	X
<i>Rana sylvatica</i> wood frog	X	X	X
<i>Opheodrys vernalis</i> smooth green snake		X	X
<i>Storeria occipitomaculata</i> redbelly snake		X	
<i>Thamnophis sirtalis</i> eastern garter snake	X	X	X

¹ Herptiles found in a study site are represented by an "X"

MAMMALS

HISTORIC INFORMATION

Historical information on the mammals of Schoodic Peninsula is limited (Greene et al. 1992) Connery et al. (1990) conducted a preliminary assessment of the occurrence of the causal agent of Lyme disease in ticks found on small mammals on ANP lands on Schoodic Peninsula in 1989. The study was successful in capturing two species of small mammals: deer mice (*Peromyscus maniculatus*) and boreal red-backed voles (*Clethrionomys gapperi*). Maine Department of Inland Fisheries and Wildlife (MDIF&W) regulates the hunting and trapping of several species of mammals on lands surrounding the study area. Harvest levels and seasons for each species are determined within wildlife management units² and address both regional and state management objectives.

METHODS

To inventory mammals in the study area, we used a combination of techniques including live trapping, straight-line drift fences with pitfall traps, ground searches for fecal droppings, tracks, other sign(s) of large mammals, and scent attractants for predators.

All small mammals captured were identified to species. Tail and body length measurements and body weight were recorded for each individual. We marked all captured animals except squirrels by clipping a small patch of dorsal guard hair to assist in identifying individuals that were recaptured. Live animals were released at the capture site and trapping mortalities were collected for voucher specimens.

Live Trapping

We established 20 transects in the major habitat types in the study area (Figures 2-4). Habitat types were identified by interpreting vegetation cover-type maps (Waggoner 1981, Northern Division Naval Facilities Engineering Command 1987), analyzing recent aerial photographs, and verifying representative areas with site visits (i.e., ground-truthing).

At each 100 m long transect we established 11 trapping stations at 10 m intervals. One medium-sized Sherman trap (24 cm x 9 cm x 8 cm) and one small-sized Sherman trap (17 cm x 6 cm x 5 cm) were placed at each station. We placed one or two Havahart live-traps (46 cm x 11 cm x 13 cm, Woodstream Corporation, Lititz, PA.) at stations located in forested habitats. Traps in open areas were shaded from direct sunlight with grasses, woody debris or other natural materials. Traps were closed during the heat of the day and opened during the evening and night except during periods of predicted rain. One or two pitfall

² Harvest levels and seasons for beaver and deer are determined in smaller subunits known as management districts.

traps (#10 metal can - 15.5 cm diameter by 17.5 cm deep) were buried at the ends of most transects.

All Sherman, Havahart, and pitfall traps were baited with a mixture of one part each of peanut butter, rolled oats, suet, raisins, to one-half part paraffin (Calhoun 1959). To minimize trap mortalities, dry polyfiber was placed in each live trap for bedding and moist cotton was used for fresh water. We visited the traps daily in the early morning to record trapping success and trap conditions.

Straight-line drift fences with pitfalls

We used six straight-line drift fences with pitfall traps to complement our small mammal trapping effort (Figures 2-4). Drift fences were 15 m long, 50 cm high, and made of 3 mil polyethylene plastic supported by wooden stakes. The lower edge of the plastic was buried approximately 10 cm into the ground to prevent animals from passing underneath. Pitfall traps made from No. 10 metal cans and placed into pits until the lip of the can was flush with the ground (Vogt and Hine 1982). When the soil was deep enough, pitfalls were made from two No. 10 metal cans (35 cm deep) taped together with duct tape and sealed at the joint with silicone. Traps were placed in pairs, on either side of the fence, every 5 m. Funnel made from bottomless margarine bowls were placed in the top of each pitfall trap to prevent escapes. The bottom of each pitfall trap was filled with water to a height of 3 cm. Weighted lids covered the pitfall traps when they were not in use.

Scent Stations and Animal Sign Surveys

We conducted ground surveys to determine animal presence by identifying feces, foot tracks, hair, lodges and burrows, and other signs of mammal activity. We identified all sign using field identification guides (Murie 1974, Stokes and Stokes 1986) and examined hair or fecal samples using a microscope and identification keys [Adorjan and Kolenosky (1969) and Moore et al. (1974)].

We complemented our ground searches by establishing a series of scent stations along suspected animal travel routes to attract and determine carnivore presence in the Schoodic Head study site. At each scent station, we cleared vegetation from a 0.5 m x 0.5 m plot and prepared the ground surface to detect animal foot prints. We placed commercially available lure and bait at the back of each cleared plot. The plots were visited once every week to record tracks and screen fresh dirt into the cleared plots.

Identifications and Voucher Specimens

We identified mammals using field guides and taxonomic keys by Burt and Grossenheider (1976), Francq (1981), and Van Zyll de Jong (1983). Shrews were identified by examining dental patterns (Baker 1983, Francq 1981, Van Zyll de Jong 1983).

Peromyscus species were initially identified using pelage color and ratio of tail length to head and body length (Choate 1973). Mouse saliva samples were collected and samples were sent to Dr. Kilpatrick, University of Vermont, for species confirmation. Dr. Kilpatrick followed methods described in Aquadro and Patton (1980) and Kilpatrick et al. (1994) to conduct

electrophoretic assay of salivary amylase. Salivary samples were obtained by rinsing each mouse's mouth with distilled water.

We collected trap mortalities as voucher specimens. We also included photographs of live specimens in the voucher collection. The voucher specimens are stored with the Natural Resources Division, ANP, Bar Harbor, Maine.

We defined a trap period as one trap that was in working condition or captured an animal between the time that the trap was set until it was monitored by inventory personnel. For drift fences a trap period was tallied for each pitfall trap open and undisturbed throughout a trapping period (Heyer et al. 1994).

RESULTS

We spent 307 hours identifying and verifying the presence of 31 mammal species from the study area (Table 4). Trapping dates and effort are summarized in Table 5. Measurements and reference numbers for mammal voucher specimens are presented in Appendix 3 and body measurements of all mammals captured are found in Appendix 4.

Following the results are brief descriptions of the species identified from the study area. Detailed descriptions and life history of these species can be found in: Burt and Grossenheider (1976), Francq (1981), and Van Zyll de Jong (1983), Baker (1983), Francq (1981), and van Zyll de Jong (1983).

Federal and State Endangered, Threatened, and Species of Concern

No Federal or Maine endangered or threatened species were captured or identified in our field surveys. Although we did **not** find or trap any mammal proposed as a species of special concern (Maine Department of Inland Fisheries and Wildlife 1994) during our inventory efforts, we did receive a bat from park ranger Bill Weidner that was killed in a collision with an automobile in the Schoodic Head study site. Dr. William Glanz (University of Maine) identified (pers. comm.) the individual as a northern long-eared bat (*Myotis septentrionalis*). This species has been proposed as a species of special concern (Maine Department of Inland Fisheries & Wildlife, 1994) in Maine.

Live trapping

We set live-traps for 1423 trap periods (Table 5). Our trapping effort using small and medium-sized live-traps resulted in 79 captures of eight species including: 38 boreal red-backed voles, 17 deer mice, 10 red squirrels (*Tamiasciurus hudsonicus*), six meadow jumping mice (*Zapus hudsonius*), three white-footed mice (*Peromyscus leucopus*), three eastern chipmunks (*Tamias striatus*), one woodland jumping mouse (*Napaeozapus insignis*), and one northern flying squirrel (*Glaucomys sabrinus*). Boreal red-backed voles were the most commonly captured species in the live traps.

Straight-line drift fence with pitfalls

We set live-traps for 1464 trap periods (Table 5). We captured 74 animals of nine species including: 52 masked shrews (*Sorex cinereus*), five southern bog lemmings (*Synaptomys cooperi*), four pygmy shrews (*Microsorex hoyi*), four meadow jumping mice, three smokey shrews (*Sorex fumeus*), two short-tail shrews (*Blarina brevicauda*), one boreal red-backed vole, one northern water shrew (*Sorex palustris*), and one star-nosed mole (*Condylura cristata*). The masked shrew was the most frequently captured species in the drift fence pitfalls traps.

Scent Stations and Searches for Sign

We identified the presence of 16 mammal species (Table 4) during our ground searches (i.e., visual encounter, scat, etc.) and from monitoring the scent stations. We identified moose (*Alces alces*), coyote (*Canis latrans*), porcupine (*Erethizon dorsatum*), bobcat (*Felis rufus*), feral housecat (*Felix domesticus*), snowshoe hare (*Lepus americanus*), river otter (*Lutra canadensis*), striped skunk (*Mephitis mephitis*), mink (*Mustela vison*), long-tailed weasel (*Mustela frenata*), white-tailed deer (*Odocoileus virginianus*), muskrat (*Ondatra zibethica*), raccoon (*Procyon lotor*), gray squirrel (*Sciurus carolinensis*), eastern chipmunk, red squirrel, black bear (*Ursus americanus*), and red fox (*Vulpes vulpes*).

SPECIES DESCRIPTIONS

Mammals found in the study area are classified in taxonomic orders: Insectivora, Chiroptera, Carnivora, Rodentia, and Artiodactyla. We present brief taxonomic and life history descriptions of the families and species within each order.

INSECTIVORA. Two families in this order were found in the study area: Soricidae (shrews) and Talpidae (moles).

Soricidae. Shrews are high energy, mouse-sized mammals with five toes on each foot. Five species were found in the study area. Although shrews are often too small to be caught and held in live traps, we captured 62 individuals in pitfall traps placed along drift fences. Most individuals were caught in wet wooded habitats.

The masked shrew was the most frequently captured shrew and small mammal. All were caught in drift fence pitfall traps located in semi-wet areas of the study area. We captured 22 individuals from Big Moose Island, 19 individuals in the Schoodic Head study site, and 11 individuals at Corea Heath for a total of 52 individuals.

The smokey shrew is similar in appearance to the masked shrew, but is generally larger and darker. Smokey shrews use small home range territories (Goodwin 1935) and prefer shaded, moist microenvironments in coniferous woods. Cranial differences are measured to positively distinguish this species from the other shrews (Van Zyll de Jong 1983). We captured a total of three smokey shrews, one each at Big Moose Island, Corea Heath, and the Schoodic Head study sites. The voucher specimens are stored at ANP for future reference.

The water shrew is the largest of the long-tailed shrews. We captured one individual in a wet forested bog on Big Moose Island. The other study sites also may have this shrew species because of the available suitable habitat (i.e., forested wetlands and bogs) and proximity to other mainland populations.

The pygmy shrew was the smallest shrew found in the study area and is distinguished from other species by dental characteristics (Van Zyll de Jong 1983). Although a difficult species to trap, we collected individuals from the Big Moose Island and Corea Heath study sites. We suspect that a population exists in the Schoodic Head study site because we found individuals on Big Moose Island and the proximity of the study site to mainland populations.

The shorttail shrew is the largest species of shrew. We captured two individuals, one each at the Big Moose Island and Schoodic Head study sites. Although this species was not captured at Corea Heath, it is probably present considering the availability of suitable habitat and proximity to other populations.

Talpidae. Pinhead sized eyes and broad front feet characterize these mammals that spend most of their life beneath the surface of the ground.

The starnosed mole is the only mole that we trapped and is recognized by a unique fleshy sensory organ surrounding its elongated nose or snout. The species prefers swamps, bogs, and wet meadows, which are plentiful within the study sites. Although we captured only one individual using a drift fence pitfall trap, in a moist forested area of the Corea Heath study site (i.e., adjacent to radar tower) the other study sites are suspected to support this species because of the availability of suitable habitat and proximity to other populations.

CHIROPTERA. The mammals in the order Chiroptera are bats, which are the only true warm-blooded mammals adapted for flight. The Maine Endangered Species program (Maine Department of Inland Fisheries and Wildlife 1994) has listed several bat species as species of special concern, although all bat species and their distributions are unknown in Maine.

Vespertilionidae. Bats in this family have plain unmodified noses and are widely distributed in North America.

A northern long-eared bat was collected after it collided with a car on the Schoodic Loop Road. No information is known about bats in the study area. This species has been nominated as a species of special concern by the Maine Department of Inland Fisheries & Wildlife (1994).

CARNIVORA. We identified five families in the order Carnivora in the study area: Ursidae (bears), Procyonidae (raccoon), Mustelidae (weasel), Canidae (canine), and Felidae (feline).

Ursidae. Bears are the largest living terrestrial carnivores in North America. They have five toes on all feet and walk on the entire foot.

Black bears are the largest carnivores in the eastern United States and are a medium sized bear. Black bears are nocturnal and may travel long distances in search of food. Although bears are rarely observed, bear scat and territory markings can indicate their use of an area. Scattered bear sightings have been reported in the Schoodic Head (Weidner, ANP, pers. comm.) and Corea Heath study sites in the past few years. No reports of bears were received in 1994. We located bear scat in the Big Moose Island and Schoodic Head study sites.

Procyonidae. Members of this family have five toes on each foot and nonretractible claws. The family is widely distributed throughout North America.

The raccoon is a nocturnal omnivore that frequents streams and wetlands searching for food. We recorded raccoon sign from all three study sites and observed tracks at Frazer Point Inlet and the wetland separating Big Moose Island and Schoodic Head study sites. Raccoons were observed this spring at Corea Heath by Navy personnel and we observed one individual searching for human food scraps at a dumpster on Big Moose Island. Scavenging for human food from recreation areas and garbage dumps is a common habit of raccoons and has earned them the reputation as a nuisance and a panhandler. Scavenging raccoons were classified as a nuisance in previous years at Frazer Point Picnic Area (Weidner, National Park Service, pers. comm.)

Mustelidae. The Mustelidae family is distinguished by odors produced by specially-developed scent glands and short slender bodies. The species found in the study area are valued as high-grade fur-bearers.

The long-tailed weasel is seasonally dimorphic except the tip of the tail, which remains black all year. Weasels have a solitary secretive nature and their clandestine behavior provides little opportunity for them to be observed. However, we observed one individual crossing the Schoodic Loop Road on the eastern side of Schoodic Peninsula.

The mink is also a weasel, but is heavier and has a larger skeletal frame than the long-tailed weasel. They frequently hunt the shorelines of fresh and saltwater coastlines. We observed mink scat on the southern shores of Big Moose Island, on the southern and western shores of Schoodic Peninsula, and the shoreline at Corea Heath. Mink have been observed by visitors in many areas on Schoodic Peninsula (Weidner, National Park Service, pers. comm.).

Otters are shy solitary animals that spend most of their active life in aquatic environments. We observed an otter in the first pond southwest of the Schoodic Loop Road. A report was received in 1992 of an otter being killed by an automobile at the south end of Schoodic Head study site (Weidner, National Park Service, pers. comm.).

Striped skunks are shy nocturnal animals and are able to dispense an extremely irritating and pungent, oily, and sulfurous compound from their scent glands. We observed one dead skunk on the Schoodic Loop Road, but found no other sign in the other study sites. Skunks were reported to be a problem at the Frazer Point picnic area in previous years (Weidner, National Park Service, pers. comm.).

Canidae. The red fox and coyote are small to medium-sized, omnivorous, dog-like animals in the Canidae family.

The red fox is common in open habitats with low brush and are rarely known from large unbroken stands of coniferous timber (Goodwin 1935). They also are reported from woodland habitats that border human agricultural and developed areas. Red foxes are mobile species that routinely traverse their home territories in search of food and to reestablish territorial boundaries. We identified red fox scat in the Corea Heath and Schoodic Head study sites. In 1993, a fox was killed by an automobile in the Schoodic Head study site (Weidner, National Park Service, pers. comm.). Foxes were periodically observed near Corea Heath Navy facilities in 1994 by Navy personnel. We were unable to document foxes on Big Moose Island, but suspect they are present because of the island's proximity to mainland populations.

The coyote is a medium to large dog-like animal with some characteristics of the gray wolf. The coyote's distribution continues to expand (Hamilton 1943, Chapman & Feldhamer 1982) apparently in response to the demise of larger predators, such as the wolf and mountain lion, in many regions of North America. Most juveniles disperse in search of suitable habitat during autumn and winter of their first year, sometimes moving more than 100 km (Harrison and Gilbert 1985). We observed the tracks and scat of coyotes in Big Moose Island, Corea Heath, and Schoodic Head study sites. Because of the coyote's mobility and proximity to mainland populations, we believe that they are a common species in the study area. We were unable to document breeding activity or den sites within the study area.

Felidae. The Felidae family are one of the most specialized of all carnivores. The bobcat, lynx (*Felis lynx*), and feral housecat are members of this family and are found throughout Maine (Burt and Grossenheider 1976). The mountain lion (*Felis concolor*) has been documented in the northern Maine and unverified sightings have been reported for the study area and other eastern areas of Maine. A small population of mountain lions exist in New Brunswick, approximately 100 miles north of the study area. The following species were identified in the study area.

Bobcats are found in a wide range of habitats, but are common to lowland forests with dense understories and high prey populations (Rolley 1987). Sightings of bobcats are made almost yearly on Schoodic Peninsula (Weidner, National Park Service, pers. comm.). Bobcat sign was abundant on the trails along the powerline and on the trail connecting the Schoodic Ranger Cabin to Blueberry Hill.

Feral cats are thought to affect the ecology of natural areas, although the specific effects are usually unknown. We observed one individual that acted wild, hunting at the southern end of Schoodic Peninsula. Wild feral cats have been observed in the vicinity of the Navy base and we believe they are visitors or residents in all three study sites because of the proximity of human communities.

RODENTIA. The order Rodentia is the largest and most diverse of the mammalian orders. Rodent families located in the study area include Sciuridae (squirrels and chipmunks), Cricetidae (mice, rats, voles, bog lemmings, and muskrat), Zapodidae (jumping mice), Leporidae (hares and rabbits), and Erethizontidae (porcupine). These following descriptions summarize life history and study site information for these families.

Sciuridae. A variety of mammals known as squirrels are found in this family and are distinguished by having four toes on their front feet and five toes on the back feet. The following four species of squirrels were found in the study area.

The eastern chipmunk is a mostly terrestrial squirrel-like mammal that hibernates in underground dens through the winter. They prefer brushy areas in deciduous forests where they live in burrows. Their diet consists of seeds, grains, and nuts. The study area has limited suitable chipmunk habitat. We live-trapped three chipmunks at Corea Heath and also observed individuals in the Big Moose Island and the Schoodic Head study sites.

Red squirrels are occasionally found on the ground, although they spend most of their time in forest canopies. Conifer seeds, typically from spruce (*Picea sp.*) and pine (*Pinus sp.*) trees, are mainstay foods in the squirrel's diet. We often observed red squirrels after hearing their noisy chatter in most of the coniferous forests and woodlands of the study area. Ten individuals were live trapped on Big Moose Island.

Gray squirrels are larger than red squirrels and are associated with hardwood forests. Nuts from oaks, beech, hickory and other hardwood species are the preferred natural foods, however, birdseed provided by humans for wintering birds and other animals is an additional food source. Landscaping with hardwood species and supplemental food sources account for the abundance of gray squirrels in human developed or residential areas. We were unsuccessful in trapping gray squirrels, but confirmed their presence in the Schoodic Head study site by identifying one individual that was killed on the Schoodic Loop Road.

The northern flying squirrel is a secretive nocturnal species that is associated with boreal forests. Seeds from conifers are often supplemented with other seasonal foods and comprise most of the squirrel's diet. Flying squirrels glide from tree to tree using a skin membrane that stretches between their outstretched limbs. We live trapped one individual on Big Moose Island and believe the species is present in the other study sites because of suitable habitat and the proximity to mainland flying squirrel populations.

Cricetidae. The family Cricetidae is the most diverse assemblage of rodents in this order.

Muskrats are nocturnal semi-aquatic animals that rarely wander far from water. Aquatic vegetation comprises the muskrat's diet and lodge materials. We observed lodges and food caches in the wetland area separating Big Moose Island from Schoodic Peninsula. Although we did not confirm this species at Corea Heath, Navy personnel (Security guards and maintenance personnel, Naval Security Group Activity-Winter Harbor, pers. comm.) report that a few individuals are observed almost every spring.

The deer mouse is a familiar species to most naturalists and is found in a variety of North America habitats from coast to coast. We live trapped individuals in different habitats and from all study sites.

The white-footed mouse is closely related to the deer mouse, but is less widespread in North America. We analyzed saliva of mice captured in the study area to confirm the identification of several individuals from the southern portion of Big Moose Island. The white-footed mouse has also been reported from Great Wass Island, another island northeast of our study area. From our finding and previous reports, we suspect that other white-footed mice populations will be found in other coastal locations of Maine.

The southern bog lemming prefers bogs where sphagnum and heaths predominate. Goodwin (1935) found this species difficult to trap and Gunderson and Beer (1953) were most successful when they set unbaited live-traps across lemming runways. We captured one individual on Big Moose Island, and two individuals in unbaited drift fence pitfall traps in the Corea Heath and Schoodic Head study sites. Our experience supports the previous researchers' observations and recommendations for successfully trapping this species.

The boreal redback vole was the species we caught most frequently. This vole favors the damp mossy understory of coniferous forests. We captured 12 individuals on Big Moose Island, 1 individual in Corea Heath, and 14 individuals from the Schoodic Head study site.

Zapodidae. These small mammals have specially developed hind quarters for jumping and are commonly known as the jumping mice. Species in this family are distinguished by this feature.

The meadow jumping mouse can occasionally be seen jumping through a grassy field or meadow. We captured these mice in low shrubby areas or mixed hardwoods at both the peninsula (i.e., near the weather station) and Corea Heath study sites.

The woodland jumping mouse has features similar to its meadow relative, but has a distinct white-tipped tail. One individual was captured on the east side of Big

Moose Island and we expect that other populations exist at the other study sites because of the availability of suitable habitat in proximity to mainland populations

Erethizontidae Only one species is found in this family and all individuals are recognized by the long sharp spines covering their back and tail.

The porcupine feeds on the young tender cambium of conifer trees, although the cambiums of other woody species and hardwoods are eaten. Porcupine sign was observed throughout the entire study area and we observed or were notified (Weidner, National Park Service, pers. comm.) of eight porcupines killed by automobiles on roads leading to the study sites and on the Schoodic Loop Road.

Leporidae This family is characterized by species with long ears and long hind legs.

The snowshoe hare, or varying hare, is the only species of rabbit or hare observed in the study area. We observed hare sign in all study sites.

ARTIODACTYLA. This order is characterized by even-toed, hoofed mammals and only the Cervidae family is found in the study area.

Cervidae. This family includes the hoofed mammals that have antlers that are shed annually. Species in this family feed on emerging green plants during spring and summer and browse on woody-stemmed plants the rest of the year.

White-tailed deer were observed in the Schoodic Head study site and scat and tracks were routinely observed in the other study sites. A few reports of partial albino (i.e., pelage is partially white or spotted) individuals have been received in the past by ANP and Navy personnel in the Schoodic Head and Corea Heath study sites.

Moose tracks and scat were frequently noted at the Corea Heath and Schoodic Head study sites. Although moose sign was not observed on Big Moose Island, we suspect that moose are occasional visitors to the island because of the proximity of moose populations from the mainland.

DISCUSSION

We documented 31 mammal species and established a mammal inventory for the study area. We attribute our success in identifying the total number and diversity of species to the combination of sampling methods that we employed. Our results represent only those species present during our study and should not be interpreted to predict the presence of these species in the study site in the future. Further, the inventory should not be interpreted as a complete inventory of terrestrial mammals that may be found in the study area.

We expect that additional species (i.e., meadow vole) are present in the study area. If additional species are present, they may be difficult to locate or identify because they are secretive, nocturnal, and difficult to trap (Goodwin 1935). Also the diversity of habitats, cyclic nature of small mammal populations, and our limited sampling periods may explain why we were unable to document several mammal species that we expected to find in the study area.

We found other species (i.e., northern flying squirrel, water shrew, long-tailed weasel, woodland jumping mouse, gray squirrel, white-footed mouse, bobcat, and skunk, etc.) in only one study site, but we assume that these species are residents in the other study sites because of the availability of suitable habitat and proximity to mainland populations. The presence of these species in the other study sites remains to be determined. Several other mammal species (i.e., smokey shrew, star-nosed mole, and muskrat) were located in more than one study site, however these species are represented by only one individual or sign at each study site and does not define their distribution or relative abundance in each study site. Additional information on the distribution and relative abundance of these species in all study sites would require additional sampling efforts. These efforts would include additional live-trapping and drift fences with pitfall traps in suitable habitats and conducting sampling efforts from spring through fall. Further, focusing sampling efforts on specific habitats or animal behavior may increase the likelihood of locating species that are difficult to document.

Additional sampling efforts also may contribute to our understanding about the distribution and relative abundance of some species and identify research questions about coastal mammal populations.

We found **no** federal or Maine threatened, endangered, or species of special concern. Documenting the presence of the white-footed mouse at Big Mouse Island provides supportive information about the species presence in eastern Maine. The presence of the northern long-eared bat in the study area raises questions about the species of bats using coastal habitats and supports our recommendation to conduct an investigation of the bat species and their ecology in coastal Maine habitats.

Although the study sites are small, their protected status may provide a refuge for medium and large mammals that are hunted and trapped. These coastal areas also may be important to other species during seasonal migration (Novak 1987) and juvenile dispersal (Chapman 1982). These reasons suggest that information be collected in all seasons to determine the seasonal and ecological significance of these areas for medium and large mammals.

However, because of the mobility and size of areas used by these medium and large species, study or monitoring efforts should be in cooperation with other land owners and management agencies.

RECOMMENDATIONS

We believe that additional sampling would determine the presence of most small and medium mammals in each study site and may document the seasons of use by the large animals. We recommend the following follow-up inventory and long-term management and monitoring program.

Follow-up Inventory

Small Mammals

- * Conduct sampling to determine if the meadow vole is present in the study area.
- * Conduct sampling to determine distribution and presence of the woodland jumping mouse, white-footed mouse, and water shrew in all study sites.
- * Conduct sampling to determine presence and distribution of all other small mammals (i.e., star-nosed mole, smokey shrew, etc.) not found in all study sites during our inventory.
- * Conduct sampling in all study sites during non-freezing seasons or to coincide with a specific activity period for a species.
- * Conduct an inventory of the bats in the study area and investigate the use of coastal wetlands by bats during breeding and migration periods.

Medium-sized Mammals

- * Conduct sampling and searches to confirm presence of secretive and nocturnal species (i.e., northern flying squirrel, striped skunk, long-tailed weasel, gray squirrel, muskrat, bobcat, and other furbearers).
- * Conduct sampling during all seasons to determine the seasonal use patterns and distribution of secretive and nocturnal species.
- * Verify species and location of medium-sized mammal observations by Navy and NPS personnel.

Large Mammal

- * While conducting other sampling efforts, record observations and signs of large mammals noting the time of use (i.e., season) and the location.
- * Verify species and location of large mammal observations by Navy and NPS personnel.

Long-term Monitoring and Management

- * Establish a log of the mammals observed by employees, residents, and visitors in each study site noting date, time, and the animal's activity.
- * Cooperate with state and federal agencies conducting population censuses and research on medium-sized (i.e., especially furbearers) and large mammals.
- * Encourage and support research on mammal species that provide specific information on the life history and ecology of species in the study area;

- * Discourage the harvesting of any species in the study area until information on population dynamics are known;
- * Prohibit the feeding (i.e., baiting, direct feeding, leaving human foods, etc.) of mammals by employees, residents, and visitors.
- * Enforce speed limits to reduce accidents with vehicles.

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Table 4. Mammal species identified¹ for each study site, Schoodic Peninsula, 1994.

MAMMAL SPECIES	STUDY SITES		
	Schoodic	Big Moose	Corea Heath
<i>Sorex cinereus</i> masked shrew	XXXX	XXXX	XXXX
<i>Sorex fumeus</i> smokey shrew	XXXX	XXXX	XXXX
<i>Sorex palustris</i> water shrew		XXXX	
<i>Microsorex hoyi</i> pygmy shrew		XXXX	XXXX
<i>Blarina brevicauda</i> short-tail shrew	XXXX	XXXX	
<i>Condylura cristata</i> star-nose mole			XXXX
<i>Myotis septentrionalis</i> northern long-eared bat	XXXX		
<i>Ursus americanus</i> black bear	X	X	
<i>Procyon lotor</i> raccoon	X	XX	X
<i>Mustela frenata</i> long-tailed weasel	XX		
<i>Mustela vison</i> mink	X	X	X
<i>Lutra canadensis</i> river otter	XX		
<i>Mephitis mephitis</i> striped skunk	XX		

Key to methods used to locate mammals or their presence in a study site: XXXX = species trapped and saved for voucher specimen; XXX = species trapped; XX = species observed; X = positive identification of tracks or scat.

Table 4. Cont. Mammal species identified for each study site, Schoodic Peninsula, 1994

MAMMAL SPECIES	STUDY SITES		
	Schoodic	Big Moose	Corea Heath
<i>Vulpes vulpes</i> red fox	X		X
<i>Canis latrans</i> coyote	X	X	X
<i>Felis rufus</i> bobcat	X		
<i>Tamias striatus</i> eastern chipmunk	XX	XX	XXX
<i>Tamiasciurus hudsonicus</i> red squirrel	XX	XXX	XX
<i>Sciurus carolinensis</i> gray squirrel	XX		
<i>Glaucomys sabrinus</i> northern flying squirrel		XXX	
<i>Ondatra zibethica</i> muskrat	X		
<i>Peromyscus maniculatus</i> deer mouse	XXX	XXX	XXX
<i>Peromyscus leucopus</i> white-footed mouse		XXX	
<i>Synaptomys cooperi</i> southern bog lemming	XXXX	XXXX	XXXX
<i>Clethrionomys gapperi</i> boreal redbacked vole	XXX	XXXX	XXX
<i>Zapus hudsonius</i> meadow jumping mouse	XXX		XXXX
<i>Napaeozapus insignis</i> woodland jumping mouse		XXX	

1. Key to methods used to locate mammals or their presence in a study site: XXXX = species trapped and saved for voucher specimen; XXX = species trapped; XX = species observed; X = positive identification of tracks or scat. 33

Table 4. Cont. Mammal species identified for each study site, Schoodic Peninsula, 1994.

MAMMAL SPECIES	STUDY SITES		
	Schoodic	Big Moose	Corea Heath
<i>Erethizon dorsatum</i> porcupine	XX	XX	X
<i>Lepus americanus</i> snowshoe hare	XX	X	X
<i>Odocoileus virginianus</i> white-tailed deer	XX	X	XX
<i>Alces alces</i> moose	X	X	X

1. Key to methods used to locate mammals or their presence in a study site: XXXX = species trapped and saved for voucher specimen; XXX = species trapped; XX = species observed; X = positive identification of tracks or scat. 34

Table 5. Trapping dates, total number of live-trap transects, and total trap periods¹ for each capture method for small and medium-sized mammals on the Schoodic Peninsula, 1994.

Study Sites	Period of Trapping Effort	Number of Transects	TOTAL TRAP PERIODS BY TECHNIQUE			
			Sherman	Pitfalls	Squirrel Live Traps	Drift Fence Pitfalls
Schoodic Peninsula	7/5 - 7/14	7	356	0	141	672
Big Moose Island	7/11 - 7/14	7	353	24	97	296
Corea Heath	7/18 - 7/21	6	365	21	111	496

¹ A trap period was defined as an open trap that was operational during a complete trap period, or contained a captured animal, or had trapped some animal that had escaped or had been eaten. The trap period began when the trap was set and extended until it was monitored by inventory personnel.

FORESTS

BACKGROUND

Limited inventories and research have been conducted on Schoodic Peninsula forest communities (Greene et al. 1992). Patterson et al. (1983) sampled and described the spruce and fir and jack pine (*Pinus banksiana*) forests from ANP lands on Schoodic Peninsula. Some of these plots were permanently marked and resampled in 1994 (Patterson, Univ. of MA, pers. comm.). Conkey et al. (1993) conducted the only other forest research on Schoodic Peninsula, examining age structure and population dynamics of jack pine stands on ANP lands.

The Navy created a forest cover-type map in 1986 using aerial photography and the following year prepared a long-range forest management plan (Northern Division Naval Facilities Engineering Command 1987). The plan reviews forest information and management activities that have been conducted on Navy lands and documents historic efforts by the Navy to manage the Corea Heath forested lands for profit. Spruce (*Picea sp.*) was planted from 1965 to 1971, but the program was abandoned when seedling survival was found to be poor. The Navy then focused efforts away from artificial regeneration and emphasized timber stand improvement. To improve conifer stands, 20 acres of Corea Heath lands were sprayed with the herbicide 2-4-5 T in 1975 in an effort to reduce hardwood competition in existing spruce and larch (*Larix laricina*) stands. Stand improvement was later abandoned when it did not prove profitable. Based on these historic activities, the plan recommends that the "best use of the Activity's (i.e., NSGA-WH) forest stands are to provide soil and water protection, wildlife habitat, outdoor recreation, and aesthetics".

METHODS

We quantitatively described forests on Big Moose Island and Corea Heath. We did not conduct forest community investigations on ANP lands on Schoodic Peninsula because of the existing information on forest communities (Patterson et al. 1983, Conkey et al. 1993). We identified primary forest communities in each area by interpreting vegetation cover-type maps (Waggoner 1981, Northern Division Naval Facilities Engineering Command 1987), analyzing recent aerial photographs, and verifying cover-types with site visits (i.e., ground-truthing). Forest communities follow those of the Maine Natural Heritage Program (1991). We used detrended correspondence analysis (DCA) ordination (Gauch 1982), a multivariate analysis technique to calculate species and forest relationships between tree species and basal area. The DCA scores were plotted to find clusters or grouped scores of samples by species, which we used to identify forest relationships or forest communities. Widely scattered scores are used to indicate no relationships or discernible forest communities.

We randomly stratified plots (Figures 2 & 3) in each forest stand. The first plot was stratified randomly within a representative location of the stand and subsequent plots were randomly selected 50 meter (m) from any corner of the preceding plot. The number of plots

was dictated by the size and homogeneity of the forest stand. We avoided sampling in transition zones and along borders of forest communities. We sampled as many suitable plots (Patterson, Univ. of MA, pers. comm.) as could be completed in the limited time available during this inventory. Plots were 10 m x 10 m (0.01 ha) and were oriented along north-south and east-west transects corrected for local declination (i.e., 19 degrees east). In each 10 m x 10 m plot, we tallied the number of trees by species and diameter at breast height (dbh, 1.37 m above ground level). A tree was defined as any upright woody stem, dead or alive, with a dbh greater than ($>$) 2.5 cm. Multi-stemmed individuals were counted as separate stems if they branched below breast height.

We determined basal area (BA), density of stems per hectare (ha), and importance values for each species from measurements taken in the forest plots. We calculated BA as described by Wenger (1984), the standard error (SE) follows in parenthesis. Density values represent the average number of stems per ha, the SE follows in parenthesis. We estimated shrub density for each community by counting stems by species in four, 2 m x 4 m belt transects. We defined shrubs as any upright woody plant with a dbh less than ($<$) 2.5 cm, regardless of height (Patterson, Univ. of MA, pers. comm.). We present the data as the number of stems by species for the two height class. Importance values, which give an artificial measure of importance of each species in each forest community (Russell and Marion 1990), were calculated by combining the relative density, relative frequency, and relative dominance for a maximum value of 300.

We aged trees by removing cores from the tree bole for all size classes of each tree species. Tree cores were removed from the bole at a location close to the ground. We counted all tree rings to determine maximum age and divided the total number of years by the total number of cm for an average number of years of growth in one cm [years/centimeter (yr/cm)]. Standard error (SE) values follow average age per cm with each vegetative cover. We observed similar sized trees both in and out of the plots indicating that we sampled all age groups including older aged individuals within each stand. However, older aged trees may have been found if we had cored trees outside of the plots.

To estimate canopy cover, we used a convex spherical densiometer to record twenty readings from each 10 m x 10 m plot; four readings in each plot corner and in the center. Foliage height profiles measure the structural complexity of forests (Brokaw and Grear 1991). We measured foliage height profiles at 21 points along each of the transects in each plot using a 15 m telescoping pole positioned vertically at each point. We estimated the vertical structure of vegetation by recording the presence or absence of vegetation and woody stems every 0.5 m between 0 and 3 m and at the following height intervals: 3-4 m, 4-6 m, 6-8 m, 8-10 m, 10-12 m, 12-15 m, 15-20 m, and >20 m. The average percent vegetation cover for each height interval for each forest community was calculated by averaging cover values for each height interval. SE is given with each vegetative cover value.

We established two 10 m transects in each plot to determine ground cover and foliage height profiles. These transects were oriented east-west and north-south, corrected for local declination (i.e., 19 degrees east), and divided each plot in to four quarters. We measured ground cover by recording all ground cover categories that made contact with a rebar stake (1.3 cm dia. x 0.5 m long) that was lowered from a height of 1 m at 1 m intervals along the

two transect lines. Ground cover categories included herbaceous plants, woody plants and stems, moss, lichen, soil, rock, and leaf litter. We averaged data for each ground cover category for all plots to determine average ground cover percentages and SE values in each forest community.

We recorded the plot locations with a Trimbal Global Positioning System (GPS). Plot boundaries were not permanently marked in the field, although true north compass bearings and known distance coordinates or Universal Transverse Mercator (UTM) for each plot will facilitate approximate relocation.

RESULTS

We present BA, density, and importance values for all forest communities in Table 6. In Table 7, we report the oldest trees and the average growth rates by species from our plots in each forest community. Vegetative cover categories for each forest community are found in Table 8. We identify average values of ground cover categories for each forest community in Table 9.

Our detrended correspondence analysis of the data identified five forest communities and establishes databases for each forest community. The five forest communities are the maritime spruce and fir, jack pine woodland, northern white cedar seepage, early successional, and pitch pine woodland, and are described in the Maine Natural Heritage Program's (1991) landscape classification system.

The forest communities are described below along with a summary of our findings.

Maritime spruce and fir forest community

The most abundant forest type in eastern coastal Maine is the maritime spruce and fir forest (Davis 1961, 1966), which is found throughout the study area. The spruce and fir forest is the major forest cover on Big Moose Island, whereas only a small stand occupies the northwest end of the Corea Heath study site. We sampled a total of eight plots in this forest community; five plots on Big Moose Island and three at Corea Heath.

Stands at Big Moose and Corea Heath consist primarily of live and standing dead red spruce (*Picea rubens*), accounting for over 75% of the total basal area (Table 6). Associate tree species included white spruce (*Picea glauca*), balsam fir (*Abies balsamea*), and paper birch (*Betula papyrifera*). Average tree density for Big Moose Island was 7140 stems/ha and for Corea Heath was 3433 stems/ha. Red spruce on Big Moose Island had the highest tree and shrub density and largest basal area of any tree species sampled. The Big Moose Island forest community also contained small scattered clusters of balsam fir and standing deadwood. The Corea Heath stand was dominated by red spruce in both basal area and tree density, but not shrub density. The Corea Heath spruce and fir community also contained small scattered clusters of white spruce and paper birch, although the birch did not occupy a substantial part of the canopy structure.

The oldest trees cored in the plots were a 180 year-old balsam fir on Big Moose Island and an 86 year-old white spruce at Corea Heath (Table 7). Diameter growth for red spruce averaged 1 cm in 3.6 years at Big Moose Island and 1 cm in 4.9 years at Corea Heath. Red spruce trees over 2.5 cm dbh at Corea Heath averaged 72 years and averaged 38 years on Big Moose Island. Red spruce under 15 cm dbh had 4020 stems/ha on Big Moose Island and 1467 stems/ha on Corea Heath.

We found the canopy coverage to be 80% (SE 1%) for the Big Moose Island study site and 74% (SE 2%) for the Corea Heath study site. We also found foliage height profiles percentages to be similar for both study sites with the only difference being in the 2-4 m interval class with 57% (SE 12%) in Big Moose Island study site and 38% (SE 2%) in the Corea Heath study site. Percent cover for all intervals is found in Table 8.

Ground cover categories for the Big Moose Island and the Corea Heath study sites are found in Table 9. We found 42 herbaceous plant species in the Corea Heath study site forest plots and 15 herbaceous plant species in the Big Moose Island study site forest plots. The difference in species also were represented respectively by differences in the herbaceous plant cover for forest plots in the Corea Heath and Big Moose Island study sites. The more common herbaceous species included blueberry (*Vaccinium angustifolium*), mountain cranberry (*Vaccinium vitis-idaea*), mountain ash (*Pyrus americana*), starflower (*Trientalis borealis*), wild lily-of-the-valley (*Maianthemum canadense*), bunchberry (*Cornus canadensis*), and wild raisin (*Viburnum cassinoides*).

Jack pine woodland forest community

The southeastern limit of the jack pine woodland forest (Maine Natural Heritage Program 1991) is found along the central Maine coastline. We identified and located populations on the southern third of Big Moose Island and scattered throughout forested areas of the Corea Heath study site. We sampled a total of six plots in this forest community, three each on Big Moose Island and Corea Heath.

Jack pine was the major tree species contributing approximately 72% of the BA from the forest plots in both study sites. We found 70% of the tree density at the Big Moose Island study site and 49% of the tree density at the Corea Heath study site was jack pine. Standing deadwood and red spruce respectively were the next most important forest community associates (Table 6) in the plots from both study sites. Average tree density from the plots on Big Moose Island was 622 stems/ha and 477 stems/ha for plots on Corea Heath. The density of jack pine shrubs was low in both areas, whereas the density of red spruce shrubs was high in both areas.

The oldest jack pine trees sampled in our forest plots were a 120 years-old individual from the Big Moose Island study site and a 79 years-old individual from the Corea Heath study site (Table 7). The forest plots from both study sites had faster average growth rates for jack pine than for red spruce (Table 7).

Canopy cover averaged 31% (SE 3%) at the Big Moose Island study site and 52% (SE 9%) at the Corea Heath study site. The canopy height differed between the two study sites being nearly 8 m for plots on Big Moose Island and only approaching 4 m for plots on Corea Heath. Other percent cover values are presented in Table 8.

Average ground cover categories are presented in Table 9 for plots on the Big Moose Island and Corea Heath study sites. The number of herbaceous plants were similar for the forest plots at both study sites with 23 species found in the Corea Heath study site and 25 species found in the Big Moose Island study site. The most common species were black chokeberry (*Pyrus melanocarpa*), blueberry, bunchberry, cow-wheat (*Melampyrum lineare*), huckleberry (*Gaylussacia baccata*), lambkill (*Kalmia angustifolia*), mountain holly (*Nemopanthus mucronata*), rhodora (*Rhododendron canadense*), and wild lily-of-the-valley.

Northern white cedar seepage forest community

The northern white cedar seepage forest community is generally found on gentle slopes with a seepage of cold, minerotrophic groundwater (Maine Natural Heritage Program 1991). We only found a few small stands of this forest community on the northern side of the Big Moose Island study site (i.e., on Navy and ANP lands). We sampled two plots in this forest community, all on Navy lands on Big Moose Island.

Mature or old-aged northern white cedar (*Thuja occidentalis*) was the dominant species in this forest community accounting for 62% of the total BA (Table 6). Red spruce was the second most common tree species. Standing deadwood, consisting primarily of white cedar and red spruce, was common in the stands. Balsam fir was scattered throughout the stand, although it contributed little to canopy cover or BA. We found no white cedar shrubs, but recorded several thousand red spruce shrubs (Table 6).

We cored a 200 year-old red spruce and a 128 year-old northern white cedar tree from plots in this forest community, which were the oldest individuals of these species found during our investigation of all forest communities. Tree growth rates were 6.8 yr/cm for white spruce, 5.1 yr/cm for red spruce, and 7.4 yr/cm for balsam fir and were the slowest rates we calculated for all forest plots in the forest communities that we sampled (Table 7). Measurements of the canopy cover averaged 81% (SE 1%) and vegetation cover percentages are found in Table 8.

Only four ground cover categories (Table 9) were recorded for this forest community. We identified 12 plant species in this forest community, which was the lowest plant diversity found in any of the forest plots that we sampled. Common herbaceous plants and shrubs encountered included starflower, interrupted fern (*Osmunda claytiana*), sarsaparilla (*Aralia nudicaulis*), and common currant (*Ribes hirtellum*).

Early successional forest community

The early successional forest community is a hardwood dominated forest associated with a recent disturbance (Maine Natural Heritage Program 1991). Tree species common to this

forest community are generally wind dispersed, shade intolerant species adapted to colonizing recently disturbed areas. We identified this forest community in small clusters along the eastern shoreline of the Corea Heath study site. We identified and sampled three plots on Corea Heath, but found no representative forest communities in the Big Moose Island study site.

Paper birch is the primary tree species in this forest community with alder, red spruce, and choke cherry (*Prunus virginiana*) present, but of lesser importance (Table 6). Alder is the primary shrub species with paper birch and standing deadwood (i.e., paper birch and alder) shrubs scattered through this forest community.

Young aged trees characterized this forest community with a 49 year-old paper birch being the oldest individual (Table 7). Growth rates for paper birch averaged 3.0 years/cm and 3.1 years/cm for red spruce, which were the fastest rates we calculated for these species. Canopy cover averaged 74% (SE 1%) (Table 8). The canopy heights varied between the three plots with maximum height of 12 m in one plot and only 6 m in another plot (Table 8)

Ground cover (Table 9) consisted mainly of herbaceous and woody cover followed closely by leaf litter cover. We identified 20 vascular plants species in this community. The common plants and shrubs included reed-bent grass (*Calamagrostis* sp.), raspberry (*Rubus idaeus*), rough-stemmed goldenrod (*Solidago rugosa*), starflower, whorled aster (*Aster acuminatus*), blackberry (*Rubus allegheniensis*), dewberry (*Rubus hispida*), and mountain alder.

Pitch pine woodland community

Pitch pine (*Pinus rigida*) woodlands are open forests associated with ledges and rock outcrops and rooted in nutrient-poor, well-drained soils. Although these communities are found primarily near the coastal zone west of Mount Desert Island (Maine Natural Heritage Program 1991), we located a small patch of pitch pine woodlands adjacent to the northern border of the Corea Heath study site. The small size of this forest community allowed only one plot to be sampled and no standard errors for this forest type were calculated nor are presented in the tables (Tables 6-9).

Pitch pine was the most abundant tree species, accounting for 83% of the total BA with jack pine the only other tree associate in this woodland community (Table 6). Shrubs included paper birch, pitch pine, and red spruce and we observed pitch pine and birch seedlings. The oldest tree in this plot was a 105 year-old pitch pine (Table 7). Canopy cover averaged 18% (SE 3%). Percent of vegetative cover became progressively smaller with each height category interval and the crown of the canopy was below 6 m (Table 8).

Ground cover consisted mainly of woody vegetation and leaf litter (Table 9). We identified 15 herbaceous plant species from this plot. The most common herbaceous plants and shrubs were: huckleberry, mountain holly, lambkill, wild raisin, blueberry, and meadowsweet (*Spiraea latifolia*).

DISCUSSION

We used detrended correspondence analysis of the forest plots to identify five forest communities as recognized by the Maine Natural Heritage Program (1991). The five communities are the maritime spruce and fir forest, jack pine woodland forest, northern white cedar seepage forest, pitch pine woodland forest, and early successional forest.

Although a sixth forest community was identified in our initial analysis, the forest community was only slightly atypical of a maritime spruce and fir forest community type (Maine Natural Heritage Program 1991) because of higher than normal white spruce basal area values. White spruce is more salt tolerant than red spruce and is often found adjacent to coastal shorelines. This spruce and fir stand was located close to the ocean shoreline in the Corea Heath study site.

The maritime spruce and fir forest community is a common forest type in Maine (Maine Natural Heritage Program 1991). This forest community is the primary forest cover on the Big Moose Island study site, whereas only a few small scattered stands occur at the Corea Heath study site. Although site suitability may dictate different stand characteristics between the study sites, the higher density and clumped age groups at Big Moose Island may also be the result of historical uses. Further, the greater number of herbaceous species and the higher ground cover percentage at Corea Heath may be the result of the lower stem density of trees and shrubs and the open canopy overstory.

The jack pine forest community reaches its southeast range limit in coastal Maine. Portions of these forests are registered as a Maine Critical Area (Maine Natural Areas Program, 1994a) because of their biological importance in the state. This forest community was found in the Big Moose and Corea Heath study sites. Conkey et al. (1993) reported a large variation in BA between her study sites on Schoodic Peninsula (20.05 m²/ha) and Mount Desert Island (4.48 m²/ha). Conkey et al. (1993) also found a equally large variation in the density of stems between her Schoodic Peninsula (1588 stems/ha) and Mount Desert Island (725 stems/ha) study sites. We determined that the Big Moose Island and Corea Heath jack pine communities were similar to the Schoodic Peninsula stands studied by Conkey et al. (1993) with a large BA and high density of stems (Table 6). Conkey et al. (1993) also reported the jack pine community on Schoodic Peninsula was older and had minimal regeneration when compared to the community on Mount Desert Island. Similarly, we found minimal regeneration of jack pine shrubs (i.e., including seedlings) contrasting with the higher density of red spruce shrubs at the Big Moose Island and Corea Heath study sites. The lack of jack pine regeneration may indicate that this forest community is changing composition and may suggest changes in this forest community. Other forest characteristics for the two study sites were similar.

Northern white cedar seepage forest communities are rare in Maine (Maine Natural Heritage Program 1991). We found this forest community in small scattered populations supporting Hill's (1919, 1923) observations about their scarce occurrence in coastal Maine. We believe that the scarcity of this community warrants the highest levels of protection throughout the state. A 200 year-old red spruce and a 180 year-old white cedar were the oldest individuals

for these tree species found in any forest community that we surveyed and we believe the ages of these trees indicate that this community has not seen the frequency or magnitude of disturbances found in the spruce and fir and the early successional forest communities that we sampled. The age of these communities are further confirmed by the high canopy cover percentage, low herbaceous plant diversity, and slow growth rates for all tree species.

The early successional forest community was dominated by species dependent on recent disturbances. We found high densities of alder and paper birch shrubs (i.e., regeneration), as a good indication that the present forest community is not changing. Tree age in these forest communities may identify the time of the most recent disturbance and may provide information on the management of disturbed sites. Fast growth rates also may indicate the availability of nutrients and the growth characteristics of the tree species. The open canopy of this deciduous forest may partially explain the high herbaceous and woody cover percentages. The differences in canopy height express the high variability of tree growth in an early successional forest community.

The small pitch pine woodland forest community found only at the Corea Heath study site is one of a few populations east of the large woodland communities located on and west of Mount Desert Island. The scattered distribution of trees and open canopy allows shrubs to be a prominent vegetative cover for this community and may explain why we found only a few understory species. Further, pitch pine woodlands typically establish on nutrient-poor and well-drained soils, which also may explain why there were so few herbaceous species. The high number of pitch pine shrubs indicate to us that the woodland community is regenerating.

The past forest management practices were ineffective in establishing a commercially viable forest and small-scale harvesting operations were evaluated (Northern Division Naval Facilities Engineering Command 1987) to be unfeasible and unprofitable. We found forest communities in both study sites recovering from human disturbances with no additional management intervention. Our investigations concur with the conclusions in the Navy's (NSGA-WH) Forest Management Plan that these forest communities are densely stocked and relatively young in age. We found that three of the five communities within the two study sites had shrub densities that were equal or higher than tree densities and a higher total stem density of shrubs (Table 6), especially on Big Moose Island. The plan reports that forest communities on Navy lands were not commercially profitable and recommends that they be managed to provide soil and water protection, wildlife habitat, outdoor recreation, and aesthetics. We support this recommendation because these soils are of low fertility and coarse-textured, acidic, and shallow and are not suited for agricultural forest practices (Davis 1966).

Although, these forest conditions may be more susceptible to natural (i.e, disease and fire) disturbances, we believe that additional forest practices or manipulation will only upset the natural recovery processes and hinder opportunities for these forests to provide resource protection, wildlife habitat, outdoor recreation, and aesthetic values. Further, ANP (Acadia National Park 1992) and the Maine Natural Areas Program (1994a) identified these forests as important ecological resources and are aesthetically important to the scenic integrity of the Schoodic peninsula coastline.

RECOMMENDATIONS

We recommend that these forests be managed as natural communities to provide erosion protection, scenic and recreational enjoyment, and provide natural habitats for native species of wildlife and plants. Further, we believe that these forest communities are not suitable for commercial harvesting and we doubt that manipulative forestry practices will be able to create forests with commercial opportunities. These recommendations concur with the Navy's recommendations identified in the forest management plan (Northern Division Naval Facilities Engineering Command 1987). We encourage the Navy to protect all forest areas and thereby retain the largest contiguous areas of each forest community.

Forests in the study area are relatively slow growing and we believe that frequent monitoring is unwarranted. However, research programs investigating the old growth component of the northern white cedar, pitch and jack pine forest communities should be encouraged to enhance our understanding of the ecological character and dynamics of coastal forest communities. We recommend the following management, monitoring, and research.

Short term

- * Encourage research on Navy and adjacent lands investigating old growth characteristics of the northern white cedar, pitch, and jack pine forest communities.
- * Encourage all research efforts on Navy lands and cooperate with adjacent land owners and managers in research efforts attempting to understand the characteristics and processes of coastal forest communities.
- * Discourage disturbance or removal of forested areas on Navy or adjacent lands to retain the aesthetic character and natural processes of these forest communities.

Long term

- * Conduct forest community assessments every twenty years by repeating forest measurements conducted in earlier investigations and reevaluating forest community health and threats.

Table 6. Basal area, density, and importance values of tree species in the forest communities in the Big Moose and Corea Heath study sites, Schoodic Peninsula, Maine, 1994.

FOREST COMMUNITY	SPECIES	BASAL AREA (M ² /ha) (SE)		DENSITY (stems/ha) (SE)				Importance Values
		Big Moose	Corea Heath	Trees		Shrubs		
				Big Moose	Corea Heath	Big Moose	Corea Heath	
MARITIME SPRUCE & FIR	Red Spruce	29.6 (5.5)	21.7 (10.8)	4020 (1448)	1467 (708)	4375 (1417)	3750 (2229)	134
	Dead Wood	10.1 (2.7)	7.3 (1.1)	1800 (767)	1233 (438)	813 (542)	208 (170)	79
	Balsam Fir	5.9 (3.2)	0	800 (235)	0	2875 (1164)	104 (85)	34
	Paper Birch	1.7 (0.7)	0.4 (0.3)	400 (291)		625 (319)	7500 (4789)	25
	White Spruce	0	9.5 (7.8)	0		0	2188 (390)	14
	Striped Maple	0.7 (0.6)	0	120 (107)	0	63 (56)	0	6
	Gray Birch	0	0.5 (0.4)	0	100 (82)	0	104 (85)	4
	Jack Pine	0	1.0 (0.9)	0	33 (27)	0	0	4
JACK PINE WOODLAND	Jack Pine	13.6 (4.6)	15.3 (1.2)	2600 (535)	1400 (205)	104 (85)	104 (85)	160
	Deadwood	2.4 (1.4)	4.5 (2.6)	767 (321)	1067 (517)	0	208 (170)	71
	Red Spruce	3.0 (0.8)	1.3 (0.7)	333 (72)	133 (72)	2396 (558)	1458 (517)	43
	Larch	0	2.2 (1.8)	0	200 (163)	0	0	13
	Gray Birch	0	0.1 (0.1)	0	67 (54)	0	833 (340)	7
	Fir	0.1 (0.1)	0	33 (27)	0	104 (85)	0	6
NORTHERN WHITE CEDAR SEEPAGE	White Cedar	45.1 (18)	N/A	2100 (424)	N/A	0	N/A	137
	Red Spruce	16.5 (1.4)	N/A	800 (141)	N/A	7344 (5193)	N/A	77
	Deadwood	9.7 (4.6)	N/A	1050 (177)	N/A	1406 (994)	N/A	70
	Fir	0.5 (0.4)	N/A	50 (35)	N/A	313 (221)	N/A	16
EARLY SUCCESSION	Paper Birch	N/A	23.0 (2.3)	N/A	1967 (213)	N/A	938 (295)	190
	Alder	N/A	1.5 (0.8)	N/A	600 (411)	N/A	1458 (1191)	48
	Deadwood	N/A	0.5 (0.2)	N/A	233 (98)	N/A	729 (595)	33
	Red Spruce	N/A	0.4 (0.3)	N/A	67 (54)	N/A	0	15
	Choke Cherry	N/A	0.1 (0.1)	N/A	67 (54)	N/A	0	14
PITCH PINE WOODLAND	Pitch Pine	N/A	33.6	N/A	1400	N/A	938	N/A
	Jack Pine	N/A	7.1	N/A		N/A	0	N/A
	Paper Birch	N/A	0	N/A	0	N/A	1250	N/A
	Red Spruce	N/A	0	N/A	0	N/A	313	N/A

Table 7. Oldest individual and average growth rate by tree species in each forest community in the Big Moose Island and Corea Heath study sites, Schoodic Peninsula, Maine, 1994.

FOREST COMMUNITY	SPECIES	OLDEST INDIVIDUAL ¹		AVERAGE AGE/CM (SE) ²	
		Big Moose	Corea Heath	Big Moose	Corea Heath
MARITIME SPRUCE & FIR	red spruce	114	78	3.6 (0.3)	4.9 (0.7)
	white spruce	N/A	86	N/A	4.6 (0.1)
	paper birch	37	47	3.6 (0.8)	4.2
	balsam fir	180	N/A	4.1 (0.7)	N/A
	striped maple	32	N/A	3.6	N/A
	gray birch	N/A	45	N/A	4.1
WHITE CEDAR SEEPAGE	white cedar	128	N/A	6.8 (1.4)	N/A
	red spruce	200	N/A	5.1 (1.0)	N/A
	balsam fir	92	N/A	7.4	N/A
	paper birch	18	N/A	2.5	N/A
	jack pine	120	79	6.0 (0.7)	6.7 (0.2)
JACK PINE WOODLAND	red spruce	109	80	4.1 (0.5)	5.4 (0.7)
	paper birch	N/A	49	N/A	3.0 (0.3)
EARLY SUCCESSIONAL	red spruce	N/A	29	N/A	3.1 (0.8)
	choke cherry	N/A	23	N/A	3.6
	mountain alder	N/A	16	N/A	1.9
	pitch pine	N/A	105	N/A	5.2 (0.9)
PITCH PINE WOODLAND	jack pine	N/A	95	N/A	3.0

¹ The oldest aged individual of each species as determined by tree core samples from the forest plots.

² The average age per centimeter (average age/cm) is the average number of years of growth in 1 cm of dbh +/- 1 standard error (SE).

Table 8. Average vegetative cover percentages at different height intervals in each forest community in Big Moose Island and Corea Heath study sites, Schoodic Peninsula, Maine, 1994.

FOREST COMMUNITY	FOREST COMMUNITY HEIGHT INTERVALS average percent cover (SE)								
	AREA	0-2 m	2-4 m	4-6 m	6-8 m	8-10 m	10-12 m	12-15 m	> 15 m
Maritime Spruce & Fir	Big Moose	39 (5)	57 (12)	55 (13)	48 (8)	47 (12)	15 (5)	7 (5)	1 (1)
	Corea Heath	49 (7)	38 (2)	43 (2)	48 (8)	46 (9)	25 (11)	10 (8)	0
Jack Pine Woodland	Big Moose	95 (1)	27 (3)	0	0	0	0	0	0
	Corea Heath	75 (21)	29 (10)	38 (10)	16 (6)	0	0	0	0
Northern Cedar Seepage	Big Moose	38 (3)	48 (7)	55 (2)	50 (12)	45 (19)	24 (10)	5 (3)	0
Early Successional	Corea Heath	81 (6)	13 (8)	38 (18)	48 (8)	51 (21)	16 (13)	0	0
Pitch Pine Woodland	Corea Heath	33	16	3	0	0	0	0	0

Table 9. Average ground cover percentages for the forest communities¹ in the Big Moose Island and Corea Heath study sites, Schoodic Peninsula, Maine, 1994.

FOREST COMMUNITY	AREA	GROUND COVER CATEGORIES						
		average percent ground cover (SE)						
		HERBS	WOODY	MOSS	LICHEN	SOIL	ROCK	LEAF LITTER
Maritime Spruce & Fir	Big Moose	7 (6)	57 (9)	31 (7)	12 (7)	3 (1)	1 (1)	46 (10)
	Corea Heath	24 (1)	54 (8)	41 (6)	11 (7)	2 (1)	0	49 (8)
Jack Pine Woodland	Big Moose	13 (1)	94 (5)	2 (1)	22 (3)	3 (1)	2 (1)	70 (1)
	Corea Heath	0	76 (14)	2 (1)	25 (13)	0	0	86 (4)
Northern Cedar Seepage	Big Moose	19 (10)	40 (5)	36 (5)	0	0	0	50 (2)
Early Successional	Corea Heath	89 (6)	19 (4)	2 (1)	0	0	0	75 (9)
Pitch Pine Woodland	Corea Heath	5	95	0	0	0	0	86

¹ Average percent ground cover by forest community +/- 1 standard error. Ground cover categories are self explanatory except for two: herbs - herbaceous vegetation; woody - woody plants or stems.

VASCULAR FLORA

HISTORIC INFORMATION

Greene et al. (1992) reported that no botanical inventories and only limited research have been conducted on the Schoodic Peninsula. We searched for information about earlier surveys and found that no organized effort to inventory the vascular flora of the area had been conducted. We did find that a few limited field surveys had been conducted by botanists, but that none of the information from these surveys has been reported nor published (Gregory, Acadia National Park, pers. comm.). Greene (1990) summarized the status and distribution of federal and state-listed species for the Schoodic Peninsula area and identified two state-listed species at Corea Heath [i.e., Pickering's reedgrass (*Calamagrostis pickeringii*) and baked appleberry (*Rubus chamaemorus*)] and two state-listed species from the Schoodic Head study site [fragrant cliff fern (*Dryopteris fragrans*) and beachhead iris (*Iris setosa* var. *canadensis*)]. Arethusa (*Arethusa bulbosa*), another state-listed species, is reported from Corea Heath by Gawler (1982).

METHODS

Prior to conducting field work, we searched the herbaria at ANP and COA for plant specimens collected from the Schoodic Peninsula. We did not search other herbaria, although additional historical collections may be present.

We examined aerial photographs to delineate the major community types in each study site and prioritize our survey efforts. We verified the community types by on-site evaluations and identified key survey areas or microhabitats. In each community type we identified plant species in the field and only collected voucher specimens of species that were unknown or difficult to identify without being compared to herbarium specimens. We conducted our surveys in the each community type throughout the growing season.

Dr. C. Greene, botanist at COA, and L. Gregory, botanist at ANP, assisted with field surveys and lab identifications. We compared taxonomically confusing species with collections in the herbaria at College of the Atlantic (HCOA) or University of Maine at Orono (UMO). Specimens that we were unable to identify or specimens from particularly difficult taxa were sent to Dr. Lisa Stanley (VHB Inc., Watertown, MA.), Arthur Hanes (Univ. of Maine), and Dr. Sue Gawler (MNAP) for verification. All collections are being accessioned into the herbarium at the College of the Atlantic.

We used Fernald (1950) for plant nomenclature. We followed the approved state nomenclature system for plants listed as threatened, endangered, and species of special concern by the Maine Natural Areas Program (Maine State Planning Office 1990). Plant names classified by Fernald (1950) that were different from the names identified in the state nomenclature system were placed in parenthesis.

State-Listed Species

The Maine Natural Areas Program of the State Planning Office maintains the official list of Maine's endangered plants as required by the Maine Endangered Plant Act (MEPA) of 1986. The official list (Maine State Planning Office 1990) is based on species information collected prior to 1989. The Natural Areas Program also maintains an up-to-date plant database (Maine Natural Areas Program 1994b) to track the status of rare plants in the state and to enable it to propose changes to the official state list. We received information on the proposed listing or de-listing status of each plant from the Maine Natural Area Program (1994b) database.

RESULTS

We spent over 250 hours searching for and identifying 342 vascular plant species that included 7 varieties and subspecies (Table 10) from the study area. We found 265 species and varieties in the Schoodic Head study site, 206 species in the Corea Heath study site, and 199 in the Big Moose Island study site. We were unable to verify the presence of two plant specimens, screw stem (*Bartonia paniculata*) and fragrant cliff fern, which were documented in earlier investigations or are in local herbariums (Greene 1988, 1990, Gregory pers. comm.). Information on the status and habitat types of each species is listed in Table 10. We are awaiting either the identification or verification of 15 species by taxonomic specialists. Upon receiving information about these species, we will send an updated species list to the NSGA-WH and Maine Natural Areas Program.

We found no federally listed endangered or threatened plants in the study area. A total of 11 state-listed endangered, threatened, special concern, or watch-list plant species have been verified from the study area (Table 11). Species descriptions and locations for all state-listed species are summarized below.

Species Descriptions for State-Listed Species

State Endangered

Three state endangered species were verified in the study area in 1994:

Screw stem (*Bartonia paniculata* subsp. *iodandra*) is an easily overlooked 2 to 4 dm high plant found in swamps, bogs, and wet meadows (Fernald 1950). Screw stem was previously reported from both the Corea Heath and Schoodic Head study sites (Gregory, Acadia National Park, pers. comm., & Famous pers. comm.). We verified this species in a bog adjacent to the Schoodic Loop Road, north of Pond Island in the Schoodic Head study site. A small population also has been reported from the northeastern corner of Corea Heath near the road, although we did not relocate this population after a 30 minute search of the area.

Pickering's reedgrass (*Calamagrostis pickeringii*) is a tall grass that is known only in Maine from Corea Heath (Greene 1987, 1990). We observed thousands of stems along the edges of the heath and along some of the ocean shoreline at Corea Heath.

Carex adusta is a sedge found in previously disturbed areas (Fernald 1950). In 1992, a large population (i.e., several dozen individuals) was discovered at Corea Heath along the road into the antenna (Gregory, Acadia National Park, pers. comm.). An intensive search of this area in 1994 located only one individual.

State Threatened

Two state-listed threatened species were verified in the study area in 1994:

Prickly sedge (*Carex echinata*) was the only state-listed threatened species located in the study sites. We found prickly sedge growing in all three study areas. This species is more common in the state than previously believed and is proposed for delisting from the state list (Maine Natural Areas Program 1994b).

Although leafy-bracted aster (*Aster foliaceus*), a state-listed threatened plant, was not located, specimens morphologically approaching this species were observed in the Schoodic Head study site. These specimens may be New York aster (*A. novi-belgii*), which is similar to, but distinct from, leafy-bracted aster. Final resolution (Dr. C.W. Greene, College of Atlantic, pers. comm.) will require taxonomic research to determine the species of these specimens (Gleason and Cronquist 1991).

State Special Concern

Two species of state special concern were identified in the study area:

Blinks [*Montia fontana* (= *M. lamprosperma*)] is a 1-2 dm high plant of wet places and is commonly found along ocean shorelines. We noted this species growing in a rocky crevice at the eastern tip of Big Moose Island.

Fragrant cliff-fern (*Dryopteris fragrans* var. *remotiuscula*) was noted by Greene (1990) growing on cliffs on the eastern edge of The Anvil, southeast of Schoodic Head (i.e., ANP lands on Schoodic Peninsula) in 1988. We did not try to relocate this small population in 1994.

State Watch List

Four species on the state watch list were observed in the study area. All of these plants are proposed for removal from the list (Maine Natural Areas Program 1994b).

Beachhead iris [*Iris setosa* var. *canadensis* (= *I. hookeri*)] is a relative of the common blue-flag iris (*Iris versicolor*) and was noted only from the Schoodic Head study site near the shore south of the Blueberry Hill overlook.

Pearlwort (*Sagina nodosa* ssp. *nodosa*) is a 1 to 2 dm high plant that grows in rock crevasses along the shoreline. We noted this species only on the eastern side of the Schoodic Head study site. This small population was growing in small rock crevasses protected by large boulders to the west.

Arethusa (*Arethusa bulbosa*) is an orchid that is frequently found in bogs on the Schoodic Peninsula. We found arethusa throughout the larger bogs of the Corea Heath and Schoodic Head study sites and in a small bog on the northwest side of the Big Moose Island study site.

Baked-apple berry (*Rubus chamaemorus*) is a species commonly found in bogs and is known for its edible fruits. We found baked-apple berry to be common in several areas of the Corea Heath study site.

Introduced Species

We identified 75 non-native species (McInnes 1986) in the study area. McInnes (1986) reports that most of these species are not highly invasive nor threaten native plant communities. However these species should be monitored every 10 years to assess populations and area of invasion. ANP and NSGA-WH should work together to track information on the invasive potential of these species into natural habitats and become familiar with integrated pest management programs. We have listed the non-native species and their location in the study area in Appendix 6.

Purple loosestrife (*Lythrum salicaria*) is a non-native species known to invade native wetland habitats, which has been documented (ANP 1991) near the study area. We did not find purple loosestrife in the study sites.

DISCUSSION

We identified 335 plant species and 7 varieties in the study area. Our review of the historic records coupled with the field surveys comprises the first documented vegetative survey on the Schoodic Peninsula. Our field surveys were conducted in selected microhabitats throughout the major vegetative communities in each study site. However, additional surveys are needed in wetlands, shorelines, and other habitats during all seasons that support state-listed species. These additional surveys will complete the initial investigation of vascular plants in the study area.

We recommend that ANP and the Navy (NSGA-WH) monitor the populations of the eleven state-listed species in the study area and report the size and condition of the populations to the Maine Natural Area Program to monitor these populations in the state and with adjacent states and provinces, to determine the protection status in the state, and in developing management programs. We present a monitoring schedule for each species as recommended by Greene (1990). However, more frequent searches may be warranted to track species with only a few individuals or a few populations, or where disturbances are expected to threaten individuals or a population.

Of the 75 non-native species that we identified, none are expected to threaten native plant species or plant communities because of their low invasive potential (McInnes 1986) and the stability of the native communities in the study area. Limiting disturbance will limit the spread of these species in the study area and reduce the opportunity for other invasive species

to become established. Periodic searches every five years should be conducted for other non-native species that have been found in the region and are known to invade natural communities.

Protective management should be adopted to avoid the introduction of purple loosestrife in the study area. Monitoring wetland habitats for this species should be conducted every two years. We recommend that disturbances to wetlands be avoided whenever possible. If wetlands are disturbed, they should be monitored more frequently. Populations on private lands should be monitored and owners of adjacent lands should be educated about the threat of purple loosestrife on native wetlands.

RECOMMENDATIONS

We recommend that ground surface disturbance be limited to developed sites and roads to reduce the spread of non-native species and protect the native plant communities. Further, cooperative relationships among the NSGA-WH, ANP, and Maine Natural Areas Program (i.e., Maine Dept. of Community & Economic Development) are important to protect the native plant communities in the study area. We recommend the following inventory efforts and long-term management programs.

Additional inventories:

- * Conduct vascular plant surveys of the coastal cliffs and non-forested wetlands during all seasons. The focus of the wetland surveys should be tidal-fresh water wetlands, seeps and springs, upland coastal peatbogs, and all depressional or slope wetlands (Calhoun et al. 1994).
- * Continue rare species surveys in all study sites and present location and population information to Maine Natural Areas Program (1994b), specifically:
 - * Screw stem - continue surveys for disjunct populations in the Corea Heath study site,
 - * *Carex adusta* - continue surveys and cooperate with efforts to understand the species ecology in Maine and the Northeast,
 - * Blinks - continue surveys in all potential habitat sites throughout the study area,
 - * Fragrant cliff-fern - arrange for surveys on the cliffs of Schoodic Head to locate populations,
 - * Beachhead iris - continue surveys for other populations on Schoodic Peninsula,
 - * Pearlwort - continue searches for other populations on Schoodic Peninsula.
- * Conduct visual surveys every two years in wetlands to determine if purple loosestrife populations are established. These surveys should report the size of the population and delineate the area of invasion. Cooperative efforts should be organized immediately with state and federal agencies and private landowners to manage identified populations. The cooperators should establish a non-native species management program that identifies control methods and a schedule, a treatment evaluation process, a population monitoring program, and the roles and responsibilities of the cooperators.

Long-Term Monitoring and Management

- * Establish a close working relationship with the Maine Natural Areas Program (1994b) in developing a long-term monitoring plan that includes a monitoring schedule and management program. The following species should be included in this plan:

Endangered

- * Screw stem - ANP and the Navy should continue to search for this species in new areas and monitor all populations at 5-year intervals (Greene 1990).
- * Pickering's reedgrass - monitor the Corea Heath population at 5 year intervals (Greene 1990).
- * *Carex adusta* - ANP and the Navy should continue to search for this species in new areas and monitor all populations at least every 5-years (Greene 1990).

State Special Concern

- * Blinks - Monitor the populations of this species at 5-year intervals (Greene 1990) until additional information is known about this species. Searches for other populations on the shorelines of Big Moose Island and Corea Heath should be done at the time of the monitoring.
- * Fragrant cliff-fern - Monitor the populations at 5-year intervals. Searches for other populations on the shorelines of Big Moose Island should be done at the time of the monitoring.

State Watch List

- * Beachhead iris - Monitor the Blueberry Hill population with ANP on a 10-year interval and search for disjunct populations on the Corea Heath shoreline,
- * Pearlwort - Cooperate with ANP in monitoring populations on Schoodic Peninsula on a 10-year interval and search for disjunct populations on the shorelines of Big Moose Island and Corea Heath.
- * Become familiar with state and regional non-native species management programs and participate with adjacent landowners in non-native management programs, which may include control treatments and educational outreach.
- * Limit all habitat or ground surface disruptions, including, but not limited, to herbicide application, burning, trenching, excavating, ground cover removal, heavy equipment travel across natural areas during frost-free periods to discourage the spread or introduction of non-native species. Disruptions to the ground surface in developed areas should be protected from soil erosion and reseeded with native seed stock or planted with native species after the disruptive activity is completed.
- * Adopt revegetation and landscaping guidelines for all contractors and agency operations that outline the use of native plant species and materials. Recommend that native plant species be used rather than non-native species for all revegetation and landscaping projects to limit the introduction of potentially invasive species or other non-native seed stock or problems (i.e., pathogens, insects, etc.) to the surrounding natural area.
- * Adopt guidelines for all contractors and agency operations that outline the use of soil and fill materials from areas surrounding the study area in all revegetation and landscaping programs and construction activities. The use of materials from the surrounding or local area (i.e., Schoodic Peninsula) will be better suited to native stock plantings and reduce the opportunity of introducing non-native species.

Table 10. Vascular plants by habitat type in the Schoodic Peninsula Study Area, 1994.

Abbreviations for species listed under the State Endangered Species Program:

I = non-native species, E = endangered, T = threatened, PE = possibly extirpated, WL = watch list, DL = proposed for de-listing, SC = special concern list.

Abbreviations for habitat communities in the study area: W = wetlands,

F = forest, S = shore; H = Schoodic Head summit, O = other habitat (i.e., rock outcrop, developed area, disturbed areas, field), Q = identification in question, taxonomic specialists contacted for verification.

SPECIES	COMMON NAME	STATUS	BIG MOOSE ISLAND		COREA HEATH NAVY LANDS	PARK LANDS ON SCHOODIC PENINSULA
			PARK	NAVY		
<i>Abies balsamea</i> (L.) Mill.	balsam fir		F,S,O	F,S,O		H,F
<i>Acer pensylvanicum</i> L.	striped maple		F	F		W,F
<i>Acer rubrum</i> L.	red maple			F,O	W,F	W,F
<i>Acer spicatum</i>	mountain maple					F
<i>Achillea millefolium</i> L.	yarrow	I		F,S,O	S,O	S,O
<i>Achillea millefolium</i> L. forma <i>rosea</i> Rand & Redf.	yarrow	I				O
<i>Agropyron repens</i> (L.) Beauv.	quackgrass			O	O	O
<i>Agropyron repens</i> (L.) Beauv. forma <i>aristatum</i> (Schum.) Holmb.	quackgrass					S
<i>Agropyron trachycaulum</i> var. <i>novae-angliae</i> (Scribn.) Fern.	quackgrass					S
<i>Agrostis alba</i> L.	redtop		F,O	F,O	O	S,O
<i>Agrostis alba</i> var. <i>palustris</i> (Huds.) Pers.	redtop					S
<i>Agrostis scabra</i> Willd.	fly-away grass		W,S	W,S	O	S,O
<i>Alnus crispa</i> (Ait.) Pursh	mountain alder		F,O	F,O	W,F	H,W,F,S
<i>Alnus rugosa</i>	speckled alder				O	F,O
<i>Ambrosia artemisiifolia</i> L.	common ragweed				O	O
<i>Amelanchier</i> sp.	common shadbush		F	F	O	
<i>Amelanchier canadensis</i> (L.) Medic.	swamp shadbush				W	W
<i>Anaphalis margaritacea</i> var. <i>intercedens</i> Hara	pearly everlasting			F		O
<i>Andromeda glaucophylla</i> Link.	bog rosemary				W	
<i>Anthemis cotula</i> L.	mayweed	I				O
<i>Anthoxanthum odoratum</i> L.	sweet vernal grass	I			O	O
<i>Apocynum androsaemifolium</i> L.	spreading dogbane			O	O	
<i>Aralia hispida</i> Vent.	bristly sarsaparilla			O	O	
<i>Aralia nudicaulis</i> L.	wild sarsaparilla		F,S,O	F,S,O	F,O	H,F
<i>Arenaria lateriflora</i> L.	grove sandwort				S,O	S,O
<i>Arethusa bulbosa</i> L.	dragon's mouth	WL(DL)	W		W	W
<i>Arisaema stewardsonii</i> Britt.	jack-in -the-pulpit					F
<i>Artemisia vulgaris</i> L.	common mugwort	I				O
<i>Aster acuminatus</i> Michx.	whorled aster		F	F	F	H,F,S
<i>Aster lateriflorus</i> (L.) Britt.	calico aster				O	
<i>Aster macrophyllus</i> L.	large-leaved aster			O	O	F

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			PARK	NAVY		
<i>Aster nemoralis</i> Ait.	bog aster		W		W,S,O	W
<i>Aster novi-belgii</i> L.	New York aster		S			O
<i>Aster puniceus</i> L.	aster					O
<i>Aster radula</i> Ait.	rough-leaved aster					O
<i>Aster umbellatus</i> Mill.	flat-topped aster		F	F	O	O
<i>Atriplex glabriuscula</i> Edmondston	orach				S	S
<i>Atriplex patula</i> L.	orach		S			S
<i>Barbarea vulgaris</i> R.Br.	winter cress	I			O	O
<i>Bartonia paniculata</i> (Michx.) Muhl. ssp. <i>iodandra</i> (Robins.)	screw stem	E			W	W
<i>Betula x caerulea</i> Blanch	blue birch				F	
<i>Betula lutea</i> Michx. f.	yellow birch					H,F
<i>Betula papyrifera</i> Marsh.	white birch		F	F	F	F
<i>Betula papyrifera</i> Marsh. var. <i>cordifolia</i> (Regel) Fern.	heart-leaved birch			F		
<i>Betula populifolia</i> Marsh.	gray birch				W,F	H
<i>Bidens frondosa</i> L.	beggar ticks			O		S
<i>Brassica nigra</i> (L.) Koch	black mustard	I				S
<i>Bulbostylis capillaris</i> (L.) C.B. Clark var. <i>capillaris</i>	dense-tuft hairsedge		O	O	O	
<i>Cakile edentula</i> (Bigel.) Hook.	sea rocket		S		S	S
<i>Calamagrostis canadensis</i> (Michx.) Beauv.	Canada bluejoint		W,F,S	W,F,S	F,S,O	W,S,O
<i>Calamagrostis pickeringii</i> Gray	Pickering's reedgrass	E			W,O	
<i>Calopogon pulchellus</i> (Salisb.) R.Br.	grass pink				W	W
<i>Calopogon pulchellus</i> (Salisb.) R. Br. forma <i>albiflorus</i> (Britt.) Fern.	grass pink				W	
<i>Campanula rapunculoides</i> L.	bellflower	I			O	
<i>Campanula rotundifolia</i> L.	harebell		S			S
<i>Capsella bursa-pastoris</i> (L.) Medic.	shepherd's purse	I			O	
<i>Carex adusta</i> Boott	sedge	E			O	
<i>Carex atlantica</i> Bailey	atlantic sedge				W	
<i>Carex buxbaumii</i> Wahlenb. forma <i>dilutior</i> Kukenth	sedge		W,S			
<i>Carex canescens</i> L. var. <i>canescens</i>	silvery sedge				W	
<i>Carex canescens</i> var. <i>disjuncta</i> Fern.	silvery sedge					H

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			PARK	NAVY		
<i>Carex communis</i> Bailey	fibrous-rooted sedge					H
<i>Carex crinita</i> Lam.	sickle-grass		F,O	F,O	O	W,S,O
<i>Carex cumulata</i> (Bailey)Mackenz	sedge				O	
<i>Carex debilis</i> Michx. var. <i>debilis</i>	slender-stalked sedge		F			
<i>Carex debilis</i> Michx. var. <i>rudgei</i> Bailey	sedge					W,O
<i>Carex echinata</i> Murray	sedge	T(DL)	W,S	W	W,O	W
<i>Carex exilis</i> Dew.	sedge					W
<i>Carex folliculata</i> L.	sedge					W
<i>Carex hormathodes</i> Fern.	marsh straw sedge		S,O	S,O	S	S
<i>Carex houghtonii</i> Torr	sedge				O	
	sedge				O	W
<i>Carex mackenziei</i> Krecz.	sedge				O	
<i>Carex nigra</i> (L.)Reichard var. <i>nigra</i>	black sedge		F		S	W
<i>Carex nigra</i> var. <i>strictiformis</i> (Bailey)Fern	black sedge				W	
<i>Carex novae-angliae</i> Schwein	New England sedge				O	
<i>Carex paleacea</i> Wahlenb.	seaside sedge		W			W,S
<i>Carex pallescens</i> L. var. <i>neogaea</i> Fern.	pale sedge				O	
<i>Carex pauciflora</i> lightf.	sedge				W	
<i>Carex paupercula</i> Michx. var. <i>irrigua</i>	bog sedge		W		W	W
<i>Carex scoparia</i> Schkuhr	rough sedge				O	O
<i>Carex stipata</i> Muhl.	awl sedge		W			S
<i>Carex trisperma</i> Dew.	three-seeded sedge		W,F		W	H,W
<i>Carex viridula</i> Michx.	green sedge		S			W,S
<i>Carex wiegandii</i> Mackenz.	sedge	SC			W	W
<i>Carum carvi</i> L.	caraway	I				S
<i>Cerastium vulgatum</i> L.	mouse-ear chickweed	I	S,O	S,O	W	S,O
<i>Chamaedaphne calyculata</i> (L.)Moench var. <i>angustifolia</i> (Ait.)Rehd.	leatherleaf		W	W	W	W
<i>Chenopodium album</i> L.	lamb's quarters	I	S			S
<i>Chrysanthemum leucanthemum</i> L.	oxeye daisy	I		O	W,O	S,O
<i>Cladium mariscoides</i> (Muhl.)Torr.	twig rush					W
<i>Clintonia borealis</i> (Ait.)Raf.	bluebead lily					F
<i>Coelopleurum lucidum</i> (L.)Fern.	seaside angelica				S	S
<i>Comptonia peregrina</i> (L.)Coult.	sweetfern		O	O	O	F
<i>Convolvulus sepium</i> L	hedge bindweed				S	S,O

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			PARK	NAVY		
<i>Coptis groenlandica</i> (Oeder) Fern.	goldthread		W	W	W	W
<i>Corema conradii</i> Torr.	broom crowberry				O	O
<i>Cornus canadensis</i> L.	bunchberry		W,F,S	W,F,S	W,F	H,W,O
<i>Cuscuta gronovii</i> Willd.	common dodder					S
<i>Cystopteris fragilis</i> (L.) Bernh.	fragile fern					O
<i>Elymus glomerata</i> L.	orchard grass	I			O	O
<i>Danthonia spicata</i> (L.) Beauv.	poverty grass		W,F	W,F		H,F,S
<i>Daucus carota</i> L.	wild carrot	I			O	
<i>Dennstaedtia punctilobula</i> (Michx.) Moore	hay-scented fern					F
<i>Deschampsia flexuosa</i> (L.) Trin.	common hairgrass		W,F			H,S,O
<i>Dianthus armeria</i> L.	deptford pink				O	
<i>Diervilla lonicera</i> Mill.	bush honeysuckle					H,F,O
<i>Digitaria ischaemum</i> (Scribn.) Muhl.	small crab-grass	I				O
<i>Drosera intermedia</i> Hayne	spatulate-leaved sundew				W	W
<i>Drosera rotundifolia</i> L.	round-leaved sundew		W	W	W	W
<i>Dryopteris disjuncta</i> (Ledeb.) C.V. Mort.	oak leaf, triplet fern					F,O
<i>Dryopteris fragrans</i> (L.) Schott	fragrant cliff-fern	SC				F
<i>Dryopteris noveboracensis</i> (L.) Gray	New York fern		F			
<i>Dryopteris phegopteris</i> (L.) Christens	long beech fern					F
<i>Dryopteris spinulosa</i> (O.F. Muell.) Watt	toothed wood fern				F	H,O
<i>Dryopteris thelypteris</i> (L.) Gray var. <i>pubescens</i> (Lawson) Nakai	marsh fern					W
<i>Echinochloa crusgalli</i> (L.) Beauv.	barnyard grass	I				O
<i>Elymus arenarius</i> L. var. <i>villosus</i> Mey.	sea lyme grass		S		S	S
<i>Elymus virginicus</i> L.	Terrell grass					S
<i>Empetrum nigrum</i> L.	black crowberry		W,F,S	W,F,S	S,W	H,W,F
<i>Epilobium angustifolium</i> L.	willow herb			O	O	O
<i>Epilobium glandulosum</i> Lehm. var. <i>adenocaulon</i> (Haussk.) Fern.	northern willow herb		S			S
<i>Epilobium leptophyllum</i> Raf.	narrow-leaved willow herb		W			W
<i>Equisetum arvense</i> L.	field horsetail				O	O
<i>Equisetum sylvaticum</i> L.	plumy horsetail				O	W

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			PARK	NAVY		
<i>Erigeron strigosus</i> Muhl.	daisy fleabane				O	
<i>Eriophorum angustifolium</i> Honckeny	tall cotton-grass		W		W	W
<i>Eriophorum spissum</i> Fern.	cotton grass				W	W
<i>Eriophorum virginicum</i> L.	Virginia cotton-grass				W	
<i>Eupatorium perfoliatum</i> L.	hare's tail				O	
<i>Euphrasia americana</i> Wettst.	eyebright			O	S	S
<i>Euphrasia canadensis</i> Townsend	eyebright		S			
<i>Euphrasia randii</i> forma <i>albiflora</i> (Fern. and Weig.) Fern.	eyebright					S
<i>Euphrasia randii</i> Robins.	Rand's eyebright		S			
<i>Festuca capillata</i> Lam.	fescue				O	O
<i>Festuca rubra</i> L.	fescue		S		S,O	S,O
<i>Festuca rubra</i> L. var. <i>commutata</i> Gaudin	fescue				W	
<i>Festuca rubra</i> L. var. <i>megastachys</i> (Gaudin) Holmb.	fescue				W	
<i>Forsythia</i> spp.	forsythia	I		O		
<i>Fragaria virginiana</i> Duchesne	wild strawberry		F,S	F,S	O	S,O
<i>Galeopsis tetrahit</i> L.	hemp nettle	I		F,O	S	F,S
<i>Galium mollogo</i> L.	bedstraw			O		
<i>Galium trifidum</i> L.	bedstraw		F	F		
<i>Gaultheria hispidula</i> (L.) Bigel.	creeping snowberry		W	W		H,W
<i>Gaultheria procumbens</i> L.	wintergreen			O	F	H
<i>Gaylussacia baccata</i> (Wang.) K. Koch	black huckleberry		F	F	W	H,W
<i>Gaylussacia dumosa</i> (Andr.) T. & G.	dwarf huckleberry				W	
<i>Geranium bicknellii</i> Britt.	cranesbill			O		
<i>Geranium robertianum</i> L.	herb robert		S			S
<i>Glaux maritima</i> L.	sea milkwort		S			S
<i>Glyceria canadensis</i> (Michx.) Trin.	rattlesnake grass				W	
<i>Gnaphalium uliginosum</i> L.	low cudweed			O	O	O
<i>Habenaria clavellata</i> (Michx.) Spreng.	green woodland orchis				W	
<i>Heracleum maximum</i> Bartr.	cow parsnip					
<i>Hieracium aurantiacum</i> L.	orange hawkweed	I		O	O	O
<i>Hieracium pilosella</i> L.	mouse ear	I	S		O	S,O
<i>Hieracium praetense</i> Tausch	field hawkweed	I	S			H,O
<i>Hieracium vulgatum</i> Fries	common hawkweed	I				W
<i>Houstonia caerulea</i> L.	bluets			O		F,S,O

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<i>Hudsonia ericoides</i> L.	golden heather					H
<i>Hypericum canadense</i> L.	Canada St. Johnswort		F,O	F,O	W,S	W,S,O
<i>Hypericum perforatum</i> L.	common St. Johnswort	I	F,O	F,O	O	O
<i>Hypericum virginicum</i> L.	marsh st. johnswort		W,S			W,O
<i>Ilex verticillata</i> (L.) Gray	winterberry		W,F	W,F	W,F	W,F,O
<i>Impatiens capensis</i> Meerb.	jewelweed					S
<i>Iris setosa</i> var. <i>canadensis</i> (B.L. Robbins) Fern.	beach-head iris	WL(DL)				S
<i>Iris versicolor</i> L.	northern blue flag		W,F	W,F	S	W,O
<i>Juncus acuminatus</i> Michx.	sharp-fruited rush		W			
<i>Juncus balticus</i> Willd. var. <i>littoralis</i> Engelm.	shore rush					S
<i>Juncus brevicaudatus</i> (Engelm.) Fern.	narrow-panicked rush		O		S	
<i>Juncus bufonius</i> L.	tufted rush		S			S
<i>Juncus canadensis</i> J. Gay	marsh rush			W	O	
<i>Juncus gerardi</i> Loisel.	black grass				S	S
<i>Juncus tenuis</i> Willd.	yard rush			O		S,W
<i>Juniperus communis</i> L. var. <i>depressa</i> Pursh	ground juniper		S		W,S	W,F,S
<i>Juniperus horizontalis</i> Moench	Bar Harbor juniper		S			S
<i>Kalmia angustifolia</i> L.	sheep laurel		W	W	W,F	H,W,F
<i>Kalmia polifolia</i> Wang.	pale laurel				W	W
<i>Larix laricina</i> (DuRoi) K. Koch	larch, tamarack		W	W	W	W,F
<i>Lathyrus japonicus</i> Willd.	beach pea		S		S	S
<i>Lechea intermedia</i> Leggett	pinweed			O	O	W,O
<i>Ledum groenlandicum</i> Oeder	Labrador tea		W,F	W,F	W	H,W
<i>Leontodon autumnalis</i> L.	fall dandelion	I		O	S	S,O
<i>Lepidium virginicum</i> L.	poor-man's pepper		O			
<i>Ligusticum scoticum</i> L.	Scotch lovage		S		S	S
<i>Limonium nashii</i> Small	sea lavender		S			S
<i>Linaria canadensis</i> (L.) Dumont	blue toadflax			O	O	O
<i>Linaria vulgaris</i> Mill.	butter-and-eggs	I		O	O	
<i>Linnaea borealis</i> L. var. <i>americana</i> (Forbes) Rehd.	twinflower		W,F	W,F		W
<i>Lobellia inflata</i> L.	indian tobacco					O
<i>Lolium perenne</i> L.	darnel	I				O

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<i>Lonicera villosa</i> (Michx.)R.&S.	mountain fly honeysuckle					W
<i>Lotus corniculatus</i> L.	birdsfoot trefoil				O	O
<i>Luzula campestris</i> (L.)DC.	woodrush	I			O	
<i>Luzula multiflora</i> (Retz.)Lejeune	woodrush				O	O
<i>Lycopus uniflorus</i> Michx.	northern bugleweed		W	W	W	O
<i>Lysimachia quadrifolia</i> L.	whorled loosestrife				W,Q	O
<i>Lysimachia terrestris</i> (L.)BSP.	swamp candles		F			H
<i>Maianthemum canadense</i> Desf.	wild lily-of-the-valley		F,S	F,S	W,F	H,W,O
<i>Malaxis unifolia</i> Michx.	green adder's mouth					W
<i>Matricaria matricarioides</i> (Less.)Porter	pineapple weed	I	S,O	S,O		O
<i>Melampyrum lineare</i> Desr.	cowwheat		F	F	W,F,O	H,F
<i>Menyanthes trifoliata</i> L. var. minor Raf.	bog bean				W	
<i>Mitchella repens</i> L.	partridge berry			W		
<i>Monotropa uniflora</i> L.	one-flowered pyrola		F	F		F
<i>Montia fontana</i>	blinks	SC	S			
<i>Myrica gale</i> L.	sweet gale		W,S	W,S	W,S	W,S
<i>Myrica pensylvanica</i> Loisel.	bayberry		W,S,O	W,S,O	W,F	H,W,S
<i>Nemopanthus mucronata</i> (L.)Loes.	mountain holly		W,F	W,F	W	H,W,F
<i>Oenothera biennis</i> L.	common evening primrose	I		O	O	S,O
<i>Oenothera perennis</i> L.	evening primrose				O	O
<i>Onoclea sensibilis</i> L.	sensitive fern			W		F,O
<i>Osmunda cinnamomea</i> L.	cinnamon fern		W,F,S			W
<i>Osmunda claytoniana</i> L.	interrupted fern		S			W,F
<i>Oxalis europaea</i> Jord.	yellow wood sorrel			O	O	S
<i>Oxalis montana</i> Raf.	common wood sorrel		F	F		F
<i>Panicum capillare</i> L.	panic grass	I				O
<i>Panicum lanuginosum</i> var. <i>implicatum</i> (Scribn.)Fern.	panic grass				O	O
<i>Phleum pratense</i> L.	common timothy	I			O	O
<i>Picea glauca</i> (Moench)Voss	white spruce		F,S	F,S	F,S	W,S,O
<i>Picea mariana</i> (Mill.)BSP.	black spruce		W		W	W
<i>Picea rubens</i> Sarg.	red spruce		F,S,O	F,S,O	F	H,F,S
<i>Pinus banksiana</i> Lamb.	jack pine		F,S	F,S	W,F	H,F
<i>Pinus rigida</i> Mill.	pitch pine				W,F	H

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				NAVY		
<i>Pinus resinosa</i> (Ait.)Soland	red pine			O		
						F
<i>Plantago juncoides</i> Lam. var. <i>decipiens</i> (Barneoud)Fern.	seaside plantain		S		S	S
<i>Plantago lanceolata</i> L.	English plantain	I		O		O
<i>Plantago major</i> L.	common plantain	I		O	O	O
<i>Plantago oliganthos</i> R.&S.	seaside plantain					W
<i>Poa annua</i> L.	low speargrass	I				O
<i>Poa compressa</i> L.	Canada bluegrass	I			W	O
<i>Poa pratensis</i> L.	Kentucky bluegrass			O		
<i>Pogonia ophioglossoides</i> (L.)Ker-Gawl.	pogonia				W	
<i>Polygonum aviculare</i> L.	common knotgrass	I		O		
<i>Polygonum cilinode</i> Michx.	fringed bindweed				O	
<i>Polygonum convovulus</i> L.	black bindweed	I				S
<i>Polygonum persicaria</i> L.	lady's thumb	I	S		O	
<i>Polypodium virginianum</i> L.	rock polypody					H,F
<i>Populus balsamifera</i> L.	balsam poplar					F,O
<i>Populus grandidentata</i> Michx.	large-toothed aspen				F	
<i>Populus tremuloides</i> Michx.	quaking aspen			F	F	F,S
<i>Potentilla anserina</i> L.	silverweed		S			W,S
<i>Potentilla argentea</i> L.	silvery cinquefoil	I		O		O
<i>Potentilla fruticosa</i> L.	shrubby cinquefoil		O			
<i>Potentilla norvegica</i> L.	rough cinquefoil		S,O	S,O	S	O
<i>Potentilla pectinata</i> Raf.	cinquefoil					S
<i>Potentilla recta</i> L.	cinquefoil				O	
<i>Potentilla simplex</i> Michx.	common cinquefoil			O	O	F,O
<i>Potentilla tridentata</i> Ait.	three-toothed cinquefoil		W,S		S,O	H,F,S,O
<i>Prenanthes trifoliata</i> (Cass.)Fern.	tall rattlesnake-root		S			F,S,O
<i>Prunella vulgaris</i> L. var. <i>lanceolata</i> (Bart.)Fern.	heal-all	I		O		S,O
<i>Prunus avium</i> L.	sweet cherry	I				F
<i>Prunus pensylvanica</i> L. f.	pin cherry			O	F,O	H,O
<i>Prunus virginiana</i> L.	choke cherry			O	O	
<i>Pteridium aquilinum</i> (L.)Kuhn var. <i>latiusculum</i> (Desv.)Underw.	eastern bracken		F	F	F	H,F

Table 10. Cont. Vascular plants by habitat type in the Schoodic Peninsula Study Area, 1994.

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Abbreviations for habitat communities in the study area: W = wetlands,

F = forest, S = shore; H = Schoodic Head summit, O = other habitat (i.e., rock outcrop, developed area, disturbed areas, field), Q = identification in question, taxonomic specialists contacted for verification.

SPECIES	COMMON NAME	STATUS	BIG MOOSE ISLAND		COREA HEATH NAVY LANDS	PARK LANDS ON SCHOODIC PENINSULA
			PARK	NAVY		
<i>Puccinellia paupercula</i> (Holm) Fern. & Weath. var. <i>alaskana</i> (Scribn. & Merr.) Fern. & Weath	alkali grass		S		S	S
<i>Pyrus americana</i> (Marsh.) DC.	American mountain ash					F,O
<i>Pyrus aucuparia</i> (L.) Gaertn.	European mountain ash	I				H,F,O
<i>Pyrus floribunda</i> Lindl.	purple chokeberry		F,S		W	H,W
<i>Pyrus malus</i> L.	apple	I				F,O
<i>Pyrus melanocarpa</i> (Michx.) Willd.	black chokeberry		W,F,O		W,S	H,W,S,O
<i>Ranunculus acris</i> L.	tall buttercup	I				O
<i>Ranunculus repens</i> L.	creeping buttercup	I		O		
<i>Raphanus raphanistrum</i> L.	wild radish	I		O		S
<i>Rhinanthus crista-galli</i> L.	yellow rattle					S,O
<i>Rhododendron canadense</i> (L.) Torr.	rhodora		W,O	W,O	W	H,W,F
<i>Rhus radicans</i> L.	poison ivy		S			
<i>Rhynchospora alba</i> (L.) Vahl	white beak-rush				W	H,W
<i>Ribes glandulosum</i> Grauer	skunk currant		F,S	F,S		F
<i>Ribes hirtellum</i> Michx. var. <i>calcicola</i> Fern.	gooseberry				S	
<i>Rosa carolina</i> L.	rose				O	O
<i>Rosa multiflora</i> Thunb.	multiflora rose	I				O
<i>Rosa nitida</i> Willd.	early swamp rose		W,S	W,S	W,S	
<i>Rosa rugosa</i> Thunb.	rugosa rose	I		O	S	S
<i>Rosa virginiana</i> Mill.	Virginia rose			O	S	S,O
<i>Rubus allegheniensis</i> Porter	common blackberry			O		S
<i>Rubus chamaemorus</i> L.	baked appleberry	WL(DL)			W	
<i>Rubus hispidus</i> L.	swamp dewberry		W,S	W,S		W
<i>Rubus idaeus</i> L.	wild red raspberry		F,S,O	F,S,O	S,O	S
<i>Rudbeckia serotina</i> Nutt.	black-eyed susan	I		O	O	
<i>Rumex acetosella</i> L.	sheep sorrel	I	S,O	S,O	S,O	S,O
<i>Rumex crispus</i> L.	curled dock	I				S
<i>Sagina nodosa</i> (L.) Fenzl subsp. <i>nodosa</i>	pearlwort	WL(DL)				S
<i>Sagina procumbens</i> L.	birdseye		S			S
<i>Salicornia europaea</i> L.	slender glasswort		S			S
<i>Salix bebbiana</i> Sarg.	long-beaked willow				O	

Table 10. Cont. Vascular plants by habitat type in the Schoodic Peninsula Study Area, 1994.

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Abbreviations for habitat communities in the study area: W = wetlands,

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SPECIES	COMMON NAME	STATUS	BIG MOOSE ISLAND		COREA HEATH NAVY LANDS	PARK LANDS ON SCHOODIC PENINSULA
			PARK	NAVY		
<i>Salix discolor</i> Muhl.	large pussy willow				O	O
<i>Sarracenia purpurea</i> L.	pitcher plant				W	W
<i>Scirpus atrovirens</i> Willd. var. <i>georgianus</i> (Harper) Fern.	bulrush					W
<i>Scirpus cespitosus</i> L.	tufted club-rush		W		W,S	
<i>Scirpus cyperinus</i> (L.) Kunth	wool grass			W	W	
<i>Scirpus maritimus</i> L.	salt-marsh bulrush					W
<i>Scutellaria epilobiifolia</i> A. Hamilton	marsh skullcap		S		S	S
<i>Sedum rosea</i> (L.) Scop.	roseroot	LR	S			
<i>Senecio sylvaticus</i> L.	wood ragwort	I	O			
<i>Senecio vulgaris</i> L.	common groundsel	I				S,O
<i>Silene cucubalus</i> Wibel	bladder campion	I		O	O	
<i>Sisyrinchium montanum</i> Greene var. <i>crebrum</i> Fern.	blue-eyed grass				O	S,O
<i>Sisyrinchium mucronatum</i> Michx.	blue-eyed grass		S			
<i>Smilacina trifolia</i> (L.) Desf.	three-leaved Solomon's seal		F		W	W
<i>Solanum dulcamara</i> L.	deadly nightshade	I	S,O		W,O	S
<i>Solidago bicolor</i> L.	silver-rod				O	
<i>Solidago canadensis</i> L.	Canada goldenrod			O		O
<i>Solidago graminifolia</i> (L.) Salisb.	grass-leaved goldenrod			O	O	S,O
<i>Solidago puberula</i> Nutt.	downy goldenrod				O	O
<i>Solidago randii</i> (Porter) Britt.	Rand's goldenrod					S,O
<i>Solidago rugosa</i> Mill.	rough-stemmed goldenrod		F,O	F,O	F	O
<i>Solidago sempervirens</i> L.	seaside goldenrod		S			S
<i>Solidago uliginosa</i> Nutt. var. <i>terraenovae</i> (T.&G.) Fern.	goldenrod		W		W	H,O
<i>Sonchus arvensis</i> L.	field sow thistle	I				S
<i>Sonchus asper</i> (L.) Hill	spiny-leaved sow thistle	I				S
<i>Sparganium chlorocarpum</i> Rydb.	bur reed				W	
<i>Spartina alternifolia</i> Loisel	cord grass		S			S
<i>Spartina patens</i> (Ait.) Muhl.	cord grass		S			S
<i>Spartina pectinata</i> Link	fresh-water cord grass					S
<i>Spargula arvensis</i> L.	corn spurry	I		O		

Table 10. Cont. Vascular plants by habitat type in the Schoodic Peninsula Study Area, 1994.

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Abbreviations for habitat communities in the study area: W = wetlands,

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SPECIES	COMMON NAME	STATUS	BIG MOOSE ISLAND		COREA HEATH NAVY LANDS	PARK LANDS ON SCHOODIC PENINSULA
			PARK	NAVY		
<i>Spergularia marina</i> (L.) Griseb.	corn spurry	I	S			S
<i>Spiraea latifolia</i> (Ait.) Borkh.	meadowsweet		W,F,S,O	W,F,S,O	W,F,S,O	W,F,S,O
<i>Spiraea tomentosa</i> L.	steeplesbush		F		O	W
<i>Stellaria graminea</i> L.	lesser stichwort	I		O	O	
<i>Stellaria media</i> (L.) Cyrillo	common chickweed	I		O		
<i>Stellaria media</i> (L.) Cyrillo	low sea blite					S
	common dandelion	I	S,O	S,O	O	O
<i>Thalictrum polygamum</i> Muhl.	tall meadow rue			W		F
<i>Thuja occidentalis</i> L.	northern white cedar		F	F	W,F	H,W,F
<i>Trientalis borealis</i> Raf.	starflower		W,F,S	W,F,S	W,F,S	H,F,O
<i>Trifolium agrarium</i> L.	hop clover	I			S	
<i>Trifolium arvense</i> L.	rabbit-foot clover	I		O		O
<i>Trifolium pratense</i> L.	red clover	I		O	O	O
<i>Trifolium procumbens</i> L.	low hop clover	I	O	O	O	O
<i>Trifolium repens</i> L.	white clover	I		O	O	S,O
<i>Triglochin maritima</i> L.	seaside arrowgrass		O			S
<i>Tussilago farfara</i> L.	coltsfoot	I			O	
<i>Typha latifolia</i> L.	common cattail			W	W	W,S
<i>Utricularia cornuta</i> Michx.	horned bladderwort				W	W
<i>Utricularia gibba</i> L.	bladderwort				W	
<i>Vaccinium angustifolium</i> Ait.	low blueberry		F,S	F,S	F,S,O	H,F,S,O
<i>Vaccinium corymbosum</i> L.	highbush blueberry				F	F
<i>Vaccinium macrocarpon</i> Ait.	large cranberry		W,F		W	H,F,S
<i>Vaccinium oxycoccus</i> L.	small cranberry		W,S		W	W
<i>Vaccinium vitis-idaea</i> L. var. minus Lodd.	mountain cranberry		F	F	S,O	
<i>Verbascum blattaria</i> L.	mullein	I			O	
<i>Verbascum thapsus</i> L.	common mullein	I		O	O	
<i>Veronica arvensis</i> L.	corn speedwell	I			O	
<i>Veronica officinalis</i> L.	common speedwell				O	
<i>Viburnum alnifolium</i> Marsh.	hobble bush					F
<i>Viburnum cassinoides</i> L.	wild raisin		W,F	W,F	W,F	H,W,O
<i>Viburnum opulus</i> L.	highbush cranberry	I				O
<i>Vicia cracca</i> L.	cow vetch	I		O	O	
<i>Vicia tetrasperma</i> (L.) Moench	vetch	I				O
<i>Viola fimbriatula</i> Sm.	violet				O	

Table 10. Cont. Vascular plants by habitat type in the Schoodic Peninsula Study Area, 1994.

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SPECIES	COMMON NAME	STATUS	BIG MOOSE ISLAND		COREA HEATH NAVY LANDS	PARK LANDS ON SCHOODIC PENINSULA
			PARK	NAVY		
<i>Viola lanceolata</i> L.	lance-leaved violet		W		S;O	
<i>Viola pallens</i> (Banks) Brainerd	northern white violet		F	F		W
<i>Viola septentrionalis</i> Greene	northern blue violet				W	W
<i>Zostera marina</i> L. var. <i>stenophylla</i> Aschers. & Graebn.	eel-grass		S			

Table 11. State-listed plant species found in the Schoodic Peninsula study area and the most recent verification of the individual or population(s).

SPECIES	STATE STATUS ¹	BIG MOOSE ISLAND		SCHOODIC PENINSULA	COREA HEATH
		ANP	NAVY		
<i>Bartonia paniculata</i>	E			1994	1992 ²
<i>Carex adusta</i>	E				1994
<i>Calamagrostis pickeringii</i>	E				1994
<i>Carex echinata</i>	T(DL)	1994	1994	1994	1994
<i>Carex wiegandii</i>	SC			1994	1994
<i>Montia fontana</i>	SC	1994			
<i>Dryopteris fragrans</i>	SC			1988 ³	
<i>Arethusa bulbosa</i>	WL(DL)	1994		1994	1994
<i>Iris setosa</i> var. <i>canadensis</i>	WL(DL)			1994	
<i>Rubus chamaemorus</i>	WL(DL)				1994
<i>Sagina nodosa</i> spp. <i>nodosa</i>	WL(DL)			1994	

¹ The following key refers to status listings: E = endangered, T = threatened, WL = watch list, DL = proposed de-listing, SC = special concern list.

² Collected by L. Gregory in 1992, voucher specimen at College of the Atlantic herbarium.

³ Documented by C. Greene (COA) (1990).

LITERATURE CITED

- Acadia National Park. 1991. Integrated pest management plan. Acadia National Park files. 43 pp.
- Acadia National Park. 1992. General Management Plan. U.S. Department of the Interior, National Park Service. 99 pp.
- Adorjan, A.S. and Kolenosky, G.B. 1969. A manual for the identification of hairs of selected Ontario mammals. Wildlife Research Report No. 90. Department of Lands and Forests, Ontario, Canada. 64 pp.
- Aquadro, C.F. and Patton, J.C. 1980. Salivary amylase variation in *Peromyscus*: use in species identification. *Journal of Mammalogy* 61(4):703-707.
- Baker, R.H. 1983. Michigan mammals. State University Press, Michigan. 642 pp.
- Brokaw N.V.L. and J.S. Grear. 1991. Forest structure before and after Hurricane Hugo at three elevations in the Luquillo Mountains, Puerto Rico. *Biotropica* 23(4a): 386-392.
- Burt, W.H. and Grossenheider, R.P. 1976. A field guide to the mammals. Boston: Houghton Mifflin Company. 289 pp.
- Calhoun, Aram J.K., J. Cormier, R.B. Owen Jr., et al. 1994. The Wetlands of Acadia National Park and Vicinity. Maine Agricultural and Forest Experiment Station Miscellaneous Publication 721. 108 pp.
- Calhoun, J.B. 1959. Revised sampling procedure of the North American census of small mammals (NACSM). pp. 1-11 in Population dynamics of vertebrates, Release No. 10, Mimeo Administration Publication, U.S. Department of Health, Education and Welfare.
- Call, M.W. 1986. Rodents and insectivores. Pp. 429-452 in Cooperrider, A.Y., R.J. Boyd and H.R. Stuart (Eds.). Inventory and monitoring of wildlife habitat. Denver, Co., U.S. Dept. of the Interior, Bureau of Land Management Service Center.
- Chapman, J.A. and Feldhamer, G.A. 1982. Wild mammals of North America. Johns Hopkins University Press, Baltimore. 1147 pp.
- Choate, J.R. 1973. Identification and recent distribution of white-footed mice (*Peromyscus*) in New England. *Journal of Mammalogy*. 54(1):41-49.
- Conant, R. and Collins, J.T. 1991. A field guide to reptiles and amphibians. Boston: Houghton Mifflin Company. 450 pp.

- Conkey, L.E., Keifer, M.B., and Lloyd, A.H. 1993. Structure and dynamics of disjunct stands of jack pine, Acadia National Park, Maine. Technical report NPS/NAR/OSS/NRTR-92/14. Department of the Interior, National Park Service, North Atlantic Region.
- Connery, J.H., Anderson, K., and Murphy, S. 1990. Small mammal trapping on Schoodic Peninsula. Unpublished data located at: Acadia National Park, Resource Management Library, Bar Harbor, Maine.
- Davis, R.B. 1961. The spruce-fir forests of the east coast of Maine. Ithaca, NY; Cornell University. Dissertation.
- Davis, R.B. 1966. Spruce-fir forests of the coast of Maine. *Ecological Monographs* 36(5): 79-94.
- Elliot, L. 1992. The calls of frogs and toads - eastern and central North America. Nature Sound Studios, Ithaca, New York.
- Fernald, M.L. 1950. Gray's manual of botany: a handbook of the flowering plants and ferns of the central and northeastern United States and adjacent Canada. Portland, Oregon: Dioscorides Press. 1632 pp.
- Fitch, H.S. 1987. Collecting and life history techniques. In: Seigel, R.A., Collins, J.T. and Novak, S.S., eds. *Snakes: ecology and evolutionary biology*. New York: Macmillan Publishing Company. pp. 143-164.
- Fitch, H.S. 1992. Methods of sampling snake populations and their relative success. *Herpetological Review* 23(1):17-19.
- Francq, E.N. 1981. Key to land mammals of New Hampshire. Unpublished report of The University of New Hampshire.
- Gauch, H.G. Jr. 1982. *Multivariate analysis in community ecology*. Press Syndicate of the University of Cambridge, Cambridge.
- Gawler, S.C. 1982. *Arethusa* (*Arethusa bulbosa* L.) a rare orchid in Maine and its relevance to the Critical Areas Program. Planning Report Number 76. Maine State Planning Office.
- Gleason, H.A. and Cronquist, A. 1991. *Manual of vascular plants of northeastern United States and adjacent Canada*. Bronx, New York: New York Botanical Garden.
- Goldsmith, F.B. 1991. *Monitoring for conservation and ecology*. New York: Chapman and Hall. 275 pp.
- Goodwin, G.G. 1935. The mammals of Connecticut. State Geological and Natural History Survey Bulletin No. 53.
- Greene, C.W. 1987. *Calamagrostis pickeringii* in Maine. *Rhodora* 89:333-336.

- Greene, C.W. 1990. Rare vascular plants of Acadia National Park and the Mount Desert Island Region of Maine. National Park Service Technical Report. 38 pp + maps and appendices.
- Greene, C.W., G.H. Mittelhauser, J. Jacobs and L. L. Gregory. 1992. Historic resource inventory for Acadia National Park. Technical report NPS/NAR/OSS/NRTR-92/01. Department of the Interior, National Park Service, North Atlantic Region. 624 pp.
- Gunderson, H.L. and Beer, J.R. 1953. The mammals of Minnesota. Minnesota Museum of Natural History Occasional Paper Number 6.
- Hall, R.J. 1967. A simplified live-trap for reptiles. Transactions of the Kansas Academy of Science 70(3):402-404.
- Hamilton, W.J. Jr. 1943. The mammals of eastern United States, an account of recent land mammals occurring east of the Mississippi. Comstock Publishing Company, New York.
- Harrison, D. and J. Gilbert. 1985. Denning ecology and movements of coyotes in Maine during pup rearing. J. Mamm. 66:712-719.
- Heyer, W.R., Donnelly, M.A., McDiarmid, R.W., Hayek, L.C., and Foster, M.S. (editors). 1994. Measuring and monitoring biological diversity: standard methods for amphibians. Washington: Smithsonian Institution Press. 364 pp.
- Hill, A.F. 1919. The vascular flora of the eastern Penobscot Bay region, Maine. Proceedings of the Portland Society of Natural History 3:199-304.
- Hill, A.F. 1923. The vegetation of the Penobscot Bay region, Maine. Proceedings of the Portland Society of Natural History 3:305-438.
- Hunter, M.L., Jr. 1984. A preliminary guide to finding and identifying the amphibians and reptiles of Maine. Located at: Acadia National Park, Resource Management Library, Bar Harbor, Maine.
- Hunter, M.L., Jr., Albright, J. and Arbuckle, J. (editors). 1992. The amphibians and reptiles of Maine. Maine Agricultural Experiment Station Bulletin 838. 188 pp.
- Johnson, J.L., J.F. Franklin, and R.G. Krebill. 1984. Research natural areas: baseline monitoring and management. Proceedings of a symposium, March 21, 1984, Missoula, Montana, USFS General Technical Report INT 173. Forest Service Intermountain Forest and Range Experiment Station, Ogden, Utah. 84 pp.
- Kilpatrick, C.W., Rich, S.M., Crowell, K.L. 1994 Distribution of the genus *Peromyscus* in coastal Maine. Maine Naturalist 2(1):1-10.
- Likens, G.E. 1987. Long-term studies in Ecology, Approaches and Alternatives. New York: Springer-verlag. 214 pp.

- Maine Department of Inland Fisheries and Wildlife. 1994. PROPOSED, Revised Species list Under Maine's Endangered Species Act (12MRSA). November 28, 1994
Ray B. Owen, Jr., Commissioner.
- Maine Natural Areas Program. 1994a. Critical area reports. Available from: Department of Economic and Community Development, Augusta, ME.
- Maine Natural Areas Program. 1994b. Elements of natural diversity: Maine's rare, threatened, and endangered plants. Available from: Department of Economic and Community Development, Augusta, ME.
- Maine Natural Heritage Program. 1991. Natural landscapes of Maine: a classification of ecosystems and natural communities. Department of Economic and Community Development, State House Station 130, Augusta, Maine. 77 pp.
- Maine State Planning Office. 1990. Maine endangered and threatened plants. Available Maine State Planning Office, Critical Areas Program, Augusta, ME.
- McInnes, D. 1986. Survey of exotic flora in Acadia National Park. Located at: Acadia National Park, Resource Management Library, Bar Harbor, Maine.
- Northern Division Naval Facilities Engineering Command. 1987. Long Range Forest Management Plan. Naval Security Group Activity, Winter Harbor, Maine.
- Moore, T.D., Spence, L.E. and Dugnolle, C.E. 1974. Identification of the dorsal guard hairs of some mammals of Wyoming. Laramie, Wyoming: Wyoming Game and Fish Department. 175 pp.
- Murie, O.J. 1974. A field guide to animal tracks. Boston: Houghton Mifflin Company. 376 pp.
- Northern Division Naval Facilities Engineering Command. 1987. Long range forest management plan. Located at: Naval Security Group Activity, Winter Harbor, Maine.
- Novak, M., Baker, J.A., Obbard, M.E., and Malloch, B. 1987. Eds., Wild Furbearer Management and Conservation in North America. Ministry of Natural Resources, Ontario.
- Patterson, W.A. III, Saunders, K.E., and Horton, L.J. 1983. Fire regimes of the coastal Maine forests of Acadia National Park. U.S. Department of the Interior, National Park Service, NAR Office of Scientific Studies.
- Russell, E.W.B. and Marion, J.L. 1990. Vegetation monitoring with permanent plots: a procedural manual for the mid-Atlantic region. Technical report NPS/MAR/NRTR-90/046. Department of the Interior, National Park Service, Mid Atlantic Region.
- Rolley, Robert E. 1987. Bobcat. Ed., Novak, Milan, James A. Baker, Martyn E. Obbard, Bruce Malloch in Wild Furbearer Management and Conservation in North America. Ministry of Natural Resources, Ontario.

- Stokes, D. and Stokes, L. 1986. A guide to animal tracking and behavior. Boston: Little, Brown and Company. 418 pp.
- Tyler, M.S. 1994. Stalking amphibians. *Maine Naturalist* 2(1):33-44.
- Tyning, T.F. 1990. A guide to amphibians and reptiles. Boston: Little, Brown and Company 400 pp.
- van Riper III, C., T.J. Stohlgren, S.D. Veirs, Jr. and S.C. Hillyer (editors). 1990. Examples of resource inventory and monitoring in national parks of California. Proceedings of the Third Biennial Conference on Research in California's National Parks, September 13-15. University of California, Davis, California. U.S. National Park Service Transactions and proceedings series No. 8.
- van Zyle de Jong, C.G. 1983. Handbook of Canadian mammals: Volume 1 - marsupials and insectivores. National Museum of Natural Sciences, National Museums of Canada.
- Vogt, R.C. and Hine, R.L. 1982. Evaluation of techniques for assessment of amphibian and reptile populations in Wisconsin. Scott, N.J., Jr., ed. *Herpetological communities: a symposium of the society for the study of amphibians and reptiles and the herpetologists' league*; 1977 August; Wildlife Research Report 13. Available from: U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C.
- Waggoner, G. 1981. Vegetation cover-type maps of Acadia National Park. Located at: Acadia National Park, Resource Management Library, Bar Harbor, Maine.
- Wenger, Karl F. 1984. *Forestry Handbook*. Second Edition. John Wiley and Sons, Inc. 1318 pp.
- Williams, G. 1994. NPS inventory and monitoring program emerges from I&M task force. *Park Science* 14(1): 3-5.
- Wilson, E.O. 1988. *Biodiversity*. National Academy Press, Washington, D.C.
- Worley, I.A. 1980. Botanical and ecological aspects of coastal raised peatlands in Maine and their relevance to the Critical Areas Program of the State Planning Office. Planning Report Number 69. Maine State Planning Office.
- Worley, I.A. 1981. Maine Peatlands, their abundance, ecology, and relevance to the Critical Areas Program of the State Planning Office. Planning Report Number 76. Maine State Planning Office.

Appendix 1. Descriptions of the endangered wildlife categories as identified in the Maine Endangered Species Act (Maine Department of Inland Fisheries and Wildlife 1994)

I. Endangered species: Species in immediate danger of extirpation (extermination).

II. Threatened species: Species that will become endangered if current populations experience further decline.

III. Special Concern species: Species particularly vulnerable to population decline due to restricted distribution and/or habitat loss.

IV. Species of indeterminate status: Indigenous wildlife believed to be of endangered, threatened, or special concern status, but about which insufficient data are available.

V. Watch list species: Species that do not meet the rigorous requirements of inclusion in Categories I through IV, but do warrant special attention

VI. Extirpated Species: Species of wildlife that were once indigenous to Maine but have not been documented as indigenous for the past 50 years.

Appendix 2 Amphibian species collected in the Schoodic Peninsula study area, 1994.

SPECIES	STUDY SITE	COLLECTION DATE	SPECIMEN #	PRESERVATIVE
wood frog	Big Moose Island	6/20/94	62094DF3	50 % alcohol, 50 % water
red-spotted eft	Schoodic Peninsula	6/14/94	61494RK1	50 % alcohol, 50 % water
redback salamander	Schoodic Peninsula	6/14/94	61494RK2	50 % alcohol, 50 % water
redback salamander	Corea Heath	6/08/94	60894DF5-1	50 % alcohol, 50 % water
redback salamander	Corea Heath	6/08/94	60894DF5-2	50 % alcohol, 50 % water
redback salamander	Corea Heath	6/08/94	60894DF5-3	50 % alcohol, 50 % water
redback salamander	Corea Heath	6/08/94	60894DF5-4	50 % alcohol, 50 % water
redback salamander	Corea Heath	6/08/94	60894DF5-5	50 % alcohol, 50 % water
redback salamander	Corea Heath	6/08/94	60894DF5-6	50 % alcohol, 50 % water
redback salamander	Corea Heath	6/08/94	60894DF5-7	50 % alcohol, 50 % water

Appendix 3. The trapping location and measurement of mammal voucher specimens from the Schoodic Peninsula study area, 1994. "DF" is the abbreviation for drift fence with pitfall trap.

Species	Date	Location	Collection #	Trap Type	Weight (grams)	Body Length (mm)	Tail Length (mm)	Remarks
<i>Blarina brevicauda</i>	6/3/94	Big Moose	60394DF31	DF	15.4	74	23	
<i>Blarina brevicauda</i>	6/29/94	Schoodic	62994DF12	DF	16	89	24	
<i>Clethrionomys gapperi</i>	6/3/94	Big Moose	60394DF32	DF	19.5	92	40	wet when weighed
<i>Condylura cristata</i>	6/13/94	Corea	61394DF51	DF	45.0	100	73	wet when measured
<i>Microsorex hoyi</i>	6/29/94	Big Moose	62794DF31	DF	4.4	49	29	wet when weighed
<i>Microsorex hoyi</i>	6/27/94	Corea	62794DF51	DF	2.6	49	29	
<i>Microsorex hoyi</i>	6/27/94	Corea	62794DF53	DF	2.7	46	29	
<i>Microsorex hoyi</i>	6/29/94	Corea	62994DF52	DF	4.2	51	29	wet when measured
<i>Sorex cinereus</i>	5/29/94	Big Moose	52994DF31	DF	6.8	61	41	wet when weighed
<i>Sorex cinereus</i>	5/29/94	Big Moose	52994DF32	DF	5.9	59	39	wet when weighed
<i>Sorex cinereus</i>	5/31/94	Big Moose	53194DF31	DF	5.6	60	39	
<i>Sorex cinereus</i>	5/31/94	Big Moose	53194DF32	DF	5.4	61	41	wet when weighed
<i>Sorex cinereus</i>	6/3/94	Big Moose	60394DF33	DF	6.1	65	39	wet when weighed
<i>Sorex cinereus</i>	6/3/94	Big Moose	60394DF34	DF	3.6	56	36	wet when weighed
<i>Sorex cinereus</i>	6/6/94	Big Moose	60694DF31	DF	5.1	59	39	wet when weighed
<i>Sorex cinereus</i>	6/8/94	Big Moose	60894DF31	DF	5.2	52	40	wet when weighed
<i>Sorex cinereus</i>	6/8/94	Big Moose	60894DF32	DF	5.8	50	40	
<i>Sorex cinereus</i>	6/8/94	Big Moose	60894DF33	DF	3.4	49	40	
<i>Sorex cinereus</i>	6/10/94	Big Moose	61094DF31	DF	3.4	49	40	
<i>Sorex cinereus</i>	6/10/94	Big Moose	61094DF32	DF	3.8	49	39	
<i>Sorex cinereus</i>	6/10/94	Big Moose	61094DF33	DF	4.2	49	40	
<i>Sorex cinereus</i>	6/13/94	Big Moose	61394DF31	DF	6.6	60	43	
<i>Sorex cinereus</i>	6/13/94	Big Moose	61394DF32	DF	3.7	56	40	wet when weighed
<i>Sorex cinereus</i>	6/13/94	Big Moose	61394DF33	DF	4.2	52	40	wet when weighed
<i>Sorex cinereus</i>	6/13/94	Big Moose	61394DF34	DF	4.6	54	39	wet when weighed
<i>Sorex cinereus</i>	6/13/94	Big Moose	61394DF35	DF	3.4	46	43	wet when weighed
<i>Sorex cinereus</i>	6/13/94	Big Moose	61394DF36	DF	5.2	54	37	

Appendix 3. Cont. The trapping location and measurement of mammal voucher specimens from the Schoodic Peninsula study area, 1994. "DF" is the abbreviation for drift fence with pitfall trap.

Species	Date	Location	Collection #	Trap Type	Weight (grams)	Body Length (mm)	Tail Length (mm)	Remarks
Sorex cinereus	6/15/94	Big Moose	61594DF31	DF	3.8	54	39	
Sorex cinereus	6/17/94	Big Moose	61794DF31	DF	3.2	49	42	
Sorex cinereus	6/29/94	Big Moose	6294DF31	DF	7.5	57	45	wet when weighed
Sorex cinereus	5/31/94	Schoodic	53194DF11	DF	5.1	59	42	
Sorex cinereus	5/31/94	Schoodic	53194DF12	DF	5.2	59	42	
Sorex cinereus	6/8/94	Schoodic	60894DF11	DF	5.2	61	46	wet when measured
Sorex cinereus	6/8/94	Schoodic	60894DF12	DF	5.8	53	41	wet when measured
Sorex cinereus	6/8/94	Schoodic	60894DF21	DF	5.2	55	40	
Sorex cinereus	6/8/94	Schoodic	60894DF22	DF	3.8	51	43	
Sorex cinereus	6/10/94	Schoodic	61094DF21	DF	4.4	55	40	
Sorex cinereus	6/13/94	Schoodic	61394DF11	DF	5.1	50	42	wet when measured
Sorex cinereus	6/13/94	Schoodic	61394DF21	DF	5.2	50	40	
Sorex cinereus	6/13/94	Schoodic	61394DF22	DF	5.7	51	40	wet when measured
Sorex cinereus	6/13/94	Schoodic	61394DF23	DF	4.0	45	39	wet when measured
Sorex cinereus	6/13/94	Schoodic	61394DF24	DF	4.1	50	38	
Sorex cinereus	6/27/94	Schoodic	62794DF61	DF	3.8	50	41	wet when measured
Sorex cinereus	6/29/94	Schoodic	62994DF11	DF	3.5	55	44	
Sorex cinereus	6/29/94	Schoodic	62994DF13	DF	5.4	59	47	
Sorex cinereus	6/29/94	Schoodic	62994DF61	DF	5.4	54	41	
Sorex cinereus	6/29/94	Schoodic	62994DF62	DF	7.8	65	42	wet when measured
Sorex cinereus	6/29/94	Schoodic	62994DF63	DF	5.8	54	47	wet when measured
Sorex cinereus	7/1/94	Schoodic	70194DF61	DF	7.3	60	41	
Sorex cinereus	6/6/94	Corea	60694DF41	DF	3.4	54	40	wet when measured
Sorex cinereus	6/6/94	Corea	60694DF51	DF	5.2	59	39	
Sorex cinereus	6/8/94	Corea	60894DF41	DF	5.8	57	42	wet when measured
Sorex cinereus	6/13/94	Corea	61394DF52	DF	5.9	52	43	wet when measured
Sorex cinereus	6/13/94	Corea	61394DF53	DF	3.7	45	40	wet when measured

Appendix 3. Cont. The trapping location and measurement of mammal voucher specimens from the Schoodic Peninsula study area, 1994. "DF" is the abbreviation for drift fence with pitfall trap.

Species	Date	Location	Collection #	Trap Type	Weight (grams)	Body Length (mm)	Tail Length (mm)	Remarks
<i>Sorex cinereus</i>	6/13/94	Corea	61394DF54	DF	6.1	58	42	wet when measured
<i>Sorex cinereus</i>	6/15/94	Corea	61594DF51	DF	3.4	49	37	wet when measured
<i>Sorex cinereus</i>	6/17/94	Corea	61794DF51	DF	3.8	53	41	wet when measured
<i>Sorex cinereus</i>	6/24/94	Corea	62494DF51	DF	8.0	58	39	
<i>Sorex cinereus</i>	6/27/94	Corea	62794DF41	DF	3.8	56	40	
<i>Sorex cinereus</i>	6/27/94	Corea	62794DF52	DF	4.0	50	44	
<i>Sorex fumeus</i>	6/03/94	Big Moose	60394DF35	DF	6.4	70	42	wet when measured
<i>Sorex fumeus</i>	6/3/94	Schoodic	60394DF11	DF	6.7	64	43	
<i>Sorex fumeus</i>	6/22/92	Corea	62294DF41	DF	9.3	74	49	
<i>Sorex palustris</i>	6/10/94	Big Moose	61094DF31	DF	9.3	68	61	
<i>Synaptomys cooperi</i>	6/20/94	Big Moose	62094DF31	DF	15	80	29	wet when weighed
<i>Synaptomys cooperi</i>	6/6/94	Schoodic	60694DF11	DF	19.0	80	11	wet when measured
<i>Synaptomys cooperi</i>	6/13/94	Schoodic	61394DF12	DF	15.3	80	16	wet when measured
<i>Synaptomys cooperi</i>	6/8/94	Corea	60894DF53	DF	26.5	88	33	wet when measured
<i>Synaptomys cooperi</i>	6/22/94	Corea	62294DF52	DF	19.0	88	18	
<i>Zapus hudsonius</i>	6/8/94	Corea	60894DF51	DF	22.5	79	127	
<i>Zapus hudsonius</i>	6/8/94	Corea	60894DF52	DF	19.5	79	118	wet when measured
<i>Zapus hudsonius</i>	6/10/94	Corea	61094DF51	DF	17.5	82	120	
<i>Zapus hudsonius</i>	6/29/94	Corea	62994DF51	DF	22.5	75	127	

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116	1/2	1/2
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145	1/2	1/2
146	1/2	1/2
147	1/2	1/2
148	1/2	1/2
149	1/2	1/2
150	1/2	1/2

Appendix 4. Locations and measurements of all small mammals captured from the Schoodic Peninsula study area, 1994.

Species	Date	Location	Transect Number	Weight (grams)	Body Length (mm)	Tail Length (mm)	Remarks
Clethrionomys gapperi	7/12/94	Big Moose	1	30	67	45	
Clethrionomys gapperi	7/12/94	Big Moose	1	23.5	75	30	
Clethrionomys gapperi	7/12/94	Big Moose	1	26.5	80	40	
Clethrionomys gapperi	7/12/94	Big Moose	1	22.5	80	42	
Clethrionomys gapperi	7/12/94	Big Moose	1	24.5	85	34	
Clethrionomys gapperi	7/13/94	Big Moose		30	85	32	recapture
Clethrionomys gapperi	7/14/94	Big Moose	1	24	85	39	recapture
Clethrionomys gapperi	7/12/94	Big Moose	2	78.5	80	40	
Clethrionomys gapperi	7/12/94	Big Moose	2		80	35	escaped
Clethrionomys gapperi	7/12/94	Big Moose	2	18.5	79	38	
Clethrionomys gapperi	7/13/94	Big Moose	2	36	90	41	
Clethrionomys gapperi	7/14/94	Big Moose	2	28	80	44	recapture
Clethrionomys gapperi	7/14/94	Big Moose	2	25	80	35	recapture
Clethrionomys gapperi	7/14/94	Big Moose	2	24.5	78	38	
Clethrionomys gapperi	7/13/94	Big Moose	6	21	80	46	
Clethrionomys gapperi	7/13/94	Big Moose	6	22	70	45	
Clethrionomys gapperi	7/14/94	Big Moose	6	20	80	39	recapture

Appendix 4. Cont. Locations and measurements of all small mammals captured from the Schoodic Peninsula study area, 1994.

Species	Date	Location	Transect Number	Weight (grams)	Body Length (mm)	Tail Length (mm)	Remarks
Clethrionomys gapperi	7/14/94	Big Moose	6				not measured
Clethrionomys gapperi	7/14/94	Big Moose	6	11	70	30	
Clethrionomys gapperi	7/21/94	Corea	6		68	42	
Clethrionomys gapperi	7/6/94	Schoodic	1	24	70	35	
Clethrionomys gapperi	7/6/94	Schoodic	1	17.5	80	31	
Clethrionomys gapperi	7/6/94	Schoodic	1	16	80	27	
Clethrionomys gapperi	7/7/94	Schoodic	1	18	75	31	recapture
Clethrionomys gapperi	7/7/94	Schoodic	1	22.5	72	38	recapture
Clethrionomys gapperi	7/7/94	Schoodic	1	71.5	66	27	recapture
Clethrionomys gapperi	7/7/94	Schoodic	1	11.5	60	27	
Clethrionomys gapperi	7/7/94	Schoodic	1	escaped	70	39	
Clethrionomys gapperi	7/8/94	Schoodic	1	22	66	30	recapture
Clethrionomys gapperi	7/8/94	Schoodic	1	17	69	32	
Clethrionomys gapperi	7/8/94	Schoodic	1	16.5	65	31	
Clethrionomys gapperi	7/8/94	Schoodic	1	16.5	66	27	recapture
Clethrionomys gapperi	7/8/94	Schoodic		14	60	29	
Clethrionomys gapperi	7/7/94	Schoodic	3	21	75	35	
Clethrionomys gapperi	7/8/94	Schoodic	3	26	83	40	
Clethrionomys gapperi	7/8/94	Schoodic	3	20.5	75	32	
Clethrionomys gapperi	7/8/94	Schoodic	3	25	74	35	
Clethrionomys gapperi	7/8/94	Schoodic	3				escaped
Glaucomys sabrinus	7/13/94	Big Moose	1				not measured
Napaeozapus insignis	7/12/94	Big Moose	1	25	90	135	
Peromyscus leucopus	7/12/94	Big Moose	2	21.5	66	73	

Appendix 4. Cont. Locations and measurements of all small mammals captured from the Schoodic Peninsula study area, 1994.

Species	Date	Location	Transect Number	Weight (grams)	Body Length (mm)	Tail Length (mm)	Remarks
<i>Peromyscus leucopus</i>	7/12/94	Big Moose	2	19.5	79	75	very reddish
<i>Peromyscus leucopus</i>	7/13/94	Big Moose	2	20	75	73	recapture
<i>Peromyscus leucopus</i>	7/14/94	Big Moose	2	21.5	72	75	recapture
<i>Peromyscus leucopus</i>	7/14/94	Big Moose	2	20.5	75	75	
<i>Peromyscus maniculatus</i>	7/13/94	Big Moose	1	15.5	65	73	
<i>Peromyscus maniculatus</i>	7/13/94	Big Moose		13	68	76	
<i>Peromyscus maniculatus</i>	7/14/94	Big Moose	1	16	80	71	
<i>Peromyscus maniculatus</i>	7/14/94	Big Moose	5	20	75	85	
<i>Peromyscus maniculatus</i>	7/14/94	Big Moose	6				escaped
<i>Peromyscus maniculatus</i>	7/19/94	Corea	3	15	66	80	
<i>Peromyscus maniculatus</i>	7/21/94	Corea	3	escaped	65	82	
<i>Peromyscus maniculatus</i>	7/6/94	Schoodic	3				escaped
<i>Peromyscus maniculatus</i>	7/6/94	Schoodic	3	16	67	80	
<i>Peromyscus maniculatus</i>	7/7/94	Schoodic	3	16	54	80	recapture
<i>Peromyscus maniculatus</i>	7/8/94	Schoodic	3	26	64	81	
<i>Peromyscus maniculatus</i>	7/8/94	Schoodic	3	16	71	80	
<i>Peromyscus maniculatus</i>	7/7/94	Schoodic	4	17	68	84	
<i>Peromyscus maniculatus</i>	7/8/94	Schoodic	6	15.5	65	71	
<i>Tamias striatus</i>	7/21/94	Corea					
<i>Tamias striatus</i>	7/21/94	Corea					
<i>Tamias striatus</i>	7/21/94	Corea					
<i>Tamiasciurus hudsonicus</i>	7/13/94	Big Moose	1				

Appendix 4. Cont. Locations and measurements of all small mammals captured from the Schoodic Peninsula study area, 1994.

Species	Date	Location	Transect Number	Weight (grams)	Body Length (mm)	Tail Length (mm)	Remarks
<i>Tamiasciurus hudsonicus</i>	7/14/94	Big Moose	1				
<i>Tamiasciurus hudsonicus</i>	7/13/94	Big Moose	3				
<i>Tamiasciurus hudsonicus</i>	7/12/94	Big Moose	4				
<i>Tamiasciurus hudsonicus</i>	7/13/94	Big Moose	4				
<i>Tamiasciurus hudsonicus</i>	7/13/94	Big Moose	4				
<i>Tamiasciurus hudsonicus</i>	7/13/94	Big Moose	4				
<i>Tamiasciurus hudsonicus</i>	7/14/94	Big Moose	4				
<i>Tamiasciurus hudsonicus</i>	7/12/94	Big Moose	5				
<i>Zapus hudsonius</i>	7/21/94	Corea	1	19.5	72	128	recapture
<i>Zapus hudsonius</i>	7/20/94	Corea	1	25.5	68	131	
<i>Zapus hudsonius</i>	7/8/94	Schoodic	4	16	83	125	
<i>Zapus hudsonius</i>	7/8/94	Schoodic	4	17	65	108	
<i>Zapus hudsonius</i>	7/8/94	Schoodic	4		85	12.4	
<i>Zapus hudsonius</i>	7/7/94	Schoodic	6				escaped

Appendix 5. Global Positioning System (GPS) coordinates for locations of transects, drift fences, and forest plots in the study area, 1994.

COREA HEATH		
Small Mammal Transect	UTM ¹ North	UTM East
T1 - 1	4916601	580106
T1 - 11	4916507	580080
T2 - 1	4916392	580000
T2 - 11	4916327	580052
T3 - 1	4916512	580400
T3 - 11	4916435	580477
T4 - 1	4917467	580429
T4 - 1	4917378	580392
T5 - 1	4917523	579929
T5 - 11	4917500	579834
T6 - 1	4917673	580560
T6 - 11	4917602	580621
Drift Fence		
DF - 4	4917477	580572
DF - 5	4916546	580126
Forest Plot		
FP - 1	4917603	579956
FP - 2	4917559	579909
FP - 3	4917327	579610
FP - 4	4917356	579655
FP - 5	4916571	580013
FP - 6	4916622	579973
FP - 7	4917409	580492
FP - 8	4917468	580489
FP - 9	4916872	579834
FP - 10	4916794	579815

¹ UTM Universal Transverse Mercator

Appendix 5. Cont. Global Positioning System (GPS) coordinates for locations of transects, drift fences, and forest plots in the study area, 1994.

BIG MOOSE ISLAND		
Small Mammal Transect	UTM ¹ North	UTM East
T1 - 1	4909160	574989
T1 - 11	4909237	574949
T2 - 1	4909176	574792
T2 - 11	4909186	574701
T3 - 1	4909730	575008
T3 - 11	4909806	575072
T4 - 1	4909844	574582
T4 - 11	4909933	574629
T5 - 1	4909915	574342
T5 - 11	4909880	574295
T6 - 1	4909314	574460
T6 - 11	4909275	574482
T7 - 1	4909275	574491
T7 - 11	4909316	574576
Drift Fence		
DF - 3	4909715	574618
Forest Plot		
FP - 1	4909853	575023
FP - 2	4909823	574975
FP - 3	4909806	575073
FP - 4	4910023	574884
FP - 5	4909977	574674
FP - 6	4909216	574768
FP - 7	4909215	574585
FP - 8	4909221	574636
FP - 9	4909194	574763
FP - 10	4909153	574789

UTM = Universal Transverse Mercator

Appendix 5. Cont. Global Positioning System (GPS) coordinates for locations of transects, drift fences, and forest plots in the study area, 1994.

SCHOODIC HEAD		
Small Mammal Transect	UTM ¹ North	UTM East
T1 - 1	4911022	575427
T1 - 11	4911099	575459
T2 - 1	4910905	574953
T2 - 11	4911005	574968
T3 - 1	4910491	575193
T3 - 11	4910555	575271
T4 - 1	4910315	575186
T4 - 11	4910215	575169
T5 - 1	4909661	575608
T5 - 11	4909638	575693
T6 - 1	4910328	575242
T6 - 11	4910271	575341
T7 - 1	4910587	574529
T7 - 11	4910621	574626
Drift Fence		
DF - 1	4911701	574238
DF - 2	4911718	574188
DF - 6	4910388	575040

¹ UTM = Universal Transverse Mercator

Appendix 6. The scientific and common names of non-native species and the habitats¹ where they were found in each study site. Invasive potential² and general comments are included.

NON-NATIVE SPECIES	COMMON NAME	HABITAT TYPE BY STUDY SITES			INVASIVE POTENTIAL AND GENERAL COMMENTS
		Big Moose	Corea	Peninsula	
<i>Achillea millefolium</i>	Yarrow	O	F,S,O	O	Moderate, concentrated at the shore
<i>Anthoxanthum odoratum</i>	sweet vernal grass	O	*	O	Minimal
<i>Artemisia vulgaris</i>	common mugwort	O	*	*	Two plants at park entrance
<i>Babarea vulgaris</i>	yellow rocket	O	*	O	Moderate, high concentration in disturbed areas
<i>Brassica nigra</i>	black mustard	S	*	*	Approx. 10-20 plants on the western shore
<i>Capsella bursa-pastoris</i>	shepherd's purse	*	*	O	Minimal, few plants in disturbed areas
<i>Cerastium vulgatum</i>	mouse-ear chickweed	*	S,O	W	Minimal-moderate, spread beyond disturbed areas
<i>Chrysanthemum leucanthemum</i>	oxeye daisy	O	O	W,O	Moderate, many stems in disturbed areas
<i>Dactylis glomerata</i>	orchard grass	*	*	O	Minimal
<i>Galeopsis tetrahit</i>	hemp nettle	F,S	F	S	High, often forms thick stands

¹ Habitat Key: F = field, S = shore, W = wetlands, O = disturbed habitats, * = not found in this study site.

² A subjective evaluation on the potential for a non-native species to spread to the surrounding native vegetative community as interpreted from descriptions in McInnes (1986).

Appendix 6. Cont. The scientific and common names of non-native species and the habitats¹ where they were found in each study site. Invasive potential² and general comments are included.

NON-NATIVE SPECIES	COMMON NAME	HABITAT TYPE BY STUDY SITES			INVASIVE POTENTIAL AND GENERAL COMMENTS
		Big Moose	Corea	Peninsula	
<i>Hieracium aurantiacum</i>	orange hawkweed	O	O	O	Moderate, often many rosettes in disturbed areas
<i>Hieracium pilosella</i>	mouse ear	O	S	O	Moderate, stoloniferous in disturbed areas
<i>Hieracium praetense</i>	field hawkweed	*	S	*	Minimal, few stolons on shore
<i>Hypericum perforatum</i>	common st. johnswort	O	F,O	O	Moderate, frequent along roadsides and disturbed areas
<i>Leontodon autumnalis</i>	fall dandelion	O	O	S	Minimal, common only in disturbed areas
<i>Linaria vulgaris</i>	butter and eggs	*	O	O	Minimal, 10-20 plants sighted in each area
<i>Matricaria matricariodes</i>	pineapple weed	*	S,O	*	Minimal
<i>Oenothera biennis</i>	common evening primrose	S,O	O	O	Moderate, multiple stems in disturbed areas
<i>Phleum pratense</i>	common timothy	S,O	O	O	Minimal
<i>Plantago lanceolata</i>	english plantain	O	O	*	Minimal, rosettes frequent in lawns

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² A subjective evaluation on the potential for a non-native species to spread to the surrounding native vegetative community as interpreted from descriptions in McInnes (1986).

Appendix 6. Cont. The scientific and common names of non-native species and the habitats¹ where they were found in each study site. Invasive potential² and general comments are included.

NON-NATIVE SPECIES	COMMON NAME	HABITAT TYPE BY STUDY SITES			INVASIVE POTENTIAL AND GENERAL COMMENTS
		Big Moose	Corea	Peninsula	
<i>Plantago major</i>	common plantain	*	O	O	Moderate, rosettes frequent in lawns
<i>Polygonum aviculare</i>	doorweed	*	O	*	Few plants sighted
<i>Polygonum persicaria</i>	lady's thumb	*	S	O	Minimal, plants scattered in rocks on shore and in disturbed areas
<i>Potentilla argentea</i>	silvery cinquefoil	*	O	*	Few plants at ballfield
<i>Prunella vulgaris</i>	heal-all	O	O	*	Minimal, 10 plants sighted
<i>Pyrus malus</i>	apple	F,O	*	*	Two trees on Schoodic
<i>Ranunculus repens</i>	creeping buttercup	*	O	*	Minimal-moderate, common in disturbed areas
<i>Rosa rugosa</i>	rugosa rose	S	O	S	High, occasional thick stands on shore
<i>Rudbeckia serotina</i>	black-eyed susan	*	O	O	Moderate, many stems in open areas
<i>Rumex acetosella</i>	sheep sorrel	O	S,O	S,O	Common on roadsides and few plants on shore
<i>Rumex crispus</i>	curled dock	S	*	*	Single plants often encountered on shore

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² A subjective evaluation on the potential for a non-native species to spread to the surrounding native vegetative community as inferred from descriptions in McInnes (1986).

Appendix 6. Cont. The scientific and common names of non-native species and the habitats¹ where they were found in each study site. Invasive potential² and general comments are included.

NON-NATIVE SPECIES	COMMON NAME	HABITAT TYPE BY STUDY SITES			INVASIVE POTENTIAL AND GENERAL COMMENTS
		Big Moose	Corea	Peninsula	
<i>Silene cucubalus</i>	bladder campion	*	*	O	Five plants at Corea Heath entrance station
<i>Senecio sylvaticus</i>	wood ragwort	*	O	*	Plants common at Schoodic Point
<i>Sisymbrium officinale</i>	hedge mustard	*	O	*	Minimal
<i>Solanum dulcamara</i>	deadly nightshade	S	S,O	W,O	Minimal, plants scattered in rocks on shore and in open disturbed areas
<i>Spargula marina</i>	corn spurrey	*	O	*	Minimal
<i>Stellaria graminea</i>	lesser stitchwort	*	O	O	Moderate, thick mats often encountered
<i>Stellaria media</i>	common chickweed	*	O	*	Minimal
<i>Taraxacum officinale</i>	common dandelion	O	S,O	O	Common in waste places
<i>Trifolium arvense</i>	rabbit-foot clover	O	O	S,O	Moderate, often thick in disturbed areas
<i>Trifolium pratense</i>	red clover	*	O	O	Minimal, sighted on roadsides
<i>Trifolium procumbens</i>	low hop clover	*	O	O	Often thick patches in waste areas

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² A subjective evaluation on the potential for a non-native species to spread to the surrounding native vegetative community as interpreted from descriptions in McInnes (1986).

Appendix 6. Cont. The scientific and common names of non-native species and the habitats¹ where they were found in each study site. Invasive potential² and general comments are included.

NON-NATIVE SPECIES	COMMON NAME	HABITAT TYPE BY STUDY SITES			INVASIVE POTENTIAL AND GENERAL COMMENTS
		Big Moose	Corea	Peninsula	
<i>Trifolium repens</i>	white clover	S,O	O	O	Minimal, found growing in lawns and disturbed areas
<i>Tussilago farfara</i>	coltsfoot	*	*	O	Minimal, approx. 20 stems in vicinity of schoolhouse
<i>Verbascum blattaria</i>	moth mullein	*	*	O	Single plant sighted in disturbed area
<i>Verbascum thapsus</i>	common mullein	*	O	O	Minimal, common on roadsides
<i>Viburnum opulus</i>	highbush cranberry	O	*	*	One shrub at Frazer Point
<i>Vicia cracca</i>	tufted vetch	*	O	O	Often trailing on shrubs in disturbed areas

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