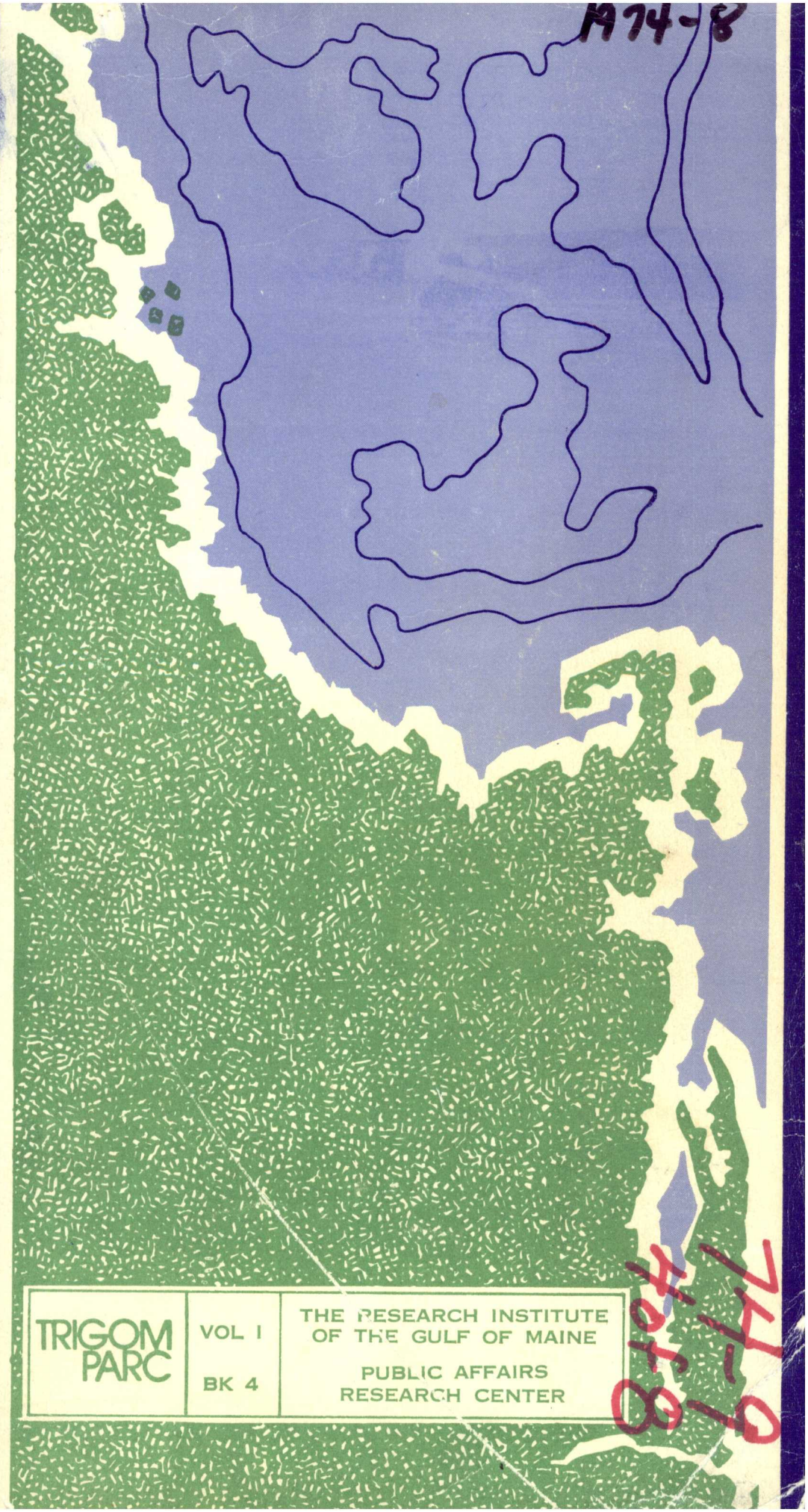
A Socio-Economic and Environmental Inventory of the North Atlantic Region

Sandy Hook to Bay of Fundy



TRIGOM PARC

VOL I

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A Socio-Economic and Environmental Inventory of the North Atlantic Region

including the Outer Continental Shelf and adjacent waters from Sandy Hook, New Jersey, to Bay of Fundy

VOLUME I

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13.1 INTRODUCTION

The birds of the study area must survive in one of the most densely populated urban regions in the world. That they do survive, and sometimes even flourish under these conditions is more a tribute to the general adaptive success and hardiness of the bird body plan, than a compliment to the magnanimity of a human population concerned with the future of other creatures. In the southern sector of the area, in the region of the New York Bight, can be found the highest human population density in the conterminous United States. New York City has a population of 26,343 people per square mile (U.S. Census, 1973), yet the same area supports an abundant and diverse avifauna with at least 150 breeding species on Long Island, New York (Bull; 1964). On the northerly coastline of the area, scarcely 336 miles, as the crow flies, from Hoboken, N. J. at the heart of the Newark Bay-New York Inner Harbor industrial area, lies Matinicus Island, home of a breeding colony of Black Guillemots, Common Puffins, Razorbills, and Arctic Terns, birds which are intolerant of human intrusion during their breeding season. However, recent controversies over construction of proposed oil refineries in New Hampshire (N.Y. Times, 1974) and Rhode Island (Providence Journal, 1974) illustrate that the status of habitats for birds anywhere in the study area is in flux.

Changes in the pattern of land use in the coastal region of the study area over the past two centuries have resulted in dramatic changes in the composition of the avifauna. Perhaps the most striking example is the astonishing success of the Herring Gull (Larus argentatus). Kadlec and Drury (1968) point out that the gull population in New England doubled between 1952 and 1966. A number of factors contributed to this increase, including increased availability of food at dumps and land fills. The increase in Herring Gull population levels has resulted in a decrease in tern populations (Gross, 1954) as the more aggressive gulls displaced the terns from suitable breeding areas.

This chapter summarizes the available information on the occurrence, numbers, population trends (where such information is available), distribution, and habitat preference of birds of the study area. Also, more detailed life history synopses are presented for those species which are considered important or "key species" by virtue of their abundance, rarity, distribution, place in the food web, or other criteria.

13.2 A WORD ON THE RELIABILITY OF POPULATION STATISTICS

Sources for population levels for many individual species can be found simply by looking up the species in question in sources like Biological Abstracts, Zoological Record, or Wildlife Review. Examples of good

population studies, carried out over relatively long periods of time include (but are not limited to) Stewart's (1958) examination of the Black Duck (Anas rubripes), Anderson and Henry's (1972) study of the Mallard (Anas platyrhynchos), and Drury's (1973, 1974) review of populations of New England seabirds. For a more general picture of changes in population levels of birds in the United States, there are four primary sources: (1) the National Audubon Society's Christmas Count, (2) the Cornell Nest Record Program, (3) the Migratory Bird Population Station (MBPS) breeding bird survey, and (4) the MBPS winter waterfowl survey.

The Christmas Count is the most readily available, and certainly the most widely publicized index of bird population levels. It is conducted annually, and its results are published in the journal American Birds (formerly Audubon Field Notes). The Christmas Count has been in existence for 73 years, and for many of those years it was, as Nathan Detroit might have said, not the best game in town, but the only game in town. Originating as a kind of sport, or friendly competition among bird-watchers, the count has now developed a degree of scientific respectability. Several criticisms of the count have been advanced. The first is that the count does not cover every square mile of the entire United States. This is a valid criticism, but hardly a fair one; there are simply not enough trained observers available in many regions. This criticism does not apply to the study area which is adequately covered. The second criticism is a curious corollary of the first. Year-to-year population figures in the count have been attacked on the grounds that, as the count has become more popular, with more participants, bird population figures have become inflated simply because there are more people to see the birds. Cruickshank (1971), then editor of the count, pointed out this difficulty, and it is true that until very recently, count figures were not weighted to reflect an increase in number of observers. Thus a reported decrease in population levels is likely to be highly significant, because the count is biased in the direction of increasing populations, but a reported increase may be either genuine or spurious, the artifact of an increased number of observers.

With the assistance of personnel at the Cornell Laboratory of Ornithology, subsequent Christmas Counts are to be put on a more substantial scientific footing. Counting and reporting techniques are to be standardized, and the count is to be machine processed.

The nature of the count makes some classes of observations more reliable than others. Rare birds, or birds with a limited geographic distribution are more likely to be reported accurately than "ordinary" widely distributed birds. Estimates of the numbers of birds which flock in enormous groups are likely to be off both in relative and absolute terms. A reasonably well-trained observer can differentiate fairly easily

between a flock of 15 sparrows and 20 sparrows, but there is not that much difference between a flock of 5,000,000 and 20,000,000 mixed blackbirds to an observer standing on the ground watching a continuous stream of birds passing from horizon to horizon. Geographic areas which are thinly populated by human beings are less likely to have sufficient numbers of enumerators to assure a comprehensive count, but this is not usually a problem in New England except in cases of extremely adverse weather, which influences both the numbers of census takers, and the visibility and activity of the birds.

In summary, the Christmas Count has many severe deficiencies, but in many cases, it is the only index available for long-term population changes.

The Cornell Nest Record Survey is a sophisticated, machine processed census of some aspects of the breeding biology of North American birds. Volunteer observers send in nest record cards containing information on species, number of eggs, number of fledglings, time of hatching, incubation period, and other variables. The survey has not been in existence long enough to generate much in the way of analyses of population trends, but the amount of data collected is impressive, and it is in a format that will eventually permit comprehensive treatment.

The MBPS breeding bird census is a new effort which is designed to correct a number of methodological difficulties with the Christmas Count, at the same time examining a different group of birds: the breeding birds, rather than the wintering birds. The breeding bird census so far is not generally available and can be studied only at the MBPS in Laurel, Maryland. The MBPS Winter Waterfowl Survey has examined population levels of waterfowl for many years. This census has the advantage of being conducted by trained observers. One of its major disadvantages is that the number of observers is only a tiny fraction of those involved in the Christmas Counts, and there is a limit to the geographic area one observer can cover.

In the study area, the only information available on long-term population changes for most species originates in the Christmas Counts, which have grave scientific objections. For policy decisions regarding land use, or assessing past or future impacts of development, there is a critical need for baseline population studies, at least for the most important species. Without these studies, conclusions about historical population trends can only be speculative.

13.3 GENERAL PICTURE OF THE BIRDS OF THE AREA

The habitats available to birds in the area run from the most heavily urbanized areas in the United States, to near wilderness conditions. The dominant geographical feature of the area, which influences both the kinds and distribution of birds, is the Atlantic Ocean. The

southerly part of the area, from Cape Cod south, is characterized by an avifauna which does not basically change in the coastal regions until the Carolinas. The northerly portion shows a different nature, in which seabirds, neritic and oceanic, assume a more dominant role. The northerly portions of the region also mark the southern boundaries of breeding for a number of birds such as the Black Guillemot, Razorbill, and Common Puffin, that generally breed in arctic regions (A.O.U., 1957).

There are 386 bird species that have been reported from the study area. This may be compared with a total of 380 species reported in coastal and offshore environmental inventory of the region Nantucket Shoals-Cape Hatteras (Heppner and Gould, 1973). Of this number, approximately 73% are routine residents, either wintering (63%), breeding (74%), or passing through in migration (74%); and 27% are accidentals or strays reported on rare occasions. Table 13-1 lists the status, breeding distribution, and changes in population numbers (where available) of all species reported from the study area.

Although in most cases, the absolute numbers of individual birds from year to year cannot be obtained, a general trend--increase or decrease--can be detected in many species. For example, the MBPS Winter Waterfowl Survey demonstrates such long-term trends. Table 13-2 lists population trends of selected winter waterfowl.

The population levels of some birds have declined so precipitously in recent years, that they are considered "rare" or "endangered" by the Federal Fish and Wildlife Service. Table 13-3 lists rare or endangered species occurring in the study area.

Some species, although not considered to be rare or endangered, have experienced recent declines of varying degrees of severity. Those species considered to be in rapid decline are also in Table 13-3.

Other species are declining somewhat over the entire study area. Table 13-4 lists those, and shows the populations in decline in the study area.

Finally, there are some species of birds which are declining in some regions of the study area, but are stable, or increasing in others. These are shown in Table 13-5.

Table 13-6 lists populations of species expanding their range or increasing in the study area, and Table 13-7 lists populations increasing in certain parts of the study area.

There are many causes for apparent decline, some natural, some human-oriented. Basically three classes of birds live in the area: breed-

ing birds, wintering birds, and migrants. A reported decline in migrants may be due simply to a change in the migration route, thus placing the migrants out of reach of enumerators. There are well documented long-term natural cycles in population levels, in species such as the Common Redpoll (Bull, 1964; Hill, 1965), which might suggest a decline, if the baseline year were a year of peak abundance. On the other hand, there are many potential causes for real long-term decline. An eelgrass (Zostera marina) blight caused a long period of decline in the Brant (Urner, 1934). Pesticides may lower breeding success (Hickey and Anderson, 1968; Stickel, 1968). Epizootic disease may thin the ranks for long periods of time (Davis, Anderson, Karstad, and Trainer, 1971). It is thus apparent that a simple statement of increase or decline is simplistic at best, and may be misleading.

13.4 "KEY" SPECIES IN AREA

Although all regularly occurring species in the area play some role in local ecosystems, it is possible to identify some species which are of greater interest than others. Table 13-8 presents detailed life history information on the species we identify as being of some ecological importance. Tables 13-9 to 11 present capsule data on a larger group, including winter waterfowl, game birds, shorebirds, and seabirds.

Some species are included simply because they exist in massive numbers in the study area, for example, the Herring Gulls, and many of the bay ducks. Others are listed for precisely the opposite reason; their numbers are low and declining, for example the Bald Eagle and Least Tern. Others play an important role disproportionate to their numbers in a particular habitat, the Great Blue Heron providing an example. Some are included because of their economic impact, primarily through hunting.

Other species are on the list because they are the most abundant forms of their type in the area, for example, the Least and Semipalmated Sandpipers among the shorebirds. The passerine birds listed are among the most common in shore, dune, and salt marsh areas.

Some seabirds have been included not so much because of their extra-ordinary numbers, but because they are fish eaters, and could thus be expected to be sensitive to increased levels of environmental pollutants. In this category are the Gannet, the cormorants and the alcids.

As the literature on the life histories of these important species was compiled, we were impressed by the observation that although a great deal is known about the lives of these birds from older studies, recent work, meeting the standards of modern ecological research, is very scarce. Future baseline studies, and perhaps more importantly, environ-

mental impact studies, must take recognizance of the fact that the most basic information on important topics like breeding success is almost non-existent for many species.

13.5 GEOGRAPHICAL FEATURES OF THE AREA IN RELATION TO BIRDS

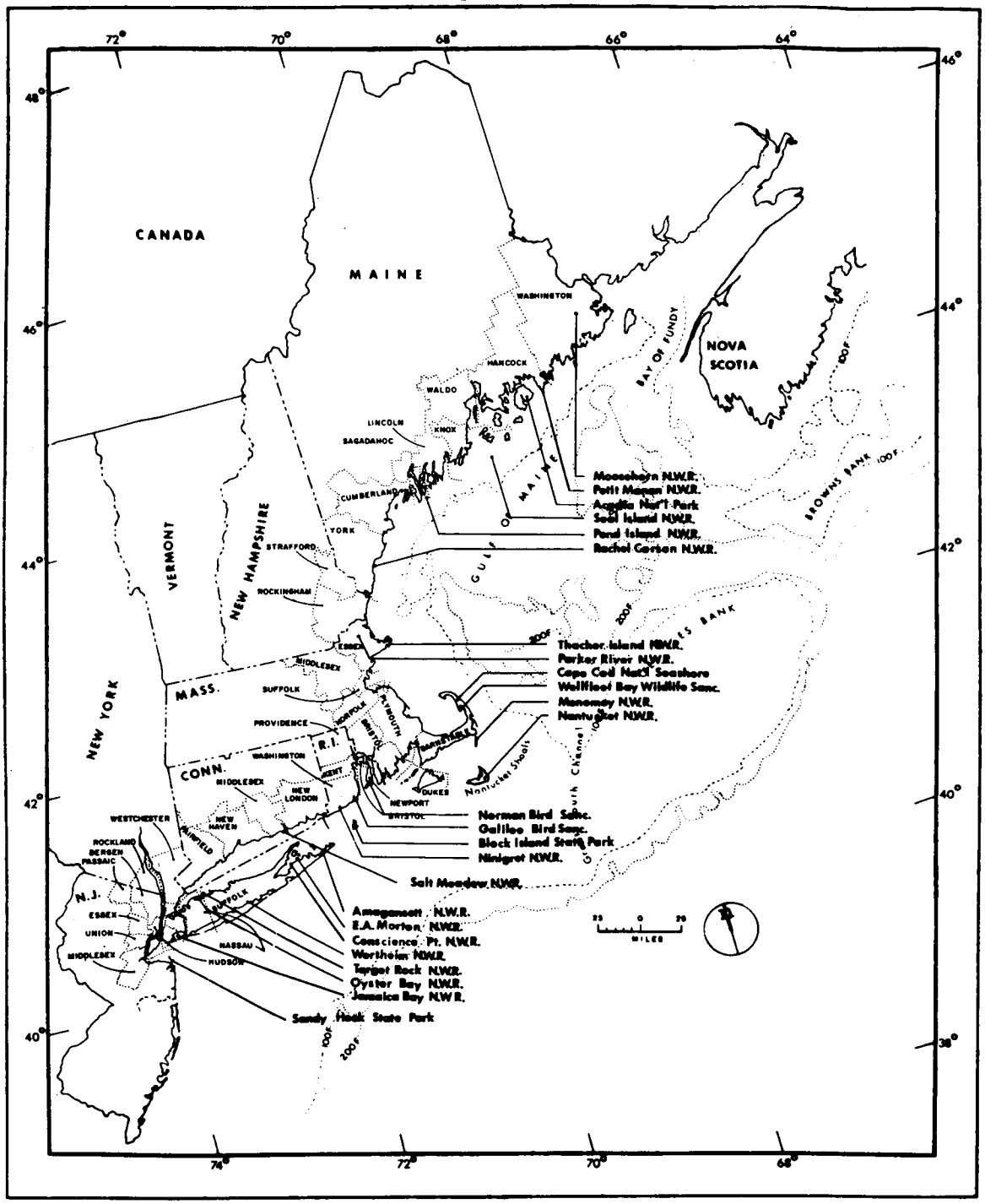
The coastline is marked by a series of shallow sawtoothed notches, and three major embayments; the Bay of Fundy, Penobscot Bay, and Narragansett Bay. To the south, Block Island and Long Island provide staging points during migration for land birds migrating along the coast. For birds, the northern portion of the study area is differentiated from the south by the presence of numerous small and medium sized islands off the coast of Maine, which provide breeding sites for sea birds.

To the south of the study area, to Cape Hatteras, the avifauna is strongly influenced by the presence of deep notches in the coastline: the major bays, Delaware Bay, Chesapeake Bay, and Albemarle Sound. These bodies of water offer obstacles to migration, and undoubtedly have been of importance in the development and evolution of historical migration routes. In the study area, no such series of obstacles exists, with the possible exception of the water barriers provided by Rhode Island and Vineyard Sounds, then Block Island Sound to Long Island. The northern small bays (Casco, Blue Hill, etc.) are bridged by series of islands.

Under certain weather conditions during migration, large numbers of small land birds will "pile up" in a restricted area, awaiting more favorable weather. In the southern portion of the study area, these areas include Sandy Hook, N.J.; Montauk, Long Island, N.Y.; Block Island, R.I.; and Cape Monomoy, Massachusetts. In the northern area, concentration points include Merrymeeting Bay and Biddeford Pool. Several of these areas are included as part of the state and federal system of refuges. Table 13-12 and Figure 13-1 show the location of the more important of these refuge areas.

Urbanization and suburbanization have drastically altered the complexion of the avifauna over the period of the last two centuries. Succession took place over much of the farmland abandoned in the great western human population movements of the 1840's and 1850's. This land was re-cleared in the last 100 years, as a result of the spread of suburbs from the great metropolitan areas. With each change in land use, there followed a change in the composition and numbers of the avifauna (Heppner and Gould, 1973; Bull, 1964).

Coastal development has also influenced the composition of the avifauna. Filling of salt marsh for residential, commercial, and industrial purposes has reduced the amount of breeding habitat for marsh birds. Resi-



A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION		
TRIGOM PARC	FIGURE 13-1	Major Wildlife Areas in the Study Region

dential developments for recreational purposes near beach areas have adversely affected Least Tern populations (Downing, 1973). Conversely, higher human population levels near the coast have provided additional food supplies for Herring and Great Black-backed Gulls.

Natural geographic forces also can alter the suitability of a given area for a particular species of bird. Beach erosion affects sand nesters. This phenomenon can be noted particularly on Cape Cod. The action of hurricanes can radically alter the location and area of salt marshes. Aerial photographs of Point Judith, R. I. taken before and after the hurricane of 1954 dramatically reveal the topographic resculpturing that follows a massive cyclone. Alterations in ocean currents can influence oceanic and neritic birds in very short order. The shift of the El Niño current off the western coast of South America affected the anchovy population, which in turn had an effect on the guanary birds, primarily cormorants.

The geography of an area is continually reshaped by natural and man-made forces, and it is to be expected that both the character and quantity of the avifauna of an area will reflect this dynamism.

13.6 BIRD HABITATS

It is possible to say with a great deal of precision that a sponge, or other sessile animal can be found in a particular habitat, and no other. One becomes more uneasy when trying to define and restrict the habitat of a creature like a lobster, or a mouse, which has a degree of mobility. For an animal like a bird, which is free to move in three dimensions, and can cover enormous distances in a short period of time, a habitat description becomes a statistical exercise, in which it can be stated that a certain habitat has a high probability of containing some species, a medium probability of containing others, and a remote, but finite chance of containing almost everything else. For example, in coastal areas strong onshore winds can carry to shore birds that normally do not get within a hundred miles of land, except for breeding.

There are about as many different ways of classifying habitat types as there are people who classify habitats. Most birds will routinely occupy one habitat type, but may occasionally be found in others. Thus a coastal and offshore inventory of birds must consider, at least briefly, habitat types that do not directly abut the shoreline. For example, the Connecticut Board of Fisheries and Game (1970) has a workable classification of near-shore areas that applies to many stretches of the study area coast. This classification includes: open water, salt marsh, open marsh, brushy marsh, hardwood swamp, open field and pastures, old field and thickets, hardwoods, and softwoods and plantations. An attempt will be made in this chapter, however, to follow the habitat classification

scheme generally followed in other portions of this report. Habitats are therefore classified as:

Oceanic: beyond the limits of the Continental Shelf

Neritic: "near-shore"--from the edge of the Continental Shelf to the littoral zone

Rocky shore: rocky areas, including jetties and breakwaters and the littoral (intertidal) zone

Beaches: sandy shore, both strand and littoral

Tidal flats: mud flats and sand bars exposed by falling tide

Upper beaches/dunes: sandy areas above high tide mark, and barrier beaches and dunes

"Salt marsh": tidal marsh and estuary, brackish marsh, seaside salt marsh, and tidal creeks

Fields: fields/pastures/meadows surrounding coastal areas; both wet and dry

Bays/sounds: bays, harbors, coves, etc.--more sheltered than oceanic and neritic

Table 13-13 indicates representative birds found in these habitats.It should be stressed that in almost all cases, birds do not occupy one habitat type exclusively, and some degree of mobility is to be expected.

13.7 ENERGY FLOW AND FOOD RELATIONSHIPS

Birds undoubtedly play an important role in many ecosystems, but precise information on energy transfer through birds is very scarce. Lucid's (1971) study of the ecology of Bissel's Cove, Rhode Island treats the role of birds quantitatively, but this paper was the only one we found concerning the birds of the study area.

Marine birds are often secondary and tertiary consumers, and at least in some areas of the world, the feeding activities of these birds are of major importance in mineral cycling, and energy flow through ocean surface environment. Coker (1962) points out that tens of thousands of tons of phosphate guano are produced in the guano islands off South America. In the offshore waters of the study area, there are many kinds, and large number of fish-eating birds, and it is probable that energy flow studies would show that these birds play an important role in energy transfer.

Although there is very little quantitative information available on food relationships in birds, qualitative information on birds' diets is easier to come by. Tables 13-14 to 18 list the known food preferences of the important birds of the area. Most birds are adventitious feeders, and if the food of choice is not available, they will turn to anything that falls within the spectrum of their dietary capabilities, thus these lists must be taken only as approximations based on the best available knowledge.

13.8 MIGRATION

One of the dominant features of the life cycle of many bird species is the annual migration to and from breeding grounds. With some significant exceptions, the study area is not the "end of the line" for many of the birds regularly occurring in the region, and the coast line represents a corridor through which migrating individuals pass twice yearly. The precise timing of migration is determined by a number of biological and geophysical factors, but the net result of these forces is an average date of departure for migration, and an expected arrival time at points along the way.

The generally consistent starting time for the journey permits the compilation of a list of estimated times of arrival at a given point along the route. Since not all individuals of a species will depart at exactly the same moment, or even the same week, there will be a range of dates in which it can be anticipated that a given species can be expected at a particular point. For example, the warblers generally pass north through Rhode Island in April and May. Table 13-19 shows the expected time of passage of migratory birds at various coastal points in the study area. Due to the difficulty of placing observers at sea during the migratory period, very little is known about the passage of oceanic birds. The individual species accounts in this report should be consulted for more detailed information about migration time of important species.

Birds passing through the study area generally follow a southwest to northwest azimuth in the spring, and reverse direction in the fall, in both cases following the coastline closely. There is increasing evidence (Gauthreaux and Able, 1970; Able, 1972, 1973) that wind direction plays a significant role in bird migration, and the mean direction of the prevailing wind may be important in the determination of the traditional migratory pathways. Coastal areas have well developed patterns of offshore and onshore winds at different times of the day, and these wind shifts may be important in both routing and timing of migration.

13.9 BREEDING AREAS, CONCENTRATION POINTS, AND REFUGES

In spite of heavy urbanization at the southern extreme of the study area, the coastline and its offshore islands provide abundant breeding habitat

for many bird species. Although the pressures of human population increase have encroached upon the available suitable habitat for some species, there remain many areas which provide the shelter, food, and other resources necessary for successful nesting. Some of these areas are surprisingly close to urban centers. Jamaica Bay National Wildlife Refuge lies within the corporate limits of New York City, for example.

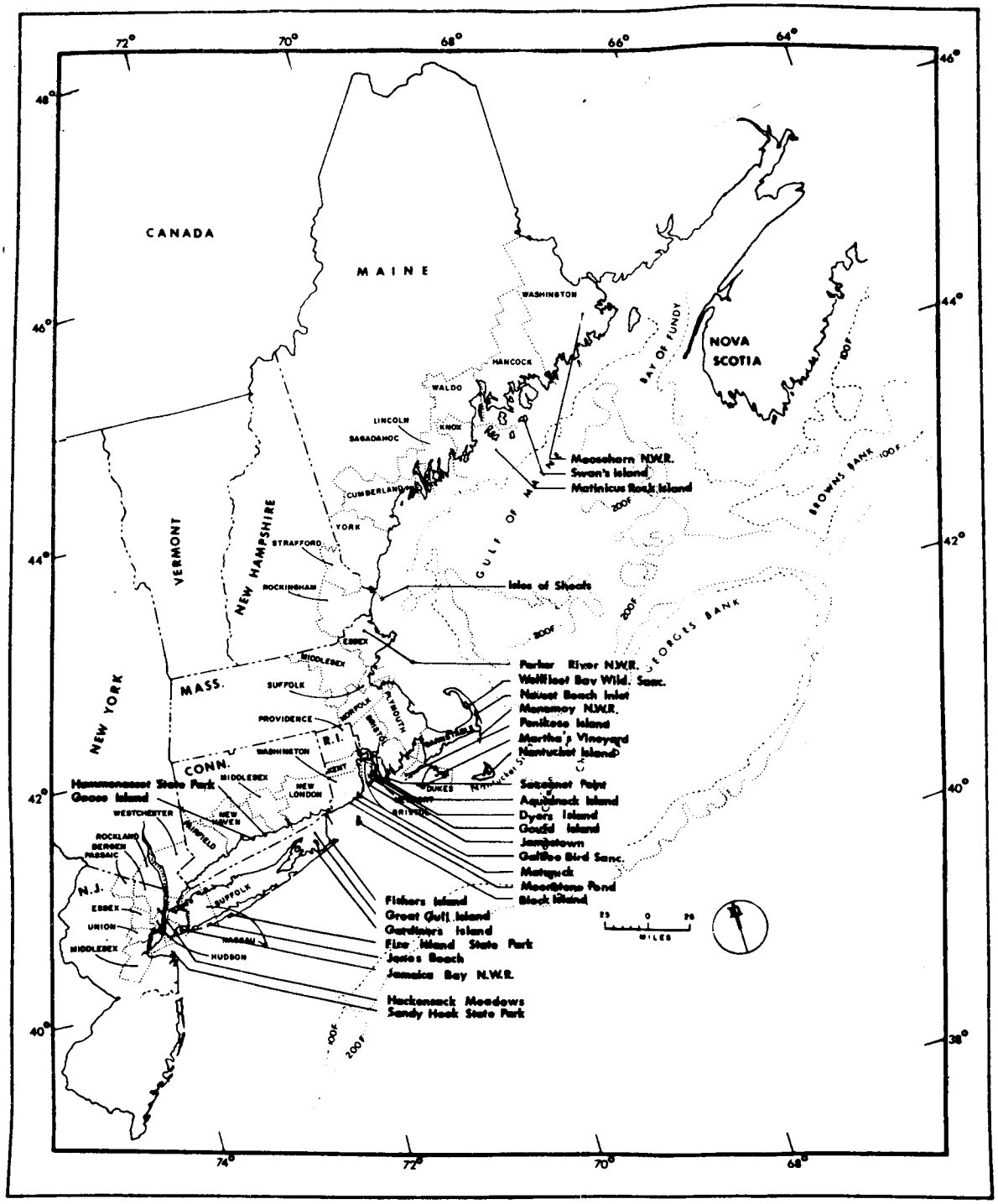
The offshore islands of Maine and New Brunswick are particularly good breeding areas for oceanic birds that normally come to land only to breed. It will be a matter of interesting debate in the near future that some of these northern islands are either sites for, or are located close to proposed heavy industrial development areas. Isles of Shoals, New Hampshire is an example of such an area, as are the islands off Machiasport, Maine.

Table 13-20 lists areas which have been identified as breeding areas for the species listed. Figure 13-2 indicates the location of the most important areas.

Many important breeding areas are now incorporated in refuges at the private, local, state and federal levels. Some of these areas are not only important breeding areas, but also places where large numbers of birds of passage gather under certain weather conditions. Block Island, Rhode Island, is such an area. The amount of protection that these areas offer to birds is widely variable. A refuge like Monomoy National Wildlife Refuge in Massachusetts has as its raison d'etre the preservation and encouragement of bird life, while some of the state parks have as their primary function outdoor recreation for humans, with bird protection being only a by-product.

13.10 CONCLUSIONS

The avifauna of this region shows both an impressive diversity, and resiliency in maintaining population levels on a self-sustaining basis in the face of severe competition from humans for space and resources. While it is true that some species, the Northern Bald Eagle for example, have demonstrated an alarming and incontrovertable decline in recent years, other species have not been adversely affected by urban and suburbanization, or have even been helped. Part of the success of the bird population of the area, taken as a whole, has been due to the fact that the northern offshore islands, home of the big seabird breeding colonies, have remained relatively isolated or unpopulated. It is probably safe to say that the real "crunch" between birds and humans in the Northeast has not yet occurred. Judging by the number of recent proposals for industrial development on the northern coast of the region, the capacity of the avifauna to absorb human intrusion may be put to the test in the not too distant future.



A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION

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FIGURE 13-2

Major Bird Breeding Areas in the Study Region

Birds are undoubtedly important elements in the ecology of the region, but quantifying this importance at present is impossible, because the most basic kinds of information are lacking. We do not know how much sea birds eat, and what influence their dietary habits have on fish populations. We are ignorant of the effects of seabird guano on the nutrient level of the ocean surface. We have very little idea of the role of sea ducks in winter, rafting on bays that have slow flushing.

The bird populations of the area, at this point in time, are generally in good shape, with some significant exceptions. Whether this happy condition will persist may well depend on decisions on land use made in the near future. These decisions will involve some hard choices, and it is hoped that the decision makers will recall the fate of Prometheous, who found to his regret that the forces of nature do not look with favor upon impudent tamperings with their affairs.

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TABLE 13-1

List of all birds occurring in area (scientific names are from Checklist of North American Birds, A.O.U., 1957 and 32nd Supplement to the A.O.U. Checklist of N.A. Birds, A.O.U., 1974). The order in which species are presented generally follows the classification of Storer (1971). Column 1 indicates the occurrence of the bird in the area. Column 2 indicates decreases or increases of the species in the study area; lack of information in this column indicates stability in numbers as far as is known. Column 3 indicates general breeding distribution within the study area. For additional information about the starred (*) species, the reader is referred to the individual species accounts. Primary sources for this table are: Bailey (1968); Bent (1919-1968); Bull (1964); Forbush (1939); Griscom and Snyder (1955); Griscom and Sprunt (1957); Hill (1965); Matthiessen (1959); Palmer (1949 Palmer (1962); and Squires (1952). In addition, the current state check-lists, and key regional check-lists for each state o: province in the study area, where available, were used to bring earlier references up to date. Definitions for status (accidental, etc.) are from Bull (1964).

Abbreviations: A=Accidental (1-6 records); C=Casual (7-12 records); Hypo=Hypothetical; Unc=Uncommon; Irreg=Irregular; Occ=Occasional; Reg=Regular; Inc=Increasing; Dec=Decreasing; Exp=Expanding; Re=Resident; W=Winter,Winters; F=Fall; Sp=Spring; Su=Summer, Summers; B=Breeds;NB=Non-breeding; (B)=Perhaps sporadic breeding or breeds in a very small part of the study area; Mg=Migrant, Migrates; n=north; s=south; e=east; w=west; c=central; Conn.=Connecticut; L.I.=Long Island, N.Y.; Me.= Maine; Mass.=Massachusetts; N.B.=New Brunswick; N.H.=New Hampshire; N.J.=New Jersey; N.Y.=New York; N.S.=Nova Scotia; R.I.= Rhode Island; N.W.R.=National Wildlife Refuge.

	Status in Study Area	Changes in #'s	Breeding Distribution
Gavia immer Common Loon	W;Mg;Su(NB)	--	--
Gavia adamsii Yellow-billed Loon	A	--	--
Gavia arctica Arctic Loon	C/A in W; rare	Has become Reg in some areas	--

Table 13 - 1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Gavia stellata Red-throated Loon	W; Mg	Inc in W on Cape Cod	--
Podiceps grisegena Red-necked Grebe	W;Mg(rare to fairly common	Erratic & Irreg	--
Podiceps auritus Horned Grebe	Su(rare) W; Mg	Inc since 1945 (Cape Cod)	--
Podiceps caspicus Eared Grebe	C/A(Mg+W)	--	--
Aechmophorus occidentalis Western Grebe	A	--	--
Podilymbus podiceps Pied-billed Grebe	Mg;W (C to N.B.)	Inc	--
Diomedea chlororhynchos Yellow-nosed Albatross	A	--	--
Fulmarus glacialis Fulmar	W s.to Mass.; C south of Mass.	Inc + expanding range	--
Puffinus diomedea Cory's Shearwater	Ranges Su + F post-B visitant	--	--
*Puffinus gravis Greater Shearwater	Mg;Su thru W visitant (ranges)	Some Inc (Cape Cod)	--
Puffinus griseus Sooty Shearwater	Su/F;Mg Post-B visitant (ranges)	Inc (Cape Cod)	--
Puffinus puffinus Manx Sheawater	C	--	--

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Puffinus assimilis Little Shearwater	A	--	--
Puffinus lherminieri Audubon's Shearwater	C	--	--
Pterodroma hasitata Black-capped Petrel	A	--	--
Pterodroma arminjoniana South Trinidad Petrel	A	--	--
Pelagodroma marina White-faced Storm Petrel	A(2 records)	--	--
Oceanodroma leucorhoa Leach's Storm Petrel	B;Ranges;Mg	Dec	N.B. to Mas
Oceanites oceanicus Wilson's Storm Petrel	Ranges(Su)	--	--
Hydrobates pelagicus British Storm Petrel	Hypo/A	--	--
Phaethon aethereus Red-billed Tropicbird	A(1 record)	--	--
Phaethon lepturus White-tailed Tropicbird	C/A	--	--
Pelecanus erythrorhynchos White Pelican	C/A(records all but N.H., N.B., N.S.)	--	--
Pelecanus occidentalis Brown Pelican	A	Dec	--
Sula leucogaster Brown Booby	A	--	--
*Morus bassanus Gannet	Mg;Su/W (Ranges)	Inc (Cape Cod)	--

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
*Phalacrocorax carbo Great Cormorant	W;Su(N.B.-s to Me.)	Inc (Cape Cod) Dec(N.B.)	--
*Phalacrocorax auritus Double-crested Cormorant	B;Su;W(L.I. south)	Inc+ Exp range	L.I.Sound to N.B.
Fregata magnificens Magnificent Frigatebird	A	--	--
*Ardea herodias Great Blue Heron	B;W;Mg	Dec in New Eng.; Inc in N.J.	Entire area but Cape Cod
Butorides virescens Green Heron	B;Mg;W(Occ)	Dec	Entire area
Casmerodius albus Great Egret	B;Su(wanders)	Inc + expanding range n	n to N.Y., Mass.
Florida caerulea Little Blue Heron	B;Su(wanders)	Inc slightly on Cape Cod; Dec N.Y.	C in Mass; mainly N.J. south
Bubulcus ibis Cattle Egret	Recorded n to Me.;B; Su	Expanding range n	B n to N.J. + L.I.
Dichromanassa rufescens Reddish Egret	A	--	--
Egretta thula Snowy Egret	B;Su(wanders) n to N.B.,N.S.	Inc + exp range n	B n to L.I. casually to Mass.
Hydranassa tricolor Louisiana Heron	B;C n of L.I.	Inc	B n to N.J. L.I.

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Nycticorax nycticorax Black-crowned Night Heron	B;W(Mass. (Irreg) s)	Dec	Entire Area
Nyctanassa violacea Yellow-crowned Night Heron	B;Su(wanders n to N.S.); W(Occ)	Inc	n to L.I., Cape Cod
Ixobrychus exilis Least Bittern	B;W(C n to N.S.)	--	Entire area rare + local
Botaurus lentiginosus American Bittern	B;W(Occ); Mg	--	Entire area
Mycteria americana Wood Stork	C	--	--
Plegadis falcinellus Glossy Ibis	B;Wanders Sp & Su n to N.S.	Inc + exp range	Irreg n to L.I., R.I.
Eudocimus albus White Ibis	C/A;wanders n to L.I., Su + F	--	--
Phoenicopterus ruber American Flamingo	A	--	--
*Cygnus olor Mute Swan	B; W	Inc + expanding range	R.I. south
Olor columbianus Whistling Swan	W; Mg	Inc on Cape Cod	--
*Branta canadensis Canada Goose	B;W;Mg	Inc (Cape Cod)	R.I.north
Branta bernicla Brant	W(Mass. s); Mg	Inc	--
Branta nigricans Black Brant	C	--	--

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Anser albifrons White-fronted Goose	W(C)	--	--
Chen caerulescens Snow Goose	W;Mg	Inc on Cape Cod	--
Dendrocygna bicolor Fulvous Tree Duck	A	--	--
*Anas platyrhnchos Mallard	B;W;Mg	Inc	Entire area
*Anas rubripes Black Duck	B;W;Mg	Dec as B in N.B.	Entire area
Anas strepera Gadwall	B;W(L.I.s); Mg	Dec in N.Y. area	Irreg n to Parker River N.W.R.,Mass.
Anas acuta Pintail	B;W;Mg	Dec	se N.B.; Parker River N.W.R.,Mass.
Anas crecca Eurasian Green-winged Teal	A/C;very rare to unc W visitant	Dec	--
Anas crecca carolinensis American Green-winged Teal	B;W;Mg	Exp B range Dec(N.Y.-non-breeders) Inc(Cape Cod-W)	Very locally & Irreg throughout study area
Anas discors Blue-winged Teal	B;Mg	Inc	Locally + rarely entire area
Anas penelope European Wigeon	W(rare to unc); Mg	Dec since 1953 N.Y. area	--
Anas americana American Wigeon	W;Mg;(B)	Inc + expanding range	2 B records in N.Y. area

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Anas clypeata Shoveler	W;B;Mg	Perhaps Inc slightly	B Irreg + locally L.I.+N.B.
Aix sponsa Wood Duck	Mg;B	--	Entire area
Aythya americana Redhead	(B);W;Mg	Dec	(Introduced L.I.+bred 1961,1962)
Aythya collaris Ring-necked Duck	W(Mass.s); B;Mg	--	Me.,N.B., N.S.; C at Cape Cod (Falmouth)
Aythya valisineria Canvasback	W(Mass.s) Mg;C/A in N.B.,N.S.	--	--
*Aythya marila Greater Scaup	W;Mg	Stable since 1930	--
Aythya affinis Lesser Scaup	W(Conn., N.Y. s); Mg;Su(Occ)	Inc on Cape Cod	--
Aythya fuligula Tufted Duck	A	--	--
*Bucephala clangula Common Goldeneye	B;W;Su(Occ)	Inc slowly on Cape Cod	--
Bucephala islandica Barrow's Goldeneye	W(rare)	--	--
*Bucephala albeola Bufflehead	W;Mg	Inc on Cape Cod	--
*Clangula hyemalis Oldsquaw	W;Mg;Su(Occ)	--	--

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Histrionicus histrionicus Harlequin Duck	W(rare to unc)	--	--
*Somateria mollissima Common Eider	W;B;Mg	Inc in Me.	Me.,N.B., N.S.
Somateria spectabilis King Eider	W(rare + Irreg s of Mass.)	--	--
*Melanitta deglandi White-winged Scoter	Su(s to Mass.) W; Mg	--	--
Melanitta perspicillata Surf Scoter	W;Mg;Su(Occ)	Inc slightly on Cape Cod	--
Melanitta nigra Black Scoter	W;Mg;Su(Occ)	--	--
Oxyura jamaicensis Ruddy Duck	(B);W(Mass. south);Mg; C(N.S.,N.B.)	Inc	B N.J., L.I., s R.I.,+ maybe Monomoy,Cape Cod + Parker River,N.W.R., Mass.
Oxyura dominica Masked Duck	A	--	--
Lephodytes cucullatus Hooded Merganser	W(N.Y. + Mass. south) Mg;Su(Occ)	Inc in N.Y. area	--
Mergus merganser Common Merganser	W;Mg;Su(Occ)	Inc on Cape Cod	--
*Mergus serrator Red-breasted Merganser	B;W;Mg	Dec in N.Y. area	B rarely + locally Monomoy, Cape Cod; L.I.,N.Y. 2nd Grand Manan area, N.B.

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Cathartes aura Turkey Vulture	B;C(Mass.-north)	Inc	n to N.J.; locally to L.I.,R.I.
Coragyps atratus Black Vulture	C	--	--
Elanoides forficatus Swallow-tailed Kite	A	Dec	--
Accipter gentilis Goshawk	W(rare + Irreg)	--	--
Accipter striatus Sharp-shinned Hawk	W;B;Mg	Dec	Entire area
Accipter cooperii Cooper's Hawk	B;W(s Me.+ Mass. south); Mg	Dec	Entire area
Buteo jamaicensis Red-tailed Hawk	B;W(s Me. south);Mg	Dec	Entire area
Buteo lineatus Red-shouldered Hawk	B;W(Mass. (rarely) south);Mg	Dec	Entire area
Buteo platypterus Broad-winged Hawk	B; Mg	--	Entire area
Buteo swainsoni Swainson's Hawk	C	--	--
Buteo lagopus Rough-legged Hawk	W(Me. s)	Dec in Cape Cod area	--
Aquila chrysaetos Golden Eagle	Su;Rare + Irreg Mg + W visitant	Dec rapidly	--
Haliaeetus albicilla Gray Sea Eagle	C	--	--

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
*Haliaeetus leucocephalus Bald Eagle	B;W;Mg;Su	Dec rapidly	--
Circus cyaneus Marsh Hawk	B;W(Mass. south);Mg Su	Dec	Entire area
*Pandion haliaetus Osprey	B;Mg	Dec rapidly	Entire area rare + local N.J. to Mass.
Falco rusticolus Gyrfalcon	Rare + Irreg Mg W visitant	--	--
Falco peregrinus Peregrine Falcon	Unc to rare Mg + W visitant	Dec (Endangered)	--
Falco columbarius Pigeon Hawk (Merlin)	Mg;B	--	N.H.(probably); Me., N.B.,N.S.
Falco tinnunculus Kestrel	A	--	--
Falco sparverius Sparrow Hawk (American Kestrel)	B;W;Mg	Dec	Entire area
Canachites canadensis Spruce Grouse	Re(Me., N.B.,N.S.)	--	Me.,N.B., N.S.
Bonasa umbellus Ruffed Grouse	Re(N.B.,N.S. to Conn.)	--	N.S.,N.B. to Conn.
Colinus virginianus Bobwhite	Re(s Me. south)	Dec	s Me. south
Phasianus colchicus Ring-necked Pheasant	Re	--	Entire area
Rallus elegans King Rail	B;W;C in Maine	--	Rare + local Mass., R.I.,Conn., L.I.+n N.J.

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Rallus longirostris Clapper Rail	B;W(s Conn. (Occ)+N.Y. south) C(Mass.to N.S.)	--	Parker River N.W.R.,Mass.; Conn.+L.I. south
Rallus limicola Virginia Rail	B;Mg	Dec in N.Y. area	Entire area (mainly fresh water)
Porzana carolina Sora	Mg;B;(W-Occ in N.Y.,Conn., Mass.)	Dec in N.Y. area	Entire area
Coturnicops noveboracensis Yellow Rail	B;Mg(rare)	--	Rare + local Me.,Mass., Conn.
Laterallus jamaicensis Black Rail	B;Mg	--	Rare + local in N.J., N.Y.,Conn.
Crex crex Corn Crake	A	Dec	--
Porphyrula martinica Purple Gallinule	C;wanders n to N.S.	--	--
Gallinula chloropus Common Gallinule	B;W(C n to N.Y.,Mass.) Su+F(C N.H. north)	Inc in L.I., N.Y.+ N.J.; Dec on Cape Cod	Locally at Parker River, Monomoy, L.I.+N.J. south
Fulica americana American Coot	B;W(Occ n to N.Y.-Mass.) Mg	Inc	Entire area
Haematopus palliatus American Oystercatcher	B;C(N.B., Mass.,Conn., N.Y.)	Inc in N.Y. area	B from L.I.+ N.J. s
Vanellus vanellus Lapwing	A	--	--

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
*Charadrius semipalmatus Semipalmated Plover	Mg;(B)	--	s N.S.
Charadrius melodus Piping Plover	B;Mg	--	Entire area
Charadrius wilsonia Wilson's Plover	C(R.I.n) B	--	Rare + local in L.I.,N.J., Conn.
Charadrius vociferus Killdeer	B;W(N.H. (Irreg) s) Mg	Inc	Entire area
Pluvialis dominica American Golden Plover	Mg	Inc slowly	--
*Pluvialis squatarola Black-bellied Plover	W(Mass (rarely) south);Mg	--	--
Arenaria interpres Ruddy Turnstone	Su;Mg; W(Occ n to Mass.)	Inc in W in N.Y. area	--
Philohela minor American Woodcock	B;W(Occ); Mg	Dec	Mass. s
Capella gallinago Common Snipe	B;W(C/Irreg); Mg	Dec in Cape Cod area	Entire area (C in southern portion)
Numenius americanus Long-billed Curlew	C	Dec	--
Numenius arquata Eurasian Curlew	A	--	--
Numenius phaeopus Whimbrel	Su(mainly N.J.s);Mg	--	--
Numenius borealis Eskimo Curlew	Mg(C)	Dec(on verge of extinction)	--

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Bartramia longicauda Upland Sandpiper	B;Mg	Dec rapidly	Rare + local in N.J.+L.I.
Actitis macularia Spotted Sandpiper	B;Mg	Dec in Cape Cod area	Parker River N.W.R.+ Cape Cod s to Md.
Tringa solitaria Solitary Sandpiper	Mg;Su(rare)	Dec on Cape Cod	--
Catoptrophorus semipalmatus Willet	B;Mg; Su	Inc slowly; Expanding range(C. s. inornatus dec)	Local in sw N.S.,N.B.
Tringa melanoleucus Greater Yellowlegs	Su;W(L.I. (rarely)s) Mg	--	--
Tringa flavipes Lesser Yellowlegs	W(L.I. (rarely) south)	Dec	--
Calidris canutus Knot	Su(Occ); W(C);Mg	Inc	--
Calidris maritima Purple Sandpiper	W;Mg	Inc	--
Calidris melanotos Pectoral Sandpiper	Mg(mainly in Fall)	Dec	--
Calidris fuscicollis White-rumped Sandpiper	Mg;Su(C)	Dec in N.Y. area	--
Calidris bairdii Baird's Sandpiper	Mg(rare + local)	--	--
*Calidris minutilla Least Sandpiper	Su;Mg;(B)	Dec in N.Y. area	Sable Is., N.S.

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Calidris ferruginea Curlew Sandpiper	C(Mg)	--	--
Calidris alpina Dunlin	W(Mass.s); Mg(Sp)	Inc	--
Limnodromus griseus Short-billed Dowitcher	Mg	Inc in Cape Cod area	--
Limnodromus scolopaceus Long-billed Dowitcher	Mg(unc to rare;mainly Fall)	--	--
Micropalama himantopus Stilt Sandpiper	Mg(F; mainly s of Me.)	Dec on Cape Cod	--
*Calidris pusillus Semipalmated Sandpiper	Mg;Su	--	--
Calidris mauri Western Sandpiper	Mg(C/rare)	--	--
Tryngites subruficollis Buff-breasted Sandpiper	Mg(Unc/rare; mainly F)	--	--
Limosa fedoa Marbled Godwit	Mg(C/rare; mainly F)	Inc in Cape Cod area	--
Limosa lapponica Bar-tailed Godwit	A	--	--
Limosa haemastica Hudsonian Godwit	Mg(Unc/rare)	Inc in Cape Cod area	--
Philomachus pugnax Ruff	C/A	Inc ?	--
*Calidris alba Sanderling	Su;W(Mass.s);Mg	Inc in Cape Cod area	--
Recurvirostra americana American Avocet	Mg(C/rare)	--	--

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Himantopus mexicanus Black-necked Stilt	Mg(C)	Dec	--
Phalaropus fulicarius Red Phalarope	Mg	--	--
Steganopus tricolor Wilson's Phalarope	Mg(C);Su	--	--
*Lobipes lobatus Northern Phalarope	Mg	--	--
Stercorarius pomarinus Pomarine Jaeger	Su(s to Mass.; offshore) W(C n to Mass.; offshore);Mg	--	--
Stercorarius parasiticus Parasitic Jaeger	W(offshore); Mg	--	--
Stercorarius longicaudus Long-tailed Jaeger	Mg;W(offshore)	--	--
Catharacta skua Skua	Su(offshore s to Mass.); W(offshore, C N.S. to Mass.)	--	--
Larus hyperboreus Glaucous Gull	W;Su(s to Me)	Dec	--
Larus glaucoides Iceland Gull	Su(s to Mass.) W	Dec on Cape Cod; Inc in N.Y. area	--
*Larus marinus Great Black-backed Gull	B;W;Mg Su;Re	Inc; Expanding range	Entire area
Larus fuscus Lesser Black-backed Gull	A	--	--
*Larus argentatus Herring Gull	B;W;Mg; Su; Re	Inc	Entire area

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Larus delawarensis Ring-billed Gull	B;Su;W;Mg	Inc	N.S.+N.B. s to L.I. (few N.J. records)
Larus canus Mew Gull	A	--	--
Larus ridibundus Black-headed Gull	C/A	Inc	--
Larus atricilla Laughing Gull	B;Mg;Su	Dec as breeder; Inc as Mg	Entire area
Larus pipixan Franklin's Gull	A	--	--
Larus philadelphia Bonaparte's Gull	Su(s to Mass.); W(C n of Mass.)	--	--
Larus minutus Little Gull	C	--	--
Pagophila eburnea Ivory Gull	W(C)	--	--
Rissa tridactyla Black-legged Kittiwake	W(along coast + offshore)	--	--
Xema sabini Sabine's Gull	(W);Mg (s to L.I.)	--	--
Gelochelidon nilotica Gull-billed Tern	C/A	Dec	--
Sterna forsteri Forster's Tern	C;Mg(n to N.H.)	Inc in N.Y. area	--
*Sterna hirundo Common Tern	B;W;Mg	Dec as breeder; Inc as Mg	Entire area

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Sterna paradisaea Arctic Tern	B;Mg	Dec	s to Cape Cod
Sterna dougallii Roseate Tern	B;Mg;Su	Dec	Local Entire area
Sterna fuscata Sooty Tern	Ranges (C)	--	--
*Sterna albifrons Least Tern	B;Mg	Dec as breeder	N.J. to Mass;very local n of Mass.
Thalasseus maximus Royal Tern	Wanders (n to Mass.	Inc	--
Chlidonias niger Black Tern	Su(n to Mass.);Mg	Inc	--
Anous stolidus Noddy Tern	A	--	--
Rynchops nigra Black Skimmer	B;Wanders (n to N.B.+ N.S.)	Inc	Local,Mass. to N.J.
*Alca torda Razorbill	B;W(s to L.I.,rarely N.J.)	Inc slowly since 1947 on Cape Cod	s to e Me.
Uria aalge Common Murre	W(C s to Mass.,L.I., N.J.)	--	--
Uria lomvia Thick-billed Murre	W	Dec in Cape Cod area	--
Plautus alle Dovekie	W(rarely s to N.J.); Su(s to e Me.)	--	--

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
*Cepphus grylle Black Guillemot	W(rarely s to L.I.+N.J.); B	Inc	s to Me,N.H. (Isles of Shoals)
Fratercula arctica Common Puffin	B;W(mainly to Mass.; C s to N.J.)	--	s to N.B + Maine
Lunda cirrhata Tufted Puffin	A	--	--
Columba livia Rock Dove	Re	--	Entire area
Zenaida macroura Mourning Dove	B;W(Occ n to Mass.); Su	Inc	Entire area
Columbina passerina Ground Dove	C/A	--	--
Coccyzus americanus Yellow-billed Cuckoo	B;Mg	--	Entire area
Coccyzus erythrophthalmus Black-billed Cuckoo	B;Mg	--	Entire area
Tyto alba Barn Owl	B;Ranges (C n to s Me. + N.S.)	--	Mass. s
Otus asio Screech Owl	Re	Dec sharply on Cape Cod since 1955	Maine s
Bubo virginianus Great Horned Owl	Re	Inc in Cape Cod area	Entire area
Nyctea scandiaca Snowy Owl	W(Irreg)	--	--
Strix varia Barred Owl	Re	--	Entire area

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Asio otus Long-eared Owl	B;W;Mg	--	Entire area
Asio flammeus Short-eared Owl	B;W;Mg	Dec	Entire area
Aegolius funereus Boreal Owl	(B);W(s to Mass.)	--	s to Grand Manan, N.B.
Aegolius acadicus Saw-whet Owl	B;W	Dec in Cape Cod area	Entire area
Caprimulgus carolinensis Chuck-will's-widow	C	--	--
Caprimulgus vociferus Whip-poor-will	B;Mg	Dec	Entire area
Chordeiles minor Common Nighthawk	B;Mg	Dec rapidly	Entire area
Chaetura pelagica Chimney Swift	B;Mg	--	Entire area
Archilochus colubris Ruby-throated Hummingbird	B;Mg;Su	--	Entire area
Megaceryle alcyon Belted Kingfisher	B;W(Unc n to Me., N.H.)	--	Entire area
Colaptes auratus Yellow-shafted Flicker	B;Re;Mg	Inc in Cape Cod area	Entire area
Dryocopus pileatus Pileated Woodpecker	B;Re(C in W in s Mass. + R.I.)	--	Entire area
Centurus carolinus Red-bellied Woodpecker	Mg	Expanding range n	--
Dendrocopos villosus Hairy Woodpecker	B;W	--	Entire area

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Dendrocopos pubescens Downy Woodpecker	B;W	--	Entire area
Tyrannus tyrannus Eastern Kingbird	B;Mg	--	Entire area
Tyrannus dominicensis Gray Kingbird	C	--	--
Tyrannus verticalis Western Kingbird	C;Mg(chiefly in F)	--	--
Muscivora tyrannus Fork-tailed Flycatcher	A	--	--
Muscivora forficata Scissor-tailed Flycatcher	C	--	--
Myiarchus crinitus Great Crested Flycatcher	B;Mg	Inc + expanding range	Entire area
Sayornis phoebe Eastern Phoebe	B;W(C); Mg	--	Entire area
Sayornis saya Say's Phoebe	A	--	--
Empidonax flaviventris Yellow-bellied Flycatcher	B;Mg	--	s to w N.Y.
Empidonax traillii Traill's Flycatcher	B;Mg	Expanding range s + e	Entire area
Empidonax minimus Least Flycatcher	B;Mg	--	Entire area
Contopus virens Eastern Wood Pewee	B;Mg	--	Entire area
Eremophila alpestris Horned Lark	B;W;Mg; Su(n to N.B.)	Inc + expanding range	Mass. s

Table 13-1 (continued)

	Status in Study Area	Changes in #'s	Breeding Distribution
*Iridoprocne bicolor Tree Swallow	B;W(Occ); Mg	--	Entire area
Riparia riparia Bank Swallow	B;Mg	--	Entire area
Stelgidopteryx ruficollis Rough-winged Swallow	B;Mg	Inc in Cape Cod area	s Maine
Hirundo rustica Barn Swallow	B;Mg	Dec in Cape Cod area	Entire area
Petrochelidon pyrrhonota Cliff Swallow	B;Mg	Dec	Entire area
Progne subis Purple Martin	B;Mg	Dec	Local, Entire area
Perisoreus canadensis Gray Jay	B;W(s to s Mass.)	--	N.B. s to Maine
Cyanocitta cristata Blue Jay	Re;Su(Grand Manan,N.B.)	--	Entire area
Corvus corax Common Raven	(Re);C (N.H. s)	--	se Me., s N.B.,N.S.
Corvus brachyrhynchos Common Crow	B;W;Mg	Dec in N.Y. area	Entire area
Corvus ossifragus Fish Crow	Re	--	Local, n to R.I.,Conn., L.I.
Parus atricapillus Black-capped Chickadee	Re;W	--	Entire area
Parus hudsonicus Boreal Chickadee	(Re);C(W, s to N.J.)	--	Me.,Grand Manan,N.B.; N.S.
Parus bicolor Tufted Titmouse	(Re);C(n of Me.)	Inc + expanding range	R.I., Mass. south

Table 13-1 (continued)

	Status in Study Area	Changes in #'s	Breeding Distribution
Sitta carolinensis White-breasted Nuthatch	Re	--	Entire area
Sitta canadensis Red-breasted Nuthatch	B;W	--	s to e Mass. (local)
Certhia familiaris Brown Creeper	B;W	--	s to se N.Y.
Troglodytes aedon House Wren	B;Mg;W (Occ)	Expanding range on Cape Cod	Entire area
Troglodytes troglodytes Winter Wren	B;W(Mass. s,mainly); Mg	--	s to Me. + N.H.;C to L.I.(not on Cape Cod)
Thryomanes bewickii Bewick's Wren	C/A	--	--
Thryothorus ludovicianus Carolina Wren	Re(n to se Mass.); B	Inc + expanding range	n to s Me.
*Telmatodytes palustris Long-billed Marsh Wren	B;W	--	Entire area
Cistothorus platensis Short-billed Marsh Wren	B;W(Occ n to L. I.); Mg	Dec in N.Y. area	Entire area
Mimus polyglottos Mockingbird	Re;C(N.B.+ N.S.)	Expanding range	se Mass. s; sporadically/ locally n to s Me.
Dumetella carolinensis Catbird	B;(W n to L.I.)	Inc	Entire area
Toxostoma rufum Brown Thrasher	B;W(C n to Mass.); Su(Grand Manan,N.B.)	Inc	Me. s
Turdus migratorius American Robin	B;W(C n to N.H.,s Me.); Mg	--	Entire area

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Ixoreus naevius Varied Thrush	C	--	--
Hylocichla mustelina Wood Thrush	B;Mg	Inc + expanding range	C N.H.+sw Me.; C n to s N.B.
Catharus guttatus Hermit Thrush	B;Mg	Dec	s to Mass.; locally on Cape Cod, L.I., n N.J.
Catharus ustulatus Swainson's Thrush	Mg	--	--
Catharus minimus Gray-cheeked Thrush	(B);Mg	--	s N.S.
Catharus fuscescens Veery	B;Mg	--	N.B.+N.S. s; very rare + local on coastal plain of L.I. + N.J.
Sialia sialis Eastern Bluebird	B;W(se Mass. s); Mg	Dec rapidly	Locally entire area
Polioptila caerulea Blue-gray Gnatcatcher	Su(C);Mg (C); B	Inc in N.Y. area	n N.J.+L.I. south
Regulus satrapa Golden-crowned Kinglet	B;W;Mg	--	south to s Maine
Regulus calendula Ruby-crowned Kinglet	B;Mg	--	N.S. + n Me. (locally s to Mt. Desert Is., Me.)
Anthus spinoletta Water Pipit	(W)(Irreg n to se N.Y., R.I.)	--	--

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Bombycilla garrulus Bohemian Waxwing	W(Irreg s to Conn., Mass.)	--	--
Bombycilla cedrorum Cedar Waxwing	B;W(Irreg, Mass. s)	--	Rare + local on coastal plain, entire area
Lanius excubitor Northern Shrike	W	--	--
Lanius ludovicianus Loggerhead Shrike	B;W(C);Mg	--	Entire area
*Sturnus vulgaris Starling	Re	Inc	Entire area
Vireo griseus White-eyed Vireo	B;Su/Mg (C n to Mass.)	Dec in N.Y.area	Local R.I. south
Vireo belli Bell's Vireo	A	--	--
Vireo solitarius Solitary Vireo	B;Mg	--	Very rare + local Entire area
Vireo olivaceous Red-eyed Vireo	B;Mg	--	Entire area
Vireo philadelphicus Philadelphia Vireo	Mg(mainly Fall)	--	--
Vireo gilvus Warbling Vireo	B;Mg	Dec in N.Y.area	Very rare + local coastal breeder, Entire area
Mniotilta varia Black-and-White Warbler	B;Mg	--	Rare + local on coastal plain, entire area
Protonotaria citrea Prothonotary Warbler	C/A	--	--

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Helmitheros vermivorus Worm-eating Warbler	B;Mg	--	n locally to N.J.,L.I., s Conn.
Vermivora chrysoptera Golden-winged Warbler	B;C(n to Me.,N.B.); Mg	--	e Mass. + s Conn. south
Vermivora pinus Blue-winged Warbler	B;C(n to s N.H.,N.B); Mg	Inc + expanding range	se Mass. s
Vermivora peregrina Tennessee Warbler	B;Mg	--	s Me., s N.B. (Grand Manan)
Vermivora celata Orange-crowned Warbler	W(C n to Mass.,N.S.); Mg	--	--
Vermivora ruficapilla Nashville Warbler	B;Mg	--	Rare + local Entire area
Parula americana Parula Warbler	B;Mg	Dec	Rare + local Entire area
Dendroica petechia Yellow Warbler	B;Mg	--	Entire area
Dendroica magnolia Magnolia Warbler	Mg	--	--
Dendroica tigrina Cape May Warbler	B;Mg	--	s to s Me.
Dendroica caerulescens Black-throated Blue Warbler	B;Mg	--	s to se N.Y., Conn., R.I., + Mass.
*Dendroica coronata Yellow-rumped Warbler	W;B;Mg	--	s to Me; formerly to coastal Mass.
Dendroica virens Black-throated Green Warbler	B;Mg	Dec	Rare + local Entire area

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Dendroica cerulea Cerulean Warbler	C	--	--
Dendroica fusca Blackburnian Warbler	B;Mg	--	N.S.+N.B. s to Mass.
Dendroica dominica Yellow-throated Warbler	W(C n to Mass.)	--	--
Dendroica pensylvanica Chestnut-sided Warbler	B; Mg	Dec on Cape Cod	N.S.+N.B. s to Mass., R.I.,Conn.
Dendroica castanea Bay-breasted Warbler	B;Mg	--	N.B.+N.S. s to s Me. + N.H.
Dendroica striata Blackpoll Warbler	B;Mg	--	N.B.+N.S. s to s Maine
Dendroica pinus Pine Warbler	B;W(C n to N.H.); Mg	Dec	Local breeder in pine woods c Maine south
Dendroica discolor Prairie Warbler	B;Mg	Dec on Cape Cod; Inc in N.Y. area	Mass. south
Dendroica palmarum Palm Warbler	B;W(C n to Cape Cod); Mg	--	s to e Maine
Seiurus aurocapillus Ovenbird	B;Mg	Dec on Cape Cod	Entire area
Seiurus noveboracensis Northern Waterthrush	B;Mg	--	s to Mass., rarely to R.I.
Seiurus motacilla Louisiana Waterthrush	B;Mg; C in Me., N.B.,N.S.	--	R.I. south
Opopronis formosus Kentucky Warbler	B;C n to Mass.,N.S.; Mg	Dec in N.Y. area	n to N.Y., Conn.

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Oporonis agilis Connecticut Warbler	Mg(mainly Fall)	Dec in N.Y. area	--
Oporonis philadelphia Mourning Warbler	B;Mg	--	s to s Me.
Geothlypis trichas Yellowthroat	B;Mg	--	Entire area
Icteria virens Yellow-breasted Chat	B;W(C n to N.Y., Mass.); Mg	Inc	s N.H. south (rare + erratic on Cape Cod)
Wilsonia citrina Hooded Warbler	B;W(C n to Me.,N.B.); Mg	Inc	Locally n to R.I.
Wilsonia pusilla Wilson's Warbler	B;Mg	--	s to n N.H., c Me.
Wilsonia canadensis Canada Warbler	B;Mg	--	Rarely to the coasts of R.I., Mass.,Conn., Me. + N.B.
Setophaga ruticilla American Redstart	B;Mg	Inc on Cape Cod	Local on coast entire area
Passer domesticus House Sparrow	Re	--	Entire area
Dolichonyx oryzivorus Bobolink	B;Mg	Dec	Entire area
Sturnella magna Eastern Meadowlark	B;W;Mg	Dec (Inc in N.B.)	Entire area
Xanthocephalus xanthocephalus Yellow-headed Blackbird	C/A	--	--
*Agelaius phoeniceus Red-winged Blackbird	B;W(C n to N.H.); Mg	--	Entire area

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Icterus spurius Orchard Oriole	B;C(N.H. north); Mg	Dec in N.Y. area	ne Mass. s (excluding Cape Cod)
Icterus galbula Baltimore Oriole	B;W(Occ); Mg	--	Entire area
Euphagus carolinus Rusty Blackbird	B;W(n to s Me.);Mg	--	N.S.,s N.B. + e Me.
Cassidix major Boat-tailed Grackle	C	--	--
Quiscalus quiscula Common Grackle	Re;Mg	--	Entire area
Molothrus ater Brown-headed Cowbird	B;W(n to Conn.; rarely to n Me.); Su(Grand Manan,N.B.)	Inc in Cape Cod area	Entire area
Piranga ludoviciana Western Tanager	A	--	--
Piranga olivacea Scarlet Tanager	B;Mg	Inc + expanding range	Local on coastal plain, entire area
Piranga rubra Summer Tanager	C	--	--
Richmondena cardinalis Cardinal	Re;C(n to Me.,N.S.)	Inc + expanding range	n to Mass., R.I.
Pheuticus ludovicianus Rose-breasted Grosbeak	B;Mg	--	Entire area
Guiraca caerulea Blue Grosbeak	C	--	--

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Passerina cyanea Indigo Bunting	B;Mg	Inc	Local, Entire area
Passerina ciris Painted Bunting	C	--	--
Spiza americana Dickissel	C	Dec on Cape Cod; Dec(erratic in N.Y. area)	--
Hesperiophona vespertina Evening Grosbeak	W;B;Mg	Inc + expanding range	e + s to N.Y., Conn., + N.J.(not Cape Cod)
Carpodacus purpureus Purple Finch	W;B;Mg	Inc	Entire area
Carpodacus mexicanus House Finch	B;W	Inc + expanding range	L.I.,parts of Conn.,R.I.,+ N.Y.
Pinicola enucleator Pine Grosbeak	B;W	--	c Me., s N.B., + N.S.
Acanthis hornemanni Hoary Redpoll	W(Irreg)	--	--
Acanthis flammea Common Redpoll	W	--	--
Spinus pinus Pine Siskin	B;W;Mg	--	Rare + local on coastal plain s to N.Y.
Spinus tristis American Goldfinch	B;W;Mg	--	Entire area
Loxia curvirostra Red Crossbill	B;W;Mg	Dec in Cape Cod area	N.S. to e Mass.
Loxia leucoptera White-winged Crossbill	B/Re; Wanders(W)	Inc on Cape Cod	N.S.+s N.B. (Grand Manan); sporadically s to Mt.Desert Is., Me.

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Piplio erythrophthalamus Rufous-sided Towhee	B;W(Mass. s);C(N.B. + N.S.)	Inc	sw Me. s
Calamospiza melanocorys Lark Bunting	Mg(C)	--	--
Passerculus sandwichensis princeps Ipswich Sparrow	W;Mg	Dec ("rare")	(Sable Is., N.S.)
*Passerculus sandwichensis Savannah Sparrow	B;W;Mg	Dec	Entire area
Ammodramus savannarum Grasshopper Sparrow	B;C(N.B.)	Dec	Maine s
Ammodramus bairdii Baird's Sparrow	A	--	--
Ammodramus henslowii Henslow's Sparrow	B;Mg	Dec	Mass.(not Cape Cod) south
*Ammospiza caudacuta Sharp-tailed Sparrow	B;W(C n to Mass.); Mg	Dec	Entire area
Ammospiza maritima Seaside Sparrow	B;W(Occ n to Mass.); C(Me.,N.B., N.S.)	--	Mass. s
Pooecetes gramineus Vesper Sparrow	B;W(Occ)	Dec	Unc local breeder Entire area
Chondestes grammacus Lark Sparrow	W(Occ);C/A	--	--
Junco hyemalis Dark-eyed Junco	B;W;Mg	--	s to Mass., Conn.
Spizella arborea Tree Sparrow	W;Mg	Dec in Cape Cod area	--

Table 13-1 (continued)

	Status in Study Area	Changes In #'s	Breeding Distribution
Spizella passerina Chipping Sparrow	B;W(rarely); Mg	--	Entire area
Spizella pallida Clay-colored Sparrow	C	--	--
Spizella pusilla Field Sparrow	B;W(Mass. south)	Dec as breeder on Cape Cod; Inc in W	s Me. south
Zonotrichia leucophrys White-crowned Sparrow	C(W+Mg)	Inc in W in N.Y. area	--
Zonotrichia albicollis White-throated Sparrow	B;W(C n of Mass.);Mg	Inc in W in Cape Cod area	Mass.,R.I. north
Passerella iliaca Fox Sparrow	W;Mg	--	--
Melospiza lincolnii Lincoln's Sparrow	B;Mg	--	e Me. north
Melospiza georgiana Swamp Sparrow	B;W(mainly Mass. s); Mg	Inc in W on Cape Cod	Entire area
*Melospiza melodia Song Sparrow	B;W;Mg	--	Entire area
Calcarius lapponicus Lapland Longspur	W	--	--
Calcarius pictus Smith's Longspur	A	--	--
Calcarius ornatus Chestnut-collared Longspur	W(C)	--	--
Plectrophenax nivalis Snow Bunting	W;Mg	--	--

TABLE 13-2

Population numbers of selected winter waterfowl, 1955-1973, northern New Jersey to Maine, numbers from Winter Waterfowl Survey, Migratory Bird Population Station, Laurel, Maryland[1]

	1955	1957	1959	1961	1963	1965	1967	1969	1971	1973
Black Duck	76,959	81,627	60,422	83,516	90,003	94,175	81,490	99,116	74,929	78,651
Bufflehead	8,241	5,442	6,788	4,912	4,913	6,290	12,420	5,795	9,104	8,144
Canvasback	1,471	7,250	8,592	3,320	4,066	9,659	11,328	4,125	4,675	6,397
Coot	1,300	695	397	240	34	300	1,013	--	310	180
Gadwall	--	40	--	--	25	10	--	7	135	--
Goldeneye	16,888	27,650	30,981	28,596	41,991	36,918	28,725	28,999	12,616	22,054
Green-winged Teal	30	--	16	35	32	--	--	--	23	--
Mallard	4,359	4,055	3,818	6,211	6,435	8,973	6,488	7,894	13,859	9,491
Merganser	4,018	8,672	6,045	7,924	7,865	7,850	6,315	3,837	5,228	4,345

[1]U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife. Office memorandum. Published yearly.

Table 13-2 (continued)

	1955	1957	1959	1961	1963	1965	1967	1969	1971	1973
Oldsquaw	587	716	1,898	1,145	6,024	1,166	3,460	684	623	2,305
Pintail	178	247	359	95	34	5	17	--	2	--
Redhead	50	100	591	5,993	6,895	50	210	2	12	9
Ruddy Duck	165	475	510	273	67	1,390	318	106	--	--
Scaup	152,074	179,503	140,068	144,565	130,179	227,629	219,709	136,253	172,731	121,782
Scoter & Eider	19,811	42,636	41,269	43,158	82,437	95,087	217,581	79,347	49,795	81,836
Wigeon	5,212	9,960	9,781	6,697	7,377	5,069	4,378	3,488	3,277	1,025

Table 13-3 Populations in rapid decline in the study area.

Species	Populations in rapid decline in the study area[1]				Literature sources
	Breeding	Wintering	Migrating	Summering	
Golden Eagle		X	X	X	Palmer,1949;Anderson & Hickey,1970
Bald Eagle	X	X	X	X	Drury,1973;U.S.Dept.of Interior, 1973
Osprey	X		X		Bailey,1968;Bull,1964
*Peregrine Falcon		X	X		Bull,1964;Hill,1965; U.S.Dept.of Interior,1973
*Eskimo Curlew(Extinct?)			X		U.S.Dept.Interior,1973; Bull,1964
Upland Sandpiper	X		X		Bailey,1968;Bull,1964
Common Nighthawk	X		X		Bull,1964;Hill,1965
Eastern Bluebird	X	X	X		Bailey,1968;Bull,1964

* = "Endangered"(official list of the U.S. Dept. of the Interior, 1973)

1 Other populations of a particular species may also be in decline outside of the study area, e.g. the breeding population of the Eskimo Curlew, and the Peregrine Falcon.

Table 13-4. Populations declining throughout most of the study area (casual/accidental species not included).

Species	Population in decline within Study Area				Literature sources
	Breeding	Wintering	Migrating	Summering	
Leach's Storm Petrel	X		X		Drury, 1973; Palmer,1949
Great Blue Heron	X	X	X		Drury, 1973
Black-crowned Night Heron	X	X	X		Bailey,1968; Drury,1973; Hill, 1965
Pintail		X			M.B.P.S.--Winter Waterfowl Survey
Wigeon		X	X		Bull,1964;M.B.P.S.--Winter Waterfowl Survey
Redhead		X	X		Bailey,1968;Bull,1964; M.B.P.S.--Winter Waterfowl Survey
Sharp-shinned Hawk	X	X	X		Bull, 1964;Hill,1965
Cooper's Hawk	X	X	X		Anderson & Hickey,1970; Henny,1972;Hill,1965
Red-tailed Hawk	X	X	X		Bailey,1968;Bull,1964
Red-shouldered Hawk	X		X		Henny,1972
Golden Eagle		X	X	X	Anderson & Hickey,1970
Bald Eagle	X	X	X	X	Drury,1973;Godfrey,1970; U.S.Dept.Interior,1973
Marsh Hawk	X	X	X	X	Anderson & Hickey,1970; Bull,1964;Hill,1965

Table 13-4 (continued)

Species	Population in decline within Study Area				Literature sources
	Breeding	Wintering	Migrating	Summering	
Osprey	X		X		Ames,1968;Ames & Mer-sereau,1964;Bailey,196 Bull,1964;Godfrey,1970 Henny,1972;Henny & Wight,1969;Hill,1965; Kury,1966
Peregrine Falcon		X	X		Anderson & Hickey,1970 Bull,1964;Godfrey,1970 U.S. Dept.Interior,197
Sparrow Hawk	X	X	X		Henny,1972
American Woodcock	X	X	X		Bull,1964;Hill,1965
Eskimo Curlew			X		Godfrey,1970; U.S. Dept. Interior,1973
Upland Sandpiper	X		X		Bailey,1968;Bull,1964 Hill,1965
Lesser Yellowlegs		X	X		Bull,1964;Hill,1965
Glaucous Gull		X		X	Bull,1964;Hill,1965
Laughing Gull	X				Bailey,1968;Bull,1964 Drury,1973;Nisbet,1971
Common Tern	X				Bailey,1968;Clement & Woodruff,1962; Drury, 1973;Hill,1965,Nisbet, 1973
Arctic Tern	X		X	X	Hawksley,1957;Nisbet,19
Roseate Tern	X		X		Clement & Woodruff,1962 Nisbet,1973

Table 13-4 (continued)

Species	Population in decline within Study Area				Literature sources
	Breeding	Wintering	Migrating	Summering	
Least Tern	X				Clement & Woodruff,196 Hill,1965;Nisbet,1973
Short-eared Owl	X	X	X		Bull,1964;Hill,1965
Whip-poor-will	X		X		Bull,1964;Hill,1965
Common Nighthawk	X		X		Bull,1964;Hill,1965
Cliff Swallow	X		X		Bull,1964;Hill,1965
Purple Martin	X		X		Bailey,1968;Bull,1964
Hermit Thrush	X		X		Bull,1964;Hill,1965
Eastern Bluebird	X	X	X		Bailey,1968;Bull,1964; Hill,1965
Parula Warbler	X		X		Bull,1964;Hill,1965
Black-throated Green Warbler	X		X		Bull,1964;Hill,1965
Pine Warbler	X	X	X		Bull,1964;Hill,1965
Bobolink	X		X		Bull,1964;Hill,1965
Eastern Meadowlark	X	X	X		Bull,1964;Hill,1965
Savannah Sparrow	X	X	X		Bull,1964;Elliott,1955; Hill,1965;Godfrey,1970; U.S. Dept.Interior, 197
Grasshopper Sparrow	X				Bull,1964;Hill,1965
Sharp-tailed Sparrow	X	X	X		Bull,1964;Hill,1965
Vesper Sparrow	X	X			Bull,1964;Hill,1965

TABLE 13-5

Populations declining in certain parts of the study area (casual/accidental species not included).

Species	Location & status of declining population	Literature source
Great Cormorant	New Brunswick: Wintering, summering	
Green Heron	Cape Cod area: Breeding, wintering, migrating	Bailey,1968;Hill,1965
Little Blue Heron	New York area: Breeding	Bull, 1964
Gadwall	New York area: Breeding, wintering,migrating	Bull, 1964
American Green-winged Teal	New York area: Summering	Bull, 1964
Red-breasted Merganser	New York area: Breeding, wintering, migrating	Bull, 1964
Rough-legged Hawk	Cape Cod area: Wintering	Hill, 1965
Bobwhite	New York area: Breeding, wintering	Bull, 1964
Virginia Rail	New York area: Breeding, migrating	Bull, 1964
Sora	New York area: Breeding, wintering, migrating	Bull, 1964
Common Snipe	Cape Cod area: Wintering, migrating	Hill, 1965
Spotted Sandpiper	Cape Cod area: Breeding, migrating	Hill, 1965
Solitary Sandpiper	Cape Cod area: Migrating	Hill, 1965
White-rumped Sandpiper	New York area: Migrating, summering	Bull, 1964
Least Sandpiper	New York area: Breeding, migrating, summering	Bull, 1964
Stilt Sandpiper	Cape Cod area: Migrating	Hill, 1965

Table 13-5 (continued)

Species	Location & status of declining population	Literature source
Iceland Gull	Cape Cod area: Summering, wintering	Hill, 1965
Thick-billed Murre	Cape Cod area: Wintering	Hill, 1965
Screech Owl	Cape Cod area: Resident, wintering	Hill, 1965
Saw-whet Owl	Cape Cod area: Resident, wintering	Hill, 1965
Barn Swallow	Cape Cod area: Breeding, migrating	Hill, 1965
Common Crow	New York area: Breeding, migrating, wintering, summering	Bull, 1964
Short-billed Marsh Wren	New York area: Breeding, wintering, migrating	Bull, 1964
White-eyed Vireo	New York area: Breeding, migrating, summering	Bull, 1964
Warbling Vireo	New York area: Breeding, migrating	Bull, 1964
Chestnut-sided Warbler	Cape Cod area: Breeding	Hill, 1965
Prairie Warbler	Cape Cod area: Breeding, migrating	Hill, 1965
Ovenbird	Cape Cod area: Breeding, migrating	Hill, 1965
Kentucky Warbler	New York area: Breeding, migrating	Bull, 1964
Connecticut Warbler	New York area: Migrating	Bull, 1964
Orchard Oriole	New York area: Breeding, migrating	Bull, 1964
Red Crossbill	Cape Cod area: Wintering	Hill, 1965
Tree Sparrow	Cape Cod area: Wintering, migrating	Hill, 1965
Field Sparrow	Cape Cod area: Breeding	Hill, 1965

TABLE 13-6. Populations expanding their range and/or increasing throughout most of the Study Area (causal/accidental species not included).

Species	Population Increasing Within Study Area				Literature sources
	Breeding	Wintering	Migrating	Summering	
Pied-billed Grebe	X	X	X		Bull,1964;Hill,1965
Fulmar		X			Salomonsen,1965
Great Cormorant		X			Bailey,1968;Bull,1964; Hill,1965
Double-crested Cormorant	X		X		Bailey,1968;Drury,1973
Great Egret	X			X	Bull,1964;Hill,1965 Post,1961
Little Blue Heron	X			X	Hill,1965;Post,1961
Cattle Egret	X			X	Bailey,1968;Bull,1964; Hill,1965
Snowy Egret	X			X	Bull,1964;Hill,1965; Post,1961
Louisiana Heron	X			X	Bull,1964;Post,1961
Yellow-crowned Night Heron	X			X	Bull,1964;Post,1961
Glossy Ibis	X			X	Bull,1964;Post,Enders & Davis, 1970
Mute Swan	X	X		X	Bull,1964;Hill,1965; Willey,1968
Brant		X	X		Bull,1964;Hill,1965
Mallard		X			M.B.P.S. Winter Waterfowl Survey

Table 13-6 (continued)

Species	Population Increasing Within Study Area				Literature sources
	Breeding	Wintering	Migration	Summering	
Blue-winged Teal	X		X		Bull,1964;Hill,1965
Shoveler	X	X	X		Bull,1964;Hill,1965
Ruddy Duck		X	X		Bull,1964;Hill,1965
Turkey Vulture	X	X	X		Bull,1964;Hill,1965
American Coot	X	X	X		Bull, 1964;Hill,1965
Killdeer	X	X	X		Bull,1964;Hill,1965
American Golden Plover			X		Bull,1964;Hill,1965
Willet	X		X		Bull,1964;Erskine,1967
Knot			X	X	Bailey,1968;Bull,1964 Hill,1965
Purple Sandpiper		X			Bull,1964;Hill,1965
Dunlin		X	X		Bull,1964;Hill,1965
Great Black-backed Gull	X	X	X	X	Drury,1973;Hickling,1969; Kadlec & Drury,1968;
Herring Gull	X	X	X	X	Bailey,1968; Bull,1964 Hill,1965
Ring-billed Gull	X	X	X	X	Bull,1964;Hill,1965
Royal Tern				X	Bull,1964;Hill,1965

Table 13-6 (continued)

Species	Population Increasing Within Study Area				Literature sources
	Breeding	Wintering	Migrating	Summering	
Black Tern				X	Bull,1964;Hill,1965
Black Skimmer	X			X	Bull,1964;Hill,1965
Black Guillemot	X	X			Drury,1973
Mourning Dove		X			Bailey,1968;Bull,1964 Hill,1965
Tufted Titmouse	X	X			Bailey,1968;Beddall,1963; Bull,1964
Carolina Wren	X	X	X		Beddall,1963
Mockingbird	X	X			Bailey,1968;Beddall,1963; Bull,1964
Catbird		X			Bull,1964;Hill,1965
Brown Thrasher	X	X			Bull,1964;Hill,1965
Wood Thrush	X		X		Bull,1964;Hill,1965
Starling	X	X	X		Bull,1964;Hill,1965
Yellow-breasted Chat		X			Bull,1964;Hill,1965
Hooded Warbler			X		Bailey,1968;Hill,1965
Cardinal	X	X	X		Bailey,1968;Beddall,1963; Bull,1964;Hill,1965
Indigo Bunting	X		X		Bailey,1968;Bull,1964; Hill,1965

Table 13-6 (continued)

Species	Population Increasing Within Study Area				Literature sources
	Breeding	Wintering	Migrating	Summering	
Evening Grosbeak		X			Bailey,1968;Bull,1964 Hill,1965
Rufous-sided Towhee		X			Bull,1964;Hill,1965

TABLE 13-7

Populations increasing in certain parts of the study area (casual/accidental species not included).

pecies	Location & status of increasing populations	Literature sources
ed-throated Loon	Cape Cod area: Wintering	Hill,1965
orned Grebe	Cape Cod area: Wintering, migrating	Hill,1965
reater Shearwater	Cape Cod area: Summer-winter visitant	Hill,1965
ooty Shearwater	Cape Cod area: Migrating	Hill,1965
annet	Cape Cod area: Migrating; Summer-winter visitant	Bailey,1968;Hill,1965
histling Swan	Cape Cod area: Wintering, migrating	Hill,1965
anada Goose	Cape Cod area: Wintering, migrating	Hill,1965
now Goose	Cape Cod area: Wintering, migrating	Hill,1965
merican Green-winged Teal	Cape Cod area: Wintering, migrating	Hill,1965
esser Scaup	Cape Cod area: Wintering, migrating	Hill,1965
ommon Goldeneye	Cape Cod area: Wintering	Hill,1965
ufflehead	Cape Cod area: Wintering	Hill,1965
ommon Eider	Maine: Breeding	Choate,1966
urf Scoter	Cape Cod area: Wintering, migrating	Hill,1965
ooded Merganser	New York area: Wintering, migrating	Bull,1964
ommon Merganser	Cape Cod area: Wintering, migrating	Hill,1965
parrow Hawk	Cape Cod area: Wintering	Bailey,1968;Hill,1965
ommon Gallinule	New York area: Breeding, wintering	Bull,1964
merican Oystercatcher	New York area: Breeding, wintering, migrating	Bull,1964
uddy Turnstone	New York area: Wintering	Bull,1964
hort-billed Dowitcher	Cape Cod area: Migrating	Hill,1965

Table 13-7 (continued)

Species	Location & status of increasing populations	Literature sources
Marbled Godwit	Cape Cod area: Migrating	Hill,1965
Hudsonian Godwit	Cape Cod area: Migrating	Hill,1965
Sanderling	Cape Cod area: Summering, wintering, migrating	Hill,1965
Iceland Gull	New York area: Wintering	Bull,1964
Forster's Tern	New York area: Migrating	Bull,1964
Razorbill	Cape Cod area: Wintering	Hill,1965
Great Horned Owl	Cape Cod area: Resident	Hill,1965
Yellow-shafted Flicker	Cape Cod area: Breeding, wintering, migrating	Hill,1965
Great Crested Flycatcher	Cape Cod area: Breeding, migrating	Hill,1965
Traill's Flycatcher	New York area: Breeding	Bull,1964
Horned Lark	Cape Cod area: Breeding	Hill,1965
Rough-winged Swallow	Cape Cod area: Breeding, migrating	Hill,1965
House Wren	Cape Cod area: Breeding, migrating	Hill,1965
Blue-gray Gnatcatcher	New York area: Breeding, migrating	Bull,1964
Blue-winged Warbler	New York area: Breeding	Bull,1964
Prairie Warbler	New York area: Breeding	Bull,1964
American Redstart	Cape Cod area: Breeding	Hill,1965
Brown-headed Cowbird	Cape Cod area: Breeding, wintering	Hill,1965
Scarlet Tanager	Cape Cod area: Breeding	Hill,1965
Purple Finch	Cape Cod area: Breeding	Hill,1965
House Finch	New York area: Breeding, wintering	Bull,1964
White-winged Crossbill	Cape Cod area: Wintering	Hill,1965
Field Sparrow	Cape Cod area: Wintering	Hill,1965

Table 13-7 (continued)

Species	Location & status of increasing populations	Literature sources
White-crowned Sparrow	New York area: Wintering	Bull,1964
White-throated Sparrow	Cape Cod area: Wintering	Hill,1965
Swamp Sparrow	Cape Cod area: Wintering	Hill,1965

List of Key Species

Puffinus gravis
Greater Shearwater

Morus bassanus
Gannet

Phalacrocorax carbo
Great Cormorant

Phalacrocorax auritus
Double-crested Cormorant

Ardea herodias
Great Blue Heron

Cygnus olor
Mute Swan

Branta canadensis
Canada Goose

Anas platyrhynchos
Mallard

Anas rubripes
Black Duck

Aythya marila
Greater Scaup

Bucephala clangula
Common Goldeneye

Bucephala albeola
Bufflehead

Clangula hyemalis
Oldsquaw

Somateria mollissima
Common Eider

Melanitta deglandi
White-winged Scoter

Mergus serrator
Red-breasted Merganser

List of Key Species (cont.)

Haliaeetus leucocephalus
Bald Eagle

Pandion haliaetus
Osprey

Charadrius semipalmatus
Semipalmated Plover

Pluvialis squatarola
Black-bellied Plover

Calidris minutilla
Least Sandpiper

Calidris pusillus
Semipalmated Sandpiper

Calidris alba
Sanderling

Lobipes lobatus
Northern Phalarope

Larus marinus
Great Black-backed Gull

Larus argentatus
Herring Gull

Larus atricilla
Laughing Gull

Sterna hirundo
Common Tern

Sterna albifrons
Least Tern

Alca torda
Razorbill

Cepphus grylle
Black Guillemot

Iridoprocne bicolor
Tree Swallow

List of Key Species (cont.)

Telmatodytes palustris
Long-billed Marsh Wren

Sturnus vulgaris
Starling

Dendroica coronata
Yellow-rumped Warbler

Agelaius phoeniceus
Red-winged Blackbird

Passerculus sandwichensis
Savannah Sparrow

Ammospiza caudacuta
Sharp-tailed Sparrow

Melospiza melodia
Song Sparrow

TABLE 13-8 Key Species in the Study Area.

Abbreviations Used in the Species Accounts

Abund. = Abundant
Acc. or Accid. = Accidental
Avg. = Average
B. or Br. = breeds, breeder, breeding
Ext. = Extreme
F. = Fall
freq. = frequent, frequently
gen. = generally, general
imm. = immature
impt. = important, importance
indiv. = individual (s)
infreq. = infrequent, infrequently
irr. or irreg. = irregular
L.I. or L. Is. = Long Island
Max. = maximum (numbers)
Mg. = Migrant, migrates, migration
N.W.R. = National Wildlife Refuge
Nfld. = Newfoundland
Occ. = occasional
partic. = particularly
pr. or prs. = pair or pairs
R.T.P. = Roger Tory Peterson (see Bibliography)
Re. = resident
Reg. or regul. = regular
Rel. = relatively
Su. = Summer
Sp. = Spring
Unc. = Uncommon
W. = Winter
W/ = with; w/in = within; w/out = without
yr. or yrs. = year or years
V. = visitant
n. = north
s. = south
e. = east
w. = west
Is. = Island
$\sim$ = approximately

N.S. = Nova Scotia
N.B. = New Brunswick
Me. = Maine
N.H. = New Hampshire
Mass. = Massachusetts
R.I. = Rhode Island
Conn. = Connecticut
N.Y. = New York
N.J. = New Jersey

Dates are recorded month first, day of the month second, and year third (e.g. 9/17/58=Sept. 9,1958) . This is consonant with the method of reporting in most of the literature reviewed in this report.

* = indicates that this subject (e.g. a predator, or food type) has a particularly important part in the life of the species being discussed

SPECIES: Puffinus gravis (O'Reilly) A.O.U. 89
Greater Shearwater

LITERATURE:

Bailey (1968): 45
Bent (1922): 65-71
Bull (1964): 78-79
Forbush (1939): 12-13
Hill (1965): 47
Palmer (1949): 30-31
Palmer (1962): 166-171
Squires (1952): 22

STATUS: Rare to abund., depending on season & local conditions, biologically "wintering"; Su.,F. & W. Mg and visitant.

DISTRIBUTION: Ranges offshore, entire area. Arrives fishing banks off New England around May. Numbers decrease northward in the Bay of Fundy.

HABITAT: Oceanic; concentrate near fish concentrations and deep-water tidal rips.

BREEDING DATA: Does not breed within the study area.

PREDATORS: Harrassment from Skua (Catharacta skua), possibly.

ADULT MORTALITY: Disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Previously, persecution from fishermen; this is now decreasing and the species may be increasing.

DIET: Fish, offal from fishing boats, cephalopods (partic. squid), larval fish; often follow whales and porpoises. Feed on nearly any form of surface swimming organisms. (Bent, 1922; Palmer, 1949)

NOTES: New York Area: Reg. Su. V. offshore, occ. common to e. end of L.I. Rare before late May and after early October. Max. 20, Easthampton, 5/23/37; 40, same area, 6/23/16; 50, Jones Beach, 6/8/57; at least 150, Moriches to Shinnecock, 6/9/57; 100, Mecox Bay, 9/23/18. (Bull)

Rhode Island: Rare Su. and F. V., early June through early October. (1970 Checklist)

Cape Cod, Mass.: Rare to abund. "wintering" V., late May through early October, peak Aug. & Sept. Counts irreg.; abund. in good fishing years. Avg. 10-100 birds; Max. 1,200 on 8/20/55, off Chatham; 1,200, 8/88/57, off Chatham. (Hill & Bailey)

Greater Sheawater Notes (continued)

(1964 Checklist) New Hampshire: Rare irreg. Mg. + Su. V. on open ocean. Season: mid-May - Early October.

(Palmer) Maine: Non-breeding Su. & F. V., common in outer offshore & oceanic waters; rare in inshore waters and bays, usually during or after periods of fog. Present early June (probably mid-May) to early November.

(Squires) New Brunswick: Unc. Su. & F. V., at the fishing grounds at the mouth of the Bay of Fundy. Present July 15-October 18.

SPECIES: Morus bassanus (L.) A.O.U. 117
Gannet

LITERATURE:

Bailey (1968): 47
Bent (1922): 216-229
Bull (1964): 85-86
Forbush (1939): 21-22
Hill (1965): 52-53
Palmer (1949): 40-41
Palmer (1962): 304-315
Squires (1952): 24

STATUS: Unc. to abund. offshore Mg. and W V. Occ. Su. V.

DISTRIBUTION: Ranges in Su. south rarely to Mass. In W. from Mass., more commonly N.Y. & N.J. south. Migrates through study area in Sp. & F.

HABITAT: Neritic and oceanic; unc. beyond outer limits of continental shelf.

BREEDING DATA: Does not breed in study area.

PREDATORS: Human beings.

ADULT MORTALITY: Disease, predation, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Killed in vast numbers and used for bait by fishermen. Greatly reduced, now protected. Young birds eaten by people (Bent; Fisher, & Vevers, 1944).

DIET: School fishes, herring, etc.; squid, maybe other mollusks and crustaceans. (Bent)

NOTES: New Jersey: Mg. & W. V. (Checklist)

(Bull) New York Area: Common/abund. offshore Mg., less numerous in W., usually in large #'s only at eastern end of L.I., partic. Montauk Pt. Regularly seen from beaches. Peak: late October - early December; late March - mid-May. Max. #'s: Fall: 500, Montauk, 10/28/24; 300, Montauk, 12/8/44; Winter: 220, Easthampton to Montauk, 12/31/49. Spring: 300 in ½ hour, off Mecox Bay, 4/16/53.

(1970 Checklist) Rhode Island: Sp. Mg., mid-March - early June; F. Mg., early September - early December. Occ. individual birds throughout the year.

(Hill & Bailey) Cape Cod, Mass.: Sp.: Common/abund. Mg., peak March - mid-May. Aug. 100-500 birds; Max.: 2,000, Truro, 3/30/61. Su.: Occ. non-breeding imm. birds at sea. F.: Oct. 24-Dec. 5, avg. 100-500; Max.: 1,000, Monomoy, 12/1/46. W.: Small #'s, up to 50.

(1964 Check-list) New Hampshire: Unc. Mg.; rare W. Re. on open ocean. Season: possible year-round, highest #'s April-May; Sept.-Nov.

(Palmer 1949) Maine: Sp. & F. Mg., common/occ. abund., in offshore waters; during gales, inshore waters. Non-breeding Su.Re. (mostly imm.), unc. offshore and occ. inshore. Maybe occ. W. Re. Sp.: April 13-May 14. F.: late Sept.-Nov. 15, peak late Oct. Su.: 12-15 birds, June & July. W.: 4 sight records, December & early January.

(Squires) New Brunswick: Unc. Sp. & F. Mg. and occ. Su. V. Formerly bred on Gannet Rock, s. of Grand Manan, to 1866. Su., 1972: a young adult established territory on Kent Is., within a dense colony of Herring Gulls. No breeding recorded (Gould,1974).

SPECIES: Phalacrocorax carbo (L.) A.O.U. 119
Great Cormorant

LITERATURE:

Bailey (1968): 47
Bent (1922): 236-243
Bull (1964): 86-88
Forbush (1939): 22
Hill (1965): 54
Palmer (1949): 41-42
Palmer (1962): 316-325
Squires (1952): 24

STATUS: Common/abund. Mg. & W. Re.; Occ. Su. V.

DISTRIBUTION: Ranges in W. s. to L.I., casually to S.C. Chief wintering grounds: off R.I. coast, Martha's Vineyard, Buzzards Bay (Bull). Breeding range extending s; no proven records w/in study area.

HABITAT: Open bays, harbors, estuaries, rocky coasts, exposed points.

BREEDING DATA: Does not breed in study area.

PREDATORS: Human beings

ADULT MORTALITY: Predation, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Killed for sport, food (Bent). Possible egg-shell thinning due to pesticides.

DIET: Primarily fish; also mollusks, crustaceans, polychaetes (Bent, Palmer)

NOTES: New Jersey: W. Re. (Sandy Hook St. Park)

(Bull) New York Area: Unc. to locally very common W. V. along coast, but rare in many areas. Great increase in recent years. Most common: Dec.-March; reg. from late Oct.-April. Max.#'s: 27, Montauk, 2/22/42; 52, Montauk, 2/23/48; 30, Larchmont, N.Y., 2/20/44; 40, Larchmont, N.Y., 1/23/53; 30, Sands Point, L.I., 2/13/54; n. N.J. coast: 90, Long Branch, Jan. 2 - Feb. 25, 1955, 100+, Sea Bright, 3/3/59.

(1970 Check-list) Rhode Island: Mg. and W. V. Mid-October-early April

(Hill & Bailey) Cape Cod, Mass.: Avg. period Nov. 1 - April 1. Reg. and in #'s up to 2,000 in Buzzards Bay & Woods Hole area. Reg. W. Re.; Increasing.

(1964 Check-list) New Hampshire: Unc. W. Re., on the ocean and rocks along coast. Season: mid-Oct.- mid-April.

(Palmer 1949) Maine: W.: Common/abund. Re., Eastport (Washington Co.) to Casco Bay; unc. westward. Max. #'s at any one roost: 60-100. Mg. common/abund. Sp. & F., entire coast. F.: Sept. 12-Oct. 20. Sp.: March-April 24. Su.: Unc. non-breeding Su. Re., Washington Co. to Muscongus Bay, occ. westward.

(Squires) New Brunswick: Common Mg. and W. Re; rare Su. Re. Formerly bred at Grand Manan -- one record, 20 June 1895. Decreasing (Godfrey, 1970).

SPECIES: Phalacrocorax auritus (Lesson) A.O.U. 120
Double-crested Cormorant

LITERATURE:

Bailey (1968): 47
Bent (1922): 243-251
Bull (1964): 88-89
Forbush (1939): 23-24
Hill (1965): 54-55
Palmer (1949): 42-47
Palmer (1962): 325-340
Squires (1952): 24-25

STATUS: B.; Su.; W.; Mg.

DISTRIBUTION: Abund. Su. B. s. to Mass.; non-breeding Su. Re., Cape Cod & L.I. s. W. L.I. (casually n. to Mass. (Kury & Cadbury, 1970)) s. to Gulf Coast.

HABITAT: Neritic. Coasts, bays, estuaries, marine islands. For breeding needs, undisturbed site and convenient food supply -- on rocks, islets, reefs, islands (Palmer; Lock & Ross, 1971).

BREEDING DATA:

Nest: Often communal; in trees or on ground; old nests used/rebuilt. Majority on ground: foundation of algae and debris; upper part of sticks, weed stalks, flotsam; lined with feathers, grass, algae, etc. (Palmer; Mendall, 1936).

Clutch size: 2-7; up to 9 reported; generally 3-4 (Palmer, Bent; Mendall, 1936).

Incubation: 25-29 days; altricial young, down forms 10 days; flight plumage at 6 weeks--flight capability 8 weeks.

No. broods/season: 1 (Mendall, 1936).

Nest losses: Lack of sanitation at nest site; exposure to inclement weather; predation; egg-shell thinning.

MORTALITY: Annual 22-26% (Mendall, 1936); by predation, disease, parasitism, human control methods.

PREDATORS: On young & eggs: Herring Gull, Great Black-backed Gull, Great Horned Owl, human beings, angler fish (Glegg, 1945).

Double-crested Cormorant Notes (continued)

RELATIONSHIP WITH HUMAN BEINGS: Shooting; some control measures undertaken due to complaints by fishermen (eat mainly non-valuable fish, but rob weirs) in Maine, 1944. Sprayed eggs with oil emulsion to prevent hatching. Disturbance of breeding areas. Pesticides--egg-shell thinning (Evenden et al., 1969; Drury, 1973).

DIET: Fish (majority cunner, sculpin & gunnel: Mendall, 1936); also eels, crustaceans, amphibians, aquatic insects & plants (Palmer, 1962; Bent, 1922).

NOTES: Population Density: New England, 1972--15,000 nesting pairs (Drury, 1973)

New Jersey: Mg. & non-breeding Su. Re. (Sandy Hook St. Park)

(Bull) New York Area: Common/very abund. coastal Mg. Reg. Su. V. on L.I. Rare in W. along coast. Max: F.: 5,500, Ram Is. Shoals, 9/13/35; 15,000, Easthampton to Montauk, 10/18/30; 900, Moriches Inlet, 9/2/51. Sp.: 5,000, Jones Beach, 4/22/34; 400, Jones Beach, 5/23/48; Su.: non-breeders reg. on eastern L.I. 220, Montauk to Acabonack, 6/20/36; 300, Moriches Bay, 7/23/49; 30 same locality, all summer 1955.

(1970 Check list) Rhode Island: Sp. and F. Mg & Su. (non-breeding) Re. Early April - early November. Individual birds throughout the year.

(Hill & Bailey) Cape Cod, Mass.: Sp. Mg.: April 25 - May 30; irreg. in #'s--up to 190 on 4/28/41 (Monomoy). Su.: Reg. in small #'s in certain areas. F.Mg.: Sept. 22 - Oct. 31; irreg. #'s; Max. 140, Eastham, 9/27/47; 400, Eastham, 10/20/62. Breeds on Cape: 1962, fish weirs of Provincetown Harbor. Other Mass. locations: Breeds in Boston Harbor and on Weepecket Is. (Off Naushon) (10+ pairs, 1960).

(1964 Check-list) New Hampshire: Abund. coastal Su. Re., estuaries, ocean & rocks along the coast. Season: Early April-early November. Selected breeding locations: Isles of Shoals.

(Palmer 1949) Maine: Numerous/very abund. Su. Re.(over 1,000 prs. in one colony) on coastal islands & rocks; non-breeding imm. birds in "shag roosts" along entire coast, primarily east of Casco Bay. Abund. Sp. & F. Mg.: Sp.:*April 10-May 4; late May flocks

mainly imm. birds. F.: late Aug.-Nov.; peak Sept. & Oct. Selected breeding locations: Booth Bay, Casco Bay, Fox Is., Jericho Bay, Muscongus Bay (e.g. Coombs Ledge, Eastern Egg Rock, Hay Ledge, Jones Garden Is., Long Ledge, Mosquito Is., Shark Ledge E., Shark Is., Western Egg Rock), Penobscot Bay (e.g. E. Goose Rock, Goose Rock, Martinicus Is., Mouse Is., Robinson Rock), Saco Bay, Swan's Is., Quoddy, Pumpkin Is.

New Brunswick: Common Su. Re. & Mg. Present April 8-Oct. 31. Up to 25,000 in Miramichi Bay in Sp. Mg. Breeds on Grand Manan (36 prs; Drury, 1973). (Squires)

SPECIES: Ardea herodias (L.) A.O.U. 194
Great Blue Heron

LITERATURE:

Bailey (1968): 48
Bent (1926): 101-114
Bull (1964): 89-90
Forbush (1939): 28-29
Hill (1965): 56-57
Palmer (1949): 48-50
Palmer (1962): 391-403
Squires (1952): 25

STATUS: Common Su. B. Re.; Mg.; W.

DISTRIBUTION: Breeds entire area; W. from coast of Mass. south. Does not breed in Cape Cod area (Hill, Bailey)

HABITAT: Shallow waters and shores of marshes, bays & oceans. Often on tidal flats and sand bars. On occasion, feeding in surf.

BREEDING DATA:

Nest: On ground, rock ledges, tree tops, sea cliffs, duck blinds, etc.; small to large colonies typical. Nests of sticks lines with twigs.

Clutch size: 3-7; avg. 4

Incubation: 28 days; Fledging period ~50 days (Palmer, 1949).

No. Broods/season: 1

Nest loses: Predation, falling from nest, flooding, shell-thinning. Nestling mortality 40%; 1st yr. mortality 70%; 29% avg. annual mortality in subsequent years; avg. max. longevity 15.7 yrs. (Kahl, 1963).

PREDATORS: Crows, ravens, gulls, vultures, hawks, parasites (Bent).

RELATIONSHIP WITH HUMAN BEINGS: Very adaptable, but some loss of heronries due to cutting of wood lots, development of real estate, etc. (Palmer). Shooting (Bent). Shell-thinning due to pesticides (Drury, 1973).

DIET: Fishes, amphibians, snakes, small mammals, crustaceans, leeches, aquatic & land insects, some birds, some vegetable matter (Palmer, Bent).

Great Blue Heron Notes (continued)

NOTES

New Jersey: Mg., year-round Re., B. 30+ prs. in 1962. (Sandy Hook St. Park)

(Bull) New York Area: Common/very common coastal Mg; fewer #'s in W; reg. non-breeding Su. V. Very local breeder. Egg dates: April 17-June 11. Max. #'s: Mg.: 75, Lawrence-Hewlett, 8/28/49; 200, Easthampton to Montauk, 9/24/29. W.: 38, Jones Beach, 1/1/58; 200 W. 1951-1952, Jones Beach to Jamaica Bay. Su.: Single or in small scattered groups, non-breeding, in L.I. salt marshes.

(1970 Checklist) Rhode Island: Mg. & Su. Re.; individual birds throughout the year. *mid-March - late Dec.

(Bailey, Hill) Cape Cod, Mass.: Fairly common F. Mg. & W. V. Unc. Sp. Mg. Sp.: April 15 - May 15, avg. 3-4; max. 8, 4/19/40. Su.: Occ. imm. stragglers. F. peak Sept. 1-Oct. 5; avg. 20-30, max. 49, 9/10/49 and 52 another occasion. W.: Unc/rare Re., avg. 10-25, max. 73 in 1957.

(1964 Checklist) New Hampshire: Common Su. Re. in the coastal salt marshes. Season: late March - mid-Nov.

(Palmer, 1949) Maine: Occ. Re. in coastal counties e. to Waldo; Occ/numerous Su. Re., w/most breeding colonies on inshore islands & adjacent mainland; common Sp. & F. Mg. in southern half of state; less so northward. Sp. Mg.: mainly April; F. Mg.: mainly Oct. 5-Nov. 12. Breeding: usually in colonies of a few to over 100 prs. Colonies: Casco Bay, Muscongus Bay (e.g. Wreck Is.) Has decreased.

(Squires) New Brunswick: Common Su. Re.; may winter casually Present: March 28 - Dec. 15.

SPECIES: Cygnus olor (Gmelin) A.O.U. 178.2
Mute Swan

LITERATURE:

Bailey (1968): 50
Bull (1964): 110-111
Forbush (1939): 47
Hill (1965): 64
Willey (1968): 1-93

STATUS: Introduced & naturalized; B., W., wanders, Mg.

DISTRIBUTION: Breeds R.I. & eastern Mass. s. to Maryland. Wanders n. to n. Mass.

HABITAT: Bays, ponds, estuaries. Nests along shores of shallow ponds and in marshes, mainly along the coast.

BREEDING DATA:

Nest: Mainly in coastal brackish habitats. Territorial: in R.I., territory avg. 4.4 acres in size (range 0.5-11.8).

Clutch size: 5-6 (Willey) Hatching success (R.I.): 87.3% (Willey).

Incubation: 35-40; avg. 39 days (Willey).

No. Broods/Season: 1

Nest losses: predation, inclement weather & flooding (40%); total nest mortality: 50% (Willey).

Juvenile mortality: Predation (*snapping turtle), weather, disease: total cygnet mortality ~66.4%.

ADULT MORTALITY: Flying into objects: 26.7%; vandalism: 13.3%; disease: 16.7%; starvation: 6.7%; hit by car: 13.3%; predation: 6.7%; poisoning: 3.3%; weather: 3.3%; killed by another Swan: 3.3%.

PREDATORS: Cats, dogs, rats, skunks, weasels, snakes, crows, internal & external parasites, snapping turtle.

RELATIONSHIP WITH HUMAN BEINGS: Fly into power lines & other obstructions (Willey). Introduced into N. America. Killed by vandals, & egg stealing (Willey).

DIET: Very adaptable, but 95% vegetable: e.g. Potamogeton, Elodea, Anacharis, Myriophyllum, etc. Some animal: snails, clams, etc. (Willey).

Mute Swan Notes (continued)

NOTES: New Jersey: Mg.
(Sandy Hook St. Park)

(Bull) New York Area: Introduced in s. N.Y. and e. L.I. in 1910, 1912 respectively. Now common to locally abund.; most numerous on bays and ponds of e. L.I. Max.#'s: 275, Easthampton to Mecox Bay, 12/31/49. Since 1950: 60 at Mill Neck, L.I.--mid-July, 1958; 155 at Fort Pond, Montauk, mid-July, 1958; 500 on Moriches Bay, 12/26/59. Egg dates: March 20-June 12. Breeds on Gardiner's Is.

(1970 Check-list) & (Willey, 1968) Rhode Island: Permanent Re. B. many areas, e.g. Almy Pond, Annaquatucket, Aquidneck Is., Big Maschaug, Briggs Marsh, Card's Pond, Chagum Pond, Easton Pond, Little Maschaug, Moonstone Pond, Point Judith, Quonochontaug, Rotary Pond, Sand Hill Cove, Watch Hill, Weekapaug, etc. Nesting period: mid-April-mid-June, peak mid-May. R.I. population: ± 500 birds (Willey).

(Hill & Bailey) Cape Cod, Mass.: Irreg. straggler, April 7 to Dec. 31. Found in shallow ponds & estuaries; has bred at Falmouth. Colony at Acoaxet on Mass. - R.I. line.

SPECIES: Branta canadensis (L.) A.O.U. 172
Canada Goose

LITERATURE:

Bailey (1968): 50-51
Bent (1925): 204-239
Bull (1964): 112-113
Forbush (1939): 49-51
Hill (1965): 65-66
Palmer (1949): 64-68
Squires (1952): 29

STATUS: B. W., & Mg. (common/abund. Mg.).

DISTRIBUTION: Breeds mainly from New England n. Occ. B. in N.Y. & N.J. Winters on the Atlantic seaboard from N.S. to S.C. Migration along seaboard.

HABITAT: Sand & mud flats; marshes; grazing in upland; also in freshwater ponds, swamps. Coastal bays, estuaries, ponds.

BREEDING DATA:

Nest: Usually on ground near water; sometimes on platforms. A depression w/leaves, grasses, etc. & a down lining; usually sheltered by vegetation.

Clutch size: 5-9 (Forbush); 4-10 (Bent); avg. 5-6.

Incubation: 28-30 days. Fledging period: $\geq$ 6 weeks.

No. Broods/Season: 1

Nest losses: Flooding, predation.

PREDATORS: Fox, skunk, weasels, hawks, eagles, human beings. etc.

ADULT MORTALITY: Predation, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Hunting persistent but still abund. Many bred in captivity & released. Geese damage young grain.

DIET: Largely vegetable: sprouting grain (wheat, corn, barley, rye, oats) & grasses, earthworms, insects & larvae; crustaceans, marsh grasses & aquatic plants; marine plants (Zostera marina, Ulva lactuca, etc.); mollusks.

NOTES: New Jersey: Mg. & W. V. (Sandy Hook St. Park)

(Bull) New York Area: Abund./very abund. Mg. & W. V. along coast. Max. #'s: Sp.: 12,000, Easthampton to Mecox, 3/9/45. F.: 4,000, same area, 11/5/50. W.: 5,000, Mecox Bay, 2/5/50. Occ. B., egg dates April 3-May 24.

(1970 Checklist) Rhode Island: Mg. & occ. Su. Re. Sp. peak: early May; F.: early Oct.-mid-Dec. Selected B. areas: Briggs Marsh, East Is. (Off Sakonnet Pt.), Jamestown, Moonstone Pond, Matunuck.

(Hill & Bailey) Cape Cod, Mass.: Common Mg. & W. V. Nov.-April. Nests in small #'s throughout the Cape. Mg.: Sp.: Common Mg., avg. March 6-May 20, peak March 15-April 15; avg. 200-800, occ. to 1,000 F.: avg. Oct. 5-Nov. 30, peak Oct. 10-Nov. 20; avg. 50-500, rarely to 2,000. Uses different F. & Sp. routes. Wintering: Common/abund. Re., avg. Dec. 5-March 5; avg. 3,000-5,000, then decrease according to severity of weather; start to depart w/ 1st mild weather in Feb. W. grounds mainly Monomoy-Wellfleet-Brewster. Selected breeding locations: Audubon Wildlife Sanctuary, Monomoy Natl. Wildl. Refuge; Parker River N.W.R. (n. of Cape Cod).

(1964 Checklist) New Hampshire: Common, local W. Re. along coastal estuaries. Season: late Sept.-mid-May.

(Palmer, 1949) Maine: Abund. Mg.; unc. Su. V. & rare Su. B.; unc. W. Re. Sp. Mg.: late Feb.-mid-April; a few flocks into mid-May. Peak concentrations in Merrymeeting Bay. F.Mg.: Fewer in # than Sp.; some may pass at sea from N.S. to Cape Cod. Oct. 10-Nov. 20. Su.: little data. W.: Dec. 5-Feb.20, small flocks (usually < 12, occ. 20-25).

(Squires) New Brunswick: Common Mg. Sp.: Feb. 24-May 28; F.: Sept. 4-Dec. 22. Formerly bred at Grand Manan (1873); may occ. still breed there.

SPECIES: Anas platyrhynchos (L.) A.O.U. 132
Mallard

LITERATURE:

Bailey (1968): 51-52
Bent (1923): 34-47
Bull (1964): 122
Forbush (1939): 58
Hill (1965): 70-71
Palmer (1949): 75-76
Squires (1952): 31

STATUS: Unc. Re.; Unc. W. V.; common/abund. Mg. in some areas.

DISTRIBUTION: Breeds from Cape Cod s. to N.C. Winters from Maine s.; greatest #'s from Maryland s. (#'s depend on ice cover of bays & inlets).

HABITAT: All types of freshwater, also salt marsh & salt bays. Feeds in shallow waters & along shores.

BREEDING DATA:

Nest: Usually on ground near water, well hidden among vegetation. In a hollow, of reeds & debris, lined with down (Bent).

Clutch size: 5-14 (Forbush); 8-12 (Bent).

Incubation: 23-29 days; usually 26 (Bent). Fledging period: probably 50-60 days.

No. Broods/Season: 1 (?)

Nest losses: Flooding, predation.

PREDATORS: Probably the usual birds, mammals, reptiles; human beings.

ADULT MORTALITY: Predation, lead poisoning, disease, oiling (Hartung & Hunt, 1966), parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Hunting--prime game species. Lead poisoning (Bent). Pesticides--egg-shell thinning (Evenden, 1969). Oiling. Known to eat mosquito larvae (Bent, Forbush).

DIET: ~ 90% Vegetable, usually freshwater; is very adaptable (Forbush) Water plants, seeds, acorns, grains; also insects, grasshoppers, small aquatic animals .

NOTES: New Jersey: Year-round Re.;B. (Sandy Hook St. Park)

(Bull) New York Area: Re. + common/loc. abund. late F. Mg. & W. V. Max.#'s: 2,500, all Christmas counts combined, 1949-50; 4,000, all counts combined, 1953-54. Egg dates: March 25-June 30. Selected breeding locations: Great Gull Is., Hammonassett St. Pk. (Conn.), Rocky Neck St. Pk. (Conn).

(1970 Checklist) Rhode Island: Individual birds throughout the year. Mg. & Su. Re. Peaks: early March-late April; early Sept.-late Dec. Selected breeding locations: Almy Pond, Briggs Marsh, Rotary Pond.

(Hill & Bailey) Cape Cod, Mass.: Su.: Scattered breeding feral prs. F.: Unc. Mg., occ. common. Avg. Sept. 10-Dec. 20, 3-8 birds, max.: 150, Eastham, 11/8/52. W.: scattered birds winter reg., usually survive. Selected breeding locations: Audubon Wildlife Sanctuary (50-75 year-round); Parker River N.W.R. (n. of Cape Cod).

(1964 Checklist) New Hampshire: Very local W. Re. in coastal salt marshes; introduced birds present also. Present year-round in some areas.

(Palmer) Maine: Unc. Sp. & F. Mg.; unc/reg. coastal W. Re.; rare summer V. Sp.: April-early May; F.: Sept-Oct., esp. numerous at Merrymeeting Bay. Not over 200 during any one day. Su.: a few records in Penobscot & Washington Counties. W.: Entire population does not exceed 100 birds.

(Squires) New Brunswick: Rare Mg.; Sp.: April 20-May 24; F.: Sept. 2-Nov. 13.

SPECIES: Anas rubripes (Brewster) A.O.U. 133a
Black Duck

LITERATURE:

Bailey (1968): 52
Bent (1923): 50-68
Bull (1964): 122-123
Forbush (1939): 59-61
Hill (1965): 71-72
Palmer (1949): 76-80
Squires (1952): 31

STATUS: Common breeding Re.; Common/abund. Mg. & W. V.

DISTRIBUTION: Breeds from Newfoundland s. to e. Va. & N.C. Winters from New Brunswick s. #'s depend on ice cover of feeding areas.

HABITAT: B. in fresh & salt ponds, marshes, swamps. Gathers in marshes, estuaries, mud flats, & protected salt water; occ. open bays & rocky coasts.

BREEDING DATA:

Nest: Usually on ground near water; usually sheltered by vegetation; in a depression, of grass, dead leaves, etc. & lined w/ down.

Clutch size: 6-12, avg. 8-10 (Bent).

Incubation: 26-28 days. Fledging period: 55-60 days (Palmer).

No. Broods/Season: 1

Nest losses: Flooding, predation, eggs not hatching (5.6%--Stotts & Davis, 1960).

PREDATORS: Crows, mammals, snakes, turtles, human beings.

ADULT MORTALITY: Predation, disease, lead poisoning, oiling (Hartung & Hunt, 1966), parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Hunting--2nd in importance. Oiling. Lead poisoning.

DIET: ~75% vegetable: *Cordgrass(Spartina spp.; mainly leaves & stems)(Hartman, 1963), pond-weeds, eel-grass, wild celery; grass & weeds, grains, wild rice; even seaweed in winter. ~25% animal: shellfish(mussels, tiny clams, snails), crustaceans (barnacles, sand fleas, shrimp, crayfish); a few fish and their eggs (Bent, Forbush, Palmer).

Shelled species include Mytilus edulis, Macona balthica, Modiolus demissus, Mya arenaria & Melampus bidentatus; non-shelled include Gammarus, Orchestia and Nereis (Grandy, 1972). According to Mendall (1949), relative amounts of food types depend primarily on the season. In Maine, found that in the fall, Black Ducks in inland tide waters ate 90.2% vegetable matter, 9.8 % animal; in coastal waters, 27.2% vegetable, 72.8% animal. In winter, coastal waters, they ate 86.9% animal, 13.1% vegetable. The leading winter foods were snails, mussels, non-edible clams, and amphipods.

NOTES: New Jersey: Year-round Re.; B. (Sandy Hook St. Park)

(Bull) New York Area: Abund./very abund. F. Mg. & W. V. on coast. Fairly common local breeder. Mg. & W.: "Our most widely distributed duck, occurring in flocks even on the ocean during severe winter weather." Max. #'s: 5,000, Shinnecock Bay, 10/16/24; 25,000, all Christmas counts combined, 1953-54. Egg dates: March 9-July 16. Breeds at Jamaica Bay N.W.R., Hammonasset St. Pk. (Conn.), Rocky Neck St. Pk. (Conn.).

(1970 Checklist) Rhode Island: Permanent year-round Re. Selected breeding locations: Briggs Marsh, Jamestown Is., Point Judith, Quonochontaug, Weekapaug.

(Hill & Bailey) Cape Cod, Mass.: Common breeder. Abund. Mg & W. V. (1) Breeding: common nesting species over the Cape, both fresh & salt water. (2)Mg.: Sp.: avg. March 5-May 24; peak March 15-April 20. Avg. 500-1,000 birds, occ. to 2,000. F.: peak Oct. 1-Nov. 16, avg. 500-1,000, max. 5,000, Brewster, 11/12/48. (3) Winter: Re. avg. Dec.1-March 5. Early Jan., avg. 7,000-8,000, max. 10,000. Some winter mortality. Selected breeding locations: Audubon Wildl. Sanctuary, Monomoy N.W.R., Parker River N.W.R. (n. of Cape Cod).

(1964 Checklist) New Hampshire: Year-round Re; abund. in W.; common in Su. Estuaries.

(Palmer) Maine: Common/numerous Su. Re.; abund. Sp. & F. Mg.; common/abund. W. Re. Sp.: March-April; F.: Sept.-Nov. Peak concentrations at Merrymeeting Bay & Scarborough marshes. Su.: Widely distributed on

mainland & some marine islands. Egg dates: April 13-May 14. W.: #'s vary widely, depending on ice cover. Max. #'s: 6,800, Black Cove, Portland, 1/3/31. Merrymeeting Bay favorite feeding place. Most abund. duck in Maine. Selected breeding locations: Penobscot Bay (e.g. Goose Rock, E. Goose Rock, Mouse Is., Robinson Rock), Casco Bay, Matinicus Is. group, Eagle Is., Stratton Is., Bluff Is., Ragged Is., Mark Is., Pumpkin Is., No Man's Land Is., Ten Pound Is., Great Spoon Is., Schoodic Is.

New Brunswick: Very common Su. Re. & Mg.; not unc.
(Squires) W. Re. on coast. Egg dates: March 15-June 15. Nests on Grand Manan Is.

SPECIES: Aythya marila (L.) A.O.U. 148
Greater Scaup

LITERATURE:

Bailey (1968): 54
Bent (1923): 207-216
Bull (1964): 136-137
Forbush (1939): 75
Hill (1965): 84
Palmer (1949): 99-100
Squires (1952): 35-36

STATUS: Common W. Re. & Mg.

DISTRIBUTION: Along Atlantic coast from Quebec to Fla.

HABITAT: On bays, salt water ponds, estuaries & large harbors; also brackish or freshwater ponds near the sea. "Rafts" w/ Lesser Scaup, Aythya affinis.

BREEDING DATA: Does not breed in study area.

PREDATORS: Man, gulls, hawks, owls, angler fish (Glegg, 1945).

ADULT MORTALITY: Predation, oiling, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Hunting, oiling.

DIET: Often feed in fairly deep water away from shore & often feed at night. Approx. equal amounts of animal & vegetable matter. Wild celery, eelgrass & its seeds; small mollusks & crustaceans, crabs, starfish, mussels. (Bent & Forbush)

NOTES: New Jersey: Mg. & W. Re. (Sandy Hook St. Park)

(Bull) New York Area: Most numerous & widespread of W. ducks. Very abund. W. V. on L.I. Sound & adjacent bays; also on bays along the outer coast. Reported every month of the year. Max. #'s: 40,000, Flushing & Little Neck Bays, 12/20/52; 85,000, Pelham Bay & L.I. Sound e. to Stamford, Conn., 12/31/53.

(1970 Check-list) Rhode Island: Individual birds throughout the year. Mainly early Oct.-mid-May. Mg. & W. Re.

(Hill & Bailey) Cape Cod, Mass.: Common/fairly common Mg. & W. V. F.: avg. Oct. 25-Dec. 5, avg. 100-300, max. 2,500, Falmouth, 12/1/55. W.: Unc./common Re., max. 700, Waquoit, 1/5/33. Su.: Occ. non-breeding stragglers, usually crippled or oiled. Sp.: Unc./common occ.

absent. Avg. March 5-April 25, avg. 50-150, max. 500 on 4/19/40 (Above includes Lesser Scaup).

(1964 Check-list) New Hampshire: Common, local W. Re. in estuaries. Season: late Sept.-early May.

(Palmer) Maine: Common/abund. W. Re., chiefly in sheltered salt water bays; numerous F. & early Sp. coastal Mg. F.: mid-Oct.--early to mid-Nov. Concentrations at Merrymeeting Bay. W.: Casco Bay eastward. Local populations fluctuate, probably due to fluctuating food supply. Sp.: W. Re. depart mainly March & early April; a few into May.

(Squires) New Brunswick: Common Mg.; casual W. Re. Sp.: April 1-May 29; F.: Oct. 4 - Nov. 10.

SPECIES: Bucephala clangula (L.) A.O.U. 151
Common Goldeneye

LITERATURE:

Bailey (1968): 54
Bent (1925): 1-14
Bull (1964): 137-138
Forbush (1939): 77-78
Hill (1965): 87
Palmer (1949):
Squires (1952): 36

STATUS: Very common/abund. W. Re.; Mg.

DISTRIBUTION: Winters N.S. s. to Fla.

HABITAT: Broad estuaries & bays, some on open ocean (not oceanic); reg. in ponds on Mg; rocky headlands (Stott & Olson, 1972).

BREEDING DATA: Does not breed in study area.

PREDATORS: Human beings, gulls, hawks, owls.

ADULT MORTALITY: Predation, oiling, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Hunting--considered good sport (Bent). Reduced in #'s 1850-1900; slow but steady increase since. Oiling.

DIET: Eel-grass, other aquatic plants; small mollusks and mussels, crustaceans, marine worms, small fish.

NOTES: New Jersey: Mg. & W. Re.
(Sandy Hook St. Park)

(Bull) New York Area: Common/very abund. W. visitant on L.I. Sound & the adjacent bays, and on the ocean at the east end of L.I. during frigid weather; in fewer #'s on the bays elsewhere. Rare before Nov. & after April. Reported every month; only vagrants in Su. Max. #'s: 8,000, Orient, 12/26/24; 4,000, Montauk, 3/15/45.

(1970 Check-list) Rhode Island: Individual birds throughout the year. Mg. & W. Re.; late Oct.-late April.

(Hill & Bailey) Cape Cod, Mass.: Abund. Mg. & W. visitant. Avg. Nov. 12-Jan. 1; peak Dec. 5-31; avg. 300-800. Max. 2,561, 1/1/50. W.: Terminal population of 300-700 birds. Seasonal mortality from 25-30%.

Sp.: Avg. March 5-April 15, peak March 15-April 5, avg. 500-900, max. 1,340, 4/3-4/42. Su.: Crippled or oiled non-breeding birds nearly every year.

(1964 Checklist) New Hampshire: Abund. W. Re. along the coast. Season: mid-Oct.-late April; less common May-Sept.

(Palmer) Maine: Common/abund. coastal W. Re. & Mg. Sp.: late Feb.-late March; small flocks on salt water into May. F.: Oct. 10-Nov. 20, peak early Nov. W.: majority on shallow, quiet coves, harbors, sheltered areas. Along outer shores, over hard bottoms, when driven out by ice.

(Squires) New Brunswick: Very common Re. & Mg. (Breeds inland). Present year-round.

SPECIES: Bucephala albeola (L.) A.O.U. 153
Bufflehead

LITERATURE:

Bailey (1968): 55
Bent (1925): 24-32
Bull (1964): 139
Forbush (1939): 79
Hill (1965): 88-89
Palmer (1949): 106-108
Squires (1952): 36-37

STATUS: Abund. W. Re. & Mg.

DISTRIBUTION: Winters New Brunswick & Nova Scotia s. to Fla.

HABITAT: Typically protected salt water of estuaries & bays rarely on open ocean, or if so, close in shore near surf.

BREEDING DATA: Does not breed in study area.

PREDATORS: Human beings, hawks, owls, gulls.

ADULT MORTALITY: Predation, oiling, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Hunting--decreased in #'s after 1875; recovery w/ protection; increasing still. Oiling.

DIET: A diver. Mainly animal matter: worms, shrimp & other crustaceans, bivalves & other small mollusks, insects, & small amounts of vegetable matter (Bent, Palmer).

NOTES: New Jersey: Mg. & W. Re.
(Sandy Hook St. Park)

(Bull) New York Area: Locally common to abund. W. visitant. Largest concentrations on coastal bays & estuaries. Max.: 500, Orient, 12.25.12; 80, Great Pond, Montauk, 3/15/45; 500, Jamaica Bay Refuge, 12/11/59. Jamaica Bay, 1956: 25 on May 5, & 5 on May 20. Rare before mid-Oct. & after April. Ext. dates: Sept. 16-23 to late May. Only rarely, summering stragglers.

(1970 Checklist) Rhode Island: Mg. & W. Re. Mid-Oct. - early May.

(Hill & Bailey) Cape Cod, Mass.: F.: fairly common Mg. Avg. Oct. 26-Jan. 1; Peak Dec. 1-25; avg. 100-175 birds, max. 885 on 12/28/58. W.: Unc/common Re. avg. 35-50 birds, Max. 225, Monomoy, 12/29/51; 200, N. Chatham, 2/22/60. Apparently little winter mortality. #'s increasing

since 1945. Sp.: Fairly common Mg., avg. March 1-April 20; Peak usually March 15-30, but variable. Avg. 90-200, max. 250 on 3/15/55. Su.: Casual as non-breeding straggler, presumably crippled.

(1964 Checklist) New Hampshire: Very local, common W. Re. in coastal estuaries. Season: early Oct.-early May.

(Palmer) Maine: Common/abund. W. Re., mainly on sheltered salt water. Common coastal Mg. Rare Su. V. (non-breeding). Sp.: late March-April; F.: Oct. 14-Nov. 20; Max. #'s: 2,000, Back Cove, Portland, 10/22/30.

(Squires) New Brunswick: Common Mg. & W. Re.; rare/casual in Su. Avg. #'s: flocks of 10-50, up to 300. Present Oct. 16-May 7.

SPECIES: Clangula hyemalis (L.) A.O.U. 154
Oldsquaw

LITERATURE:

Bailey (1968): 55
Bent (1925): 32-50
Bull (1964): 139
Forbush (1939): 80-81
Hill (1965): 89-90
Palmer (1949): 108-110
Squires (1952): 37

STATUS: Common/abund. W. Re. & Mg.; Occ. Su. V.

DISTRIBUTION: Winters on the Atlantic coast from Newfoundland south to S.C.

HABITAT: Shallow offshore waters with sandy bottoms & mussel beds; also in large estuaries & harbors (Hill). Also near rocky shores (Palmer). "Rafts".

BREEDING DATA: Does not breed in study area.

PREDATORS: Human beings, gulls, hawks, owls.

ADULT MORTALITY: Predation, oiling, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Many shot, because mixed w/ scoters; not considered very good eating (Bent). Were decreased in 1800's; cycle of high counts 1938-1943; fewer since, perhaps due to shifting mussel beds (Hill). Oiling (Austin-Smith, 1968).

DIET: A diver. Mussels (Mytelis edulis) & other mollusks; shrimp & fleas; crustaceans, insects, small fish, some seaweeds & aquatic plants.

NOTES: New Jersey: Mg. & W. Re.
(Sandy Hook St. Park)

(Bull) New York Area: Common to occ. very abund. W. V. on L.I. Sound, partic. at the east end and on nearby bays; in fewer #'s on the ocean and in the inlets along the south shore. Gen. unc. before late Oct. and after April; reported every month. Oiled & sterile birds not infrequent in Su. Max. #'s: 5,000, Gardiner's Bay, 3/24/10; 1,100, Fire Is.Inlet, 3/30/53; 1,250, Orient, 1/15/54.

(1970 Check- Rhode Island: Individual birds throughout the year. Mg. & W. Re. early Nov.-late April.

Oldsquaw Notes (continued)

(Hill & Bailey) Cape Cod, Mass.: Common Mg. & W. visitant; abund. off Monomoy. Decreasing. F.: avg. Oct. 24-Dec. 10, peak Nov. 9-Dec. 1; avg. 5,000-15,000 birds, max. 40,000-50,000 on Nov. 12, 1939, Monomoy. W.: avg. 1,000 inshore & 1,000-3,000 offshore on shoals, max. 10,000, 2/2/39. Sp.: avg. March 20-May 5. Peak April 1-20, avg. 200-1,200, max. 2,000, Monomoy, 4/19/40. Su.: Non-breeding stragglers, often oiled.

(1964 Check-list) New Hampshire: Common W. Re. on ocean. Season: mid-Oct-mid-May.

(Palmer) Maine: Abund. coastal W. Re. & Mg. Occ. Su. V. on coast. Sp.: March-mid-May. Peak in April. F.: Oct. 20-Nov. W.: Flocks of varying size along entire coast, mainly outside of harbors & other sheltered waters.

(Squires) New Brunswick: Common Mg. & W. Re. Sp.: Most have departed by mid-May. F.: mid-Oct - Nov. ("1000's" reported in Nov.). Dates: Sept. 12-June 18.

SPECIES: Somateria mollissima (L.) A.O.U. 159
Common Eider

LITERATURE:

Bailey (1968): 55-56
Bent (1925): 79-102
Bull (1964): 141
Forbush (1939): 83-84
Hill (1965): 91-93
Palmer (1949): 117-120
Squires (1952): 38

STATUS: Breeds; W.; Mg.; Su.

DISTRIBUTION: Common breeding Re. Maine to Nova Scotia. Winters Newfoundland s. regularly to Mass. & e. end of L.I., N.Y.; rarely to N.J. & Delaware; casual south to Va. & N.C.

HABITAT: Most oceanic of all ducks (R.T.P.). Congregate in shallow offshore waters with sandy bottoms & mussel beds (Hill). Like wave-washed rocks at sea (Forbush). Breed on offshore islands, both wooded & treeless.

BREEDING DATA:

Nest: Colonial. Nest a hollow in ground either in the open or a sheltered spot; occ. use an old gull nest. Nest of grass, seaweed, other vegetation, lined w/ down. (Palmer). Nesting density: 3.8-8.9 nests/1000 sq. ft. (Choate, 1966)

Clutch size: 4-6 (Palmer) 3-4 (Paynter, 1951; Choate,1966).

Incubation: 28 days (Palmer); 26 days (Choate, 1966)
Fledging period: unknown (Palmer)

No. Broods/Season: 1

Nest losses: *Predation, partic. by gulls. Nesting success: 3.15 birds/nest (Paynter, 1951); 36-39% success (Choate, 1967).

PREDATORS: *Herring Gull, *Great Black-backed Gull, hawks, owls.

ADULT MORTALITY: Predation, oiling, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Greatly reduced from hunting & taking of eggs, & hunting for down (eiderdown); increasing since protection (Bent). Oiling (Austin-Smith, 1968) Disturbance of nesting sites, leading to increased gull predation (Choate, 1967).

DIET: A diver. *Mussels (Mytelis edulis) & other mollusks, crustaceans, echinoderms, worms, fish spawn.

NOTES: New Jersey: Very rare coastal visitant.

(Bull) New York Area: Unc./occ. very common W. V. in the Montauk area. Rare & local elsewhere. Increased greatly since 1942. Recent max. #'s: 1947, off Montauk Pt.--32, Jan.1; over 140, Feb. 23. 1950, from the Point to Ditch Plains--42, Dec. 10 & 115, Dec. 31. Ext. dates: Nov. 8 to March 27.

(1970 Checklist) Rhode Island: Individual birds throughout the year. Mg. & W. Re. early Nov.-late April.

(Hill & Bailey) Cape Cod, Mass.: F.: abund. Mg., mostly a terminal population arriving on Monomoy Shoals, but some moving on to Nantucket & Vineyard shoals. Avg. mid-Sept.-mid-Dec. (arrival) #'s increasing, but w/ wide fluctuations due to oil disasters.
W.: Abund. Re. increasing, from 40-50 in 1894 to 12,000 Jan. 1954 (Cape Cod Bay). On Monomoy Shoals: from Dec. 1940 to Dec. 1950, increased from 15,000 to 500,000. Oil disaster in March 1952. Down to 150,000 in 1952, but back up to 500,000 in Dec. 1960.
Sp.: Abund. Mg., mostly departure Mg. Avg. March 15-April 25. Peak March 25-April 15; 500-1,000/flock.
Su.: Many non-breeding stragglers, small groups & flocks up to 100; max. 300, Su. 1961, Monomoy.

(1964 Checklist) New Hampshire: Rare W. Re. on the ocean. Season: mid-Oct.-mid-May.

(Palmer) Maine: Common/numerous breeding Su. Re., abund. coastal Mg.; numerous/abund. W. Re. Sp.: March-late April. F.: Oct.-late Nov. Su.: Egg dates June 3-July 5, mostly June 7-16. Also flocks of non-breeding imm. birds. W.: Peak concentrations Boothbay Harbor (Lincoln Co.) e. to Petit Manan Pt. (Washington Co.)--prob. 80,000 in this area, w/ 20,000 total east & west of this area.
Selected breeding locations: Booth Bay, Penobscot Bay (e.g. E. Goose Rock, Flat Is., Goose Rock, Mouse Is., Robinson Rock), Jericho Bay, Casco Bay (e.g. Mark Is.), Quoddy.

(Squires) New Brunswick: Unc. Mg. & Su. Re. Est. 2,000 breeding prs. in the Bay of Fundy in 1949. Egg dates: May 9-July 7. Present April 7 - Oct. 15. Breeds on Grand Manan Is.

SPECIES: Melanitta deglandi (Bonaparte) A.O.U. 165
White-winged Scoter

LITERATURE:

Bailey (1968): 56
Bent (1925): 131-142
Bull (1964): 143
Forbush (1939): 85-86
Hill (1965): 94-95
Palmer (1949): 122
Squires (1952): 39

STATUS: Abund. W. Re.; Mg.; Su.(non-breeding).

DISTRIBUTION: Summers s. to Mass. Winters on Atlantic coast from Gulf of St. Lawrence s. to S.C.

HABITAT: Shallow salt water from estuaries to open ocean, rarely on freshwater ponds on migration; sand flats (Hill, Bent). Associates w/other scoters (Palmer); coastline with sandy beaches (Stott & Olson, 1972).

BREEDING DATA: Does not breed in study area.

PREDATORS: Human beings, hawks, owls, angler fish (Glegg, 1945).

ADULT MORTALITY: Predation, oiling, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Hunting, one of the favorites for sport (all scoters); eggs taken (Forbush); 50% decrease 1840-1890. #'s now stabilized. Oiling(Austin-Smith, 1968).

DIET: A diver. *Small mussels & other mollusks, sea clams, small fish, fish spawn, crabs; some vegetation, including eel-grass (Bent, Palmer).

NOTES: New Jersey: Mg. & W. Re.
(Sandy Hook St. Park)

(Bull) New York Area: Very abund. Mg. & W. V. on ocean & L.I. Sound. Most numerous of the scoters. Large flocks occur from Oct. to Apr., a few present in Su. Max. #'s: 180,000, Montauk, 3/16/30; 90,000, Jones Beach, 12/7/52; 150, 3 miles off Mt. Sinai, 6/28/55.

(1970 Check-list) Rhode Island: Individual birds throughout the year. Mainly Mg. & W. Re., mid-Sept. - early June.

(Hill & Bailey) Cape Cod, Mass.: Abund. Mg. & W. V. F: Avg. Aug. 25-Dec. 10; peak Oct. 2-15 for migrants entering Cape Cod Bay; avg. 30,000-40,000 in 10 day period; Nov 1-20

for gatherings, avg. 100,000-200,000; max. 400,000 on 11/14/43 off Monomoy. W.: Common Re., Monomoy, Cape Cod Bay & sounds to Buzzards Bay. Counts drop to avg. 10,000-20,000 in Jan. & Feb., max. 40,000, Monomoy, 2/2/39. Sp.: avg. March 25-June 1. Peak April 5-25; max. 10,000, Falmouth, 4/6/44. Su.: Reg. non-breeding stragglers & small flocks.

(1964 Check-list) New Hampshire: Abund. W. Re. and rare Su. Re. Ocean. Season: mid-Sept.-early June; less common July & Aug.

(Palmer) Maine: Abund. coastal Mg.; common/numerous coastal W. Re.; common non-breeding coastal Su. Re. Sp.: early April-early June; most depart late May. F.: Sept.-Oct. into early Nov. Su.: flocks mainly 1st year birds. W.: along entire coast, usually flocks of less than 40 birds.

(Squires) New Brunswick: Common Mg. & W. Re. on coast. Dates: Aug. 12-June 15.

SPECIES: Mergus serrator (L.) A.O.U. 130
Red-breasted Merganser

LITERATURE:

Bailey (1968): 57
Bent (1923): 13-22
Bull (1964): 146-147
Forbush (1939): 93-94
Hill (1965): 101
Palmer (1949): 130-132
Squires (1952): 41

STATUS: Abund. W. Re.; Mg.; B.; Su.

DISTRIBUTION: Breeds casually on L.I., N.Y. & Gardiner's Is., N.Y. & Sandy Hook, N.J.; rarely on the coast of Mass. & Mt. Desert Is., Maine. Winters Nova Scotia s. to Fla.

HABITAT: Breeds in/near freshwater ponds & streams, near the sea; spends greater part of year on salt water. In migration & winter on open ocean, sounds, bays, estuaries, sheltered waters, tidal bays & inlets. Rock headlands (Stott & Olson, 1972).

BREEDING DATA:

Nest: On ground, sheltered. Cavity of plant material lined with down.

Clutch size: 6-16 (Forbush); usually 8-10 (Bent).

Incubation: 26-28 days (Bent) Fledging period: unknown.

No. Broods/Season: 1 (Palmer)

Nest losses: Predation, flooding.

PREDATORS: Human beings, hawks, owls, angler fish (Glegg, 1945).

ADULT MORTALITY: Predation, oiling, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Hunting, habitat disturbance (Forbush); oiling (Austin-Smith, 1968).

DIET: Chiefly fish; also crustaceans, mollusks (Bent).

NOTES: New Jersey: Year-round re.; B. (Sandy Hook St. Park)

(Bull) New York Area: Common/very abund. coastal Mg. & W. V. Reg. in Su. (non-breeder); very rare breeder. Mg. & W.: Occurs in largest #'s in Montauk area, L.I. Sound & on the larger bays. Max. #'s: 10,000,

Montauk area, 11/23/37; Montauk to Easthampton, late Nov. 1941--25,000 on Nov. 27, ≥ 40,000 on Nov. 30; 1,500, Reynolds Channel, Atlantic Beach, 3/11/50. Recorded breeding at: Fisher's Is., Gardiner's Is., Oyster Pond (Montauk), Shinnecock Bay, & Mastic; since 1942: Jones Inlet (Short Beach), Aug. 3, 1953.

(1970 Checklist) Rhode Island: Mg. & W. Re. Individual birds throughout the year. Early Oct.-mid-May.

(Hill & Bailey) Cape Cod, Mass.: F: Common Mg., avg. Oct. 18-Dec. 25, peak Nov. 9-Dec. 10, avg. 200-500; flocks up to 2,000 in Cape Cod Bay near Jeremy Pt., Wellfleet. max. 1,300, Eastham to Chatham, 11/12/49. W.: Fairly common/abund. Re., avg. 50-100. Sp.: Common Mg., avg. March 1-May 15, peak April 3-25; avg. 100-500, max. 2,500, Chatham to Eastham, 4/10/49; 2,500, Provincetown, 4/21/57. Su.: Nested regularly at Monomoy since 1877. Also elsewhere. Some scattered non-breeding birds.

(1964 Checklist) New Hampshire: Common W. Re. and rare Su. Re., along coast. Season: early Oct.-mid-May; less common June-July.

(Palmer) Maine: Fairly common breeding Re. on islands westward into Penobscot Bay, unc. from there to Casco Bay. A few non-breeding Su. visitants on coast. Very common W. Re., numerous Sp. Mg. & abund. F. Mg. Sp.: March 21-May 24. F.: late Sept.-Nov., peak last half of Oct. W.: On salt water as far out as the Matinicus Islands. Max. #'s: 300, Penobscot Bay, 2/18/43. Decreasing.

(Squires) New Brunswick: Common Re. & Mg. Present year-round. Prob. breeds Grand Manan area.

SPECIES: Haliaeetus leucocephalus (L.) A.O.U. 352 & 352a
Bald Eagle

LITERATURE:

Bailey (1968): 59
Bent (1937): 321-349
Bull (1964): 157-158
Forbush (1939): 116-119
Hill (1965): 108-109
Palmer (1949): 146-149
Squires (1952): 45-46

STATUS: B.; W.; Mg. (H.l.leucocephalus Endangered (U.S. Dept. of Int., 1973)

DISTRIBUTION: Breeds coast of Newfoundland s. to N.J. & Md. (H. leucocephalus alascanus). Winters Nova Scotia s. through breeding range & beyond.

HABITAT: Chiefly near oceans, rivers & lakes; W. as far n. as ice-free water permits (R.T.P.).

BREEDING DATA:

Nest: High in trees, on cliffs; has been known to nest on ground. Nest of limbs & branches lined w/twigs & other vegetation. Use same nest in successive years (Palmer).

Clutch size: 1-4, avg. 2 (Bent).

Incubation: 35 days (Bent, Palmer) Fledging period: 10-11 weeks (Palmer).

No. Broods/Season: 1 (Bent, Palmer).

Nest losses: Predators, inclement weather, falling from nest, shell thinning due to pesticides.

PREDATORS: Hawks, crows, human beings.

ADULT MORTALITY: Predation, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Shot. Pesticides--causing egg-shell thinning & ∴ lowered reproductive success. Habitat loss.

DIET: Fish, birds, (scaup, coots, ducks, grebes, Little Blue Heron, Snowy Egret, terns, Killdeer, geese, brants, crows, loons, gulls, cormorants, grouse); mammals; often carrion, & wounded, sick, disabled fish, livestock, animals, and birds (Bent).

NOTES: New Jersey: Mg. & W. Re.
(Not Sandy Hook St. Park)

(Bull) New York Area: Gen. rare, but locally fairly common W. visitant & F. Mg.; rare Su. V. Very rare breeder; reported every month. Decreasing. Max. 5, Idlewild, 9/24/50. Breeding: Rarely along coast, near tidal estuaries. Nested on Gardiner's Is. until 1930.

(1970 Checklist) Rhode Island: Rare Mg. & W. V. Individual birds throughout the year. Mainly mid-Nov.-early March.

(Hill & Bailey) Cape Cod, Mass.: Rare visitor, avg. 1-3/year. Formerly 3 populations: (1)Breeding: now extinct. (2) Summering: unc. & irreg. visitor, usually imm. Avg. May 30-Sept. 1; peak June 15-July 31. Only single birds seen since 1940. Collect at herring runs in June then disperse over entire Cape. (3) Wintering: Unc./irreg., avg. Dec. 15-March 15, peak, usually mid-Jan.; avg. 1-4, max. 9, 12/21/47. Scattered over Cape, concentrating eastward in cold weather where seen on ice in bays and estuaries feeding on dead & dying ducks.

(1964 Checklist) New Hampshire: Rare W. Re., estuaries. Possible year-round, less common June-Aug.

(Palmer) Maine: Unc. Su. Re., common local W. Re. on coast; coastal Mg. Sp.: population shift Jan.-mid-March, W. birds departing to nesting territories. F.: Begin to congregate at suitable locations on coast in Aug.; Mg. in Sept. & Oct. Su.: local breeder. Egg dates March 26-April 23.

(Squires) New Brunswick: Unc. Re. & Mg. Present year-round.

SPECIES Pandion haliaetus (L.) A.O.U. 364
Osprey

LITERATURE:

Bailey (1968): 59
Bent (1937): 352-379
Bull (1964): 159-160
Forbush (1939): 121-123
Hill (1965): 110-111
Palmer (1949): 152-154
Squires (1952): 47

STATUS: B.; Mg. Decreasing rapidly

DISTRIBUTION: Breeds Newfoundland s. to Fla.

HABITAT: Near lakes, bays, oceans, estuaries, swamps.

BREEDING DATA:

Nest: Tops of large dead/isolated trees, rocks, bluffs, platforms, etc. Occ. on ground. Often in colonies. Uses same nest in successive years. Nests of branches, driftwood, seaweed, and varied other vegetation, lined w/finer materials.

Clutch size: 2-4, usually 3. (Forbush, Bent); 2.3 (Reese, 1969).

Incubation: ~28 days (Bent) 35-38 days (Palmer)
Fledging period: prob. 55-65 days (Palmer).

No. Broods/Season: 1

Nest losses: Predation, inclement weather, falling from nest, shell thinning due to pesticides, infertility.
% eggs producing fledglings: 32-40% (Reese, 1970);
Avg. # young/breeding adults: 0.93 (Reese, 1965).

MORTALITY: 1st year 53.3%; 2nd-5th years 19.6% (Henny & Wight, 1969). Adult mortality due to predation, disease, parasitism.

PREDATORS: Owls, hawks, eagles, large herons, human beings, raccoons, rats, etc. Bald Eagle robs the Osprey of its prey.

RELATIONSHIP WITH HUMAN BEINGS: Hunting, egg collecting. Pesticides, habitat loss, disturbance at nest site (Ames & Mersereau, 1964).

DIET: *Fish: generally surface or shallow-water fish. Occ. young ducks, snakes, frogs.

NOTES: New Jersey: Mg.; Su. non-breeding and breeding. (Sandy Hook St. Park)

(Bull) New York Area: Fairly common/common Mg. along coast. Locally common to formerly very common breeder on e. end of L.I., but has decreased considerably in recent years; unc/rare elsewhere. Max. Mg.: Sp.: 50, Orient, 4/1/44. F.: 135, Mecox to Shinnecock Bays, 9/2/29; 44, Sherwood Is. off Westport, Conn., 9/12/54. Rare before late March and after early Nov. Ext. dates: March 10-Dec. 7. Breeding: Largest colony formerly on Gardiner's Is. In 1908, Chapman said were at least 300 nests in early 19th century; between 150-200 were present in 1908. In 1962, at least 21 "active" nests. Also decreased at Orient Pt. (25 nests in 1951) & on Shelter Island (30 active nests, 1961); 6 nests, 1961, on Fishers Is. Elsewhere, rare and local. 1963--very few eggs hatched, perhaps due to pesticides. Egg dates: April 18-June 12. Avg. annual rate of decline in Conn.: 13-14%/year--due to lowered reproductive success (Henny, 1972)

(1970 Checklist) Rhode Island: Mg. & Su. Re. Individual birds throughout the year. Mainly mid-March-early Oct. Selected breeding locations: Matunuck, Jamestown Is.

(Hill & Bailey) Cape Cod, Mass.: Rare visitor; formerly nested (last record, 1962). Sp.: Rare Mg. avg. April 20-March 30; usually single birds. Su.: single, wandering birds. F.: unc. Mg. Avg. Aug. 12-Oct. 13; peak Sept. 1-30; avg. 1-2 birds, occ. 3. Other Mass. locations: 10 prs. breeding, 1974, Westport (M. House, pers. comm.)

(1964 Checklist) New Hampshire: Unc. coastal mg. Season: early April-mid-Oct. (less common June-Aug.).

(Palmer) Maine: Common Su. Re. on coast & islands from Casco Bay eastward; common coastal Mg.; 4 W. records. Sp.Mg.: March 28-May 8, peak April 3-19. F.Mg.: Sept. 4-Oct. 22, peak 2nd & 3rd weeks of Sept. Breeding: Egg dates early May-early June. Selected breeding locations: Loud Is. (Damariscotta): 8 nests in 1966, total of 3 young hatched & fledged (Kury, 1966). Avg. annual rate of decline in Me. 12-13%; due to lower reporductive success, caused by egg-shell thinning.

New Brunswick: Not unc. Su. Re. & Mg. Egg dates (Squires) May 14-June 10 (4 nests). Present March 19-Nov. 7.

SPECIES: Charadrius semipalmatus (Bonaparte) A.O.U. 274
Semipalmated Plover

LITERATURE:

Bailey (1968): 63
Bent (1929): 217-229
Bull (1964): 184-185
Forbush (1939): 172
Hill (1965): 124
Matthiessen & Stout (1967): 158
Palmer (1949): 193-194
Squires (1952): 54

STATUS: Common/abund. Mg.; (W.);(B.)

DISTRIBUTION: Migrates along the Atlantic coast. Winters rarely n. to N.J. & N.Y. Breeds Sandy Hook St. Park, N.J.

HABITAT: Rubble, gravel, patches of stranded debris. As Mg. & W. V. usually on mud flats & to lesser extent on beaches. Extensive tidal flats along outer coast. Beaches (M.&S.; Bull; Palmer).

BREEDING DATA:

Nest: A depression in the sand, with no lining or a few bits of shells, grass, or seaweed (Bent).

Clutch size: 3-4 (Bent)

No. Broods/Season: 1?

Incubation: Unknown; prob.~22 days (Bent) Fledging period:~1 month.

Nest losses: Flooding, predation.

PREDATORS: Probably gulls, hawks, owls, rats, etc.

ADULT MORTALITY: Predation, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Hunting--now recovered & common (M. & S.). Habitat loss. Eats mosquito larvae and other injurious insects (Bent).

DIET: Insects; small worms, mollusks, crustaceans (M. & S.).

NOTES: New Jersey: Mg. & breeds. (Sandy Hook St. Park)

New York Area: Common/very abund. coastal Mg. Small
(Bull) #'s in Su. in outer coast. Very rare in W. Among most numerous of shorebirds. Found most often in

largest #'s on extensive tidal flats on the outer coast. Rare before late April & after Oct. Ext. dates: March 23 and early April to Nov. 20; Dec. 7 & 10. Max. #'s: Sp.: 6,000, Idlewild, 5/17/39; 700, Idlewild, 6/1/48. F.: 4,000, Idlewild, 8/24/51.

(1970 Checklist) Rhode Island: Mg. Sp.: late April-early June. F.: mid-July-late Oct.

(Hill & Bailey) Cape Cod, Mass.: Sp.: Common Mg. Avg. May 5-June 2. peak May 20-30 birds, max. 150, 5/21/50. Su.: Rare, scattered, non-breeding stragglers. F.: Abund. Mg. Avg. July 20-Oct. 15; peak Aug. 1-10 for adults, avg. 300-500, max. 5,000,8/4/55; also Aug. 23-Sept.1, same avg., max. 2,300, 8/23-24/41. Max. #'s at Monomoy, Nauset, Wellfleet, Provincetown. Counts stable for 25 years.

(1964 Checklist) New Hampshire: Abund. Mg.; mud flats & beaches. Season: mid-May-early June; late July-late Oct.

(Palmer) Maine: Common Sp. Mg. & fairly common F. Mg. Rare non-breeding Su. Re. Sp.: May 20-June 11. F.: Aug.-Oct. 13. Peak in Sept.

(Squires) New Brunswick: Common Mg., more common in F. Present May 8-Nov. 2, peak in Aug. & Sept.

SPECIES: Pluvialis squatarola (L.) A.O.U. 270
Black-bellied Plover

LITERATURE:

Bailey (1968): 64
Bent (1929): 154-171
Bull (1964): 189
Forbush (1939): 176-177
Hill (1965): 131-132
Matthiessen & Stout (1967): 159-163
Palmer (1949): 198-199
Squires (1952): 55

STATUS: W.; Abund. Mg.; Su.(non-breeding).

DISTRIBUTION: Winters on the Atlantic coast from N.J. (rarely Mass.) south. Migrates in Sp. & F. along the Atlantic coast. Summers (non-breeding) mainly Mass. s.

HABITAT: Mud flats & shallows, intertidal zone, moist fields; at times grassy & other dry places (M. & S.). Salt meadows, marshes (Bull, Palmer).

BREEDING DATA: Does not breed in study area.

PREDATORS: Large predatory birds, mammals.

ADULT MORTALITY: Predation, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Formerly hunted & decreased. Full recovery since protection (Hill).

DIET: Fishes, crabs, algae, marine worms, small mollusks, crustaceans (Forbush, Bent).

NOTES: New Jersey: Mg. & W. Re. (Sandy Hook St. Park).

(Bull) New York Area: Very common/abund. coastal Mg. Reg. in W. & Su. (non-breeding). Largest flocks in May; F. flights more protracted (Aug.-Nov.). Max. #'s: Sp.: 6,000, Hewlett to Oceanside, 5/30/54. F.: 600, Idlewild, 9/2/46; 50, Jamaica Bay, 12/2/50. W.: Reg. since 1929. Max.: 15, Fire Is. Inlet, 1949. 88 on all Christmas counts combined, 1952; 1953-54 census: 150 from Brooklyn-Nassau-Queens area; 63 from Westport, Conn. area. Su.: Reg. in small #'s on outer coast. Max. 25, Jones Beach, 6/29/39.

(1970 Check-list) Rhode Island: Mg.; Su. & W. V. Individual birds throughout the year. Main dates: mid-April-early June; early July-late Nov.

(Hill & Bailey) Cape Cod, Mass.: Sp.: Abund. Mg. Avg. April 20-June 3; peak May 20-25. Avg. 1,000 birds, max. 3,500, Monomoy, 5/21/43. Su.: Most reg. and common of non-breeding shorebird stragglers. F.: Abund. Mg. Avg. July 25-Oct. 25, peak Aug. 15-25 for adults, avg. 800-1,500 birds, max. 2,500, Nauset, 8/25/45; also Sept. 5-Oct. 1, avg. 1,500-2,000 birds, max. 3,000, North Beach, 9/30/50. W.: Reg. in small #'s avg. 1-5, & often surviving successfully.

(1964 Check-list) New Hampshire: Abund. Mg., mud flats & salt marshes. Season: early May-early June; late July-mid-Nov.

(Palmer) Maine: Common Mg.; rare Su. V. Sp.: May 14-June 11. F. Aug. 14-Oct. 24, peak late Aug.-Sept.

(Squires) New Brunswick: Not unc. Mg. Season: May 1-June 8, Aug. 1-Nov. 9.

SPECIES: Calidris minutilla (Viellot) A.O.U. 242
Least Sandpiper

LITERATURE:

Bailey (1968): 68
Bent (1927): 202-213
Bull (1964): 205-206
Forbush (1939): 198
Hill (1965): 147-148
Matthiessen & Stout (1967): 215-216
Palmer (1949): 225-226
Squires (1952): 61

STATUS: Very common/abund. Mg.; Su.(non-breeding);(W.).

DISTRIBUTION: Summers (non-breeding) Newfoundland s. to S.C. Winters from N.C. s. (rarely n. to N.J. & N.Y.). Migrates along Atlantic coast.

HABITAT: Prefers grassy, sheltered situations: edges of estuaries, about pools in salt marshes, edges of lagoons; also alga-covered wet rocks in intertidal zone; seldom out on open shore. Salt meadows, mud flats, sandfill (M.&.S., Bull).

BREEDING DATA: Does not breed in study area.

PREDATORS: Predatory birds, mammals.

ADULT MORTALITY: Predation, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Habitat loss; hunting--now protected. Needs mowed meadows.

DIET: Small crustaceans, worms, insects, & larvae.

NOTES: New Jersey: Mg.

(Bull) New York Area: Common/abund. coastal Mg.; occ. more numerous. Very rare in W. Rare before late April & after early Oct. Reg. Su. stragglers. Ext. dates: April 3-Nov. 18. Max. #'s: 5,000, Idlewild, 5/19/39; 1,200, Oak Beach, 7/18/48. More recently flocks of 20-50 are the rule.

(1970 Check-list) Rhode Island: Mg. Sp.: early May-mid-June. F.: early July - late Oct.

(Hill & Bailey) Cape Cod, Mass.: Sp.: Fairly common Mg. Avg. May 10-May 30. Peak May 20-25. avg. 50-200, max. 700, Monomoy, 5/21/43. Su.: Very rare non-breeding straggler. F.: Common Mg. Avg. July 4-Oct. 1. Peak July 13-30. avg. 100-300, max. 1,500, Monomoy, 7/18/54. Slight increase in past 25 years.

Least Sandpiper Notes (continued)

(1964 Checklist) New Hampshire: Common Mg.; mud flats & salt marshes. Season: early May-early June; early July-late Sept.

(Palmer) Maine: Common Sp. Mg., abund. F. Mg. A few non-breeding Su. Re. Sp.: *May 15-31; a few into mid-June. F.: mid-July-Oct. 1 Peak July 25-Sept. 10. Su.: A few small flocks, usually 5-8 birds.

(Squires) New Brunswick: Very abund. Mg.; non-breeding Su. Re. Season: May 14-Nov. 16.

SPECIES: Calidris pusillus (L.) A.O.U. 246
Semipalmated Sandpiper

LITERATURE:

Bailey (1968): 69
Bent (1927): 244-255
Bull (1964): 212-213
Forbush (1939): 202-203
Hill (1965): 152-153
Matthiessen & Stout (1967): 217-221
Palmer (1949): 230-232
Squires (1952): 62

STATUS: Abund. Mg.; W.;Su.; B.

DISTRIBUTION: Migrates along the Atlantic coast. Winters n. to Md. & s. N.J., very rarely to L.I. & Mass. Summers (non-breeding) entire area. Breeds Sandy Hook State Park, N.J.

HABITAT: Mud flats & beaches in intertidal zone (M.&S.); edges of marsh vegetation (Palmer); rocky shores & seaweed drift (Bent).

BREEDING DATA:

Nest: Amid grass or vines in sand dunes; a depression in sand, lined with leaves, grass stems (Bent).

Clutch size: 4 (Bent)

Incubation: 17 days (Bent) Fledging period: ~1 month (Bent)

No. Broods/Season: 1 (Bent)

Nest losses: Predation, flooding.

PREDATORS: Owls, hawks, gulls.

ADULT MORTALITY: Predation, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Hunting--now protected & recovered (Hill, Bull). Eats mosquito larvae.

DIET: Aquatic insects & their larvae; small mollusks (Littorina), worms & crustaceans (Gammarus orchestia), bits of seaweed (M.&S.;Bent).

NOTES: Sandy Hook, N.J.: B.,Su., Mg.

(Bull) New York Area: Common to very abund. coastal Mg. Very rare in W. Rare before late April and after Oct. Ext. dates April 3-Dec. 7. Su.: non-breeding

birds reg. & not unc. Max. #'s: 25,000, Easthampton to Mecox Bay, 5/19/24; 6,000, Idlewild, 8/24/51. W.: 17, Hewlett Bay, 12/30/61.

(1970 Checklist) Rhode Island: Mg. & Su. V. Individual birds throughout the year. Main dates: early May-mid-June; mid-July-late Oct.

(Hill & Bailey) Cape Cod, Mass.: Sp.: Abund. Mg. Avg. May 5-June 2. peak May 25-30, avg. 5,000-12,000 birds, max. 35,000, Monomoy, 6/1/57. Su.: Unc. non-breeding straggler. F.: Abund. Mg., avg. July 6-Oct. 20. Peak July 22-Aug. 18, avg. 2,000-5,000 birds, max. 25,000, Monomoy, 8/4/55. Found on sand and mud flats along bays and marshes, less on outer beaches. Highest counts at Monomoy, Nauset, Wellfleet, Barnstable, and Provincetown.

(1964 Checklist) New Hampshire: Abund. Mg.; mud flats & beaches. Season: early May-early June; mid-July-mid-Oct.

(Palmer) Maine: Sp. Mg, abund. F. Mg., small #'s in Su. (non-breeding). Sp.: May 12-early June, a few into mid-June. F.: July 18-Oct. 19, peak July 24-Sept. 25. Su.: Small flocks mainly on islands; more rarely on coastal mainland.

(Squires) New Brunswick: Unc. Sp. Mg.; very abund. F. Mg. Season: May 14-Oct. 17. A few Su. records (non-breeding).

SPECIES: Calidris alba (Pallas) A.O.U. 248
Sanderling

LITERATURE:

Bailey (1968): 70
Bent (1927): 265-277
Bull (1964): 216-217
Forbush (1939): 206-207
Hill (1965): 157-158
Matthiessen & Stout (1967): 233-238
Palmer (1949): 234-236
Squires (1952): 63

STATUS: Su.; W.; Mg.

DISTRIBUTION: Summers (non-breeding) mainly Mass. s. to Fla. Winters from Mass. south. Migrates in Sp. along the Atlantic coast n. to New Brunswick (rare); in F. over the Sp. routes in increased #'s.

HABITAT: Hard sandy beaches & shores, to lesser extent coastal & inland mud flats. Outer beaches & edges of surf (M. & S., Hill). Occ on rocks, mudbanks (Palmer); also tidal flats, gravel beaches.

BREEDING DATA: Does not breed in study area.

PREDATORS: Gulls, hawks, owls, etc.

ADULT MORTALITY: Predation, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Hunting--now protected & increasing (Hill).

DIET: Sand fleas & other crustaceans, small mollusks, worms, beach insects; small buds & seeds. (M. & S., Bent, Forbush).

NOTES: Sandy Hook, N.J.: Mg. & W.

(Bull) New York Area: Common/abund. Mg. on outer coast. Fewer #'s in W. & as a summering non-breeding Re. Usually unc. Mg. on inner coast (L.I. Sound). Max. #'s: 1,800, 6/6/46; 1,300 8/9/47--both at Idlewild. W.: 200, Plum Beach, 12/20/58; 300, all Jan., 1952, Atlantic Beach to Pt. Lookout.

(1970 Check-list) Rhode Island: Mg. & Su. V. Individual birds throughout the year. early May - mid-June; late July-late Nov.

(Hill & Bailey) Cape Cod, Mass.: Sp.: Abund. Mg. Avg. May 15-June 1, avg. 5,000-20,000, max. 27,000, Monomoy, 5/30/52. Su.: Fairly common non-breeding straggler. F.: Abund. Mg., avg. July 15-Nov. 10, peak July 22-Aug. 12. Avg. 500-3,000, max. 10,000, Monomoy, 7/22/54.

W.: Reg. though unc. Re., usually surviving.

(1964 Check-list) New Hampshire: Common Mg. & rare W. Re.; beaches and mud flats. Season: late July-early June (less common late Nov.-early May).

(Palmer) Maine: Rare Sp. Mg., fairly common/abund. F. Mg. Occ. W. records. Sp.: May 5-June 12 (Max. #'s: 8); F.: mid-July (rarely) - mid-Nov. Peak Aug. 15 - Oct. 20.

(Squires) New Brunswick: Rare Sp. Mg.; common F. Mg. Season: July 7-Nov. 16.

SPECIES: Lobipes lobatus (L.) A.O.U. 223
Northern Phalarope

LITERATURE:

Bailey (1968): 71
Bent (1927): 15-28
Bull (1964): 220-221
Forbush (1939): 211-212
Hill (1965): 160-161
Palmer (1949): 238-240
Squires (1952): 64-65

STATUS: Migrates

DISTRIBUTION: Migrates abundantly along the Atlantic coast, often well offshore.

HABITAT: Open ocean; sometimes more inland, partic. after storms and in foggy weather (M. & S.)(Bull)(Forbush). Regularly enters large bays and sounds.

BREEDING DATA: Does not breed in study area.

PREDATORS: Gulls, hawks, owls; occ. sharks, large fish, seals (Glegg, 1945).

ADULT MORTALITY: Predation, oiling, striking man-made objects, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Fly into lighthouses (Forbush, Hill). Oiling (M.&S.).

DIET: Insects: flies and larvae, mosquito larvae, bugs, beetles; spiders, marine worms, small mollusks and crustaceans, a few small fishes, few seeds (Bent, M.& S.) Reportedly follow whales (M.&S.). A swimmer.

NOTES: New Jersey (Sandy Hook St. Pk.): Mg.

(Bull) New York Area: Reg. Mg., partic. in Sp. Occ Su. straggler. Sp: Rare before mid-April; Ext.: March 29+ April 2-June 3. Max. #'s: 900+, Westhampton Beach to Shinnecock Inlet, April 28-May 2, 1958; "1000's", May, 1969, Westhampton to Easthampton, ~1,300, May9-12, 1969, Montauk (Davis & Morgan, 1969). F.: Rare after mid-Oct. Ext.: July 16, 19, 28-Nov. 15, 23. Max. #'s: 165, off Montauk Pt., 9/13/16.

(1970 Check-list) Rhode Island: Mg.; early May-early June; early July-late Sept.

(Hill & Bailey) Cape Cod, Mass.: Common/abund. offshore Mg. Sp. Peak: May avg. 10-40 birds. Ext. dates: April 14-June 1. Max. #'s: 3,000, North Beach, 5/19/63. F.: Avg.: Aug. 1-Oct. 12, peak in Sept.; avg. 20-500 birds; Max. #'s: 1,000+ on 9/7/53, in easterly gale at Nauset; 10,000, Provincetown Harbor, 9/9/63. Ext. dates: July 24-Nov. 11.

(1964 Check-list) New Hampshire: Unc. Mg.; open ocean. Season: early May - early June; early Aug. - late Oct. (?).

(Palmer) Maine: Abund. Mg.; reported Su. & W. Sp.: Greatest #'s offshore & inshore near West Quoddy Head, Washington Co. May 21-June 11. F.: Reg. in e. Me. inshore waters the 3rd week in July, & from 28 July of Casco Bay. "Many 1000's" present near West Quoddy Head by last week of July through Aug., perhaps up to several hundred thousand. By Sept. 10 only small #'s remain, few to Sept. 22.

(Squires) New Brunswick: Very common Mg.; congregates in "enormous numbers" s. of Grand Manan. Season: April 6-May 12; July 11-Sept.

SPECIES: Larus marinus (L.) A.O.U. 47
Great Black-backed Gull

LITERATURE:

A.O.U. (1957)
Bailey (1968): 72
Bent (1921): 77-86 (1947 ed.)
Bull (1964): 229-231
Forbush (1939): 218-219
Hill (1965): 165-166
Palmer (1949): 245-247
Squires (1952): 66-67

STATUS: B.; Su.; W., Mg.

DISTRIBUTION: Breeds from Greenland s. to Va. (locally). Non-breeding birds summer s. to N.C. Winters s. to N.C.

HABITAT: Beaches, harbors w/fishing industry; ponds; garbage dumps; tidal rivers; sewage out-flows. Nest on outer islands in Gulf of Maine. Does not occur so far out at sea as the Herring Gull (Palmer).

BREEDING DATA:

Nest: Usually in colonies on islands in sea or freshwater. Nest on ground or rocks, occ. in vegetation. Of seaweed, grass, sticks, debris. (Forbush, Palmer).

Clutch size: 2-3, avg. 3 (Bent, Palmer).

Incubation: 26-28 days (Bent, Palmer) Fledging Period: 7-8 weeks in Europe (Palmer).

No. Broods/Season: 1 (?)

Nest losses: Predation; flooding.

Nesting Success: (Erwin, 1971) Somewhat dependent on laying date, and # of breeding gulls in surrounding area. % eggs hatched: 44%; # eggs/pr.: 2.83 # young/pair: 1.25. Drury (1973) suggests a high mortality among nestlings & juveniles; new birds may add only 10-15% to winter population.

PREDATORS: Other gulls, jaegers, skua, mammals (inc. human beings); angler fish (Glegg, 1945).

ADULT MORTALITY: Predation, disease, oiling, striking human objects; human control methods

RELATIONSHIP WITH HUMAN BEINGS: Shot--protected after 1915 (Hill); Comes to human garbage dumps to feed. Follows fishing boats occ. Is being controlled in some area, as

it preys on ducklings; considered competitive to duck production. Aircraft strikes; disease vector (Thomas, 1972). (See also Species Account on the Herring Gull).

DIET: Fish (dead & alive); robs other birds of prey; eats eggs, young, & occ. adults of other birds (e.g. Dovekies); small mammals, shellfish, crustaceans, carrion, garbage, sewage (Bent, Forbush, Palmer; Hunt & Hunt, 1973).

NOTES: Sandy Hook St. Pk., N.J.: Year-round Re. breeds.

(Bull) New York Area: Common/locally abund. visitor along coast, most #'s Mgs. & W. Greatly increased in recent years. Very local breeder on L.I. Drury (1973): 12,400 prs. on L.I. in 1972 (compared to 30 in 1930). Selected breeding locations: Jamaica Bay (Canarsie Pol), Cartwright Is., Gardiners Is., Great Gull Is.

(1970 Checklist) Rhode Island: Permanent Re. Mean laying date: 22-25 April. Selected breeding locations: Block Is. Sound, East Is. (off Sakonnet Pt.), Jamestown Is., West Is.

(Hill & Bailey) Cape Cod, Mass.: Common Re. & Mg. Sp.: avg. March 20-May 1, avg. 300-600 birds. Su.: Breeding in small groups mostly on small islands since 1955. Increasing. F.: avg. Aug. 5-Nov. 20, peak Sept. 1-20. 800+ migrating at rate of 120/hr. on 9/6/58, Sagamore. 6,000, Nauset, 8/20/62. W.: Common Re. Christmas count max.: 230, 1930's; 1,550, 1940's; same, 1950's. Avg. up to 50 all during W. Selected breeding locations: Boston Harbor, Chatham, Great Egg Rock (Mass. Bay), Green Is. (Mass. Bay), Is. s. of Cat Island (Mass. Bay), Little Calf Is. (Mass. Bay), Marblehead Rock (Mass. Bay), Milk Is. (North Shore), Monomoy N.W.R., Muskeget Is. (off Nantucket), No. Gooseberry Is. (Mass. Bay), Provincetown, Thacher Is. (No. Shore), Wellfleet, Wellfleet Bay Wildl. Sanc.

(1964 Checklist) New Hampshire: Permanent Re. along the coast. Selected breeding locations: Isles of Shoals.

(Palmer) Maine: Common/numerous breeding Re. on coastal islands; Mg.; W. Re. Dispersal from breeding areas in late July & Aug.; F. Mg. in Sept. & Oct. Return flight peaks in Feb. Selected breeding locations: Booth Bay, Casco Bay (e.g. No. upper Green Is., Two Bush Is.),

Fox Is., Green Is. (off Petit Manan), Hog Is., Jericho Bay (e.g. Green Is. Ledge), Little Brimstone Is., Muscongus Bay (e.g. Jones Garden Is., Mosquito Is., Shark Is.), Penobscot Bay (e.g. E. Goose Rock, Goose Rock, Matinicus Is., Mouse Is., Pond Is., Roberts Is., Robinson Rock, Sloop Is.), Saco Bay (e.g. Gooseberry Is.), Swan's Is.

(Squires) New Brunswick: Common Re. Greatly increased in recent years. Present year-round. Breeding dates: April 29-July. Selected breeding locations: Grand Manan, Kent Is., Quoddy, E. Green Is., Little (Western) Green Is., White Horse Islet.

SPECIES: Larus argentatus (Pontoppidan) A.O.U. 51
Herring Gull

LITERATURE:

Bailey (1968): 72-73
Bent (1921): 102-120 (1947 ed.)
Bull (1964): 233-235
Forbush (1939): 219-221
Hill (1965): 166-167
Palmer (1949): 248-257
Squires (1952): 67

STATUS: Re.; B.; W.; Mg.

DISTRIBUTION: Breeds s. along Atlantic coast to L.I., locally to s. Va. & N.C. Non-breeding birds summer along the entire coast. Winters entire area. Migrates along both coasts of N. America.

HABITAT: Lakes, rivers, bays, oceans, beaches, garbage dumps, sewage outlets, tidal estuaries & inlets.

BREEDING DATA:

Nest: Usually in colonies on islands. Bulky nest on ground among scattered vegetation, or in low conifers; sometimes a stump or ledge. Of twigs, seaweed, grass, or debris. (Forbush, Bull, Palmer)

Clutch size: 3-5 (Forbush); 1-4, avg. 3 (Bent)

Incubation: 24-28 days, avg. 26 (Bent) Fledging period: 6-7 weeks (Palmer).

No. Broods/Season: 1

Nest losses: Predation, flooding.

Nesting success & mortality: % of eggs hatched: 44% (Erwin); 20-42% of eggs fail to hatch (Baerends & Drent, 1970); 30% (Kadlec & Drury, 1968); 29-35% (Paynter, 1949); # young/pr.: 1.76 (Erwin, 1971); 0.8-1.4 young/pr. (Kadlec & Drury, 1968); # eggs/pr.: 2.69. Mortality through 1st W.: 20-25%; through 2nd W.: 20-22% (Kadlec & Drury, 1968); Adult mortality 30% per year. Life expectancy after adulthood: 2.8 years (Lack, 1954); maximum 18 years (Jonkel & Pettingill, 1974).

PREDATION: Other gulls, owls, jaegers, skua, mammals (inc. human beings), angler fish (Glegg, 1945).

ADULT MORTALITY: Predation, disease, parasitism, striking human objects, human control methods.

RELATIONSHIP WITH HUMAN BEINGS:

During the 1800's, gull populations were nearly decimated due to egging, the millinery trade and being taken for food and bait. With protection, the Herring Gull increased dramatically into the 1950's, then leveled off and may now be decreasing somewhat. The population increase seems to be due largely to proliferation of human refuse, as this gull (like Larus marinus) is a scavenger, eating garbage, sewage, etc. and following fishing boats for offal.

Because of their large numbers, the Herring Gull and the Great Black-backed Gull are being controlled in some areas. Their droppings create both a health hazard and a nuisance aesthetically on buildings and vessels. Aircraft strikes are also a problem with these birds. They will occasionally steal bait and eat fish spread on fields for fertilizer if the fish is not quickly plowed under. They have been known to frighten fish in a pound, thereby forcing them downward and smothering the fish. These gulls will eat herring, pollock, and mackerel, and are also known to eat young lobsters, crabs, and shrimp. They have been known to damage blueberry crops.

L. Argentatus and L. marinus have had detrimental effects on many bird species and are mainly responsible for the rapid decline of the Laughing Gull in the northeast United States; this gull cannot compete with the larger gulls. These gulls prey extensively on the eggs and young of the double-crested Cormorant, eiders and other ducks, and terns; they have been known to eat adult terns, sandpipers, and dovekies.

These species do have beneficial aspects. They will eat carrion and refuse; and insects, including grasshoppers in plowed or mowed fields. They are also adversely affected, as are so many birds, by oiling, pollution, human disturbance of breeding sites (e.g. by picnickers), and habitat loss.

The major control method used on L. marinus and L. argentatus is spraying the eggs with an oil-formalin emulsion, so that they will not hatch. Although this method is successful, it is expensive and time-consuming, and will require many years before it has a noticeable effect on the gull populations (similar to the "lag" period for human birth control methods). (Austin-Smith, 1968; Bent, 1921; Drury, 1973-74; Gross, 1954; Hunt, 1972; Nisbet, 1971; Palmer, 1949; Thomas, 1972).

DIET: Scavenger: carrion, fish offal, sewage, squid, crustaceans, mollusks, echinoderms, worms, garbage, insects, occ. eggs & young of other birds; occ. other birds (Bent). Will eat almost anything.

NOTES

Sandy Hook St. Pk., N.J.: Resident year-round; B.

(Bull) New York Area: Very abund. Mg. & Re., greatest #'s in W. Locally common breeder on coast. 1st nested at Orient, 1931. By 1941, over 1,000 breeding prs. on L.I. Now most #'s on e. L.I. W.: 30,000 to 40,000 in some areas; total may be over 1,000,000. Selected breeding locations: Canarsie Pol (Jamaica Bay), Cartwright Is., Gardiner Is., Great Gull Is., Jamaica Bay N.W.R., Goose Is. (off Guilford, Conn.), Hammonassett State Pk. (Conn.), Sheep Rocks (off Norwalk, Conn.)

(1970 Checklist) Rhode Island: Permanent year-round Re. Selected breeding locations: Block Is. (Sandy Pt.), Block Is. Sound, Dyer's Is., East Pt. and "the Clumps" (off Sakonnet Pt.), Jamestown Is., Sandy Point Is. (off Napatree Pt.), Gooseberry Is. (off Hope Is.), Gooseberry Is. (off Newport), West Is. Mean laying date: 7-10 May.

(Hill & Bailey) Cape Cod, Mass.: Abund. Re. & very abund. Mg. Peak July-Nov. Sp.: avg. March 25-May 25. avg. 1,000-3,000, max. 10,000, Chatham, 4/10/49. Su: Breeds in small groups all over Cape--disrupts & displaces tern and laughing gull colonies; also many non-breeders present. Nesting began 1925-1930. 100 in 1938; 1,800 in 1947; 10,000 in 1950; 15,000 in 1956. F.: avg. Aug. 1-Dec. 1, avg. 2,000-7,000, max. 7,000, Monomoy, 8/3/52. W.: Abund. Re. 1,000-10,000 in 1930's; 2,000-10,000 in 1950's; max. 21,487 in 1960. Selected breeding locations: Boston Harbor, Chatham, Coatue (Nantucket), Gurnet Pt. (Plymouth Co.), Martha's Vineyard, Mass. Bay (e.g. Great Egg Rock, Green Is., Is. s. of Cat Is., Little Calf Is., Marblehead Rock, No. Gooseberry Is.), Milk Is. (North Shore), Monomoy N.W.R., Muskeget Is., Nantucket, Norman's Woe, Penikese Is. Provincetown, Tern Is., Thacker Is. (North Shore), Wellfleet.

(1964 Checklist) New Hampshire: Abund. permanent Re. along coast. Selected breeding locations: Isle of Shoals.

(Palmer) Maine: Common/abund. Re.; abund. Mg. & W. Re. Sp.: Many small flocks in mid-Feb.--arrive at Kent Is., N.B. colony last week of Feb. F.: Dispersal movement--peak in last half of Aug. Breeding: Laying May 10-June 10. Selected breeding locations: Booth Bay, Brothers Is. (e. Me.), Casco Bay (e.g. No. Upper Green Is., Two Bush Is.), Cone Is. (e. Maine), East Brown Cow Is., East Duck Is., Fisherman's Is., Fox Is., Green Is. (off Petit Manan), Hog Is., Jericho Bay, Little Brimstone Is., Metinic Green Is., Muscongus Bay (e.g. Jones Garden Is., Mosquito Is., Shark Is. (Rock)), No Man's Land Is., Old Man Is., (e. Maine), Penobscot Bay (e.g. East Goose Rock, Flat Is., Goose Rock, Great Duck Is., Green Is. Ledge, Little Duck Is., Matinicus Is., Mouse Is., Pond Is., Roberts Is., Robinson Rock, Sloop Is.), Petit Manan Is., Saco Bay (e.g. Gooseberry Is.) South Fox Is., Swan's Is.

(Squires) New Brunswick: Very abund. Re., present year-round. Egg dates: May 12-June 2. Selected breeding locations: E. Green Is., Grand Manan Is., Kent Is., Little Green Is., Outer (Little) Wood Is., Quoddy, White Horse Islet.

SPECIES: Larus atricilla (L.) A.O.U. 58
Laughing Gull

LITERATURE:

Bailey (1968): 73
Bent (1921): 154-163
Bull (1964): 237-239
Forbush (1939): 222-223
Hill (1965): 169
Palmer (1949): 258-262
Squires (1952): 68

STATUS: B.; Mg.

DISTRIBUTION: Breeds n. to Petit Manan Is., Me.; perhaps to Machias Seal Is., N.B. Migrates mainly inland along the larger streams near the eastern seaboard.

HABITAT: Depends on region: salt marsh, rocky islands with grassy areas; sand, either with much or little vegetation; thickets of poison ivy & bayberry (Bent, Bull, R.T.P.); Ocean beaches, mud flats, bays, reservoirs (Bull).

BREEDING DATA:

Nest: Breeds on grassy islands or in salt marsh; colonial. Nest of weeds, sticks, grass, debris, lined with finer materials. Usually under some protective vegetation. (Palmer, R.T.P., Bent).

Clutch size: 2-4, usually 3 (Bent, Palmer).

Incubation: 20 days (Bent, Palmer) Fledging period: ?

No. Broods/Season: 1 (Palmer)

Nest losses: Predation, disturbance by grazing livestock (Nisbet, 1971) & human beings (Packard, 1970).

PREDATORS: Other gulls, jaegers, skuas, mammals (e.g. rats).

ADULT MORTALITY: Predation, parasitism, disease, pollution.

RELATIONSHIP WITH HUMAN BEINGS: Habitat loss, partic. due to sheep grazing in breeding areas. Feeds on human refuse; Greatly decreased as breeder due to disturbance of breeding areas (by livestock & picnickers) & competition with Herring Gull & Great Black-backed Gull (Drury, 1973; Nisbet, 1971; Packard, 1970; Hunt, 1972).

DIET: Garbage, offal, dead fish & carrion; fish, mollusks, crustaceans; eggs of other gulls & terns; cicadas (Bent, Forbush, Hill). Has been seen to fish by "skimming"

(Tolonen, 1970). Also is "cleptoparasitic" on terns--chases terns & steals fish (Hatch, 1970).

NOTES: Sandy Hook St. Pk, N.J.: Year-round Re.; B.

(BULL) New York Area: Common/locally abund. coastal Mg. & Su. V. Unc. in W., but increasing. Has decreased as breeder but increased as non-breeding Su. & W. V. Migration: Greatest #'s around N.Y. Harbor & L.I. Sound. Rare before late March & after mid-Dec. Sp.: Max. #'s: 800, Narrows, 4/28/49; 200, Centre Is., L.I., 5/15/60. Su.: 1,000,(imm.), Setauket, L.I., 6/27/34; F.: 300, Idlewild, 8/24/51; 1,000, Little Neck Bay, 9/24/49; 300, Jamaica Bay Refuge, 9/27/59; 2,000, Lower Bay, 10/28/51. W.: Usually only 1-2/W.; max. 50, Conn.--Westchester-Bronx-Manhattan-Brooklyn areas, 12/23/50.

(1970 Check-list) Rhode Island: Mg. & Su. Re.; individual birds throughout the year.

(Hill & Bailey) Cape Cod, Mass.: Fairly common Mg. & Su. V.; very local breeder (formerly in much greater numbers). Su.: Small #'s of non-breeding Re. & wandering birds from other colonies. Largest #'s on the Lower Cape in July & Aug.; up to 30 are reg. along protected bays and inlets, occ. offshore.
Sp.Mg.: Avg. April 12-June 4, peak May 20-30, avg. 75-200 birds; max. 300, 5/25/41, Chatham.
F.Mg.: Avg. July 20-Oct. 12, peak July 25-Aug. 15 (adults); Aug. 8-20 (young). Avg. 100-300, max. 700, Monomoy, 7/29/39. W.: very rare straggler, never proven to survive entire season.
History: Increased greatly after 1900; now decreasing, mainly due to habitat loss & competition with the Herring Gull & Great Black-backed Gull (e.g. 1930--20,000 bred on Muskeget Is.; 1970--50 prs.).
Selected breeding locations: Monomoy N.W.R., Muskeget Is., possibly Weepecket Is. (Nantucket Sound), possibly Nahant (Nisbet, 1971).

(1964 Check list) New Hampshire: Rare Mg., estuaries & ocean.
Season: late April-early June; mid-Aug.-late Sept.

Laughing Gull Notes (continued)

(Palmer) Maine: Unc./fairly common Mg.; unc.(non-breeding) Su. Re.; local breeding Re. Mg.: Sp. arrival May 7-12; F. departure mainly Sept. Su.: a few non-breeding residents--prob. no more than 35. Breeding colonies increased 1900-1940, to 250-300 prs.; since 1940 has decreased to ~150 prs. in 1972 (Drury, 1974). Selected breeding areas: Cuckold Is. (Booth Bay); Matinicus Rock--3-4 prs. in 1970; Matinicus Seal Is.; Petit Manan Is.--50-55 prs., 1970 (Nisbet, 1971).

(Squires) New Brunswick: Very rare Su. V. Formerly bred on Machias Seal Is. (1948).

SPECIES: Sterna hirundo (L.) A.O.U. 70
Common Tern

LITERATURE:

Bailey (1968): 74-75
Bent (1921): 236-241 (1947 ed.)
Bull (1964): 245-247
Forbush (1939): 229-231
Hill (1965): 176-178
Palmer (1949): 265-271
Squires (1952): 69-70

STATUS: B.; Mg.

DISTRIBUTION: Breeds from Newfoundland s. along the Atlantic seaboard to N.C. Migrates along coast.

HABITAT: Offshore to protected salt-water & sometimes inland fresh-water ponds. Beaches, marshes (Bent, Bull, Hill).

BREEDING DATA:

Nest: Colonial, on sandy beaches & small islands (R.T.P., Bull). Nest is a hollow in sand or among pebbles, sometimes among weeds, grasses. Nesting material (when added) of straws, twigs, feathers, shells, pebbles, debris (Palmer, Bent).

Clutch size: 2-6, usually 3-4 (Bent, Forbush, Palmer).

Incubation: 21 days (Bent) 23-26 (Palmer).
Fledging period: 30 days (Palmer).

No. Broods/Season: 1 (Bent, Palmer).

Natality rate: 1.5-4.9, avg. 2.4-3.0 young/pr./year.
% of nests recording hatching: 16.5% (Cooper, Hays & Pessino, 1970).

Nest losses & Mortality: Predation; flooding; pollution.
Avg. yearly mortality: 19-25% (Austin & Austin, 1956); max. longevity 25-30 years (Welty, 1962).

PREDATORS: Other gulls & terns; jaegers, skua, mammals, crows, owls, Red-winged Blackbirds (Pessino, 1968), Black-crowned Night Heron (Collins, 1970).

ADULT MORTALITY: Predation, pollution, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Nearly extirpated in early 1900's by plume trade; protected after 1913, & recovered by 1920's (Bull). Habitat loss (Gochfield, 1973; Hill).

Loss of breeding grounds due to increase of gulls. Chemical contamination of water & food sources; human disturbance of nesting sites; Human trash may cause mortality (e.g. beer tops) (Gochfield, 1973; Nisbet, 1973).

DIET: Small fish or fry: alewives, herring, sand-lances, menhaden; crustaceans, worms, insects (Bent, Forbush).

NOTES: Sandy Hook St. Park, N.J.: Mg.; Su.; B.

(Bull) New York Area: Locally abund. breeder & Mg. along coast. Mg.: 1,500, Oak Beach, 5/10/36; 5,000, Moriches Inlet, after hurricane, 9/3/49; 500, Sunken Meadow Beach, 8/26/50. Rare before May & after mid-Oct. Ext. dates: April 15-Dec. 5. Breeding: Variously rare to abund. Nest at Moriches Bay (5,000 prs.+ in 1961); Fire Island Beach (2,000+ prs. in 1960); Cedar Beach (1,500+ prs. in 1961); Also Bull Is. (Orient Pt.), Great Gull Is.(1,300 prs. in 1966 & 1967, Donaldson, 1968; Cooper, Hays & Pessino, 1970), Hobart's Beach, Jamaica Bay N.W.R., Meadow Is. & Short Beach. Also a few Conn. localities: Goose Is., Little Tavern Is., Faulkner Is., Hammonasett St. Pk., Lobster Rock, Pebble Beach. Egg dates: May 12-Aug. 14.

(1970 Checklist) (Clement & Wooddruff, 1962) Rhode Island: Mg. & Su. Re. breeds. Individual birds throughout the year. Selected breeding locations: Aquidneck Is., Block Is. Sound, Briggs Marsh, Jamestown Is., Narragansett Bay, Sakonnet Pt., Cormorant Rock (Middletown), Gull Rock (Newport), Island Rocks (Middletown), Ninigret Pond, Round Rock (off Hope Is.), Seal Rock (Mt. Hope Bay), Trustom Pond.

(Hill & Bailey) Cape Cod, Mass.: Sp.: Re. arrive, abund. Mg.'s Avg. Re. arrival: May 5-15; avg. Mg. period: May 12-June 1. Peak: May 14-25, avg. 2,000-5,000 birds, max. 10,000, Chatham, 5/14/52. Su.: Locally abund. breeding Re. Main colony: Tern Is., Chatham. Other colonies variable from year to year. 30,000 breeding birds 1931-1946; by 1956, 15,00-20,000: gradual loss of breeding areas. F.: Abund. Mg. Avg. July 10-Oct. 25. peak: July 28-Aug. 10, avg. 1,000-5,000 birds, max. 18,000, Monomoy, 7/30/38; 30,000, Monomoy, 8/4/54. Occ. second peak, Sept. 10-Oct. 3. W.: Casual straggler; never surviving.

Selected breeding locations: Bird Is. (Buzzard's Bay), Boston Harbor, Cape Ann, Cape Cod Bay, Cohasset, Craigville, Fish Is. (Buzzard's Bay), Gray's Beach, Great Pt. (Nantucket), Jeremy's Pt., Martha's Vineyard (e.g. Norton's Pt. & Sylvia Beach), Monomoy N.W.R., Nantucket, Nantucket Sound, Nashawena (Wood's Hole), Nauset Beach Inlet, No Man's Land Is. (off Martha's Vineyard), North Sandwich, Penikese Is., Plum Is., Plymouth Beach, Ram Is. (Buzzard's Bay), Sampson's Is., Sandy Neck, Sarson Is. (off Martha's Vineyard), Snake Is., Tern Is. (off e. Cape Cod), West Dennis, Parker River N.W.R. 1972: Total all Mass. colonies: 6,700 prs (Nisbet, 1973). Decreasing.

(1964 Check-list) New Hampshire: Common Su. Re. along coast. Season: mid-May-late Sept.

(Palmer) Maine: Common/abund. Su. Re. on marine islands; common (?) Sp. & F. Mg. Sp.: Majority arrive May 14-27; birds continue to arrive at colonies into 2nd week of June. F.: Begin to leave colonies 2nd week in Aug. Migration mainly Aug. 18-Sept. 8. Occ. in late Oct. Egg dates: Laying completed May 27-June 5. Selected breeding locations: Booth Bay, Casco Bay, Jericho Bay, Machias Bay, Muscongus Bay, Penobscot Bay, Petit Manan Is. (~1,200-1,500 prs. Arctic & Common Terns--1969(Hatch, 1970)).

(Squires) New Brunswick: Common Su. Re. & Mg. Egg dates: June 13-July 8. Season: May 21-Oct. 15. Selected breeding locations: Grand Manan, Machias Seal Is.

SPECIES: Sterna albifrons (Pallas) A.O.U. 74
Least Tern

LITERATURE:

Bailey (1968): 75-76
Bent (1921): 270-279 (1947 ed.)
Bull (1964): 253-254
Forbush (1939): 235-236
Hill (1965): 181-182
Palmer (1949): 275-276
Squires (1952): 70-71

STATUS: B.; Mg.

DISTRIBUTION: Breeds along coasts & coastal islands from n.e. Mass. (locally to s. Maine) to Georgia.

HABITAT: Ocean beaches, sand flats (Bull, Bent); outer beaches, chiefly on drier sand (Hill)

BREEDING DATA:

Nest: On open sand or slightly pebbly sand, or broad flat beaches above high-tide mark. Hollow in sand. Small or large colonies.

Clutch size: 2-4, usually 2 (Bent)

Incubation: 14-16 days (Bent)

No. Broods/Season: 1 (?)

Nest losses: Flooding, predation, human disturbance.

ADULT MORTALITY: Predation, pollution (chemical & solid waste), disease, parasitism.

PREDATORS: Domestic cats, dogs, rats, other mammals, gulls, crows, hawks, etc. (Bent, Fisk, 1972).

RELATIONSHIP WITH HUMAN BEINGS: Reduced by egging & plume trade--has increased since protection (Hill, Bull, Bent, Palmer). Destruction of habitat from "dune buggies" (Hill, Bailey). Habitat loss--development of beaches, (Bull). Human distrubance at breeding areas; chemical contamination of water & food sources; trash may cause mortality (Gochfield, 1973; Nisbet, 1973).

DIET: Small fish, crustaceans, beach insects, "sand eels" (Bent).

NOTES: Sandy Hook St. Park, N.J.: Mg.; Su. Re.; B.

(Bull) New York Area: Common/abund. Mg. on outer coast. Local breeder, occ. numerous. Mg.: Rare before May; departs by late Aug. or early Sept. Rare after mid-Sept. Ext. dates: April 20-Oct. 9. Max. #'s: Sp.: 300, Atlantic Beach, 5/6/45. F.: 500, Moriches Inlet, 9/3/49 (after a tropical storm). Breeding: 1942: 300+ prs. on s. shore of L.I. Recent Max.: June 21, 1951, 200+ prs. in Short Beach area; 20 prs. in Port Jefferson area. Conn.: 5 prs. in 1961, 1962. Egg dates: May 10-July 25. Selected breeding locations: Canarsie Pol Jamaica Bay), Hobart's Beach, Meadow Is. & Short Beach, Sherwood Is. (Westport, Conn.).

(1970 Checklist) (Clement & Woodruff, 1962) Rhode Island: Mg. & Su. Re. Season: early May-mid-Sept. Selected breeding locations: Briggs Marsh, Moonstone Beach, Matunuck, Galilee, Green Hill Beach, Misquamicut, Sandy Pt. (off Napatree Pt.) (may no longer be breeding here).

(Bailey & Hill) Cape Cod, Mass.: Common Mg. & Su. Re. Sp.: Mainly arrival of residents, avg. May 10-15. Avg. Mg. period: May 20-30. Avg. #'s: 30-60, max. 100, Chatham, 5/28/49. F.: Unc. Mg. Avg. July 20-Sept. 10, peak July 25-Aug. 5, avg. 30-100 birds. Max. #'s: 200, several times; Nauset, 600, 7/8/62; 400, Monomoy, 7/8/64. Su.: Locally common/fairly common breeding Re. 500+prs.--location fluctuate; found on suitable beaches from Falmouth & Sagamore e. to Chatham & n. to Provincetown. Selected breeding locations: Cotuit, Craigville, Crane's Beach, Great Point (Nantucket), Gurnet Pt. (Duxury area), Ipswich, Martha's Vineyard (e.g. Norton's Pt.), Monomoy N.W.R., Nashawena (Wood's Hole), No Man's Land Is. (off Martha's Vineyard), North Beach, Plum Island, Plymouth Beach, Sandy Neck, Sarson Is. (off Martha's Vineyard), Snake Is., Tern Is., Wellfleet, West Dennis, Parker River N.W.R. Total, all Mass. colonies, 1972: 950 breeding prs. (Nisbet, 1973). Is decreasing.

(1964 Checklist) New Hampshire: Rare Su. Re., estuaries & beaches Season: mid-June - early Sept. Selected breeding locations: Hampton Harbor.

(Palmer & Drury, 1973-1974) Maine: Mg. & Su. Re. Increasing since protection, renewed breeding in 1961. Selected breeding locations: Booth Bay, Scarboro Beach.

(Squires) New Brunswick: Cas./Acc.

SPECIES: Alca torda (L.) A.O.U. 32
Razorbill

LITERATURE:

Bailey(1968): 77
Bent (1919): 199-208
Bull (1964): 260-261
Forbush (1939): 242-243
Hill (1965): 186
Palmer (1949): 283-285
Squires (1952): 72

STATUS: B.; W.

DISTRIBUTION: Breeds s. to Penobscot Bay, Maine. Winters from Greenland s. to N.Y. (L.I.) rarely to N.J. Del., Md.

HABITAT: Offshore, and larger bays with sandy & rock bottoms (Hill). Prefers rocky coast (Bull). Feeds on plankton & nekton zones, not oceanic (Palmer).

BREEDING DATA:

Nest: In colonies on islands; in crevices, cavities, ledges; usually somewhat concealed.

Clutch size: 1 (Bent)

Incubation: 30 days, by both sexes (Bent) Fledging period: ~25 days (Bent); 15.7 days (Keighley & Lockley, 1947).

No. Broods/Season: 1

Nest losses: Predation

PREDATORS: Hawks, gulls, owls, angler fish (Glegg, 1945).

ADULT MORTALITY: Predation, oiling, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Oiling (Bull, Hill; Austin-Smith, 1968). Eggs & flesh eaten by people; also hunted for skin & feathers.

DIET: Fish, crustacea, mollusks (Bent).

NOTES: New Jersey: Unc. W. V.

(Bull) New York Area: Rare & irreg. W. V. on outer coast, occ. #'s at Montauk Pt. Perhaps more regular offshore. Rare before late Dec. & after early March. Ext. dates: Nov. 2-May 18. Avg. 1-3 birds (Montauk

area); max. Jan. 1932 (after severe storm): 80, Jan 1; 100 between Montauk Pt. & Ditch Plains, Jan. 3; 50, Jan. 10.

(1970 Check-list) Rhode Island: Unc. W. V. Season: late Nov.-early April.

(Hill & Bailey) Cape Cod, Mass.: Rare/unc. W. V., irreg. in #'s. avg. 1-2 birds. Max. #'s: 400 (after severe storm), 11/16/59, off First Encounter Beach, Eastham. Greatest #'s from Provincetown to Monomoy; more common along rocky coasts n. of Cape Cod (e.g. Cape Ann). Su.: Scattered oiled or crippled birds, rarely surviving to Sept.

(1964 Check-list) New Hampshire: Unc. W. Re., ocean & open ocean. Season: mid-Nov.-early April (?)

(Palmer) Maine: Unc./rare Su. Re. & non-breeder; unc/fairly common Mg. & W. Re. in inner offshore waters; F.: Dispersal from breeding grounds in mid-Sept.; migration late Oct.-Dec. Sp.: Movement to breeding grounds Feb.-early March. W.: #'s fluctuate; counts from the M.V. Bluenose between Bar Harbor & Yarmouth indicate a significant offshore wintering population. Selected breeding locations: Matinicus Is. and Seal Is., Penobscot Bay; Old Man Is. (e.Me.)

(Squires) New Brunswick: Rare Re & Mg. Egg dates: June 1-Aug. 3. Present year-round. Formerly more abund. Selected breeding locations: Grand Manan, Kent Is., Machias Seal Is.

SPECIES: Cepphus grylle (L.) A.O.U. 27
Black Guillemot

LITERATURE:

Bailey (1968): 78
Bent (1919): 156-161
Bull (1964): 264-265
Forbush (1939): 247-249
Hill (1965): 188-189
Palmer (1949): 288-290
Squires (1952): 73

STATUS: B.; W.; Mg.

DISTRIBUTION: Breeds from s. Labrador to Isles of Shoals, N.H.; Winters on open water s. to Mass & R.I., very rarely to L.I., N.Y. and casually to N.J. (Egg Harbor).

HABITAT: Off rocky shores & outer shoals; frequently feed just beyond line of breakers (Hill, Bull, Palmer).

BREEDING DATA:

Nest: On offshore islands, in burrows, crevasses, ledges of rocky shores. Between high-tide line and edge of vegetation. No real nest made--may add a few sticks, stones, or bits of seaweed at site (Palmer).

Clutch size: 1-2, usually 2 (Forbush, Palmer).

Incubation: ~21 days, by both sexes (Palmer). Fledging period: Unrecorded, probably 4-5 wks. (Palmer); 15.8 days (Keighley & Lockley, 1947).

No.Broods/Season: 1 (Palmer)

Nest losses: Flooding, predation.

PREDATORS: Gulls, crows, hawks; mammals; angler fish (Glegg, 1945).

ADULT MORTALITY: Predation, disease, oiling, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Oiling.

DIET: Small eels, small fish, mollusks, crustaceans, marine worms, other marine invertebrates (Bent).

NOTES: New Jersey: C. W. V.

New York Area: Very rare W. V., rocky shores & breakwaters. 2 dozen records (½ from Montauk Pt. area). Ext. dates: Oct. 26-April 12.

(1970 Checklist) Rhode Island: Very rare/casual W. V.

(Hill & Bailey) Cape Cod, Mass. Rare W. V., rocky shores & breakwaters. More commonly seen north of Cape Cod. Ext. dates: Oct. 26-April 2. Max. #'s: 2, Provincetown, 1/15/66.

(1964 Checklist) New Hampshire: Unc. W. Re., ocean & open ocean. Season: early Nov.-early April (?). Breeds on Smuttynose Is., Isles of Shoals--this is the southernmost breeding location.

(Palmer) Maine: Fairly common/numerous Su. Re. from Muscongus Bay east, on islands; also non-breeding Su. birds, occ./unc., westward. Sp. & F. Mg., & W. Re. Sp.: Return to breeding areas, April-early May. F.: Mainly dispersal from breeding areas, early Aug. Su.: Clutches usually completed June 10-18. Selected breeding locations: Booth Bay, Casco Bay (e.g. Two Bush Is.), Cross Is., Fisherman's Is., Fox Is., Jericho Bay (e.g. Green Is. Ledge, Saddleback Is., Southern Mark Is.), Jordan's Delight (off Petit Manan), Little Spoon Is (off Swan's Is.), Long Is. (off Swan's Is.), Machias Bay, Marblehead Is. (off Fox Is.), Muscongus Bay (e.g. Eastern Egg Rock, Mosquito Is.), No Man's Land Is., Old Man Is., Penobscot Bay (e.g. East Goose Rock, Goose Rock, Great Duck Is., Great Spoon Is., Green Ledge (off Matinicus Is.), John's Is., Little Duck Is., Matinicus Is., Mouse Is., Robinson Rock, Shag Ledge Is. (off Matinicus), Ten Pound Is. & Seal Is. (off Matinicus Is.), Wooden Ball Is. (off Matinicus Is.)), Petit Manan Is., Saco Bay, Schoodic Is. (off Petit Manan), Swan's Is., York shore.

(Squires) New Brunswick: Common coastal Re. Present throughout the year. Egg dates: May 25-July 30. Selected breeding locations: East Green Is., Grand Manan, Kent Is., Little Green Is., Quoddy, White Horse Islet.

SPECIES: Iridoprocne bicolor A.O.U. 614
Tree Swallow

LITERATURE:

Bailey (1968): 84
Bent (1942): 384-400
Bull (1964): 304-305
Forbush (1939): 324-326
Hill (1965): 214-215
Palmer (1949): 363-365
Squires (1952): 89

STATUS: B.; W.; Mg.

DISTRIBUTION: Breeds from Newfoundland s. to Va. Winters n. to N.Y. (rare).

HABITAT: Open wooded swamps near water; shorelines, marshes, bogs.

BREEDING DATA:

Nest: Near water, in holes, bird houses, occ. dock pilings. Nest of grass & straw lined with feathers. (R.T.P., Bent, Bull, Palmer)

Clutch size: 4-6 (Bent, Palmer).

Incubation: 13-16 days (Bent) Fledging period: 16-24 days (Palmer)

No. Broods/Season: 1-2 (Bent) 1 (Palmer).

Nest losses: Inclement weather.

PREDATORS: ?

ADULT MORTALITY: Severe weather, starvation, predation, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Competes for nest sites with the Starling and House Sparrow (Palmer). Eats injurious insects.

DIET: ~80.5% animal, 19.5% veg. (Bent). Insects: ants, Dipterans, grasshoppers, spiders, etc. Vegetable: bayberries & a few seeds (Bent).

NOTES: Sandy Hook St. Park, N.J.: Mg. & occ. W. Re.

(Bull) New York Area: Common/abund. Mg.; peak in F. along outer coast. Rare in W., chiefly on coast. Local breeder. Arrives in late March, occ. earlier.

Begins departure in July, continues to Nov. or even Dec. Peak F. Mg.: late Aug.-mid-Sept. On s. shore of L.I., freq. estimates of 50,000 to 100,000 birds. W.: Eats bayberries. max.#'s: 66, Raritan Bay, 12/29/53. Egg dates: April 28-June 19.

(1964 Checklist) Rhode Island: Mg. & Su. Re.; individual birds throughout the year. Season: late March - mid-Oct.

(Hill & Bailey) Cape Cod, Mass.: Sp.: Re.'s arrive; unc. Mg. avg. arrival April 1-May 3; seldom more than 100 birds. Su.: Fairly common but local breeder. F.: Abund. Mg. avg. Aug. 15-Oct. 10, peak late Aug.-Sept. Counts irreg.: 500-10,000. W.: Casually attempts, occ. survives.

(1964 Checklist) New Hampshire: Abund. Su. Re., semi-open country & swamps. Season: late March -mid-Sept.

(Palmer) Maine: Common/numerous Su. Re., both on coast & coastal; numerous Sp. & F. Mg. Sp.: Usually present in s. Me. e. to Penobscot Bay by April 12; further east by April 18-early May. F.: Most have departed by Aug. 17; a few flocks into mid-Sept. Su.: Clutches probably completed by May 25. Breeding population decreasing.

(Squires) New Brunswick: Very common Su. Re. & Mg. Usually present by mid-April; rare after early Sept. Season: April 11-Nov. 10. Egg dates: June 2-June 22.

SPECIES: Telmatodytes palustris
Long-billed Marsh Wren

A.O.U. 725 & 725d

LITERATURE:

Bailey (1968): 89
Bent (1948): 235-240
Bull (1964): 328-329
Forbush (1939): 363-365
Hill (1965): 229-230
Palmer (1949): 402-404
Pearson, Brimley & Brimley (1959):
Squires (1952): 95

STATUS: B.; W.; Mg.

DISTRIBUTION: Breeds from New Brunswick (very rare), Maine, Cape Cod & R.I. (locally) south to Va. Winters (locally) through breeding range & s. to Fla.

HABITAT: Coastal & estuarine marshes; tidal rivers, brackish & salt marsh (Bull).

BREEDING DATA:

Nest: In Cattail & Phragmites marshes & other grasses--both brackish & salt water; colonial, in shrubs, grasses, etc. (Bent). Nest of cattail leaves, grasses & sedges, lined with cattail down, feathers, rootlets, duckweed, etc., with an inner lining of fine shredded plant material (Palmer).

Clutch size: 3-6, usually 4 (Bent, Palmer) 5-9 (Pearson).

Incubation: 14 days, by female only (Palmer) Fledging period: 14 days (Palmer).

No. Broods/Season: 1-2 (Palmer).

Nest losses: Inclement weather; flooding; predation (Bent)(Forbush).

PREDATORS: Rats, snakes, etc. (Bent).

ADULT MORTALITY: Severe weather, predation, disease, starvation, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Habitat loss (very sensitive to human disturbance) (Pearson).

DIET: Insects & their larvae; spiders. (Pearson).

NOTES: New Jersey: Mg. & Su. Re.

Long-billed Marsh Wren Notes (continued)

(Bull) New York Area: Locally common/abund. breeder. Very rare Mg. Rare but reg. in W. in coastal marshes. Arrives on breeding grounds by early May & departs in Oct. Max. #'s: W: total of 22, Queens-s. Nassau Christmas counts, late Dec.-early Jan., 1953-1954. Breeding: (most recent record) 160 prs., Troy Meadows, 1947. Egg dates: May 22-July 26.

(1970 Check-list) Rhode Island: Mg. & Su.Re. Season: late April-mid-Oct. Individual birds throughout the year. Selected breeding locations: Aquidneck Is., Briggs Marsh, Portsmouth.

(Hill & Bailey) Cape Cod, Mass.: Unc. F. Mg.; very local breeding Re. Max. #'s: Sept.-mid-Nov. Sp.: Arrival of Re's; very rare Mg. in late May. Su.: Very local; known to be at Mashpee (6-8 prs.) & West Harwich (25 prs.). F.: Rare but fairly reg. Mg. Avg.: Sept. 12-Nov. 20, avg. 1-3, max. 7, Monomoy, 11/11/52; 4, Chatham, 10/16/64. W.: Reg. attempts to W. in small #'s, 1-5 birds, not known to survive past February.

(1964 Check-list) New Hampshire: Very local Su. Re., marshes. Season: early May-mid-Oct. (?). Selected breeding locations: Great Pond; Hanover.

(Palmer) Maine: Common,local Su. Re.; Mg. Sp.: Arrives early May-mid-June. F.: Departs Sept.-mid-Oct. Su.: Most first clutches completed by the first week in June. Selected breeding locations: Belgrade, Brewer, Waterville.

(Squires) New Brunswick: Very rare Su. Re. Season: May 28-Oct. 8. Breeds at Midgic.

SPECIES: Sturnus vulgaris A.O.U. 493
Starling

LITERATURE:

Bailey (1968): 93
Bent (1950): 182-214
Bull (1964): 354-355
Forbush (1939): 399-400
Hill (1965): 243
Palmer (1949): 437-440
Squires (1952): 102

STATUS: Re.; Mg.

DISTRIBUTION: Resident entire area. Migratory in N.B., Maine, s. to N.Y. (partially).

HABITAT: Cities, towns, country, roadsides, fields, pastures, marshes; on some islands. In W. & Mg. feed at garbage dumps, mud flats, stables, bird feeders (Palmer).

BREEDING DATA:

Nest: Extremely varied; often in holes or cavities. Usually from 10'-25' above ground (range: 2'-60'). Loose structure of grasses, twigs, straw, etc. (Bent).

Clutch size: 4-8, usually 4-5 (Bent, Palmer).

Incubation: ~14 days (Bent, Palmer) Fledging period: 14-21 days (Bent).

No. Broods/Season: 1-2

Nest losses: Predation

PREDATORS: Cats, hawks (Bent).

ADULT MORTALITY: Predation, disease, human control methods, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Introduced in 1890--has greatly increased. Comes to bird feeders. Damages some crops. Eats injurious insects. Drives off "desirable" species, e.g. E. Bluebird, Flicker, Tree Swallow,(Bull, Bent, Palmer).

DIET: 57% animal: *Insects: weevils, beetles, ants, bees, wasps, grasshoppers, etc.; various other small invertebrates. 43% vegetable: Wild & cultivated fruits, berries, seeds, grains. (Bent).

NOTES: Sandy Hook St. Park, N.J.: Year-round Re.; B.

(Bull) New York Area: Abund. "nuisance" species. Up to 150,000 reported from certain W. roosts in 1940's & '50's. Partially migratory. Egg dates: March 18-Aug. 20.

(1970 Checklist) Rhode Island: Year-round Re.; B.

(Hill & Bailey) Cape Cod, Mass.: Common/abund. Re. & Mg. Largest flocks Nov. 15-Jan. 1; avg. 200-800, max. #'s: 9,140, 12/28/58 (Christmas count). Population increasing since 1954. 1st recorded on Cape Cod in 1916 in Provincetown.

(1964 Checklist) New Hampshire: Abund. year-round Re.

(Palmer) Maine: Abund. Su. Re.; unc. on some islands. Sp. & F. Mg.; numerous/abund. W. Re. with smaller #'s on some islands. 1st flock of Starlings in Maine reported in Rumford, in Jan., 1913. Sp.: Mg.: early March-late April; during same period, dispersal of W. Re. F.: Mg.: early Sept.-mid-Nov. Su.: Most eggs laid late April-mid-May.

(Squires) New Brunswick: Very abund. Su. Re. & Mg. 1st recorded in Province on Grand Manan, in 1924--greatly increased; flocks to 5,000 birds. Season: Throughout the year.

SPECIES: Dendroica coronata
Yellow-rumped Warbler

LITERATURE:

Bailey (1968): 96
Bent (1953): 239-258
Bull (1964): 376
Forbush (1939): 426-427
Griscom & Sprunt (1957): 125-127
Hill (1965): 255-256
Palmer (1949): 465-467
Squires (1952): 108

STATUS: B.; W.; Mg.

DISTRIBUTION: Breeds s. to Me., formerly to s. Mass. Winters on the Atlantic coast n. to Maine (occ.).

HABITAT: Myrtle & bayberry thickets on the coast; roadsides, thickets, edges, pastures, salt marshes (G.&.S.;Bent).

BREEDING DATA:

Nest: Both inland and on inshore islands. In evergreen trees, occ. hardwood. Majority in cedar, fir & spruce. Ht. above ground: range is 4' to 25', avg. 8'-10'. Nest of twigs & weed stalks, lined with feathers.

Clutch size: 3-5, usually 4 (Palmer).

Incubation: 12-13 days. Fledging period: 12-14 (?) (Palmer).

No. Broods/Season: 1 (Palmer)

Nest losses: Inclement weather, predation.

PREDATORS: Snakes, mammals.

ADULT MORTALITY: Predation, disease, migration hazards, strikes, inclement weather, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Killed in large #'s by striking towers, ceilometers, etc. (G.&.S.). Comes to feeding stations, (Bailey). Habitat loss.

DIET: Bayberries, insects; also sumac. poison ivy, virginia creeper, cedar berries; grass and weed seeds (G. & S.; Bent).

NOTES: Sandy Hook St. Park, New Jersey: Mg. & W. Re.

Yellow-rumped Warbler Notes (continued)

(Bull) New York Area: Common/abund. Mg. Variously rare/very common in W. along the coast--depends on presence or absence of bayberries. Mg.: Rare before Sept. & after mid-May. Ext. dates: Aug. 4-June 22. Max. #'s: Sp.: 325, Prospect Park, 4/30/53. F.: 1,000, Prospect Park, 10/15/50. W.: Survives so long as there are enough bayberries. Max. 800, Easthampton to Montauk, Jan. & Feb., 1924.

(1970 Check list) Rhode Island: Mg. Y W. Re.; individual birds throughout the year. Season: mid-Sept.- late May.

(Hill & Bailey) Cape Cod, Mass.: F.: Common/abund. Mg., largely terminal. Avg. Sept. 20-Dec. 1. peak: for Mg.'s Oct. 5-30, counts vary, avg. 100-400, max. 2,000, Monomoy, 10/16/64. W.: Common/abund. Re. Arrive late Oct. & early Nov. peak in late Dec. Max. #'s: 3,280, 12/31/50. Heavy mortality in severe winters. Sp.: Departure of W. birds; some Mg.'s. avg. April 1-May 10, max. 250, 4/9/49; most Mg's. April 20-May 10, avg. 20-50.

(1964 Check list) New Hampshire: Abund. Mg. & very local year-round Re; mixed & coniferous woods. Season: mid-April-mid-Nov., less common late Nov.-early April.

(Palmer) Maine: Unc/very common Su. Re.; numerous/abund. Sp. & F. Mg. a few W. records, more recently. Sp.: April 15-25 May, peak, 1st half of May. F.: Begins flocking in early August; migration begins in latter half of Aug.--peak Sept. 5-Oct. 10. A few birds into Nov. Su.: Eggs laid in June.

(Squires) New Brunswick: Common Su. Re. & Mg. Arrives late April-early May; leaves Sept.-mid-Oct. Egg dates: June 5-June 28. Season: April 12-Nov. 4.

SPECIES: Agelaius phoeniceus (L.) A.O.U. 498
Red-winged Blackbird

LITERATURE:

Bailey (1968): 101
Bent (1958): 123-150
Bull (1964): 404-405
Forbush (1939): 465-466
Hill (1965): 275-276
Palmer (1949): 505-507
Squires (1952): 116

STATUS: B.; W.; Mg.

DISTRIBUTION: Breeds from Nova Scotia s. to Fla. Winters from Mass. (rarely) s. to Fla.

HABITAT: Marshes, salt & fresh; cattails, edges, bushes, sedges.

BREEDING DATA: Colonial.

Nest: Of grasses, reeds,mud, usually near water; sometimes on ground, occ. in trees, sometimes in shrubs, bayberry bushes, weeds, etc.

Clutch size: 3-5, avg. 4 (Bent).

Incubation: 10-14, avg. 11 days. Fledging period: ~16 days (Bent, Palmer).

No. Broods/Season: 1-2; occ. 3 (Bent, Palmer).

Nest losses: Flooding, predation, starvation ; ~50% mortality (Francis, 1971).

PREDATORS: Crows, grackles, Long-billed Marsh Wren, hawks, owls, minks, foxes, squirrels, snakes, etc.

ADULT MORTALITY: Predation, human control methods, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Shot as pest, & for food. Crop damage. Eats injurious insects.

DIET: Weed seeds, insects, spiders, grasshoppers, caterpillars, occ. mollusks. Some grain, less than expected: mainly oats & corn (Bent).

NOTES: Sandy Hook St. Park, N.J.: Year-round Re.; B.

New York Area: Very common/abund. F. Mg. Unc./ very common in W.; locally very abund. in W. roosts.

(Bull) Common/abund. breeder. Arr. late Feb. or early March, males 1st. Departs usually by mid-Nov. Egg dates: May 7-July 4. Max. #'s: 50,000, Iona Is., 11/5/54; 125,000, Raritan River roost, 12/23/52.

(1970 Check list) Rhode Island: Mg. & Su. Re.; individual birds throughout the year. Season: early March - late Nov.

(Hill & Bailey) Cape Cod, Mass.: Common Mg. & nester. Sp.: Arr. pf Re's; some Mg's. Avg. Re. arr.: for males, March 15-May 20, peak April 10-20; for females, April 15-May 30, peak May 10-20. Avg. flocks: 20-150 birds. Avg. Mg. period: April 1-May 5; irreg. #'s, occ. to several hundred. Su.: Common breeding Re. F.: Dispersal of Re's; a few Mg's. Avg. Re. departure: for males, July 25-Aug. 5; for females & young, by Aug. 15. Avg. Mg. period: Sept. 8-Oct. 28. Counts irreg.; seldom 30. Max. 400, Eastham, 10/16/63. W.: rare/irreg. stragglers; a few may survive.

(1964 Check-list) New Hampshire: Abund. Su. Re.; rare W. Re.; marshes & open country. Season: early March - mid-Nov., less common late Nov.-late Feb.

(Palmer) Maine: Common/numerous Su. Re., including on many larger islands; numerous Sp. & F. Mg. Sp.: Mg. March 12-April; peak March 21-early April. F.: Most birds depart in Sept.; a few flocks seen through Oct. Su.: Most eggs laid during 1st 10 days of June.

(Squires) New Brunswick: Common Su. Re. & Mg. Sp.: Mg. & arrival: late March-April. F.: most depart in Sept., a few into Oct. Season: March 23-Oct. 22. Egg dates: May 29-June 12.

SPECIES: Passerculus sandwichensis (Gmelin) A.O.U. 542
Savannah Sparrow

LITERATURE:

Bailey (1968): 107
Bent (1968): 675-696
Bull (1964): 444-445
Forbush (1939): 507-508
Hill (1965): 296-297
Palmer (1949): 549-550
Squires (1952): 126-127

STATUS: B.; W.; Mg.

DISTRIBUTION: Breeds from Nova Scotia s. to s.e. N.Y. (Hicks Is., Plum Is., Long Is.), N.J. & Md. Winters from Mass. s. on Atlantic coast to Fla.

HABITAT: Beaches, sand dunes, salt marshes; in dunes with Ammophila grass (Bull, Forbush); on grassy islands & drier parts of salt marshes (Palmer).

BREEDING DATA:

Nest: In fields, meadows, salt marshes & grassy slopes on islands. In hollow or depression on ground or tussock of grass along edge of driftwood, etc., concealed by grasses. Of coarse grass stems, lined with finer rootlets, grasses, or hair (Forbush, Bent, Palmer).

Clutch size: 3-6, avg. 4-5 (Bent, Forbush, Palmer).

Incubation: 12 days (Bent, Palmer) Fledging period: 14 days (Bent, Palmer)

No. Broods/Season: 2 (Palmer)

Nest losses: Predation, flooding, cowbird parasitism.

PREDATORS: Crows, hawks, foxes, cats, owls, etc. (Bent).

ADULT MORTALITY: Predation, migration hazards, disease, parasitism, severe weather, starvation.

RELATIONSHIP WITH HUMAN BEINGS: Fly into buildings on Mg., partic. TV towers & airport ceilometers (Bent). Habitat loss (Hill, Bull) (subspecies Passerculus sandwichensis princeps: "rare" (U.S. Dept. of Interior status)--habitat loss). Eats injurious insects & weed seeds.

DIET: ~46% animal: beetles, butterflies & moths, grasshoppers, wasps, ants, bugs; spiders, snails, etc.
~54% vegetable: *Grass seeds, weed seeds, some fruits & berries.

NOTES: Sandy Hook State Park, N.J.: Mg. & W. Re.; Su. Re. (breeds) in areas not in the park.

(Bull) New York Area: Common/very abund. F. Mg. along coast; unc./occ. very common in W. on coast. Locally numerous breeder on coast. Mg.: Usually arrives in late March & departs by mid-Nov. Avg. to 12. Max. #'s: 2,000, Orient, 10/12/55; W.: 210, Jamaica Bay area, 12/20/52. Su.: Nests along coast on sand dunes. 1935, Newark Meadows, ~125 nesting prs.; 1953, Jamaica Bay Refuge, 100 prs. Decreasing due to habitat loss. Egg dates: May 5-June 28.

(1970 Check-list) Rhode Island: Mg. & Su. Re. Individual birds throughout the year. Season: early April-mid-Nov.

(Hill & Bailey) Cape Cod, Mass.: Common Mg. & Su. Re.; recorded every month of year, chiefly April - Oct. Sp.: Arr. of Re. late March-April, peak early April. F.: Avg. Sept. 10-Nov. 20, peak Sept. 20-Oct. 20, avg. 15-30, occ. up to 50. Max. #'s: 50, Brewster, 9/28/53; 100, Monomoy, 8/23/61. Su.: Nests in beach grass & drier salt meadows throughout the Lower Cape--most numerous in extensive & undisturbed areas. 30+ prs. at Monomoy; 40-50 each at Barnstable & Orleans; smaller counts elsewhere. W.: Fairly reg. in small #'s, occ. surviving; W. max.: 27, Christmas Count, 12/30/61.

(1964 Check list) New Hampshire: Common Su. Re.; rare W. Re.; fields & salt marshes. Season: late March-early Nov., less common mid-Nov.-mid March.

(Palmer) Maine: Very common coastal & island Su. Re.; numerous Sp. & F. Mg.; a few W. records. Sp.: Arrives mainly mid-April-early May. F.: Peak mid-Sept.-mid-Oct. Su.: 1st clutches usually completed May 26 -mid-June; 2nd clutches started 2nd or 3rd week in July.

(Squires) New Brunswick: Abund. Su. Re. & Mg. Sp.: arrives mid-April-early May. Su.: Raises 2 broods; egg dates: May 29-July 30. Season: April 3-Nov. 3.

SPECIES: Ammospiza caudacuta (Gmelin) A.O.U. 549--
Sharp-tailed Sparrow

LITERATURE:

Bailey (1968): 107-108
Bent (1968): 989-1012
Bull (1964): 448-451
Forbush (1939): 512-513
Hill (1965): 298-299
Palmer (1949): 551-555
Squires (1952): 127-128

STATUS: B.; W.; Mg.

DISTRIBUTION: Breeds on the Atlantic coast from James Bay s. to N.C. Winters: in coastal marshes from S.C. s. to Fla.; casually n. to N.Y.

HABITAT: Coastal marshes, salt & brackish, primarily in marshes of Spartina patens and Spartina alterniflora (Palmer, Bailey).

BREEDING DATA:

Nest: In wetter portions of salt marshes, primarily in S. patens, S. alterniflora & Distichlis spicata. On ground above high tide line, or in sedges above ground (1-4 inches); of coarse grasses & seaweed, lined with finer material (Bent, Palmer).

Clutch size: 3-7, usually 3-5 (Bent)

Incubation: 11 days Fledging period: ~10 days (Bent)

No. Broods/Season: 1-2 (Bent)

Nest losses: Flooding, predation.

PREDATORS: Probably the same as most ground-nesting species (Bent).

ADULT MORTALITY: Predation, severe weather, starvation, disease, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Habitat loss: filling & diking of marshes (Hill, Bull)(Bent). Development & building (Bull). Eats injurious insects.

DIET: 81% Animal: Wasps, ants, beetles, grasshoppers, crickets, butterflies & moths, bugs, flies, etc.
19% Vegetable: Weed & Grass seeds & waste grain.

NOTES: Sandy Hook St. Pk., New Jersey: Year-round Re. B.

(Bull) New York Area: Common/locally abund. coastal Mg. partic. in F. Reg. but unc./rare in W., occ. more numerous. Common/locally abund. breeder in coastal salt marshes. Mg.: Usually arrives late April, departs by late Oct. Max. #'s: 9/21/38 1,000 in Orient region after a hurricane. W.: 32, Jones Beach Area, 1940-41. Breeding(A. c caudacuta): Gardiner's Bay, Montauk area; both shores of L.I. Sound; Westport, Conn. area; becoming less numerous on Staten Is., Hackensack Meadows, Newark Bay, & along n. New Jersey coast, due to filling of tidal marshes. Max. #'s: 120 prs., Pelham Bay area, 1955. Egg dates: May 9-Aug. 4.

(1970 Checklist) Rhode Island: Mg. & Su.Re.; individual birds throughout the year. Season: early May-late Oct.

(Hill & Bailey) Cape Cod, Mass.: 3 populations: Breeding & transients (A.c. caudacuta), vagrants. (1) Breeding: Re. arrive avg. May 23-June 1. Locally common/abund. breeding Re., in small colonies at the Audubon Sanc., Nauset Marsh in Eastham, & North Beach Marsh in Orleans. 1,000 prs. at Barnstable; 15-20 prs. each at Nauset & Monomoy. Smaller #'s elsewhere. Re. leave in Sept.-late Oct. W.: stragglers into early W. after mild F.; survival unsure; no records after Jan. 1. (2) Transients: Unc. Sp. Mg.,avg. May 28-June 5, avg. 3-5, max. 30, Monomoy, 5/30/53; Unc. F. Mg., avg. Sept. 20-Oct. 31, peak Oct. 1-10, avg. 2-6, max. 30, Nauset, 9/6/53; 25+, Barnstable, 10/11/53. (3) Vagrants of 2 subspecies, A.c. subvirgata & A.c. nelsoni.

(1964 Checklist) New Hampshire: Very local Su. Re., salt marshes . Season: mid-May-mid-Oct. (?).

(Palmer) Maine: A.c.subvirgata: Very common Su. Re. in a few salt or brackish marshes in Sagadahoc, Waldo, Hancock, & Washington Counties; rather rare in Lincoln & Knox Counties. Common/abund. Sp. & F. Mg. in coastal marshes. Sp.: Mg. May 20-early June. F.: mid-Sept.-Oct., peak Oct. 1-24. Su.: Nests in wetter portions of salt & brackish marshes. A.c. caudacuta: Common Su. Re. in York & Cumberland

Counties salt marshes. A.c. nelsoni: rare Sp. & F. Mg., Cumberland Co.

New Brunswick: A.c. subvirgata: Not unc. Su. Re. (Squires) & Mg. Egg dates; May 28-July 10; probably 2 broods. Season: April 22-Oct. 22.

SPECIES: Melospiza melodia (Wilson) A.O.U. 581--
Song Sparrow

LITERATURE:

Bailey(1968): 1492-1513
Bent (1968): 111
Bull (1964): 464-465
Forbush (1939): 533-535
Hill (1965): 310-311
Palmer (1968): 574-576
Squires (1952): 132-133

STATUS: B.; W.; Mg.

DISTRIBUTION: Breeds from Newfoundland s. to N.C. Winters from Nova Scotia s. to Fla.

HABITAT: Many areas, from interior highland to coastal beaches. Nests from woodlands to thickets on coastal sand dunes.

BREEDING DATA:

Nest: From on ground to 12' above. Mostly on ground in brush, bushes or grasses, sedges, cattails. Occ. in trees & holes in trees. Of leaves, weeds, grasses, strips of bark, lined with fine grasses (Bent, Palmer).

Clutch size: 3-6, usually 4 (Bent, Palmer).

Incubation: 10-14 days Fledging period: 10-14 days (Bent, Palmer).

No. Broods/Season: 1-4, usually 2 (Bent, Palmer).

Nest losses: Flooding, predation, Cowbird parasitism.

PREDATORS: Hawks, owls, snakes, turtles, external & internal parasites, cats, other mammals & predatory birds, man (Bent, Forbush).

ADULT MORTALITY: Predation, disease, severe weather, starvation, migration hazards, parasitism.

RELATIONSHIP WITH HUMAN BEINGS: Comes to feeders. Flies into lighthouses, buildings (Squires). Eats injurious weed seeds & insects (Bent).

DIET: Insects of many kinds; seeds of weeds & grasses; wild berries & fruits, occ. small minnows (Bent).

NOTES: Sandy Hook State Park, New Jersey: Year-round Re.;B.

(Bull) New York Area: Common/abund. Mg. Rare/locally common in W., esp. near coast. Common & widespread breeder, in many habitats. F.: peak in Oct.; departs by late Nov. Max. 75, Central Park, 10/13/53. W.: max. 185, Orient, 12/22/18. Sp.: Arrives in early March, peak in March. Max. 125, Flushing Meadow Park, 3/30/40. Egg dates: April 20-Aug. 14.

(1970 Checklist) Rhode Island: Year-round Re.; B.

(Hill & Bailey) Cape Cod, Mass.: Sp.: Arrival of Re's.; common Mg. Avg. Re. arrival: Feb. 26-March 25. Avg. Mg.: March 20-April 28; avg. 50-150 birds. Su: Abund. breeding Re. F.: Abund. Mg. Avg. Sept. 20-Nov. 18, peak Oct. 1-25; avg. 20-75 birds; max. "100's", Nauset, 10/16/53. W.: Fairly common, survives season with fair success.

(1964 Check-list) New Hampshire: Abund. Su. Re. & Unc. W. Re., thickets & bushland. Season: mid-March-early Nov., less common mid-Nov.-early March.

(Palmer) Maine: Common/numerous Su. Re., numerous Sp. & F. Mg.; Unc./reg. W. Re. Sp.: Arrives late March-early May. F.: Sept.-Oct., a few into mid-Nov. Su.: May 16-Aug. 8; mostly May 23-June 5. W.: 1-3 birds in coastal counties e. to Hancock throughout the W.

(Squires) New Brunswick: Abund. Su. Re.; casual in W. Sp.: Arrives late March into May. F.: leaves Sept. & Oct.; a few into early Nov. Egg dates: May 10-July 16; raises $\geq$ 2 broods. Season: March 16-Nov. 4.

List of Abbreviations and Definitions of Terms
Used in Table 13.9 and Table 13.10 and Table 13.11

Acc. = Accidental
Cas. = Casual
a = abundant
c = common
fc = fairly common
u = uncommon
r = rare
o = occasional
rg = regular
i = irregular
v = very

R = Resident (i.e. breeds)
Sp. = Spring
S = Summer
F = Fall
W = Winter
V = Visitant
M = migrant, migrates
YR = year-round
HYPO = hypothetical
loc = locally
p = possible

Months of the Year
1 = January
2 = February
3 = March
4 = April
5 = May
6 = June
7 = July
8 = August
9 = September
10 = October
11 = November
12 = December

Symbols for Abundance (these figures represent the average # of birds likely to be seen in one day, or at a partic. locality. The highest figure given for a species means the average # during peak seasons):

I = 1 to 100
II = 100 to 500
III = 500 to 1,000
IV = 1,000 to 5,000
V = 5,000 to 10,000
VI = 10,000 to 100,000
VII = over 100,000

In reference to months:
e = early
m = mid
l = late
(e.g. l11 = late Nov.)

An asterisk (*) beside a symbol indicates that the greatest concentrations occur at that time or locality.

Oceanic = beyond the limits of the Continental Shelf
Neritic = "near shore"; to limits of the Continental Shelf
"Salt marsh" = tidal marsh & estuary, brackish marsh, seaside salt marsh, tidal creeks
Beaches = sandy shore, both strand and littoral
Rocky shores = rocky areas and littoral
Tidal flats = mud flats, sand bars

The locations given for each species (e.g. "east shore"; "bays/sounds") indicate where the species is most likely to be found; this does not mean that the birds do not occur in other locations. In a few cases (e.g. the Wood Duck) the species is more common inland on fresh water, and rare in the location indicated in the study area.

NOTE: For the N.Y.-N.J. area: "North shore" = Long Is. Sound and the areas bordering it (Western Conn., and the north shore of L.Is.); "East shore" = the area around Montauk Pt., Long Is., and the ocean from Montauk to Block Is., R.I. "South shore" = the south shore of Long Is., and the eastern shore of n. New Jersey.

Table 13-9

Seasonal and Habitat Distribution, and Relative Abundance of Winter Waterfowl and Game Birds within the Study Area.

TABLE 13-9

	RHODE ISLAND		LONG ISLAND, N.Y. & NEW JERSEY								
	STATUS	DATES PRESENT	Neritic	Bays/Sounds	"Salt marsh"	Tidal flats	North shore	South shore	East shore	STATUS	DATES PRESENT
Common Loon	oM + WV	e9-5	X	X	X			X	X	c/a M+WV I-II	YR; *11; *4-5
Red-throated Loon	M+WV	e10-1 5	X	X	X			X	X	c/a M+WV I-II	*11-12 *4
Red-necked Grebe	M+WV	11-4	X	X	X			X	X	u/fcM + iWV; I	10-4
Horned Grebe	o M +WV	11-e5	X	X	X		X	X	X	c/a M + WV;I-III	m10-1 4
Pied-billed Grebe	Sp. +FM	e3-e5 1 8-1 11		X	X			* X	* X	fc/cM; uWV; I	YR *9;4
Mute Swan	R	YR		X	X			X	* X	R I-II	YR
Whistling Swan	r M	1 3-1 4 11-e12		X	X			X	X	u/r M&WV I	11-3
Canada Goose	R & M	YR;*3-4 *10-m12		X	X	X		X		a M & WV I-V	YR *3-11
Brant	cM	m3-5 10-e12	X	X	X	X		* X		r/a M&WV I-VI	12-4
Snow Goose	u M	1 3-1 4 e10-e12		X	X			X		r/c M&WV I-III	*m11-12 *m3-m4
Mallard	SR + WV M	YR *9-4		X	X	X				c/a R, M+ WV;I-II	YR
Black Duck	R	YR	X	X	X	X		* X		aFM&MV; SR;I-IV	YR
Gadwall	M; o SV &WV	YR;*1 3-4;10-e12			X			* X		a/u M+WV loc. I	YR *9-4
Pintail	M & MV	YR *9-e4			X			* X		fc FM + WV I-III	9-4
Eurasian Green-winged Teal	Acc.			X	X					r/cas. WV I	12-4
American Green-winged Teal	M;oYR	*e3-e5 *18-e12		X	X			X		c/a M;u WV; I-II	9-4
Blue-winged Teal	M + SV	YR *13-1 10			X			* X		r/loc.aFM cas WV; I	4-10
European Wigeon	rM + WV	10-4		X	X			X	X	u/r M+WV ofc; I	10-3
American Wigeon	M + WV	1 8-4		X	X			X	X	c/aM+WV I-IV	9-4
Shoveler	u M	9-m12 1 3-4			X			X		loc c/aM +WV; I	9-4
Wood Duck	M + SR	e3-m11			X					c FM;rWV I	3-m11

Table 13-9 (continued)

	RHODE ISLAND		LONG ISLAND, N.Y. & NEW JERSEY								
	STATUS	DATES PRESENT	Neritic	Bays/sounds	"Salt marsh"	Tidal flats	North shore	South shore	East shore	STATUS	DATES PRESENT
Redhead	uM+WV	1 10-12 3		X	X				X	r/fc WV I	10-4
Ring-necked Duck	M+WV	10-e12 e3-e5		X	X					loc.c/aM+WV;I-II	1 10-m4
Canvasback	M+WV	1 10-12 3-m4		X	X					c WV I-III	11-e4
Greater Scaup	M+WV	10-m5		X	X		X	X		a WV I-VI	YR
Lesser Scaup	M	10-11 3-4			X					fcSpM rWV	?
Common Goldeneye	M+WV	110-4	X	X			X		X	c/a WV I-V	11-e4
Bufflehead	M+WV	m 10-e 5		X	X			X	X	loc.c/aWV I-II	m10-4
Oldsquaw	M+WV	11-4	X	X			X		X	c/oa WV I-IV	YR 1 10-4
Common Eider	M+WV	11-4	X	X			X	X	X	c/aM+WV I-VI	10-4
White-winged Scoter	M+WV	1 9-5	X						X	aM + WV I-VI	11-3
Surf Scoter	M+WV	1 9-5	X	X			X		X	c/aM+WV I-VI	10-4
Common Scoter	M+WV	1 9-5	X	X			X	X	X	c/aM+WV I-VI	10-4
Ruddy Duck	M	3-e5 1 9-e12		X	X			X	X	c/aFM+WV I-III	10-3
Hooded Merganser	M+WV	m10-12 3-4			X			X	X	c/aM+WV I	10-4
Red-breasted Merg.	M+WV	e10-1 5	X	X			X		X	c/aM+WV I-V	11-3
Common Merganser	M+WV	11-m4		X						u WV; I	11-4
King Rail	uM+SR	e5-e11			X					rM+WV; I	10-3
Clapper Rail	M+SR	1 4-11			X		X	X		c SR;u/r WV; I	YR
Sora Rail	M+SR	1 4-e11			X					fc FM+W I	YR *5; *10
American Coot	M+WV	9-e5		X	X			X	X	c/a FM+WV; I-III	YR
American Woodcock	M+SR	e3-e11						X		fc M; rWV I	3-11

Table 13-9
(continued)

CAPE COD, MASSACHUSETTS

	Neritic	Bays/Sounds	"Salt marsh"	Tidal flats	North shore	South shore	East shore	STATUS	DATES PRESENT
Common Loon	X	X	X					cM; rSV cWR; I	YR; m9-m12; *10,5
Red-throated Loon	X	X	X					c/aM; rSV fcWV; I-II	YR; *4; *11-12
Red-necked Grebe	X		X					rM + WV I	m10-m5
Horned Grebe	X	X	X					r/c M;u/c WR;I-II	m10-4
Pied-billed Grebe		X	X					SR; iWV fc/cFM; I	6-2 *9-12
Mute Swan			X			X	X	i V; I	4-12
Whistling Swan		X	X					Acc. M; I	11-12
Canada Goose		X	X	X		X	X	cM + WV SR;I-IV	YR *11-4
Brant		X	X	X	X		X	c/aM;oSV fcWV;II-IV	YR; *m10-15
Snow Goose			X	X	X	X	X	u/r M I	10-4 *10-11
Mallard		X	X	X				u R & M I	YR *9-12
Black Duck		X	X	X	X			cSR; aM+ WV;I-V	YR *m11-2
Gadwall			X					r FM I	m9-m12
Pintail			X					u/r M+ WV; I	9-4 *9-11
Eurasian Green-winged Teal							X	Acc.; I	4
American Green-winged Teal			X				X	cM; locSR I	YR *8-11
Blue-winged Teal			X					fcM; loc SR; I	4-1 11
European Wigeon		X	X			X	X	r/i M I	10+11
American Wigeon		X	X			X	X	fcFM;u/r SM; WR;II	YR; *9-4;*10-11

Table 13-9
(continued)

CAPE COD, MASSACHUSETTS

	Neritic	Bays/sounds	"Salt marsh"	Tidal flats	North shore	South shore	East shore	STATUS	DATES PRESENT
Shoveler			X			X	X	r/iM	10-11
Wood Duck			X					rFM; I	9-10
Redhead			X			X	X	r M; I	11-12 m3-m4
Ring-necked Duck		X	X				X	u M; iWV I	10-3
Canvasback		X	X			X	X	u/rM; r WV; I	1 10- 1 12
Greater Scaup		X	X		X		X	c M+WV I-II	1 10-1 3
Lesser Scaup		X	X				X	fc M+WV I	1 10-m4
Common Goldeneye	X	X	X					cM + WV I-III	m 10-4
Bufflehead	X	X	X					fcWV+M I-II	11-3 ;*1 11-12
Oldsquaw	X	X	X		X		X	c/aM+WR IV-VI	m10-1 4
Common Eider	X	X			X	X	X	a M + cWV I-VI	9-4
White-winged Scoter	X	X	X		X	X	X	a M+WR I-VII	YR *e10-4
Surf Scoter	X	X	X		X	X	X	a M; fcWV I-V	m9-1 4
Common Scoter	X	X	X		X	X	X	a M; c WV I-VI	9-4
Ruddy Duck		X	X		X	X	X	uFM+WV I-II	m9-m4
Hooded Merganser		X	X					u/rM+WV I	10-m5 *12
Red-breasted Merganser	X	X	X		X			c M+WV I-IV	m10-1 4
Common Merganser		X	X					fcM+WV I-II	11-m4
King Rail			X		X	X	X	r M; I	1 9-12* 15*
Clapper Rail			X					uM; loc SR I	1 5-1 11
Sora Rail			X			X	X	u/r FM I	9-e10
American Coot		X	X				* X	c FM;uSp M; I-II	YR *9-1
American Woodcock			X		X			u M+loc SR; I	3-11

Table 13-9
(continued)

	NEW HAMPSHIRE						MAINE					
	Neritic	Bays/sounds	"Salt marsh"	Tidal flats	STATUS	DATES PRESENT	Neritic	Bays/sounds	"Salt marsh"	Tidal flats	STATUS	DATES PRESENT
Common Loon	X	X			c WV rare SV	pYR	X	X			uSV;cM fcWV	*l4-m5; l0-e11; pYR
Red-throated Loon	X	X			u WV	e10-l5	X	X	X		cM;oSV uWV	pYR;m4-l5;l9-m11
Red-necked Grebe	X	X			u WV	l9-m5	X	X			u/ocM;uo cWV;vrSV	*l3-e5; l9-m11
Horned Grebe	X	X			vc/aWV	e10-m5	X	X			c/oaM;c/a WV;rSV	*l3-4;e10 -11 pYR
Pied-billed Grebe		X			v loc SR	l3-l11		X			o/u FM	e9-e11
Mute Swan												
Whistling Swan			X		r M	l10-e12		X	X		rM	l3-l4; l9-I 11
Canada Goose			X		c locWV	l9-m5		X	X		c/aM;rSR; uSV;uWV	*l2-m4; m10-l11YR
Brant			X		u M	e4-e6; e10-m11		X	X		aM;rSV I-IV	*m3-m4; l10-m12
Snow Goose			X		r M	*l3-m4; I10-l11		X	X		u/cM	*4
Mallard			X		u loc WV u R	YR		X	X		u/ocM;rg WV;rSV II	*m3-e5; 10
Black Duck			X		vc/aWV; cSR	YR	X	X	X		c/aSR;aM; c/aWV	*3-4; 9-l11
Gadwall			X		rFM	e9-l10			X		oFM	m9-e11
Pintail			X		uM	l3-l5; *e9-e12			X		o/aM;c/a WV; rSV	*l3-m4; l8-l11 pYR
Eurasian Green-winged Teal											Cas.	
American Green-winged Teal			X		uM+SV	l3-l11;*l3 -l5;9-11			X		o/cSpM;c/a FM; oSR	*l3-l4; m9-m12
Blue-winged Teal			X		uM;rSV	e4-m10;*e4 -5;8-m10			X		fcSpM;aFM rg uloc SR	*m4-e5; l8-m9
European Wigeon								X	X		oFM;Acc. SpM	m9-e12
American Wigeon			X		c loc M	m3-l4; *e9-l12		X	X		uM	l3-m4; l9-e11
Shoveler			X		rM	l3-l4 e9-I11			X		rM	4; 9-10

Table 13-9 (continued)

	NEW HAMPSHIRE						MAINE					
	Neritic	Bays/sounds	"Salt marsh"	Tidal flats	STATUS	DATES PRESENT	Neritic	Bays/sounds	"Salt marsh"	Tidal flats	STATUS	DATES PRESENT
Wood Duck			X		uSR	13-e11		X	X		c/rM;rSR (on inshore islands)	*4;*m9-m10
Redhead			X		rM	m3-m4; e10-e12			X		rFM;Acc. Sp.M	
Ring-necked Duck		X	X		uM	13-111; *13-5; 10-1 11		X	X		fcSR; c/fcM	*4; 10-e11
Canvasback			X		rM	m3-14; m10-e12			X		rFM; Acc.Sp.M	*m10-e11
Greater Scaup			X		clocWV	19-e5		X	X		c/a WV; cM	*3-e4 m10-m11
Lesser Scaup			X		rM	13-e5; 19-1 11			X		cM;rWV	*m3-14 10-e11
Common Goldeneye	X	X			vc/aWV	m10-14; p5-9	X	X			fcSV;c/a WV; M	*12-e5; m10-1 11
Bufflehead			X		c loc WV	e10-e5		X	X		c/aWV;u/c M; o rSV	*13-4;m10-11; p YR
Oldsquaw	X				c WV	m10-m5	X	X			aWV;aM oSV	*3-e4; m10-11
Common Eider	X				i u WV	m10-m5	X				cSR;aM; c/aWV;I-VI	*3-4; 10-11
White-winged Scoter	X				vc/a WV; rSV	*m9-e6 p7-8	X	X			aM;c/aWV; cSV; I	*e4-15; 9-10
Surf Scoter	X				WV	19-e6	X	X			cM; uWV; uSV; I	*m4-m5; e10-m11
Common Scoter	X				u WV	19-e6	X	X			c/aM;u rg WV;u rgSV I	*e4-e5; e9-m11
Ruddy Duck			X		rM	13-e5; *e10-1 11			X		uFM I	e10-m11
Hooded Merganser		X			uM;rR	13-1 11 p12-2		X			cSR;cM	*13-m4 m10-m11
Red-breasted Merganser	X	X			cWV;rSR	e10-m5 p6-9	X	X			cSR;vcWV; c/a M	*13-15; 19-11
Common Merganser			X		loc u WV	YR *11-4		X	X		uWV;c/aM	*m3-14 m10-11
King Rail			X		SR	14-1 10			X		rFV	e8-m12
Clapper Rail			X		r SR	e5-1 10			X		Cas.	
Sora Rail			X		u loc SR	14-m10			X		r loc SR fcM	*14-?; 19-m10
American Coot			X		u loc M	e4-e5; *m9-m11		X			rSpM;fcM; r S+WV	*13-e4;19-10 pYR
American Woodcock			X		vc/a SR	13-e11			X		o/c SR;cM; oWV	*13-m4 e10-m11 pYR

TABLE 13-10

Seasonal and Habitat Distribution, and Relative Abundance of Shorebirds within the Study Area.

TABLE 13-10

LONG ISLAND, N.Y. & NEW JERSEY

	Rocky shores	Beaches	Dunes	Tidal flats	"Salt marsh"	Wet fields	Dry fields	North shore	South shore	East shore	STATUS	DATES PRESENT
Semipalmated Plover		X		X					* X		c/aM;fcSV vrWV I-II	pYR 13-e12 *14-110
Piping Plover		X		X					* X		fcSR;c/aM vrWV I	*m3-19 pYR
Wilson's Plover		X	X						* X		vrV I	14-e10
Killdeer		X		X		X	X	X	X		c/vcM;fcW V;uSR I-II	*e8-e10 YR
American Golden Plover		X		X			X			* X	u/fcFM; u/r SpM I	*m8-m11 *e4-e5
Black-bellied Plover				X	X		X				vc/aM; rg W+SV I-III	YR *5;*8-11
Ruddy Turnstone	X	X		X							vc/aM;u rg rWV I	pYR 5-m11
Common Snipe				X	X						u/vcM;u/fc WV;CasSR I	pYR m7-15
Whimbrel (Hudsonian Curlew)		X	X	X	X	X	X				u/r,rgSp M;c/vcFM I-II	14-e10;*14-15;*e8-110
Upland Plover							X				u/rM;rSR I	m4-m9
Spotted Sandpiper		X	X			X	X				fcM; fc SR I	14-m10
Solitary Sandpiper				X	X						fcM I	m4-m10
Willet		X		X	X					* X	r/cSpM; fc/vc FM; oSV I	14-110
Greater Yellowlegs			X	X	X	X	X				vc/aM;u/ rgWV; fc SV I	pYR 13-11 *e8-110
Lesser Yellowlegs				X	X						c/aFM;r/rg SpM; vrWV; rSV I-II	YR *e7-m9
Knot	X			X	X					* X	vc/aM;oSV r/fcWV I-III	pYR m5-110 *15; *17
Purple Sandpiper	X							* X	X		vc loc WV I	pYR 110-m5
Pectoral Sandpiper				X	X						c/loc aFM;u/fc,rg SpM I	e4-e6; 17-110
White-rumped Sandpiper		X		X	X						fc/aFM; u/vcSpM I	m5-e11;*15-e6;*18-e10

Table 13-10
(continued)

LONG ISLAND, N.Y. & NEW JERSEY

	Rocky shores	Beaches	Dunes	Tidal flats	"Salt marsh"	Wet fields	Dry fields	North shore	South shore	East shore	STATUS	DATES PRESENT
Least Sandpiper	X			X							c/aM;vrWV; rgSV I	pYR l4-e10
Dunlin				X	X						c/loc aM+ WV; SV I-II	pYR *5, *10 l11-e4
Short-billed Dowitcher		X		X						* X	c/vaM;uSV; vrWV I-II	pYR 5-e10 *5,7
Stilt Sandpiper					X						u/loc cFM, occ.vc;vr SpM; I	e7-m11 *l7-e9
Semipalmated Sandpiper		X		X	X					* X	c/vaM; rg SV;rWV I-IV	pYR l4-l10
Buff-breasted Sandpiper		X			* X						r/rgFM I	e8-m10
Hudsonian Godwit		X		X							r/u, rgFM vrSpM I	5;m7-10
Sanderling		* X		X					* X		c/aM;fcSV +WV I-III	YR *5-9

Table 13-10
(continued)

CAPE COD, MASSACHUSETTS

	Rocky shores	Beaches	Dunes	Tidal flats	"Salt marsh"	Wet fields	Dry fields	North shore	South shore	East shore	STATUS	DATES PRESENT
Semipalmated Plover		X		X							Unc.Sp Mg; rSV;c/aFM I-II	17-m10,*8 e5-e6; *15
Piping Plover		X		X							fcSpM;fcSR fcFM;Cas. WV I	13-14,*m4; 17-19,*e8-e9; 13-e9 pYR
Wilson's Plover		X	X	X							Acc.V I	
Killdeer		X		X		X	X				rSpM;rSR+ V;r/cFM; vrWV I	pYR *e4-15 *e8-m11
American Golden Plover		X		X			X				vrSpM;vrSV u/rFM I	*5; *18-110
Black-bellied Plover				X	X	X					aSpM; cSV; aFM; rgWV I-IV	pYR 14-e6, *m-15; 17-110 *m8+e9-e10
Ruddy Turnstone	X	X		X							vcSpM;uSV; cFM; vrWV I-III	pYR e5-16, *16, 17-e10, *e-m8
Common Snipe				X	X						uFM;rWV; vrSpM I	*13-m5; m9-111,*110-e11
Whimbrel (Hudsonian Curlew)		X	X	X	X	X	X				riSpM;riSV; cFM I	14-19;*14-15; *m7-19
Upland Plover			X				X				riFM I	m8-e9
Spotted Sandpiper		X	X			X	X				uSR; uFM I	m5-e9 *17-e9
Solitary Sandpiper				X	X						riSpM; rFM I	5; 18-e10
Willet		X		X	X					* X	uSpM;vrSV rFM I	m4-15,*14-15 17-e9
Greater Yellowlegs			X	X	X	X	X				uSpM;rSV; fcFM;vr/i WV I-II	pYR e4-m9 *5;*18-m9
Lesser Yellowlegs				X	X						r/iSpM;vr/i SV;u/rFM; vr/iWV I	pYR 14-15 m7-e11; *17-m8
Knot	X			X	X					* X	cSpM; uSV; cFM;iWV I-III	pYR e5-e6; e7-e11; *17-e8
Purple Sandpiper	X							* X	X		r/locWV I	m11-m3

Table 13-10
(continued)

CAPE COD, MASSACHUSETTS

	Rocky shores	Beaches	Dunes	Tidal flats	"Salt marsh"	Wet fields	Dry fields	North shore	South shore	East shore	STATUS	DATES PRESENT
Pectoral Sandpiper				X	X						vr/iSpM; u/iFM	17-110 *m9-m10
White-rumped Sandpiper		X		X	X						uSpM;r/iSV u/fcFM I	15-e6 17-e11
Least Sandpiper	X			X	X						fcSpM;vrSV cFM I-II	e5-15, *15 e7-e10,*m-17
Dunlin				X	X						cSpM;uSV; aFM; rg WV I-IV	pYR e4-e6,*m4-e5; m9-e12, *m10-m11
Short-billed Dowitcher		X		X						* X	c/occ rSpM; uSV;aFM I-II	m5-e6,*15 e7-19, *17-e8
Stilt Sandpiper					X						Cas SpM; u/rFM I	m7-m9, *m8
Semipalmated Sandpiper		X		X	X					* X	aSpM; uSV; aFM I-VI	e5-e6, *15 e7-110;*17-m8
Buff-breasted Sandpiper					* X						vr/iFM I	18-m9
Hudsonian Godwit		X		X							Cas SpM; u/r FM	m7-e11, *e-m8
Sanderling		* X		X							aSpM;fcSV; aFM; u/rg WV I-VI	YR m5-e6,*15 m7-m11, *17-m8

Table 13-10 (continued)

	NEW HAMPSHIRE									RHODE ISLAND	
	Rocky shores	Beaches	Dunes	Tidal flats	"Salt marsh"	Wet fields	Dry fields	STATUS	DATES PRESENT	STATUS	DATES PRESENT
Semipalmated Plover		X		X				vc/a M	m5-e6; l7-l10	Sp+FM	l4-e6 m7-l9
Piping Plover		X						u loc SR	l3-l8	M+SR	l3-l9
Wilson's Plov.											
Killdeer		X				X	X	cSR	m3-m11	M+SR	l3-111 pYR
American Golden Plover				X			X	rFM	m8-l10	unc.FM	e8-111 pYR
Black-bellied Plover				X	X			vc/aM	e5-e6; l7-m11	Sp+FM	m4-m6; e7-111; pYR
Ruddy Turnstone	X			X				cM	m5-e6; l7-e10	Sp+FM	e5-e6; l7-e10 pYR
Common Snipe					X			uM	e4-e11 *e4-5; 9-e11	Sp + FM	m3-14; m9-l11 pYR
Whimbrel				X	X			rM	m5-e6 *l7-m9	FM	e7-e10 pYR
Upland Plover					X		X	rSR	l4-e9	uM + SV	l4-m9
Spotted Sandpiper		X						cSR	l4-m10	M + SR	l4-e10
Solitary Sandpiper				X	X			cM	l4-l5; m7-m10	Sp+FM	5; m7-e10
Willet				X	X			rM	m5-e6 *e8-l9	uM	e5-e6; m7-l9
Greater Yellowlegs				X	X			vc/aM	e4-e6 m7-e11	Sp+FM	l3-e6; e7-m11 pYR
Lesser Yellowlegs				X	X			vc/aM	e5-e6 *m7-l9	Sp+FM	m4-l5; e7-l10 pYR
Knot				X	X			uM	m5-e6 *l7-l10	Sp+FM	e5-e6; e7-l10
Purple Sandpiper	X							cWV	e11-l5	SpM+WV	e11-m5
Pectoral Sandpiper				X	X			uM	e4-l5 *m7-e11	Sp+FM	e4-l5 e7-l10

Table 13-10 (continued)

	NEW HAMPSHIRE										RHODE ISLAND	
	Rocky shore	Beaches	Dunes	Tidal flats	"Salt marsh"	Wet fields	Dry fields	STATUS	DATES PRESENT	STATUS	DATES PRESENT
White-rumped Sandpiper				X	X			uM	m5-e6; e8-m11	Sp+FM	e5-e6; l7-m11
Least Sandpiper				X	X			cM	e5-e6; e7-l9	Sp+FM	e5-m6; e7-l10
Dunlin				X	X			cM a locWV	m9-e12 (p m12-e6)	Sp+FM	l4-e6; e9-l11 pYR
Short-billed Dowitcher				X	X			cM	m5-e6; m7-l9	Sp+FM	l4-m6; e7-e10
Stilt Sandpiper				X	X			rFM	l7-m9	FM	e7-e10 pYR
Semipalmated Sandpiper		X		X				vc/aM	e5-e6; m7-m10	Sp+FM	e5-m6; e7-l10 pYR
Buff-breasted Sandpiper					X	X	X	rFM	e8-m9	uFM	l8-l9
Hudsonian Godwit				X	X			rFM	e8-l10	rFM	e8-e10 pYR
Sanderling		X		X				cM;rWV	l7-e6; *l7-m11; m5-e6	Sp+FM	e 5-m6; l7-l11 pYR

Table 13-10
(continued)

MAINE

	Rocky shores	Beaches	Dunes	Tidal flats	"Salt marsh"	Wet fields	Dry fields	STATUS	DATES PRESENT
Semipalmated Plover		X		X				cM; rSV	*m5-e6; e8-l9
Piping Plover	X	* X		X				cSR; M	m4-m9
Wilson's Plover									
Killdeer		X		X		X	X	fcSR;AccWV	l3-e10
American Golden Plover		X		X			X	rFM	m8-l10
Black-bellied Plover				X	X			cM; rSV	*m5-e6; m8-l10
Ruddy Turnstone	X	X						fc/rSpM; c/aFM	*m5-e6 e8-e9
Common Snipe					X			fc/cM;fc SV; rWV	*l3-e5; e9-m10 pYR
Whimbrel		X		X				rSpM;o cFM	m5-e6; m7-m9
Upland Plover					X		X	uSR	l4-e9
Spotted Sandpiper	X	X		X				fcSR;cM; Acc.WV	l4-e10
Solitary Sandpiper				X	X			c/rSpM; c/uFM	*e5-l5; l7-m9
Willet		X			X			rSpM; uiFM	5;8
Greater Yellowlegs				X	X			c/fcM; oSV	*l4-l5; l7-l10
Lesser Yellowlegs				X	X			u/r SpM; c/a FM	e5-l5; l7-m9
Knot		X						rSpM; uFM; Acc.SV	l5-e6; e8-m9
Purple Sandpiper	X							cWV; fcM I	pYR *e11-l3
Pectoral Sandpiper					X	X		rSpM; c/aFM	*m4-m5; m8-l10
White-rumped Sandpiper		X		X				rSpM; cFM	*l5-l5; l7-e11

Table 13-10
(continued)

MAINE

	Rocky shores	Beaches	Dunes	Tidal flats	"Salt marsh"	Wet fields	Dry fields	STATUS	DATES PRESENT
Least Sandpiper		X		X	X			cSpM; aFM; oSV	*m5-l5; m7-m9
Dunlin				X	X			rSpM; cFM	m5-e6; l9-m11
Short-billed Dowitcher	X	X		X				fc/rSpM; cFM; rSV	*m5-e6; m7-m9
Stilt Sandpiper				X	X			uFM	l7-l9
Semipalmated Sandpiper		X		X	X			cSpM; aFM; rgSV	*m5-e6 l7-l9
Buff-breasted Sandpiper					X		X	rFM	e8-l9
Hudsonian Godwit		* X		X	X			oFM	e8-l10
Sanderling	X	* X		X				rSpM; c/a FM; Acc. WV	e5-e6; e8-l10

TABLE 13-11

Season and Habitat Distribution, and Relative Abundance of "Seabirds" (Gulls, Terns, Petrels, Shearwaters, Jaegers, and Alcids) within the Study Area.

Table 13-11

	RHODE ISLAND		LONG ISLAND, N.Y. & NEW JERSEY											
	STATUS	DATES PRESENT	Oceanic	Neritic	Bays/sounds	"Salt marsh"	Tidal flats	Beaches	Rocky shore	North shore	South shore	East shore	STATUS	DATES PRESENT
Fulmar	Acc.		X	X									Acc;I	10-1
Cory's Shearwater	SV;I	8-10	X	X								X	c/a 1S& FV;I-III	7-m11 *18-1 10
Greater Shearwater	r S&FV	6-e10	X	X								X	r/c SV I-II	15-e10
Sooty Shearwater	u SV	15-e9	X	X								X	c/a SV I-II	15-m9 *15-e6
Leach's Storm Petr.	Acc; 4 records		X	X									Cas. S&FV	e5-e11
Wilson's Storm Petrel	SV	6-m9	X	X	X							X	c/a SV I-V	15-18
Gannet	o Sp & FV	13-e6 9-e12	X	X								X	c/a M; o in W	13-m5; 10-e12
Red Phalarope	u S & F M	e4-5 17-11	X	X								X	c S&FM I-IV	13-14 9-e11
Wilson's Phalarope	u FM	17-9		X	X	X					X		Sp&FM; cas.SpM I-III	m4-5 8-m10
Northern Phalarope	Sp&FM	5; 8-10	X	X	X	X						X	rFM;cas SpM; I	7-9
Pomarine Jaeger	r FM	8-10	X	X							X		u/rg M I	e5-m11
Parasitic Jaeger	u M	m5-e6 17-m10	X	X	X						X		rg M; I	e5-m11
Long-tailed Jaeger	Acc.		X								X		cas M	15-e6 e8-e9
Glaucous Gull	u WV	12-e4		X				X	X		X	X	u/r,rg WV I	YR
Iceland Gull	u WV	12-e4		X	X			X					r/u,rg WV; I	11-3 *12-2
Great Black-backed Gull	R	YR		X	X	X	X	X	X	X	X	X	c/a R& M;II-IV	YR *9
Herring Gull	R	YR		X	X	X	X	X	X	X	X	X	Very a R; VI	YR *12-2
Ring-billed Gull	u M+WV	17-m4			X	X					X		c/aM& WV; fc SV;I-IV	YR *8-11
Black-headed Gull	u WV I	111-e4			X					X	X		u/rWV oSV; I	11-13
Laughing Gull	M & SV	e4-e11		X	X	X		X		X	X		c/aM+SV uWV;I-IV	YR; *13-m12

Table 13-11 (continued)

	RHODE ISLAND		LONG ISLAND, N.Y. & NEW JERSEY											
	STATUS	DATES PRESENT	Oceanic	Neritic	Bays/sounds	"Salt marsh"	Tidal flats	Beaches	Rocky shore	North shore	South shore	East shore	STATUS	DATES PRESENT
Bonaparte's Gull	o V	m10-4			X					X	X	X	c/a M+WV oSV; I-V	10-5
Black-legged Kittiwake	r WV	11-e4	X	X							X	X	u/c WV I-II	11-2
Gull-billed Tern	Acc.			X				X			X	X	r/i S+FV I	e6-m9
Forster's Tern	u FM	8-m10		X		X		X			X	X	u/c FM; r Sp M; SR; I-II	8-e11
Common Tern	F, Sp, SR oWV	e5-e10		X	X	X	X	X	X	X	X	X	aM; S R II-IV	5-m10
Arctic Tern	Acc.												Acc.	
Roseate Tern	M & SR	e5-19		X				X		X	X	X	u/a SR & FM; I-II	m5-9
Least Tern	M & SR	e5-19		X				X			X		c/a M; fc SR; I-II	5-m9
Royal Tern	u FM	e7-e9		X	X			X			X		I r S & FV	7-10
Sandwich Tern	Acc.			X				X					Cas.	9
Caspian Tern	u M	m5; m8-9		X	X	X		X			X		u M; SR in N.J. I-II	5 8-9
Black Tern	M	e5-m6 e7-9		X	X			X			X		u/o a M; o SV; I-IV	15-e10
Black Skimmer	u FM	18-m10		X		X		X			X		loc SR, c/a o SV I-IV	m5-m10
Razorbill Auk	u WV	m11-e4	X	X							X	* X	r/i WV; I	112-e3
Common Murre	r WV	111-14											Cas.; I	
Thick-billed Murre	r WV	m11-e4	X	X							X	X	r/i WV; I	12-2
Dovekie	u WV	e11-13	X	X							X	X	r/rg WV I	m11-e3
Black Guillemot	Acc.			X					X			X	cas/r WV I	11-3
Common Puffin	Acc.			X					X			X	cas. WV; I	11-3

CAPE COD, MASSACHUSETTS

Table 13-11
(continued)

	Oceanic	Neritic	Bays/sounds	"Salt marsh"	Tidal flats	Beaches	Rocky shore	North shore	South shore	East shore	STATUS	DATES PRESENT
Fulmar	X	X								X	Acc.; I	9-5
Cory's Shearwater	X	X							X		SV; I	5-10 *m7-m9
Greater Shearwater	X	X						X		X	r/a SV I	5-10 *8-9
Sooty Shearwater	X	X							X	X	u/c SV I	15-e9
Leach's Storm Petrel	X	X						X	X		r SV & FM I	5-10 *9-10
Wilson's Storm Petrel	X	X						X	X	* X	c/a M I-III	6-e9
Gannet	X	X						X	X	* X	c/a M I-II	m9-11 13-m5
Red Phalarope	X	X								X	c/aM I-IV	m4-m5 m8-11*
Wilson's Phalarope		X	X	X						X	r M (F) I	m8-e9
Northern Phalarope	X	X		X				X		X	c/a M I-II	5; 8-m10; *9
Pomarine Jaeger	X	X								X	cas/r M & SV; I	15-m6 8-9
Parasitic Jaeger	X	X	X					X	X	* X	u/fc M r SV; I	15; 18- m9
Long-tailed Jaeger	X									X	cas SpM r FM I	15; m8-m9
Glaucous Gull		X				X	X			X	r WV; o SV; I	*11-3
Iceland Gull		X	X					X		X	r/i WV; o SV; I	m12-m4 *12-1
Great Black-back. Gull		X	X	X	X	X	X	X	X	X	c R & M I-IV	YR *8-11
Herring Gull		X	X	X	X	X	X	X	X	X	a R & M IV-VI	YR *7-11
Ring-billed Gull			X	X		X					u SpM+WV rSV; cFM	(I-II) YR *4;8-12
Black-headed Gull			X							X	r/i/Acc. I	9,11,12 2,3
Laughing Gull		X	X	X	X	X					fcM + SV rWV;I-II	YR;*4-e6 8-m10
Bonaparte's Gull			X						X		uFM;r/i SpM; oS VI	14-5 10-e 1
Black-legged Kittiwake	X	X								X	c WV; rF V; I-II	9-4 *11-12
Gull-billed Tern		X				X					r/i SV I	m8-m9

Table 13-11
(continued)

CAPE COD, MASSACHUSETTS

	Oceanic	Neritic	Bays/sounds	"Salt marsh"	Tidal flats	Beaches	Rocky shore	North shore	South shore	East shore	STATUS	DATES PRESENT
Forster's Tern		X		X		X				X	u/r FM I	m8-m10
Common Tern		X	X	X	X	X	X	X	X	X	a M; cSR IV-V	*5;17-110; *e8
Arctic Tern		X				X					u S R I	15-e8
Roseate Tern		X				X					c/a M; fc SR; II-IV	5-e11 *5; 8
Least Tern		X				X					c/u M & SR I-II	15-e9 *15+e8
Royal Tern		X				X				X	r SV; I	e7-m8
Sandwich Tern		X				X		X		X	r SV; I	7-9
Caspian Tern		X	X	X		X		X		X	r M; I	5; 18-9
Black Tern		X		X		X			X	X	u/fc M I	15-e6 17-9
Black Skimmer		X		X		X				X	r/u SV I	7-m9
Razorbill Auk	X	X	X					X	X	X	u/rWV; I	1 11-4 *11
Common Murre	X	X	X					X		X	r/iWV; I	m11-e4
Thick-billed Murre	X	X	X					X	X	X*	r WV; I	m11-e4
Dovekie	X	X								X	u WV; a o I-IV	e11-e4
Black Guillemot		X					X			X	r WV; I	m12-13
Common Puffin		X	X				X	X		X	r WV; I	12-m4

Table 13-11 (continued)

	NEW HAMPSHIRE									MAINE								
	Oceanic	Neritic	Bays/sounds	"Salt marsh"	Tidal flats	Beaches	Rocky shore	STATUS	DATES PRESENT	Oceanic	Neritic	Bays/sounds	"Salt marsh"	Tidal flats	Beaches	Rocky shore	STATUS	DATES PRESENT
Fulmar											X						Cas.	10-3
Cory's Shearwater	X	X						rV	e8-e10									
Greater Shearwater	X	X						rV	m5-e10	* X	X						cS+FV	m5-m11
Sooty Shearwater	X	X						rV	e5-m9	X	* X						Sp-F, fc	15-e9
Leach's Storm Petrel	X	X						rare M	e5-110	X	X						c/aSR; cM; rWV	*e5-15; *m8-m9 pYR
Wilson's Storm Petrel	X	X						uV	e6-e9	X	X						u/c S + FV	15-m9
Gannet	X	X						uM + iuWV	pYR; *4-5; 9-11		X						c/aM; u/c SV; oWV	*m4-m5; 19-m11; pYR
Red Phalarope	X	X						rM	e4-e6; *17-111		X						c/rSpM; c/u rg FM; rSV	*5; 18-9
Wilson's Phalarope				X	X			rFM	m8-m9								Acc.	
Northern Phalarope	X	X						uM	e5-e6; e8-110	X	X						aM o W + SV	*5-e6; 17-e9
Pomarine Jaeger	X	X						rM	m5-e6; *e8-e11	X	X						vc/u M r SV	5-6; *18-19
Parasitic Jaeger	X	X						rM	e5-15; *17-e10	X	X						vc/u M; rSV; pWV	pYR*15-e6; 17-18
Long-tailed Jaeger										* X							vrFM	
Glaucous Gull		X				X		uWV	m11-e5		X		X		X		uM+WV I	e10-m4 *112-13
Iceland Gull		X				X		rWV	m11-e5		X	X			X		i u M+WV Acc.SV I	m11-e4
Great Black-backed Gull		X	X	X	X	X	X	cR	YR		X	X	X	X	X	X	c/aR; M+ WV	YR *9-10; 2
Herring Gull		X	X	X	X	X	X	vc/a R	YR		X	X	X	X	X	X	c/aR; M+WV	YR
Ring-billed Gull			X	X		X		uM; rWV	pYR*3-5; 8-12			X	X		X		u i SpM u/cFM; uWV; rSV	pYR*13-4 e9-10
Black-headed Gull		X		X				rM	13-15; 18-111								Acc.	
Laughing Gull		X		X				rM	14-e6; m8-19			X	X				uSp; fc FM; SV	*e -m5; 9
Bonaparte's Gull		X		X				cM; rWV	17-e6 *17-11 14-e6				X				c/aM; ou SV; oWV	m5-e11 *15-m6; m8-e11

Table 13-11 (continued)

	NEW HAMPSHIRE									MAINE								
	Oceanic	Neritic	Bays/sounds	"Salt marsh"	Tidal flats	Beaches	Rocky shore	STATUS	DATES PRESENT	Oceanic	Neritic	Bays/sounds	"Salt marsh"	Tidal flats	Beaches	Rocky shore	STATUS	DATES PRESENT
Black-legged Kittiwake	X	X						uWV	e11-e3	X	X	X					c/oa WV fcM;rSV	pYR *11-e3
Gull-billed Tern																	Acc.M	
Forster's Tern				X				rFM	e9-m11								Acc.FM	
Common Tern		X	X	X	X	X	X	vc/a SR	m5-l9		X	X	X	X	X	X	c/aSR; c(?)M	m5-e10
Arctic Tern		X		X		X		uM	l5-e6; e8-l8	X	X		X			X	c/a loc SR;M	m5-e9
Roseate Tern		X		X				c locM	m5-e6; l7-m9		X		X			X	c/aloc SR; M	l5-e9; *m8-l8
Least Tern				X		X		r SR	m5-e9		X				X	X	r SR	
Royal Tern																		
Sandwich Tern																		
Caspian Tern		X		X				rM	e5-l5; e9-e10		X						rM	5;l7-9
Black Tern		X				X		rM	e5-e6; l7-m9		X		X				u/r M	m5-m9; *8
Black Skimmer																	Acc.	
Razorbill Auk	X	X						uWV	m11-e4		X						locSR; rSV;u/o fc M+WV	*m9-e3 YR
Common Murre	X	X						rWV	l12-m4	X	X						rWV	m12-m3
Thick-billed Murre	X	X						u WV	e11-m4	X	X						fc/cM+ WV I	*11-e3
Dovekie	X	X						u WV	e11-m4	X	X						u/cM+WV Acc.SV	*e10-m3
Black Guillenot		X						u WV	e11-e4		X					X	fc/cSR; o/uSV; M + WV	YR
Common Puffin		X					X	r WV	e11-m3		X					X	c/a SR WV	YR *3-10

TABLE 13-12 Major Wildlife Areas within the Study Area Listed by State or Province

Nova Scotia

Chignecto Game Sanctuary

New Brunswick

Black Beach Provincial Park
Castalia Provincial Park, Grand Manan
Dennis Beach Provincial Park
Fort Beausejour National Historic Park
Fundy National Park
Kent Island (research station & bird sanctuary)
Long Pond Sanctuary, Grand Manan
Machias Seal Island (bird sanctuary)
New River Beach Provincial Park
Rockwood Park, St. John
Roosevelt Campobello International Park
The Rock Provincial Park
Tintamarre National Wildlife Area

Maine

Acadia National Park
Carlton Pond Waterfowl Production Area
Moosehorn National Wildlife Refuge
Petit Manan National Wildlife Refuge
Pond Island National Wildlife Refuge
Rachel Carson National Wildlife Refuge
Sea Island National Wildlife Refuge

New Hampshire

Adams Point Management Area
Bellamy River Management Area
Great Bay Management Area
Hampton Salt Marsh Conservation Area

Table 13-12 (continued)

Massachusetts

Cape Cod National Seashore
Monomoy National Wildlife Refuge
Nantucket National Wildlife Refuge
Nickerson State Park
Parker River National Wildlife Refuge
Thacher Island National Wildlife Refuge
Wellfleet Bay Wildlife Sanctuary

Rhode Island

Block Island State Park
Colt State Park
Galilee Bird Sanctuary
Marsh Meadows Wildlife Refuge
Ninigret National Wildlife Refuge
Norman Sanctuary
Ocean Drive State Park
Sachuest Neck State Park
Sapowet Marsh Wildlife Reserve

Connecticut

Barn Island Wildlife Management Area
Campbell Falls State Park
Cockaponst State Forest
Great Island Wildlife Management Area
Hammonasset State Park
Harkness Memorial State Park
Lords Cove and Nott Island Wildlife Management Area
Nells Island and Charles E. Wheeler Wildlife Area
Rocky Neck State Park
Salt Meadows National Wildlife Refuge
Sherwood Island State Park

New York (Long Island)

Amagansett National Wildlife Refuge
Captree State Park
Caumsett State Park
Conscience Point National Wildlife Refuge
Elizabeth Alexandra Morton National Wildlife Refuge
Heckscher State Park

Table 13-12 (continued)

Hither Hills State Park
Jacob Riis Park
Jamaica Bay National Wildlife Refuge
Jones Beach State Park
Montauk Point State Park
Orient Beach State Park
Oyster Bay National Wildlife Refuge
Robert Moses State Park
Sunken Meadow State Park
Target Rock National Wildlife Refuge
Wertheim National Wildlife Refuge
Wildwood State Park

New Jersey

Cheese Quake State Park
Sandy Hook State Park

Coastal and offshore habitat utilization by birds in the study area (casual/accidental species excluded). Birds which breed within the habitat listed are marked with an asterisk (*). Occ. = occasionally.

TABLE 13-13

Oceanic

Fulmar
Cory's Shearwater
Greater Shearwater
Sooty Shearwater
Leach's Storm Petrel
Wilson's Storm Petrel
Gannet
Red Phalarope
Northern Phalarope
Pomarine Jaeger
Parasitic Jaeger
Long-tailed Jaeger
Black-legged Kittiwake
Razorbill Auk
Common Murre
Thick-billed Murre
Dovekie

Neritic

Common Loon
Red-throated Loon
Red-necked Grebe
Horned Grebe
Fulmar
Cory's Shearwater
Greater Shearwater
Sooty Shearwater
Leach's Storm Petrel
Wilson's Storm Petrel
Gannet
Great Cormorant
Double-crested Cormorant
Brant
Black Duck
Common Goldeneye
Bufflehead
Oldsquaw
Common Eider
King Eider
White-winged Scoter
Surf Scoter
Common Scoter
Red-breasted Merganser
Red Phalarope
Wilson's Phalarope
Northern Phalarope
Pomarine Jaeger
Parasitic Jaeger
Glaucous Gull
Iceland Gull
Great Black-backed Gull
Herring Gull
Laughing Gull
Black-legged Kittiwake
Sabine's Gull
Gull-billed Tern
Forster's Tern
Common Tern
Arctic Tern
Roseate Tern
Least Tern
Royal Tern
Sandwich Tern
Caspian Tern
Black Tern
Black Skimmer
Razorbill Auk
Common Murre
Thick-billed Murre
Dovekie
Black Guillemot
Common Puffin

Table 13-13 (continued)

Rocky Shores (including rock jetties, breakwaters;offshore islands)

Great Cormorant
*Double-crested Cormorant
*Common Eider
Piping Plover (occ.)
Ruddy Turnstone
Spotted Sandpiper
Knot
Purple Sandpiper
White-rumped Sandpiper
Least Sandpiper
Sanderling
Glaucous Gull
*Great Black-backed Gull
*Herring Gull
*Ring-billed Gull
*Common Tern
*Roseate Tern
*Arctic Tern
*Razorbill Auk
Common Murre
Thick-billed Murre
*Black Guillemot
*Common Puffin
Common Raven

Tidal Flats (Mud flats, sand bars, etc.)

Great Blue Heron
Green Heron
Little Blue Heron
Great Egret
Snowy Egret
Louisiana Heron
Black-crowned Night Heron
Yellow-crowned Night Heron
American Bittern
Glossy Ibis
Canada Goose
Brant
Snow Goose
Mallard
Black Duck
American Green-winged Teal
Semipalmated Plover
Piping Plover
Wilson's Plover
Killdeer
American Golden Plover
Black-bellied Plover
Ruddy Turnstone
Common Snipe
Whimbrel
Eskimo Curlew
Spotted Sandpiper
Solitary Sandpiper
Willet
Greater Yellowlegs
Lesser Yellowlegs
Knot
Pectoral Sandpiper
White-rumped Sandpiper

Table 13-13 (continued)

Tidal flats (continued)

Baird's Sandpiper
Least Sandpiper
Dunlin
Short-billed Dowitcher
Stilt Sandpiper
Western Sandpiper
Semipalmated Sandpiper
Hudsonian Godwit
Sanderling

Bays/sounds

Common Loon
Red-throated Loon
Red-necked Grebe
Horned Grebe
Pied-billed Grebe
Wilson's Storm Petrel
Great Cormorant
Double-crested Cormorant
Great Blue Heron
Great Egret
Snowy Egret
Glossy Ibis
Mute Swan
Whistling Swan
Canada Goose
Brant
Snow Goose
Mallard
Black Duck
Eurasian Green-winged Teal
American Green-winged Teal
European Wigeon
American Wigeon
Wood Duck
Redhead
Ring-necked Duck
Canvasback
Greater Scaup
Lesser Scaup
Common Goldeneye
Bufflehead
Oldsquaw
Common Eider
White-winged Scoter
Surf Scoter
Common Scoter
Ruddy Duck
Hooded Merganser
Red-breasted Merganser
Common Merganser
American Coot
Wilson's Phalarope
Northern Phalarope
Parasitic Jaeger
Iceland Gull
Great Black-backed Gull
Herring Gull
Ring-billed Gull
Black-headed Gull
Laughing Gull
Bonaparte's Gull
Forster's Tern
Common Tern
Royal Tern
Caspian Tern
Black Tern
Black Skimmer
Razorbill
Common Murre
Thick-billed Murre
Common Puffin

Great Black-backed Gull
Herring Gull
Laughing Gull
Sabine's Gull (occ.)
Common Tern
Common Raven
Common Crow
Fish Crow

Table 13-13 (continued)

"Salt Marsh"

Common Loon
Red-throated Loon
Red-necked Grebe
Horned Grebe
*Pied-billed Grebe(occ. breeds)
*Great Blue Heron
*Green Heron
*Little Blue Heron
*Cattle Egret
*Great Egret
*Snowy Egret
*Louisiana Heron
*Black-crowned Night Heron
*Yellow-crowned Night Heron
*Least Bittern(more freq. in freshwater)
*American Bittern
*Glossy Ibis
*Mute Swan
Whistling Swan
*Canada Goose
Brant
Snow Goose
*Mallard
*Black Duck
*Gadwall
*Pintail
Eurasian Green-winged Teal
*American Green-winged Teal
*Blue-winged Teal
European Wigeon
American Wigeon
Shoveler
Wood Duck
Redhead
Ring-necked Duck
Canvasback
Greater Scaup
Lesser Scaup
Common Goldeneye
Bufflehead
Oldsquaw
White-winged Scoter
Surf Scoter
Common Scoter
*Ruddy Duck
Hooded Merganser
Common Merganser
Red-breasted Merganser
Rough-legged Hawk
*Bald Eagle
*Marsh Hawk
*Osprey
Gyrfalcon
Peregrine Falcon
Pigeon Hawk
*King Rail
*Clapper Rail
*Sora Rail
*Yellow Rail
*Black Rail
*Common Gallinule
American Coot
Black-bellied Plover
American Woodcock
Common Snipe
Whimbrel
Eskimo Curlew
Upland Sandpiper
Solitary Sandpiper
Willet
Greater Yellowlegs
Lesser Yellowlegs
Knot
Pectoral Sandpiper
White-rumped Sandpiper
Baird's Sandpiper
Least Sandpiper
Dunlin
Short-billed Dowitcher
Stilt Sandpiper
Semipalmated Sandpiper
Buff-breasted Sandpiper
Hudsonian Godwit
Wilson's Phalarope (occ.)
Northern Phalarope
Glaucous Gull
Great Black-backed Gull
Herring Gull
Ring-billed Gull
Black-headed Gull
*Laughing Gull
Bonaparte's Gull
Gull-billed Tern

Table 13-13 (continued)

"Salt Marsh" (continued)

*Forster's Tern
Common Tern
Arctic Tern
Roseate Tern
Least Tern
Caspian Tern
Black Tern
Black Skimmer
*Barn Owl
Snowy Owl
Short-eared Owl
Common Nighthawk
*Belted Kingfisher
Eastern Kingbird ?
Eastern Wood Pewee
Horned Lark
*Bank Swallow
*Tree Swallow
Barn Swallow
Common Raven
Common Crow
*Fish Crow
Black-capped Chickadee
*Long-billed Marsh Wren
Short-billed Marsh Wren
American (Water) Pipit
Loggerhead Shrike
Myrtle Warbler
Northern Waterthrush
Bobolink
Eastern Meadowlark
*Red-winged Blackbird
*Boat-tailed Grackle
*Savannah Sparrow
*Seaside Sparrow
*Sharp-tailed Sparrow
*Swamp Sparrow (occ.)
*Song Sparrow
Lapland Longspur

Table 13-13 (continued)

Beaches/Sandy shore

Great Blue Heron
Sharp-shinned Hawk
Broad-winged Hawk (occ.)
Gyrfalcon
Peregrine Falcon
Pigeon Hawk
Semipalmated Plover
Piping Plover
Wilson's Plover
Killdeer
American Golden Plover
Ruddy Turnstone
Whimbrel
Spotted Sandpiper
Willet
Knot
White-rumped Sandpiper
Least Sandpiper
Short-billed Dowitcher
Stilt Sandpiper (occ.)
Semipalmated Sandpiper
Buff-breasted Sandpiper
Hudsonian Godwit
Sanderling
Glaucous Gull
Iceland Gull
Great Black-backed Gull
Herring Gull
Ring-billed Gull
Laughing Gull
Black-legged Kittiwake (occ.)
Gull-billed Tern
Forster's Tern
Common Tern
Arctic Tern
Roseate Tern
Least Tern
Royal Tern
Sandwich Tern
Caspian Tern
Black Tern
Black Skimmer
Rock Dove
Short-eared Owl
Common Nighthawk
Eastern Kingbird
Lapland Longspur

Table 13-13 (continued)

Dunes/Upper beaches

*Snowy Egret
Sparrow Hawk
*American Oystercatcher
*Semipalmated Plover
*Piping Plover
*Wilson's Plover
Whimbrel
Eskimo Curlew
Upland Sandpiper
*Spotted Sandpiper
*Willet
Greater Yellowlegs (occ.)
*Great Black-backed Gull
*Herring Gull
*Ring-billed Gull
*Laughing Gull
*Forster's Tern
*Common Tern
*Arctic Tern
*Roseate Tern
*Least Tern
*Black Skimmer
Black-billed Cuckoo
Snowy Owl
Short-eared Owl
*Common Nighthawk
Traill's Flycatcher
Eastern Wood Pewee
Horned Lark
White-breasted Nuthatch
Red-breasted Nuthatch
Brown Creeper
Carolina Wren
Mockingbird
Brown Thrasher
Hermit Thrush
Gray-cheeked Thrush
Veery
Blue-gray Gnatcatcher
Golden-crowned Kinglet
American (Water) Pipit
Northern Shrike
Red eyed Vireo
Black-and-White Warbler
Yellow Warbler
Yellow-rumped Warbler
Palm Warbler
Northern Waterthrush
Louisiana Waterthrush
Connecticut Warbler
American Redstart
Common Grackle
Brown-headed Cowbird
Rufous-sided Towhee
*Savannah Sparrow
*Seaside Sparrow (occ.)
Slate-colored Junco
Clay-colored Sparrow
*Song Sparrow
Lapland Longspur
Snow Bunting

Table 13-13 (continued)

Fields

Sharp-shinned Hawk
*Killdeer
American Golden Plover (dry)
Black-bellied Plover (wet)
American Woodcock
Whimbrel
Upland Sandpiper (dry)
Greater Yellowlegs (occ.)
Pectoral Sandpiper (wet)
Buff-breasted Sandpiper (dry)
Mourning Dove
Barn Owl
*Common Nighthawk
*Horned Lark
Barn Swallow
Rough-winged Swallow
Common Crow
Hermit Thrush
Olive-backed Thrush
Starling
American (Water) Pipit
Northern Shrike
Loggerhead Shrike
Yellow-rumped Warbler
Palm Warbler
Yellow-breasted Chat
Bobolink
*Eastern Meadowlark
Brown-headed Cowbird
Dickcissel
*American Goldfinch
Rufous-sided Towhee
*Grasshopper Sparrow
*Henslow's Sparrow
*Vesper Sparrow
Lark Sparrow
Chipping Sparrow
*Field Sparrow
White-crowned Sparrow
*Song Sparrow
Lapland Longspur
Snow Bunting

TABLE 13-14

Utilization of plant materials by birds within the study area. The "General" category is used when specific plant types are not known, and/or to indicate the amount of plant material utilized. An asterisk (*) indicates that plant material forms a major portion of the diet. Percentages are given where known. An "s" under a category indicates only small amounts of the material are utilized. A "c" under a category indicates that cultivated varieties may be included in the diet.

	"General"	Carex spp.: Sedges	Juncus spp.: Rushes	Marine algae	Polygonum spp.: Smartweeds	Potamogeton spp.: Pondweeds	Scirpus spp.: Bulrushes	Vallisineria spp.: Wild Celery	Zostera marina spp.: Eel-grass	Miscellaneous Vegetation	Acorns	Berries	Fruits	Nuts	Grains	Seeds
Common Loon	X															
Horned Grebe	s															
Pied-billed Grebe	X															
Double-crested Cormorant	s															
Great Blue Heron	s															
Snowy Egret	s															
Mute Swan	95%			X		X				X						
Whistling Swan	*			X					X						c	X
Canada Goose	*			X					X	X					c	X
Brant	*			X					X							
Snow Goose	*		X							X		X	X		c	X
Mallard	*									X	X				c	X
Black Duck						X	X	X	X	X					c	X
Gadwall	*									X	X			X	X	X

Table 13-14
(continued)

	"General"	Carex spp.: Sedges	Juncus spp.: Rushes	Marine algae	Polygonum spp.: Smartweeds	Potamogeton spp.: Pondweeds	Scirpus spp.: Bulrushes	Vallisineria spp.: Wild Celery	Zostera marina spp.: Eel-grass	Miscellaneous Vegetation	Acorns	Berries	Fruits	Nuts	Grains	Seeds
Pintail	*					X				X					X	X
American Green-winged Teal		X		X		X				X		X		X	X	
Blue-winged Teal		X		X	X	X				X					x	
European Wigeon									X							
American Wigeon	*	X		X		X				X						
Shoveler	X									X						
Wood Duck	*					X		X		X	X			X	X	
Ring-necked Duck										X						X
Canvasback	*							X	X	X						
Greater Scaup	50%							X	X	X						X
Common Goldeneye									X	X						
Barrow's Goldeneye	X															
Bufflehead	s															
Oldsquaw				X						X						
White-winged Scoter	s								X	X						
Surf Scoter				X					X							
Black Scoter	s															
Ruddy Duck	*									X						
Common Merganser										X						
Bobwhite										X		X				X

Table 13-14
(continued)

	"General"	Carex spp.: Sedges	Juncus spp.: Rushes	Marine algae	Polygonum spp.: Smartweeds	Potamogeton spp.: Pondweeds	Scirpus spp.: Bulrushes	Vallisineria spp.: Wild Celery	Zostera marina spp.: Eel-grass	Miscellaneous Vegetation	Acorns	Berries	Fruits	Nuts	Grains	Seeds
Ring-necked Pheasant												X			c	c
King Rail	X														X	X
Clapper Rail	X															
Virginia Rail												X			X	X
Sora							X									X
Yellow Rail																X
Black Rail																X
Common Gallinule										X						X
American Coot				X				X		X						
Killdeer																X
Black-bellied Plover				X												
Ruddy Turnstone				s												
Common Snipe	20%															X
Whimbrel												X				X
Eskimo Curlew												X				
Upland Sandpiper																s
Willet										X					c	X
Knot										X						
Purple Sandpiper				X						X						
Pectoral Sandpiper																X

Table 13-14
(continued)

	"General"	Carex spp.: Sedges	Juncus spp.: Rushes	Marine algae	Polygonum spp.: Smartweeds	Potamogeton spp.: Pondweeds	Scirpus spp.: Bulrushes	Vallisineria spp.: Wild Celery	Zostera marina spp.: Eel-grass	Miscellaneous Vegeta.	Acorns	Berries	Fruits	Nuts	Grains	Seeds
White-rumped Sandpiper																X
Baird's Sandpiper				X												
Dunlin																s
Short-billed Dowitcher									s							s
Long-billed Dowitcher	s															
Stilt Sandpiper	30%															X
Semipalmated Sandpiper				s												
Buff-breasted Sandpiper																X
Sanderling										X						X
American Avocet																X
Wilson's Phalarope																X
Northern Phalarope																s
Parasitic Jaeger												s				
Glaucous Gull												s				
Iceland Gull												s				
Rock Dove																X
Mourning Dove															c	X
Yellow-billed Cuckoo												s	s			
Black-billed Cuckoo												s	s			
Belted Kingfisher												X				

Table 13-14
(continued)

	"General"	Carex spp.: Sedges	Juncus spp.: Rushes	Marine algae	Polygonum spp.: Smartweeds	Potamogeton spp.: Pondweeds	Scirpus spp. Bulrushes	Vallisineria spp.: Wild Celery	Zostera marina spp.: Eel-grass	Miscellaneous Vegetation	Acorns	Berries	Fruits	Nuts	Grains	Seeds
Yellow-shafted Flicker												X	X			X
Eastern Kingbird												X	X			X
Traill's Flycatcher	4%											X				X
Eastern Wood Pewee												s	s			
Horned Lark	48%											X	X			X
Tree Swallow	20%											X				s
Barn Swallow												s				s
Common Crow												c	c		c	X
Fish Crow													c	X	c	X
Black-capped Chickadee	30%											X	X		X	X
White-breasted Nuthatch											X			X		X
Red-breasted Nuthatch																X
Carolina Wren	6%											s		s		s
Mockingbird	52%											X	X			X
Catbird												X	X			X
Brown Thrasher	37%											X	X			X
Hermit Thrush	35%											X	X			X
Gray-cheeked Thrush	25%											X	X			
Veery	40%											X	X			
American Pipit	10%											X	X			

Table 13-14
(continued)

	"General"	Carex spp.: Sedges	Juncus spp.: Rushes	Marine algae	Polygonum spp.: Smartweeds	Potamogeton spp.: Pondweeds	Scirpus spp.: Bulrushes	Vallisineria spp.: Wild Celery	Zostera marina spp.: Eel-grass	Miscellaneous Vegetation	Acorns	Berries	Fruits	Nuts	Grains	Seeds
Starling	43%											X	X		c	X
Red-eyed Vireo	14%											X	X			
Yellow-rumped Warbler												X	X			X
Chestnut-sided Warbler												s				s
Palm Warbler																s
Connecticut Warbler												s				s
Yellow-breasted Chat												s	s			
American Redstart												s				
House Sparrow	97%									X		X	X		X	X
Bobolink	43%														X	X
Eastern Meadowlark	26%														X	X
Red-winged Blackbird															c	X
Boat-tailed Grackle	60%														c	X
Common Grackle												X	X		c	X
Brown-headed Cowbird	78%											X	X		X	X
Dickcissel	68%														X	X
American Goldfinch	*														X	X
Rufous-sided Towhee	70%											X	X		X	X
Savannah Sparrow	54%											X	X			X
Grasshopper Sparrow	37%														X	X
Henslow's Sparrow	18%														X	X

Table 13-14
(continued)

	"General"	Carex spp.: Sedges	Juncus spp.: Rushes	Marine algae	Polygonum spp.: Smartweeds	Potamogeton spp.: Pondweeds	Scirpus spp.: Bulrushes	Vallisineria spp.: Wild Celery	Zostera marina spp.: Eel-grass	Miscellaneous Vegetation	Acorns	Berries	Fruits	Nuts	Grains	Seeds
Sharp-tailed Sparrow	19%														X	X
Seaside Sparrow	20%															X
Vesper Sparrow	67%															X
Dark-eyed Junco																X
Tree Sparrow	*									X		s	s			X
Chipping Sparrow	62%															X
Field Sparrow	*												X			X
White-throated Sparrow	*															X
Swamp Sparrow																X
Song Sparrow												X	X			X
Lapland Longspur																X
Snow Bunting																X

TABLE 13-15

Utilization of insects (adults, eggs, & juvenile stages), Annelids, Arachnids, and Echnioderms by birds within the study area. An asterisk (*) indicates that the category forms a major portion of the diet; percentages are given where known. An "s" indicates that only small amounts of the material are utilized.

	Insects/insect eggs/larvae	Arachnids	Annelids	Echinoderms
Common Loon	X		X	
Red-throated Loon	X		X	
Red-necked Grebe	X		X	
Horned Grebe	43%		X	
Pied-billed Grebe	46%			
Fulmar			X	
Great Cormorant			X	
Double-crested Cormor.	X		X	
Great Blue Heron	X		X	
Green Heron	X	X	X	
Little Blue Heron	X	X		
Cattle Egret	*	X		
Great Egret	X			
Snowy Egret	X		X	
Louisiana Heron	X	X	X	
Black-crowned Night Heron	X		X	
Yellow-crowned Night Heron	X		X	
Least Bittern	X		X	

Table 13-15
(continued)

	Insects/insect eggs/larvae	Arachnids	Annelids	Echinoderms
American Bittern	X	X		
Glossy Ibis	X		X	
Whistling Swan	X		X	
Canada Goose	X		X	
Brant	X		X	
Snow Goose	X			
Mallard	X			
Gadwall	X		X	
Pintail	X			
American Green-winged Teal	X		X	
Blue-winged Teal	X		X	
European Wigeon	X			
American Wigeon	X		X	
Shoveler	X		X	
Wood Duck	X	X		
Redhead	X		X	
Ring-necked Duck	X			
Canvasback			X	
Greater Scaup				X
Common Goldeneye			X	

Table 13-15
(continued)

	Insects/insect eggs/larvae	Arachnids	Annelids	Echinoderms
Bufflehead	X		X	
Oldsquaw	X			
Common Eider			X	X
King Eider				X
Black Scoter				X
Hooded Merganser	X		X	
Sharp-shinned Hawk	X			
Cooper's Hawk	X			
Red-tailed Hawk	X			
Red-shouldered Hawk	X	X	X	
Broad-winged Hawk	X	X	X	
Marsh Hawk	X			
Pigeon Hawk	X	X		
Sparrow Hawk	X			
Bobwhite	X	X		
Ring-necked Pheasant	X			
King Rail	X		X	
Clapper Rail	X			
Virginia Rail	X		X	
Sora	91%	X		

Table 13-15
(continued)

	Insects/insect eggs/larvae	Arachnids	Annelids	Echinoderms
Black Rail	X		X	
Common Gallinule	X		X	
American Coot	X		X	
American Oystercatcher			X	
Semipalmated Plover	X		X	
Piping Plover	X		X	
Wilson's Plover	X		X	
Killdeer	*	X		
American Golden Plover	X		X	
Black-bellied Plover			X	
Ruddy Turnstone	X	X	X	
American Woodcock	X		*	
Common Snipe	*		X	
Whimbrel	X	X	X	
Eskimo Curlew	X	X	X	
Upland Sandpiper	*	X	X	
Spotted Sandpiper	*		X	
Solitary Sandpiper	X		X	
Willet	X		X	
Greater Yellowlegs	X		X	

Table 13-15
(continued)

	Insects/insect eggs/larvae	Arachnids	Annelids	Echinoderms
Lesser Yellowlegs	X		X	
Knot	X	X	X	
Purple Sandpiper	X	X	X	
Pectoral Sandpiper	*	X	X	
White-rumped Sandpiper	X		X	
Baird's Sandpiper	X		X	
Least Sandpiper	X		X	
Dunlin	X		X	
Short-billed Dowitcher	X		X	
Long-billed Dowitcher	71%			
Stilt Sandpiper	X		X	
Semipalmated Sandpiper	X		X	
Western Sandpiper	X		X	
Buff-breasted Sandpiper	*	X		
Marbled Godwit	X		X	
Hudsonian Godwit	X		X	
Sanderling	X		X	
American Avocet	X		X	
Red Phalarope	X		X	
Wilson's Phalarope	*			
Northern Phalarope	X	X	X	
Parasitic Jaeger	X			

Table 13-15
(continued)

	Insects/insect eggs/larvae	Arachnids	Annelids	Echinoderms
Long-tailed Jaeger	X			
Herring Gull	X		X	X
Ring-billed Gull	X			
Laughing Gull	X			
Bonaparte's Gull	*		X	
Black-legged Kittiwake			X	
Forster's Tern	*			
Common Tern	X		X	
Least Tern	X			
Black Tern	X			
Common Murre			X	
Thick-billed Murre			X	
Black Guillemot			X	
Common Puffin			X	
Yellow-billed Cuckoo	*			
Black-billed Cuckoo	*			
Barn Owl	X			
Great Horned Owl	X			
Short-eared Owl	X			
Whip-poor-will	*			
Common Nighthawk	*			

Table 13-15
(continued)

	Insects/insect eggs/larvae	Arachnids	Annelids	Echinoderms
Chimney Swift	*			
Belted Kingfisher	X			
Yellow-shafted Flicker	*			
Eastern Kingbird	90%			
Traill's Flycatcher	X	X		
Eastern Wood Pewee	*	X		
Horned Lark	X	X		
Tree Swallow	*	X		
Bank Swallow	*			
Rough-winged Swallow	*	s		
Barn Swallow	*	X		
Cliff Swallow	*	s		
Purple Martin	*			
Common Crow	67%	X	X	X
Fish Crow	X	X	X	
Black-capped Chickadee	*	X		
White-breasted Nuthatch	*			
Red-breasted Nuthatch	X			
Brown Creeper	*	X		
House Wren	98%			
Winter Wren	*			

Table 13-15
(continued)

	Insects/insect eggs/larvae	Arachnids	Annelids	Echinoderms
Carolina Wren	*	X		
Long-billed Marsh Wren	*	X		
Short-billed Marsh Wren	*	X		
Mockingbird	*	X	X	
Catbird	*	X	X	
Brown Thrasher	*	X	X	
Hermit Thrush	*	X	X	
Gray-cheeked Thrush	*			
Veery	*	X	X	
Blue-gray Gnatcatcher	*	X		
Golden-crowned Kinglet	*			
American Pipit	*			
Northern Shrike	X			
Loggerhead Shrike	68%	4%		
Starling	*	X	X	
Red-eyed Vireo	*			
Black-and-white Warbler	*			
Yellow Warbler	*			
Yellow-rumped Warbler	X			
Chestnut-sided Warbler	*			
Palm Warbler	*			

Table 13-15
(continued)

	Insects/insect eggs/larvae	Arachnids	Annelids	Echinoderms
Northern Waterthrush	*	X	X	
Louisiana Waterthrush	*	X		
Connecticut Warbler	*			
Yellowthroat	*	X		
Yellow-breasted Chat	*	X		
American Redstart	*	X		
House Sparrow	X			
Boblink	*	X		
Eastern Meadowlark	*	X		
Red-winged Blackbird	X	X		
Boat-tailed Grackle	X	X	X	
Common Grackle	X	X	X	
Brown-headed Cowbird	X	X		
Dickcissel	X	X		
American Goldfinch	X			
Rufous-sided Towhee	X	X		
Savannah Sparrow	X	X		
Grasshopper Sparrow	*	X	X	
Henslow's Sparrow	*			
Sharp-tailed Sparrow	*			
Seaside Sparrow	*			

Table 13-15 (continued)

	Insects/insect eggs/larvae	Arachnids	Annelids	Echinoderms
Vesper Sparrow	X	X	X	
Dark-eyed Junco	X			
Chipping Sparrow	X	X		
Field Sparrow	*	X		
White-throated Sparrow	X			
Swamp Sparrow	*			
Song Sparrow	X			
Snow Bunting	X	X	X	

TABLE 13-16

Utilization of mollusks, crustaceans, and plankton by birds in the study area. The "General" category is used when specific animal groups are not known, and/or to indicate the amount of animal material utilized. An asterisk (*) indicates that the animal group forms a major portion of the diet (percentages are given where known). An "s" under a category indicates only small amounts of the material are utilized.

	MOLLUSKS				CRUSTACEANS			
	General	Bivalves	Cephalopods	Gastropods	General	Entomostraca[1]	Malacostraca[2]	PLANKTON
Common Loon	X				X			
Red-throated Loon				X	X			
Red-necked Grebe	X				X			
Horned Grebe					X			
Pied-billed Grebe	X				31%		X	
Fulmar	X				X			X
Cory's Shearwater			X		X			
Greater Shearwater			X					
Sooty Shearwater			X					
Manx Shearwater			X		X			
Leach's Storm Petrel	X				X			X
Wilson's Storm Petrel								X
Gannet			X		X			
Great Cormorant	X				X			
Double-crested Cormorant					X			
Great Blue Heron					X			
Green Heron	X				X			
Great Egret					X			
Little Blue Heron							X	
Snowy Egret				X			X	
Louisiana Heron				X	X			
Black-crowned Night Heron	X				X			
Yellow-crowned Night Heron	X				98%			

Table 13-16
(continued)

	MOLLUSKS				CRUSTACEANS			
	General	Bivalves	Cephalopods	Gastropods	General	Entomostraca[1]	Malacostraca[2]	PLANKTON
Least Bittern				X	X			
American Bittern	X						X	
Glossy Ibis	X						X	
Mute Swan		X		X				
Whistling Swan					X			
Canada Goose	X				X			
Brant	X				X			
Snow Goose	X				X			
Mallard	X				X			
Black Duck		X		X		X	X	
Gadwall	s				s			
Pintail	X				X			
American Green-winged Teal	X				X			
Blue-winged Teal				X	X			
European Wigeon	X				X			
American Wigeon				X				
Shoveler				X			X	
Wood Duck					X			
Redhead		X		X				
Ring-necked Duck				X				
Canvasback				X				
Greater Scaup		X					X	
Common Goldeneye		X			X			
Barrow's Goldeneye	*	X		X				
Bufflehead		X		X			X	
Oldsquaw		X				X	X	
Harlequin Duck	*	X			X			
Common Eider	*	X			X			

Table 13-16
(continued)

	MOLLUSKS				CRUSTACEANS			
	General	Bivalves	Cephalopods	Gastropods	General	Entomostraca[1]	Malacostraca[2]	PLANKTON
King Eider	*	X				X	X	
White-winged Scoter	*	X					X	
Surf Scoter	*	X						
Black Scoter	*	X		X	X			
Ruddy Duck							X	
Hooded Merganser		X		X	X			
Common Merganser		X		X			X	
Red-breasted Merganser	X				X			
Red-tailed Hawk							X	
Broad-winged Hawk							X	
Bobwhite	X				X			
King Rail				X			X	
Clapper Rail				X			X	
Virginia Rail				X			X	
Sora	X							
Yellow Rail				X				
Common Gallinule				X				
American Coot				X	X			
American Oystercatcher		X					X	
Semipalmated Plover	X				X			
Piping Plover	X				X			
Wilson's Plover	X						X	
Killdeer				X			X	
American Golden Plover	X				X			
Black-bellied Plover	X						X	
Ruddy Turnstone	X				X			
American Woodcock				X				
Common Snipe	X				X			

Table 13-16
(continued)

	MOLLUSKS				CRUSTACEANS			
	General	Bivalves	Cephalopods	Gastropods	General	Entomostraca[1]	Malacostraca[2]	PLANKTON
Whimbrel	X					X	X	
Eskimo Curlew				X				
Upland Sandpiper				X				
Spotted Sandpiper	X							
Solitary Sandpiper	X				X			
Willet		X		X			X	
Greater Yellowlegs		X		X			X	
Lesser Yellowlegs	X				X			
Purple Sandpiper		X		X		X	X	
Knot		X		X	X			
Pectoral Sandpiper		X		X	X			
White-rumped Sandpiper	X							
Dunlin	X				X			
Short-billed Dowitcher	X				X			
Stilt Sandpiper	X							
Semipalmated Sandpiper	X				X			
Western Sandpiper				X				
Marbled Godwit	X				X			
Hudsonian Godwit	X				X			
Sanderling	X					X		
American Avocet					X			
Red Phalarope	X				X			
Wilson's Phalarope					X			
Northern Phalarope	X				X			
Parasitic Jaeger							X	
Long-tailed Jaeger	X				X			
Glaucous Gull	X				X			
Iceland Gull	X				X			
Great Black-backed Gull	X				X			

Table 13-16
(continued)

	MOLLUSKS				CRUSTACEANS			
	General	Bivalves	Cephalopods	Gastropods	General	Entomostraca[1]	Malacostraca[2]	PLANKTON
Herring Gull		X	X	X	X			
Ring-billed Gull	X				X			
Laughing Gull	X				X			
Bonaparte's Gull					X			
Black-legged Kittiwake	X				X			
Common Tern	X				X			
Arctic Tern					X			
Least Tern					X			
Royal Tern	s				X			
Caspian Tern	X				X			
Black Tern	X				X			
Black Skimmer					X			
Razorbill	X				X			
Common Murre	X				X			
Thick-billed Murre	X				X			
Dovekie					X			X
Black Guillemot	X				X			
Common Puffin					X			
Black-billed Cuckoo	X							
Belted Kingfisher		X					X	
Horned Lark	s							
Common Raven	X				X			
Common Crow	X				X			
Fish Crow	X				X			
Mockingbird				X			X	
Veery				X	X			
American Pipit	X				X			
Northern Waterthrush	X				X			

Table 13-16
(continued)

	MOLLUSKS				CRUSTACEANS			
	General	Bivalves	Cephalopods	Gastropods	General	Entomostraca[1]	Malacostraca[2]	PLANKTON
Louisiana Waterthrush				X	X			
Connecticut Warbler				X				
Red-winged Blackbird	s							
Boat-tailed Grackle					X			
Common Grackle	X				X			
Brown-headed Cowbird				X				
Rufous-sided Towhee				X	X			
Savannah Sparrow				X				
Grasshopper Sparrow				X				
Seaside Sparrow				X			X	
Snow Bunting							X	

[1]Entomostraca=fairy shrimp, water fleas, copepods, barnacles, etc. (Classification from Barnes, 1969).

[2]Malacostraca=crabs, shrimp, lobsters, etc. (Classification from Barnes, 1969).

TABLE 13-17

Utilization of vertebrates (fish, amphibians, reptiles, birds, & mammals) by birds within the study area. An asterisk (*) indicates that the category forms a major portion of the diet; percentages are given where known. An "s" indicates that only small amounts of the material are utilized.

		Amphibians			Reptiles			Birds		Mammals	
	Fish	Frogs/tadpoles	Toads	Salamanders	Snakes	Lizards	Turtles	Adults	Eggs & Young	Rodents	Others
Common Loon	80%	X									
Red-throated Loon	*										
Red-necked Grebe	X	X		X							
Horned Grebe	43%										
Pied-billed Grebe	24%	X		X							
Fulmar	X										
Cory's Shearwater	X										
Greater Shearwater	X										
Sooty Shearwater	X										
Manx Shearwater	X										
Leach's Storm Petrel	X										
Wilson's Storm Petrel	X										
Gannet	*										
Great Cormorant	*										
Double-crested Cormorant	*	X									

Table 13-17
(continued)

		Amphibians			Reptiles			Birds		Mammals	
	Fish	Frogs/tadpoles	Toads	Salamanders	Snakes	Lizards	Turtles	Adults	Eggs & Young	Rodents	Others
Great Blue Heron	X	X	X	X	X			s		X	
Green Heron	X	X	X		X	X	X				
Great Egret	X	X		X	X					X	
Little Blue Heron	X	X			X	X	X				
Cattle Egret		X				X				X	
Snowy Egret	X	X			X						
Louisiana Heron	X	X		X							
Black-crowned Night Heron	50%	X			X				s	X	
Yellow-crowned Night Heron		X							s	s	
Least Bittern	X	X		X						s	
American Bittern	X	X			X					X	
Glossy Ibis		X			X						
Whistling Swan	X	X									
Black Duck	X										
Gadwall	s										
Blue-winged Teal		X									
American Wigeon	X										
Shoveler	X	X									
Redhead	X	X				X					

Table 13-17
(continued)

		Amphibians			Reptiles			Birds		Mammals	
	Fish	Frogs/tadpoles	Toads	Salamanders	Snakes	Lizards	Turtles	Adults	Eggs & Young	Rodents	Others
Ring-necked Duck		X									
Canvasback	X	X		X							
Common Goldeneye	X										
Barrow's Goldeneye	X	X									
Oldsquaw	X										
Harlequin Duck	X										
Common Eider	X										
King Eider	X										
White-winged Scoter	X										
Ruddy Duck	X										
Hooded Merganser	X										
Common Merganser	*										
Red-breasted Merganser	*										
Sharp-shinned Hawk								X		X	
Cooper's Hawk		X	X					X	X		
Red-tailed Hawk		X	X		X	X		X		*	X
Red-shouldered Hawk		X			X	X		X		*	X
Broad-winged Hawk	X	X			X	X		X		X	X

Table 13-17
(continued)

		Amphibians			Reptiles			Birds		Mammals	
	Fish	Frogs/tadpoles	Toads	Salamanders	Snakes	Lizards	Turtles	Adults	Eggs & Young	Rodents	Others
Rough-legged Hawk										*	*
Golden Eagle								X		*	*
Bald Eagle	X							X		X	X
Marsh Hawk					X					*	X
Osprey	*	s			s				s		
Gyrfalcon								*		X	X
Peregrine Falcon								*		s	s
Pigeon Hawk		X			X	X		*			
Sparrow Hawk		X			X	X		X		X	
King Rail	X										
Clapper Rail	X										
Virginia Rail	X	X			X						
American Coot	X	X									
American Golden Plover	X										
Black-bellied Plover	X										
Ruddy Turnstone	X								X		
Common Snipe	X										
Solitary Sandpiper		X									
Willet	X										

Table 13-17
(continued)

	Amphibians			Reptiles			Birds		Mammals	
	Fish	Frogs/tadpoles	Toads	Salamanders	Snakes	Lizards	Turtles	Adults	Eggs/Young	Rodents	Others
Greater Yellowlegs	X										
Lesser Yellowlegs	X										
Purple Sandpiper	X										
Short-billed Dowitcher	X										
Stilt Sandpiper		X									
American Avocet	s										
Red Phalarope	X										
Northern Phalarope	s										
Pomarine Jaeger	*								X		
Parasitic Jaeger	X							X	X	X	
Long-tailed Jaeger	X							X	X	X	X
Skua	X							X	X		
Glaucous Gull	X							s	X		
Great Black-backed Gull	X							s	X	X	X
Iceland Gull	X										
Herring Gull	X							s	X		
Ring-billed Gull	X								X	X	

Table 13-17
(continued)

		Amphibians			Reptiles			Birds		Mammals	
	Fish	Frogs/tadpoles	Toads	Salamanders	Snakes	Lizards	Turtles	Adults	Eggs & Young	Rodents	Others
Laughing Gull	X								X		
Bonaparte's Gull	X										
Black-legged Kittiwake	X										
Forster's Tern	X										
Common Tern	X										
Arctic Tern	*										
Roseate Tern	*										
Least Tern	*										
Royal Tern	*										
Caspian Tern	*								s		
Black Tern	X										
Black Skimmer	*										
Razorbill	X										
Common Murre	*										
Thick-billed Murre	X										
Dovekie	X										
Black Guillemot	X										
Common Puffin	*										

Table 13-17
(continued)

		Amphibians			Reptiles			Birds		Mammals	
	Fish	Frogs/tadpoles	Toads	Salamanders	Snakes	Lizards	Turtles	Adults	Eggs & Young	Rodents	Others
Black-billed Cuckoo	X								s		
Barn Owl		s						X		X	
Great Horned Owl		X	X		X	X		X		X	X
Snowy Owl	X							X		X	
Short-eared Owl								X		X	
Belted Kingfisher	*	X			X	X	X			X	
Eastern Kingbird	s										
Common Raven	X	X	X	X	X	X			X	X	
Common Crow	X	X	X	X	X	X		X	X	X	
Fish Crow	X										
Brown Thrasher					s	s			X		
Northern Shrike		X	X	X	X	X			X	X	
Loggerhead Shrike		X	X	X	X	X			X	X	
Louisiana Waterthrush	X										
Boat-tailed Grackle	X	X									
Common Grackle	X	X		X					X		
Rufous-sided Towhee				X		X					
Song Sparrow	s										

TABLE 13-18

Utilization of carrion, fish offal, garbage, and sewage effluent by birds within the study area. An asterisk(*) indicates that the category forms a major portion of the diet. An "s" indicates that only small amounts of the material are utilized.

	Carrion	Fish Offal	Garbage	Sewage Effluent
Fulmar	X	X		
Cory's Shearwater		X		
Greater Shearwater		X		
Sooty Shearwater		X		
Manx Shearwater		X		
Leach's Storm Petrel		X	X	
Wilson's Storm Petrel		X		
Turkey Vulture	*			
Bald Eagle	X			
Parasitic Jaeger		X	X	
Long-tailed Jaeger		X	X	
Skua	X	X		
Glaucous Gull	X		X	
Iceland Gull	X	X	X	
Great Black-backed Gull	X	X	X	X
Herring Gull	X	X	X	X
Ring-billed Gull	X			
Laughing Gull	X	X	X	X

Table 13-18
(continued)

	Carrion	Fish Offal	Garbage	Sewage Effluent
Black-legged Kittiwake		X	s	
Forster's Tern	X			
Rock Dove			X	
Common Raven	X	X	X	
Common Crow	X		X	
Fish Crow	X	X	X	
Northern Shrike	s			
Starling			X	
House Sparrow			X	
Boat-tailed Grackle			X	
Common Grackle			X	

TABLE 13-19

Average arrival times in spring, and departure times in the fall of general types of migrating birds, at New Brunswick; Maine; New Hampshire; Cape Cod, Mass.; Rhode Island; and Long Island, New York. Peak months are underlined.

	Cape Cod		R.I.		L.I.,N.Y.	
	Avg. Sp. Arr.	Avg. Fall Dept.	Avg. Sp. Arr.	Avg. Fall Dept.	Avg. Sp. Arr.	Avg. Fall Dept.
Wading Birds	Late Apr. early May	Aug.- Sept.	Apr.	Mid- Sept.- Mid.- Nov.	Apr.	Oct.
Waterfowl	Mid- Mar.- Apr.	Nov.	Mar.- Apr.	Nov.	Mar.- Apr.	Oct.- Nov.
Raptors	Apr.	late Sept.- Nov.	Mar.- Apr.	Oct.	Apr.	Oct.
Shorebirds	May	Aug.- Sept.	late Apr.	Aug.- Sept. early Oct.	Apr.- May	Aug.- Sept.
Gulls & Terns	May	Aug.- Sept.	Apr.- May	late Sept.- early Oct.	May	Aug.- Sept.
Flycatchers, Swallows	May	July- Aug.- Sept.	Apr.- May	Sept.- early Oct.	late Apr.- May	Aug.- Sept.
Jays, Crows	May- June	Oct.	--	--	Mar.- May	Aug.- Oct.
Chickadees, Nuthatches, Wrens, Creeper	Apr.- May	Sept.- Oct.- Nov.	Apr.	Oct.	Apr.- May	Sept.- Oct.

Table 13-19 (continued)

	Cape Cod		R.I.		L.I.,N.Y.	
	Avg. Sp. Arr.	Avg. Fall Dept.	Avg. Sp. Arr.	Avg. Fall Dept.	Avg. Sp. Arr.	Avg. Fall Dept.
Mimics, Thrushes	Mar.-May	Sept.-Oct.-Nov.	Mar.-May	Oct.	Mar.-May	Sept.-Oct.-Nov.
Kinglets, Vireos, Warblers	Mar.-May	Sept.-Oct.-Nov.	Apr.-May	Sept.-Oct.	Apr.-May	Sept.-Oct.
Blackbirds	Apr.	Sept.-Oct.	Mar.-Apr.-May	Oct.	Mar.-May	Sept.-Oct.
Tanagers, Buntings, Finches Sparrows	Apr.-May	Sept.-Nov.	Mar.-Apr.-May	Oct.	Mar.-Apr.-May	Sept.-Oct.-Nov.

	N.B.		Maine		N.H.	
	Avg. Sp. Arr.	Avg. Fall Dept.	Avg. Sp. Arr.	Avg. Fall Dept.	Avg. Sp. Arr.	Avg. Fall Dept.
Wading Birds	Apr.	mid-Oct.-mid-Nov.	late Apr.	late Sept.	mid-Apr.	mid-Sept.-mid-Oct.
Waterfowl	late Mar.-Apr.	Oct.-Nov.	Apr.	Sept.-Oct.	early Apr.	mid-Nov.
Raptors	Mar.	early Nov.	early Apr.	late Sept.	Apr.	mid-Oct.
Shorebirds	May	mid-Aug.-late Oct.	Apr.-May	Aug.-Sept.	May-June	Sept.-Oct.
Gulls & Terns	May	Oct.	May	late Aug.	May	Sept.
Flycatchers Swallows	Apr.	Oct.	early May	Aug.	late Apr.	Sept.

Table 13-19 (continued)

	N.B.		Maine		N.H.	
	Avg. Sp. Arr.	Avg. Fall Dept.	Avg. Sp. Arr.	Avg. Fall Dept.	Avg. Sp. Arr.	Avg. Fall Dept.
Jays & Crows	--	--	Apr.	late Aug.	--	--
Chickadees, Nuthatches, Wrens, Creeper	late Apr.	late Sept.	late Apr.	late Sept.	early May	early Oct.
Mimics, Thrushes	Apr.	Sept.- Oct.	late Apr.	late Sept.	early May	Oct.
Kinglets, Vireos, Warblers	early May	Sept.- Oct.	May	Sept.	early May	Sept.- Oct.
Blackbirds	late Mar.	late Oct.	late Mar.	Sept.	mid- Mar.	early Nov.
Tanagers, Buntings, Finches, Sparrows	mid- Apr.	Oct.	late Apr.	late Sept.	late Apr.	late Oct.

TABLE 13-20

Major breeding areas within the study area, and representative birds breeding in each locality. (For complete listing of each locality, see individual checklists, or state/regional bird books).

New Jersey

Hackensack Meadows: Least Bittern, Blue-winged Teal, Ruddy Duck, Marsh Hawk, Virginia Rail, Common Gallinule, American Coot.

Sandy Hook State Park: Great Blue Heron, Green Heron, Great Egret, Black-crowned Night Heron, Mallard, Black Duck, Wood Duck, Red-breasted Merganser, Osprey, Sparrow Hawk, Bobwhite, Clapper Rail, Sora, Semipalmated Plover, Killdeer, American Woodcock, Semipalmated Sandpiper, Great Black-backed Gull, Herring Gull, Laughing Gull, Common Tern, Least Tern, Mourning Dove, Great Horned Owl, Whip-poor-will, Belted Kingfisher, Flicker, Downy Woodpecker, Horned Lark, Barn Swallow, Blue Jay, Common Crow, Fish Crow, Black-capped Chickadee, House Wren, Mockingbird, Catbird, Brown Thrasher, Robin, Starling, Yellowthroat, American Redstart, House Sparrow, Red-winged Blackbird, Brown-headed Cowbird, Cardinal, House Finch, American Goldfinch, Rufous-sided Towhee, Sharp-tailed Sparrow, Seaside Sparrow, Field Sparrow, Song Sparrow.

New York

Canarsie Pol (Jamaica Bay): Glossy Ibis, Great Black-backed Gull, Herring Gull, Least Tern.

Cartwright Island: American Oystercatcher, Great Black-backed Gull, Herring Gull, Roseate Tern, Black Skimmer.

Fire Island State Park: Piping Plover, Wilson's Plover, Common Tern, Roseate Tern, Black Skimmer.

Fisher's Island: Great Egret, Yellow-crowned Night Heron, Herring Gull.

Gardiner's Island: Great Egret, Little Blue Heron, Cattle Egret, Snowy Egret, Black-crowned Night Heron, Glossy Ibis, Mute Swan, Red-breasted Merganser (may no longer breed), Osprey, American Oystercatcher, Great Black-backed Gull, Herring Gull, Roseate Tern, Black Skimmer.

Great Gull Island: Mallard, Spotted Sandpiper, gulls, Common Tern, Roseate Tern, Barn Swallow, Starling, Yellowthroat, Red-winged Blackbird, Song Sparrow.

Table 13-20 (continued)

Breeding areas (continued)

New York (continued)

Hobart's Beach: Common Tern, Least Tern, Black Skimmer.

Jamaica Bay National Wildlife Refuge: Pied-billed Grebe, Green Heron, Great Egret, Little Blue Heron, Snowy Egret, Louisiana Heron, Yellow-crowned Night Heron, Least Bittern, Glossy Ibis, Black Duck, Gadwall, Pintail (1 record, 1962), American Green-winged Teal, Blue-winged Teal, American Wigeon, Shoveler, Redhead, Ruddy Duck, Common Gallinule, American Coot, Herring Gull, Common Tern, Roseate Tern, Black Skimmer, Horned Lark; songbirds.

Jones Beach--Tobay Pond: Great Egret, Little Blue Heron, Snowy Egret, Louisiana Heron, Yellow-crowned Night Heron, Glossy Ibis, Gadwall, Shoveler, Black Rail, Willet (3 records, 1966), Black Skimmer, Traill's Flycatcher, Horned Lark; songbirds.

Meadow Island and Short Beach: Common Tern, Least Tern, Black Skimmer.

Moriches Bay: American Oystercatcher, Common Tern, Roseate Tern, Black Skimmer.

Oak Beach Marsh (Great South Bay): Virginia Rail, Black Rail (?).

Tiana Beach (near Shinnecock Inlet): American Oystercatcher, Piping Plover.

Troy Meadows: American Bittern, Virginia Rail, Sora.

Connecticut

Faulkner Island: Common Tern, Roseate Tern.

Gone Island: Roseate Tern

Goose Island (off Guilford): Herring Gull, Roseate Tern.

Goose Island (off Norwalk): Common Tern, Roseate Tern.

Hammonasset State Park: Green Heron, Mallard, Black Duck, Red-tailed Hawk, Clapper Rail, Killdeer, plovers, sandpipers, gulls, terns, sparrows.

Little Tavern Island: Common Tern, Roseate Tern.

Table 13-20 (continued)

Breeding areas (continued)

Connecticut (continued)

Lobster Rock: Common Tern, Roseate Tern.

Pebble Beach: Common Tern, Roseate Tern.

Ram Island (Fairfield Co.): Snowy Egret, Yellow-crowned Night Heron.

Rocky Neck State Park: Mallard, Black Duck, Clapper Rail.

Sheep Rocks (Norwalk): Herring Gull.

Sheffield Island (Fairfield Co.): Great Egret, Snowy Egret.

Sherwood Island (off Westport): Piping Plover, Least Tern.

Rhode Island

Aquidneck Island: Mute Swan, Common Tern, Long-billed Marsh Wren, Black-throated Green Warbler, Savannah Sparrow.

Block Island: Green Heron, Yellow-crowned Night Heron, Marsh Hawk, Spotted Sandpiper, Herring Gull, Mourning Dove, Barn Owl, Long-eared Owl, Yellow-shafted Flicker, Savannah Sparrow.

Briggs Marsh: Mute Swan, Canada Goose, Mallard, Black Duck, mergansers, Piping Plover (?), Common Tern, Least Tern, Long-billed Marsh Wren.

Cormorant Rock (Middletown): Common Tern.

Dyer's Island: Herring Gull.

East Island (off Sakonnet Pt.): Canada Goose, Great Black-backed Gull, Herring Gull.

Galilee: Killdeer, Least Tern.

Gooseberry Island (off Hope Island): Herring Gull.

Gooseberry Island (off Newport): Herring Gull.

Gould Island: Green Heron, Great Egret, Little Blue Heron, Cattle Egret, Black-crowned Night Heron, Yellow-crowned Night Heron.

Table 13-20 (continued)

Breeding areas (continued)

Rhode Island (continued)

Green Hill Beach: Least Tern.

Gull Rock (Newport): Common Tern.

Island Rocks (Middletown): Common Tern.

Jamestown Island: Green Heron, Canada Goose, Black Duck, Cooper's Hawk, Broad-winged Hawk, Marsh Hawk, Osprey, Sparrow Hawk, Ring-necked Pheasant, Clapper Rail, Killdeer, American Woodcock, Upland Plover, Spotted Sandpiper, Great Black-backed Gull, Herring Gull, Common Tern, Mourning Dove, Barn Owl, Screech Owl, Great Horned Owl, Yellow-shafted Flicker, Hairy Woodpecker, Downy Woodpecker, House Wren, House Finch, Mockingbird, Song Sparrow.

Matunuck: Canada Goose, Osprey, Least Tern.

Moonstone Pond: Mute Swan, Canada Goose, Gadwall(?), Least Tern.

Napatree Point (Watch Hill): Piping Plover, Herring Gull.

Quonochontaug: Black-crowned Night Heron, Mute Swan, Black Duck, Virginia Rail (?), Common Tern.

Round Rock (off Hope Island): Common Tern.

Sakonnet Point: Spotted Sandpiper, Common Tern.

Sandy Point Island (off Napatree Pt.): Herring Gull, Least Tern (?).

"The Clumps" (off Sakonnet Pt.): Herring Gull.

Trustom Pond: Piping Plover, Common Tern.

West Island: Great Black-backed Gull, Herring Gull.

Massachusetts

Bird Island (Buzzards Bay): Common Tern, Roseate Tern.

Audubon Wildlife Sanctuary: Canada Goose, Mallard, Black Duck, Blue-winged Teal, Clapper Rail.

Boston Harbor: Double-crested Cormorant, Great Black-backed Gull, Herring Gull, Common Tern.

Table 13-20 (continued)

Breeding areas (continued)

Massachusetts (continued)

Chatham: Black Rail; major gull colonies.

Coatue (Nantucket): Herring Gull.

Cohasset: Common Tern.

Cotuit (Cape Cod): Least Tern.

Craigville (Cape Cod): Common Tern, Least Tern.

Crane's Beach (Essex Co.): Least Tern.

Fish Island (Buzzards Bay): Common Tern.

Gray's Beach: Common Tern, Roseate Tern.

Great Egg Rock (Massachusetts Bay): Great Black-backed Gull, Herring Gull.

Great Point (Nantucket): Common Tern, Arctic Tern, Least Tern.

Green Island (Mass. Bay): Great Black-backed Gull, Herring Gull.

Gurnet Point (Duxbury area, Plymouth Co.): Herring Gull, Least Tern.

Island South of Cat Island (Mass. Bay): Great Black-backed Gull, Herring Gull.

Jeremy's Point: Common Tern.

Little Calf Island (Mass. Bay): Great Black-backed Gull, Herring Gull.

Marblehead Rock (Mass. Bay): Great Black-backed Gull, Herring Gull.

Martha's Vineyard: Herring Gull, Common Tern, Arctic Tern, Least Tern, Common Grackle, Sharp-tailed Sparrow, Seaside Sparrow.

Milk Island (North Shore): Great Black-backed Gull, Herring Gull.

Table 13-20(continued)

Breeding areas (continued)

Massachusetts (continued)

Monomoy National Wildlife Refuge: Black-crowned Night Heron, American Bittern, Canada Goose, Black Duck, American Green-winged Teal, Blue-winged Teal, Ruddy Duck(?), Red-breasted Merganser, American Coot, Common Gallinule, Marsh Hawk, Piping Plover, Spotted Sandpiper, Great Black-backed Gull, Herring Gull, Laughing Gull, Common Tern, Arctic Tern, Least Tern, Roseate Tern, Black Skimmer; songbirds.

Muskeget Island (off Nantucket): Great Black-backed Gull, Herring Gull, Laughing Gull (50 pairs in 1970--Nisbet,1971).

Nantucket Island: Canada Goose, Black Duck, Marsh Hawk, Spotted Sandpiper, Piping Plover, Great Black-backed Gull, Herring Gull, Laughing Gull (200 pairs, 1970), Common Tern, Arctic Tern, Roseate Tern (the terns may no longer breed, as of 1970--Wetherbee, 1972), Short-eared Owl, Barn Swallow, Starling, Red-winged Blackbird, Savannah Sparrow, Sharp-tailed Sparrow, Song Sparrow.

Nahant: Laughing Gull (May no longer breed--Nisbet,1971).

Nashawena (Wood's Hole): Common Tern, Least Tern.

Nauset Beach Inlet: Clapper Rail, Piping Plover, Spotted Sandpiper, Common Tern, Arctic Tern, Roseate Tern, Prairie Horned Lark.

Norman's Woe: Herring Gull.

North Sandwich: Common Tern.

North Beach (Cape Cod): Least Tern.

Norton's Point(Katama, Martha's Vineyard): Common Tern, Least Tern.

Parker River National Wildlife Refuge: Pied-billed Grebe, Green Heron, Black-crowned Night Heron, Least Bittern, American Bittern, Canada Goose, Mallard, Black Duck, Gadwall, Pintail, American Green-winged Teal, Blue-winged Teal, Ruddy Duck, Marsh Hawk, Sparrow Hawk, Ring-necked Pheasant, Clapper Rail, Virginia Rail, Sora, Common Gallinule, American Coot, Piping Plover, American Woodcock, Spotted Sandpiper, Common Tern, Least Tern, Mourning Dove, Great Horned Owl, Belted Kingfisher, Yellow-shafted Flicker, Eastern Kingbird, Tree Swallow, Cliff Swallow, Barn Swallow, Purple Martin, Blue Jay, Common Crow, Black-capped Chickadee, Catbird, Brown Thrasher, American

Table 13-20 (continued)

Breeding areas (continued)

Massachusetts (continued)

Parker River N.W.R. (continued): Robin, Cedar Waxwing, Starling, Yellow Warbler, American Redstart, House Sparrow, Eastern Meadowlark, Red-winged Blackbird, Common Grackle, Brown-headed Cowbird, Rufous-sided Towhee, Savannah Sparrow, Seaside Sparrow, Vesper Sparrow, Chipping Sparrow.

Penikese Island: Leach's Storm Petrel, Herring Gull, terns.

Plum Island: Common Tern, Least Tern, Seaside Sparrow.

Plymouth Beach: Common Tern, Arctic Tern, Roseate Tern, Least Tern, Black Skimmer.

Provincetown (Cape Cod): Common Gallinule, major gull colonies.

Ram Island (Buzzards Bay): Common Tern, Roseate Tern.

Sampson's Island (Cape Cod): Common Tern.

Sandy Neck (Cape Cod): Common Tern, Least Tern.

Sarson Island (Martha's Vineyard): Common Tern, Least Tern.

Snake Island: Common Tern, Least Tern.

Sylvia Beach (Martha's Vineyard): Common Tern.

Tern Island (off e. Cape Cod): Herring Gull, Common Tern, Arctic Tern, Roseate Tern, Least Tern.

Thacher Island (North Shore): Great Black-backed Gull, Herring Gull, Arctic Tern.

Weepecket Island (off Naushon): Double-crested Cormorant.

Wellfleet: major gull colonies, Least Tern.

Wellfleet Bay Wildlife Sanctuary: Green Heron, Blue-winged Teal, Broad-winged Hawk, Clapper Rail, Great Black-backed Gull; songbirds.

West Dennis (Cape Cod): Common Tern, Least Tern.

Westport: Osprey (10 pairs, 1974).

Table 13-20 (continued)
Breeding areas (continued)

New Hampshire

Isles of Shoals: Double-crested Cormorant, Great Black-backed Gull, Herring Gull, Black Guillemot.

Maine:

Brimstone Island (off Fox Island): Leach's Storm Petrel.

Brothers Island (e. Maine): Herring Gull.

Calais: Yellow Rail.

Cone Island (e. Maine): Herring Gull.

Coombs Ledge (Muscongus Bay): Double-crested Cormorant.

Cross Island: Black Guillemot.

Cuckolds Island(Booth Bay): Laughing Gull.

Deer Isle: Tennessee Warbler.

East Brown Cow Island: Herring Gull.

East Duck Island: Herring Gull.

Eastern Egg Rock (Muscongus Bay): Double-crested Cormorant, Black Guillemot.

East Goose Rock (Penobscot Bay): Double-crested Cormorant, Black Duck, Common Eider, Great Black-backed Gull, Herring Gull, Black Guillemot, Song Sparrow.

Fisherman's Island: Herring Gull, Black Guillemot.

Flat Island (Penobscot Bay): Common Eider, Herring Gull.

Fostern Island (Machiasport): Arctic Tern (300-400 pairs, 1970--Nisbet, 1971).

Fox Island: Double-crested Cormorant, Great Black-backed Gull, Herring Gull, Black Guillemot.

Goose Rock (Penobscot Bay): Double-crested Cormorant, Black Duck, Common Eider, Great Black-backed Gull, Herring Gull, Black Guillemot, Song Sparrow.

Table 13-20 (continued)

Breeding areas (continued)

Maine (continued)

Gooseberry Island (Saco Bay): Great Black-backed Gull, Herring Gull.

Great Duck Island (Penobscot Bay): Leach's Storm Petrel, Herring Gull, Black Guillemot.

Great Spoon Island (Penobscot Bay): Leach's Storm Petrel, Black Guillemot.

Green Island Ledge (Jericho Bay): Great Black-backed Gull, Herring Gull, Black Guillemot.

Green Island (off Petit Manan): Great Black-backed Gull, Herring Gull.

Green Ledge (off Matinicus Rock): Black Guillemot.

Hay Ledge (Muscongus Bay): Double-crested Cormorant.

Hog Island: Great Black-backed Gull, Herring Gull, Cape May Warbler.

Johns Island (Penobscot Bay): Leach's Storm Petrel, Black Guillemot.

Jones Garden Island (Muscongus Bay): Double-crested Cormorant, Great Black-backed Gull, Herring Gull.

Jordan's Delight (off Petit Manan): Black Guillemot.

Large Green Island: Leach's Storm Petrel, Laughing Gull,

Little Brimstone Island: Great Black-backed Gull, Herring Gull.

Little Duck Island (Penobscot Bay): Leach's Storm Petrel, Herring Gull, Black Guillemot.

Little Spoon Island (off Swan's Island): Black Guillemot.

Long Island (off Swan's Island): Black Guillemot.

Long Ledge (Muscongus Bay): Double-crested Cormorant.

Louds Island (Damariscotta): Osprey

Marblehead Island (off Fox Island): Black Guillemot.

Table 13-2C (continued)

Breeding areas (continued)

Maine (continued)

Mark Island (Casco Bay): Great Blue Heron, Black-crowned Night Heron, Black Duck, Common Eider, Osprey, Arctic Tern.

Matinicus Rock Island: Leach's Storm Petrel, Double-crested Cormorant, Great Black-backed Gull, Herring Gull, Laughing Gull (maybe), Arctic Tern (450 pairs, 1970--Nisbet,1971), Razorbill Auk, Common Puffin, Savannah Sparrow.

Matinicus Seal Island (off Matinicus Rock Is.): Leach's Storm Petrel, Laughing Gull.

Metinic Green Island: Leach's Storm Petrel, Herring Gull.

Metinic Island (off Port Clyde, mouth of Penobscot Bay): Leach's Storm Petrel.

Moosehorn National Wildlife Refuge: Common Loon, Pied-billed Grebe, American Bittern, Canada Goose, Black Duck, American Green-winged Teal, Blue-winged Teal, Wood Duck, Ring-necked Duck, Common Goldeneye, Hooded Merganser, Common Merganser, Goshawk, Sharp-shinned Hawk, Cooper's Hawk, Red-tailed Hawk, Red-shouldered Hawk, Broad-winged Hawk, Bald Eagle, Marsh Hawk, Osprey, Sparrow Hawk, Spruce Grouse, Ruffed Grouse, Ring-necked Pheasant, Virginia Rail, Sora, American Coot, American Woodcock, Common Snipe, Spotted Sandpiper, Yellow-billed Cuckoo, Black-billed Cuckoo, Screech Owl, Great Horned Owl, Barred Owl, Saw-whet Owl, Whip-poor-will, Common Nighthawk, Chimney Swift, Ruby-throated Hummingbird, Belted Kingfisher, Yellow-shafted Flicker, Pileated Woodpecker, Yellow-bellied Sapsucker, Hairy Woodpecker, Downy Woodpecker, Eastern Kingbird, Great Crested Flycatcher, Eastern Phoebe, Yellow-bellied Flycatcher, Traill's Flycatcher, Least Flycatcher, Eastern Wood Pewee, Olive-sided Flycatcher, Tree Swallow, Bank Swallow, Cliff Swallow, Purple Martin, Gray Jay, Blue Jay, Common Raven, Common Crow, Black-capped Chickadee, Boreal Chickadee, Red-breasted Nuthatch; songbirds.

Mosquito Island (Muscongus Bay): Double-crested Cormorant, Herring Gull, Great Black-backed Gull, Black Guillemot.

Mount Desert Island: Red-breasted Merganser, Ruby-crowned Kinglet, White-winged Crossbill (sporadically).

Mouse Island (Penobscot Bay): Double-crested Cormorant, Black Duck, Common Eider, Great Black-backed Gull, Herring Gull, Black Guillemot, Song Sparrow.

Table 13-20 (continued)

Breeding areas (continued)

Maine (continued)

No Man's Land Island: Leach's Storm Petrel, Herring Gull, Black Guillemot.

North Upper Green Island (Casco Bay): Great Black-backed Gull, Herring Gull.

Old Man Island (e. Maine): Herring Gull, Razorbill Auk, Black Guillemot.

Petit Manan Island: Laughing Gull (50-55 pairs, 1970--Nisbet,1971); Common Tern, Arctic, Roseate Tern (10 pairs maximum--Drury,1973), Black Guillemot.

Pond Island (Penobscot Bay): Great Black-backed Gull, Herring Gull.

Roberts Island (Penobscot Bay): Great Black-backed Gull, Herring Gull.

Robinson Rock (Penobscot Bay): Double-crested Cormorant, Black Duck, Common Eider, Great Black-backed Gull, Herring Gull, Black Guillemot, Song Sparrow.

Saddleback Island (Jericho Bay): Black Guillemot.

Scarboro Beach: Least Tern.

Schoodic Island (off Petit Manan): Black Guillemot.

Seal Island (off Matinicus Rock Is.): Razorbill Auk, Black Guillemot, Common Puffin.

Shag Ledge Island (off Matinicus Rock Is.): Black Guillemot.

Shag Ledge East (Muscongus Bay): Double-crested Cormorant.

Shark Island (Muscongus Bay); Double-crested Cormorant, Great Black-backed Gull, Herring Gull.

Sloop Island (Penobscot Bay): Great Black-backed Gull, Herring Gull.

Southern Mark Island (Jericho Bay): Black Guillemot.

Southern Fox Island: Herring Gull.

Table 13-20 (continued)

Breeding areas (continued)

Maine (continued)

Sugar Loaves (Booth Bay): Roseate Tern.

Swan's Island: Double-crested Cormorant, Great Black-backed Gull, Herring Gull, Common Tern, Black Guillemot.

Ten Pound Island (off Matinicus Rock Is.): Black Guillemot.

Two Bush Island (Casco Bay): Great Black-backed Gull, Herring Gull, Black Guillemot.

Western Egg Rock (Muscongus Bay): Double-crested Cormorant.

Wooden Ball Island (off Matinicus Rock Is.): Leach's Storm Petrel, Black Guillemot.

Wreck Island (Muscongus Bay): Great Blue Heron.

New Brunswick

East Green Island: Leach's Storm Petrel, Common Eider, Great Black-backed Gull, Herring Gull, Black Guillemot.

Grand Manan: Double-crested Cormorant, Common Eider, Red-breasted Merganser, Great Black-backed Gull, Herring Gull, Arctic Tern (5,000 pairs; Drury,1973), Razorbill Auk, Black Guillemot, Common Puffin, Boreal Owl, Boreal Chickadee, Common Raven, Barn Swallow, Tennessee Warbler, Blackpoll Warbler, Palm Warbler, Myrtle Warbler, House Sparrow, Eastern Meadowlark, White-winged Crossbill.

Kent Island: Leach's Storm Petrel, Black-crowned Night Heron, American Green-winged Teal, Common Eider, Spotted Sandpiper, Great Black-backed Gull, Herring Gull, Razorbill Auk, Black Guillemot, Tree Swallow, Barn Swallow, Bank Swallow, Cliff Swallow, Blue Jay, Common Raven, Common Crow, Black-capped Chickadee, Boreal Chickadee, Red-breasted Nuthatch, Brown Creeper, Winter Wren, Catbird, American Robin, Swainson's Thrush, Golden-crowned Kinglet, Starling, Parula Warbler, Yellow Warbler, Magnolia Warbler, Myrtle Warbler, Black-throated Green Warbler, Blackpoll Warbler, Yellowthroat, American Redstart, Brown-headed Cowbird, Savannah Sparrow, White-throated Sparrow, Song Sparrow.

Little Green Island: Leach's Storm Petrel, Common Eider, Great Black-backed Gull, Herring Gull, Black Guillemot.

Table 13-20 (continued)

Breeding areas (continued)

New Brunswick (continued)

Machias Seal Island: Leach's Storm Petrel, Laughing Gull(?), Common Tern, Arctic Tern, Razorbill Auk, Common Puffin.

Mud Island: Gray-cheeked Thrush.

Outer (Little) Wood Island: Leach's Storm Petrel, Herring Gull.

White Horse Islet (southeast of Outer Wood Is.): Leach's Storm Petrel, Double-crested Cormorant, Common Eider, Great Black-backed Gull, Herring Gull, Black Guillemot.

Chapter 14 Marine Mammals

The purpose of this chapter is to review the status and life history information known of pinniped and cetacean species of the Gulf of Maine. More generally, it serves as a reference pertinent to northeastern United States coastal waters, supplementing information given by Pilson and Goldstein (1973) in their inventory of marine mammals occuring from Cape Hatteras to Nantucket Shoals.

Efforts have been made to provide complete life history descriptions for key species - those important for their present abundance, estimated historical abundance, or for their ecological importance to the Gulf of Maine. Species less often sighted or about which less is known of abundance, distribution, and habits have been described as completely as possible.

All species, when data permitted, have been characterized by the following headings: general description, distribution and habitat preference, migration characteristics, population density, growth and longevity, natural mortality, reproductive characteristics, food and feeding methods, indications of environmental stress (generally speaking, man-induced), and aesthetic and economic importance.

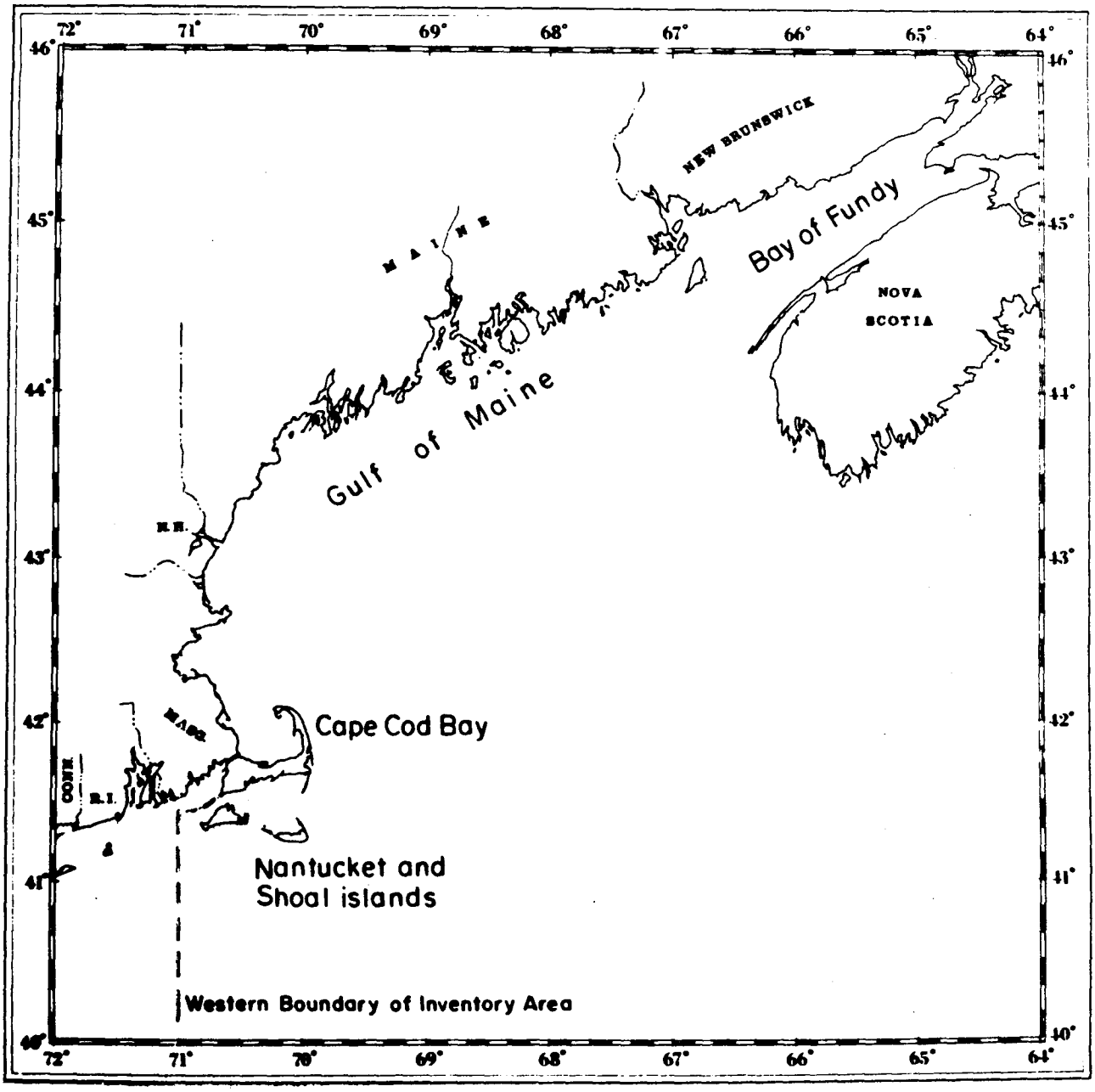
14.1 PINNIPEDS OF THE GULF OF MAINE

14.1.1 INTRODUCTION

Over two hundred years ago, Linnaeus wrote of the group of animals now known as the Pinnipedia:

> This is a dirty, curious, quarrelsome tribe, easily tamed, and polygamous; flesh succulent and tender; fat and skin useful. They inhabit and swim under water and crawl on land with difficulty because of their retracted fore-feet and united hind-feet; feed on fish and marine productions, and swallow stones to prevent hunger, by distending the stomach. (Turton's translation of 1806, in: Scheffer, 1958).

Five pinniped species may be found in Gulf of Maine waters: one as a resident, one as a seasonal transient, and three as rare or occasional strays. The resident harbor seal, found year-round in inshore waters basking on near-shore half-tide ledges and islands, is familiar to to most coastal residents. The gray seal, however, is found among harbor seals during warmer months and has not been recognized until recently as a distinct species by fishermen and residents in Maine. Their great size, massive head, and straight-bridged nose distinguish them from the smaller harbor seal which has a head of canine proportions.



A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION

TRIGOM PARC	FIGURE 14-1	Inventory Area

Nevertheless, many non-scientists do not distinguish between the two species. Even the scientific community was unaware of the continued presence of a breeding colony of gray seals at Nantucket until the late 1960's. Until Andrews and Mott (1967) identified the Nantucket gray seals, it was not suspected that they might be regularly entering U.S. waters from the Maritimes. The sparse records of harp seals, hooded seals, and walrus in the Gulf of Maine is to be expected since their normal range of distribution makes their occurrence unlikely south of the Gulf of St. Lawrence (harp and hooded seals) or Hudson Strait (walrus). (See Table 14-1).

The daily habits of harbor seals are closely tied to the tide cycle. They depend on land for sunning, grooming, and whelping, and on water for feeding. This species favors the inshore, intertidal, and estuarine habitats for all these life functions. The gray seal, likewise, inhabits the near-shore environment but prefers those haulouts well removed from coastal embayments and estuaries. Gray seals are capable of long periods of pelagic existence as evidenced by their wide dispersal from breeding sites in the Maritimes to coastal ledges of Maine or to sand shoals of Nantucket.

The Gulf of Maine is not a part of the normal range of harp seals, hooded seals, or walrus. It is unclear whether historic records of occurrence or recent sightings prove that the Gulf of Maine was formerly part of their range. In past geologic time, however, the Gulf of Maine habitat may have more closely approximated their present environment. Further discussion will involve only the harbor and gray seals as key species, based on their present or recent abundance and ecological importance to the Gulf of Maine.

Evidence that exists for the historical abundance and distribution of seals in the Gulf of Maine is scant and difficult to assess objectively. No reliable quantitative data of past abundance of seals are available. This is due in part to the fact that neither species has been exploited commercially to any great extent (thus precluding fisheries management research). Limited field sightings by naturalists exist but were not conducted systematically and do not provide a reliable base of data to distinguish distributional changes from alleged changes in local abundance.

Estimates of past abundance given by fishermen may include bias related to past fisheries (e.g., herring taken by stationary weirs) where substantial numbers of seals would be drawn into active fishing areas, versus present fisheries (e.g., purse seining for herring) involving a more mobile fisherman with less concern for seal predation at fishing sites. A decline in seals utilizing certain haulout sites is reported by coastal residents and may reflect changes in distribution caused by shoreline development, boat traffic, or harassment, rather than changes in abundance.

Such local changes may be temporary and may reflect changes in available schooling fish or other feed in local inshore waters.

The first census of the entire Maine coast seal population was conducted in 1973 using aerial photography (Richardson, in press). The upper Bay of Fundy harbor and gray seal populations have recently been estimated by Boulva (unpublished data) using catch statistics, questionnaires returned by fisheries officers, data from the bounty kill, and personal observations (see sections on population density for both species). A word of caution is in order: these estimates are in need of confirmation and systematic refinement including development of statistically valid sampling techniques using aerial imagery and boat census to provide "ground truth."

A reputation for raiding entrained fish and allegedly preying upon soft lobsters has caused many fishermen to view harbor and gray seals as competitors. Various bounties applied off and on by Massachusetts, Maine, and the Canadian Provinces has provided intermittent incentive for the hunting of both species. Norton (1930) gives an interesting account of the skillful fabrication by Passamaquoddy Indians of "seal snouts" that were required for bounty payments on harbor seals (see economic importance section).

The taking of seals for food, oil, and climbing skins, has contributed in a minor way to hunting mortality. Other more important population-limiting factors included capture of seal pups and juveniles for zoos, public display, and zoological and medical research. Natural mortality rates are determined by stillbirth, accidents (including storms and abandonment), disease, infestation by parasites, and predation by hawks, eagles, sharks, and possibly whales. It is possible that reduced stocks of fish such as herring, haddock, halibut, and cod in the Gulf of Maine may have affected local abundance and, more likely, the distribution of the inshore seal populations. It is likely that seals readily substitute in their diet finfish species which are conveniently caught near favored haulout areas. Little is known of the subtle effects, perhaps long term, which organic pollutants, including sewage effluents, and body burdens of heavy metals, and organochlorine compounds may have on mortality of marine mammals.

Acceptance of appreciation of wildlife as a legitimate value and heightened public consciousness of man's inhumane methods of capturing and killing seals and whales for economic gain brought support for a federal law to protect diminishing and remnant marine mammal stocks from further depredations. The Marine Mammal Protection Act of 1972 sets forth a national policy to prevent populations "...from diminishing, as a result of human activities, beyond the point at which they cease to be a significant functioning element in the marine ecosystem." Congress directed that the primary objective of marine mammal management should be "...to maintain the health and stability of the marine ecosystem, and, when consistent

with this primary objective, to reach and maintain optimum sustainable populations of marine mammals within the optimum carrying capacity of the habitats" (P.L. 92-522; U.S.C. 1361; 86 Stat. 1027). The broad basis of ecosystem health upon which this Act finds marine mammal conservation justified challenges scientists to define new standards - namely, "optimum sustainable population" and "optimum carrying capacity." New methodology must be developed to measure parameters of these standards which depart from the traditional concepts of maximum sustainable yield management.

Table 14-1 Pinniped species in the Gulf of Maine

Family	Common Name(s)	Species Name	Western Atlantic Range or Distribution	Habitat	Abundance in Gulf of Maine	Relative Dominance in Gulf of Maine
Phocidae	*Harbor seal or common seal	Phoca vitulina concolor (Dekay)	Labrador to Rhode Island; occasionally to Carolinas	Inshore residents of bays and estuaries. Breeding, sunning, and resting on half-tide ledges- Non-migratory	6000+ Maine waters 5000-6000 Canadian Maritime provinces	Common
Phocidae	*Gray seal or Atlantic seal "horsehead seal"	Halichoerus grypus (Fabricus)	Gulf of St. Lawrence to coast of Newfoundland; S. to Massachusetts	Remote coastal ledges and sand shoals. Dispersal outside of breeding seasons; transient in Maine waters	18,000 Maritime province waters 100± seasonally in Maine; breeding colony of 10-15 at Nantucket	Uncommon in U.S. Gulf of Maine waters
Phocidae	Harp seal	Pagophilus groenlandicus (Erxleben)	N. Atlantic and adjoining Arctic waters	Pelagic, breeding on pack ice; migratory	Occasional stray	Rare, accidental
Phocidae	Hooded seal	Crystophora cristata (Erxleben)	S. Greenland and Baffin Island to Gulf of St. Lawrence	Pelagic, breeds on drifting floe ice	Occasional stray	Rare, accidental
Odobenidae	Walrus	Odobenus rosmarus (Linnaeus)	Ellsmere Is. to Barrow Strait S. to Hudson Bay and Hudson Strait	Remains in near-shore waters of remote islands or ice	Rare visitor	Rare, accidental

*Denotes key species based on present abundance, estimated historical abundance or ecological importance

14.1.2 LIFE HISTORY DESCRIPTIONS

FAMILY PHOCIDAE: HARBOR SEAL, COMMON SEAL, Phoca vitulina concolor

The harbor seal is the dominant pinniped of inshore Gulf of Maine waters. It is a resident species of bays, harbors, and estuaries and favors half-tide ledges, nonvegetated islands, rocks, and beaches for sunning and resting at low-tide hours. Adult males reach a nose to tail length of 1.5 to 1.8 m compared to 1.2 to 1.5 m for adult females. Maximum weight is about 115 kg. Pelage coloration varies greatly from light gray, irregularly spotted with black, to tan and hues of brown and red.

(1) Distribution and habitat preference. The western North Atlantic harbor seal is common from Labrador to Rhode Island and is found occasionally as far south as South Carolina (Brimley, 1931). Rare sightings have been confirmed in Florida (Caldwell and Caldwell, 1969). P. vitulina utilizes sheltered and undisturbed rocky ledge haulout sites of coastal bays and estuaries of the Maine coast. Distribution is scattered and abundance is not well known south of Isle of Shoals. Harbor seal habits are closely tied to the tidal cycle. Day or night, individuals usually return to the same ledge, appearing early on the falling tide. Preferred ledges are of gentle slope, covered with seaweed, and removed from potential sources of harassment and boat traffic. The species tends to form loosely gregarious herds each day, and when not hauled out, individuals usually disperse along the shore and become solitary. Reasons for choice of haulouts is often not obvious. Large groups will congregate at certain chosen ledges, very often marked on navigation charts as "seal ledges", leaving other apparently suitable ledges unoccupied. Seasonal movements of adults into upper reaches of bays and estuaries in the spring is later followed by a segregation of pregnant females and mothers and pups on well protected ledges apart from males and juveniles. Seals may show curiosity for human activity in inshore waters and come quite close to boats during the high tide foraging hours.

Reaggregation of herds following weaning of pups occurs in late June and July. In late fall most colonies have moved out of the upper estuaries, choosing ledges associated with deeper water. Sunning on ledges is less frequent during winter months (Richardson, unpublished notes).

(2) Migration characteristics. The harbor seal has no known migratory patterns. Seasonal changes take place in local areas with greater numbers of seals in upper bay waters during pupping season but movement thereafter to ledges near deeper water following whelping and after the onset of colder bay water temperatures. Abrupt disappearance of seals at certain ledges often occurs due to repeated harassment or in coincidence with local migrating or schooling fish

populations. Absence of seals at ledges during winter months may reflect a greater pelagic existence during the short daylight foraging hours and an absence of gregarious fishes from inshore waters and bays.

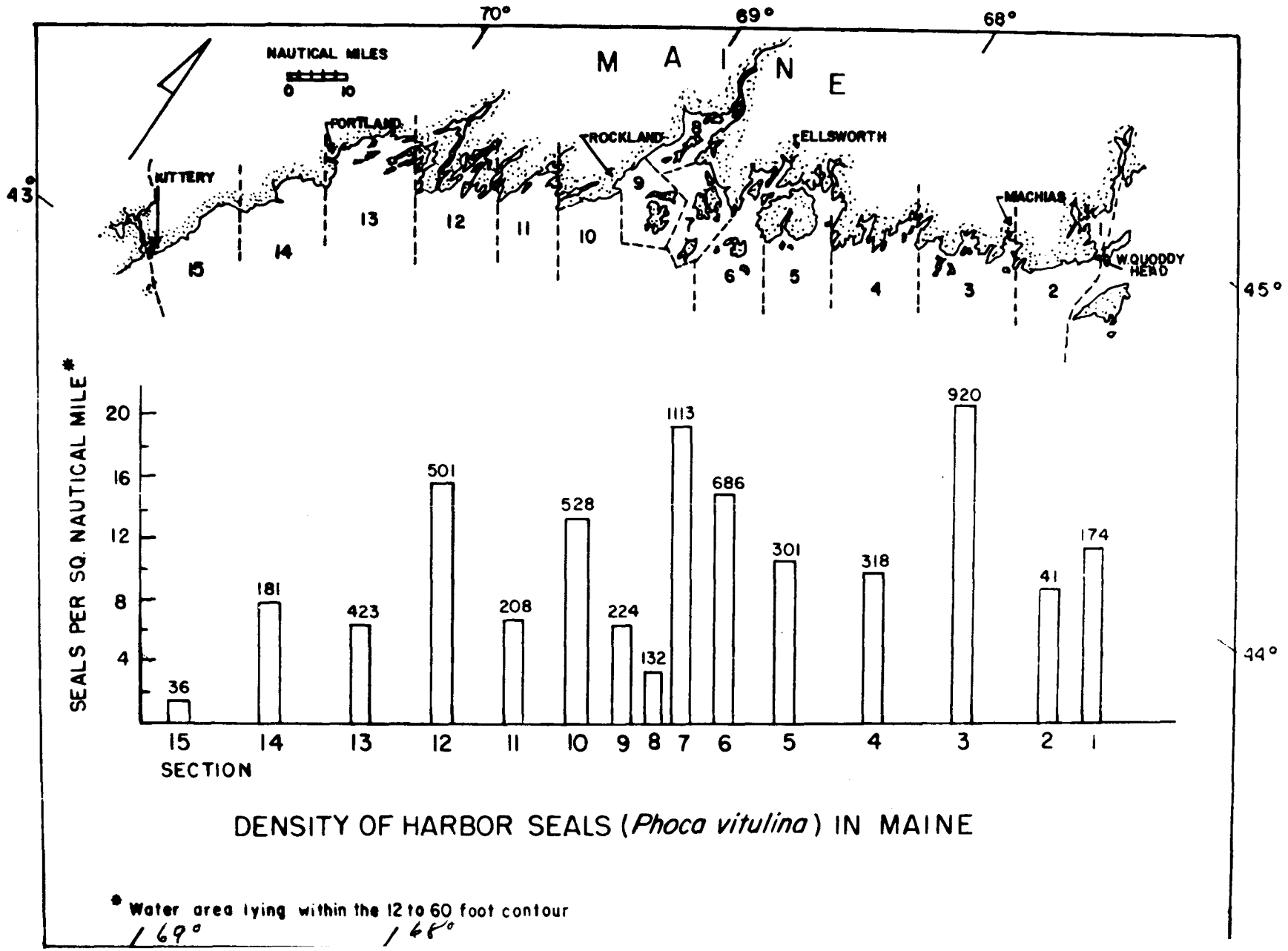
(3) Population density. Fisher (1949) estimated the Canadian maritime (excluding Sable and Magdalen Islands) harbor seal population to be between 10,000 and 15,000. Boulva (in press) estimated the 1972 harbor seal population of the Maritimes to be 5,000-6,000 with about 900 occurring in Canadian waters of the Bay of Fundy.

An initial estimate of the harbor seal population of Maine waters (Richardson, MS in preparation) reveals a population in excess of 6,000 with densities greatest east of Casco Bay. It is unlikely that more than a few hundred individuals inhabit the coastal shore of New Hampshire and Massachusetts to Cape Cod. Therefore, excluding those seals on the east shore of Nova Scotia, the Gulf of Maine proper supports in excess of 7,000 harbor seals. Figure 14-2 shows the density of seals along the coast of Maine by section.

(4) Growth and longevity. Boulva (1971) gives for Sable Island harbor seals length measurements of new born males and females to be 80.5 and 78.5 cm respectively, gaining 11 and 8 cm respectively in the first three weeks of life. Female and male pups average 11 kg at birth with females reaching 19.5 kg and males 24 kg at three weeks of age. Bigg's studies (1969a,b) of west coast harbor seals show that females mature at 2-5 years with most maturing at 3 and 4 years. Males mature between 3 and 6 years of age with most maturing by 5 years. From birth to 5 years of age females and males grow at similar rates. Females continue to grow until 9-10 years, attaining an average weight of 64.5 kg and an average length of 147.7 cm. Males at the same age attain an average weight and length of 87.0 kg and 161.1 cm respectively. It is not known how long seals live in the wild, but records of 12 and 14 years in captivity have been recorded (King, 1964).

(5) Natural mortality. Natural mortality rates are determined by stillbirth, accidents (including storms and abandonment), disease, infestation by parasites, and predation by hawks, eagles, sharks, and possibly whales.

Boulva (1971) found that 12 percent of the harbor seal pups on Sable Island died in the first year. Van Bemmel (1956) assumed that seals in the Netherlands had a 20 percent mortality in the first year and Bigg (1969a) estimated first year mortality to be 21 percent. Bigg (1969a) estimated annual mortality for age classes 0 to 5 years to be 21 percent for males and 20 percent for females. After 5 years, mortality for males increased to 29 percent and decreased for females to 15 percent. It is likely that ascarid worms, including Porrocaecum



TRIGOM PARC | FIGURE 14-2 | Density of Seals by Section

decipiens, Anisakis sp., and Contracaecum sp. keep a strong check on the populations of harbor seals and gray seals (Scott and Fisher, 1958; Mansfield, 1967).

(6) Reproductive characteristics. Studies by Richardson (unpublished notes) in the Gulf of Maine, by Bigg (1969a and 1969b) on west coast harbor seals, and by Boulva (1971, and in press) for Sable Island harbor seals reveal the following information pertinent to the Gulf of Maine populations: Harbor seals whelp on the ledges during May and June with the peak of pups born in late May and early June. Pups nurse from two to six weeks, during which time mothers and pups and pregnant females choose to haul out together at some distance from males and juveniles of the herd. Consolidation of the herd appears to take place as pups are weaned. Following termination of lactation in late June - July, ovulation occurs. Mating takes place in the water, since copulation has not been observed on land. A delayed implantation of the embryo for about two months during the stressful period of molting in August and September is followed by a seven and one-half month gestation period (Fisher, 1954). West coast adult males are reproductively active (sperm in the epididymis) from March to November and reproductively inactive from December to February. Females mature at 2-5 years of age with most maturing at 3 and 4 years. Males mature between 3 and 6 years with most maturing by 5 years. On the average, 88 percent of mature females produce a single pup each year (Bigg, 1969a).

(7) Food and feeding methods. Studies by Hunt (1948) and Richardson (unpublished notes) of harbor seal feeding habits suggest that seals are opportunists, foraging for a variety of finfish available in the haulout area rather than moving great distances in search of certain species. Changes in haulout locations of specific colonies and feeding activity have been correlated with schooling herring and migrating alewife populations (Richardson, unpublished notes). Strategies and methods of pursuing and ingesting live fish are not well understood. Rae (1968) reports the mutilation of cod by seals, suggesting that a tearing and ripping at the entrails of large fish is not followed by attempts to strip the skeleton of flesh. Adult harbor seals are capable of swallowing whole mature alewives, mackerel, and herring. Fishermen report seals surfacing with flounder, using forelimbs to aid in "curling" the body along its length to aid in swallowing it whole. Hunt (1948) stated that Maine seals preyed significantly on all flatfish species, herring, and squid when locally abundant, and other groundfish and species having little commercial value, such as sculpin and skates.

Griffin (1936) reports stomachs from harbor seals from Barnstable, Massachusetts, containing menhaden (Pomolobus sp.) and alewives (Alosa pseudoharengus). Spaulding (1964) reports that fish having commercial value (flatfish, salmon, eulachon, hake, whiting, sable-

fish, ling cod, and herring) comprise about 54 percent of the west coast harbor seal diet; Havinga (1933) estimated 75 percent in Dutch waters. Rae (1973) examined 78 stomachs of common seals in Scottish waters and found 53 percent had recognizable stomach contents which included by percent occurrence: Whiting (Merlangius merlangus) 22.2; herring (Clupea harengus) 12.2; Saithe (Pollachius virens) 17.1; salmon (Salmo salar) 4.9; cod (Gadus morhua) 4.9; flounder (Platichthys flesus) 2.4; Crustacea (Pandalus borealis, 2.4; amphipoda, 7.3), and cephalopods (squid) 9.8 percent. Montreuil (personal communication) states that during 10 years of research on acanthocephalan parasites of pinnipeds involving collection and examination of 1,000 digestive tracts of harbor and gray seals, no evidence was found for lobster, Homarus americanus, as a dietary item for either seal species.

Sergeant (1973b) and Spaulding (1964) estimated that daily food intake by seals may average 6 percent of body weight for approximately ten months of the year. Assuming a Gulf of Maine population of 7,500 seals and using values for mean weight by year class from Bigg's (1969a) harbor seal study, the total biomass for the population is about one million pounds. A daily food intake of 6 percent would mean a yearly consumption of finfish by Gulf of Maine seals of approximately 18 million pounds.

(8) Indications of environmental stress. Pollution effects on the existing North Atlantic seal population are not well known. Gaskin et al. (1971) reported alarmingly high residues of organochlorine pesticides in the tissues of harbor porpoises (Phocoena phocoena) taken in the Bay of Fundy. The average DDT level in the blubber of males was 306.74 ppm, exceeding the highest published value for any wild mammal. A recent study by Gaskin, et al. (1973) analyzed mercury, DDT, and PCB levels in harbor seals taken in the Bay of Fundy and Gulf of Maine. DDT and PCB levels were comparable to those reported for harbor porpoises with DDT ranging from 25 to 139 ppm and 8 to 52 ppm in blubber from seals taken from Boothbay Harbor and Grand Manan respectively. PCB levels ranged from 28 to 240 ppm and 7 to 63 ppm in blubber from seals taken from Boothbay Harbor and Grand Manan respectively. Total Hg ranged from 0.5 to 7.9 ppm and 1.7 to 5.1 ppm in liver from seals taken from Boothbay Harbor and Grand Manan respectively.

An increased incidence of bacterial (possibly viral) sores or lesions, particularly among pups, was reported by two seal collectors from the Blue Hill Bay region of Maine. It is not known whether greater incidence of such lesions is a natural phenomenon, perhaps having cyclical incidence, or whether incidence may be influenced by sewage effluents(Geraci, personal communication). Bacterial pollution of estuarine waters, as well as contamination by heavy metals and pesticides, may have subtle, long-term effects on mortality

rates of marine mammal populations.

In an unfortunate way, harbor seals and other marine mammals will continue to be valuable "indicator" organisms in monitoring the levels and rates of change of contaminants having potential human toxicity.

(9) Aesthetic and economic importance. The harbor seal has had little economic importance to the Gulf of Maine. Norton (1930) reported that around 1900, the Penobscot and Passamaquoddy Indians, stimulated by a state bounty, nearly exterminated this species locally. Fishermen also thought that extermination of seals would remedy the scarcity of fish. Such views still persist to some degree today. In 1895 a statewide bounty of one dollar encouraged the killing of seals, the state paying as much as $3,842 annually for seal noses. In 1905 the state realized it had paid over $24,000 for genuine and fabricated noses, the latter having been produced by "shrewd workmen" (mainly Passamaquoddies) taking sealskin, "burning off the hair with a hot iron, blackening the hide, and burning two nostrils, and by sewing a few strands of catgut in for bristles, [completing] a nose sufficiently well-made to pass the criticism of the unsuspecting town treasurer." (Norton, 1930) Since repeal of the bounty in 1905, until 1972, seals have been unprotected.

Seals have allegedly been taken for use as mink food, for trial production of leather products, and for fabrication of climbing skins for skis. One hundred or more seal pups were being taken in Maine waters by four or five collectors during the summer of 1972 for use in biomedical research and for public display. Harbor seals continue to be taken in Canadian waters for similar purposes.

Protection afforded all seals in U.S. waters by the Marine Mammal Protection Act of 1972 was initiated, supported, and passed largely through efforts of conservation groups representing millions of persons appreciating seals, sea lions, sea otters, whales, walrus, and polar bears as a wildlife resource. Humans are recognizing the intrinsic value of these highly intelligent mammals and their "wilderness value" in an increasingly exploited and threatened ecosystem.

FAMILY PHOCIDAE: GRAY SEAL, WEST ATLANTIC GRAY SEAL, HORSEHEAD SEAL, Halichoerus grypus

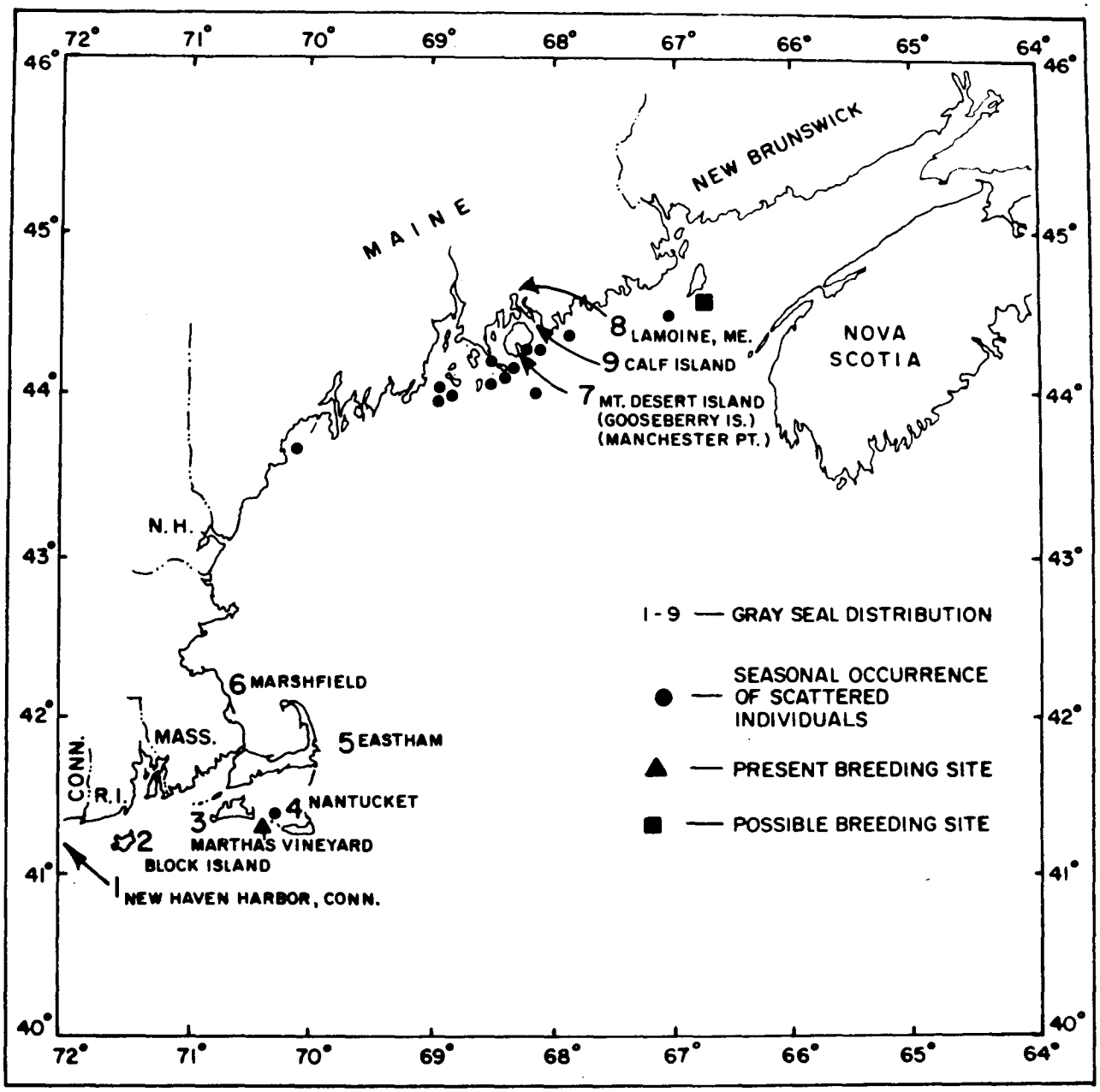
A larger seal than Phoca vitulina, Halichoerus is seen only during warmer months in Maine waters. Immatures are difficult to distinguish from harbor seals but adult males may reach 2.75 m and up to 360 kg. However, the species exhibits sexual dimorphism with adult females only reaching 2.1 m and up to 275 kg. The adult male has a high, arched "roman" nose

and long snout with large, nearly parallel nostrils when seen anteriorly. The name "horsehead" seal is descriptive. The coat color of both sexes varies enormously. Males, as a general rule, have a dark brown, black, or gray background with irregular spotting of a lighter tone on the dark background. Females, as a general rule, have a lighter, continuous background color, often a creamy tan in the neck and chest area, becoming darker to gray-brown on the back. Irregular spots and patches of a darker color occur on the lighter background.

(1) Distribution and habitat preference. The gray seal inhabits both sides of the North Atlantic Ocean, with major populations in eastern Canada, Iceland, and northwestern Europe. The western Atlantic population is centered in the Gulf of St. Lawrence with a relatively large breeding center in the Northumberland Strait and breeding colonies near the Magdalen Islands, Basque Island, and Sable Island (Davies, 1957). Colonies totaling less than 100 are found in the Grand Manan archipelago of the Bay of Fundy Mansfield, 1966a). Archaeological records of gray seals in shell heaps from Frenchman Bay, Maine; Nantucket; Martha's Vineyard; Eastham; and Block Island, Rhode Island (Andrews and Mott, 1967) indicate distribution at least as widespread as found today (see Figure 14-3. The southern limit of the gray seal extends to Nantucket where the existence of a small breeding colony was confirmed in 1958 by Clinton Andrews of Nantucket (Andrews and Mott, 1967). A remnant colony, having survived bounty shooting until 1962, perhaps 10 to 15 animals persist today. Although not considered migratory, gray seals, particularly pups and juveniles, are known to disperse widely, following the breeding season in late winter. Immatures branded at Sable Island have been found at Mount Desert Rock, Maine (Katona, personal communication) in 1973 and at Nantucket (Valerie Schurman, personal communication) in 1971. Figure 14-3 shows areas where gray seals were sighted in Maine waters in recent years. It is clear that this species prefers the exposed offshore rocky habitat and does not seek the sheltered bays as does the harbor seal.

(2) Migration characteristics. No definite migration patterns exist for the species. However, wide dispersal by adults and particularly immatures and pups occurs following the breeding season, and probably accounts for all gray seals sighted in Gulf of Maine waters. A return to breeding grounds occurs during winter months in the Western Atlantic population. However, individuals of the colony of gray seals at Nantucket are seen there throughout the year by fishermen.

(3) Population density. Gulf of Maine (including Nantucket, Massachusetts): Perhaps 100 gray seals are sighted during the warmer months in Maine waters (Figure 14-3). A resident population of 10-15 individuals occurs at Nantucket. Small scattered colonies totaling fewer than 100



A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION

TRIGOM PARC	FIGURE 14-3	Historical and Present Gray Seal Distribution (Waters, 1967; Andrews and Mott, 1967)

individuals occur in the Grand Manan archipelago but probably do not reside or breed there (Mansfield, personal communication).

The world population is estimated at 50,000 to 60,000 animals with two-thirds of these occurring in the British Isles (Smith, 1966; Bonner, 1972). Mansfield (1966a) and Smith (1966) both estimated the Canadian population to be about 5,000. Boulva (personal communication) estimated the gray seals to be on the increase, totaling perhaps 18,000 in the western Atlantic in 1972.

(4) Growth and longevity. Pups weigh about 16 kg and measure 75 cm nose to tail at birth. The embryonal, creamy white coat is usually shed within 10 days to 2 weeks. Lactation lasts for several weeks during which time pups gain about 1.8 kg daily, reaching about 45 kg at time of weaning (Coulson and Hickling, 1964). At sexual maturity, cows weigh about 68 kg, bulls about 100 kg (Hewer, 1964).

Gray seals in captivity have reached ages of 28 (female) and 41 (male) years of age. Of 300 wild gray seals examined by Hewer (1964), the oldest cow was 34 years (when shot) and the oldest bull was 23 years. He speculates that bulls are not likely to exceed 21 or 22 years, nor cows to exceed 35 years of age. Reduced survival potential may be due to competition for space and breeding activities with selection favoring larger males with higher metabolic rates. Such physiological stress could result in infection following the breeding season and prior to the rigors of winter (Hewer, 1964; Drury, personal communication).

(5) Natural mortality. Coulson and Hickling (1964) showed that mortality during the first year of life varies greatly due to crowding and available shoreline in relation to numbers of seals using the whelping grounds (Farne Islands, U.K.). When breeding seals are well spread out, calf mortality of about 9 percent is expected. Increased mortality appears with crowding. This condition increases the mortality on the Farne Islands to about 40 percent. Hewer (1964) predicted mortality as high as 60 percent occuring in the first year; also that territorial bulls after age 10 had a 40 percent mortality rate (for reasons discussed in the preceding section).

(6) Reproductive characteristics. Isolation of world gray seal populations is indicated by differing breeding periods of Canadian and Baltic stocks versus the British population. The former are born mostly in February whereas the latter are born mostly in September and October (Davies, 1957). Cows reach sexual maturity in their fourth and fifth years. Bulls reach maturity in their fifth and sixth years (Coulson and Hickling, 1964).

The extent or degree of territorial defense behavior during breeding

season displayed by bulls has been found to be density dependent. Bulls at Basque Island, Nova Scotia, tend harems of up to six animals under crowded conditions. At Sable Island, Nova Scotia, space is unlimited with males scattered well apart and unchallenged by more dominant bulls, creating conditions for essentially monogamous breeding (Mansfield, 1966a). Mating occurs about 2 weeks after the birth of pups with copulation occurring both on land and in water (Cameron, 1967). Lactation continues for two to three weeks after birth with mating occurring before pups are weaned (Mansfield, 1966b). Weaned pups remain on breeding beaches for several weeks until moulting is complete before dispersing for feeding.

(7) Food and feeding methods. Worthington (1964), in analyzing 200 stomachs of gray seals taken from Scotland, reports finding salmon, sea-trout, cod, plaice, sand eels, squid, and crabs. He states that "...seals, like fishermen, are opportunists, so when (certain) fisheries are operating at a maximum, seal activity is also greatest in the same area." Andrews (personal communication) indicates that Nantucket's gray seals feed on alewives which are plentiful from March to May, and probably feed on skates and flounder, although a drastic decline in numbers of flounder has not affected the small number of gray seals or may not be a critical food item. Sergeant (1973b) cites studies by Fisher and Mackenzie (1955) reporting gray seals and harbor seals in the Maritimes to feed mostly on benthic animals such as gadid and pleuronectid fish and cephalopod molluscs (squid). It is likely that both gray seals and harbor seals are adaptable to fluctuations in the abundance of local species.

(8) Indications of environmental stress. Heppleston (1973) reports total DDT and PCB values in blubber of gray seals from the Farne Islands to be as high as 10.7 ppm and 31.0 ppm respectively. The next highest values for organochlorines occurred in liver and kidney. Nursing pups showed concentrations of DDT and PCB half those of the mother's blubber and there appeared to be no significant accumulation of residues with age in any tissues in contrast to levels of heavy metals such as mercury and cadmium which accumulate with age (Heppleston and French, 1973). Holden (1969) and Holden and Marsden (1967) also report high organochlorine contents in fish, seals, and porpoises. Sergeant and Armstrong (1973) agree with Heppleston, showing concentrations of mercury increased with age and appeared to vary with the position in the marine food web of the organisms which they eat. They maintain that bay seals which feed on small pelagic fish and crustaceans accumulated an order of magnitude less mercury than gray seals or harbor seals which feed on large pelagic and benthic fish and cephalopods. One 25-year-old male gray seal from Sable Island had a remarkable 387 ppm mercury

in the liver - a level much in excess of levels found toxic to humans. Tolerance to high mercury levels may be due to a protective effect by selenium which has been found to occur in a 1:1 molar ratio with mercury in common seals, porpoises and dolphins (Koeman, Peeters, Koudstaal-Hol, Tjioe, DeGoeij, 1973). Sergeant's data points to the vulnerability of high-order carnivores, seals as well as man, to effects of mercury poisoning in the coastal environment.

(9) Aesthetic and economic importance. The gray seal, being in such limited numbers in U.S. Gulf of Maine waters, is of considerable aesthetic importance as a rare or uncommonly sighted member of the near-coastal fauna. An increase in numbers of gray seals in Maritime waters has caused complaints by fishermen that the gray seals raid entrained herring and schooling fish, causing damage to nets and gear (Boulva, unpublished notes). The gray seal has been shown to be the most important vector for the codworm, Porrocaecum decipiens, in the Maritimes, having a high mean number of worms per seal of 378 compared with 73 and 12 for harbor seals and harp seals respectively (Mansfield, 1968). Rae (1960, 1968, 1973) has implicated gray seals in the British Isles as predators of commercially valuable finfish species.

FAMILY PHOCIDAE: HARP SEAL, GREENLAND SEAL, SADDLEBACK SEAL, Pagophilus groenlandicus

A migratory species having a complex annual cycle of reproduction, moulting, migration, and feeding. Adult males and females are about 1.85 m nose to tail length and weigh about 182 kg. Considerable change and variation in coat color and markings occur from newborn "white coat" to post-moult "beater" (10 days to a year, having a spotted coat) to "bedlamers" or immatures and finally to adults having the dark horseshoe-shaped marking along the flanks and across the back.

(1) Distribution and habitat preference. The harp seal is distributed in the North Atlantic from Europe to Eastern Canada where it makes long yearly migrations southward for breeding to the White Sea, to the Greenland Sea north of 73° N and to southern Labrador, northeastern Newfoundland, and the Gulf of St. Lawrence. Occasional strays have been sighted on the U.S. east coast as far south as Cape Henry, Virginia (Scheffer, 1958). Norton (1930) reports that Manly Hardy identified a seal of this species being taken "down river," or about Penobscot Bay, in the early 1890's, and that remains of six harp seals were found in shell heaps at Flag Island and remains of one seal at White Island, Casco Bay.

(2) Migration characteristics. The following resumé is from Fisher (1952a) July to October - scattered schools in the Arctic, feeding in waters

of West Greenland and eastern Canadian Arctic.

November to January - southward migration splitting at Belle Isle to proceed to areas east of Newfoundland (the "Front") and in the Gulf of St. Lawrence (the "Gulf"); active feeding and fattening. Immatures lag behind main herds (Sergeant, 1965a).

February - northward movement of adults to whelping ice in mid-Gulf and off southern Labrador. Whelping begins in last few days of month.

March - majority of females whelp on ice early in month, leave pups two to three weeks after birth, mate with males. Pups moult the white coat near end of month and begin entering water.

April to June - completion of mating. Adults and immatures from both the Gulf and Front populations haul out on ice off latter area to moult. Sergeant (1965a) states Gulf population moults while pelagic. Pups drift or swim south into open water, some remaining until mid-May. Herds widely scattered but by June all are usually north of Belle Isle.

(3) Sergeant (1971b) estimated that the northwest Atlantic population in the late 1960's produced about 300,000 young annually, necessitating a prewhelping stock size of about 1.3 million animals. This estimate shows an apparent decline since the early 1950's when Fisher (1952) estimated by aerial census a total population of about 3,225,000. The number of pups born decreased from about 400,000 in 1960 to 300,000 in 1970. The population size in 1970 was less than that giving maximum production, and estimates indicated the 1970 catch was well in excess of the sustainable yield (Sergeant, 1971b).

According to Bychkov (1971), harp seal stocks of the northeastern Atlantic and Arctic Oceans (White Sea, Jan Mayen Island, and Newfoundland populations) numbered 3.0 - 3.5 million in the mid-20th century. Bychkov (1971) also stated that the White Sea population totaled 3.0 - 3.5 million animals in 1926-28 and only 400,000 in the 1960's.

(4) Growth and longevity. Newborn young weigh about 9 kg and are about 35 kg when weaned at two weeks of age. Five year old harp seals weigh about 90 kg (Sergeant, 1973b). The average length of life is well over 20 years, and the upper age limit is probably over 30 years (King, 1964).

(5) Natural mortality. Natural mortality may be attributed to storms, accidents amid drifting pack ice, orphaning, predation by killer

whales and sharks, and by disease and infestation of parasites. Fisher (1952) estimated natural mortality to be less than 15 percent in the 1942 to 1945 year classes when sealing was closed.

(6) Reproductive characteristics. The harp seal breeds on drifting pack ice in the North Atlantic and adjoining waters of the Arctic Ocean. Three breeding stocks are known, the eastern (White Sea), central (Norwegian Sea around Jan Mayen Island) and western (Newfoundland). The latter is comprised of two substocks, one east of Belle Isle on winter pack ice drifting southward - the "Front", and the other in the southern Gulf of St. Lawrence - the "Gulf".

Pupping occurs from late February to early April with the peak of pupping in early March (King, 1964). Mating and conception take place in mid to late March with a delayed implantation of the embryo for about 3 months (Sergeant, 1966). Most females reach sexual maturity in the fourth year and bear their first pup at the end of the fifth or sixth year. Females are fecund for 10 to 15 years and probably 80 percent of mature females bear young (Fisher, 1952a).

(7) Food and feeding methods. A very complete account of the feeding habits is summarized in this quote from Sergeant (1973b):

> The food of harp seals inhabiting the northwest Atlantic consists chiefly of pelagic fish, especially capelin, Mallotus villosus, and pelagic and benthic Crustacea (Euphausiacea, Mysidacea, Amphipoda, Decapoda), with smaller quantities of benthic fish. Feeding has been observed to take place on individual items by pursuit and suction at the last moment before biting small prey, which are taken tail first. Feeding is intensive in winter and (by deduction) in summer, less intensive during spring and autumn migration, and in spring during whelping and moult.... In spring, the only time when all age classes are in the same geographic area, there is a stratification of feeding by size of organism and by depth, from chiefly Euphausiacea taken in surface waters by the weaned young, through capelin taken probably at intermediate depths by immature animals, to herring, cod, and other groundfish taken by moulting adults to depths of perhaps 150-200 m. Social feeding begins at about one year of age with the change from Crustacea to pelagic fish. ...annual weights of food items eaten by the northwest Atlantic population of harp seals are roughly estimated as: all organisms, 2×10^6 metric tons; capelin, 0.5×10^6 tons; and herring, 2×10^4 tons. Predation by harp seals on capelin stocks off eastern Canada occurs only during the winter months when pack ice is present

substrate, the same resource being consumed in the summer months by the great whales (Balaenopteridae).

(8) Indications of environmental stress. Harp seals were shown to have the lowest levels of mercury in liver (3.6 ppm mean), blubber (0.03 ppm mean), and muscle (0.38 ppm mean) tissue compared to gray, harbor, and hooded seals (Sergeant and Armstrong, 1973). They attribute lower levels to the fact that harp seals feed one stage lower in the food web, in which mercury may not be concentrated to the same levels as in organisms consumed by the other seal species.

Harp seals taken from the Saguenay River, Gulf of St. Lawrence, were analyzed for DDT metabolites, PCB's and dieldrin (Addison, Kerr, Dale, Sergeant, 1973). The quantity of DDT ranged from 3.1 to 22.6 ppm, PCB's from 2 to 22 ppm, and dieldrin from 0.1 to 0.3 ppm of blubber. DDE showed a proportional increase in concentration with age; the quantity of DDT and PCB variance suggested a similar correlation with age. It is thought that parturition and/or lactation may cause reductions in blubber residue concentrations.

(9) Aesthetic and economic importance. Commercial sealing in the Gulf of St. Lawrence and off the east coast of Newfoundland has, in the last decade, reduced the harp seal populations (see section on population density) and raised an outcry of citizen protest at the alleged brutality of clubbing and skinning white-coat pups - often in the presence of the helpless mother. In Newfoundland, bedlamer seals are hunted pelagically for fur, blubber, and meat, with oil producing about 50 percent of the total revenue (King, 1964). Commercial hunting of harp seals has been carried on for over 200 years in Newfoundland with a record kill in 1831 of 687,000 seals, including hooded seals, being taken (King, 1964). Annual catches have ranged from 141,000 to 341,000 between 1950 and 1969 (Sergeant, 1971b). Declining stocks and public pressure have resulted in a moratorium on the harvesting of harp seals in the Gulf of St. Lawrence (except by landsmen) imposed by the International Commission on North Atlantic Fisheries (ICNAF) and the Fisheries Research Board of Canada.

FAMILY PHOCIDAE: HOODED SEAL, CRESTED SEAL, BLADDER NOSE, Cystophora cristata

Adult males reach a nose to tail length of 2.75 to 3.0 m and a weight of 410 kg. Females are slightly smaller. Adult coat color is gray, with black patches of irregular shape and size. The most striking feature of adult males is an enlargement of the nasal cavity which may be inflated to form a crest or hood on the top of the head about twice the size of a football. Male hooded seals also possess an inflatable nasal septum

which can be everted through the nostril as a large balloon-like sac. Some limited investigation of these structures suggest that intense anger or excitement may stimulate inflation in the wild, but this is not well documented (King, 1964).

(1) Distribution and habitat preference. Hooded seals occur mainly in the east Greenland pack ice from Bear Island and Spitzbergen to Jan Mayen, Iceland, and Denmark Strait. They also occur off southern Greenland, southeastern Labrador and the Gulf of St. Lawrence. Stragglers have appeared in the Gulf of Maine. "Leon B. Strout photographed an adult female and a pup in 'blueback' stage at North Harpswell, Maine, 25 March 1928. The pup was certainly the 'newly born pup' listed by Norton (1930) as a harbor seal." (Scheffer, 1958) Recent identification was made of a hooded seal whelping at South Brooksville, Maine on April 10, 1974 (Richardson, in press). There are three records of hooded seals south of Cape Cod; the southernmost at Cape Canaveral, Florida (Miller, 1917; Goodwin, 1954). Hooded seals prefer deep water and thick, drifting ice floes. Norton (1930) reports several alleged occurrences of stray hooded seals in Casco Bay at Green Island Reef (1896?), near Cape Elizabeth (May, 1880), and in the Kennebec River in the 1870's. Dr. Glover Allen identified bones taken from post-Pleistocene clay in Westbrook as those of hooded seal(s) (Norton, 1930).

(2) Migration characteristics. Migration is poorly understood. Scheffer (1958) describes two main breeding places:

(1) The Jan Mayen site or Norwegian Sea between Bear Island and Iceland, where hooded seals breed in spring and then disperse northward toward Svalbard in summer and fall.

(2) The Newfoundland site south of Greenland. Here hooded seals breed in spring farther out to sea, and to the east of the harp seals. In summer and fall the hoods move to ice off Greenland. There seem to be complex local migrations for purposes of feeding and molting.

(3) Population density. According to Scheffer (1958) the herds of hooded seals in the middle of the 20th century were estimated at 300,000 to 500,000. Sergeant (1965b) states that the catch rate of hooded seals has been high. The average annual kill from the Jan Mayen Island herd declined from about 53,000 (1949-53) to about 50,000 (1959-63) (Popov, 1967 in: Dent, 1973).

(4) Growth and longevity. Pups are born from the end of March to the first part of April. They are 1.1 m long and weigh 23 kg, having

an exceptionally beautiful silver gray coat with a creamy white ventral surface. These animals are called "bluebacks" and are valued for their skins (King, 1964). Pups are nursed about 2 weeks. Both sexes mature at age 4-6 years and have a maximum life span of about 30 years (Dent, 1973).

(5) Natural mortality. Although the greatest enemy of young seals is man, young hooded seals are susceptible to ice accidents and both adults and pups must escape predation by polar bears (King, 1964). Possibly predation by killer whales and even sharks, as well as disease and infestation by parasites contribute to natural mortality.

(6) Reproductive characteristics. Although solitary for most of the year, the reproductive unit is the family comprised of bull, cow, and pup. The adults will fiercely defend their pup. Adults mate following lactation in April or early May and return to the sea while pups remain on drifting ice floes for about two weeks before also taking to the sea (Scheffer, 1958; King, 1964).

(7) Food and feeding methods. Hooded seals feed on redfish, Greenland turbot, octopus, squid, herring, capelin, cod, shrimps, mussels, and starfish. They fast during the breeding period (Dent, 1973).

(8) Indications of environmental stress. No specific research for this species is known to be available.

(9) Aesthetic and economic importance. Hooded seals have been taken simultaneously with harp seals for fur and oil. Scheffer (1958) cites investigations reporting an average annual take of 38,000 hooded seals off eastern Greenland in 1924-30. Scheffer (1958) cites a consensus of opinion among North Atlantic zoologists that "...while the Jan Mayen population is not immediately threatened, the Newfoundland stock has been reduced to a few thousands and is facing complete extinction."

The newborn "blueback" pup has been prized for its beautiful steel-gray-blue (dorsally) and cream (ventrally) colored pelt.

FAMILY ODOBENIDAE: WALRUS, Odobenus rosmarus rosmarus

Largest of the pinnipeds known to have occurred in the Gulf of Maine, an adult male may reach 3.1 m and 910 kg. The adult female is smaller - about 2.6 m and 570 kg (Mansfield, 1966b). The walrus' square head bears stiff whiskers and long conspicuous tusks (both sexes). The rough, wrinkled skin has the appearance of being too large and, in fact, reaches a thickness of up to 6.4 cm in the neck of the male. The relatively sparse coat of reddish brown hair may be almost absent in older animals.

Adult animals have unique pharyngeal pouches, part of the elastic pharynx and just posterior to the glottis, extending back laterally between the muscles of the neck. When inflated, they can be used for buoyancy during sleep or if wounded (King, 1964).

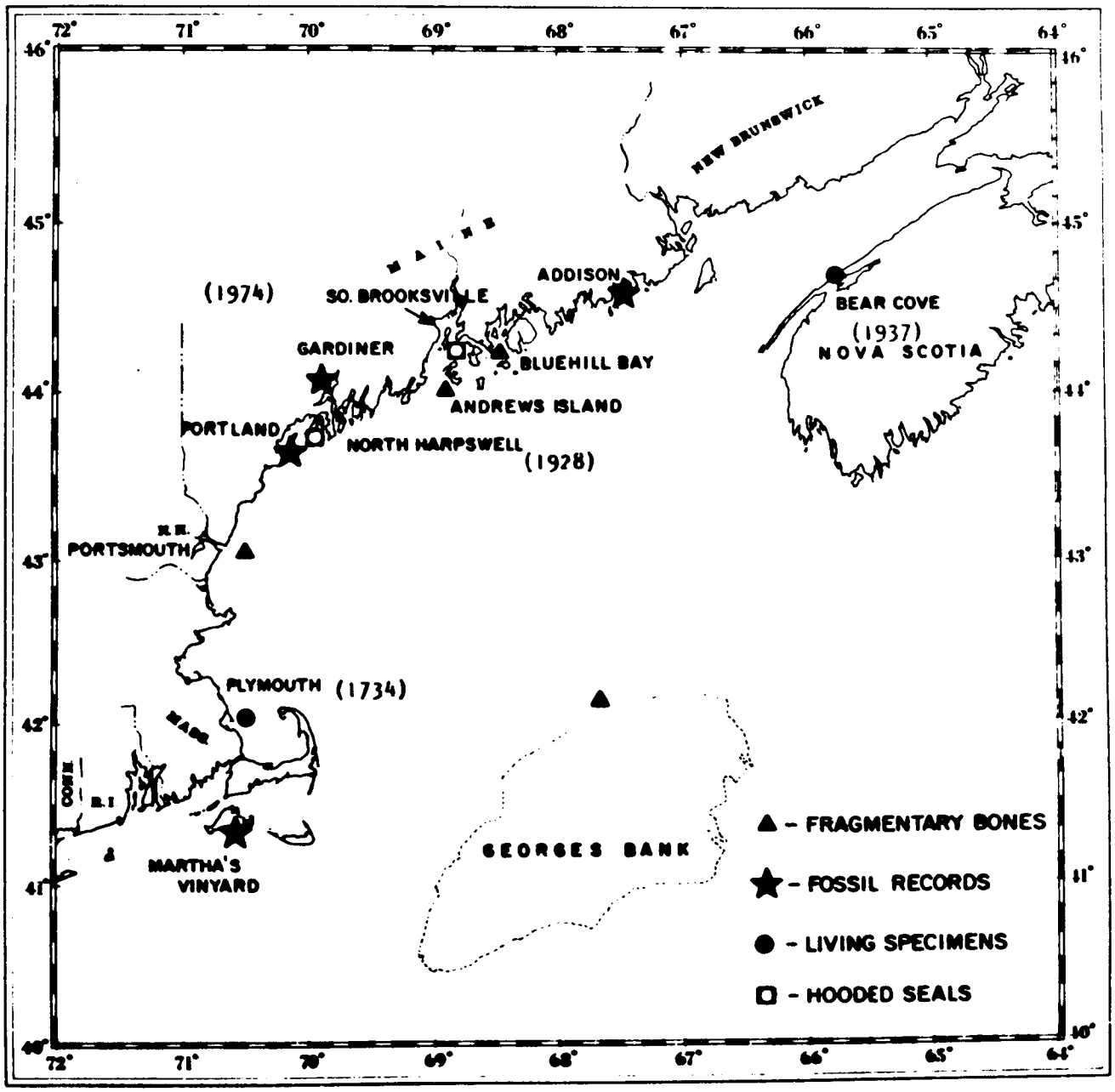
The permanent upper canines erupt when the animal is about four months old and grow as tusks throughout the life of the animal, being about 2.5 cm at one year of age, 10.2 cm at two years, and 28.0 cm at five years. Tusks have been known to reach 1.0 m and 5.36 kg (King, 1964).

(1) Distribution and habitat preference. The walrus occurs in Arctic waters of both the Atlantic and Pacific. In eastern North America the walrus' northern limits are probably the north coast of Ellsmere Island, west to Barrow Strait and south to Hudson Bay and Hudson Strait; in historic times as far south as Magdelen Islands in the Gulf of St. Lawrence, Sable Island (known historic breeding ground), and even to Massachusetts (Scheffer, 1958).

It is apparent from records of recent living specimens, fragmentary bones, and fossil records (see Figure 14-4) that the walrus has been and may still be expected to be an occasional visitor south of Labrador and into the Gulf of Maine. As recently as 1937 a live walrus was reported at Bear Cove, S.W. Nova Scotia. No doubt, climatological changes since the Pleistocene as well as hunting by man have limited the walrus' present occurrence to waters far to the north of its past range (Manville and Favour, 1960).

Palmer (1944) reported remains of walrus bones in potters clay from Orrington, Maine, and a skull dredged in 1941 from Georges Bank, Gulf of Maine. Dow (1954) reported a cranium and two tusks of a young adult dredged from deep water in Blue Hill Bay, Maine. However, Loughrey (1959) states that such evidence may not indicate past distribution but rather that animals "drifted on ice down the Labrador coast" and strayed into Gulf of Maine waters, such rare strays being of little significance. Manville and Favour (1960) suggest such individuals may have been "social outcasts - injured or otherwise unfit to remain with northern herds - which, through the vagaries of winds and currents, are driven far south of their normal range."

The walrus favors a habitat of floating ice remaining above suitable feeding shallows, usually not deeper than 80-100 meters. Animals crowd together on ice floes to rest between feeding excursions, or lacking ice will haul out on land close to favored feeding shallows. A wariness of man's predation causes herds to choose low prominent headlands and small islands surrounded by deep enough water for rapid access to the sea (Mansfield, 1966b).



A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION		
TRIGOM PARC	FIGURE 14-4	Historical and Present Occurrence of Hooded Seals and Walrus in the Gulf of Maine

(2) Migration characteristics. The Atlantic walrus migrates, but apparently not all animals do so every year. In some Arctic areas walruses reside year-round but follow the retreating ice edge north during warmer months. In October, when the ice advances again, the walruses move south (King, 1964). Mansfield (1966b) indicates, however, that some herds haul out on land when ice is dispersed. These land sites the Eskimos term uglit (pl.).

(3) Population density. Scheffer (1958) cites the total Atlantic and Pacific populations of walruses to be between 20,000 to 40,000 and 25,000 to 50,000 respectively. The populations of walrus in the eastern Canadian Arctic are not well known. However, in the area of Southampton and Coats Islands where hunting pressure is heavy, boat and aerial censuses estimated the populations to be about 3,000 yielding an annual calf production of 210. The latter figure is very close to the yearly annual kill by Eskimos in that area (Mansfield, 1966b). In western Greenland there are an estimated 10,000 animals (King, 1964).

(4) Growth and longevity. Newborn walrus calves weigh about 55 kg and are almost 1.2 m in length from nose to tip of tail. At one year of age both sexes average 204 kg and about 1.5 m in length. Thereafter growth rates of the sexes diverge with adult females reaching about 568 kg and 2.5 m and adult males reaching 908 kg and 3.1 m (Mansfield, 1966b; King, 1964) states that there is no exact information regarding longevity of the walrus, but that they live for at least sixteen and probably up to thirty years.

(5) Natural mortality. Man and killer whales are probably the walrus' only significant predators, although polar bears occasionally attack young walruses (King, 1964). Mansfield (1966b) states that a more prevalent cause of natural mortality in the young would be hazards of shifting ice, or getting crushed and wedged in rocks by larger animals on land.

(6) Reproductive characteristics. Walrus calves are born in April and early May and are nursed for over a year with no other source of food. Weaned animals are known to stay with the mother for a year or more, presumably because, having very short tusks, they lack ability to acquire food for themselves (King, 1964).

A characteristic behavior pattern of calf clinging to the mother's back is deeply ingrained in this gregarious species and remains even after immatures reach large size (Mansfield, 1966b). The walrus is also one of the few pinnipeds to readily adopt orphaned calves.

Males have an annual breeding cycle but females, who mature at five years, calve but once every two years and older females less fre-

quently. Mating occurs in April and May shortly after birth of the pups, and gestation spans almost a year. There is apparently no delayed implantation of the embryo as there is in other pinnipeds. Twin foetuses are rare (King, 1964).

(7) Food and feeding habits. The walrus feeds primarily on clams which it digs from the sand and gravel shallows by means of a side to side rotation and forward shoveling motion of the tusks (Mansfield, n.d.; King, 1964). The soft parts of Mya truncata, Saxicava arctica, and Cardium groenlandium are sucked, ripped, or otherwise torn from the shell. As much as 85 pounds of mollusc flesh have been recorded in a bull walrus (King, 1964). Annelids and sipunculid worms, echinoderms, whelks, sea cucumbers, shrimps, hermit crabs, and polar cod are known dietary items (Mansfield, 1966b; King, 1964). "Rogue male walruses," recognized by Eskimos due to their grease-stained tusks, are known to have eaten ringed and bearded seals and even young walrus, either as carrion or as prey (Mansfield, 1966b).

(8) Indications of environmental stress. No research specific for this species is known to be available.

(9) Aesthetic and economic importance. Walrus have been hunted since the ninth century and heavily since the 17th century for ivory, meat, oil, and hides (for ropes, harnesses, whips and boat skins) (King, 1964). Eskimos have hunted walrus for prized ivory used in native carvings, for implements and weapons such as harpoon sockets and harness toggles, and for use in scrimshaw art. The Canadian and Siberian governments have permitted hunting by license, but recording of catches is difficult and no international regulations or protective measures have been adopted. Fortunately for the walrus, quite inaccessible areas in the Arctic islands makes hunting of many herds unlikely and future replenishment of depleted stocks likely. Aesthetic appreciation of walrus expressed both by the Eskimo (for its aggressiveness in the hunt) and by wildlife and research persons may equal economic considerations in protecting this magnificent marine mammal.

14.1.3 REFERENCES

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14.2 CETACEANS OF THE GULF OF MAINE

14.2.1 INTRODUCTION

As listed in Table 14-2, twenty species of cetaceans have been reported from the Gulf of Maine region. Of this number, six species are relatively common now or were common in historical times; seven species are occasionally observed (even though they may be present or even somewhat common in some places, such as in the offshore waters of the Gulf); and seven species are so rarely seen in this area that they should be considered strays. In Table 14-3, the habitat preferences of the various species are described. Table 14-4 summarizes information on the distribution, abundance, and importance of the various species in the Gulf of Maine. Finally, descriptions of each species include data on distribution, migration, population size, growth and longevity, reproduction, and economic or aesthetic importance.

One could possibly expect any species of cetacean known from the North Atlantic Ocean to occur in the Gulf, at least on rare occasions. If the present increased public and scientific interest in cetaceans continues, and sightings and strandings continue to be reported on a regular basis, additional species will probably be added to the list of Gulf of Maine cetacean records. However, it is likely that the additional species will not be ecologically or numerically important to the area.

A word of caution is in order about the interpretation of statements on the apparent relative abundance of the species. Data for such statements consist simply of published sighting reports for each species. Numerous problems attend the interpretation of such data, even if it is assumed that all species identifications are correct. For example, observers generally tend to report sightings of rare species (when they can be identified) more commonly than sightings of the species which are routinely seen. This tends to minimize the estimate of abundance of common species and to exaggerate the importance of rarer species. In addition, observers are more apt to report the sighting or stranding of a large creature than a small one. This idiosyncrasy tends to exaggerate the apparent abundance of large whales. Data on the relative abundance of many of the large whales is almost surely affected by the inability of an untrained observer to discriminate between the species at sea. For example, New England fishermen usually call minke whales "young finbacks." Often no attempt is made to identify smaller whales. Perhaps they "all look alike" to the average observer.

Another problem is the different habitat preferences of the various species. Some whales routinely approach the coast, can be seen by many small boat operators or even shore observers, and perhaps strand relatively frequently. Other species appear to prefer more offshore regions, where they may in fact be quite common, but where they are unlikely to be seen by many people. For all of these reasons, and probably more, it is more

difficult than it would seem to make a realistic comparison between the abundance of species such as the fin whale--which is large, known to approach the coast at certain times, easy to confuse with some other rorqual whales, and is frequently seen--and the common dolphin (Delphinus delphis), which is a small offshore species that is not easy to identify positively and travels in schools. The common dolphin is sometimes stated to be the most numerous cetacean in the world, and one would like to know its true abundance in the Gulf. This particular example points out one final problem in the estimation of abundance, namely the difficulty of enumerating an observer's report of a "school" of whales or porpoises. Even in the best of circumstances, it is difficult to compare the abundance of two species, one of which is known from 50 separate sightings and the other from just one or two sightings of schools.

The qualitative categorization of relative abundance presented in Table 14-3 certainly incorporates all of the errors discussed above and is subject to change as new information becomes available.

In general, one has the impression that many of the whales that are observed in the Gulf of Maine are in some stage of migration. Although it is possible that some of the individuals seen spend the summer feeding in our nearshore waters, or the winter in our offshore waters, most of the whales are probably on their way to join the bulk of the population of their species in known summering grounds farther north or in wintering grounds farther south. An exception might be the population of the harbor porpoise, Phocoena phocoena, in which one northwestern Atlantic population center appears to be in the approaches to the Bay of Fundy. However, in most cases, it appears that the cetaceans are only transient in those waters of the Gulf of Maine which are most accessible to observers. The general impression that cetaceans are scarce or absent from the inshore waters of the Gulf or the Bay of Fundy during the winter is not supported by very much hard data, but it does appear to be true from most reports, even when one takes into account the fact that far fewer observers are at sea or around beaches during the colder months.

Data on the abundance and relative importance of cetacean species in the offshore waters of the Gulf are sorely needed. Only scattered reports are now available, most of which have been made incidentally to the pursuance of some other activities, such as fishing or other oceanographic work. The configuration of the coast and bottom between Cape Cod and Nova Scotia suggests the possibility that many more whales might be seen at sea than in the inshore waters of the Gulf. A whale could swim along that path in a direct route and remain over some of the most productive areas in the northwestern Atlantic, namely Georges Bank and Browns Bank. It could then continue north along the Emerald Bank, Horseshoe Bank, and other shoal areas offshore from Nova Scotia, finally reaching the Grand Bank of Newfoundland which is probably near the location where Richard

Mather's journal of a trip by sea to New England in 1635 recorded, "This day in the afternoon, we saw multitudes of great whales, which now was grown ordinary and usual to behold."(Young, 1846) Levenson (1972) estimated that 54,000 large whales inhabit the western north Atlantic Ocean. Lent (1973) and Mitchell (1973a) include recent population estimates by species.

If the migration of a species did not require proximity to land, the species could follow a direct north-south route and could rely upon the shoal banks to provide food in the form of copepods, euphausiids, squid, and fish in greater abundance than is present in more coastal areas. A program to monitor the number of cetaceans in an offshore area would be of great importance in helping to compare the numbers of whales in offshore and inshore areas of the Gulf.

Some general statements are in order about the ecological relationships of cetaceans of the Gulf of Maine. Among the 80 living cetacean species listed by Hershkovitz (1966) a great deal of geographical, temporal, and ecological separation of species minimizes competition for food and perhaps for other resources which are present for whales in limited supply. Within the Gulf of Maine, some whales feed heavily on swarms or schools of copepods (sei); copepods and euphausiids (right); fish (fin, minke, humpback); or squid (pilot), although a good deal of overlap may at times occur. Whereas the large baleen whales either filter food continuously while swimming (right, sei) or strain it from single large mouthfuls (fin, humpback), the smaller whales (including the smallest local baleen whale, the minke) are more dependent on pursuing single prey. There is some evidence that competitive exclusion may keep certain species out of some habitats. For example, it is possible that competition from Phocoena phocoena, the harbor porpoise, is partly responsible for the exclusion of the bottle-nosed porpoise (Tursiops truncatus) or the common dolphin (Delphinus delphis) from inshore waters, although other factors are undoubtedly involved. In turn, competitive pressure from these species and also predator pressure from the killer whale (Orcinus orca) may be partly responsible for the rarity of the beluga whale (Delphinapterus leucas) in our area. Most of what is known about the biology of cetaceans which occur in the Gulf of Maine has been learned in other places. Little is known about the ecology of the various species as they live and interact in our area, and additional information would be very useful, although it will be hard to obtain.

Also of interest are some general comments about the economic importance of the cetaceans in this area. Indians in the Cape Cod area and in the Bay of Fundy area certainly hunted small whales, and perhaps occasionally right whales from canoes before white people arrived. The earliest white whalers, the Basques, were hunting right whales in Newfoundland and the Gulf of St. Lawrence in the 1500's, but they did not hunt in the Gulf of Maine. American colonists hunted right whales in Massachusetts Bay as early as 1662 in the Cape Ann area, and later near the Isles of Shoals, between Salem and Cape Cod, and probably in other locations. As time

passed, boats from many small coastal towns occasionally hunted whales either from shore or in waters near shore. Most of the whales taken were right whales, then humpbacks and some finbacks (even though the latter are very fast and hard to catch). However, by the mid-1700's right whales were already rare in the Gulf of Maine, victims of continued hunting pressure by colonists as well as previous predations by Basques on their summer grounds. Although few records or catch data exist for most of the whaling that did occur, Allen (1916), Clark (1887), Goode (1884, 1887) and Norton (1930) included useful historical information. All told it appears that local cetaceans were of limited direct value to the inhabitants of much of the coast of the Gulf, although on fortunate occasions their capture was probably important. The industry which developed to hunt whales in distant waters was of much greater economic and cultural importance to coastal residents of the Gulf, and their contributions to the building and sailing of whaling ships during the 18th and 19th centuries were notable, but need not be discussed here.

The direct economic contribution of cetaceans to the inhabitants of our area has been even less in the 20th century. Hardly any whaling has gone on for the last 75 years, and now the Marine Mammal Protection Act of 1972 forbids all hunting of these creatures.

In addition, although there are no actual data available, the impression of most observers is that whales are much less common today than they were formerly. The general idea that there used to be more whales can be traced back for several hundred years. For example, Allen (1880) wrote that there are many allusions to the abundance, in early times, of seals, whales, and the smaller cetaceans. He quoted one early anonymous writer who said, referring to Massachusetts Bay, "for it is well known that it equalizeth Groinland [sic] for Whales and Grampuses." It is certainly true that right whales used to be common in Massachusetts Bay and perhaps other parts of the Gulf of Maine, but that they had nearly disappeared by the middle of the 18th century. Perhaps the following passage from Captain John Smith's diary, quoted by Allen (1916) may indicate that fin whales also used to be more plentiful than they now are:

> In the month of April, 1614, with 2 ships from London, of a few merchants, I chanced to arrive in New England, a part of America, at the Isle of Monahiggan [sic] in forty-three and a half of northerly latitude. Our plot was there to take whales and make trials of a mine of gold and copper. If this failed, fish and furs was then our refuge, to make ourselves savers howsoever. We found this whale fishing a costly conclusion. We saw many, and spent much time chasing them; but could not kill any, they being a kind of jubartes, and not the whale that yields fins and oil as we expected.

One can only wish that Captain Smith had kept count of the "jubartes," which according to Allen (1916) is an early name for the finback whale, Balaenoptera physalus.

Today, many people appear to be more interested in observing and learning about whales than in hunting them. This trend, along with the relative dearth of whales and the Marine Mammal Protection Act, make it unlikely that cetaceans will make any direct economic contribution to the economy of this area in the near future.

The indirect economic contribution of cetaceans is also probably small at the present time. Tourists hoping to see whales may contribute some monies to the economics of coastal towns. An occasional whale or porpoise can become entangled in a fishing net or weir while in pursuit of food, causing some losses. However, with the passing of the weir from most of the shorelines of the Gulf of Maine (some weirs remain in the Bay of Fundy area) the opportunity for marine mammals to interfere with fishing operations is diminished. Probably the chief losses to human fishing operations occurred through damage to fishing gear, or possibly through dispersal of fish schools by feeding seals or whales, rather than by direct competition with humans for fish. Nevertheless, some fishermen still shoot seals (and occasionally whales), and it would be helpful if everyone would understand that the greatest populations of fish and other harvestable marine resources coexisted with the great whale, seal, and bird populations, and all occurred before human intervention in marine ecosystems became so dominant.

On the positive side, some fisherman find whales helpful. Near Lubec, Maine, for example, whales have a tendency to drive herring toward shore, where they can be caught more easily, according to some fishermen. In other areas, fishing captains are known to use the presence of whales as an indicator of the presence of fish.

Probably the greatest contributions that the cetaceans now make to people in our region are intangible. Some are aesthetic, educational, or inspirational such as the various records of whale songs and sounds which are now available, and the films about whales which have been made (Wray, 1974), or the opportunity to see captive cetaceans at close range in aquariums and to perform some scientific studies upon them. Perhaps of more importance than any other factor is the contribution that cetaceans are now making to our ecological and environmental awareness. In many places, whales are now the best known symbol of all endangered wildlife, and citizens from many countries are working in concert and on an international basis in behalf of their preservation. Resolutions and plans for the protection of whales and for increased research on their biology have come from international, national and local governmental agencies, wildlife and conservation organizations, and citizen groups. Perhaps

the greatest contribution of these creatures to our society will have been to point out our own destructive potential and to force us to design ways to prevent its continued realization. Whales are among the first endangered citizens of our "last frontier," the oceans. They have helped us to realize that it is no longer an unspoiled frontier wilderness. The conservation struggle over the great whales will help to point out all of the ways in which human activities are affecting the health of the ocean and thereby the continued existence of vigorous whale populations. Contamination of parts of the ocean by oil, heavy metals, pesticides, and solid waste material such as plastics all will affect cetacean populations, as will continued degradation of coastal habitats and lagoons. The efforts to conserve cetaceans will require continuous, effective regulation of whale hunting, and sustained efforts and vigilance to maintain a clean world ocean.

Table 14-2 Relative abundance of cetacean species in the Gulf of Maine

COMMON -- FREQUENTLY REPORTED

Harbor porpoise, Phocoena phocoena
Pilot whale, Globicephala melaena
Finback whale, Balaenoptera physalus
Minke whale, Balaenoptera acutorostrata
Humpback whale, Megaptera novaeangliae

COMMON IN THE PAST, NOW RARE

Right whale, Eubalaena glacialis

OCCASIONALLY SEEN

Killer whale, Orcinus orca
Common dolphin, Delphinus delphis
Bottlenosed dolphin, Tursiops truncatus
White-beaked dolphin, Lagenorhynchus albirostris
White-sided dolphin, Lagenorhynchus acutus
Risso's dolphin, Grampus griseus
Beluga, Delphinapterus leucas

RARE

Blue whale, Balaenoptera musculus
Sei whale, Balenoptera borealis
Sperm whale, Physeter catodon
Pygmy sperm whale, Kogia breviceps
Northern bottlenose whale, Hyperoodon ampullatus
True's beaked whale, Mesoplodon mirus
Dense-beaked whale, Mesoplodon densirostris

Table 14-3 Habitat preferences of cetaceans recorded from the Gulf of Maine

KNOWN TO ENTER ESTUARIES OR RIVERS

*Harbor porpoise, Phocoena phocoena
Beluga, Delphinapterus leucas
Bottlenosed dolphin, Tursiops truncatus
Common dolphin, Delphinis delphis
Killer whale, Orcinus orca

OFTEN FOUND IN BAYS, INSHORE, OR IN COASTAL WATERS

*Harbor porpoise, Phocoena phocoena
*Pilot whale, Globicephala melaena
*Right whale, Eubalaena glacialis
*Humpback whale, Megaptera novaeangliae
*Fin whale, Balaenoptera physalus
*Minke whale, Balaenoptera acutorostrata
Beluga, Delphinapterus leucas
Killer whale, Orcinus orca

USUALLY FOUND WELL AT SEA

*Fin whale, Balaenoptera physalus
*Minke whale, Balaenoptera acutorostrata
*Right whale, Eubalaena glacialis
Blue whale, Balaenoptera musculus
Sei whale, Balaenoptera borealis
Sperm whale, Physeter catodon
Common dolphin, Delphinis delphis
Gray grampus, Grampus griseus
White-sided dolphin, Lagenorhynchus acutus
White-beaked dolphin, Lagenorhynchus albirostris

HABITAT POORLY KNOWN, BUT USUALLY FOUND WELL AT SEA

Pygmy sperm whale, Kogia breviceps
Gray grampus, Grampus griseus
North Atlantic bottlenosed whale, Hyperoodon ampullatus
True's beaked whale, Mesoplodon mirus
Dense-beaked whale, Mesoplodon densirostris

*Signifies key species, based on present abundance or estimated historical abundance.

Table 14-4 Species summaries

COMMON IN GULF OF MAINE

Family	Common Name(s)	Species Name	Western Atlantic Range and Distribution	Habitat	Estimated Abundance in Western North Atlantic	Dominance in Gulf of Maine
Phocoenidae	Harbor porpoise	Phocoena phocoena	New Jersey to Baffin Bay; Center of population in approaches to Bay of Fundy and inshore Gulf of Me.	Coastal and inshore waters	4,000-10,000	Numerically dominant cetacean
Delphinidae	Pilot whale	Globicephala melaena	New York to Greenland; Especially common in Newfoundland	Pelagic (winter) & coastal (summer)	No estimates; Most common whale seen in Cape Cod Bay; Schools of up to 300 on Georges Bank	Frequently seen
Balaenopteridae	Finback whale	Balaenoptera physalus	Population centered between 41°21'N and 57°00'N and from coast to 2000 m contour	Pelagic, but enter bays and inshore waters in late summer	7,200	Dominant large whale; one of most common cetaceans
Balaenopteridae	Minke whale	Balaenoptera acutarostrata	Chesapeake Bay to Baffin Island in summer, eastern Gulf of Mexico, northeast Florida and Bahamas in winter	Pelagic, but may stay nearer to shore than other rorquals (except humpback)	No estimates	Less common than finback, but sightings are routine
Balaenopteridae	Humpback whale	Megaptera novaeangliae	Common near land, but can be found in deep ocean	Approaches land more closely and commonly than other large whales; also found in deep ocean	800-1,500	Routinely seen but much reduced from past abundance
Balaenidae	Right whale	Eubalaena glacialis	New England to Gulf of St. Lawrence; Possibly found as far south as Florida	Pelagic and coastal; not normally inshore	200-1,000	Much reduced from former importance; rare
OCCASIONALLY SEEN IN GULF OF MAINE						
Delphinidae	Killer whale	Orcinus orca	Tropics to Greenland, Spitzbergen, Baffin Bay	Mainly pelagic and oceanic, however they do commonly approach coast	No estimate; apparently not seen as commonly as in more northerly areas	Uncommon
Delphinidae	Common dolphin	Delphinis delphis	Caribbean Sea to Newfoundland; very wide ranging; may be most widespread and abundant delphinid in world	Seldom found inside 100 m contour, but does frequent seamounts, escarpments, & other offshore features	Poorly known; probably more common than available records indicate; may be more common in Massachusetts Bay; no estimates	Not known; possibly Phocoena is a competitor

Delphinidae	Bottle-nosed dolphin	Tursiops truncatus	Argentina to Greenland, but most common from Florida, West Indies, & Caribbean to New England	Usually close to shore & near islands; enters bays, lagoons, rivers	Rare, especially in inshore regions; no estimates	Rare; perhaps Phocoena is a competitor.
Delphinidae	White-beaked dolphin	Lagenorhynchus albirostrus	Massachusetts to Davis Strait, but ranges farther north into Arctic waters than L. acutus; rarely seen south of Labrador and Newfoundland	Coastal waters	Rare stray in Gulf of Maine; no estimates	Apparently minimal
Delphinidae	White-sided dolphin	Lagenorhynchus acutus	Cape Cod to Davis Strait	Often schools with pilot whales, but is less common than that species	Not common	Apparently not important by numbers
Delphinidae	Grey grampus, Risso's dolphin	Grampus griseus	Ranges south from Massachusetts	Coastal waters; habitat poorly known	Uncommon, but possibly not rare; no estimates	Much less common than Phocoena
Monodontidae	Beluga	Delphinapterus leucas	St. Lawrence River and Gulf to Arctic regions	Prefers estuaries & shallow water areas	Rare visitor from Gulf of St. Lawrence	Rare

RARE IN GULF OF MAINE

Balaenopteridae	Blue whale	Balaenoptera musculus	Gulf of St. Lawrence to Davis Strait; routinely sighted on banks fringing outer Gulf of Maine; Population much reduced from original number of about 1,100 in western N. Atlantic	Pelagic, deep ocean; however occasionally approaches land in deep water regions, e.g., the Laurentian Channel of the St. Lawrence River	Generally not common; some sightings expected in offshore regions; no estimates	Much less common than finback
Balaenopteridae	Sei whale	Balaenoptera borealis	New England to Arctic Ocean	Pelagic, does not usually approach coast	1,570 off Nova Scotia	Much less common than finback
Physeteridae	Sperm whale	Physeter catadon	Equator to 50°N (females & juveniles) or Davis Strait (males)	Pelagic, deep ocean	Estimated 22,000 inhabit North Atlantic Ocean	Uncommon visitor
Physeteridae	Pygmy sperm whale	Kogia breviceps	Tropics to Nova Scotia	Pelagic in warm ocean waters	Very rare; only one record	Minimal
Ziphiidae	Bottle-nosed whale	Hyperoodon ampullatus	Rhode Island to Davis Strait	Pelagic; cold temperate and subarctic waters	Poorly known; between 260-700 taken annually in North Atlantic Ocean, 1968-70	Poorly known
Ziphiidae	True's beaked whale	Mesoplodon mirus	Northern Florida to Nova Scotia	Nothing is known	Extremely rare; poorly known	Minimal
Ziphiidae	Dense-beaked whale	Mesoplodon densirostris	Tropics to Nova Scotia	Probably pelagic in tropical and warm waters	Extremely rare: stray visitor	Minimal

14.2.2 LIFE HISTORY DESCRIPTIONS

FAMILY BALAENOPTERIDAE: FIN WHALE, FINBACK WHALE, RORQUAL, FINNER, PIKE WHALE, Balaenoptera physalus physalus

This is the second largest whale in the Balenopterine group, reaching a maximum length of about 24.5 m and a weight of perhaps 59 metric tons. It resembles the other whales in the genus quite closely in general form, but may be distinguished by certain characteristics. Most distinctive is the asymmetric coloration of the jaws and the baleen. On the left side both are the same dusky gray as the dorsal part of the body. However, the right side of the lower jaw is white or light gray externally on the anterior quarter, shading to the dark color of the head posteriorly. Correspondingly, the first third of the baleen of the right side is white or slightly yellowish, while the posterior portion and entire left side is dark blue-black. The portion of the external right upper jaw in contact with the light-colored baleen is also white. The coloration of the interior of the right jaw may be reversed from that of the exterior, at least in males (Tomilin, 1957).

The ventral portion of the body is mainly white, including the underside of the flukes and flippers. The body of the fin whale is more slender than that of other balenopterines. The dorsal fin displays small differences in morphology from that of the sei or minke, but this is not always discernible at sea. While feeding, the fin whale often blows three or four times, at equal intervals, dives for five to ten minutes, then reappears (Mitchell, 1972a). The long period between the blow and the appearance of the dorsal fin (over one second, but less than two or three seconds in the case of the blue whale) may help an experienced observer to recognize the species at sea (in conjunction with an estimate of size and, especially, a glimpse of asymmetric head coloration). The finback does not show flukes when diving. Arnold and Gaskin (1972) saw one finback breach twice in the Bay of Fundy, but this behavior is unusual for the species. Allen's (1916) description of this whale is useful.

(1) Distribution and habitat preference. The range of the fin whale covers all oceans of the world. It is somewhat less numerous in the Northern Hemisphere and somewhat less numerous in the North Atlantic than in the North Pacific. It is not found in the tropics (Tomilin, 1957). Within the North Atlantic, the finback is very widely distributed from Spitzbergen and Greenland south to the Azores (Kellogg, 1929). It is the most commonly seen large whale in the Bay of Fundy (Neave and Wright, 1968), along the Maine coast (Norton, 1930), and is the most commonly stranded large whale along the New England coast (Allen, 1916). The latter fact probably stems from the fact that in New England it readily enters inshore shallow waters probably in pursuit of small schools of fish, although it normally stays at some distance from the main-

land (Allen, 1916). This is perhaps peculiar to our area, because in most other locations the finback is considered to be a creature of the deep sea (Tomilin, 1957; IUCN, 1972). Allen (1916) felt that waters off Cape Ann and in the northwest part of the Gulf of Maine seemed to be favorite haunts of the finback. Sergeant (1966) and Mitchell (1972d) considered the fin whales in the Gulf of Maine-Grand Banks-Davis Strait areas to be a distinct population group with no interchange with the west Greenland or the east Greenland populations. Mitchell (1974) considered the following populations to be distinct, with little or no interchange: (1) Nova Scotian stock, (2) Labrador stock (10 percent interchange with Nova Scotia), (3) West Greenland stock, (4) East Greenland-Iceland stock. Fin whales in the Gulf of Maine should probably be considered part of the Nova Scotian stock for the time being, however no data are yet available.

(2) Migration. According to Mitchell (1974), the major population of northwest Atlantic fin whales is centered between about 41°20'N and 57°00'N and from the coast to the 1000 m depth contour. That area can be considered the summer feeding range of northwest Atlantic fin whales. Within that area, fin whales appear to spend summer months in the northern reaches and winter months farther south. However, there appears to be enough latitudinal stratification of discrete fin whale populations along the western Atlantic coastline that grounds occupied by a southern population in the summer are probably occupied by a northern population in the winter (Mitchell, 1972d). Although Allen (1916) could find no evidence for a regular migration of finbacks, he nevertheless observed regular periodicities of abundance in which the whales were present in summer but not winter. On the whole, migrations of this species in the North Atlantic are apparently less regular than in other areas (Tomilin, 1957), and are also less regular and less well known (Kellogg, 1929) than those of the blue or humpback whales. However, Mitchell (1972d) has demonstrated by tagging returns a general seasonal migration from Cape Cod in June and July up to and including waters on the central Labrador Coast up to 57°N latitude, although individual whales probably do not make the entire trip. Mitchell (1974) has also demonstrated a regular migration parallel to the Nova Scotia coast. Tomilin (1957) thought that the warm water of the Gulf Stream provided favorable breeding conditions not only at low latitudes but also relatively far to the north and allowed some fins to winter on their feeding grounds, because food is still abundant. He listed April through October as the periods of fin whale abundance in the Gulf of Maine, with January and February being times of extreme rarity. Clark (1887) reported the northward migration of large numbers of finbacks in the Gulf of Maine early in March. During autumn, the bulk of the finwhale population migrates (pregnant females first) south from summering grounds in the Arctic, or off the coasts of Newfoundland, Iceland, New England, and elsewhere to more southerly winter feeding grounds,

which are not well known. Depending probably on their stock of origin, some finbacks reach the Bay of Biscay, Portugal, the Mediterranean, the Azores, or possibly the Gulf of Mexico or the temperate U.S. Atlantic coast. However, some finbacks apparently winter on the Grand Banks of Newfoundland (Kellogg, 1929), while others reach Nantucket or Bermuda. On the whole, one can suspect that the migrations of fin whales are primarily determined by the abundance of the gregarious fishes (capelin, herring) which form the main food items in the North Atlantic, and that food abundance is governed to an important degree by temperature variations. Mitchell (1974) mentioned the possibility that winter dispersion of the population is not random, but that individuals return year after year to the breeding areas where they were conceived and born.

(3) Population density. As far back as records are available, the fin whale has always been one of the most common large whales in New England waters. According to Tomilin (1957) it is the dominant species of whalebone whale in the Northern Hemisphere. Although no quantitative records of past abundance are available, Clark (1887) called it the most common whale taken in Massachusetts Bay, and Norton (1930) called it the most common near Portland. Colonial and 19th century whaling concentrated on the right and humpback whales because they were easier to catch; however, a fishery for the finback was prosecuted on and off in Massachusetts Bay for many years (True, 1904), and sporadic hunting occurred from the Maine coast (Norton, 1930) despite the fact that Captain John Smith's group could not catch any in 1614. Allen (1916) recorded that the finback was not hunted during early New England whaling ventures. However, during the period from 1810 to 1896, finbacks were pursued with success by coastal whalers in small ships from Prospect Harbor, Tremont, and Winter Harbor, Maine; and from Gloucester, Provincetown, and Nantucket, Massachusetts. During 1885, 5 small steamers were engaged in this fishery in the Gulf of Maine, but no data are available on the catch (Allen, 1916).

Now, especially since the serious decline of right whale and humpback populations, the fin is by far the most abundant large whale in our area. During a cruise along the continental shelf from Cape Cod to northern Labrador, 57 percent of all cetaceans sighted were fin whales (Mitchell, 1972d). During a whalewatch from Mt. Desert Rock Lightstation in the Gulf of Maine, about 75 percent of the 350 cetaceans seen from June 7 through September 20, 1973, were probably fin whales (Katona, Kraus, and Savage, in preparation).

Data from strip census and tagging studies suggest that a total of about 7,200 fin whales inhabited the North Atlantic in 1967 (Mitchell, 1972d). Canadian whaling stations in Dildo and Williamsport, Newfoundland, and in Blandford, Nova Scotia (Schmitt, 1972) used to take up to 748 fin whales per year before whaling was stopped in December, 1972. Whereas stocks of fin whales used to be hunted

at various places within the North Atlantic (Canada, Iceland, Greenland, Norway, Portugal, Straits of Gibraltar), little, if any, hunting now occurs.

(4) Growth and longevity. Data summarized by Harrison (1969) on the southern hemisphere finbacks illustrate the course of growth in the northern subspecies, which is generally somewhat smaller. At birth, calves are 6.5 m long. After 7 months of nursing the length is about 12 meters, at which time weaning occurs. Sexual maturity is reached at an average age of five years (3-8) and a length of 19-21 meters. However, Canadian finback males mature at 16.9-17.5 meters and females mature at about 17.6 to 18.4 meters (Mitchell, 1974). At sexual maturity, cetaceans are about 85 percent of their full size at physical maturity. The latter state is usually approached, rather than reached, as the growth process gradually slows and epiphyseal fusion of the vertebrae occurs. The maximum recorded length is 26 meters. Longevity appears to be 50 years, and fin whales normally live for 40 years.

(5) Natural mortality. In life the fin whale apparently has no serious enemies. Killer whales probably do not often harm this large, very fast whale (25 km/hr, possibly 40-50 km/hr in a sprint), although fin whales are known to flee an area inhabited by killers. However, at other times, the two species may be seen feeding together on herring (Tomilin, 1957).

(6) Reproduction characteristics. The peak of the breeding season in the North Atlantic appears to be January to March (Tomilin, 1957) or November to March (Harrison, 1969), at which time most fins are on their southern warm-water feeding grounds. Mating occurs at the surface, in a horizontal belly-to-belly position. Gestation is 11-12 months. Single births are the rule, but twins are occasionally seen. Calving occurs between December and April off the Canadian coast (Mitchell, 1974). Lactation continues for 7 months. After weaning, young whales feed mainly on small planktonic crustaceans, such as Calanus sp., a trend that may be related to the fact that their baleen fringe is much finer than that of adults (Tomilin, 1957). This may represent an economical way of partitioning resources between fin whales of different ages. The maternal instinct is highly developed in fin whales, but possibly less strong than in humpback whales. Females probably produce calves every other year.

(7) Food and feeding methods. Although young fin whales feed on small plankton, older whales feed on larger planktonic crustaceans such as euphausiids (Thysanoessa sp., Euphausia sp., Meganyctophanes norvegica), gregarious fishes (capelin, herring, mackerel, sardines, and in various areas sand lances, arctic cod, rockfish, arctic smelt, chum salmon, cod, walleye pollock, (and occasionally dogfish), some cephalopods, and small crustaceans (Calanus). The diet varies

according to season and food abundance. Nemoto (1970) listed the "preferred" order of diet items as: euphausiids=large copepods= gregarious fish>small copepods>squids. All told, the fin whale is the most euryphagous of the large whales, a feature that may underlie its wide distribution in the world ocean.

When feeding on crustaceans, fin whales scatter; however, they assume a more gregarious concentration when feeding on fishes. When feeding on fishes, a fin whale usually swims on its side and turns round the body axis, belly up, so that the heavy lower jaw emerges from the water. This maneuver may help to prevent fish from slipping out of the whale's mouth and may help close the mouth faster. Water is forced out of the mouth through the baleen with the tongue, and food is retained on the inner surface of the baleen. Mowat (1972) reported that a fin whale he observed swam clockwise in circles around schools of fish, herding them toward the center and then catching them. Millais (1973) also described this behavior. Mowat (1972) hypothesized that the light-colored portions of the right side of the baleen and jaws helped to startle the fish and keep them within a tight school. Mitchell (1972b) suggested that this coloration is used for obliterative countershading to avoid startling fish. Either idea is more intriguing than Mackintosh and Wheeler's (1929) suggestion that the dark pigmentation of the left side of the jaws protects them from slightly greater exposure to light when the whale swims on its right side.

Schevill, Watkins, and Backus (1964) reported that fin whales are responsible for producing the somewhat ubiquitous high-intensity 20 Hz signals that had previously been detected in various waters. It is possible that the fin whale uses sounds to help locate food (Perkins, 1966; see also Beamish and Mitchell, 1973) or in orientation (Norris, 1969).

(8) Indications of environmental stress. None available except for evidence of depleted populations. The concentrations of Strontium-90 and Cesium-137 in 11 different tissues from 7 fin whales taken near Blandford, Nova Scotia, in August, 1968, were all very low (Samuels, et al., 1970).

(9) Aesthetic and economic importance. After the demise of the blue whale, the fin whale became the most important species for the world whaling industry. In 1937, when the world take of this species reached its peak, 1197 were killed in the North Atlantic. The North Atlantic generally yielded only 3 to 10 percent of the Antarctic take of fin whales. In the years 1964-1971, respectively, the three eastern Canadian whaling stations killed 56, 141, 427, 748, 700, 510, 576, and 470 fin whales (Mitchell, 1968, 1972d; Allen, 1970). Earlier catch data are summarized in Allen (1970) and Mitchell (1972d,

1974). Recent Canadian whaling has apparently exceeded the sustainable yield of Canadian fin whales, which appears to be about 418 whales or less (Mitchell, 1972d).

The fin whales has always been a moderately valuable whale to the industry. In the old Blue Whale Unit system, two fin whales were worth one blue whale. The whalebone is coarser than that of the right whales and was used in the fabrication of brushes, springs, soft furniture, and other items. The usual products (glycerin, lard, soap, margarine, thin leather, meat, oil, lubricants, cattle meal, fertilizer, liver oil, and pharmaceutical extracts, among others) were made from fin whales and continue to be produced in Japan and Russia. Substitutes for all products are available.

The fin whale is a relatively inconspicuous creature. It is only the second or third largest animal ever to have inhabited the earth. It is not unusually acrobatic; it is not known to be notably vocal; very little of its huge bulk is ever exposed to human view. On the other hand, underwater films and photographs by Jacques Cousteau (Cousteau and Diole, 1972) have revealed it to be a graceful, powerful creature possessing surprising beauty. Also of interest, a fin whale is the tragic hero of a recent book (Mowat, 1972) which has helped to focus popular attention on an examination of the relationship between humans and the great whales and has contributed a great deal to current sentiment for whale conservation.

FAMILY BALAENOPTERIDAE: MINKE WHALE, LITTLE PIKED WHALE, SHARP-HEADED FINNER, LESSER RORQUAL, PIGMY WHALE, BAY WHALE, Balaenoptera acutorostrata

This is the smallest species of the genus Balaenoptera. In common with the other three species of this genus present in the Northern Hemisphere and in the Gulf of Maine, it has baleen, a dorsal fin, and ventral grooves. However, its small size (usually 6-9 m, occasionally 10 m), yellowish-white whalebone, and characteristic transverse band of pure white across the flipper distinguish it from the blue, sei, and fin whales. Dorsally, the minke is dusky or black-gray with a bluish tinge. It is lighter on the flanks, but usually lacks the ovate spots produced by epiphytic or parasitic organisms that flourish on other balaenopterines while they are in warm waters. Ventrally the minke is porcelain white; however, the ventral grooves sometimes take on a rosy hue owing to the distension of blood vessels.

At sea, the minke can be recognized by its small size, the nearly simultaneous appearance of the blow and the dorsal fin, the sharply pointed head (from which the species derives its name), and the white patch on the flipper. It is the most acrobatic of the balaenopterine whales and often breaches. Its jump is more graceful and arching than the humpback's. Finally, the minke has the habit of approaching ships. Additional general

information on this species may be found in Sergeant (1963), Tomilin (1957), Mitchell (1972a), and Scattergood (1949).

(1) Distribution and habitat preference. The minke is a widely distributed whale, found from the poles to the subtropics (in the Southern Hemisphere it is represented by B. bonaerensis, a very closely related form). In the western North Atlantic it occurs in Davis Strait, Baffin Bay, and Greenland down to 25°N. The frequency of occurrence in the Davis Strait can be described as rare in summer, and in Baffin Bay it is also rare. It is common in the Gulf of St. Lawrence, off Labrador. In New England waters it is most frequent in August, but rare in winter (Tomilin, 1957); Allen, 1916). According to Sergeant (1963) the northwest Atlantic population of minke whales summers along the coast between Cape Cod and Ungava Bay, Labrador, and winters offshore and south to Florida. Allen (1916) compiled 15 certain and 9 possible records of occurrence of this species in New England, 16 of which were from the Gulf of Maine. Of the 15 certain historical records summarized by Scattergood (1949) for the occurrence of this whale along the Atlantic coast of North America, 13 were from the Gulf of Maine. Norton (1930) also found this to be a common whale in Maine waters. Sergeant (1961, 1963) described its presence in eastern Canadian waters and pointed out that almost all individuals recorded from the Gulf of Maine and farther south have been immature, whereas specimens from more northerly areas include many mature specimens. Although this whale is often found far from land, it still appears to stay nearer the shore than do the other rorquals, not counting the humpback (Tomilin, 1957). Sergeant (1963) mentioned that areas of cold, turbulent water may be especially attractive to this species and Allen (1916) noted that it tends to frequent bays, harbors, and shallow waters near shore during its search for herring.

(2) Migration characteristics. In some areas the minke performs regular migrations, but they are not well understood. There probably is a southern movement through or within the Gulf of Maine or outside of it during the winter and a return to these waters in spring. Sergeant (1961) concluded that the population migrates north past Nova Scotia in May, reaching Newfoundland in June and northern Labrador in August, then starting south for winter. Sergeant (1963) judged that the earliest weaning females migrate north earlier than females which calve in August, then starting south for winter. Usually the minke swims alone, less often in couples, and rarely (only in food concentrations) in groups (Tomilin, 1957). When pursuing fish schools it may travel with larger rorquals.

(3) Population density. Historically the minke has been a relatively abundant whale (Scattergood, 1949), no doubt in large part because it was until recently too small for large whaling operations to hunt. Now, with the successive decline of the populations of

blue, fin, and sei whales, the hunting of minkes is taking place at an accelerating rate. The International Whaling Commission established a quota for this species for the first time in 1971. While it is not yet an endangered species, there is serious concern for some stocks of this species if hunting persists. Populations probably still number in the tens of thousands, at least, within the northwestern Atlantic Ocean. The population in the North Pacific is probably less than 46,000 (Mitchell, 1972), but no data are available for the Atlantic Ocean.

(4) Growth and longevity. The minke is about 3 m long at birth (Scattergood, 1949), and is physically mature at 7-8 m (Tomilin, 1957). The time required for maturation may be four years (Tomilin, 1957). In the northwest Atlantic, females reach sexual maturity at 7.3 m and males become mature at 6.7 to 7.0 m (Sergeant, 1963). Along with other balenopterine whales, this species probably lives for decades (Mitchell, 1972), but no data on maximum lifetime are available.

(5) Natural mortality. In addition to the usual assemblage of parasites and disease expected for any wild mammal (Tomilin, 1957), the minke whale is probably subject to predation by killer whales (Orcinas orca), a common problem shared by all whales but perhaps more serious in minkes than in other balenopterines due to its small size and slower swimming speed. In addition, this species (and especially juveniles) are quite prone to entanglement in fishing apparatus and subsequent drowning (Tomilin, 1957).

(6) Reproductive characteristics. Knowledge of the breeding habits is scanty, but in the northwest Atlantic, mating appears to be spread over several winter or early spring months (Sergeant, 1963; Scattergood, 1949). In the North Atlantic Ocean, the pairing season appears to be from January to May; females give birth every year (Christensen, 1972). Gestation occupies about 10 or 11 months. Calving appears to take place from December to February. A calf abandons its mother at 2 years of age and is ready to mate at four years, according to old data cited in Tomilin (1957). Much more information is needed, and research in progress by Dr. Edward Mitchell of the Fisheries Research Board of Canada will help clarify our knowledge of the reproductive cycle of this species in the northwest Atlantic.

(7) Food and feeding. Although these processes are not yet well studied in this species, certain conclusions can be made. Of all the baleen whales, the minke shows the greatest dependence on fish as food (Tomilin, 1957), and its short baleen plates appear to be well-suited to catching them. In northern waters, herring (Clupea sp.) is eaten frequently, and capelin (Mallotus sp.) is also a common food. Other fish such as cod (Gadus sp.), pollock (Pollachius sp.), and whiting (Merlangus sp.) are eaten in European waters (Scattergood, 1949). In Newfoundland, capelin, cod, "red bait" (copepods?), "shrimp"

(euphausiids?), squid (Illex illecebrosus), salmon, and herring are eaten in that order of importance (Sergeant, 1963). The consumption of euphausiids ("krill"), crabs, shrimps, or planktonic crustaceans appears to be less common, at least in the Northern Hemisphere. Beamish and Mitchell (1973) presented evidence that the minke whale produces pulsed audio frequency sounds which could be used for echo-location of fish during feeding.

(8) Aesthetic and economic importance. Although certain local fisheries in Norway, Canada, and Iceland have hunted this species in the past it has usually not been an economical whale to pursue and the commercial value has apparently not been great. It should be mentioned that the minke has been the subject of one of the most barbaric hunting operations in the world in fjords near Bergen, Norway, where individuals were trapped in bays and shot with arrows that had been dipped in the festering sores of a previously caught whale. After a period of time the animal died from blood poisoning and was captured. Up to 20 whales per year were taken this way until rifles were introduced in the 1940's (Scattergood, 1949).

Probably the most valuable qualities of this whale are aesthetic. Its extraordinary tendency to approach ships (Mitchell, 1974) and to perform graceful, acrobatic leaps may provide people of the sea and its shores with breathtaking experiences that will long be remembered. Weighed against this must be its eating of harvestable fish and the occasional damage to fishnets caused by entanglements of this whale during its pursuit of food. One must suspect that the size of herring stocks was probably much larger hundreds of years ago when minke whales were more abundant, leading to the conclusion that whales (and other marine mammals) are not primary or serious reasons for the apparent decline in fish stocks. The damage done to fishing gear is probably scattered and, in toto, rather small.

FAMILY BALAENOPTERIDAE: BLUE WHALE, SULPHUR BOTTOM, Balaenoptera musculus

The blue whale is the largest of all the whales and probably the biggest animal that has ever existed. The average length is 25 m, although the largest record is of a female measuring 31 m long. The weight reaches 150 tons. The color of this species is a mottled, pale blue-gray with black baleen plates and fringes. The body is long and streamlined with a relatively small dorsal fin set far back and with small flippers which are approximately 1/8 of the body length. The numerous ventral grooves are close together and extend from 55 to 58 percent of the body length. This is the only one of the rorqual whales which may consistently show flukes upon sounding (Rice, 1972; Allen, 1916). At sea, it may be identified by its extremely large size and by the long interval (2 to 3 seconds) and long expanse of back that pass between the blow and the appearance of the small fin; and by the numerous patches of light skin which give the whale a mottled appearence.

(1) Distribution and habitat preference. The blue whale is found in the Atlantic, Pacific, and Indian Oceans. There is no exchange of populations between the Northern and Southern Hemispheres and those in the northern population are slightly smaller than those in the southern population (by approximately 1.5 meters at the same age) (Nishiwaki, 1972). In the Southern Hemisphere the blue whale spends its summer in the packed ice area around Antarctica, but there is some disagreement about where it breeds in the winter. While the IUCN Red Data Book (1972) and Pilson and Goldstein (1973), state that this species breeds in temperate waters, and Allen (1916) states that it avoids tropical seas, Nishiwaki (1972) claims that it winters in the warm waters near the equator. Perhaps Tomilin's (1957) suggestion that the wintering grounds of the blue whale in the Southern Hemisphere are in the areas of the subtropics away from navigation routes may account for some of the confusion and lack of information. The Northern population spends its summer in the cold waters of the Arctic seas, but little is known of its breeding grounds. Allen (1916) gives its southward limit as New Jersey.

The occurrence of the blue whale in New England waters is rare. Allen (1916) was only able to find occasional possible records of its presence and no positive record. It appears to prefer cool waters (Rice and Scheffer, 1968) and is usually found north of the Gulf Stream (Allen, 1916). It used to be common in summer in Newfoundland waters and in the Gulf of St. Lawrence, scattering about the Grand Banks in winter. Blue whales still congregate in the St. Lawrence River near the Saguenay River (Dr. E. Mitchell, personal communication). Occasional sightings of blue whales are made at the entrance of Passamaquoddy Bay in summer (Sergeant, 1961). The sightings of blues in the Bay of Fundy during the study of Neave and Wright (1965) are open to question owing to the difficulty of identifying blue whales at sea. The species is best categorized as nearly completely pelagic; however, all four of the relatively small (18-20 m long) blue whales studied by Cummings and Thompson (1971a) off the coast of Chile were in water less than 175 m deep, and one was observed so close to the beach of Guato Island that it was among breaking waves in water estimated to be only 7 m deep.

(2) Migration characteristics. The blue whale travels singly or in pairs and does not seem to gather into large groups (Allen, 1916). In the Southern Hemisphere, this species migrates towards the equator in the fall and remains in this area, where it breeds, until spring. In the spring it moves south to the region around Antarctica. The blue whale population in the Northern Hemisphere spends the winter breeding in the temperate waters north of the equator. Then it migrates to the Arctic Sea in the spring and stays there until the end of summer, when it begins moving south again. The migrations are not well documented.

(3) Population density. In the past years the blue whale population has been greatly decimated because of extensive hunting. Over 350,000 blue whales were killed during modern whaling prior to 1956 (Ruud, 1956). Most hunting was done in the decade of the 1930's. In 1930-31 alone, 28,235 blue whales were killed in the Antarctic (Pilson and Goldstein, 1973). The species has declined from an original worldwide population of about 200,000 in the 1900's before intensive pelagic whaling concentrated on it, to about 15,000 in the Southern Hemisphere, 1,500 in the North Pacific, and only a few hundred in the North Atlantic (Rice, 1972). Allen (1970) concluded that the initial stock size in the northwest Atlantic was slightly over 1,100 blue whales. Mitchell (1974) noted that the blue whale population in this area has not recovered from overexploitation as rapidly as has the humpback whale. The species is now fully protected worldwide by the member nations of the International Whaling Commission; however, some hunting may still go on off the South American coast. All stocks are seriously reduced in numbers, and even with full protection it will be on the order of 50 years before the blue whale is once again abundant. During the 1960's and early 1970's, many authors expressed the fear that the blue whale might become extinct. Now that some stocks appear to be increasing slowly, there is reason to hope that that possibility has been averted.

(4) Growth and longevity. The life expectancy of this species is perhaps 90 years and rarely over 100 (Nishiwaki, 1972). At birth the calf is about 7.5 m long and weighs 2,500 kg. It gains about 90 kg per day and reaches 15-17 m and 22,700 kg by age seven months, when it is weaned (Ruud, Jonsgard, and Ottestad, 1950).

(5) Reproduction characteristics. Extimates of the time of sexual maturity for the blue whale vary from 4-5 years (male) and 5-6 years (female) (Harrison, 1969) to 10 years (Rice, 1972). The pregnancy lasts from 10 to 11 months, and in the Southern Hemisphere birth takes place in temperate seas during July and August. The lactating mother and calf then travel together for approximately 12 months. After weaning the female can be impregnated again for the following winter (Nishiwaki, 1972). The average female will give birth every 2 or 3 years. In the Northern Hemisphere this species also breeds in temperate waters in the winter months. Twins occur in 0.7 percent of births (Harrison, 1969).

(6) Food and feeding methods. Most of the feeding is done in the summer in the regions near the Antarctic and the Arctic, where the blue whale is able to find swarms of planktonic food. Food may be echolocated (Beamish and Mitchell, 1971). The blue whale eats by taking in huge amounts of water where the food is swarming and then discharging the water through the baleen plates, using the large,

flabby tongue. The food becomes caught on the inside of the rough fringes of the short, tough baleen plates. In the Antarctic the major diet items of this species are Euphausia crystallorophias, Euphausia superba, Thysanoessa macrura, and Thysanoessa viana. In the Arctic, euphausiids make up the main part of the diet (Nemoto, 1970). The blue whale has possibly the shortest food chain of all the baleen whales. It consists of phytoplankton→ herbivorous euphausiids→ blue whale (Mackintosh, 1965). Furthermore, of all the balaenopterine whales, blues are the most stenophagous, rarely eating anything besides euphausiids (Rice, 1972; Beamish and Mitchell, 1971). Beamish and Mitchell (1971) recorded narrow band sound pulses of frequencies between 21 and 31 kHz in the presence of a blue whale and suggested that the sounds could be used for echolocating euphausiids. However, Cummings and Thompson (1971a) recorded only low frequency moans of frequencies 14-222 Hz which they felt would not be suitable for echolocating planktonic crustaceans. Instead, they suggested that those sounds could be used for long-distance communication. They also noted that the moans were the most powerful sustained utterances known from whales or any other living source.

(7) Indications of environmental stress. Other than evidence of severely depleted population size due to hunting, no data are available.

(8) Aesthetic and economic importance. In the modern history of whaling the blue whale has been the most valuable to the whaling industry, since one whale along yielded 20 tons of oil, plus tons of meat and byproducts. Between 1900 and 1950, approximately 25 million tons of blue whales were taken in the Antarctic. However, because of the present scarcity, this species is now of little economic importance and since 1967 has had complete worldwide protection (Rice, 1968). The fact that this whale is the largest animal ever to have inhabited this planet must certainly confer upon it a unique aesthetic and biological value.

FAMILY BALAENOPTERIDAE: SEI WHALE, POLLOCK WHALE, RUDOLPH'S RORQUAL, Balaenoptera borealis

The body plan of the sei whale is similar to that of the other whales in the genus Balaenoptera, but its coloration may be somewhat more variable between individuals. The back of the sei whale is a dark gray with a bluish tinge. The flanks are lighter, often with small, bright spots, and the belly is a light gray with a patch of white. The inner surface of the flippers and the undersides of the flukes are gray, and the baleen plates are black with fringes of fine, white bristles. The flippers are smaller, relative to the body, than in other rorquals. The dorsal fin, however, is relatively large. It is triangular in shape and curved backwards. The largest sei whales recorded in the International Whaling Statistics are an 18.5 m male and a 20 m female. More recently the largest caught are 15 to 16 m in length (Nishiwaki, 1972). The sei whales

in the Northern Hemisphere are about 2 m shorter than those in the Southern Hemisphere (Tomilin, 1957).

(1) Distribution and habitat preference. According to Kellogg (1929), sei whales have a "roving disposition and occur sporadically in large numbers from time to time at widely scattered localities." This is a cosmopolitan species; however, in neither hemisphere does it seem to frequent as high latitudes as do other rorquals. It is rarely seen in the packed ice regions (Nishiwaki, 1972; Tomilin, 1957). It spends its winter in temperate seas, but is also seen in small numbers in tropical areas where it is more abundant than are other rorquals. Within the North Atlantic, the sei whale seems to be commonest in the waters of Northern Europe (Allen, 1916). This species does not frequent the coasts and is rarely seen in New England waters, perhaps because it bypasses the region during its migration (Pilson and Goldstein, 1973). However, it may actually be more numerous than the records show, as it can easily be mistaken for a fin whale. In fact, experienced whale scientists are often very skeptical that this species can be positively identified at sea. The records of Neave and Wright's (1968) study are certainly suspect. However, Beamish and Mitchell's (1971) sightings of two on the south edge of Sable Bank in late May, 1969, are reliable. The only stranding and the only possible sighting known to Allen (1916) for this species in New England, occurred in August, but both occurred on the south shore of Cape Cod. Sightings in eastern Canada (Sergeant, 1961) have also occurred in August. A herd of up to 2,000 sei whales has been reported to frequent waters southeast of Cape Sable, Nova Scotia.

(2) Migration characteristics. The migration cycle of the sei whale is probably generally similar to that of other rorquals, but it is not well known. For example, neither the geographic limits, migration, nor ranges of the sei whale population that was fished at Blandford, Nova Scotia are known (Mitchell, 1972c). The sei whale appears to spend summers in higher latitudes, and remains during winters in temperate and subtropical waters. However, according to Tomilin (1957), the movements of this species may differ from those of other rorquals in several respects. First, the sei appears later in the high latitudes than do other species. For example, its peak appearance in Antarctica is in February and March as opposed to January and February for the larger baleen whales (Mackintosh, 1965). Second, it has lower tolerance for cold and makes less distant migrations in the summer. Third, it concentrates in the regions of warm currents in the temperate and temperately cold belt. Fourth, the migrations of the sei whale are much less regular than those of other rorquals and migration paths may undergo large, sudden fluctuations in regions affected by warmer currents. According to Mitchell (1972a) sei whales tend to travel in groups of about 10; but Tomilin (1957) records that they occur mostly alone or in pairs, except when food is abundant, at which times groups of 50 or more may congregate. Although they may graze in company with right

whales (Nemoto, 1970), there is apparently a mutual exclusiveness between the distribution of sei whales and of the other rorquals. This is probably explained by the different prey size requirement as described below (Tomilin, 1957).

(3) Population density. In 1971 the estimated population of the sei whale in the North Pacific was 46,000 (Mitchell, 1972a). No estimates for other areas seem to be available.

(4) Growth and longevity. No sei whales have been found older than 70 years (Nishiwaki, 1972), suggesting that the life span might be shorter than that of either the blue whale or the fin whale. Newborn sei whales are 4.3 to 5.3 m long and they grow at the rate of about 2 cm per day. According to Nishiwaki (1972), sexual maturity is attained at lengths of 12 m for males and 12.8-13.5 m for females, and physical maturity is attained at 10 to 11 years of age. However, at the Blandford, Nova Scotia whaling station, where an average of 114 sei whales were taken from 1968-1970, most mature females were at least 15.1 m long.

(5) Natural mortality. According to Tomilin (1957), the sei whale is one of the fastest whales and is probably not bothered by killer whales. However, no data are available on the relative swimming speeds of the two species.

(6) Reproduction characteristics. Sei whales become sexually mature by at least 18 months of age, and begin to mate in the second year of life (Tomilin, 1957). Gestation lasts for 10 to 12 months (Mackintosh, 1965), and lactation for approximately 5 months. Females generally give birth every 2 years with a 6 to 7 month interval between lactation and conception (Tomilin, 1957). Sexual activity continues the year round; however, the peak mating periods are January and February in the Northern Hemisphere, and July and August in the Southern Hemisphere.

(7) Food and feeding methods. The sei whale has the typical rorqual baleen: short, tough plates with rough fringes. However, both plates and fringes are more delicate than those of the blue whale or the fin whale, allowing the capture of smaller food species. In the Southern Hemisphere the sei feeds on various plankton, including carnivorous amphipods (Parathemisto gaudichaudi), herbivorous copepods (Drepanopus pectinatus, etc.), and also zooplankton, including the decapod Munida gregaria (Lobster krill). All of these are found in the Antarctic and subtropical convergences, and this is the reason that the sei does not move into higher latitudes (Nemoto, 1970). In the North Pacific, the sei feeds on copepods (Calanus plumchris). The diet of the sei in order of importance is made up of: copepods>amphipods>euphausiids>swarming fish>squid. Its "food chain" is: small phytoplankton→ protozoa, larvae of zoo-

plankton, small copepods→ carnivorous amphipods→ sei whale (Nemoto, 1970). In the North Atlantic the sei whale is very closely associated with the crustacean Calanus finmarchicus (Allen, 1916; Tomilin, 1957).

The sei uses two methods of feeding. The first, which is used for food that is swarming, is to swallow large amounts of water and then to use the tongue to discharge it through the baleen plates where the food becomes stuck on the inner surfaces. The second method, which is used when food is more sparse, is to swim along the surface with an open mouth. This method could subject the animal to stress from any surface pollution of the ocean, including oil, plastic wastes, or pollutants accumulated in the surface monolayer (MacIntyre, 1974). When skimming for crustaceans, the sei whale may swim slowly at a depth of 1 m, covering a distance of 15 to 20 m at a time, and rolling gently from side to side so that the left and right margins of its upper lip alternately touch the surface. After seven minutes of such swimming, the whale rolls on its side (Tomilin, 1957). The respiratory rate of sei whales is much more even and constant than that of other rorquals, according to Mitchell (1972a), because it does not dive deeply and stays near the surface.

The sei whale is less well adapted to feeding on fish than are fins or humpbacks and uses a different method on the unusual occasions when it does so. It does not make sudden half turns around the body axis, but instead pursues fish at the surface with its dorsal fin exposed. Although fish such as capelin, walleye pollock, Arctic cod, sand lances, anchovies and sardines are taken in various locations, copepods - and especially Calanus species - remain the overwhelmingly important diet item. Tomilin (1957) suggested that this whale probably evolved in the North Atlantic, since it is here that the structure of its baleen is best adapted to the small size of the local food.

(8) Indications of environmental stress. Although the sei whale is not listed in the IUCN Red Data Book (1972), it is listed on the U.S. Department of the Interior's Endangered Species List of 1971, as are all the baleen whales except the minke, owing to the serious decline in population numbers from overhunting. As blue and fin whales became rarer, attention turned to sei whales, whose catches increased dramatically, starting in the middle 1950's (Mitchell, 1972a; Mackintosh, 1965). Canada's three whaling stations began catching sei whales in 1966. In 1968, 104 were caught. Canada stopped all East Coast whaling in December, 1972. Although our Gulf of Maine population is now apparently safe from hunting, the sei whale is under heavy pressure in other areas of the world.

(9) Aesthetic and economic importance. In 1938 the sei whale was rarely hunted because of its small size, but as other species declined the

sei has grown in economic importance. The sei is now among the 8 species commercially most important in the world (Pilson and Goldstein, 1973). An average of 114 sei whales were taken at Blandford Land Station in Nova Scotia each year from 1968-1972. The world catch in 1970-71 was 11,051 sei whales (Pilson and Goldstein, 1973).

FAMILY BALAENOPTERIDAE: HUMPBACK WHALE, Megaptera novaengliae

The humpback whale has a short, fat body with long flippers that are approximately 1/4 the length of its body. The color is dark, with some unpigmented skin on the ventral side whose extent varies among individuals. Coloration in this species is quite variable (Tomilin, 1957). The North Atlantic population is distinguished by the huge, pure white flippers, which are a striking field mark and help in the identification of this whale at sea. The edges of the tail and flippers are irregular and the head, snout, and flippers are covered with knoblike swellings each of which contains a sensory hair. The dorsal fin is small and set fairly far back. The ventral grooves, which extend back to the navel, are widely spaced, with only 12 to 36 grooves as compared with the Balaenopterine whales, which all have more than 40 grooves. The largest humpback recorded was a 19 m female although at present the average seems to be closer to 15 m (Nishiwaki, 1972). The species is also characterized by its acrobatic behavior. This includes frequent breaching (leaping completely out of the water) followed by rolling over onto the back, rolling on the water surface, and turning somersaults under and above water. The humpback usually shows its flukes before sounding, and their irregular trailing margins make a good field mark. This species is known to follow or play alongside ships for long periods (Tomilin, 1957).

(1) Distribution and habitat preference. The range of the humpback is very large, comprising almost all of the oceans between the Arctic and Antarctic. The range in both hemispheres is from the poles to the tropics (Tomilin, 1957). There are 6 separate populations within the Southern Hemisphere, but there is little exchange across the equator (Mackintosh, 1965). Similarly, there are probably a number of separate stocks within the Atlantic Ocean, but their identity and relationships are not yet well known. Within the Gulf of Maine the species is well known from strandings and, expecially, from live sightings at sea (Allen, 1916; Norton, 1930). Most of the records are of schools seen about Nantucket Shoals, on the Georges Banks or off Provincetown and the outer parts of Massachusetts Bay (Allen, 1916). Allen (1916) included records of sightings of large schools of humpbacks near Cape Elizabeth, Maine (June, 1841); in the Bay of Fundy near Grand Manan Island (July-early August, 1859); and of over a hundred humpback individuals or pairs seen during a cruise from the Isles of Shoals to Nova Scotia (September 4-6, 1903). Norton (1930) included one observation of a herd of about 100 humpbacks inside of Stratton's Island near Portland, Maine.

Tomilin (1957) characterized this species as living close to land, although it can be found in the deep ocean. Tomilin (1957) furthermore suggested that the long flippers may help these whales to free themselves if they become beached in shallow water, and furthermore that individuals may be helped out of such situations by other whales. Voice communication is apparently used (compare Mowat, 1972). Schevill and Backus (1960) observed a daily patrol by a humpback of a fixed area near Portland, Maine over a 10-day period, sometimes only one or two miles from land.

(2) Migration characteristics. In general, the humpback migrates along well-defined routes, generally close to the coast (Tomilin, 1957), however the tracing of movements of specific stocks or herds in the northwest Atlantic is not yet possible due to lack of information. In both hemispheres this species arrives in the polar regions in the summer to feed, and begins returning to the tropics in the early fall. It reaches its tropical breeding grounds in mid-winter and remains there until early spring (Kellogg, 1929). Northward and southward migrations each take about 2 months. Five and one-half months are thus spent on the feeding grounds and a little over one month on the breeding grounds (Wolman, 1972). Humpbacks usually travel in pods of 2 to 5 individuals, and the average rate is less than 4 knots (Wolman, 1972). Apparently males and barren females leave the wintering grounds (near Bermuda and the Greater Antilles) first and are later followed by the lactating females and newborn calves.

From Massachusetts to Maine, humpbacks first appear in April and May (Kellogg, 1929) and large herds seen about 200 miles offshore in April probably indicate that many humpbacks travel over the banks rather than entering the Gulf of Maine. Later migrants remain offshore of New England instead of going north to Newfoundland, Greenland, or Iceland (Tomilin, 1957). The southward migration may be more gradual, and may also take place largely offshore. According to Kellogg (1929), humpbacks have been observed off the New England Coast as late as October, with one December record for Massachusetts.

(3) Population density. Before exploitation by hunting, the humpback whale population probably numbered from 40,000 to 50,000 in the Southern Hemisphere and somewhat less in the Northern Hemisphere (Wolman, 1972). Sources generally agree that the present world population is under 10,000. The IUCN Red Data Book (1972) gives the total population as 7,000 to 8,000 while Wolman's figure is 5,000 (Wolman, 1972). Since 1966, this species has enjoyed world-wide protection. Within the northwestern Atlantic Ocean, Allen (1970) estimated the population to be 1500 on the basis of cumulative catch data, but a large scale strip census survey from shipboard which covered over 6 million square nautical miles yielded only 96 sight-

ings during spring and summer, 1966-1969, leading to a population estimate of 1259 (Mitchell, 1973b). The interrelationships among stocks from the Caribbean, Bermuda, the eastern U.S., the Nova Scotian shelf, and the Grand Banks are not yet clear.

(4) Growth and longevity. According to Tomilin (1957), individuals live at least to 20 to 22 years, judging by old harpoons found in their bodies; but they probably can live much longer.

(5) Reproduction characteristics. Sexual maturity of the North Pacific humpback is attained at the age of two years and physical maturity at the age of 10 years (Tomilin, 1957). Females are polyestrous and may ovulate 5 times per year. The gestation period is 11 to 12 months and lactation lasts 11 months. Females generally bear a calf every 2 or 3 years, and only rarely 2 years in succession. Birth appears to be in mid to late winter in the northwest Atlantic, where newborn calves have been sighted off Puerto Rico in February, 1969, and one suckling calf has been seen on the Grand Bank on 8 March 1961 (Mitchell, 1974). In the Southern Hemisphere, breeding peaks in August (Mackintosh, 1965) in areas very close to the equator (Tomilin, 1957). In the Northern Hemisphere, the peak is between October and December in latitude 10°N to 20°N (Nishiwaki, 1972). A newborn humpback measures 4.5 to 5 m in length. Its rate of growth is somewhere between 17 cm and 45 cm per month. The incidence of twins is about 0.5 percent (Tomilin, 1957). Maternal instinct is exceptionally strong in humpbacks, and females will not abandon calves even in extreme danger. Weaning occurs when calves are 8 to 9 m long. Growth decelerates after weaning. Calves stay with their mothers at least for a year, and perhaps longer. It now appears that the main calving area for perhaps half of the northwest Atlantic population of humpacks is in the Navidad Bank-Silver Bank area off the Dominican Republic, where up to 700 whales have been seen.

(6) Food and feeding methods. The ash black baleen plates of the humpback are short and tough with rough baleen fringes. The main foods are euphausiids and gregarious fish, both of which can form swarms. The humpback eats by taking in large mouthfuls of water and food, then discharging the water through the baleen plates, where the food becomes caught, by using the tongue as a plunger (Nemoto, 1970). In the North Atlantic, humpbacks are known to eat the euphausiids Thysanoessa inermis and Meganyctiphanes norvegica, herring, capelin, and rarely, cephalopods and pteropod molluscs. Euphausiids appear to be more important to the diet than fish in this area. Southwell (1904) described a humpback whale that was found dead near Scotland, apparently after eating too many cormorants, which had perhaps been swallowed accidentally.

(7) Aesthetic and economic value. The humpback was one of the most

important species to commercial whalers. It was easy to catch, because of its slow movement, coastal habitat, and lack of fear of humans. A small fishery for humpback whales used to be carried on near Seguin Island, Portland, Maine (Norton, 1930) and Clark (1887) noted that whalers out of Wellfleet, Massachusetts used to sail to the Mt. Desert Island region for humpback whaling. From 1810-1860, humpbacks were the main object of the Maine shore whaling stations at Prospect Harbor, Tremont, and Winter Harbor (Allen, 1916). Additional humpback whaling along the coast of Cape Cod also occurred during the 18th and 19th centuries. Between 1909 and 1947, 11.4 percent o 902,000 whales killed in the world were humpbacks (Tomilin, 1957). As a result of extreme overfishing, many populations of the species have been decimated and since 1966 the species has had complete protection, so that it is now of no direct economic importance. Populations of humpback whales are growing very slowly, if at all, and even under full protection many will take as long as 50 years to recover maximum sustainable yield levels (Allen, 1973; Wolman, 1972).

Vocalization ability is remarkable, consisting of a wide range of tones and an extensive vocabulary. The "song" consists of long sequences of phrases repeated in series of up to one-half hour's duration (Wolman, 1972). The "songs", which are the subject of scientific studies (Payne and McVay, 1971), are available on several popular recordings (Capitol Records, 1971; Hovaness, 1970). There is no evidence that humpbacks sing while in New England waters, and all recordings of complex sounds have been made around the presumed breeding area near Bermuda or in the Caribbean. Dr. Howard Winn of the University of Rhode Island is trying to detect dialects in the vocalizations of humpbacks to make an estimate of the population size in the West Indies (Anonymous, 1971). The songs of the humpback whale have probably kindled public interest in whale conservation more than any other discovery, with the possible exception of Lilly's (1961, 1967) early work on Tursiops.

Finally, the acrobatic nature of this whale (Millais, 1973), its striking coloration and morphology, and its habit of playing around or following ships earned it the nickname of "veselyi kit" -- "the merry whale" -- among Russian whalers (Tomilin, 1957). One can hope that this interesting and inspirational species will recover from human depredations and will once again enliven our waters with its abundant presence. The possibility for making the Navidad Bank-Silver Bank area a humpback whale reserve has occasionally been mentioned.

(8) Indications of environmental stress. Samples taken by Mitchell (1973b) are being analyzed for pesticide and heavy metal residues, but no data are yet available.

FAMILY BALAENIDAE: RIGHT WHALE, BISCAYAN RIGHT WHALE, NORTH ATLANTIC RIGHT WHALE, Eubalaena glacialis glacialis

This species is easily recognized by its thick, stout body, arched jaw, the absence of a dorsal fin, and by the large, light-colored wart-like calluses or "bonnets" which adorn the anterior of the upper jaw and various other positions around the blowhole, eye, and lower jaw. Individual whales have somewhat distinctive patterns of bonnet arrangement. The baleen plates are olive black, and the body is a deep ebony black. The maximum recorded length for an Atlantic right whale is 16.5 m.

It is called the "right whale" because it was traditionally the right whale to hunt, owing to its large yield of oil and whalebone, slow swimming speed, and tendency to float when killed. In the Atlantic Ocean, this species was hunted for at least 1,000 years, and it and the humpback (Megaptera novaeangliae) were the two whales most commonly hunted by earliest colonial whalers in America. However, by 1750 right whaling had already been nearly abandoned at Cape Cod due to the lack of whales (Allen, 1916).

Nishiwaki (1972) and Tomilin (1957) provide additional general information on this species, and Allen (1916) includes a wealth of biological and historical data on the right whale in New England waters.

(1) Distribution and habitat preference. The right whale is found in temperate waters of the North Atlantic Ocean and once was distributed from the Gulf of St. Lawrence to Florida (Clark, 1887; True, 1904; Allen, 1916; Tomilin, 1957); however, it is absent in the tropics, and it avoids the ice of latitudes higher than about 70°N. Following centuries of depredation by hunting, this whale was protected in 1937 by international agreement; however, it still remains an endangered and fully protected species (IUCN, 1972). The population now appears to be recovering and can once again be seen in New England waters, although it will be many years before this whale regains its former abundance here (Allen, 1916). Between 1620 and 1913, Allen (1916) recorded over 50 instances of sighting or capture of right whales in New England waters, 22 of them from the Gulf of Maine. Most records were made between February and May, and less frequently between June and September. Waters and Rivard (1962) reported an increase in numbers in Massachusetts, and in Cape Cod Bay a herd of 30 to 50 individuals can sometimes be seen. In addition to summarizing sightings south of Cape Cod, Pilson and Goldstein (1973) listed sightings of a school off Cape Cod in 1953, an individual at Cape Cod Canal in June, 1957, and a school in Cape Cod Bay in May, 1959 and May, 1961. Watkins and Schevill (1972) recorded the sounds from members of a herd of 20 right whales in Cape Cod Bay in May, 1970.

Whereas Allen (1916) listed no sightings from along the Maine coast

and considered it rare in this area (perhaps owing to lower productivity in the northern portion of the Gulf of Maine), Norton (1930) listed one stranding in summer, 1919, in Sheepscot Bay. Recently, Arnold and Gaskin (1972) sighted at least five E. glacialis in the Bay of Fundy in late August, 1971. The photograph of a right whale which appeared in the Calais, Maine Advertiser for September 2, 1971 could be one of that group. Neave and Wright (1968) included the record of a herd of 15 right whales in the Bay of Fundy during August, 1968, and although that report was criticized by Schevill (1968) with good reason, the additional comments of Neave and Wright (1969) lend support to the record. Residents of Eastport and Lubec, Maine, claim that right whales often appear near the West Quoddy Head Lightstation during August and may engage in mating activity. However, the whales were not seen in 1973. Most recently, one E. glacialis was observed for 3 hours from Mt. Desert Rock Lightstation, July 12, 1973 (Katona, et al., in preparation).

(2) Migration characteristics. Although Allen (1916) noted that this whale migrates individually, in pairs, or in very small groups of 3 to 5 individuals, the recent sightings of herds indicate that larger groupings can be expected more commonly as the species becomes more numerous. Allen's (1916) observations indicate that the northward migration began to pass through Massachusetts waters in January, became stronger in February and March, and peaked in April. Southbound right whales appeared to pass that coast in November. E. glacialis appears to migrate through the Gulf of Maine in early spring on its way to feeding grounds around the Grand Bank, Newfoundland, the mouth of Davis Strait, Iceland, the Faero Islands, and the Hebrides. However, as Allen (1916) pointed out, most right whales probably bypass the Gulf of Maine. In late summer and autumn, they return to warmer temperate waters, probably including Florida, Bermuda, the coasts of Georgia and the Carolinas (Caldwell and Golley, 1965), and possibly Massachusetts Bay (Allen, 1916).

(3) Population density. This whale is still exceedingly rare everywhere in its range. The northwest Atlantic stock was hunted as early as 1631, and by 1750 the right whale fishery off the United States had collapsed (Allen, 1908) owing to the drastic decline of the stock. Mitchell (1974) summarized evidence that the population may possibly be recovering slowly both in the southern and northern limits of its range, however the population still appears to be only in the tens of individuals in the region off eastern Canada during summer. The total population inhabiting the waters of eastern North America and eastern Canada has been estimated variously as less than several hundred and perhaps less than 100 (IUCN, 1972).

(4) Growth and longevity. Newborn calves measure 4.5 to 6 m in length. There are practically no data on growth rate (Tomilin, 1957). Sexual

maturity is attained in 3 to 5 years (Nishiwaki, 1972).

(5) Natural mortality. Attacks by killer whales may occur (Allen, 1916), but are poorly documented (Tomilin, 1957).

(6) Reproduction characteristics. Like other baleen whales, the right whale female calves once every two years after a gestation period of about one year. Mating occurs in May to July, and birth from January to March. Pregnant females tend to remain apart from the rest of the stock (Tomilin, 1957). Calving probably occurs in still waters near shore (Tomilin, 1957; Payne, Curtsinger, and Nicklin, 1972). The exact location of calving grounds is not known. Lactating females have very well developed maternal instincts and apparently refuse to abandon sucklings even after death (Tomilin, 1957).

(7) Food and feeding methods. The baleen of this whale is very finely fringed, allowing it to strain small plankton animals from the water, and its diet correspondingly consists of copepods, especially Calanus finmarchicus (3-6 mm) and less commonly, euphausiids such as Thysanoessa inermis (16 mm). Occasionally pteropod molluscs are taken. The right whale sometimes grazes in company with the sei whale. It is important to note that the method of feeding is quite different from the "gulping" strategy of most balaenopterine whales. The right whale is a "skimmer", cruising along the surface with its mouth open and continuously filtering out food (Nemoto, 1970). This suggests that the right whale is probably much more vulnerable to any pollution of the ocean surface than are whales which feed underwater. Pollution of the ocean surface with oil could possibly affect this whale in a serious way, although no data are currently available. Similarly, the accumulation of pollutants in the organic surface microlayer of the ocean (MacIntyre, 1974) could affect this whale more than other species.

(8) Indications of environmental stress. Other than the drastically reduced populations of this species, owing to over hunting, no data are available.

(9) Aesthetic and economic importance. Prior to the adoption of steam-powered whaling vessels and the invention of the explosive harpoon, this whale was a mainstay of the whaling industry. After intensive hunting by many nations (starting in the 9th century), the North Atlantic population was decimated by the 18th century, and whalers turned to its Arctic relative, the Greenland right whale (Balaena mysticetus). Very few have been killed in the last 80 years, because few were left alive. In the old days these whales yielded up to 18 tons of oil and up to 600 kg of whalebone each. The species probably will not be commercially important in the near future, and its return to abundance will have to be encouraged for non-monetary

reasons. Among these might be its occasionally acrobatic nature, its unique morphology, the possibility that it might produce complex sounds and communicate vocally, and for related scientific and aesthetic reasons.

FAMILY PHYSETERIDAE: SPERM WHALE, SPERMACETI, CACHALOT, Physeter catodon

The sperm whale is the largest of all the toothed whales (Order Odontoceti). Males may reach a length of 18.3 m, although a 15.2 m length is more common. The females are significantly smaller than the males (as is the case in most Odontocetes) and average under 11.3 m. The head is massive and makes up from 1/4 to 1/3 of the body length. Most of the volume of the head is made up of the barrel-shaped spermaceti organ, called the case, which contains the spermaceti. The spermaceti is the sperm whale "oil." Although it is a clear liquid when heated (or refined), it has a white paraffin-like consistency when cooled.

There are 50 teeth on the long, narrow, lower jaw, 25 on each side. The upper jaw contains cavities into which the teeth fit, however it sometimes contains several rudimentary teeth which do not show outside the gums. The whale does not possess a dorsal fin, but instead has a somewhat rectangular hump or dorsal prominence set near the back of the body. Females appear to have a "callus" on the hump which adult males lack (Kasuya and Ohsumi, 1966). The flippers are relatively short and round. One of the unique characteristics of the sperm whale is that the blowhole, which is single as in all the Odontocete whales, is offset toward the left side of the head. The color of the adult body is generally slate gray above with a paler shade of gray on the abdomen. A young sperm whale is light colored, but grows darker as it matures and then becomes faded and light again when it grows old. The skin around the mouth is particularly pale and is almost white. In all sperm whales, the skin has a wrinkled, corrugated appearance that is distinctive.

(1) Distribution and niche preference. The sperm whale lives in all oceans of the world, and its range extends from the equator to both the North and South Poles. However, the distribution of males and females is quite different. While females tend to remain between the latitudes 45°N and 45°S and to perform abbreviated migrations (Tomilin, 1957), males annually migrate from tropical waters to the polar regions (Rice, 1971). The females, including those that are pregnant or lactating, along with juveniles of both sexes, tend to congregate in groups called "nursery schools," which may number from 10 to several hundred whales, and average 25 individuals. After weaning, some young whales may form "juvenile schools" (Ohsumi, 1971). After attaining puberty (9 years), males gradually leave their nursery or juvenile schools to form "bachelor schools" containing 10 whales or less. During the breeding season, eligible males (males may start breeding at age 25) apparently vie with each other to join

a nursery school and to breed with the mature females. Such a group is then called a "harem" when it includes a bull. Old "socially mature" males form small "bull schools" or live alone. Harem bulls probably leave the nursery school at the end of the breeding season and live alone or in a "bull school" until the next season (Ohsumi, 1971; Rice, 1971). The behavioral repertoire of the species is quite varied (Gambell, 1968; Gaskin, 1964; Ashley, 1944) and requires further study.

While Nishiwaki (1967) states that no sperm whale marked in one hemisphere has been sighted in the other, Mackintosh (1965) claims that the world population is not segregated into northern and southern stocks. Instead he suggests that the population is separated into Atlantic, Pacific, and Indian Ocean stocks with some mingling at the southern ends of the continents. Bennet (1840) claimed that sperm whales are fond of areas where there are powerful currents or where currents flow in opposite directions.

The sperm whale is seen only rarely in New England waters. It is generally an oceanic whale, found in deep water; however, it is not uncommon in coastal waters in some areas. The bulk of the population generally is located south of our waters. Although males do migrate to high latitudes, they probably migrate along the continental slope, and they may follow the Gulf Stream or stay outside of the Gulf of Maine for other reasons. Only a few records of the sperm whale are available since its first description here in 1668 by Josselyn (1674), including Norton's (1930) listing of 3 seen in 1918 south of Monhegan Island. In October, 1968, a live female sperm whale stranded at Seawall on Mt. Desert Island and died. During the summer of 1973, one enterprising mariner chased a sperm in the region of Provincetown in an attempt to kill it for its teeth (Malcolm Jones, personal communication).

Evidently the Micmac Indians of the Passamaquoddy Bay region had a name for the sperm whale (Ded-men-ak-part = "head cut off squarely or sharply") and Piers (1923) suggested that the species may have been somewhat more common along the Nova Scotia coast in past times.

(2) Migration characteristics. The migration pattern of the sperm whale is unique among all the cetaceans. Much of the population, including all the females and juveniles, as well as the males involved in mating appear to remain within temperate waters all year round (Rice, 1971). Short migrations are made in the spring, northward in the Northern Hemisphere and southward in the southern (Tomilin, 1957). Unlike other cetaceans, mating is done in spring and early summer, and this prevents the mating males from moving to colder waters during the warm periods, as usually occurs in the other large cetaceans.

The males not involved in mating also migrate in the spring, but

their migrations are far more extensive, and they spend their summers in the polar regions. They return to lower latitudes in the fall (Tomilin, 1957). Little is known of the migration routes. The extent to which the non-breeding males become separated from the rest of the population is still not clear.

(3) Population density. The total population of all ages in the northwest Atlantic is estimated to be about 22,000. Evidently far fewer sperm whales inhabit our seas than live in the North Pacific (70,000 males; 184,000 females) or southern oceans (128,000 males; 295,000 females) (Dent, 1973). The sperm whale has been only lightly exploited in the North Atlantic since the mid-19th century, and complete cessation of whaling would probably permit a slow return to pre-whaling population size (Allen, 1973). Few published records exist for the sperm whale in the Gulf of Maine, probably because it stays farther out to sea during migrations.

(4) Growth and longevity. Calves are about 4.0 m long at birth. Females mature sexually at about 8 to 11 years of age and at a length of 11.0 to 11.5 m. Males reach sexual maturity at 10.0 to 11.9 m (Ohsumi, 1971; Dent, 1973) and at 19 to 25 years of age. At 25 years, males are "socially mature." Males continue growing until they are 15.5 to 16.8 m long. Both sexes can live to be 70 years old (Ohsumi, 1966).

(5) Reproduction characteristics. Many aspects of reproduction are still unclear in this species, and there is some disagreement on statistics among authors. The sperm whale is polygamous, and during the mating season, harems are formed, composed of from 10 to several hundred females and juveniles and from one to several breeding males. The female comes into heat in the spring or early summer. Judging from the scars and tooth marks found on mature males, battles over females may occur commonly (Ohsumi, 1971) and Hopkins (1922) witnessed and described a serious battle between two males which left one with severe injuries. One bull may service 14 sexually mature females on the average (Ohsumi, 1971). Gestation lasts 16 months in the Southern Hemisphere; however, it may be shorter by four months in the Northern Hemisphere (Rice, 1971; Tomilin, 1957). Estimates of the length of the lactation period vary from 6 months (Tomilin, 1957) to 13 months (Ommanney, 1971; Nishiwaki, 1972) to 2 years (Rice, 1971). The relationship between cows and calves is very close, and mothers will not desert a wounded calf. Calves are weaned at about 6.7 m length.

Females go through a period of sexual inactivity after calving, but there is disagreement about the average interval between calves. Estimates include every two years (Tomilin, 1957), every three years (Ommanney, 1971) and every four or five years (Rice, 1971).

(6) Food and feeding. The main food of this species is squid, particularly the larger species (Rice, 1971). The mouth of the sperm whale seems to be particularly adapted for seizing slippery cephalopods, but the sharp teeth are apparently not used for chewing. Many authors believe that the sperm whale must battle with some of the larger squid, which may reach 18 m in length. This is suggested by the scars left by the suckers of squid around the mouth and body of many sperm whales (Tomilin, 1957). In order to catch the squid, sperms must dive to tremendous depths. They are probably the deepest diving whales. Drowned sperms have been found entangled in submarine cables 3,720 feet deep (Rice, 1971). Sperm whales can remain underwater for at least an hour.

Sperm whales may feed most frequently at night (Gaskin, 1967). At any rate, there is no sunlight at the depths where the sperm whale usually hunts squid, and it relies strongly on a well-developed echo-location system. The whale emits clicks at a rate of 6 per second and the encased spermaceti may somehow act to focus these pulses (Rice, 1971). Additional information on the sperm whale's sonic capabilities is given by Backus and Schevill (1966). Gaskin (1967) contends that the sperm whale could not possibly support its huge food requirements by hunting individual squids, even if it does have the ability to locate them. He hypothesized that the whales may take advantage of the luminescent secretions of some squids in the following manner. The whale could echolocate a squid, catch it, and allow some of the luminescent material to remain between its teeth. The whale could then hang motionless in the water with its mouth open and let the light lure other squids to it. This energy-saving mechanism would be analogous to the use of luminescent lures by some fish, for example, the deep sea angler fish. Heezen and Hollister (1971) presented additional evidence that sperm whales may also plow furrows in the bottom with their lower jaws in search of food, which would explain the propensity of this species to become entangled in cables lying on the sea floor. One must conclude that much more information is needed on the feeding methods of this species. For example, one would like to learn the importance of Murphy's (1924) finding of seal vibrissae in the stomach of a sperm whale.

When the sperm whale dives deeply it experiences a significant drop in water temperature from the relatively mild surface temperatures. This fact may help to explain the narrow geographical distribution of females and juveniles, which remain within temperate or tropical waters. Sperm whale calves do not possess the thick blubber of the adults, and may require relatively warmer habitats. The deeper warmed layer of tropical waters may allow them to dive to greater depths when they begin to seek their own food, then to return to the surface to warm up. Additional reasons for this geographical pattern are available in Tomilin (1957).

(7) Economic and aesthetic value. In the 18th and 19th centuries, spermaceti was a crucial part of the New England and world economies. This waxy substance was the main lubricant and liquid fuel in use at that time. Ambergris, which is a hard, dark, lumpy substance found in the intestine of this whale, and probably forms as a concretion around undigested squid beaks, was used as a stabilizer for the scent of perfumes. It has always been rare and valuable, and in 1962 its price was $100 per kg (Nishiwaki, 1972). A synthetic substitute is now available. Scrimshaw is the name given to the art of carving on sperm whale teeth. The art was practiced extensively by American whalemen during their long voyages.

The New England sperm whale hunting industry began in 1712 when the first sperm whale was caught - by accident. For the next 150 years, the industry prospered and Yankee whalers ranged the seas of the world in the hunt for sperm. American interests dominated the industry. Whaling expeditions lasted as long as 5 years and reached every part of the globe. The hunt was pursued from open boats and was exciting and dangerous. Unlike the more passive rorquals, sperm whales were often aggressive, especially when wounded. Whale boats were often overturned and loss of life was not uncommon. On some occasions, whole whaling ships were sunk, the most famous examples being the sinking of the Essex in 1820 after ramming by a sperm whale and the sinking of the Ann Alexander off Peru in 1851 (Nayman, 1973). The world's best known whaling story, Melville's Moby Dick centers on a sperm whale and is an excellent historical description of the whaling industry of the mid-1800's when the American industry was at its peak. At the time there were over 700 American whaling vessels, and over 100,000 barrels of sperm oil were brought in annually. This amount of oil represented a kill of only 500 to 700 whales, which apparently did not affect the stocks of sperm whales. New Bedford, Massachusetts was the center of the industry, whose rise and fall has been chronicled by Allen (1973) in a recent best-seller.

In 1859 the industry suffered a sharp decline and eventual death when petroleum, which proved to be a superior fuel and lubricant, and which was easier to obtain than sperm oil, was discovered.

In the 1870's the modern harpoon was perfected by the Norwegians. Its use, in combination with the use of steam whaleships, would soon make possible the capture of the large, swift, rorqual whales. This began a new, more effective phase in the whaling industry. At first the sperm whale was largely ignored, because its waxy oil was not as popular as the oil from baleen whales. Prior to World War II, the annual sperm whale catch rarely totalled more than two or three thousand animals. However, as rorqual whale populations decreased due to over hunting, sperm whales were once again subjected to increased hunting pressure. The annual catch began to rise and

reached 25,921 in 1967 (Rice, 1973). In 1971, 22,781 sperms were killed worldwide, 558 in the Atlantic Ocean (Dent, 1973). The sperm whale is currently the most important species of the world whaling industry.

It is difficult to speculate on what effect this harvest has on the sperm whale stocks. Owing to the polygamous social structure of this species, many male sperm whales can be killed without reducing reproductive potential. However, if we have learned anything at all from the vast over-exploitation of the other whales, it is that we can no longer afford to be complacent about the ocean's resources. The continuation of sperm whaling must also be weighed against the fact that the meat of these whales is not eaten, even in Japan or Russia. The products obtained from its body are used entirely for industrial products of many kinds, including crayons, photographic film, oils, waxes, and lubricants. Synthetic or vegetable substitutes are readily available for all these products.

FAMILY PHYSETERIDAE: PYGMY SPERM WHALE, LESSER CACHALOT, Kogia breviceps

The maximum length of the pygmy sperm whale is 4 m, and males are larger than females. The general form resembles a dolphin (Tomilin, 1957) and the skull is as wide as it is long (Nishiwaki, 1972). The dorsal fin is quite low and somewhat to the rear of the middle of the body. The dorsal body is a dark gray and the ventral surface is light gray to white. The flippers and tail flukes are slate gray, and the flippers are rounded and large (1/6 body length).

(1) Distribution and habitat preference. This species is widely distributed in warm waters of the Indian, Atlantic, and Pacific oceans. However, as it is rarely seen, nothing is known of the size of the world population (Nishiwaki, 1972). One individual was stranded in Nahant, Massachusetts, in 1910 (Waters and Rivard, 1902), and a decayed specimen washed up at Sable Island in January, 1969 (Sergeant, Mansfield, and Beck, 1970). Piers (1923) reported a female found dead under the ice in the outer part of Halifax Harbor, Nova Scotia, on January 17, 1920.

(2) Migration characteristics. Gunter, Hubbs, and Beal (1955) as well as Caldwell and Golley (1965) indicate that the stranding records for the species suggest a northward migration in summer with a return to warmer waters in the fall for breeding. The pygmy sperm whale has only been seen singly or in pairs.

(3) Food and feeding habits. Nishiwaki (1972) and Handley (1966) report that this species feeds on squid, crabs, and shrimp.

(4) Aesthetic and economic importance. Since specimens have only been stranded at the very fringes of the Gulf of Maine, with only one record on the shores of the Gulf itself, this species is of value merely as a scientific curiosity in this region.

FAMILY DELPHINIDAE: BOTTLENOSED DOLPHIN, Tursiops truncatus

This species reaches a length of 2.5 to 3.0 m. Males are somewhat longer than females. The triangular dorsal fin is located at the midpoint of the body, while the flippers are quite far forward. Although the rostrum is long, the melon is large and therefore the beak is actually fairly short (1/21 body length). The dorsal surface is a bluish steel gray which gradually fades to the pale colors of the ventral surface. There is a dark line running from blowhole to the base of the beak and also sometimes one or two dark lines run from the eye to the rostrum.

(1) Distribution and habitat preference. This species is distributed along all coasts in the regions of warm water in both hemispheres (Tomilin, 1957). Although it is quite common along the southern portion of the eastern coast of North America, it does not reach New England frequently. Usually it is seen within 12 miles of the coast (Gunter, 1942). There are only a few records of its occurrence in the area north of Cape Cod; however, Norton (1930) said that fishermen frequently saw this species, often in schools, jumping and playing near Portland, Maine. Although these dolphins usually travel in small groups of under 10 individuals, schools of up to 100 have been seen. They are fairly slow, show little fear of humans, and are easily tamed. There are numerous bottlenosed dolphins living in aquaria and oceanariums, where they have been studied extensively. It is ironic, however, that while many obscure biological facts are known about this species, the information on their behavior in their natural environment is still rather sparse (Tomilin, 1957).

(2) Food habits. The food of this species is mainly bottom fishes (Tomilin, 1957; Gunter, 1942) and squids (Nishiwaki, 1972), which are hunted by echolocation. Sergeant (1969) reported that this species ate 10.8 percent of its body weight per day in 3 to 4 feedings. In an unusual observation, Hoese (1971) watched two of these dolphins cooperating to feed in a salt marsh by swimming together and creating a bow wave which overflowed the low bank. The dolphins then ate little fish that had been left stranded on the shore.

(3) Reproduction. The calving period of the bottlenosed dolphin seems to be protracted, although it generally coincides with the warmer times of the year. In British waters, parturition occurs between February and June (Harrison, Boice, and Brownell, 1969). According to observation of aquarium dolphins, gestation lasts 11 months. Lactation, under normal conditions, lasts from 4 to 6 months (Tomilin, 1957).

Strong bonds between pairs, and between mother and young are routinely formed. Harrison, et al. (1969) noted that the maximum number of offspring produced during a female's lifetime may be as few as eight and that sexual maturity is reached at 5 years (females) or 6 to 7 years (males). Sergeant and Caldwell (1973) reported that females from northeast Florida matured at age 12 years and males at age 13 years. More data are obviously needed. Longevity appears to be about 25 years (Sergeant, et al., 1973). In captivity, males compete for females and will try to mate with virtually anything that moves. In the wild, there may also be strong competition for females. Copulation takes place vent to vent with the female underneath, while the pair continue to swim at up to 18 miles per hour (Webb, 1973). Females ovulate once per year, on the average (Sergeant, et al., 1973), but follicle development and ovulation may be induced, rather than cyclic, and may be inhibited during captivity (Harrison, et al., 1969

(4) Aesthetic and economic importance. A large dolphin fishery used to exist on the American Atlantic coast. From November 15, 1884 until May, 1885, 12,000 dolphins (not necessarily all T. truncatus) were taken at the Carolina shores. In 1915, the annual catch in the region of Cape Hatteras was from 500 to 1,500 individuals (Tomilin, 1957). Whereas several hundred bottlenosed dolphins used to be taken annually in the USSR (Tomilin, 1957), all killing of dolphins and porpoises within that country was stopped in 1966. In announcing that action, the Soviet Minister of Commerce described the dolphin as "the brother of man."

Tursiops truncatus is probably the best-known of all cetaceans to the general public. Dolphins of this species are perhaps the most entertaining of all aquarium residents and can be trained to do complicated tricks or practical tasks. Some workers suspect that this species has exceptionally high intelligence (Lilly, 1967, 1961), although others (Caldwell and Caldwell, 1974) compare its intellect to that of a dog. Animals of this species have starred in movies such as "Day of the Dolphin," in television serials such as "Flipper," and have been central figures in many stories and science-fiction novels such as Clarke (1957). Numerous legends and eye-witness accounts suggest that porpoises of this species have come to the aid of humans in distress (Nayman, 1973). There is some evidence that Tursiops will not permit sharks to stay in an area, but will kill them or chase them away (Gunter, 1942).

FAMILY DELPHINIDAE: WHITE-BEAKED DOLPHIN, SQUID HOUND, Lagenorhynchus albirostris

This species is similar in shape to the white-sided dolphin, but is somewhat larger, and it may reach 3 m in length. The dorsal body is

black, including the flippers, the flanks are dusky and the ventral surface is white. Specimens from the Gulf of Maine area probably do not have a noticeably white beak.

(1) Distribution and habitat preference. This form ranges from France northward and west past Greenland to Canada and from the Davis Strait to the coast of Massachusetts (Tomilin, 1957). The first reported sighting in New England waters (Waters and Rivard, 1962) refer to an individual seen April 27, 1901 thirty miles north of Cape Cod, and another was washed ashore at Orleans, Massachusetts April 29, 1901. Watkins and Schevill (1972) saw some L. albirostris in Cape Cod Bay during May, 1970. Gilpin described 2 white-beaked dolphins (called L. leucopleurus) which were shot at Digby Gut in August, 1875 during the Micmac Indian porpoise fishery in the Bay of Fundy. One specimen measured 1.78 m long and the other was longer. This species apparently prefers colder waters than L. acutus (Sergeant and Fisher, 1957) and could possibly be considered a stray in the Gulf of Maine region.

(2) Migration characteristics. The migrations are poorly known. The species apparently travels in schools of more than 1,500 individuals in some areas (Nishiwaki, 1972). In the Davis Strait, this species appears in spring and summer together with harbor porpoises (Phocoena phocoena) after the rorqual whales, belugas and narwhals have already appeared and migrated north (Tomilin, 1957).

(3) Reproductive characteristics. It is assumed that most calves are born in mid-summer (Tomilin, 1957)

(4) Food and feeding characteristics. The dolphin's food consists of squid, octopus, cod, herring, capelin, and small crustacea (Nishiwaki, 1972).

(5) Economic importance. White-beaked dolphins are taken commercially along Norwegian shores, where they are known as squid hounds. There they occur in spring and fall (at least March to May and October to November) in small herds of 6 to 8 which apparently do not associate with other species.

FAMILY DELPHINIDAE: WHITE-SIDED DOLPHIN, Lagenorhynchus acutus

Male white-sided dolphins are between 2.3 and 2.75 m long and females range from 2 to 2.4 m in length (Tomilin, 1957). The dorsal body is mostly black, and the ventral side is white or yellowish gray with a sharp boundary between the shades. A wide white band runs along the body on both sides below the dorsal fin and onto the caudal peduncle. A black line runs from either the eye or the mouth to the all-black flipper, and another from the caudal peduncle to the black dorsal por-

tion. However, there is a great deal of individual variation of color pattern, and there may be a variety of different white portions on the black dorsal area. The flippers are short and the dorsal fin is high.

(1) Distribution and habitat preference. This species is commonly found in coastal waters south of Greenland, off Norway, near the Shetland and Orkney Islands off Great Britain, and off Cape Cod, Massachusetts. It has never been seen in tropical waters (Nishiwaki, 1972). The species visits inshore waters of Newfoundland in summer (July to October) often in the company of pilot whales, and there is a record of some white-sided dolphins being driven ashore with pilot whales (Sergeant and Fisher, 1957).

The species is seen more frequently in New England waters than is the white-beaked dolphin (L. albirostris), perhaps because it likes the warmer waters of the area. Nevertheless, there are not many published records of sightings, probably because it does not approach shore as closely as does the harbor porpoise and because most people do not report sightings of small cetaceans, even if they are able to identify them. Norton (1930) traced the history of one museum specimen which was supposedly taken from Casco Bay, Maine. Beamish and Mitchell (1974) saw four specimens on May 22, 1969 near the Sable Island Bank, NS. Fifteen individuals beached themselves in Wellfleet, Massachusetts on May 11, 1973 (McGrath and Thomas, 1973; Mead, 1973).

(2) Migration characteristics. The species is quite gregarious and has been seen in schools of one to 1,000 or 1,500 individuals (Tomilin, 1957). Little is known of its migrations. Sergeant and Fisher (1957) reported that it usually forms medium-sized herds of 40 to 50 individuals.

(3) Population density. No accurate estimate of population has been made; estimates range from 30,000 to 50,000.

(4) Reproduction characteristics. Birth of calves is thought to take place either in midsummer (Tomilin, 1957) or in spring and summer (Nishiwaki, 1972). Gestation lasts about 10 months (Tomilin, 1957). Little or nothing is known about the longevity of the species. Of the 12 dolphins which stranded at Cape Cod on May 11, 1973 which were examined (Mead, 1973). 9 were females, 8 of which were pregnant or near term. The ninth female may have had a calf a year before and was still lactating. One other female with a yearling lived for a short time at the Sealand Aquarium in Brewster, Massachusetts.

(5) Food and feeding methods. The species feeds on pelagic fish, benthopelagic fish, and crustaceans. Eight dolphins beached at Wellfleet and Orleans, Massachusetts in May, 1973 had been feeding on herring, striped bass, and bait fish when beached.

(6) Natural mortality. Predation by killer whales or sharks is probably an important source of mortality. Carcasses of the dolphins which stranded at Cape Cod were found to have heavy parasitic infestation in the inner ear and nasal passages which may have impaired their sonar ability so that they could not find their way to deep water (Mead, 1971).

(7) Aesthetic and economic importance. The white-sided dolphin is of little economic importance and is only taken in Norway in the summer when it enters the fjords in pursuit of herring (Tomilin, 1957).

FAMILY DELPHINIDAE: COMMON DOLPHIN, SADDLEBACK DOLPHIN, Delphinus delphis

This species reaches a length of about 2.5 m with males slightly larger than females. The color of the highly streamlined body is distinctive although there is some variation among individuals. The entire dorsal surface is black, the ventral surface, except for the caudal peduncle and flukes, is white. The complex and variable color pattern on the flanks is basically composed of an anterior and a posterior field of light gray, separated by a downward projection of the black dorsal coloration in the region below the dorsal fin. These gray fields include washes of ochre, intrusions of lighter shades, and narrow, dark bands, whose arrangements probably differ among the different geographical races. The head possesses a long, markedly defined beak. The fairly high dorsal fin is triangular and sharply pointed with a slight backward curve. The sides of the body may bear parallel scratch marks, perhaps inflicted by other dolphins (Sergeant, 1958). Tomilin (1957) includes information on intraspecific fighting and other behavior.

(1) Distribution and habitat preference. The common dolphin is a pelagic and widely distributed species, found in tropical and warm temperate ocean waters (Sergeant, 1958). It is known to range from the Atlantic seaboard of the United States northward to Labrador (Marcuzzi and Pilleri, 1971). It is also found in the Indian Ocean and the North and South Pacific. It does not, however, move into the cold waters (Nishiwaki, 1972), and since it is a deep-water pelagic species it is rarely seen alive close to shore (Tomilin, 1957).

Delphinus delphis sometimes ascends rivers, and a school of 30 to 40 was observed in the Hudson River (Moore, 1953). In 1956, 2 individuals were seen 75-175 miles up the Hudson. Although sighting reports of this species are relatively numerous from the region south of Cape Cod, there are not many published records for the Gulf of Maine.

Eleven animals were stranded in South Wellfleet, Massachusetts in February, 1949 (Waters and Rivard, 1962). An individual stranded at Falmouth, Maine on March 13, 1974 and autopsied at the New England

Aquarium was originally identified as Delphinis delphis, but may actually be Stenella ceruleoalba (S. Katona, unpublished information).

(2) Migration characteristics. The common dolphin's migrations have not been studied except in the Black Sea, where it seems that the large herds follow the movements of the sardines and herring, which comprise the main part of their diet (Tomilin, 1957). However, an individual shot in Newfoundland while associating with a school of pilot whales (Globicephala melaena) had been feeding on squid (Sergeant, 1968).

Although most Massachusetts records involve winter encounters, they are believed to be most common in these waters during the summer months (Waters and Rivard, 1962). They are also numerous off the east coast of Nova Scotia in late summer (Sergeant and Fisher, 1957). This may indicate a seasonal migration pattern.

(3) Population density. The number of Delphinus delphis found in the Atlantic Ocean and all adjoining seas is estimated at more than 30,000 (Nishiwaki, 1972). Far greater numbers are found in other areas such as the Black Sea, the Mediterranean Sea, and along the coast of Anatolia, where populations number in the hundreds of thousands or millions (Tomilin, 1957).

(4) Growth and longevity. Sexual maturity in this species is reached at three years. Individuals are assumed to live 25 to 30 years.

(5) Reproductive characteristics. The peak mating season in the Black Sea is from August to October, and the peak breeding season is from June to August with a nine-month gestation period. In California, birth occurs in December through March and the gestation period is reported to be 11 months (Harrison, et al. 1969) Mating may take place mainly in mid to late summer. There is a period of 9 months after every three pregnancies when the female remains infertile. The lactation period is 4 months, and females are thought to mate and calve annually (Tomilin, 1957; Harrison, et al., 1969) Additional data including descriptions of copulation, birth, and lactation are included in Tomilin (1957).

(6) Food and feeding methods. Common dolphins typically feed on pelagic fish which they catch in the upper layers of water far from shore. Their very sharp teeth are extremely numerous (160-260) and well adapted to seize and hold slippery prey. Although Tomilin (1957) lists crustaceans and molluscs as accidental dietary items, the most important foods are a variety of fishes, including mackerel, anchovy, pipefish, mullet, flying fish and others, depending on season and location. Cephalopods may at times be secondary food items. Data cited in Tomilin (1957) indicate that a common dolphin

can eat between 5 and 10 kg of fish per day. Food is found by echo-location (Tomilin, 1957).

(7) Aesthetic and economic importance. In some areas, common dolphins consume large amounts of commercially valuable fish. For example, in the Black Sea they consume about 2,500 tons of fish daily and along the coast of Anatolia they consume about 4 times as much (Tomilin, 1957). On the other hand, Mediterranean fishermen follow dolphins and find them helpful in herding anchovies or sardines to the surface where they can be netted. The importance of the species in our region has not been evaluated.

FAMILY DELPHINIDAE: RISSO'S DOLPHIN, GRAY GRAMPUS, WHITE-HEADED DOLPHIN, Grampus griseus

Full-grown Risso's dolphins are 4.0 to 4.2 m long. The head and front part of the body are quite round and fat, but the posterior body, from anus to flukes, is slender. The dorsal fin, which is high and narrow, is sharply pointed and curved backward. There are no teeth in the upper jaw and only 2 to 7 pairs of teeth in the lower jaw (average 3 or 4). The color is generally gray, with dark gray on the back, light gray on the flanks, and white on the belly. The dorsal surfaces of Risso's dolphin becomes covered with white scars and scratches inflicted by squid or possibly by members of their own species during fights (Nishiwaki, 1972; Tomilin, 1957).

(1) Distribution and habitat preference. The Risso's dolphin is widely distributed in the warm waters of the world. However, since it is seen only rarely, its exact distribution and migration pattern is unknown (Tomilin, 1957). It keeps to the open seas and approaches the coasts only rarely. There is only one uncertain record of a stranding on the New England shore. Risso's dolphins often travel alone or in pairs (Tomilin, 1957), although they may also be seen in small groups (Nishiwaki, 1972) Schevill (1954) reported sighting 3 individuals 200 miles east of Cape Cod in 1950 and 60 individuals 70 nautical miles south of Block Island (Latitude 40°00'N, Longitude 71°31'W) August , 1952. The animals were grouped in threes and fours, and were quite frolicsome, often breaching clear. Sometimes one waved the posterior third of the body in the air. They were shy of the ship but approached a dory. They appeared to be in vocal communication with each other. Schevill (1954) noted that field marks for the species include the high slender dorsal fin, reminiscent of that of Orcinus orca, the pale gleam of the back in front of the fin, a rather blunt snout, slender tail with lunate flukes, and characteristic scratch marks on the back.

(2) Food habits. Cephalopods are the main, if not the exclusive, diet of this species (Tomilin, 1957).

(3) Reproduction. Almost nothing is known of the breeding biology of the species, although there is apparently one documented record of successful interbreeding between Grampus griseus and Tursiops truncata (Tomilin, 1957).

(4) Aesthetic and economic importance. There is no fishery for Risso's dolphin. One Risso's dolphin named Pelorus Jack, became famous in New Zealand for its habit of accompanying ships across Cook Strait between Wellington and Nelson, New Zealand, from 1888 to 1912. The dolphin was protected by an Order in Council. It disappeared before the outbreak of World War I (Tomilin, 1957; Nayman, 1973).

FAMILY DELPHINIDAE: PILOT WHALE, BLACKFISH, CAAING (=CALLING) WHALE, POTHEAD, Globicephala melaena

The pilot whale reaches 6.5 m in length and, as in almost all other toothed whales, males are larger than females. The color of the body is black and is more deeply pigmented above than below. A narrow, mid-ventral streak of light color widens into an anchor-shaped spot at the base of the flippers and on the throat. Viewed from the side, there is no constriction between the head and body and the flippers, which are pointed, long (1/5 body length), and appear to be attached at the neck. The dorsal fin is high, strongly recurved, very wide at the base, and is set slightly behind the midpoint of the body. The forehead is high and bulbous. The shape of this bulge (also called the "melon") can be changed by the individual whale, to focus pulses of sound for echolation (Norris, 1968; Matthews, 1968).

(1) Distribution and habitat preference. Despite the fact that it is apparently much more common north of the Canadian Maritime provinces (Mercer, 1974), the pilot whale is still one of the most commonly seen species of whale in New England waters. Norton (1930) listed it as common in waters near Portland, Maine. This species is common throughout the North Atlantic reaching from the Mediterranean Sea and Madeira to New Jersey, and from southwest and southeast Greenland to northwestern Norway. It is found most frequently between Iceland and Scotland, near the Faroes, Shetland, and Orkneys, as well as in the region of Newfoundland (Tomilin, 1957). Strandings reported for Virginia, North Carolina, and Florida (McGrath and Thomas, 1973) could possibly refer to G. macrorhyncha (Mercer, 1974). Although it generally favors the pelagic regions, this species can come quite close to shore in its search for food (Tomilin, 1957). In a list of whale strandings kept by the British Museum since 1911, there are many more instances of pilot whales coming ashore than any other species (Ommanney, 1971). The species is quite gregarious, often traveling in herds numbering in the hundreds. There is one record of a herd of 1,975 which beached in 1895,

near Wellfleet, Massachusetts, and another record of a herd of 3,000 stranded on Cape Cod in 1874 (Pilson and Goldstein, 1973). This tendency to strand en masse is one of the most interesting features of the pilot whale. There are numerous reports of large herds becoming stranded on beaches and eventually dying. The pilot whale seems to have a strong tendency to follow the leader of the herd and once the leader becomes stranded, the rest follow. This herding tendency has been exploited in the past by the hunters on the northern British islands, who used to drive several individuals from a herd ashore and then wait for the rest to follow. Ommanney (1971) explained this on the basis of inherent limitations in the whales' echolocation systems. Pilot whales, like many other whales, use echolocation to find food, maintain communication and perhaps to navigate. Experiments carried out on the bottlenosed dolphin (Tursiops truncatus) have shown that the beam of sound pulses emitted by that species never falls below the horizontal. A majority of pilot whale strandings have occurred on long sloping beaches of sand or mud, which must present two problems to a whale approaching the shore. First, mud and sand never give as clear an echo as do more solid substances. Second, when the whale is very close to shore, its upwardly directed beam will receive no echo at all because of the gentle slope (Ommanney, 1971). The strongly developed schooling instinct impels the other animals to follow and stay with injured or stranded fellows.

(2) Migration characteristics. The pilot whale spends its winter in the warmer waters of the North Atlantic offshore of the Continental Shelf, and in the early summer moves northward. The direction and extent of northward migration is determined by the abundance of squid, which is the main food of this species (Sergeant and Fisher, 1957). The times of arrival of the squid in northern waters seem to be determined mainly by the temperature of the water, the preferred range being from 5 to 15 C. It is, therefore, difficult to give the summer range of the pilot whale, since it varies greatly with the fluctuations in squid distribution. For example, in the summer of 1954, pilot whales reached as far north as White Bay, Newfoundland, where the squid were also abundant that summer. In other years, when squid were scarce in the area, pilot whales failed to reach Newfoundland inshore waters at all (Sergeant and Fisher, 1957). Pilot whales do not commonly penetrate into the coastal waters in the southern Canadian maritime provinces (Sergeant and Fisher, 1957). Although it is so commonly sighted in Maine waters, the species is still outside of its main range when in our area. South of New York, G. melaena is replaced by the subtropical G. machrorhyncha, but the species interactions in that area require much more study.

(3) Population density. No data have yet been obtained.

(4) Growth and longevity. The maximum age has been estimated at 25 years (Tomilin, 1957). Newly born calves average about 1.8 m. By

age one year, females are 2.3 m long and males 2.4 m. The largest individuals finally weigh up to 3 tons.

(5) Reproduction characteristics. The age of sexual maturity has been estimated for females as 6 years, and for males as 13 years. Females seem to breed between the ages of 6 and 18 years, and in that time produce 5 to 6 young, usually as single calves. The periods of gestation and lactation each last about a year. Although newborn calves are found in all seasons, the peak of the mating period is in June and July, and the peak of breeding period is in July and August. The sex ratio in herds seems usually to be equal; nevertheless, the pilot whale is a polygamous animal and bachelor males may sometimes form separate herds (Tomilin, 1957).

(6) Food and feeding methods. The main diet of the pilot whale consists of cephalopods and gregarious fishes. The wide rostrum with sharp teeth in its forward portion allows this species to catch both fish and slippery invertebrates. Judging by the marks left by the suckers of squids on the lips and head of pilot whales, the squids consumed may reach 1 m in length (Tomilin, 1957). The pilot whale sometimes dives to the bottom for food and its stomach may contain stones and sand (Tomilin, 1957). Squid species on which it feeds include Ilex illecebrosus, Ommatostrephos sagittatus and Todarodes sagittatus. In Newfoundland waters, I. illecebrosus (short-finned squid) is usually the only food eaten and an average-sized pilot whale (4 m long, 830 kg) will eat about 34-41 kg (4.1 to 4.9 percent of its body weight) per day (Mercer, 1974).

(7) Aesthetic and economic importance. A fishery for pilot whales was developed in 1947, in Trinity Bay, Newfoundland, where a few thousand were taken every summer (Sergeant and Fisher, 1957). This species has also been important to the people of the Faroes, Orkney and Shetland Islands. For hundreds of years it has been hunted there for its oil, which provides these islands with winter fuel, and for its meat (Ommanney, 1971; Tomilin, 1957). However, in recent years the number taken in the North Atlantic has decreased considerably, from 6,412 in 1955 (Sergeant and Fisher, 1957) to 738 in 1970 (Pilson and Goldstein, 1973), leading to the speculation that the population has declined. Mitchell (1974) and Mercer (1974) calculated that overfishing during 1951-1961 severely depleted the G. melaena population around Newfoundland. During that period, over 47,000 pilot whales were killed there, over 30,000 between 1953 and 1957.

Owing to its propensity to strand in great numbers, the pilot whale is more intimately known to many people than are other cetaceans. There are frequent reports of people who have worked to rescue stranded whales. For example, clamdiggers worked to rescue a stranded pilot whale in Milbridge, Maine on March 28, 1973. After covering it with seaweed to keep it moist, they went to get the game

warden. Before they could return, local youths killed the animal. Often these animals swim back to the beach after being towed off.

Pilot whales of the genus Globicephala have been maintained by various marine aquaria since about 1949 (Kritzler, 1949; Brown, 1962). The animals respond to training and provide an opportunity for many people to see a live whale for the first time.

FAMILY DELPHINIDAE: KILLER WHALE, Orcinus orca

The color pattern of the killer whale is strikingly beautiful and distinctive. The dorsal body is black and the ventral side is white, with a clear division between the two colors. On the posterior flanks, the white pattern comes part way up the side. Over the eye is a white oval patch. Behind the dorsal fin on either side is a gray patch. Sometimes the gray patches are connected to form a gray "saddle." The length of this species may reach 10 m in males and about 7 m in females (Scheffer, 1971). The dorsal fin is quite prominent, reaching a height of up to 1.7 m in old males, but never exceeding 1 m in females. The flippers are rounded and about 1/7 to 1/5 of the body length. The males weigh 9 tons and the females 4.5 tons. Albino killer whales have been seen regularly around Vancouver Island (Scheffer, 1971).

(1) Distribution and niche preference. Killer whales are found in all oceans of the world, although they seem to be most abundant in the Pacific and the Atlantic. Also, they are more common in cooler waters and productive coastal waters (Dent, 1973). Generally, there is no intermingling between cetacean populations in the Northern and Southern Hemispheres. However, this is not true with the killer whale, and there seems to be no isolation between any of its populations. Instead, there is one species which travels extensively (Nishiwaki, 1972). The killer whale is only rarely reported now in New England waters. There have only been about two dozen sight records published in the last 20 years. However, Norton (1930) mentioned that Captain H. L. Spinney, keeper of the Seguin Light from 1893 to 1907, saw killer whales frequently in that area. Ulmer (1941) cited reports that killers were abundant when right whales were also abundant, and also mentioned Allen's (1869) report that small schools of killers were occasionally seen in Massachusetts Bay. Perhaps a more thorough system for making and reporting observations would reveal this species to be somewhat more common in our area than previous data would indicate.

(2) Migration. Very little is known of the migratory habits of killer whales, but it is probable that they follow their food supply (Dent, 1973). Killer whale distribution in the northeast Atlantic is related to herring distribution and movement (Jonsgard and Lyshoel, 1970). In other areas their distribution parallels that of the baleen whales.

(3) Population density. There are no estimates of the size of most killer whale populations. A recent census in the waters of Washington and British Columbia gave counts of 459 killer whales in 1971 and 255 in 1972 (Dent, 1973). The Japanese took 567 from the Okhotsk Sea to south of Japan from 1948-57, while the Norwegians harvested 6,417 in the northeastern North Atlantic between 1938 and 1967 (Dent, 1973).

(4) Growth and longevity. A newborn calf is 2.4 m long and weighs approximately 182 kg (Dent, 1973). Females attain sexual maturity at 4 years of age, but as yet there are no figures for males. Killer whales appear to live longer than 35 years (Nishiwaki, 1972). The deterioration of its teeth with increasing age may contribute to the causes of death (Ulmer, 1941).

(5) Reproduction characteristics. Breeding occurs all year round, but in the Northern Hemisphere it seems to peak from May to July, while most births occur in the autumn. Gestation probably lasts from 13 to 16 months (Dent, 1973). The calves are suckled for approximately one year (Tomilin, 1957). The killer whale is highly gregarious and travels in packs containing from 10 to 100 individuals (Dent, 1973). Females and young seem to stay slightly separated from the bachelors and bulls. The killer whale is probably polygamous (Scheffer, 1971).

(6) Feeding habits. The structure of the killer whale's mouth, rostrum, teeth, powerful masticatory muscles, and great fins is adapted to predatory feeding. There is great variety in the diet. This species eats fish (mainly cod, flatfish, and sardines), squid of all sizes, octopus, and marine mammals (Dent, 1973). There are also reports of killer whales consuming sea birds, including penguins, brants, and mergansers (Tomilin, 1957). The marine mammals in its diet include seals, walruses, sea otters, dolphins, and small whales. There are reports of the killer whale attacking all of the larger whale species, in particular the gray whale (Baldridge, 1972) which has been shown to avoid the underwater sounds of killers (Cummings and Thompson, 1971). There are numerous reports of successful killer whale attacks on the young of this species (Tomilin, 1957), and they may prefer to attack young whales rather than adults. Killer whales hunt in packs of up to 100 and in this way seem to be successful at killing very large prey. The pack displays highly coordinated and cooperative hunting behavior as it circles around large prey, biting and tearing at its flesh. The killers try particularly to open the mouth in order to chew on the tongue and throat (Tomilin, 1957). Hancock (1965) reported that 7 killers stripped off and ate the skin of a minke whale.

Although the killer whale can be a voracious predator, there seem to be no facts to support its reputation as a human killer. There

is not one authenticated report of killer whales attacking a human (Dent, 1973); in fact, killer whales in captivity seem to be gentle and affectionate to their trainers (Cousteau and Diole, 1972). One individual in captivity ate food amounting to about 4 percent of its body weight per day (Sergeant, 1969).

(7) Aesthetic and economic importance. Killer whales do not seem to be of great economic importance in western countries at the present time, although they are still being hunted in Asian waters for oil and meat (Scheffer, 1971). However, killer whales are becoming more important for entertainment and scientific purposes. They have been easy to train, and killer whales are now on display in many oceanariums. It is the largest marine mammal species ever held in captivity, and its adaptations for swimming and diving, its life processes, and forms of communication are now being studied. A popular record features Canadian flautist Paul Horne, playing a "duet" with a killer whale (Horne, 1973). Two Canadian scientists have been able to establish a rapport with a pack of these whales off the British Columbia coast and a full length feature film called "Living with Killers" is now being shot to chronicle this relationship. Consideration is now being given to making Puget Sound a killer whale sanctuary. On the other hand, it is interesting that 3 killer whales apparently rammed and sank the schooner Lucette near the Galapagos Islands (Robertson, 1973).

FAMILY PHOCOENIDAE: HARBOR PORPOISE, PUFFING PIG, Phocoena phocoena

This is the smallest Odontocete, reaching a length of about 1.8 m and a weight of 45 to 54 kg. Males are slightly larger than females. Detailed morphological data are provided by Tomilin (1957). The back, head, flippers, and flukes may be a dark gray, greenish brown, or almost black. The ventral side is always lighter, from white to dark gray, and its coloration is somewhat variable. The gradual transition from light ventral color to darker dorsal color is characteristic of the species. The triangular dorsal fin, which bears small tubercles on its anterior margin, is located slightly posterior to the midlength and leans forward. It is a swift swimmer and usually blows 3 to 4 times at intervals of 2 to 30 seconds, then sounds for up to 3 to 4 minutes. It usually does not jump. An excellent summary of the biology of this species has been compiled by Gaskin, Arnold, and Blair (1974).

(1) Distribution and habitat preference. Phocoena is widely distributed within the Northern Hemisphere, in the Atlantic, Pacific, and in the Black Sea, Mediterranean Sea (rarely), and Sea of Azov. In the western Atlantic, it penetrates north as far as Baffin Bay (72°N) and Scoresby Sound (70°N) and as far south as New Jersey (39°N) (Tomilin, 1957). It is a coastal species which appears to avoid the open sea and frequently ascends rivers. In New England, this is the

common porpoise along our shores and in our bays (Norton, 1930). It is exceptionally common in the Bay of Fundy (Sergeant and Mansfield, 1970; Sergeant and Brodie, 1969) and is also common in Frenchman and Blue Hill Bays (Coman, 1972). It is probably the most common cetacean observed along the Maine coast (Mairs and Scattergood, 1959).

(2) Migration characteristics. Phocoena sometimes occurs in large schools during runs of gregarious fishes, but usually only 2 to 10 individuals swim together. Neave and Wright (1968) concluded that they were only common in the Bay of Fundy from July through September and that they migrated offshore during winter. Schevill (1968) criticized their conclusion because it was based on observations by untrained observers. Nevertheless, further discussion by Neave and Wright (1969), including reference to Leighton's (1937) work on the Indian porpoise fishery in the Bay of Fundy during the 1800's, suggests that their conclusions are reasonable. Sergeant and Fisher (1957) noted that this species is well known along the eastern Canadian coast during summer, but not during winter.

(3) Population density. Data on growth rates of embryos and calves are provided by Tomilin (1957). Newborn calves weigh 2.8-7.9 kg and attain sexual maturity in 2 years. Maximum lifespan is not known, but one can guess that this species might live up to 20 to 25 years. Endoparasites are common in the species (Tomilin, 1957) and could affect longevity.

(4) Natural mortality. Sources of natural mortality include stranding, predation by sharks (Arnold, 1972; Sergeant, et al., 1970) or killer whales (Tomilin, 1957), and entrapment in fishing apparatus (Tomilin, 1957).

(5) Reproductive characteristics. Harbor porpoises calve during the warmer portion of the year, and full-term embryos are found from mid-April through July in the North Atlantic (Tomilin, 1957). Calves are found at the same times. A newborn calf with the umbilical cord still attached stranded on Baker Island, near Mt. Desert Island, Me., on August 4, 1973 (Townsend, 1973). Single births are the rule; twins are rare. Lactation lasts up to 8 months. Two to three months after calving, mating occurs again. Gestation takes about 11 months. Sexual maturity is attained at age 3 to 4 years, at lengths of about 1.33 m in males and 1.45 m in females (Fisher and Harrison, 1970). Individuals display strong succorant behavior to mates and young. Additional information is available in Gaskin, Arnold, and Blair (1974).

(6) Food and feeding methods. According to Tomilin (1957) and Sergeant and Fisher (1957) the species feeds mainly on fish and invertebrates living near the bottom. Pelagic fishes are consumed only when they

form dense schools, in which case various herring species form important food items. In the North Atlantic, herring, capelin, mackerel, sardine, Baltic cod, whiting, eel, hake, pollock, small salmonids, and sole are common prey. Molluscs (including cephalopods), and occasional decapod crustaceans are also eaten. In the Bay of Fundy, this species eats mainly herring cod and mackerel; the mean feeding rate appears to be about 10.8 percent of the body weight per day (Smith and Gaskin, 1974). Harbor porpoises can dive at least 70-75 m in search of food. Prey is probably echolocated (Schevill, Watkins, and Ray (1969).

(7) Indications of environmental stress. There are very clear indications that this species could already be under stress from environmental contamination. Gaskin, Holdrinet, and Frank (1971) found the average total DDT content of the blubber of males from the Bay of Fundy to be 306.74 ppm, the highest published value for a wild population of any mammal. Furthermore, Gaskin, Ishida, and Frank (1972) found up to 91.30 ppm of mercury in the liver of females from the same region.

(8) Aesthetic and economic importance. Porpoises of this species have considerable aesthetic significance because they are abundant at the time (summer) and in the place (inshore waters) where most people have the opportunity to observe them. The mysterious appearance and disappearance of their shiny backs at the water surface is a source of excitement to many sailors, tourists, and travellers on ferry boats. In the past, Micmac Indians prosecuted a porpoise fishery in the Gulf of Maine centered on this species (Neave and Wright, 1969; Gilpin, 1875). Goode (1887) mentioned that porpoises, probably of this species, were also hunted at Eastham, Salem, and Barnstable, Massachusetts. In Scandinavia and the USSR large numbers of Phocoena were purse-seined for meat. Whereas the meat was not esteemed in the USSR, that of young animals formed a "royal dish" in some countries. According to Dr. W. H. Drury of the Massachusetts Audubon Society (personal communication), some shooting of porpoises for food may go on along the Maine coast at the present time, in violation of the Marine Mammal Protection Act. Other products made from Phocoena in other parts of the world have been oil, soap, fuel, vitamin-containing liver oil, glue, footwear, and other leather goods. Substitutes for all these products are currently available. Many Phocoena phocoena drown during drift net fishing operations for salmon along the West Greenland coast. In 1972, 1,500 harbor porpoises died in that way (Lear and Christensen, 1974). In Ireland, fishermen regard this species as somewhat of a nuisance, because it gets entangled in nets (O'Riordan, 1974).

FAMILY MONODONTOIDEA: BELUGA, WHITE WHALE, SEA CANARY, BELUKHA, Delphinapterus leucas

The pure white color of this small whale makes it one of the most conspicuous and beautiful of all cetaceans. The average size is about 5 m total length and 1,500 kg for males and 1,350 kg for females. The largest individuals on record are a male 7.3 m long and a female 7 m long. As is the case with all Arctic whales adapted for living near the ice pack, there is no dorsal fin. This feature probably helps the whale to break breathing holes in the ice with its back. The head is relatively small and is remarkably maneuverable from side to side. The large bulge ("melon") in the forehead region is filled with clear, fine oil, and its shape can be changed at will by muscular control (Fay, 1971; Matthews, 1968) for purposes of focusing sound pulses during echolocation.

The beluga has a complex vocabulary of very lovely and haunting high-pitched whistles, trills, chirps, and bell-like tones, which have led to its nickname "sea canary." These sounds appear to be useful in communication between animals and perhaps in finding food.

The beluga's closest relative is the narwhal, Monodon monoceros L., and the two are the only living members of the family Monodontidae, a small group of ancient, primitive whales, now restricted to Arctic seas.

(1) Distribution and habitat preference. The beluga is found throughout the Canadian, American and Russian arctic and subarctic regions. In many instances, there appears to be little population exchange (Sergeant and Brodie, 1969). In the Northwest Atlantic, three different sizes of belugas appear to be characteristic of different conditions in different areas. In subarctic estuarine conditions, such as in the western part of Hudson's Bay, the whales tend to be small (males 3.5 to 3.7 m, females 3.1 m). In Arctic water having some oceanic influence, such as along the Arctic coasts of Canada, they attain medium size (males 4.0 to 4.4 m, females 3.4 to 3.7 m). Finally, at the southernmost end of the range, in subarctic conditions under oceanic influence, such as on the coast of West Greenland, the belugas are largest of all (males 4.5 m, females 3.9 m). The differences in sizes of the various populations appear to be directly related to food availability; and their general restriction to estuarine Arctic habitats may be mediated by pressure from predators, especially killer whales, and competing species (e.g., Phocoena phocoena) (Sergeant and Brodie, 1969).

Belugas sometimes occur in the Bay of Fundy (Gilpin, 1875; Fisher and Sergeant, 1954; Mairs and Scattergood, 1958; Sergeant and Fisher, 1957), in bays or harbors of the Gulf of Maine (Norton, 1930), and even as far south as Ipswich and Rockport, Massachusetts, (Townsend, 1929) and the Cape Cod Canal (Anonymous, 1972). These individuals probably come from the stable beluga population which

inhabits the St. Lawrence River, after following the Gaspé current along the coast of the southern Gulf of St. Lawrence and around Cape Breton Island and then following the cold coastal Labrador current around Nova Scotia and into the Bay of Fundy (Sergeant and Brodie, 1969). The cool, low salinity water of these currents (Hachey, Hermann, and Baily, 1954) is similar to the conditions favored by this species. Nevertheless, belugas fail to survive and multiply in these southern regions, possibly as a result of heavy competition from other species (Sergeant and Brodie, 1969). Apparently spring and summer are the most likely times for belugas to be seen in the Gulf of Maine; however, some winter sightings are available (Norton, 1930).

(2) Migration characteristics. Although various beluga populations do perform seasonal latitudinal migrations along the coasts of Alaska and Siberia or within Hudson Bay (Sergeant, 1973) the St. Lawrence River population is resident year round and only makes small migrations (Sergeant and Brodie, 1969). Belugas which penetrate to the Gulf of Maine should probably be considered "lost", rather than in migration. Belugas normally travel in groups of from 2 to 3 up to hundreds of individuals. Belugas will enter fresh water to find food, and some have been seen 900 to 1,200 miles upstream in large northern rivers (Fay, 1971).

(3) Population density. This species must be considered rare in this study region. The total St. Lawrence River population is estimated to be less than 5,000 (Mitchell, 1974).

(4) Growth and longevity. Although data are likely to differ for different populations, the following information may be a useful baseline. The maximum lifespan appears to be 30 years (Brodie, 1971). Newborn calves in the Cumberland Sound-Baffin Island population averaged 1.6 m long and 78.3 kg. Physical maturity is reached in about 10 years (males 4.3 m, females 3.6 m) and sexual maturity in males is reached in about 8 years and in females in 5 years. When sexual maturity is reached the animals measure about 85 percent of the physically mature lengths. Ages at sexual maturity are similar in Hudson Bay (Sergeant, 1973). Calves are born dark brown. Within a year, they are dark blue gray. Whitening begins at 6 years of age and is completed at 9.5 years in females and 11 years in males (Sergeant, 1973).

(5) Natural mortality. Predation by killer whales is probably an important source of mortality except when belugas are in waters which exclude them (e.g., along the margins of pack ice, or in shallow estuarine waters. Underwater projection of killer whale sounds has been used successfully to keep belugas out of an Alaskan river to prevent heavy predation on juvenile red salmon (Fish and Vania, 1971). Polar bears are also natural enemies; and various parasites,

including helminths, are apparently a source of mortality (Dent, 1973).

(6) Reproduction characteristics. Belugas are polygamous and breed in spring. The gestation period is 13 to 14 months and females probably calve in alternate years. Sergeant (1973) calculated that Hudson Bay females calved once every 3 years and had a maximum of 10 pregnancies. Calves are dependent on nursing for their first year and supplement mothers milk with captured food in the second year, for a total lactation period of about 20 months. Tooth eruption begins late in the second year of life (Brodie, 1971). Weaning presumably occurs during the end of the second year. Single births are the general rule. Females with calves generally stay together in herds separate from males (Fay, 1971). Females mature faster than males and are ready to breed several years earlier. One captive beluga in the New York Aquarium at Coney Island has successfully borne a calf and another (Frances) recently died during pregnancy, but details on mating behavior and on breeding habits in nature remain sketchy. A total overall herd production of 8 percent per year appears to describe the fecundity of the Baffin Island beluga herd (Brodie, 1971).

(7) Food and feeding methods. Belugas feed on a very wide variety of prey species found from midwater to the bottom. At least 100 different types of foods are taken, including octopus, squids, crabs, shrimps, clams, snails, sandworms, and fishes such as capelin, char, herring, smelt, Greenland cod, flounder, Arctic cod, cisco, pike, and young salmon (Fay, 1971; Sergeant, 1973; Sergeant and Brodie, 1969; Dent, 1970). The greatest known depth of a dive is about 40 meters. Fishes larger than 4 kg are rarely eaten. Swimming prey are probably hunted by echolocation. The white color of the adults may be useful in startling or herding fish during hunting, but it is probably also useful as camouflage among ice floes and as an adaptation to reduce heat loss (Tomilin, 1957). About 40 simple, conical teeth are evenly distributed between the upper and lower jaws, suitable for catching and holding, but not chewing, prey. The teeth become rounded and flattened by wear in old age. When teeth are lost, they are not replaced.

(8) Indications of environmental stress. In some areas, for example Cumberland Sound, Baffin Island, belugas have been overexploited by hunting. No other data are available.

(9) Aesthetic and economic importance. The beluga has no economic importance in our study area, although in other places the skin, meat, or blubber has been used as food for people or dogs. It is interesting to note that Micmac Indians in the Bay of Fundy region had a superstitious dread of the beluga and never attacked it (Gilpin, 1875). The skin has provided heavy leather for shoes, harnesses,

and drive belts in the USSR and Canada. The melon oil has been used for high quality lubricants and body fat or blubber for making margarine, soap, and salves. Sausage casing has been made from the intestines. Fay (1971) expects the beluga hunting industry to increase in the future as people become more dependent on renewable resources. Natural substitutes for all beluga products are available.

The beluga has considerable aesthetic significance. It is an extraordinarily lovely whale, and its pure white body against a deep blue sea is an unforgettable sight. The haunting, unearthly sounds which it makes create an aural impression as startling as its visual appearance. Several aquaria have displayed captive belugas to the public and one beluga at the New York Aquarium has produced live young. The progress of the pregnancy of Frances, another beluga at the New York Aquarium, was a focus for national attention during spring, 1974, until her death in late May.

FAMILY ZIPHIIDAE: DENSE-BEAKED WHALE, BLAINVILLE'S BEAKED WHALE, Mesoplodon densirostris

This species averages about 4.6 m in length. The body is dark with a small dorsal fin set far back. The flukes have no median notch. The body is generally covered with white scars, possibly formed from wounds suffered during intraspecific fights. As this species is known solely by stranded specimens, there is little information on its life cycle or migrations.

(1) Distribution and habitat preference. M. densirostris is found in all oceans having tropical and warm temperate waters (Rice and Scheffer, 1968). True (1910) reported a female stranded at Annisquam, Massachusetts, in August, 1898 and that is the only record of this species in the Gulf of Maine. Originally, Allen (1906) described that specimen as M. bidens. One individual stranded at Peggy's Cove, Nova Scotia (Sergeant and Fisher, 1957). However, Since the species appears to be mainly pelagic in warm waters (Ulmer, 1941; Moore, 1958), individuals found in the Gulf of Maine are probably strays from the main population and might be unhealthy, drifting animals.

One possible reason for the lack of sightings of M. densirostris is that its breath is apparently directed forward over the snout instead of straight up into the air, as in most other cetaceans which have been observed (Anonymous, 1973). If this is true, it may be nearly impossible to see these whales at sea, unless the observer is very close.

(2) Aesthetic and economic importance. None, although any new records or information would be of great scientific interest.

FAMILY ZIPHIIDAE: TRUE'S BEAKED WHALE, Mesoplodon mirus

This whale is about 5.2 m in length, with a slender body compressed laterally. The forehead is low and the dorsal fin is situated behind the middle of the body. The flippers are small and the flukes lack a median notch. The whale is black above and on flippers and flukes. The underside is yellowish purple flecked with black, though the coloration varies.

(1) Distribution and habitat preference. Mesoplodon mirus is primarily a North Atlantic species (Moore and Wood, 1957). It has been found in the Gulf of Maine on one occasion in which a male was stranded on Wells Beach, Maine.as reported by Raven (1937). Its distribution is inferred from the records of strandings, which have occurred from Florida to Nova Scotia and on the British Isles. Little is known of its migrations and life cycle.

(2) Food and feeding methods. Stomach contents of beached speciments indicate the whale's food to be squid and sometimes fish.

(3) Reproductive characteristics. A newborn calf measuring 2.2 m was found with a mother of 5.2 m in March (Brimley, 1943).

FAMILY ZIPHIIDAE: NORTHERN BOTTLENOSED WHALE, Hyperoodon ampullatus

Full-grown females of the species reach 7.3 m and males reach 9.1 m. The dorsal surface is usually described as a dark, charcoal gray and the ventral surface is a pale gray. However, observers who have been fortunate enough to see the animal at sea usually describe the color as brown. Winn, et al. (1970) noted that smaller animals were a uniform chocolate brown, while larger ones had varying amounts of cream or yellow blotchiness. The ventral portions were cream colored. The largest individual possessed a cream-colored, bulbous head and the smaller individuals possessed distinctly brown or tan heads. The short flippers are darker than the body. The forehead is high and bulging, particularly in males, and becomes larger as the animal grows older. The rostrum is in a "bottlenose" shape, which prompted its common name.

(1) Distribution and habitat preference. The range of this species is limited to the North Atlantic (Tomilin, 1957). Northern bottlenose whales have beached in North Dennis, Massachusetts (True, 1910). and in 1906 at Wells Beach, Maine (Norton, 1930). The species penetrates quite far north and frequently is seen among the floating ice. It is a pelagic species but occasionally is seen close to shore including off the New England coast (Tomilin, 1957). Mitchell (1974) reported that concentrations occur mainly in early summer months near Sable Island and along the edge of the continental shelf

around Newfoundland and along Labrador. Winn, et al. (1970) encountered small groups of 2, 5 and 4 animals off the Nova Scotia coast near the 100-fathom line at 43°50'N, 58°56'W on August 24 and 25, 1969, in water of 17 C surface temperature. A 21-foot immature male H. ampullatus was found beached on the shores of Cobequid Bay, Nova Scotia on October 9, 1969 (Case and Densmore, 1970). Informal reports suggest that bottlenose whales approach stopped vessels very closely or are attracted to non-motorized vessels (Winn, et al., 1970).

(2) Migration characteristics. In the spring, the whales migrate to the Arctic where they spend the summer. The return migration begins in September and continues into the winter. Gray (1882) reported that females and juveniles migrated closer to shore than did males. Little is known of their wintering grounds. The species forms herds of up to 10 individuals. Bottlenosed whales generally keep together in small schools, and if one is harpooned, the others usually do not leave it, but move more or less close to it until it has been killed (Jonsgard, 1969). Southwell (1884) reported that the species was playful and that individuals reacted to sounds in the water.

(3) Reproductive characteristics. Very little is known of the reproduction of the bottlenosed whale. It appears that most calves are born from March through June and the lactation period may last 5 to 7 months (Tomilin, 1957).

(4) Food and feeding methods. The chief diet of the bottlenosed whale consists of cephalopod mollusks and occasional fishes (Tomilin, 1957). Supposedly, this whale can dive for longer (2 hours) than any other cetacean, but no recent evidence confirms Gray's (1882) old report.

(5) Economic importance. In the late nineteenth century after Greenland right whales had become scarce, bottlenosed whales were hunted extensively until the development of the rorqual fisheries. They were hunted for the oil in their blubber, and also for the spermaceti in their foreheads (Southwell, 1882; Nishiwaki, 1972). They have been hunted in recent times by the Norwegians, Danes, and occasionally the Canadians within the northwest Atlantic. A total of 2,014 were killed by those three countries from 1966-1970.

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Chapter 15 Unique, Significant & Endangered Environments

15.0 UNIQUE, SIGNIFICANT, AND ENDANGERED ENVIRONMENTS

15.1 INTRODUCTION

This section is intended to identify and describe important ecological areas particularly sensitive to man's activities and therefore endangered by increased development which may result as a consequence of offshore lease activities.

Several interest groups have been involved in the inventory of such environments in the study area for some time, the efforts of some dating as far back as 1947. Within the last decade this interest has grown considerably, and presently a substantial body of information exists on the subject. The following discussion will first describe various inventories surveyed for the North Atlantic region and then detail the sites identified by these. A separate section is devoted to the general category of wetlands as an endangered environment, a special case of high political as well as ecological significance.

15.2 SUMMARY OF INVENTORIES

Six natural areas inventories are described below, four of which encompass the entire New England area, and two being relatively local (one covering the immediate coastal area of Maine, and the other, the Connecticut River basin). Nearly all were federally funded, and three were conducted by federal agencies.

(1) Natural Areas Project: Funded by the New England Regional Commission, and coordinated by the New England Natural Resources Center in Boston, this inventory was conducted throughout the entire New England area from 1971 to 1972, and resulted in the identification of over 4,000 sites of historical-cultural or ecological significance. (A listing of the categories used in identifying these sites is included in Table 15 - 1. The inventory was organized, on a state by state basis, with a "cooperator" designated for each state, and responsible for that state's effort. (A listing of the cooperators is contained in Table 15 - 2). For the most part, the inventory involved literature searching, interviewing various specialists and knowledgeable persons, field surveyes, and workshops. In many ways then, it was a "grass-roots" inventory.

Many of the sites identified by this inventory fall into the category of "Unique, Significant, and Endangered Environments" as discussed in this section. These are displayed on Figures 15-1 through 15-11 , to include such areas as habitats of rare and endangered species, environments of exceptional diversity and productivity, etc. It should be noted that the maps presented here plot locations of sites in coastal counties only. Plottings

for the entire area as well as for other categories can be obtained if desired. Permission from the state cooperators is required before any information from the inventory can be obtained, however, due to the proprietary nature of much of the inventory. Listings of exact sites are similarly obtainable in certain cases, again, with the permission of the state cooperators and under the condition that this not be disclosed to the public. This is to protect such fragile areas as eagle's nests and unexcavated archeological sites from various human pressures. A sample listing is included (see Figure 15- 11a).

Table 15-1 Classification of Natural Areas

The following is a list of the categories and sub-categories for the classification of natural areas as suggested by the New England Natural Resources Center for the 1971 Natural Areas Survey:

Geologic (Landform)

1 Gorges
2 Distinctive mountain features
3 Cliffs, palisades, bluffs, rims
4 Natural rock outcrops of geologic significance
5 Manmade rock outcrops of geologic significance (road cuts, quarries)
6 Volcanic (geologic evidence, i.e., lava flows, volcanic cores)
7 Glacial features, i.e., moraines, kames, eskers, drumlins, kettles, cirques, boulders and/or boulder fields, rock outcrop scarification, till banks, stria, U-shaped valleys, cols, glacial plucking
8 Natural sand, beach, dune, features, ripple marks, bifurcation, superposed, overhanging, beach chute, lineation, rill mark, mud balls, frost mark, burial of beach features by redistribution of surface sediments, including air or water transport, ice, animals, kelp, or other marine algae
9 Fossil evidence
10 Cave formations
11 Other unusual geologic formations

Soils (unusual soil groups; undisturbed by human activity)

Hydrologic

1 Significant and unusual water-land interfaces (i.e., islands; scenic stretches of coast, rivers or streams; lakes, ponds)
2 Whitewater stretches
3 Waterfalls
4 Natural springs
5 Marshes, bogs, swamps, flats (estuarine)
6 Rivers and streams supporting anadromous fish
7 Marshes, bogs, swamps (inland)
8 Aquifer recharge areas
9 Water areas supporting unusual or significant marine aquatic life (including off-shore underwater areas)
10 Water areas supporting unusual or significant freshwater aquatic life
11 Lakes, ponds of unusually low productivity
12 Lakes, ponds of unusually high productivity
13 Unusual natural river, lake, pond physical shape
14 Coastal stream with tidal bore
15 Reversing falls

Table 15 - 1 (Cont.)

Biologic (Flora)

1 Rare, remnant or unique species of plants
2 Unique plant communities
3 Plant communities unusual to a geographic area (i.e., spruce and fir association in southern New England is unusual but common in northern New England)
4 Individual plant specimens of unusual significance (i.e., large trees)
5 Plant communities representative of standard forest plant associations as identified by the Society of American Foresters and American Geographical Society
6 Areas exhibiting outstanding seasonal color

Biologic (Fauna - terrestrial animals)

1 Habitat area of rare, endangered and unique species
2 Habitat area of unusual significance to a fauna community (i.e., feeding, breeding, wintering, resting)
3 Fauna communities unusual to a geographic area (i.e., a pond and surrounding land area supporting moose in southern New England)
4 Habitat areas supporting fauna communities of unusual diversity and productivity

Biologic (Fauna - birds)

1 Habitat area of rare, endangered and unique species
2 Habitat area of unusual significance to a fauna community (i.e., feeding, breeding, wintering, resting)
3 Fauna communities unusual to a geographic area (i.e., a pond and surrounding land area supporting eagle nest in Rhode Island)
4 Habitat areas supporting fauna communities of unusual diversity and productivity

Biologic (Fauna - aquatic life)

1 Habitat area of rare, endangered and unique species including mammalian
2 Habitat area of unusual significance to a fauna community (i.e., feeding, breeding, wintering, resting)
3 Fauna communities unusual to a geographic area (i.e., a stream supporting salmon in southern New England)
4 Habitat areas, including off-shore bottom supporting fauna communities of unusual diversity and productivity
5 Relict populations isolated since climatic optimum (i.e., hard clams and eastern oysters)
6 Exotic introductions such as European oysters, Japanese oysters, and several West Coast clams

Table 15 - 1 (cont.)

Archeological

1 Native campsites, village sites or working sites
2 Unusual artifacts
3 Native burial grounds
4 Colonial settlements, graveyards, and forts
5 Early industrial sites
6 Colonial and native transportation routes (e.g., Mohawk Trail)
7 Kitchen middens

Cultural - Aesthetic - Visual

1 Manmade features (farmsteads) having unusual aesthetic significance due to natural setting
2 Scenic gravel or unimproved roads
3 Vista points
4 Unusual juxtapositioning of manmade and natural features (i.e., covered bridge crossing a scenic stretch of a stream or river) or significant aesthetic appeal
5 Trail systems

Table 15 - 2 New England Natural Areas, program cooperators

CONNECTICUT

Connecticut Forest and Park Association, Inc.
P.O. Box 389, 1010 Main Street
East Hartford, Connecticut 06108 (203) 289-3637

MAINE

Natural Resources Council of Maine
20 Willow Street
Augusta, Maine 04330 (207) 622-3101

MASSACHUSETTS

Trustees of Reservations
224 Adams Street
Milton, Massachusetts 02186 (617) 698-2066

Massachusetts Audubon Society
South Great Road
Lincoln, Massachusetts 01773 (617) 259-9500

NEW HAMPSHIRE

Society for the Protection of New Hampshire Forests
5 South State Street
Concord, New Hampshire 03301 (603) 224-9945

RHODE ISLAND

Audubon Society of Rhode Island
40 Bowen Street
Providence, Rhode Island 02903 (401) 521-1670

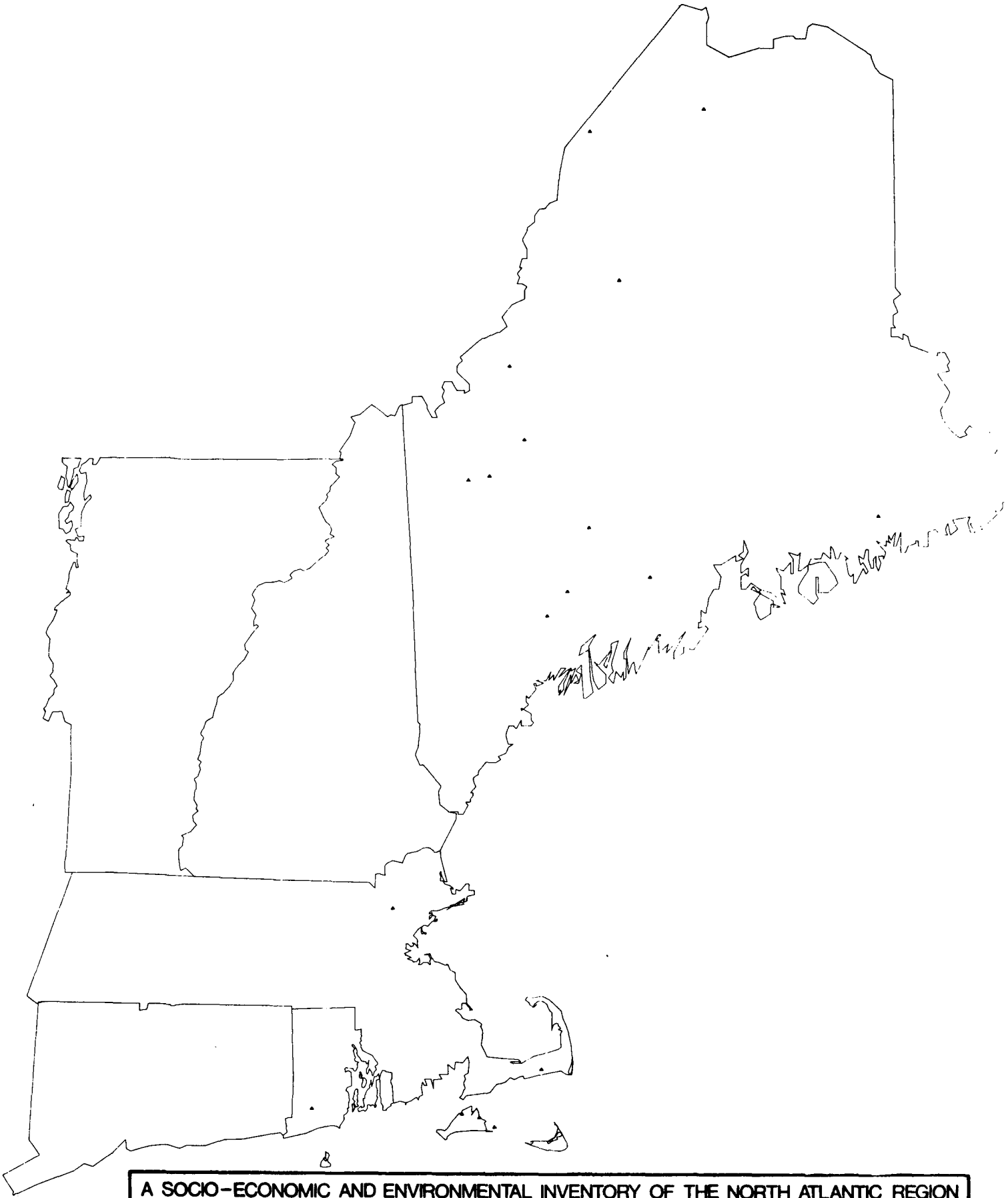
VERMONT

Vermont Natural Resources Council
97 State Street
Montpelier, Vermont 05602 (802) 229-9496

Or contact the
New England Natural Resources Center
506 Statler Office Building
Boston, Massachusetts 02116 (617) 542-9370

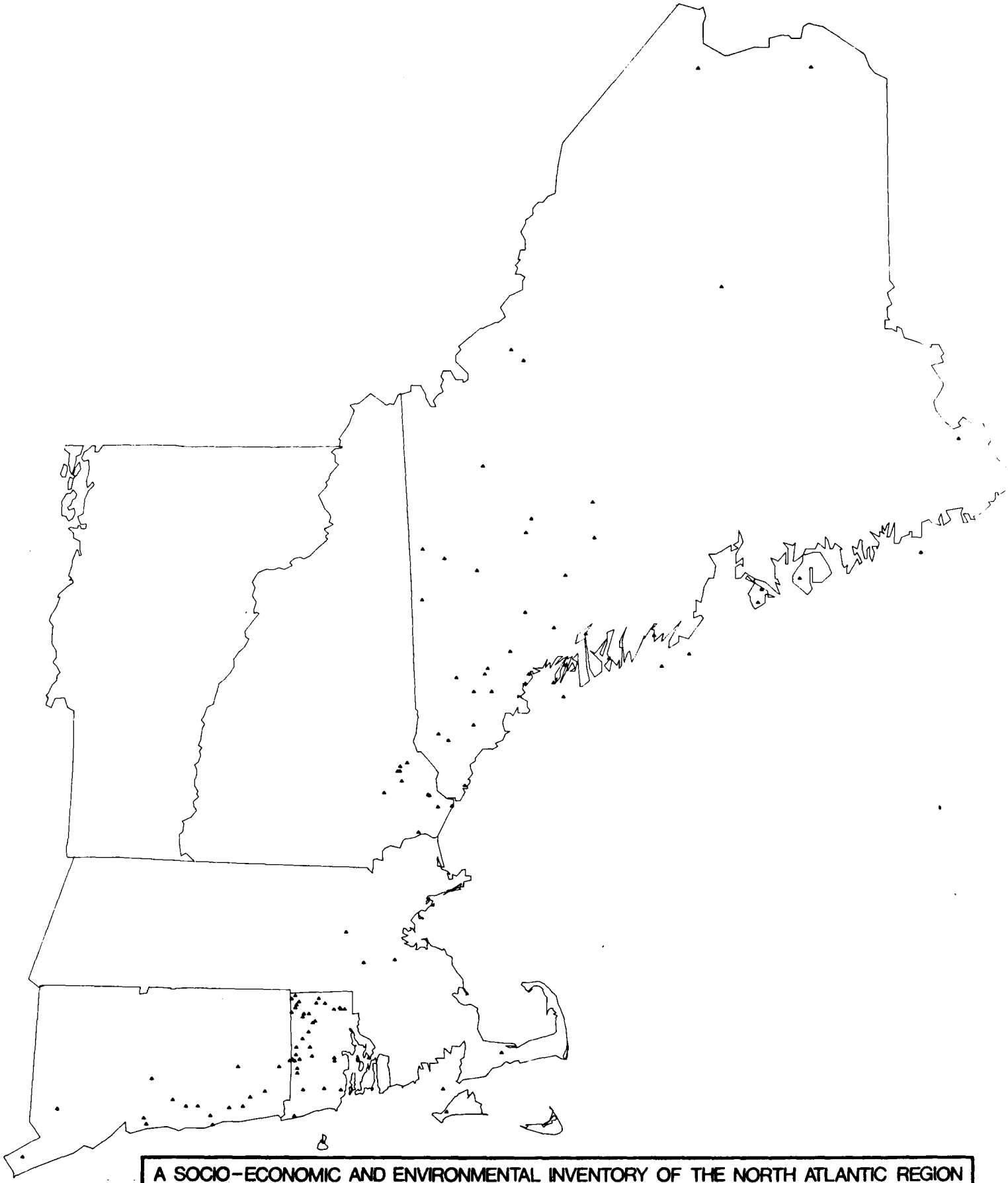
A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION

TRIGOM PARC	FIGURE 15-1	Rivers and Streams Supporting Andramous Fish (New England Natural Resources Center, 1973)



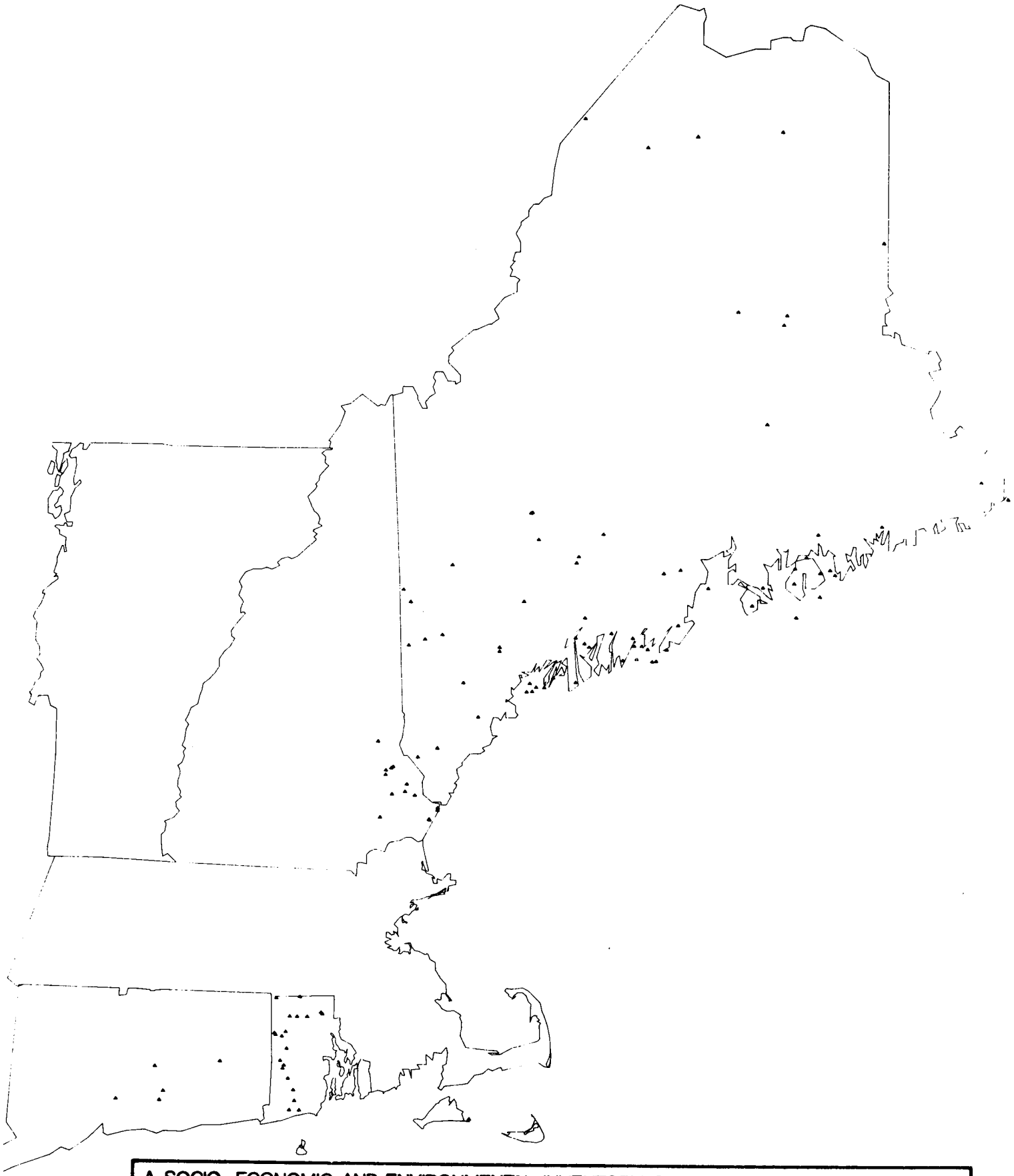
A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION

TRIGOM PARC	FIGURE 15-2	Lakes and Ponds of Unusually High Productivity (New England Natural Resources Center, 1973)



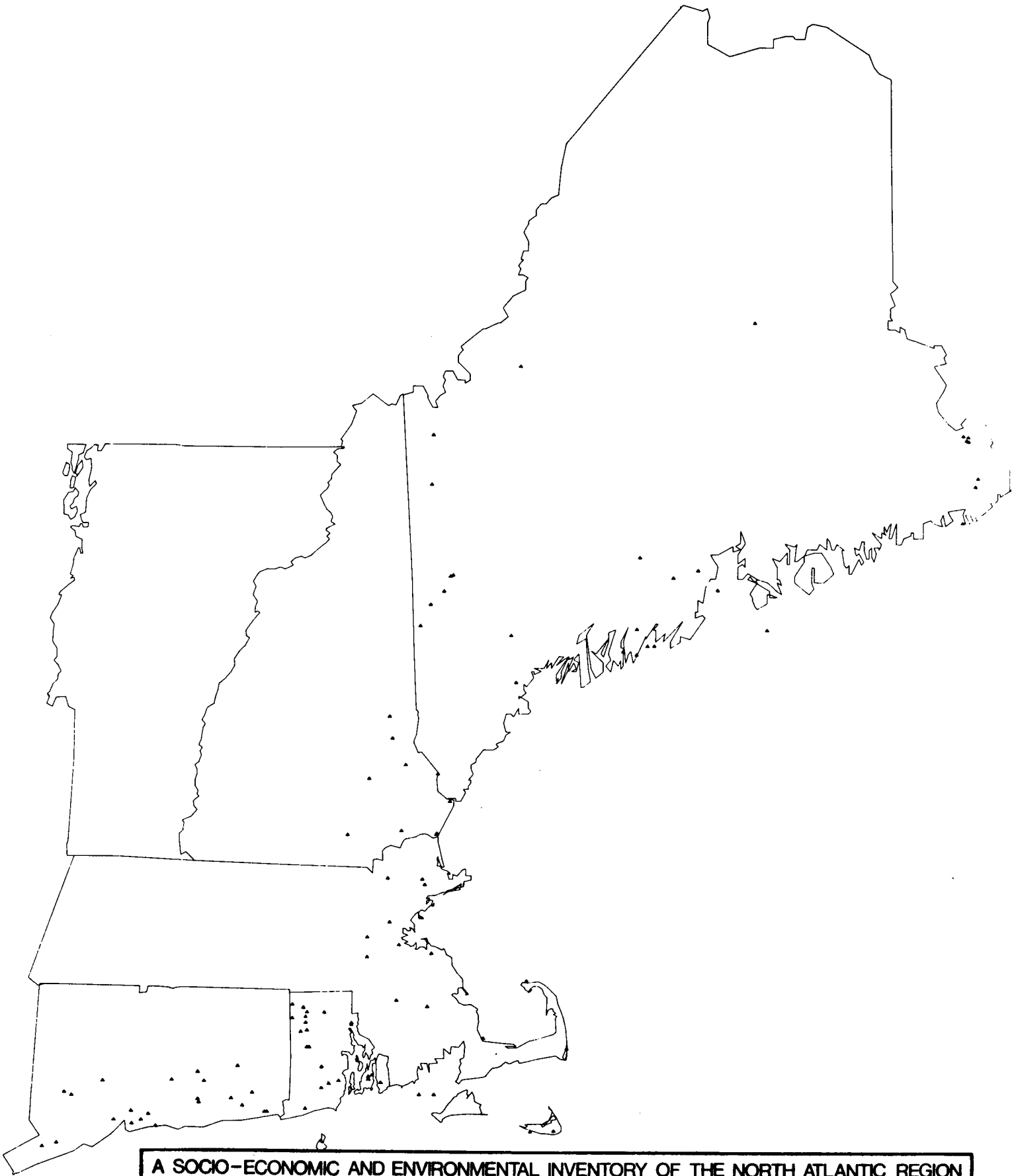
A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION

TRIGOM PARC	FIGURE 15-3	Rare Remnant or Unique Species of Plants (New England Natural Resources Center, 1973)



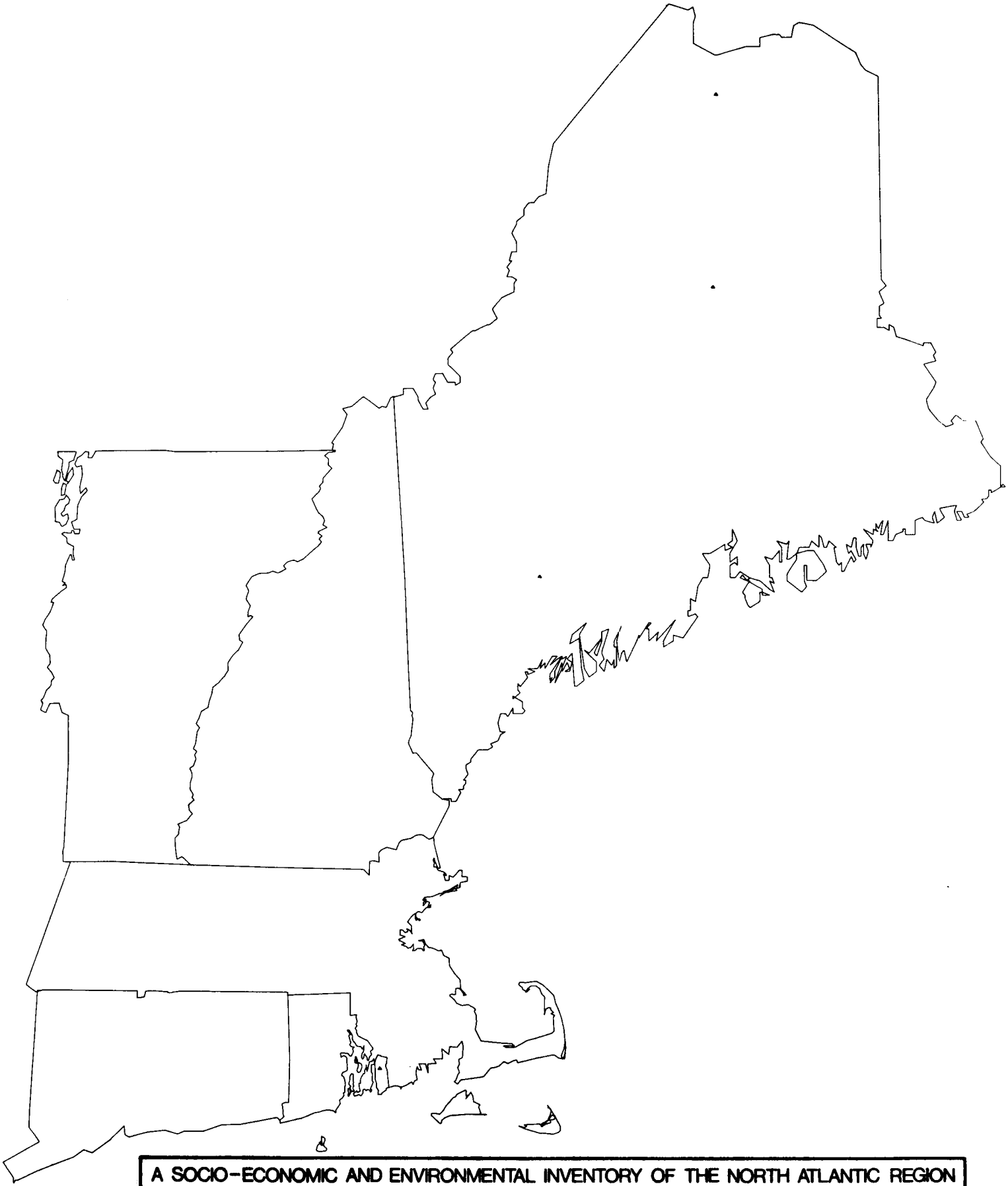
A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION

TRIGOM PARC	FIGURE 15-4	Unique Plant Communities (New England Natural Resources Center, 1973)



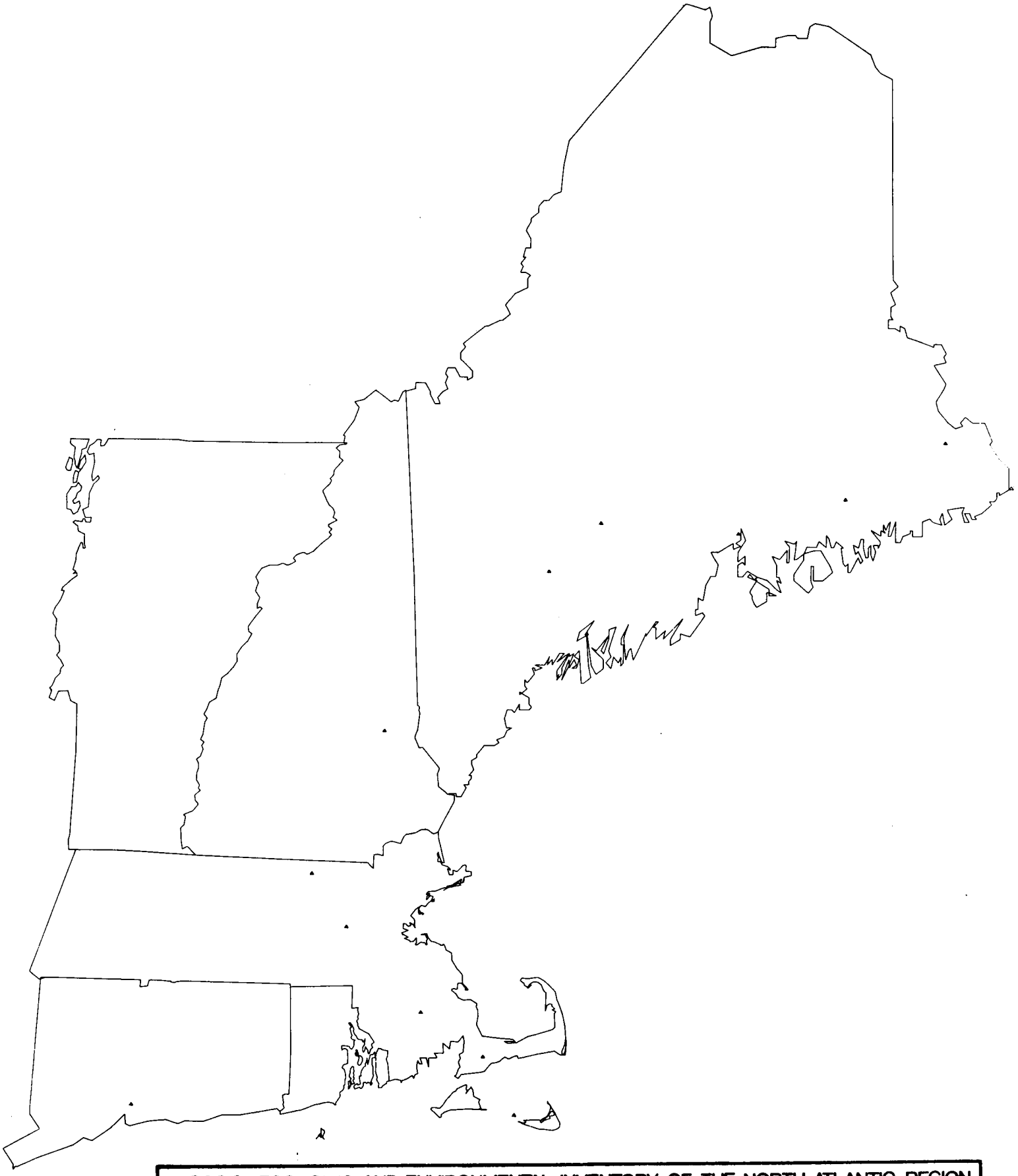
A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION

TRIGOM PARC	FIGURE 15-5	Plant Communities of Unusual Diversity and Productivity (New England Natural Resources Center, 1973)



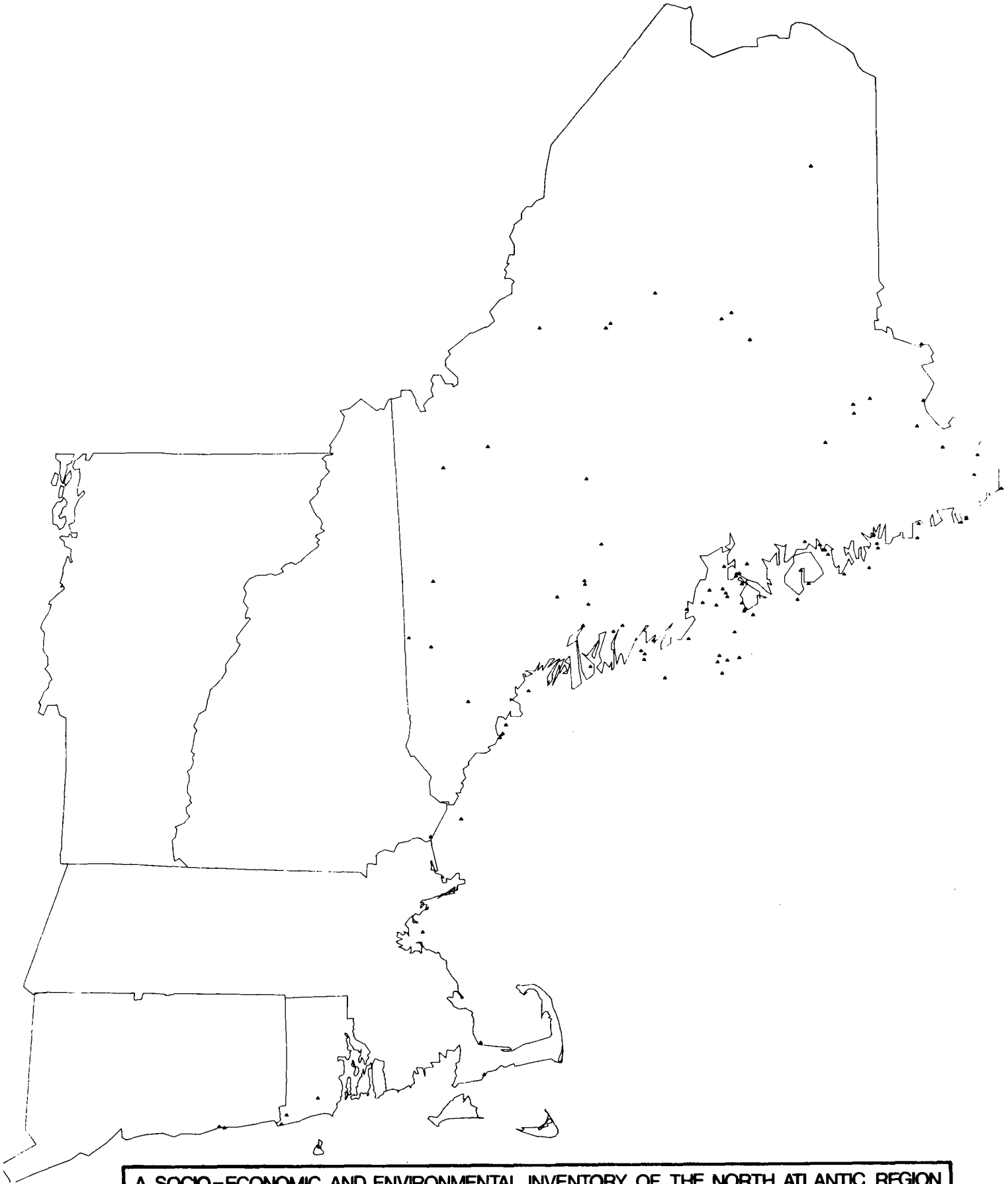
A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION

TRIGOM PARC	FIGURE 15-6	Habitat Area of Rare, Endangered and Unique Terrestial Fauna (New England Natural Resources Center, 1973)



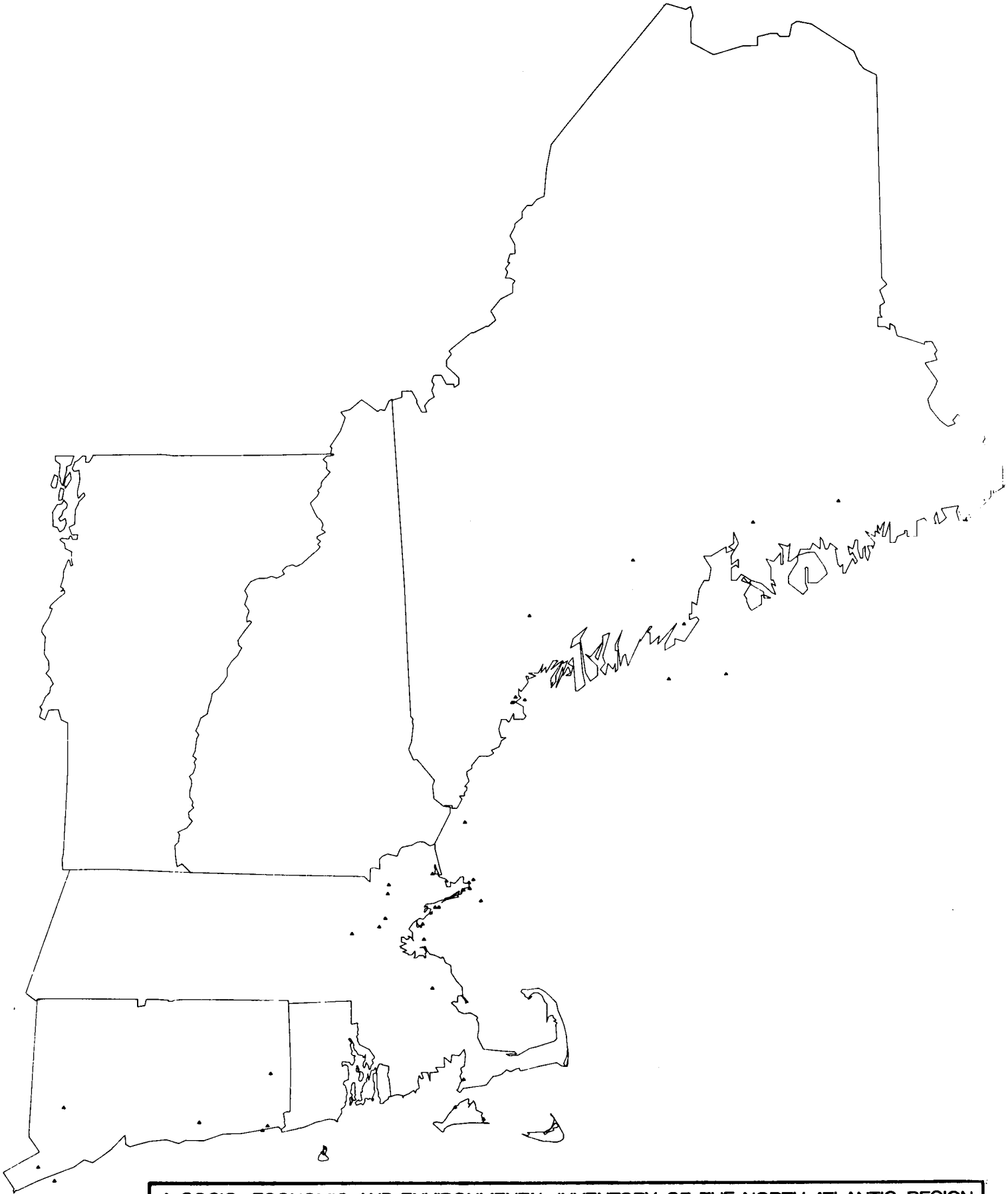
A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION

TRIGOM PARC	FIGURE 15-7	Habitat Area of Unusual Diversity and Productivity (Terrestial Fauna) (New England Resources Center, 1973)



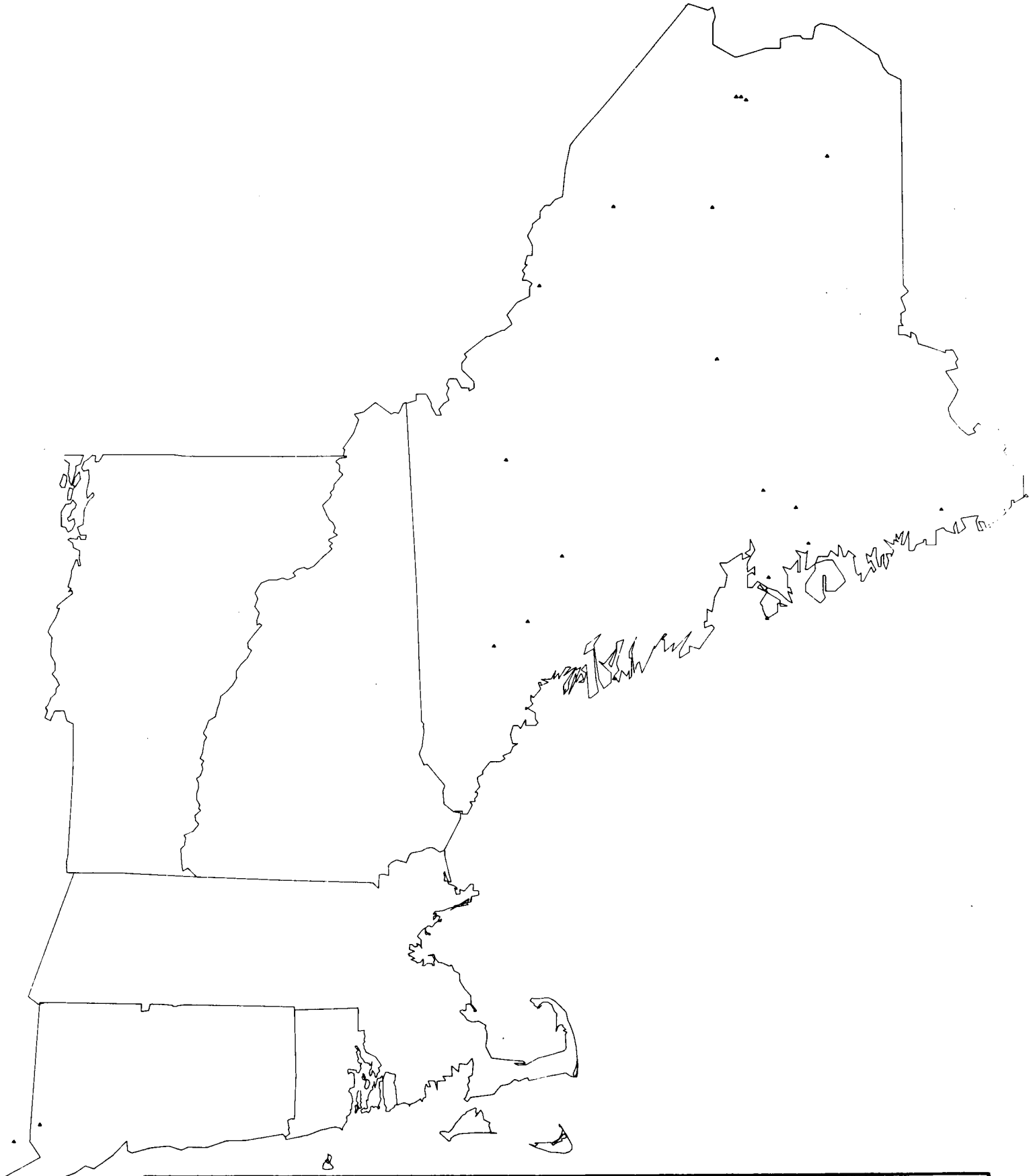
A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION

TRIGOM PARC | FIGURE 15-8 | Habitat Area of Rare Endangered and Unique Birds (New England Resources Center, 1973)



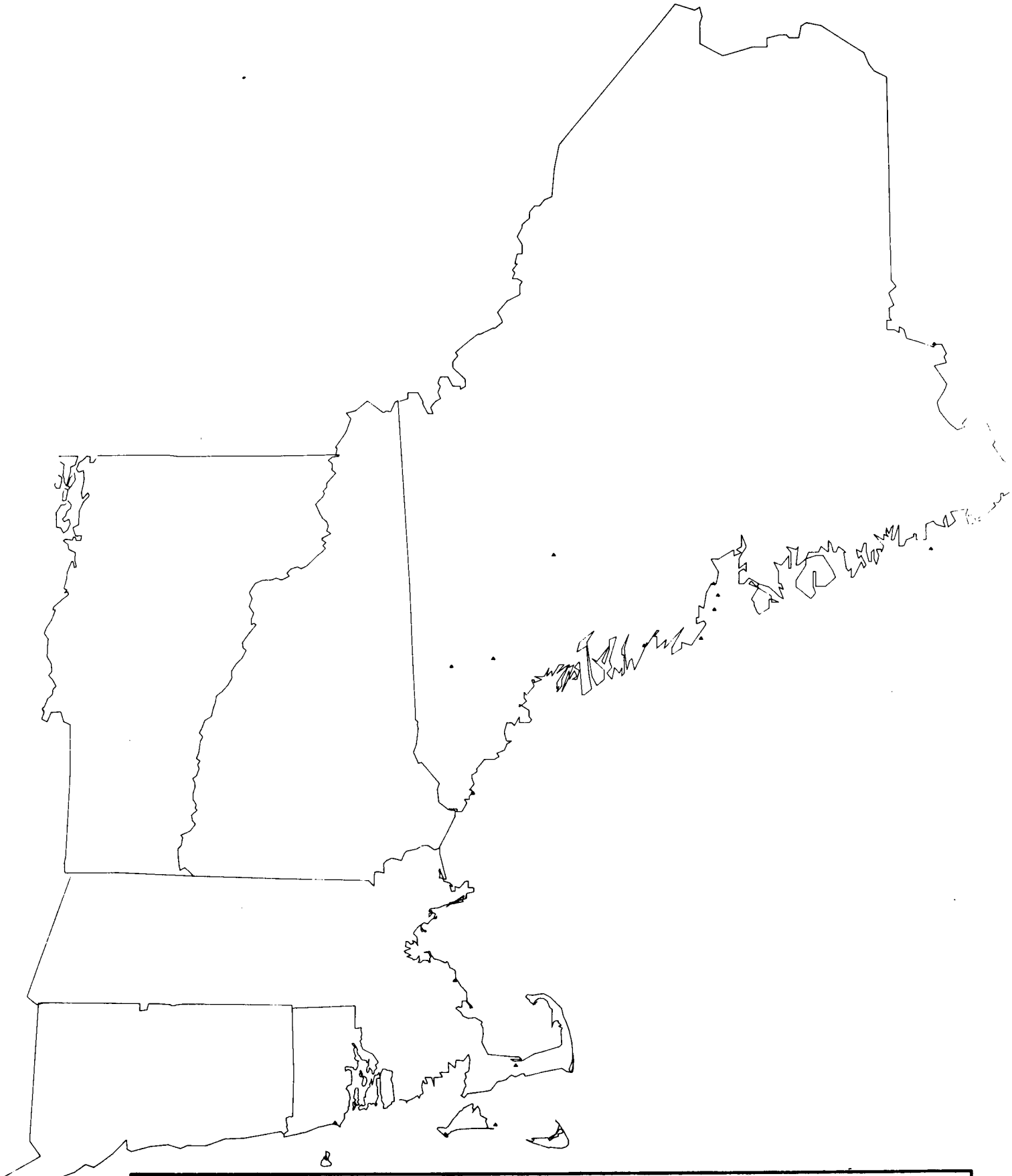
A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION

TRIGOM PARC | FIGURE 15-9 | Habitat Area of Unusual Diversity and Productivity (Birds) (New England Resources Center, 1973)



A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION

TRIGOM PARC	FIGURE 15-10	Habitat Area of Rare Endangered and Unique Species (Aquatic Fauna) (New England Resources Center, 1973)



A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION

TRIGOM PARC	FIGURE 15-11	Habitat Area of Unusual Diversity and Productivity (Aquatic Fauna) (New England Resources Center, 1973)

Area Number and Name:	M0325 Ship Stern Island
Primary Category:	601 Habitat area of rare, endangered, and unique species
Secondary Category:	103 Cliffs, palisades, bluffs, rims
Tertiary Category:	301 Significant and unusual land-water interfaces
One-Line Description:	Eagles Nest
County:	Washington
Town - City:	Harrington
Quadrangle - Series:	Petit Manan 15
Latitude - Longitude:	44 28' 25'' N 67 48' 5'' W
Area and Elevation:	15 acres 0 feet
Ecological Unit:	Marine
Occurrence:	Rare
Visual Impact:	High
Diversity:	Moderate
Naturalness Factor:	Naturally transitory
Significance Level:	Local, state, regional, and national
Inventory Date:	1971
Surrounding Land:	Water
Access/Impact:	Slight
Ownership:	Private ownership
Integrity of Area:	Unknown

Text:

Eagles nest located on small, highly scenic island. Island has spectacular cliffs which rise 75 ft. - 90 ft. above the water. The island is undeveloped and is privately owned. Security of the area is unknown. Protection should be provided for at least the eagles nest, if not the whole island. 29230

Names:

Maine Audubon Society, Baxter Blvd., Portland, Me. 04101
Barna Norton, Jonesport, Maine 04649

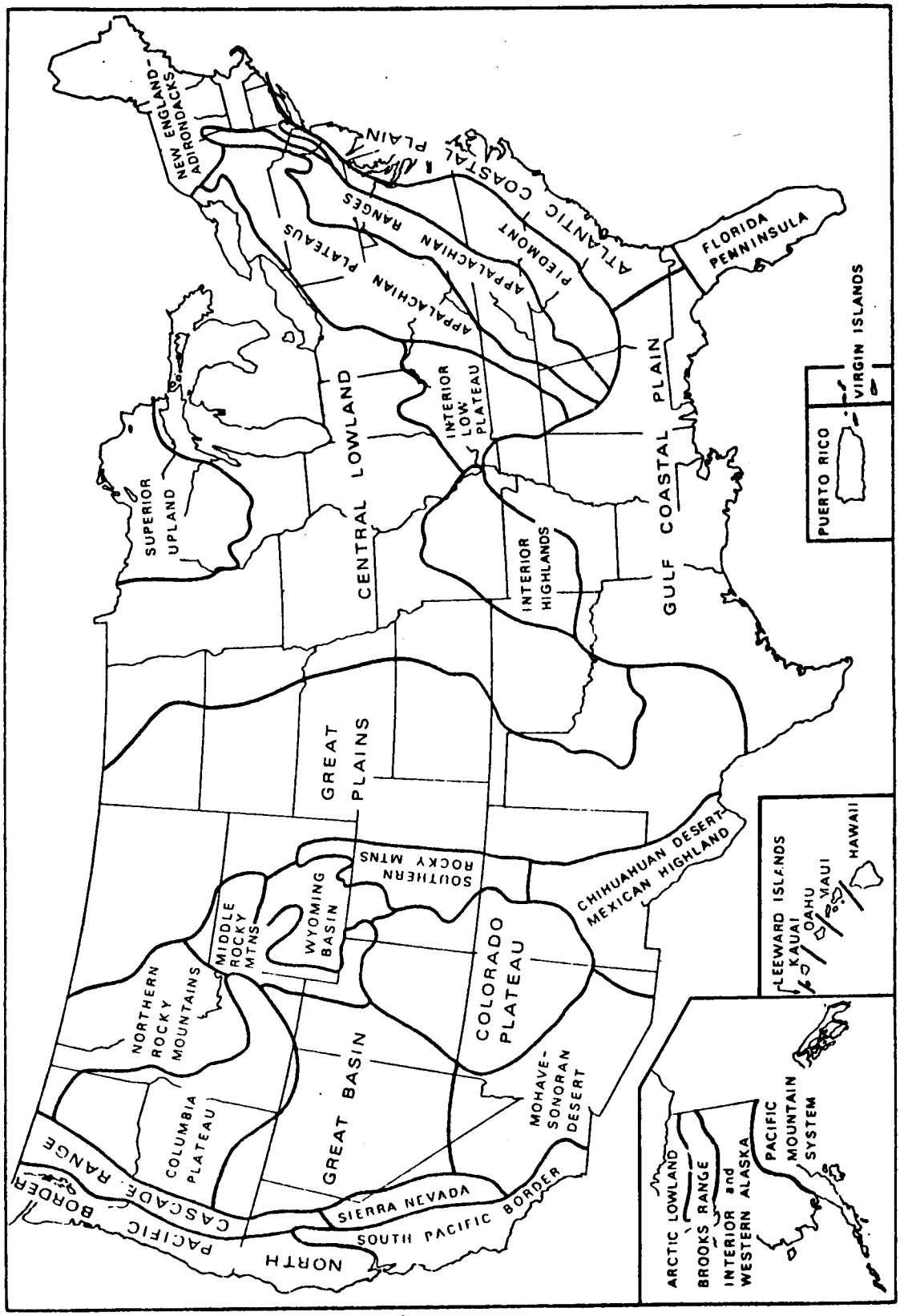
(2) The Natural Landmarks Program: This program is conducted by a branch of the National Park Service. Its objective, among others, is "to encourage the preservation of sites illustrating the geological and ecological character of the United States." (National Park Service brochure, the Natural Landmarks program, GPO 1971-483-417/16). Studies are sponsored which identify potential areas of national significance according to specific criteria. These are reviewed by Park Service officials and if qualified, classed as eligible, and after final review, added to the National Registry of Natural Landmarks. As with national historic sites, these sites are not protected by any legal mechanism; it is merely hoped that their designation as areas of national significance will help to preserve them. Consequently, they have been included as significant and endangered environments.

Detailed listings of potential, eligible and registered natural landmarks are included in Tables 15 - 3 through 15 - 7 in the following section.

Descriptions of these sites are contained in Attachment 15-1 at the end of this chapter. The sites, with the exception of those recommended by the Smithsonian Center for Natural Areas, were identified as a result of a series of "theme studies" sponsored by the Park Service, including Inland Wetlands, Eastern Deciduous Forest Types, Works of Volcanism, and Dinosaur Sites. Theme studies have recently been replaced by "regional studies" which involve comprehensive inventories of all themes for a particular physiographic region.

Within the study area, one such inventory is now under way. This covers the Atlantic Coastal Plain, including in our area, Cape Cod and Islands, Long Island, and northern New Jersey. The Smithsonian Center for Natural Areas has the contract, and a preliminary listing of sites is included below. A similar regional study is planned for the immediate future: the New England - Adirondack region. No contract has been awarded to date, however. Figure 15-12 illustrates the natural regions defined for the regional studies.

(3) Natural Areas of the Society of American Foresters: The Society of American Foresters (SAF), since 1947, has been identifying and listing "natural areas." A natural area is defined as "a physical and biological unit in as near a natural condition as possible which exemplifies typical or unique vegetation and associated biotic, edaphic, geologic and aquatic features." A total of 281 such sites are identified (SAF, 1972) nationwide, only six of which fall in the coastal counties of the study area. These are listed in the following section, on Table 15 - 8, which also displays size, ownership and forest types.



SOURCE: National Park Service

A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION

TRIGOM PARC

FIGURE 15-12

Natural Regions of the National Park Service (New England Resources Center, 1973)

(4) Research Natural Areas: This is a list of sites compiled in 1968 by the Federal Committee on Research Natural Areas. It is restricted to sites on federal lands, but nevertheless, identifies over 300 areas. Such sites are defined as areas where "natural processes are allowed to predominate and which (are) preserved for the primary purposes of research and education" (Federal Committee on Research Natural Areas, 1968). Table 15 - 8 in the following section lists and describes these areas.

(5) Conservation Priorities for Coastal Maine: Included in this inventory of coastal Maine (coastal defined as coastal towns which is a strip 10 to 20 miles wide) is a list of "areas of ecological significance which should be given the highest priority for conservation or protection." Reed and D'Andrea (a land use planning firm) conducted this extensive survey and analysis under funding from the New England Regional Commission, Maine State Planning Office, The Nature Conservancy, and the Smithsonian Center for Natural Areas. The latter has assumed administrative responsibility for the project. A draft report has been issued to date and is under review. It contains two listings:

(a) High priority Conservation Areas, 17 in number (referred to as Phase I Conservation Zones) and

(b) Second Priority Conservation Zones, 15 in number (referred to as Phase II Conservation Zones).

These are detailed in Table 15 - 9 and described in Attachment 15-2.

This effort is the most extensive and sophisticated inventory and priority analysis undertaken in the entire study region. Two processes of selection criteria were involved, the first utilizing a straightforward inventory classification scheme such as that used by the Natural Resources Center (described above and in Table 15-1 and the second introducing such concepts as diversity, rarity, international importance, research and educational value, representativeness, naturalness, and appropriateness of size to ensure self-support.

(6) Connecticut River Basin Comprehensive Land and Water Resources Investigation: This study, published in 1970, contains a listing of significant natural sites, selected by the National Park Service. (Volume IX, Appendix O, A Report of History and Environment). The sites appropriate to the immediate study area (coastal counties) are listed below (Table 15 -10).

15.3 LISTINGS OF SITES

The following tables detail the sites identified by the above inventories. Descriptions, excerpted from National Park Service "Landmark Briefs", and from the draft report of Reed and D'Andrea or Conservation Priorities for Maine (1973) are included in Attachments 15-1 and 15-2.

TABLE 15 - 3

NATIONAL REGISTRY OF NATURAL LANDMARKS

NORTH ATLANTIC COASTAL COUNTIES

REGISTERED SITES - SUMMARY: (as of January, 1974)

MAINE: None

NEW HAMPSHIRE: None

MASSACHUSETTS:

Bristol County - Northwest of New Bedford: Acushnet Cedar Swamp

Dukes County - Western tip of Martha's Vineyard: Gay Head Cliffs

RHODE ISLAND: None

CONNECTICUT: None

NEW YORK:

Westchester County - 2 miles south of Bedford: Mianus River Gorge

NEW JERSEY:

Passaic County - Paterson: Great Falls of Paterson

TABLE 15 - 4

NATIONAL REGISTRY OF NATURAL LANDMARKS

NORTH ATLANTIC COASTAL COUNTIES

ELIGIBLE SITES - SUMMARY: (As of January, 1974):

MAINE:
Washington County - 3 miles west of the village of Meddybemps: Meddybemps Heath

NEW HAMPSHIRE:
Strafford County - 2 miles west-southwest of Durham: Spruce Hole Bog

MASSACHUSETTS:
Essex and Middlesex Counties - between Wakefield and South Lynnfield: Lynnfield Marsh

RHODE ISLAND: None

CONNECTICUT:
Middlesex County - 2 miles west-southwest of the village of Chester: Chester Cedar Swamp
New London County - 1 1/2 miles northeast of the village of Voluntown: Pachaug - Great Meadow Swamp

NEW YORK:
Suffolk County - 3 miles west of Montauk Point: Big Reed Pond
Suffolk County - 100 miles east of New York City, in Block Island Sound off Long Island: Gardiner's Island

NEW JERSEY:
Essex County - in the borough of Roseland: Riker Hill Fossil Site

TABLE 15 - 5

NATIONAL REGISTRY OF NATURAL LANDMARKS

NORTH ATLANTIC COASTAL COUNTIES

POTENTIAL SITES - SUMMARY (as of January, 1974):

MAINE:

Washington County - Deciduous forest theme

(1) Bertand E. Smith Natural Area - Town of Baring; Lat 45°5'50" N; Long.67°18' W.
(2) Camp Two Natural Area - Edmunds Township; Lat.44°49' N; Long.67°13' W.
(3) Carrying Place Cove Bog - Town of Lubec; Lat.44°48'36" N; Long.66°59' W.
(4) Deblois Barrens - Town of Bangor; Lat.44°43' N; Long.67°55' W.
(5) Edmunds Natural Area - Lat.44°51'45" N; Long.67°12' W.
(6) Great Wass Island Jack Pine - Town of Beals; Lat.44°27'10" N; Long. 67°34'10" W.

Washington County - Inland Wetlands theme

(7) Deblois Barrens - Township 18; about 55 miles southeast of Bangor.
(8) Sunken Bog Natural Area - Moosehorn National Wildlife Refuge

Hancock County - Deciduous forests theme

(9) Chicken Millpond Jack Pine - Town of Gouldsboro; Lat.44°29'30" N; Long.68°1'30" W.
(10) Dayton Natural Area - in U. S. G. S. 15' quad for Nicatous Lake.

Knox County -Deciduous forests theme

(11) Appleton Bog - Town of Appleton; Lat.44°20' N; Long.69°15'W.
(12) Eastern Head Natural Area - Isle au Haut; Lat.44°1' N; Long.68°37' W.
(13) Meadow Mountain - Town of Warren.

Cumberland County - Deciduous forests theme

(14) Adams Pond - Town of Bridgton; Lat.43°59'36" N; Long.70°43' W.
(15) Gerard Jack Pine Stand - Town T 05 R 07 BKP WKR; Lat.45°29'20"N; Long.70°15'30" W.
(16) Gorham Mt. Laurel Stand - Town of Gorham; Lat.43°40' N; Long.70°27'30" W.
(17) Gray Pitch Pine Barrens - Town of Gray; Lat.43°55'50" N; Long.70°20' W.
(18) Great Mark Island - Town of Gray; Lat.43°42'54" N; Long.70°1'42"W.
(19) New Gloucester Black Gum Stand - Town of New Gloucester; Lat.43°58'34" N; Long.70°20'20" W.
(20) Otter Pond Rhododendron - Town of Standish; Lat.43°45'48" N; Long. 70°30'25" W.

TABLE 15 - 5

- (Continued)

MAINE - Cumberland County - (Continued)

(21) Portland White Pine Stand - City of Portland; Lat.43°43'15" N; Long. 70°18'10" W.
(22) Standish Rhododendron Stand - Town of Standish; Lat.43°47'40"N; Long.70°29'15" W.

York County - Deciduous forests theme
(23) Berwick Bearberry Stand - Town of Berwick; Lat.43°19'34" N; Long. 70°51'45" W.
(24) Harvey Butler Rhododendron Sanctuary - Town of Springfield; Lat.43°26' N; Long.70°49' W.
(25) Newfield Rare Plant Location - Town of Newfield; Lat.43°38' 35" N; Long. 70°58'30" W.
(26) Sand Pond - Lat.43°23'45" N; Long.70°45' W.

NEW HAMPSHIRE:

Strafford County - Deciduous Forests Theme
(27) College Woods - Durham - Town of Durham; Lat.43°07' N; Long. 70°59' W.
(28) Deciduous Forest with Flowering Dogwood - Township of Barrington and Rochester; Lat.43°16' N; Long.71°02' W.
(29) Eastern White Cedar Swamp - Barrington - Barrington Township; Lat.43°11' N; Long.71°01' W.
(30) Maple - Oak - Hickory Forest - Durham - Town of Durham; Lat.43°07' N; Long.70°52' W.

Rockingham County - Deciduous Forests Theme
(31) Saltmarsh - Seabrook - Seabrook Township; Lat. 42°53' N; Long. 70°50' W.
(32) Sand Spit - Hampton - Hampton Township; Lat.42°53' N; Long. 70°49' W.
(33) Seabrook Dunes - Seabrook Township; Lat.42°53' N; Long.70°49' W.
(34) Spruce Swamp - Fremont Township; Lat.43°00'N; Long.71°06' W.

MASSACHUSETTS:

Plymouth County - Inland Wetlands Theme
(35) Vinal Nature Reserve - 4 miles south of Cohasset.

Plymouth County - Deciduous Forests Theme
(36) Mast Island or Halfway Pond Island - 3 miles from Plymouth.

Barnstable County - Deciduous Forests Theme
(37) Sandy Neck and Great Marshes - in Town of Barnstable on State Route 6A.

TABLE 15 - 5 (cont.)

POTENTIAL SITES - MASSACHUSETTS - (Continued)

Bristol County - Inland Wetlands Theme
(38) South Hanson Swamp - Between South Hanson and Monoponsett Pond.
(39) Hockamock Swamp - 3-4 miles north of Taunton, reached via Rt. 138.

RHODE ISLAND:

Providence County - Inland Wetlands Theme
(40) Bowdish Reservoir Floating Bogs - 5 miles west of Chepachet, via Route 44.
(41) Lonsdale Marshes - adjacent to Central Falls, via Routes 122, 123.

Washington County - Inland Wetlands Theme
(42) Potts Bog - 4 miles northeast of East Greenwich, via Rt. 2.
(43) Newton Swamp - 1 mile east of Westerly, via Route 91 or U.S. 1.
(44) Ell Pond - 3.5 miles west of Hope Valley, reached via West Rockville Road from Rt. 138 at Rockville.
(45) Great Swamp - 5 miles of the Atlantic Ocean bordering the north shore of Wordens Pond.
(46) Indian Cedar Swamp - 4 miles east of Bradford via Route 91.

NEW YORK:

Rockland County - Inland Wetlands Theme
(47) Iona Island Marsh (Salisbury Meadow)- about 2 miles west of west side of the Hudson River.

Suffolk County - Inland Wetlands Theme
(48) Nissequogue River - One mile west of Smithtown via the Jericho Turnpike and Route 25.
(49) Long Pond - 3 miles north of Bridgehampton.
(50) Kellis Pond - 1 mile southwest of Bridgehampton, via Route 27.

NEW JERSEY:

Hudson County - Works of Volcanism Theme
(51) Palisades of The Hudson - on New Jersey side of the Hudson River.

TABLE 15 - 6

NATIONAL REGISTRY OF NATURAL LANDMARKS

NORTH ATLANTIC COASTAL COUNTIES

POTENTIAL SITES: Additional areas (second priority) proposed by Ed Flaccus, Eastern Deciduous Forests Theme Study, National Park Service

NAME	TOWN	COUNTY	DESCRIPTION
MAINE			
Allen Island	St. George	Knox	Sea cliff, unusual plants, 500 A., probable high rank
Baker Island			Spruce forest
Bald Head Cliff	York	York	Juniperus horiz. (So. most)
Bald Porcupine Island Natural Area	Gouldsboro	Hancock	White spruce-fir-birch
Barred Island	Deer Isle	Hancock	Spruce, 2 acres
Basket Island	Cumberland	Cumberland	Wooded, 11 acres
Big Garden Island	Vinalhaven	Knox	Varied deciduous, 10 acres
Big White Island	Vinalhaven	Knox	Unspecified, 10 acres
Black Mountain	T 10 SD	Hancock	Bog at pond edge; 1000 A.
Blagden Reserve	Bar Harbor	Hancock	Dense spruce forest; 110 A.
Cow Island	Bremen	Lincoln	Untouched spruce forest; 100 acres
Crescent Beach	C. Elizabeth	Cumberland	Beach & dunes, 189 acres

TABLE 15 - 6 (continued)

NAME	TOWN	COUNTY	DESCRIPTION
MAINE (continued)			
Crocket Cove Woods	Stonington	Hancock	Boggy area, 46 acres
Damariscove Island	Boothbay	Lincoln	Grassy, rocky island, 200 A.
Dram Island	Sorrento	Hancock	Spruce forest, 6 acres
Eustis Preserve	Georgetown	Sagadahoc	Beach, 43 acres
Fernald's Neck	Camden	Knox, Waldo	Coniferous forest, 300 A.
Fifth Machias Lake	T 36 MD BPP	Washington	Northern hardwood; Coniferous forest, 120 A.
Georgetown Bog	Georgetown	Sagadahoc	Sphagnum bog, 1 acre
Goose River	Swanville	Waldo	Marshes - 1000 acres
Groveville Kettle Pond	Buxton	Cumberland	Kettle bog, orchids, 40 A.
Harkness Grant	Rockport	Knox	Unspecified, 5 acres
Hot hole Pond	Orland	Hancock	Fresh marsh, 100 acres
Ketterlinus Preserve	Mt. Desert	Hancock	Forest, 25 acres
Knight Pond	Lincolnville	Waldo	Fresh marsh with white cedar, 102 acres
La Verna Reserve	Bristol	Lincoln	Coniferous forest, 119 A.

TABLE 15 - 6 (Continued)

NAME	TOWN	COUNTY	DESCRIPTION
MAINE (Continued)			
Lane's Island	Vinalhaven	Knox	Salt meadow, 44 acres
Limington Mt. Laurel	Limington	York	Unusual species, Mt. Laurel, 5 acres, probable high rank
Mark Island		Knox	Northern Hardwood, Coniferous forest, 36 acres
Mill Cove	South Portland	Cumberland	Tidal flats, 32 acres
Montsweag Preserve	Woolwich	Sagadahoc	Northern hardwood, Coniferous forest, 45 acres
Ogunquit Beach	Ogunquit	York	Beach & dunes, 50 acres, probable high ranking
Parsons Beach	Kennebunk	York	Beach & dunes, 100 acres, probable high ranking
Plummer Point	South Bristol	Lincoln	Spruce-pine forest, 70 A.
Robert Tristam Coffin Wild Flower Reserve	Woolwich	Sagadahoc	175 acres
Rockland Bog (The Bog)	Rockland	Knox	Bog, 650 acres
Round Island	Stonington	Hancock	Spruce, 40 acres
St. Clair Trac 5	Northport	Waldo	Bog, including white cedar, 250 acres, probable high ranking

TABLE 15 - 6 (continued)

NAME	TOWN	COUNTY	DESCRIPTION
MAINE: (continued)			
Salt Pond	Bristol	Lincoln	78 Acres
Scarboro Marsh	Scarboro	Cumberland	Salt marsh, 2741 acres high ranking probable
Shaw's Meadow	Woolwich	Sagadahoc	Bog and orchids, 3 acres
Smith Island Preserve	Vinalhaven	Knox	Barren, rocky, 20 acres
Swett Marshes	Georgetown	Sagadahoc	Salt marsh, 845 acres, probable high ranking
Turtle Island	Winter Harbor	Hancock	New England spruce-fir forest, 152 acres
Vaughn's Island	Kennebunkport	York	35 acres
Woolwich Dike	Woolwich	Sagadahoc	Salt marsh, 50 acres
Wreck Island	Stonington	Hancock	Rock ledge, 70 acres
NEW HAMPSHIRE			
Adams Point	Durham	Strafford	Salt marsh, 40 acres, probable high ranking
Ayre's Pond Dogwood	Barrington	Strafford	Flowering dogwood, 10 A.
Barrington Gum Swamp	Barrington	Trafford	Black gum swamp, virgin, 50 acres

TABLE 15 - 6 (continued)

NAME	TOWN	COUNTY	DESCRIPTION
NEW HAMPSHIRE (continued)			
Bellamy R. Hardwoods	Madbury	Strafford	Transition hardwoods, 100 A.
Brown's Mill Bog	Rye	Rockingham	Eastern white cedar bog forest, 10 acres
Durham Oak-Hickory	Durham	Strafford	Transition hardwood, 3 A.
Fairhill Swamp	Rye	Rockingham	Eastern white cedar bog forest, 37 acres
Kingston Cedar Swamp	Kingston	Rockingham	Eastern white cedar bog, 100 acres
Lee Dogwood	Lee	Strafford	Flowering dogwood, transition hardwoods, 6 acres, probable high ranking
Merrymeeting River Marsh	Alton	Strafford	Marshes, 6000 acres, high ranking probable
Barrington Dogwood	Barrington	Strafford	Flowering dogwood, 38 acres, probable high ranking
Piscataqua River Estuary	Dover	Rockingham	Salt marsh, 10,000 acres

TABLE 15 - 7

NATIONAL REGISTRY OF NATURAL LANDMARKS

NORTH ATLANTIC COASTAL COUNTIES

POTENTIAL SITES: Preliminary list proposed by Center for Natural Areas, Smithsonian Institution, to National Park Service, February 1971, for the Atlantic Coastal Plain Natural Region

AREA	ACREAGE	OWNERSHIP	VEGETATION	COUNTY
NEW YORK				
Mashomack Peninsula	-	Private	-	Suffolk
Wolfswamp Sanctuary	20	Private	-	Suffolk
Daniel R. Davis Sanctuary	40	Private	-	Suffolk
Davenport Sanctuary	8	Private	-	Suffolk
Edwin C. Hoyt Woods	4	Private	-	Suffolk
Butler-Huntingdon Woods	66	Private	-	Suffolk
Delafield Woods Preserve	16	Private	-	Suffolk
Ruth Wales Dupont Wildlife Sanctuary	32	Private	-	Suffolk
Kellis Pond	19	Private	Fresh Marsh	Suffolk
Long Pond	45	Private	Fresh Marsh Upland Hardwood	Suffolk
Nissequogue River	400	-	Bog/Bottomland Hdwd.	Suffolk
West Yaphank Woods	150	-	-	Suffolk
Church Tract	20	Private	-	Nassau
Tickapausha Preserve	50	State	-	Nassau
Kings Point Pond Preserve	15	Private	-	Nassau
To be investigated				
Plum Island	-	Federal, Private	Fresh Marsh Dunes	Suffolk
Fishers Island	-	Federal, Private	Fresh Marsh Dunes Maritime Forest	Suffolk
Shinnecock Inlet	-	Private	Salt Marsh/Dune Maritime Shrub Thicket	Suffolk
Fire Island (Sunken Forest)	-	Federal	Maritime Forest	Suffolk
Montauk	-	-	Bog	Suffolk

TABLE 15 -- 7 (Continued)

AREA	ACREAGE	OWNERSHIP	VEGETATION	COUNTY
MASSACHUSETTS				
To be investigated				
Hardings Beach	-	Private	-	Barnstable
Mashpee River	-	Private	-	Barnstable
Monomoy National Wildlife Sanctuary		Federal	Dunes/Maritime Forests	Barnstable
Martha's Vineyard	-	Private	Dunes/Maritime Shrub Thicket/Upland Hdwd.	Dukes
Naushon Island	-	-	Dunes/Maritime Forests	Dukes
Nantucket Island	-	Private	Dunes/Maritime Shrub Thicket	Barnstable
NEW JERSEY				
Helmetta Woods, Bogs	200	Private	Bog/Upland Pine Forest	Middlesex

TABLE 15 - 8

UNIQUE AND SIGNIFICANT ENVIRONMENTS
IDENTIFIED BY OTHER NATURAL AREAS INTEREST GROUPS

NORTH ATLANTIC COASTAL COUNTIES

NAME	COUNTY	ACREAGE	OWNERSHIP [a]	VEGETATION-DESCRIPTION	IDENTIFIED BY [b]
MAINE					
Bald Porcupine Island Natural Area	Hancock	40	NPS	White spruce-Balsam fir-Paper birch	SAF, FCRNA
Bertand E. Smith Natural Area	Washington	160	BSF & W	White pine; Paper birch-Red spruce-Balsam fir	SAF, FCRNA
Moosehorn Meadows Natural Area	Washington	50	BSF & W	Poplar-Birch	SAF, FCRNA
Sunken Bog Natural Area	Washington	13	BSF & W	Black spruce-Tamarack	SAF, FCRNA
Eastern Head Natural Area	Knox	140	NPS	White Spruce-Balsam fir-Paper birch	SAF, FCRNA
Edmunds Unit Natural Area	Washington	160	BSF & W	Red spruce-Balsam fir; Northern white-cedar	SAF, FCRNA
MASSACHUSETTS					
Ludlow Griscom Dune Natural Area	Essex	150	BSF & W	Bayberry-Beach plum-American beach grass	FCRNA

[a] NPS = National Park Service
BSF & W = Bureau of Sport Fisheries and Wildlife
[b] SAF = Society of American Foresters
FCRNA = Federal Committee on Research Natural Areas

SOURCES: Robert E. Buckman and Richard L. Quintus, 1972, Natural Areas of The Society of American Foresters: Society of American Foresters, Washington D. C.; Federal Committee on Research Natural Areas, 1968, A Directory of Research Natural Areas on Federal Lands of the United States: U. S. Superintendant of Documents, U. S. G. P. O., Washington D. C..

TABLE 15 - 9

CONSERVATION PRIORITIES FOR MAINE

SOURCE: Reed and D'Andrea, September, 1973 draft, Conservation Priorities Plan - Coastal Overview: prepared for the Smithsonian Center for Natural Areas, Washington, D. C.

First Priority Areas:

1. Cobscook Bay, Washington County; including South Bay, Straight Bay and Whiting Bay, and all land surrounding these bays except for Moosehorn National Wildlife Refuge.

2. Downeast, Washington County: including the coast from Quoddy Head in Lubec to Dennison Point in Cutler.

3. Little Kennebec Bay, Washington County: including the entire bay from its mouth at Point of Main, the East and West Branches and Mill Pond, the drainage of the Englishman River, and the open coast from Shoppee Point to Howard Cove.

4. Rogue Island Archipelago, Washington County: including Rogue Island, the adjacent islands and all islands to the east which lie within the Town of Jonesport.

5. Great Wass, Washington County: including all islands south of Mark Island in the town of Jonesport, Great Wass Island, and those smaller islands to the east and west that are in the town of Beals.

6. Pleasant Bay, Washington County: including all the islands and and mainland within Pleasant, Narraguagus and Harrington Bays. Numerous salt marshes to the North and the Pleasant River drainage extending to the Barrens are to be included in the area.

7. Petit Manan, Washington County: including Gouldsboro Bay, Dyer Bay and Pigeon Hill Bay. All the mainland, Bois Bubert Island and the drainages of Whitten Parren Stream and Chicken Mill Stream. All subsidiary Bays such as West Bay, Joys Bay and Grand Marsh Bay are understood to be included in this area.

8. Tunk Lake, Hancock County: including the area bounded by the Schoodic Mountains and the drainage of Tunk Stream.

9. Merchants Row, Hancock County: including all islands lying south of Stonington and north of Isle Au Haut with Scraggy Island being the western boundary and Phoebe Island the eastern.

TABLE 15 - 9 (cont.)

10. Fox Island Group, Knox County: including the northern half of Vinalhaven (including The Basin), the smaller islands to the south and southwest, and the islands north on North Haven and west of Deer Isle.

11. Muscongus Bay, Lincoln, Waldo Counties: including the entire Muscongus Bay, St. George River, Muscle Ridge region, the eastern shore of of Pemaquid Neck, the Medomak River to Waldoboro, the St. George River to Thomaston, and the western shore of Penobscot Bay to Owls Head; also the offshore islands to Metinic Island.

12. Upper Sheepscot River, Lincoln County: including the east and west banks of the Sheepscot River from North Edgecomb to Whitefield, (excluding the developed areas), Cod Cove, the northeast half of Davis Island, Lehman, Woodbridge and Cunningham Islands to Marsh and Dyer Rivers, Sherman Lake and Deer Meadow.

13. Back River, Sagadahoc County: including the east and west shores of the Sasona River from Hanson Bay (Woolwich) to Soldier Point (Georgetown); Brookings, Hockomock, Hall, and Nubble Bays and all islands therein; shores of the Back River from Flying Point to Bald Head and Crow Island; shores of the Kennebec River from Marr Island (Georgetown) to Bluff Head (Arrowsic), Goat Island, Lee Island, Ram Island, and the Cutting Creek marsh (Phippsburg).

14. Morse Mountain, Sagadahoc County: including the Branch, Cape Small, and Head, and Popham beaches and offshore rocks and ledges; bounded by a line extending from Ashdale Corner southerly along Highway 216, crossing Cape Small Harbor and extending to Philippsburg - Georgetown town line, following that line to Cox Head and west to Ashdale Corner; to include Heron and Fox Islands.

15. Damariscotta River, Lincoln County: including both shores of the Damariscotta River from Salt Bay South, and including Upper Pond and Marsh, Johns River all islands at the mouth of the Damariscotta to Damariscove and the Pumpkin Islands.

TABLE 15 - 9 (cont.)

16. Merrymeeting Bay, Sagadahoc County: including the entire Bay, the Kennebec River to the northern end of Swans Island (Bath-Woolwich) the Abagadasset River to Baker Brook, the Cathance River to its source north of Bowdoin Center, the west branch north of Bowdoinham, the Muddy River to its source, the Androscoggin River to the Railroad Bridge, Wiskeag Creek to the railroad bridge, and the Eastern River in Dresden.

17. Gerrish Island, York County: from Rayne's Neck in York to Chauncey Creek in Kittery.

Second Priority Areas:

1. Cross Island, Washington County, Town of Cutler.

2. Chandler River, Washington County, Towns of Jonesboro and Jonesport.

3. Indian River, Washington County, Towns of Addison, Columbia Falls, Jonesboro, Jonesport.

4. Skillings River, Hancock County, Towns of Hancock, Lamoine.

5. Long and Bartlett Islands, Hancock County, Towns of Blue Hill, Mt. Desert, Tremont.

6. Salt Pond, Hancock County, Towns of Blue Hill, Brooklin, Sedgewick.

7. Baduce River, Hancock County, Towns of Brooksville, Castine, Penobscot.

8. Sears Island, Waldo County, Towns of Searsport, Stockton Springs.

9. Islesboro, Waldo County, Town of Islesboro.

10. Lower Sheepscot Estuary, Lincoln County, Towns of Boothbay, and Edgecomb.

11. Harpswell and the Basin, Cumberland and Sagadahoc Counties, Towns of Harpswell and Phippsburg.

12. Wolf Neck, Cumberland County, Town of Freeport.

TABLE 15 - 9 (cont.)

13. Spurwink River, Cumberland County, Towns of Scarboro, Cape Elizabeth.

14. Little River, York County, Towns of Biddeford, Kennebunkport.

15. Machias River, Washington County, Towns of Centerville, Machias. Northfield, Whitneyville, T-19-MD, T-25-MD.

TABLE 15 - 10

SIGNIFICANT SITES IN THE CONNECTICUT RIVER BASIN

MIDDLESEX COUNTY

SOURCE: U. S. Department of the Interior, National Park Service, June, 1970, Comprehensive Water and Related Land Resources Investigation, Connecticut River Basin, Volume IX, Appendix O, A Report of History and Environment: prepared for the Connecticut River Basin Coordinating Committee.

1. Spiderweed - near Middletown; 157 acres of heavy hardwood forests; ownership: Connecticut Chapter of the Nature Conservancy.

2. Meadow Woods - Town of Essex; 97 acres of heavily wooded upland: oak, maple, hickory, beech, birch, about 50 years old; ownership: Connecticut Chapter of the Nature Conservancy.

3. Salt Marshes along lower Connecticut River - including Great Island Complex, state-owned Ragged Rock Creek area, 200 acres in the Griswold Point - Blackhall River section, 300 or 400 acres on the Lieutenant River.

4. Salt Marshes in Old Lyme - 15 acres south of the mouth of the Lieutenant River, just south of the New Haven Railroad Tracks; ownership: Connecticut Chapter of the Nature Conservancy.

5. Burnham Brook Preserve - Town of East Haddam; 98 acres including a perennial spring-fed trout stream, beech, yellow-birch, hemlock forests; also oak-hickory stands; ownership: The Nature Conservancy.

15.4 WETLANDS AS AN ENDANGERED ENVIRONMENT

15.4.1 INTRODUCTION

Protection of wetlands has become a significant environmental issue, nationwide, in the last two decades, as awareness of the intrinsic values and rapid rate of destruction of these environments has increased. Several landmark works have been published describing the values of wetland, among the most notable, Wetlands Preservation by Peter L. Johnson of the Open Space Institute (1969). While it is not the purpose of this section to detail the functions and values of these environments, a brief listing will illustrate the importance of wetlands, and explain their selection as an endangered environment of particular sociological and ecological significance. (A detailed discussion of the ecology of marine wetlands is contained in a previous section, Chapter 4, Section 4.6.4).

According to Johnson (1969), tidal marshes serve the following functions (many of which can be attributed to inland wetlands as well):

(a) Hydrologic Function: The marsh provides water absorption and storage capacity (from tidal surges and upland runoff) which minimizes erosion and flood water damage. One acre of marsh is capable of absorbing and holding 300,000 gallons of water.

(b) Hydraulic-Hydrographic Function: The marsh mitigates the potentially damaging physical impact of storm tides and waves against the upland and developed areas. It serves as a natural buffer. Its sponge-like qualities (peat, bog and heavy grasses) intercept and absorb storm tide and wave shock.

(c) Sedimentation Control Function: The marsh serves as a settling and filtering basin, collecting silt and organic material as well as other pollutants (from tidal surges and upland runoff). The marsh prevents or restrains direct deposition of these raw materials into adjacent waters.

(d) Antipollution Function: The marsh serves as a biological and chemical oxidation basin where materials described in (c) are oxidized and metabolized (composted, decomposed and digested) while being converted to nutrients. The oxidation process uses great quantities of oxygen. The living marsh produces abundant quantities of oxygen through photosynthesis. Through the marsh's oxidation, respiration and metabolic processes, organic matter (including potential pollutants) is disposed of through primary nutrient production and returned to the food chain. Thus, the marsh serves to control pollution by utilizing those materials which would otherwise degrade the marine environment.

(e) Marine Food Production Function: Tidal marsh nutrient production is well documented, approaching a magnitude seven times greater than the per-acre protein production of a Kansas wheat field. Respiration, oxidation, and nutrient production are intimately interdependent in this nearly closed system. Primary nutrient production is ultimately made available to many top predators, including man, for it provides essential links in the food chain among wildlife, fin and shellfish, microscopic marine organisms, and new marsh vegetation.

Future importance of tidal marshes in world food production can only be guessed, but it is already substantial and increasing.

(f) Fish and Wildlife Function: The marsh provides essential breeding, nesting, resting, feeding grounds and predator-escape cover for myriad forms of fish and wildlife. Without the existence of the tidal marsh, these forms of life could not survive. About two-thirds of all fish and shellfish taken by the U. S. fisherman (commercial and sport) are dependent on the marsh-estuarine ecosystem at some time in their life cycle.

(g) Thermal Exchange Function: Shoal waters, including the marsh-estuarine ecosystem, warm more rapidly than deeper waters off-shore. The tidal marsh and its associated shallow water, mud and sand flats, intertidal zone (low marsh) and salt hay meadow areas (high marsh) readily absorb and hold heat from the sun. Through this energy exchange, the marsh maintains the essential water temperatures which activate spawning and growth of the marine organisms and vegetation. Tidal marshes and especially their surrounding waters also mitigate air temperature extremes, creating a more comfortable, temperate climate for man.

(h) Education and Research Function: Tidal marshes provide a wide range of opportunities as outdoor bio-physical laboratories and living educational classrooms.

(i) Recreation Function: The marsh provides a wide range of active and passive recreation opportunities: hunting, fishing, hiking, bird watching, photography.

Some interesting attempts to attach monetary values to these functions have been made by Gosselink and Odum of the University of Georgia in "The Value of the Tidal Marsh" (no date), and by Charles Wharton, 1970, "The Southern River Swamp," School of Business Administration, Georgia State University. Gosselink and Odum place the value of a tidal marsh at $4,000/acre; Wharton calculated these values for a southern river swamp: $1,750/acre/year for education, $1,000/acre/year for silt deposition on agricultural lands, $450/acre/year for water quality and erosion control, $250/acre/year for hardwood production, and $100/acre/year for

water supply, giving a total of $3,500/acre/year. The latter estimates do not include loss of fish and game.

The above discussion is indicative of the interest generated by the wetlands protection issue in general, and is supportive of the inclusion of this general environment in the present treatment of unique, significant and endangered environments. The following sections will describe the present extent of coastal and inland wetlands in the study area, the rate at which they have been destroyed in recent years by dredge, fill, and drainage operations, and the legislative controls instituted in the various states to protect them.

15.4.2 PRESENT EXTENT OF MARINE AND INLAND WETLANDS

Table 15-11 summarizes the areal extent of coastal wetlands and important open shoal water by state, for the North Atlantic region, as estimated by Spinner (1969). A number of other investigators have inventoried wetlands in the study region, some with results substantially differing from Spinner, and many in greater detail (by town or county, for instance). These studies have been summarized in Appendix E: Areal Extent of Marine Habitats.

Table 15-12 summarizes inland wetlands information by state or region for the study area. More detailed information is contained in Table 15-13

15.4.3 WETLANDS MODIFICATION AND LOSSES

Figure 15 - 13 illustrates the degrees of modification imposed on the estuarine areas of the study region, as depicted by the U. S. Bureau of Sport Fisheries and Wildlife and the Bureau of Commercial Fisheries in the National Estuary Study of 1970.

Spinner (1969) has tabulated acres of coastal wetlands and shoal water habitats lost by dredge and fill operations in the period from 1954-1968. These data are summarized in Table 15-14 along with a number of other sources. These figures should be qualified by the fact that a large percentage of the original wetland environments were destroyed prior to these inventories. According to one survey, an estimated one-third of the nation's total original wetlands were destroyed by 1956 (Shaw and Fredine, 1956).

Table 15 - 11 Extent of important estuarine zone in North Atlantic coastal states (in acres) 1968

STATE	COASTAL WETLANDS	PERCENT OF TOTAL FOR EAST COAST	IMPORTANT OPEN SHOAL WATER HABITAT	PERCENT OF TOTAL FOR EAST COAST	TOTAL ESTUARINE ZONE HABITAT
Me.	28,882	1.3	14,300	.5	43,182
N. H.	5,910	.2	9,000	.3	14,910
Mass.	44,695	2.0	29,000	1.0	73,695
R. I.	2,050	.1	13,800	.5	15,850
Conn.	11,544	.5	18,200	.6	29,744
N. Y.	32,395	1.5	121,700	4.0	154,095
N. J.	215,760	9.8	357,400	11.7	573,160
Total	341,236	15.4	563,400	18.6	904,636
Total for E. Coast	2,201,394	100.	3,046,400	100.	5,247,794

SOURCE: Spinner, 1969.

Table 15 -12 Extent of inland wetlands in the North Atlantic coastal states

STATE	ACRES	NUMBER	PERCENT OF TOTAL LAND
Maine[a]	1,211,304	5,000	6
N.H.			
Mass.[b]	102,874+		
R.I.[c]	25,570+		
Conn.[d]	800,000		25
N.Y.			
N.J.			

[a]From Maine Wetlands Inventory, Department of Inland Fish and Game, December 1972.

[b]From the Southeastern New England Study, NERBC, unpublished, single purpose reports for the following basins:

Ipswich - North Shore Basins, Charles - Mystic - Neponset Basins, South Shore Coastal Basins, Cape Cod and Islands, Narragansett Bay Drainage Areas in Massachusetts.

[c]From NERBC, Southeastern New England Study, for Narragansett Bay Drainage and Pawcatuck River Basins.

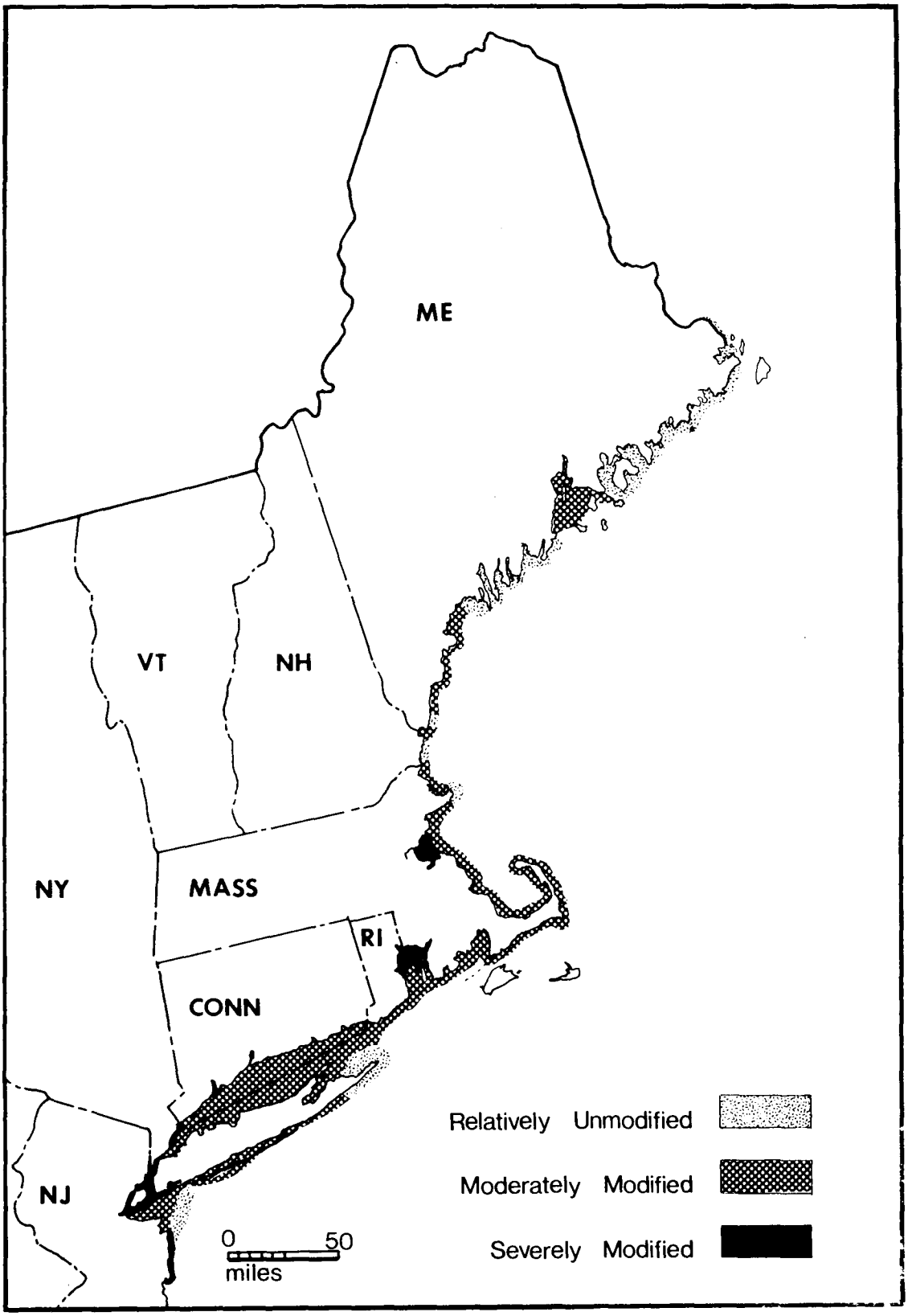
[d]From Niering and Goodwin, 1973, Inland wetland plants of Connecticut: The Connecticut Arboretum, New London, Connecticut.

TABLE 15-13

EXISTING INLAND WETLANDS (1973) IN THE NORTH ATLANTIC REGION

STATE	COUNTY/BASIN	ACRES	NUMBER	% TOTAL LAND AREA
MAINE [a]				
(Counties)	Washington	127,028	183	6.
	Hancock	72,140	287	5.
	Waldo	20,363	130	4.
	Knox	7,836	48	1.
	Lincoln	14,189	75	4.
	Sagadahoc	12,609	51	6.
	Cumberland	61,943	126	9.
	York	16,602	211	2.
	All Other	878,594	3,889.00	
NEW HAMPSHIRE	-			
MASSACHUSETTS [b]				
(Basins)	Ipswich-No. Shore	35,500	1,550	12.
	Charles River	18,787	1,050	9.
	Mystic River	1,627	150	3.5
	Neponset River	9,126	250	10.8
	South Shore Coastal	19,920	730	8.5
	Cape Cod and Islands	12,124	1,333	3.
	Narragansett Bay	5,790	-	-
RHODE ISLAND [b]				
(Basins)	Narragansett Bay	14,570	-	-
	Pawcatuck River	11,000	-	-
CONNECTICUT	-			
NEW YORK	-			
NEW JERSEY				

a. From the MIDAS (Maine Information Display Analysis System)
b. From the SENE Study (Southeastern New England), unpublished, New England River Basin Commission



A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION

TRIGOM PARC	FIGURE 15-13	Estuarine Modifications (U.S. Interior BSF&W, 1970)

TABLE 15-14

LOSS OF IMPORTANT ESTUARINE HABITAT IN THE NORTH ATLANTIC COASTAL STATES (ACRES)

STATE	COASTAL WETLANDS			SHOAL WATER HABITAT		
	AREA a 1954	LOSS 1954 - 1968	% LOSS	BASIC HABITAT b	LOSS 1947 - 1967	% LOSS
MAINE	29,182	300	1.0	15,300	1,000	6.5
NEW HAMPSHIRE	6,060	150	2.0	10,000	1,000	10.0
MASSACHUSETTS	45,895	1,200	2.6	31,000	2,000	6.5
RHODE ISLAND	2,200	150	.7	14,700	900	6.1
CONNECTICUT	14,744	3,200	21.7	20,300	2,100	10.3
NEW YORK	43,215 c	16,746 d	39.0	132,500 g	10,800	15.0
NEW JERSEY	21,356 e	11,900 f	56.0 f	411,300	53,900	13.1

a Includes Wetland Types 12 and 13 (Freshwater Species Affected by Tides), 15 (Salt Grass), 16 (Salt Meadow Cordgrass), 17 (Needle Rush), 18 (Saltmarsh Cordgrass).
b Area of important habitat
c Long Island only
d Losses for Bronx, Queens and Kings County recorded through 1964
e Data for 1953, Bergen, Hudson, Union, Essex, Middlesex and Monmouth Counties, only.
f Losses recorded through 1973
g Includes Great Lakes

SOURCE: Spinner 1969. A plan for the marine resources of the Atlantic Coastal Zone, American Geographical Society, New York; New Jersey Department of Environmental Protection, Division of Fish, Game, and Shell Fisheries, 1973, Wetland ecology, marsh destruction, progress report; Johnson, Peter, 1969, Wetlands Preservation, Open Space Institute, New York; New York State Office of Planning Services, 1972, Long Island Marine Wetlands, Albany.

15.4.4 LEGISLATIVE CONTROLS ON WETLANDS MODIFICATION

The following briefly summarizes state level legislation regulating the modification of wetlands, both coastal and inland. Where information on implementation and enforcement was available, this aspect is also included, although no concerted effort was made to obtain this type of information.

MAINE

Coastal wetland legislation was passed in 1971 and amended in 1972 (T. 12, R.S., Part 5, Chapter 421: Wetlands). This requires a permit from the Board of Environmental Protection before any owner may fill, dredge or alter any coastal wetland. The Maine courts have held that owners must be compensated for any restrictions imposed for "preservation" but not those aimed at pollution and public health.

Inland wetlands are not protected as such, but their modification can be regulated through the Site Selection Law, (T. 6, R.S., Chapter 571) passed in 1971 and amended in 1972. This law applies to all development in incorporated areas which (a) requires permits for air or water discharges, (b) exceeds 20 acres, (c) contemplates removal of natural resources or (d) occupies a structure of over 60,000 square feet of floor area. The Board of Environmental Protection is the responsible agency. Development may be disallowed due to "impact on the natural environment." Another law (Statute 12 M.R.S.A. 681-689) similarly regulates development in unincorporated areas. The state Land Use Regulation Commission (LURC) is responsible in this case.

NEW HAMPSHIRE

In 1967, this state enacted a "dredge and fill" law (R.S.A. Chapter 215, Section 483-A) which requires a permit from the New Hampshire Port Authority before "any bank, flat, marsh, or swamp in, and adjacent to, tidal waters" can be excavated, dredged or filled. This law also applies to inland wetlands, according to one source (Golet, 1973).

MASSACHUSETTS

This state passed the nation's first coastal wetlands protection act in 1962 (G.L., Chapter 130, Section 27A) and the first inland wetlands protection act in 1965 (G.L., Chapter 131, Sec. 40), called the "Hatch Act." Both have been further defined by amendments (G.L., Chapter 131, Section 40 -- amended by Chapter 784, Acts of 1972; G.L. Chapter 131, Section 40A -- amended by Chapter 782, Acts of 1972).

Coastal restriction has been successful due to the public benefits recognized, such as storm protection and conservation of marine fish and shellfish industries. The restrictions on inland wetland modifi-

cations have not been as successful due to misunderstandings of the law and the problem of delineating boundaries of inland wetlands.

RHODE ISLAND

In 1965, Rhode Island enacted its dredge and fill law, (T. 46, G.L., Chapter 23, Section 11-46.1-1), to "Prohibit the Spoliation of Intertidal Salt Marshes." This requires a permit from the Department of Public Works before anyone excavates, fills, or "disturbs the ecology of intertidal salt marshes." Modification of inland wetlands are also regulated (G.L., Chapter 2-1).

CONNECTICUT

In 1969, Connecticut enacted "An Act Concerning the Preservation of Wetlands and Tidal Marsh and Estuarine Systems," Public Act 695. This act gives the Department of Agriculture and Natural Resources responsibility for issuing permits for coastal wetland modification. In 1972, the state passed Public Act 155, regulating activities on inland wetlands, which were defined so as to include floodplains. In 1973, this act was undergoing revision.

NEW YORK

This state only recently passed legislation protecting its tidal wetlands. In 1973, the Tidal Wetlands Act was passed, becoming effective as of September 1. The Department of Environmental Conservation is the responsible enforcement agency. Violators are required to restore any illegally dredged or filled wetlands as best they can to their original condition - removing or replacing fill and replanting the wetlands themselves. No similar legislation for inland wetlands exists.

NEW JERSEY

In 1970, New Jersey enacted a Wetlands Act requiring the State Department of Environmental Protection (DEP) to set regulations controlling further dredging, filling, polluting, or otherwise altering natural features of any land subject to tidal action (N.J.S.A. 13:9A-1). In April, 1972, the New Jersey DEP issued "New Jersey Wetlands Order" in which a permit procedure was outlined for dredge and fill activities including the filing of an environmental impact statement by the applicant. A hearing and review process was also detailed. In 1973, P.L. 1973, Chapter 185, the "Coastal Area Facility Review Act," was passed to regulate the construction of certain industries in the coastal zone which would directly or indirectly adversely effect the coastal wetlands. No similar legislation exists for inland wetlands.

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ATTACHMENT 15-1

NATIONAL REGISTRY OF NATURAL LANDMARKS

REGISTERED SITES - DESCRIPTION:

1. Site: Acushnet Cedar Swamp, Bristol County, Massachusetts

Description: In this 1,800-acre area there is upland forest adjacent to a wetland complex of swamp, bog and pond. About half of the swamp portion is dominated by Atlantic White Cedar in dense, nearly pure stands ranging in age from 25 to 175 years. Other species conspicuous in the swamp and becoming dominant in places include red maple, American holly, mountain laurel and hemlock. A 70-acre mill pond dammed about 1787 covers very large stumps believed to be remains of the presettlement forest. Adjoining the pond is a bog of about 60 acres where large expanses of leatherleaf are separated by swales of sedges and grasses. Small islands of high ground within the cedar swamp add to the diversity of the habitat. It is located along the northwest side of the city of New Bedford at elevations ranging from 65 feet to about 170 feet.

Owner: Acquired by Commonwealth of Massachusetts from the Acushnet Saw Mills Company in 1971.

Proposed by: Catherine Keever in Eastern Deciduous Forest theme study and by Mr. Evans C. Hawes and Mr. Matthew B. Connolly, Jr., of the Massachusetts Department of Natural Resources.

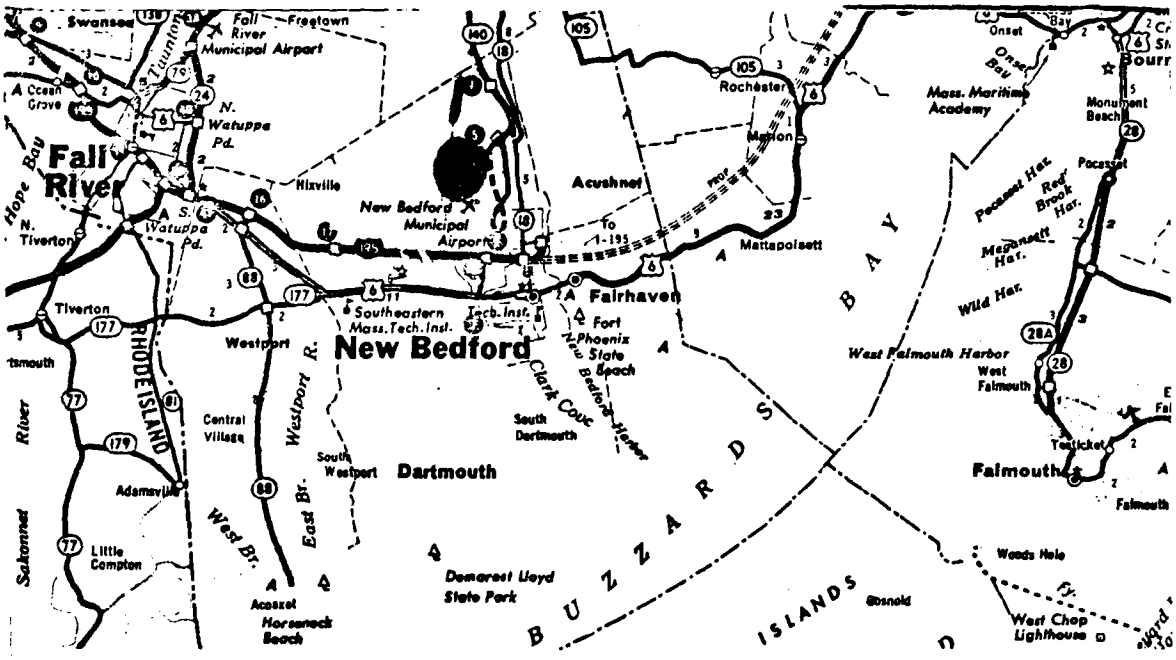
Significance: Keever calls this "one of Massachusetts largest, wildest and most impenetrable swamps." It is an outstanding illustration of the diversity of conditions and species found in the glaciated section of the Oak-Chestnut forest type.

Present condition: Considering its proximity to downtown New Bedford the swamp has a remarkable degree of integrity. The Commonwealth acquired the site to preserve it as a natural area for the enjoyment and education of the public.

Special conditions: Continued existence of the swamp depends upon a delicate balance of water. Heavy industrial development north of the area could disturb the water level and movement thus altering the botanical character of the swamp.

Studied by: Paul G. Favour, Jr., with contributions by John P. Richardson, Evans C. Hawes and Matthew B. Connolly, Jr., all of the Massachusetts Department of Natural Resources.

SOURCE: Natural Landmark Brief March 1972
National Park Service



A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION		
TRIGOM PARC	FIGURE 15-14	Acushnet White Cedar Swamp-New Beford, Mass. (Dr. Catherine Keever, n.d.)

2. Site: Gay Head Cliffs, Martha's Vineyard, Massachusetts

Description: If a segment of the varicolored Painted Desert of the Southwest were transported to the Atlantic Coast and propped upright at the edge of the sea it might rival the spectacular beauty of Gay Head.

The cliffs of Gay Head rise vertically for as much as 150 feet above the sea. Their striking colors are from the white, red, gray, black and yellow sands, clays, gravels and lignites of the Raritan and Magothy Formations in exposed Cretaceous sediments. Above these are beds of fossil-bearing greensand of middle Miocene Age overlain by fossil-bearing, iron-impregnated sand of either Pliocene or very early Pleistocene Ages. As is true throughout most of the New England Islands and mainland coastal plain these Cretaceous and Tertiary sediments are overlain by glacial deposits of Pleistocene Age. Gay Head presents an unusual cross section of these deposits and an outstanding opportunity for their study.

These formations rest upon the crystalline basement complex of metamorphic and igneous rocks which lie about 770 feet below sea level at this site.

Gay Head forms the western tip of Marthas Vineyard, Massachusetts. The landmark site includes approximately one mile of the exposed cliff of Gay Head and a crown strip some 100 to 200 yards wide. The area probably is less than 20 acres.

Ownership: Owned commonly by the Town of Gay Head. Adjoining land owned by Dukes County.

Significance: Gay Head is distinctive as an exposure of pre-glacial sedimentary formations resting upon the Continental Shelf and detached from the mainland.

SOURCE: Natural Landmark Brief September, 1965
National Park Service

3. Site: Mianus River Gorge, New York

Description: The site recommended for natural landmark status embraces the most rugged and spectacular portion of Mianus Gorge contains a fine climax forest of hemlocks, some of which are estimated to be 300 years old. More than 500 species of trees, shrubs and smaller plants, and a varied fauna, indigenous to the northeast comprise the biotic community within the area.

The proposed Mianus River Gorge Natural Landmark contains a basic tract of 207 acres, or more, of contiguous lands by purchase, or agreement, or both. The site is located in lower Westchester County, New York, and is easily accessible to motorists from either the Greenwich or the Long Ridge Road Exits along the Merritt Parkway.

It is a natural exhibit of exceptional value in illustrating piedmont physiography and geomorphology.

Owner: The owners of tracts to which title has been acquired and the benefiting party to acreages covered by agreements are the Mianus River Gorge Conservation Committee of The Nature Conservancy of which Mrs. Anthony Anable, 219 Old Long Ridge Road, Stamford, Connecticut, is Chairman.

Significance: Mianus River Gorge is not only a natural exhibit of exceptional value in illustrating piedmont physiography and geomorphology but is also unsurpassed in the east as an area in which natural conditions have remained relatively undisturbed from the time of discovery and early exploration to the present.

Present Condition: The site is under highly responsible, sympathetic and efficiently managed ownership and administration. It demonstrates a significant conservation achievement by well organized and directed citizen effort and is a tribute to the zeal and dedication of a group of public-spirited individuals. Therefore, the outlook for permanent and effective protection of areas in ownership plus parcels which may be acquired, or protected by agreement, in the future is most promising.

SOURCE: Natural Landmark Brief: January, 1964
National Park Service

4. Site: Great Falls of Paterson, Paterson, New Jersey

Description: The Falls of the Passaic River are located within the city of Paterson. The natural landmark site of approximately ten acres, includes the basalt cliffs over which the river flows, short stretches of river above and below the falls and the overlook park located on the right bank opposite the notch through which the river flows.

The basaltic ridge here resulted from one of three, or possibly four, extrusive lava flows which occurred in the region at various times in the Triassic Period concurrently with deposition of great thicknesses of shales, sandstones and conglomerate. It is a relic of a significant phase of the great crustal unrest known as the Appalachian Revolution. The river notch and vertical cliffs in which it occurs exhibit a phenomenal joint system which is characteristic of basalt mass. Huge boulders below the cliff face illustrate the action of stream and frost in disrupting jointed rocks. The Passaic River is the principal drainage of the Great Swamp area which formerly was occupied by the glacial Lake Passaic. At this point it drops about 75 feet vertically from the basalt cliffs and cuts its downstream channel into the more erodable sandstone.

Owner: It is owned by the city of Paterson and administered in part by the Department of Parks and in part by the Water Department.

Proposed by: Theme study for volcanism and river action.

Significance: The site is nationally significant as a unique illustration of a series of geological events and processes which influenced the present day land forms over a large area of north-central New Jersey.

Present Condition: The esthetic beauty of Passaic Falls and immediate surroundings is much impaired by manmade structures and debris but these intrusions have not destroyed its integrity as illustration of important geologic processes. The site is used frequently for field study in geology.

SOURCE: Natural Landmark Brief: March, 1967
National Park Service

NATIONAL RIGISTRY OF NATURAL LANDMARKS

ELIGIBLE SITES - DESCRIPTION:

1. Site: Meddybemps Heath, Washington County, Maine

Description: This 4,500-acre area, which allows vistas of up to 2 miles, contains a beautiful, virtually untouched, gently undulating heath interspersed with numerous small wooded islands. The two major streams that wind through the area, each 50 to 100 feet wide and bordered by sedges, are surrounded by vast, 3-10" high, heath shrub vegetation such as sweetgale, leatherleaf, Labrador-tea, bog-rosemary, and bog-laurel. The raised heath, often undergrown by extensive areas of lichens, is interspersed with wetter areas ranging from small depressions only several feet in diameter to large ponds. Bog species, such as pitcher plants, sundew, and cranberry, are abundant on or around these areas and offer a contrast to the more elevated places. Narrow bands of spruce and larch along the streams, and islands with sizable red and white pines add to the diversity of the area. The entire heath area is ringed with stands of black spruce and larch. Drainage is via the two streams which have cut through a series of eskers along the shore of Meddybemps Lake. This site borders the southwestern shore of Meddybemps Lake and is approximately 3 miles west of the village of Meddybemps.

Owner: The major portion of the site is owned by the Georgia Pacific Corporation. Smaller parcels are owned by Mr. Robert Gillespie, Meddybemps, Maine, and Mr. Carleton Davis, Alexander, Maine.

Proposed by: Goodwin and Niering in the Inland Wetlands theme study.

Significance: The area is an outstanding example of a large, undisturbed northern bog.

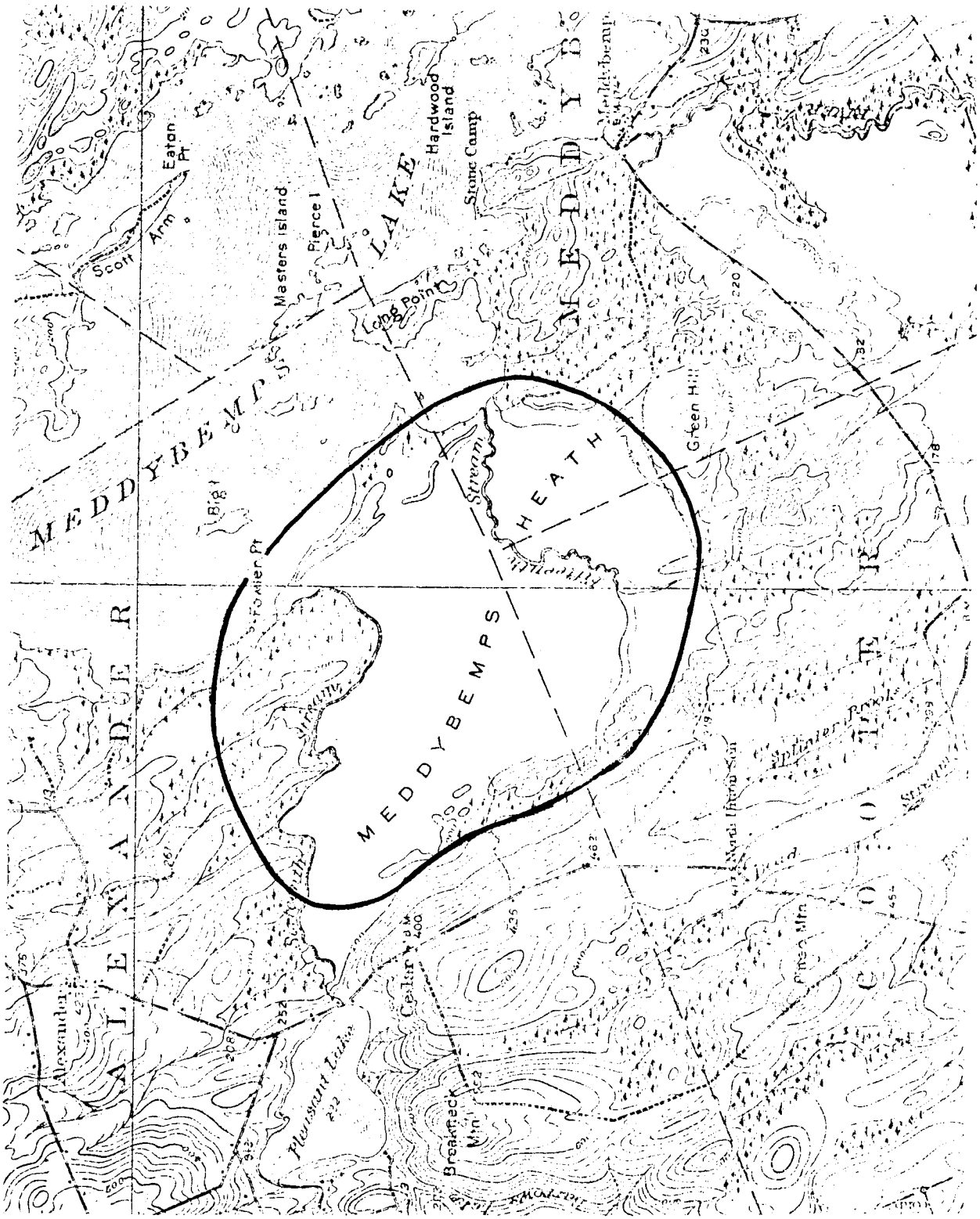
Present conditions: The area is used occasionally by hunters, trappers, fishermen, and boaters. Timber and pulpwood will undoubtedly be cut on adjacent forests in the future as they have been in the past.

Special conditions: There are no apparent dangers to the area. Cutting wood on the adjacent lands is not likely to have any significant impact on the heath. No mention was made by the owners of mining peat, although this activity is receiving increasing attention by commercial interests in Maine.

Studied by: Dr. Malcolm W. Coulter, Professor of Wildlife Resources, University of Maine with assistance from Dr. Ray B. Owen, Jr., and Mr. James B. Barnes.

SOURCE: Natural Landmark Brief February 1973

National Park Service



A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION

TRIGOM PARC	FIGURE 15-15	Meddybemps Heath Washington County, Maine (U.S.G.S. Calais Quad)

2. Site: Monhegan Island, Maine

Description: On Monhegan Island there exists a prime example of northeast United States coastal and island flora and fauna in an essentially virgin condition. The island shores are rugged, mostly steep cliffs, which on the seaward side rise to headlands as high as 160 feet. History of habitation and use, dates from early in the 17th century but the impact of intensive human influence on island ecology has been concentrated within its southern half. Here the original forests were logged off and through the years the land was used for pasture and crops. Today human habitation and its concomitant developments are largely restricted to the western part of this southern half. Some of the old cropland and pastures are now returning to extensive flats on which bayberry and prostrate juniper are abundant and viburnums and sumac are common. Toward the seaward side of the island second growth forest of birches, maples and aspen but predominantly spruce and fir, replace the shrubs. Over 400 species of annual and perennial wildflowers have been identified on the island.

The northern half of the island is all but covered with forest which has been logged very little, if at all. The Cathedral Woods is almost pure red spruce which grows in dense stands. Few of these trees reach more than ten inches in diameter due to rugged growing conditions and competition. One eleven-inch spruce was over 90 years old by ring count. There is little or no understory in Cathedral Woods except where trees have been wind-thrown or where a streamlet or other topographic obstacle prevents growth of the spruce.

The Monhegan Island fauna, like that of most islands far from the mainland, is deficient in mammal species. One the other hand its location on the flyway gives it a rich bird fauna with 200 species recorded.

Monhegan Island is about 1-1/2 miles long by 1/2 mile wide. It is in Lincoln County, Maine and lies in the Atlantic Ocean ten miles south of Port Clyde.

Ownership: Its lands are owned by approximately 160 individuals, many of whom are members of Monhegan Associates Incorporated. This Association "is dedicated to preserving the natural wild beauty, biotic communities, and desirable natural, artificial and historic features of the so-called 'wild lands' portion of Monhegan Island, Maine, and its environs, as well as the simple, friendly way of life that has existed on Monhegan as a whole."

SOURCE: Natural Landmark Brief: February, 1966
National Park Service

3. Site: Spruce Hole Bog, Strafford County, New Hampshire

Description: Spruce Hole Bog is an excellent example of a kettle-hole bog. An elliptical pond about 80 by 40 feet occupies the bottom of a crater-like depression. Surrounding the pond is a floating mat of predominantly sphagnum and leatherleaf which in turn is surrounded by a high shrub zone dominated by poison sumac, highbush blueberry and black spruce. At the outer fringe of the shrub zone is an imperfect moat and from here dry ground rises steadily on all sides to a rim averaging 50 feet above the bog. The slopes of this crater are forested with mature white oak, red oak, other hardwoods and young white pine. The bog proper is about 1.4 acres. The wooded slopes of the crater provide a buffer for the bog and are an integral part of the ecosystem, which includes approximately 7 acres. It is located about 2 miles west-southwest of the village of Durham just off Packers Falls Road. Elevation ranges from 100 feet at bog level to about 150 feet at the crater rim.

Owner: Mr. Norman R. Morgan, Durham, New Hampshire is sympathetic with natural landmark objectives.

Proposed by: Goodwin and Niering in Inland Wetlands theme study.

Significance: Spruce Hole Bog has exceptional value as a complete ecological community occupying a true kettle hole. Dr. Hodgdon reports that this is the last of six such sites he has known. The others have been destroyed by human activity.

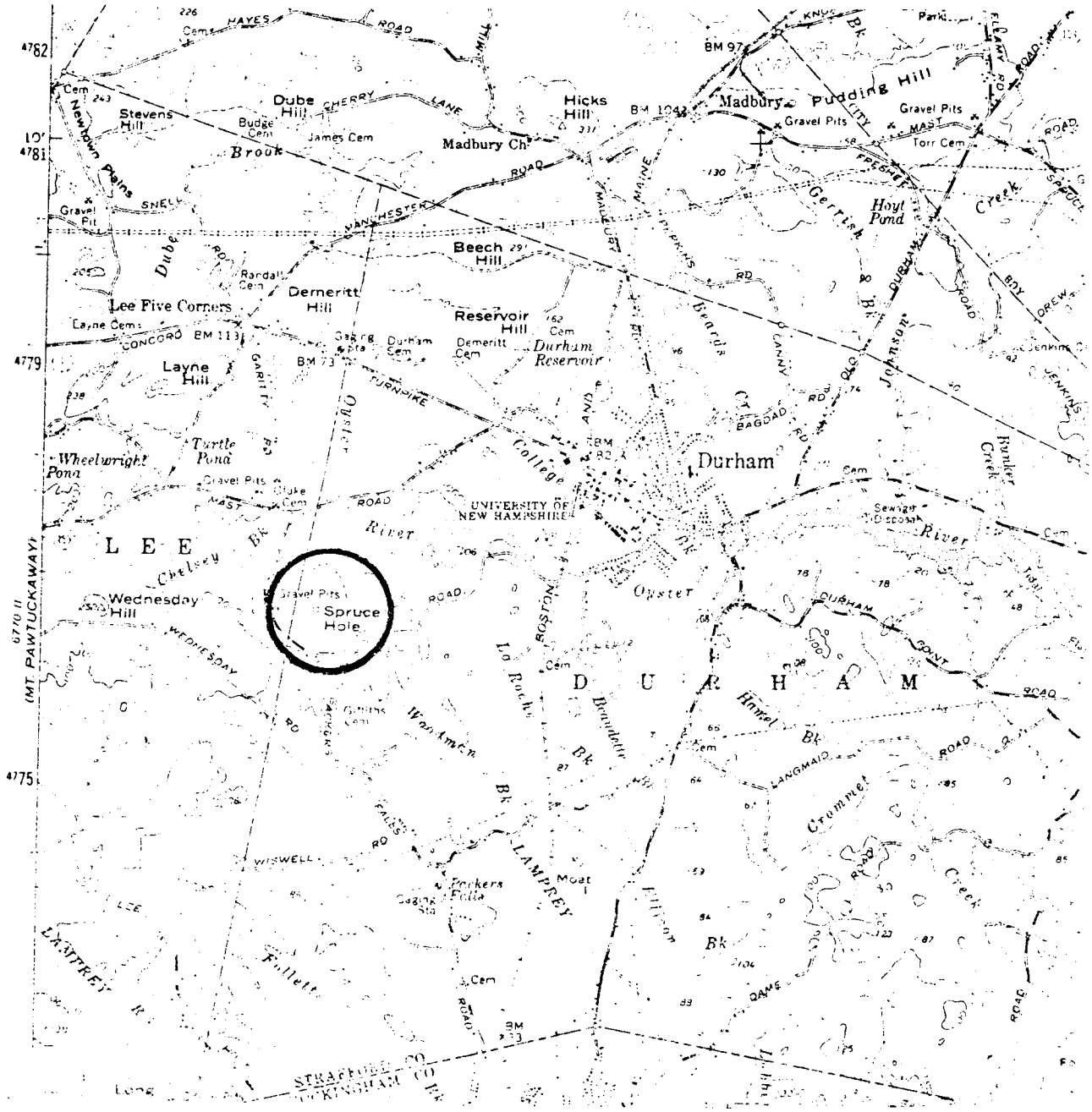
Present condition: Considering the "crater rim" as the boundary, this is nearly a closed ecosystem in which the only obvious intrusion is the removal of mature white pine some years ago.

According to Goodwin and Niering, a gravel pit being developed nearby may threaten the bog.

Special conditions: None.

Studied by: Paul G. Favour, Jr., with assistance of Dr. Albion R. Hodgdon, University of New Hampshire.

SOURCE: Natural Landmark Brief March 1972
National Park Service



A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION		
TRIGOM PARC	FIGURE 15-16	Spruce Hole Bog - Durham, N.H. (U.S.G.S. Dover Quad)

ATTACHMENT 15-1 (cont.)

4. Site: Lynnfield Marsh, Massachusetts

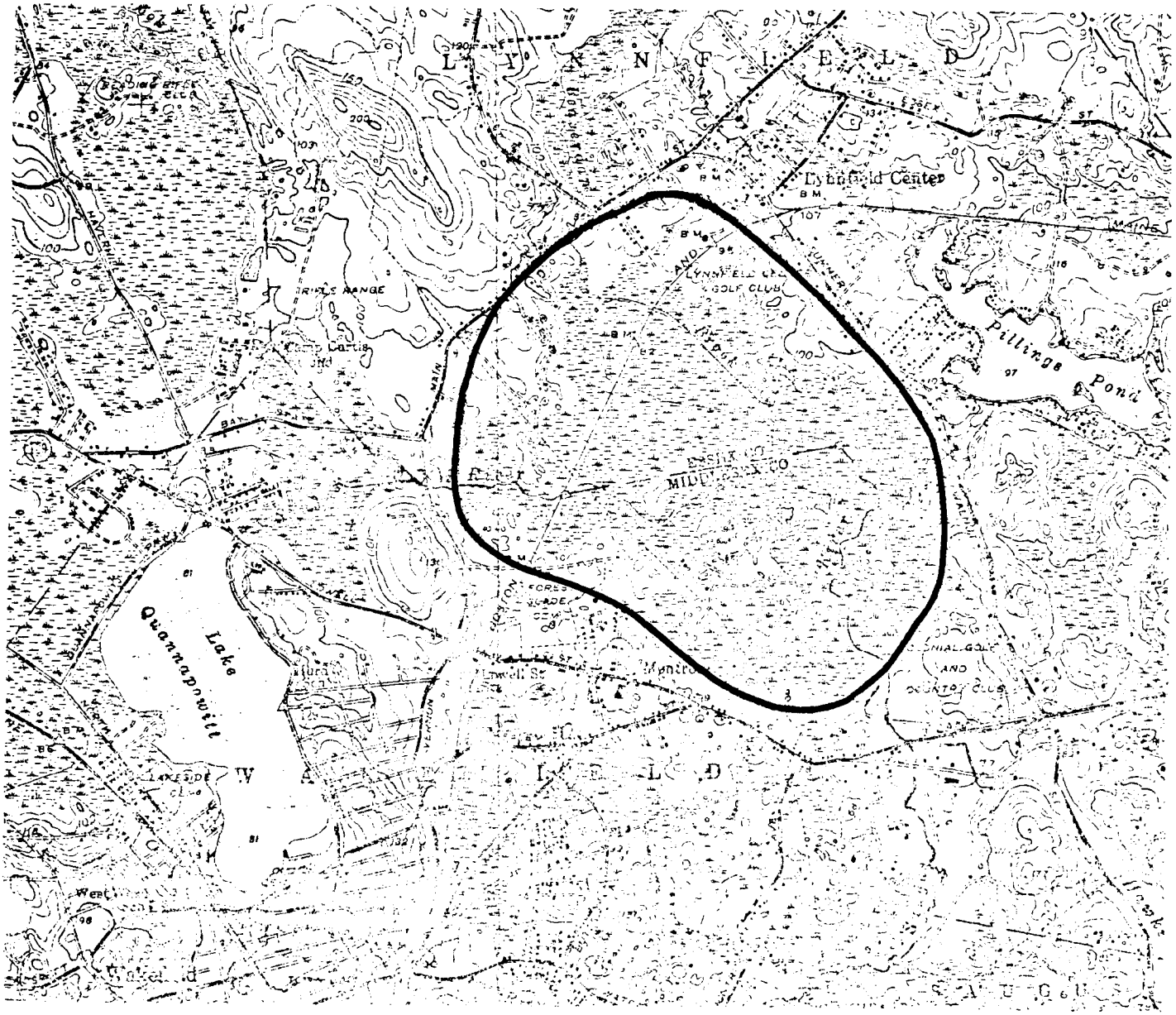
Description: Cattail marsh; traditional site for finding migrant marsh birds. Surrounded by sprout hardwoods, liberally scattered with houses. Acreage: 300.

Present Condition: Industrial and amusement park developments have come right up to the edge on two sides; a golf course is on a third. Parts may be in control of local conservation commissions but it is annually subjected to treatment for mosquito control.

Proposed by: Goodwin and Niering, Inland Wetlands theme study, 1971

Data Source: William H. Drury, Jr., Hatheway School of Conservation Education, Lincoln, Massachusetts, 01773.
Other Knowledgeable Persons: Bennett Keenan, 17 Hart Road, Lynnfield, Center, Massachusetts, 01940.

SOURCE: Goodwin and Niering, Inland Wetlands Theme, 1971



A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION

TRIGOM PARC

FIGURE 15-17

Lynnfield Marsh - Wakefield, Mass. (U.S.C.S.)

5. Site: Chester Cedar Swamp, Middlesex County, Connecticut

Description: This 380-acre site is an outstanding example of a wetland complex containing primarily second-growth wooded swampland, but also a small elongate pond with its adjacent bogland and some upland forest. About 2/3 of the swamp is dominated by relatively mature (50-80 years) Atlantic white cedar, with other associated species being red maple, ash, yellow birch and hemlock. Beneath these canopy trees grow a variety of shrubs such as winterberry, sweet pepperbush, mountain-laurel, northern arrow-wood, spicebush, and numerous others including ferns and sphagnum moss at ground level. In the northern part of the site, the small pond is covered with floating plants such as bladderwort, pondweed, knotweed, and pond lilies. Along Pattaconk Brook, which widens to form the pond, the vegetation is more boglike with a thin mat of sphagnum moss and clumps of leatherleaf. Drier areas of the swamp, such as the southwestern corner, contain hemlock codominant with white cedar. On the higher ridges on the east and west, which bound and slope into the wet swampland, one finds upland forest of the hemlock-white pine-northern hardwoods type. The site is located 2 miles west-southwest of the village of Chester and is reached by driving north on the Cedar Swamp Road from State Route 80 in the village of Winthrop.

Owner: The southern 230 acres are part of the Cockaponset State Forest and hence owned by the State of Connecticut. The remaining 150 acres are privately owned by several persons.

Proposed by: Goodwin and Niering in the Inland Wetlands theme study.

Significance: It is the finest remaining Atlantic white cedar swamp in the State of Connecticut.

Present condition: There appears to be no special uses of the site other than general appreciation of its natural values. The State hopes to acquire the privately owned 150-acre tract, and retain the entire area in its natural state.

Special conditions: None.

Studied by: Paul G. Favour, Jr., Special Assistant to the Director, Northeast Region, National Park Service.

SOURCE: Natural Landmark Brief February 1973
National Park Service

A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION

TRIGOM PARC	FIGURE 15-18	Cedar Swamp, Chester, Conn. (U.S.G.S. Deep River Quad)

ATTACHMENT 15-1

6. Site: Pachaug-Great Meadow Swamp, New London County, Connecticut

Description: This 855-acre forested swamp, which is part of the much larger Pachaug State Forest, is traversed in the southern part of the site from east to west by the Pachaug River and in the easterly portion by Great Meadow Brook which runs north to south and flows into Pachaug River. Almost half the swamp is dominated by young Atlantic white cedar with red maple the prevalent species in the remainder of the swamp. The edges of the wetland are bordered by white pine, hemlock and some hardwoods. The bog-like vegetation bordering the streams which drain this swamp is a sphagnum-sedge-shrub growth which varies in width from a few feet to several hundred feet. Along the lower part of the Pachaug River, leatherleaf is dominant accompanied by shrubs like sweet pepperbush, highbush blueberry and speckled alder. Along the central and upper portions of the Great Meadow Brook, there are large open spaces dominated chiefly by marsh sedges, one such open area being described as an extensive cranberry bog. The site is located 1½ miles northeast of the village of Voluntown and 3 miles west of the Rhode Island State line, and its southwest corner may be reached by driving east on State Route 138 from Voluntown and then taking State Route 49 1/2 mile northward.

Owner: About 60% of this proposed site is State-owned, being part of the Pachaug State Forest, and the rest is owned by several private persons.

Proposed by: Goodwin and Niering in the Inland Wetlands theme study.

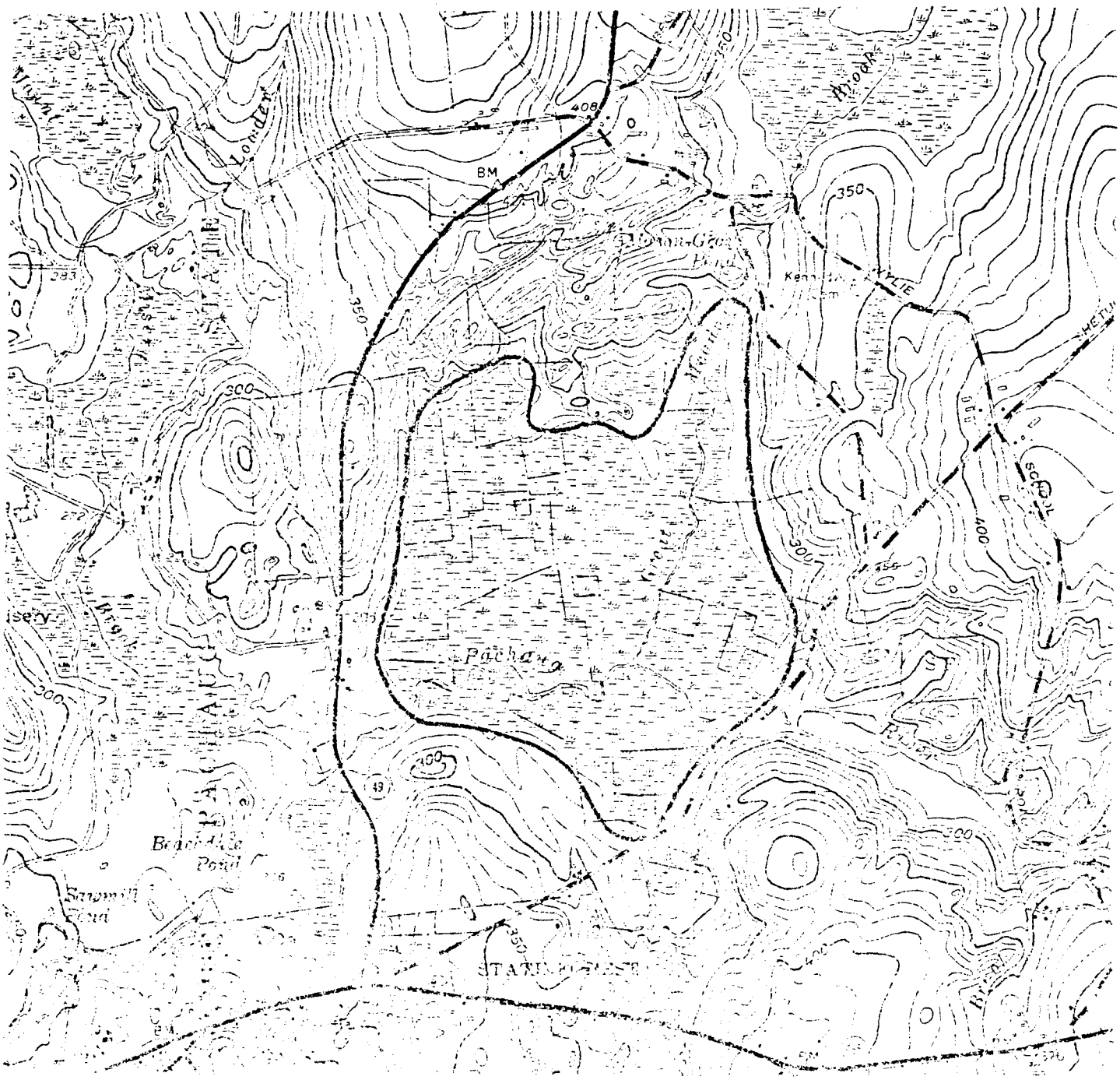
Significance: Pachaug Great Meadow Swamp is the most extensive Atlantic white cedar swamp in the State of Connecticut and has been recognized by the State Natural Area Preserves Advisory Committee as one of the two best such swamps in Connecticut which warrants preservation.

Present conditions: Principal uses seem to be fishing, duck hunting, canoeing and nature appreciation.

Special conditions: A camp is apparently going to be built on high ground in the southwest corner of the site. While this is an adverse development, it is not felt that it would sufficiently affect the natural values to preclude landmark status.

A dam exists 1 mile downstream from the site on the Pachaug River which has created a lake in this area. Since the dam has existed 100-125 years, the water level in the wetland has adjusted to this change and it is conceivable that the bulk of the swamp is relatively little affected by the backed-up water of the river.

Studied by: Paul G. Favour, Jr., Special Assistant to the Director, Northeast Region, National Park Service.



A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION

TRIGOM PARC	FIGURE 15-19	Pachaug Great Meadow, Uduntown, Conn. (U.S.G.S. Rhode Island Quad)

7. Site: Gardiner's Island, New York

Description: Island with osprey breeding area and unspoiled estuaries. Located off the eastern end of Long Island, Gardiner's Island is about 100 miles east of New York City.

In addition to its famous breeding population of osprey the island provides important habitat for a diverse variety of other avifauna, particularly waterfowl and shore birds. The tidal lagoons are in excellent condition and constitite some of very few remaining which have not been dredged or polluted. The adjacent salt marshes also maintain a high degree of natural integrity. Together the lagoons and marshes represent an outstanding example of an estuarine ecological unit. In the virgin upland forests many majestic old white oaks can be seen. In addition, the island supports many well preserved and unspoiled acres of seaside vegetation which spreads as a heath-like carpet over the rolling topography of the island. From 100-foot sea bluffs dropping away to beaches below, the green island and blue sea presents a charming maritime seascape. Excellent examples of glacial ice deformation of sedimentary bedded rocks can be seen in these sea bluffs.

Owner: This 4,000-acre island is part of a trust estate administered by the U. S. Trust Company for the Gardiner family.

Significance: National significance for Gardiner's Island stems from the integrity of its estuarine environment and the osprey nesting area which has been well known to ornithologists for more than fifty years as the largest and most consistently used in Long Island Sound. The site is of extreme importance in view of recent critical reductions in the population of this magnificent raptor.

Present Condition: While much of the area of this island has been altered through human use it includes significant and important elements which are relatively undisturbed. In view of the rapid development of the island in Long Island Sound it is of utmost importance that some examples be preserved. Gardiner's Island appears to have been less altered than most in the sound and with proper encouragement might become an outstanding illustration of an environment which is being lost rapidly.

SOURCE: Natural Landmark Brief: March, 1967
National Park Service

8. Site: Big Reed Pond, Suffolk County, New York

Description: On this 128-acre site is a 55-acre, shallow, muddy bottomed, fresh water pond fringed with emergent vegetation such as Juncus, Saggitaria, and cattails at the southwest end. Coarse sedges, sensitive ferns, and assorted herbs dominate the first terrestrial zone, which, for much of the pond, merges with a lush, dense border of shrubs and low trees entangled by the vines of wild roses, greenbriar, ivies, and morning-glories. Tall shrubs of blueberries, wild cherry trees and oaks form the bulk of the low wooded pond margins, although several oak-beech-hickory stands border the pond, especially along the southeastern corner. Curiously, peat moss (Sphagnum) and sundew (Drosera), along with other bog plants, inhabit the depressions between the old dunes northwest of the pond. Black bass, muskrats, turtles and various marsh birds inhabit the pond, and a sizable deer population use the pond as a source of fresh water since it is the eastern terminus of fresh water on Long Island. The site is near the extreme eastern end of Long Island about 3 miles west of Montauk Point.

Owner: Suffolk County is in the process of acquiring a 1,000-acre county park, which would encompass Big Reed Pond.

Proposed by: Inland Wetlands theme study.

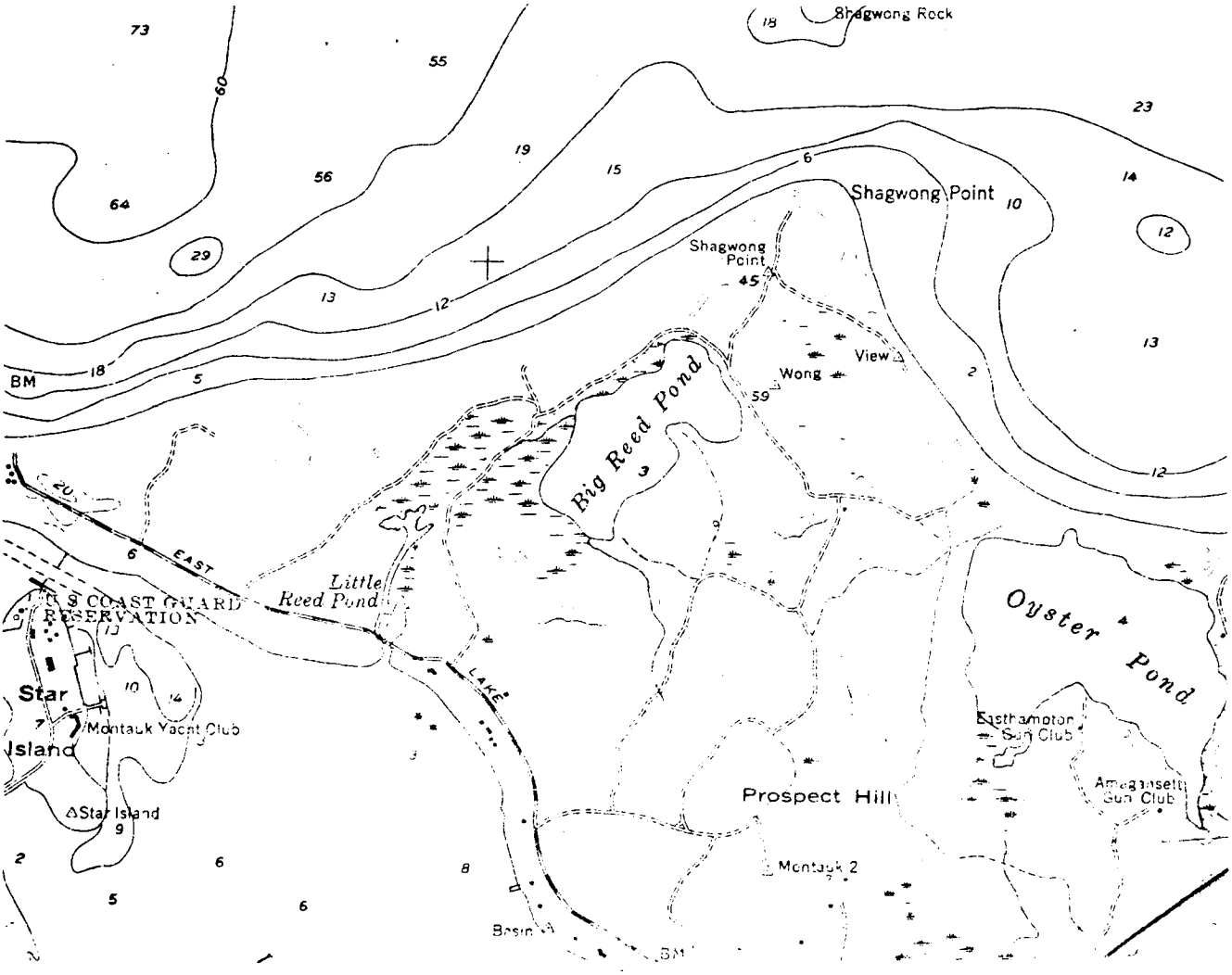
Significance: The pond is the easternmost terminus of fresh water on Long Island. A fresh water pond in a region consisting mostly of brackish marshes and ponds within several hundred yards of natural dune development at the edge of the Atlantic Ocean represents an unusual ecological situation. The fresh water pond supports a herd of whitetail deer and other wildlife, and has no extensive shoreline development along its shores.

Present conditions: Present land use appears to be restricted to people walking or riding (dune buggies, horses, jeeps, etc.) enroute to the adjacent sea beaches, as well as some fishing and seasonal hunting in and around the pond.

After land acquisition is completed for the proposed 1,000-acre county park, recreation in the park is envisioned to be restricted to light beach and picnicking activities. Big Reed Pond will be protected as a natural site.

Special conditions: The eastern terminus of a hard surface airstrip exists about 200 yards from the pond. The extent of the disturbance caused by low flying aircraft is unknown. Eighty percent of the watershed of the pond lies within the proposed county park.

A drainage ditch was at one time dug from Big Reed Pond to Little Reed Pond, but it is now ineffective.



A SOCIO-ECONOMIC AND ENVIRONMENTAL INVENTORY OF THE NORTH ATLANTIC REGION		
TRIGOM PARC	FIGURE 15-20	Big Reed Pond - Suffolk County, N.Y. (U.S.G.S. Montauk Point Quad)

9. Site: Riker Hill Fossil Site, Essex County, New Jersey

Description: The Riker Hill Quarry, located in the borough of Roseland, is the site of recent discoveries of dinosaur and other vertebrate animal footprints. It includes about 16 acres which prior to discovery of the fossils had been quarried for traprock. The site is contiguous with Essex County's park land.

The fossil-bearing rock beds consist of Upper Triassic shales and sandstones of the Brunswick Formation (Newark Group).

Owner: The Walter Kidde Company, Inc., Clifton, New Jersey

Proposed by: Three Livingston, New Jersey teenage boys: Paul Olsen, Anthony Lessa and Bruce Lordi. Recommended by Dr. John H. Ostrom in theme study of Mesozoic Vertebrates.

Significance: The Riker Hill Quarry is not unique, but is is one of only two known localities of major size along the northeastern coast where large numbers of various kinds of dinosaurian footprints can be preserved in situ. Since its discovery in 1968, the site has produced more than 1,000 specimens of dinosaur and other vertebrate animal footprints, insect trails, and other fossil remains of Late Triassic times. Most of the footprints are those of several types of bipedal, probably flesh-eating dinosaurs; and a quadrupedal, crocodile-like reptile (thecodont). Many other kinds of footprints are preserved, but these have not as yet been positively identified. Most notable of the latter are several specimens of very tiny footprints of a bipedal dinosaur which was about the size of a pigeon. Besides the vertebrate trails, numerous invertebrate (insect and other) trails are preserved, together with various ripple marks and other sedimentary features. The variety of species represented here appears to be greater than at the Dinosaur Trackway in Connecticut which is a registered natural landmark.

Present Condition: An unknown number of specimens have been removed from the site, but many of these have been preserved and are maintained in local collections, principally through the efforts and council of Mr. Robert Salkin who directs a fossil education program for the Newark school system. The site has not been fully exploited and considerable potential remains for preservation in situ of an area of the principal footprint-bearing surface.

Special Condition: The Walter Kidde Company has offered to donate the fossil area to Essex County with the proviso that it be fenced and the fossils protected for research, education and public enjoyment. The county has expressed willingness to accept the donation which is contingent upon approval of a subdivision

of the Kidde property by the Roseland Borough Council. A negative decision of the council is being appealed.

Studied By: C. K. Dale with the assistance of James W. Taylor, Secretary-Director, Essex County Park Commission.

SOURCE: Natural Landmark Brief: March, 1971
National Park Service

NATIONAL REGISTRY OF NATURAL LANDMARKS

NORTH ATLANTIC COASTAL COUNTIES

POTENTIAL SITES: Description

MAINE

(1) Bertrand E. Smith Natural Area

Characterization:
White pine forest
Acreage: 660
Elevation: 90'
Ownership: U.S. (Moosehorn National Wildlife Refuge)
Present Land Use:
Data Source:
Other Knowledgeable Persons:
R.V. Wade, Refuge Manager, Moosehorn National Wildlife Refuge 04619

Location: Washington Co.
Lat. 45°5'50" N; Long. 67°18' W
USGS: Calais (15')
Town of Baring

Description:
This is a designated Research Natural Area. NW part contains some of best old-growth pine in this vicinity. Other areas have patches of younger pine, plus Betula papyrifera, Picea rubens and Abies balsamea.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

(2) Camp Two Natural Area

Characterization:
Bog forest: fir
Acreage:
Elevation:
Ownership: U.S. (Moosehorn National Wildlife Refuge)
Present Land Use:
Data Source: Maine Survey, 1971
Other Knowledgeable Persons:
R.V. Wade, Moosehorn National Wildlife Refuge, Calais, Me. 04619

Location: Washington Co.
Lat. 44°49' N; Long. 67°13' W
USGS: Eastport (15')
Edmunds Township

Description:
One of the purest Abies balsamea stands on the refuge. Ground cover almost entirely Sphagnum moss.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

(3) Carrying Place Cove Bog

Characterization:
Bog, open to heath
Acreage: 20
Elevation: 60'
Ownership: private
Present Land Use:
Data Source: Maine Survey, 1971
Other Knowledgeable Persons:
A. E. Brower, 8 Hospital St., Augusta, Maine

Location: Washington Co.
Lat. 44°48'36"N; Long. 66°59'W
USGS: Eastport (15')
Town of Lubec

Description:
The best raised bog in the State. Usual bog spp.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

(4) Deblois Barrens

Characterization:
(1) Bog
(2) unspecified
Acreage: 200-600
Elevation: 200-280'
Ownership: probably private
Present Land Use: none
Data Source: A.E. Brower, 8 Hospital St., Augusta, Me. 04330
via Goodwin & Niering, 1971
Other Knowledgeable Persons:
Luther Davis, Maine Forest Service, Cherryfield, Me.

Location: Washington Co.
Lat. 44°43'N; Long. 67°55'W
USGS: Cherryfield (7½')
Town of Bangor (55 mi. SE of)
reached via Rte. 193 & dirt rd.
around Schoodic Lake

Description:
Remarkable series of glacial formations: barrens, steep slopes, lakes without outlets, potholes, Sphagnum bog & heath areas.

Goodwin & Niering, 1971

Sounds interesting, though information on vegetation is lacking.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS
Proposed by: Dr. Goodwin & Dr. Niering: Inland Wetlands Theme Study: NPS 1971

(5) Edmunds Natural Area

Characterization: Northeastern red spruce-fir forest
Location: Washington Co.
Lat. 44°51'45"N; Long. 67°12'W
USGS: Eastport (15')
Acreage: 160
Elevation: 90'
Ownership: U.S. (Moosehorn National Wildlife Refuge)
Present Land Use: Designated Research Natural Area
Data Source: Maine Survey, 1971
Other Knowledgeable Persons:
R. V. Wade, Refuge Manager, Moosehorn Nat. Wildlife Refuge, Calais, Me.

Description:
Picea rubens - Abies balsamea stands, but with 10% estimated Thuja occidentalis.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

(6) Great Wass Island Jack Pine

Characterization: Unusual species: Jack pine, disjunct
Location: Washington Co.
Lat. 44°27'10"N; Long. 67°34'10"W
USGS: Great Wass (15')
Town of Beals
Acreage: 5
Elevation: 20'
Ownership: private
Present Land Use:
Data Source: Maine Survey, 1971
Other Knowledgeable Persons:
A. Hodgdon, Dept. Botany, UNH, Durham, N.H. 03821

Description:
Good stand of Pinus banksiana growing on sandy, rocky, shallow, acid soils.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

(7) See Number 4.

Att. 15-1 (cont.)

(8) Sunken Bog Natural Area

Acreage: 10
Location: Washington Co.; Moosehorn National Wildlife Refuge
Description: Bog lakes surrounded by sphagnum heath with black spruce and tamarack
Ownership: BSFW, Moosehorn National Wildlife Refuge
Data Source: RNA-332
Other Knowledgeable Persons: Refuge Manager, Moosehorn National Wildlife Refuge, Box 285, Calais, Me. 04619

Proposed by: Dr. Goodwin and Dr. Niering: Inland Wetlands Theme Study: NPS 1971

(9) Chicken Millpond Jack Pine

Characterization:
Unusual species: Jack pine
Acreage: 20
Elevation:
Ownership: private
Present Land Use:
Data Source: Maine Survey, 1971
Other Knowledgeable Persons:
A. E. Brower, 8 Hospital St., Augusta, Maine 04330

Location: Hancock Co.
Lat. 44°29'30"N; Long. 68°1'30"W
USGS: Bar Harbor (15')
Town of Gouldsboro

Description:
This is a good stand of Pinus banksiana, which is uncommon in the State.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

(10) Dayton Natural Area

Characterization:
Northern hardwood-conifer forest, red spruce
Acreage: 30
Elevation:
Ownership: Nature Conservancy
Present Land Use: Protected
Data Source: Charles P. Bradford, Manchester, Me. 8-20-71

Location: Hancock Co.
USGS: Nicatous Lake (15')

Description:
In wildlands. Many glacial phenomena. Island rises to height of 40', center covered with forest of Fagus grandifolia, Acer saccharum, etc. Rimming shore are Pinus strobus, Pinus resinosa, Tsuga canadensis, Thuja occidentalis.

There was an extensive forest fire in 1854. Since then there has been no lumbering.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

(11) Appleton Bog

Characterization:
Bog forest: Eastern whitecedar
Acreage: 84
Elevation: 300'
Ownership: Nature Conservancy
Present Land Use: Protected
Data Source: Charles P. Bradford, Manchester, Me., August 1971

Location: Knox Co.
Lat. 44°20'N; Long. 69°15'
USGS: Washington (7½')
Town of Appleton

Description:
Most northerly - White Cedar (Chamaecyparis thyoides) swamp. Trees to 16" dbh.

About 50% of the white cedar has been cut, but is reproducing.

Alnus rugosa swamp also. Characteristic bog flora.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study; NPS

(12) Eastern Head Natural Area

Characterization:
Boreal white spruce-fir forest
Acreage: 140
Elevation:
Ownership: U.S.D.I. (Acadia National Park)
Present Land Use: Designated Research Natural Area
Data Source: Maine Survey, 1971
Other Knowledgeable Persons:
Supt. Acadia Nat. Park, Box 338, Bar Harbor, Me. 04609

Location: Knox Co.
Lat. 44°1'N; Long. 68°37'W
USGS: Deer Isle (15')
Isle of Haut

Description:
Picea glauca - Abies balsamea - Betula papyrifera stand (boreal forest).

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

(13) Meadow Mountain

Characterization:
(1) Northern hardwood-conifer forest, red spruce
(2) Marsh, fresh meadow
Acreage: 285
Elevation:
Ownership: Nature Conservancy
Present Land Use: Protected
Data Source: Charles P. Bradford, Manchester, Me. 8-20-71

Location: Knox Co.
USGS: West Rockport (7½')
Town of Warren

Description:
Quercus sp., Acer sp., Pinus sp., Betula sp., Picea sp., Tsuga canadensis, Abies balsamea.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study; NPS

(14) Adams Pond

Characterization:
Northern hardwood-conifer forest
Acreage: 15
Elevation: 630'
Ownership: Kennebec Girl Scout Council
Present Land Use:
Data Source: Me. 1971 Survey
Other Knowledgeable Persons:
Clifton Foster, Dry Miles Rd., Gray, Me. 04039

Location: Cumberland Co.
Lat. 43°59'36"N; Long. 70°43'
USGS: Sebago Lake (15')
Town of Bridgton

Description:
Stand of 150-200 yr. old Tsuga canadensis, Betula lutea, Quercus rubra, Pinus strobus.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

Att. 15-1 (cont.)

(15) Gerard Jack Pine Stand

Characterization:
Unusual species: Jack pine, disjunct
Acreage: 500
Elevation:
Ownership: Scott Paper Co.
Present Land Use:
Data Source: Maine Survey, 1971
Other Knowledgeable Persons:
Ken Anderson, Dept. Fish & Game, Augusta, Me. 04330

Location: Cumberland Co.
Lat. 45°29'20"N; Long. 70°15'30"W
USGS: Spencer Lake, Ahean
Town T 05 R 07 BKP WKR

Description:
Stands of Pinus banksiana (only 5 known locations in Maine?)

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

(16) Gorham Mt. Laurel Stand

Characterization:
Unusual species:
Mountain laurel, disjunct
Acreage: 5
Elevation:
Ownership: private
Present Land Use:
Data Source: Maine Survey, 1971
Other Knowledgeable Persons:
Steven Orack, Scott Paper Co., Westbrook, Me. 04092

Location: Cumberland Co.
Lat. 43°40'N; Long. 70°27'30"W
USGS: Portland (15')
Town of Gorham

Description:
Kalmia latifolia is rare in Maine. This is a good stand located in an undeveloped, wooded area.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

(17) Gray Pitch Pine Barrens

Characterization:
Pitch pine-oak forest
Acreage: 175
Elevation: 200'
Ownership: Private
Present Land Use:

Location: Cumberland Co.
Lat. 43°55'50"N; Long 70°20'W
USGS: Gray (15')
Town of Gray

Data Source: Maine Survey, 1971
Other Knowledgeable Persons:
Clifton Foster, Dry Mills, Gray, Me. 04039

Description:
A large stand of typical pitch pine barrens. Maine turnpike bisects the area.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

(18) Great Mark Island

Characterization:
(1) Cliffs
(2) Unusual species:
Eastern whitecedar

Location: Cumberland Co.
Lat. 43°42'54"N; Long. 70°1'42"W
USGS: Casco Bay (15')
Town of Gray

Acreage: 15
Elevation: 0
Ownership: private
Present Land Use: development unlikely
Data Source: Maine Survey, 1971
Other Knowledgeable Persons:
Clifton Foster, Dry Mills Road, Gray, Me. 04039

Description:
Cliffs rise 75' from ocean. Chamaecyparis thyoides occurs, near northern limit of its range, and very stunted due to site. Rhus radicans 4' tall.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

(19) New Gloucester Black Gum Stand

Characterization:
Hardwood swamp forest:
Black gum

Location: Cumberland Co.
Lat. 43°58'34"N; Long 70°20'20"W
USGS: Gray (15')
Town of New Gloucester

Acreage: 5
Elevation: 380'
Ownership: Private organization
Present Land Use:
Data Source: Maine Survey 1971
Other Knowledgeable Persons:
Clifton Foster, Dry Mills Rd., Gray, Maine 04039
Warren Chandler, New Gloucester, Me. 04260

Description:
Stand of Nyssa sylvatica, 75' tall, 24" dbh., located at northern limit of this species.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

(20) Otter Pond Rhododendron

Characterization:
Unusual species:
Rhododendron, disjunct
Acreage:
Elevation:
Ownership: Portland Water District
Present Land Use:
Data Source: Maine Survey, 1971
Other Knowledgeable Persons:
R. Anderson, Maine Audubon Society, Portland, Me.

Location: Cumberland Co.
Lat. 43°45'48"N; Long 70°30'25"W
USGS: Sebago Lake (15')
Town of Standish

Description:
One of the largest Rhododendron stands in the State.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

(21) Portland White Pine Stand

Characterization:
White pine forest
Acreage:
Elevation: 80'
Ownership: Private
Present Land Use:
Data Source: Maine Survey, 1971
Other Knowledgeable Persons:
Clifton Foster, Dry Mills Rd., Gray, Me.

Location: Cumberland Co.
Lat. 43°43'15"N; Long 70°18'10"W
USGS: Portland (15')
Town of Portland

Description:
Old growth Pinus strobus, 150-200 yrs. old, large, 125-140' tall.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

Att. 15-1 (cont.)

(22) Standish Rhododendron Stand

Characterization:
Unusual species:
Rhododendron, disjunct
Acreage: 5
Elevation: +200'
Ownership: Private
Present Land Use:
Data Source: Me. Survey 1971
Other Knowledgeable Persons:
S. Orack, Scott Paper Co., Westbrook, Me. 04092

Location: Cumberland Co.
Lat. 43°47'40"N; Long. 70°29'15"W
USGS: Gray (15')
Town of Standish

Description: Good stand.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

(23) Berwick Bearberry Stand

Characterization:
(1) Unusual species:
bearberry stand
(2) Bog
Acreage: 30
Elevation:
Ownership: Private
Present Land Use:
Data Source: Me. Survey 1971
Other Knowledgeable Persons:
A. E. Brower, 8 Hospital St., Augusta, Me. 04330

Location: York Co.
Lat. 43°19'34"N; Long. 70°51'45"W
USGS: Berwick (15')
Town of Berwick

Description:
Largest stand of Arctostaphylos uva-ursi in Maine, located in bog area near Little River.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

(24) Harvey Butler Rhododendron Sanctuary

Characterization:
Unusual species:
Rhododendron, disjunct
Acreage: 60
Elevation: 460'
Ownership: N.E. Wildflower Pres. Society

Location: York Co.
Lat. 43°26'N; Long 70°49'W
USGS: Berwick (15')
Town of Springfield

Present Land Use: Protected
Data Source: Maine Survey, 1971
Other Knowledgeable Persons:
Dr. A. Hodgdon, Dept. Botany, UNH, Durham, NH 03824
Albert Prosser, Box 98, Springvale, Me. 04083

Description:
"Best rhododendron stand in New England." A number of wildflower spp. occur.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

(25) Newfield Rare Plant Location

Characterization:
Unusual species: Sweet pepper
Acreage:
Elevation: 600'
Ownership: Privately owned
Present Land Use:
Data Source:
Other Knowledgeable Persons:
A. S. Brower, 8 Hospital St., Augusta, Me.

Location: York Co.
Lat. 43°38'35"N; Long 70°58'30"W
USGS: Newfield (15')
Town of Newfield

Description:
Only Maine location of Clethra alnifolia (sweet pepper bush) and Lindera benzoin (spice bush).

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

(26) Sand Pond

Characterization:
Unusual species: rare
Acreage: 50
Elevation: +230'
Ownership: Private
Present Land Use:
Data Source: Maine Survey, 1971
Other Knowledgeable Persons:
A. R. Hodgdon, U. of New Hampshire, Durham, NH

Location: York Co.
Lat. 43°23'45"N; Long. 70°45'W
USGS: Berwick, Kennebunk (15')

Description: This is a Kettle hole, with species of plants that are found nowhere else in New England.

Proposed by: Ed Flaccus: Eastern Deciduous Forests Theme Study: NPS

Att. 15-1 (cont.)

(36) Mast Island or Halfway Pond Island

This four-acre privately owned site is located in Halfway or Cotuit Pond in Plymouth County about three miles from Plymouth. From Boston go the Southeast Expressway to Route 3 to Myles Standish State Forest. The pond is east of the forest and west of the Long Pond Road. This information was supplied by John P. Richardson of the Massachusetts Department of Natural Resources. Mr. Matthew B. Connolly Jr. of the Department of Natural Resources is also familiar with the site.

Mast Island lies in Halfway or Cotuit Pond. It is called Mast Island because ships masts were cut there during early Plymouth ship building era. The region surrounding Halfway Pond, including Myles Standish State Forest, has a serious and very destructive forest fire history. The island appears to have escaped the numerous conflagrations. The region surrounding the pond supports a dense, often inpenetrable growth of pitch pine (P. rigida) and "scrub oak" (Q. ilicifolia). Mast Island supports a totally different botany than the "pine barrens" of the surrounding region and probably is a key to the virgin forest type. No detailed study has been made recording the plant species, tree measurements, ages, etc. of Mast Island. The writer would welcome a chance to do this if the information was needed.

It might be of interest to note that certain heavily wooded kettle holes on the adjacent mainland, near Mast Island, escaped complete destruction by the numerous forest fires. The fires appear to have raced over the top severely damaging but not killing the pitch pine - scrub oak forest on the floor of the kettle hole. Beneath this heavy canopy are many suppressed white pine (P. strobus) and in one even a few hemlock (T. canadensis). Two of these pine, measuring only 2'8" tall and 3'5" tall contained 38 and 42 annual rings. This suppressed undergrowth in a nearly total pitch pine-scrub oak forest adds some weight to the claim that Mast Island represents the region's true climax forest type.

Evaluation: This site is smaller than I would usually recommend but since undisturbed areas are rare in this part of Massachusetts it should be investigated. Priority 2.

Proposed by: Dr. Catherine Keever: Eastern Deciduous Forest Theme Study: NPS

Att. 15-1 (cont.)

(37) Sandy Neck and Great Marshes

This 6600-acre site is located in Barnstable County, Massachusetts, 70 miles from Boston, Massachusetts and Providence, Rhode Island in the town of Barnstable on State Route 6A. It is owned by the town of Barnstable and private parties. A responsible person at the site is the Chairman, Conservation Commission, Town Hall, Town of Barnstable, Hyannis, Massachusetts. The site is used for recreation, including a public bathing beach, hunting, and fishing; and for commercial shellfishing. This information was supplied by Alfred C. Redfield, Box 106, Woods Hole, Massachusetts who has been familiar with the area since 1908 and has studied the marshland intensively since 1955.

Those familiar with the site are:

Dr. K. O. Emery, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts
Dr. H. L. Sanders, same address
Dr. John Teal, same address
Dr. David C. Grant, Marine Biological Laboratory, Woods Hole, Massachusetts
Mr. B. W. Powell, Stonebridge Road, Wilton, Connecticut
Dean John L. Blum, College of Letters and Science, University of Wisconsin, Milwaukee, Wisconsin
Mr. Lee C. Davis, Main Street, Barnstable, Massachusetts
Mr. Crawford H. Hollidge, Cotuit Road, Marstons Mills, Massachusetts

References:

Redfield, A. C. 1965. Ontogeny of a Salt Marsh. Science 147:50-55.

Sanders, H. L. and others. 1963. Intertidal Fauna of Barnstable Harbor. Limnology and Oceanography 7:63-79.

Phleger, F. B. and W. R. Walton. 1950. Ecology of Marsh and Bay Foraminifers, Barnstable. American Journal of Science 248:274-94.

Powell, W. B. 1967. Archaeological Traverse of Sandy Neck, Cape Cod, Massachusetts. Bull. Massachusetts Archaeological Soc. 28:27-32.

Proposed by: Dr. Catherine Keever: Eastern Deciduous Forest Theme Study: NPS

Att. 15-1 (cont.)

(38) South Hanson Swamp

Acreage: 500
Location: Bristol Co.; Hanover and Whitman Quadrangles; along the railroad tracks between South Hanson and Monoponsett Pond
Description: A large area of white cedar and red maple
Data Source: William H. Drury, Jr., Hatheway School of Conservation Education, Lincoln, Massachusetts 01773
Other Knowledgeable Persons: Mr. Paul Anderson, RFD 2, Winter St., Middleboro, Massachusetts 02346; Ralph Bean & Richard J. Eaton (retired), who have served on the New England Botanical Club herbarium committee; Albion Hodgdon, Dept. of Botany, University of New Hampshire, Durham, NH 03824

Proposed by: Dr. Goodwin and Dr. Niering: Inland Wetlands Theme Study: NPS

(39) Hockamock Swamp

Acreage: 6000
Location: Bristol Co.; Taunton Quadrangle; 3-4 miles north of Taunton; reached via Rt. 138
Description: An extensive cedar swamp, one of the few remaining white cedar swamps in the state
Encroachments: Attempts to purchase area have been thwarted by local business interests who wish to fill around the perimeter for industrial development
Ownership: Presumably private
Data Source: Warren W. Blandin, Div. of Fisheries & Game, Field Headquarters, Westboro, Mass. 01581
Other Knowledgeable Persons: Louis Schlotterbeck, District Mgr., Mass. Division of Fisheries & Game, Bourne, Mass. 02532; Norman Cousins, Dept. of Natural Resources, 100 Cambridge Street, Boston Mass. 02202

Proposed by: Dr. Goodwin and Dr. Niering: Inland Wetlands Theme Study: NPS 1971

RHODE ISLAND

(40) Bowdish Reservoir Floating Bogs

Acreage: 20 estimated
Location: Providence Co.; Thompson Quadrangle; 5 miles west of Chepachet; reached via Rt. 44
Description: Islands with typical bog species. They vary in size, but all are small, being mostly less than 0.25 acre.
Encroachments: Bowdish Reservoir is fairly well developed with summer and year-round homes. Islands normally are not in danger of encroachment unless they end up in an individual's bathing area, etc. It appears that these are too small to be considered Natural Landmarks.
Ownership: Not known
Data Source: John M. Cronan, Div. of Conservation, 83 Park St., Providence, R.I. 02900

Proposed by: Dr. Goodwin & Dr. Niering: Inland Wetlands Theme Study: NPS 1971

(41) Lonsdale Marshes

Acreage: 25
Location: Providence Co.; Pawtucket Quadrangle; adjacent to Central Falls; reached via Rts. 122, 123
Description: Open flood plain on the Blackstone River. Typical marsh vegetation of various grasses and sedges. Excellent area for waterfowl and muskrats; good for many kinds of aquatic animals.
Encroachments: Serious; lies in a highly developed area; is slowly becoming eliminated
Ownership: Many owners
Data Source: John M. Cronan, Div. of Conservation, 83 Park St., Providence, R. I. 02900.
Other Knowledgeable Persons: George Lavallee, Lavallee Drive, Cumberland, R. I. 02864

Proposed by: Dr. Goodwin and Dr. Niering: Inland Wetlands Theme Study: NPS 1971

(42) Potts Bog

Acreage: About 400
Location: Washington Co. and Kent Co.; Wickford Quadrangle; East Greenwich, 4 miles northeast; site may be reached via Rt. 2
Description: Bog adjoining Hunt's River, typical bog plant species
Encroachments: Highway construction presently a problem. Since it is in an area that is developing rapidly, it may have problems with various types of developments
Ownership: Many owners
Data Source: John M. Cronan, Div. of Conservation, 83 Park St., Providence, R.I. 02900
Other Knowledgeable Persons: Alfred Hawkes and Cal Dunwoody, 83 Park St., Providence, R.I. 02900

Proposed by: Dr. Goodwin and Dr. Niering: Inland Wetlands Theme Study: NPS 1971

(43) Newton Swamp

Acreage: About 2000
Location: Washington Co.; Ashaway and Watch Hill Quadrangles; 1 mile east of Westerly; reached via Rt. 91 or US 1
Description: Major vegetation white cedar and buttonbush; some red maple and various grasses and sedges. Excellent habitat for waterfowl and other water birds as well as various mammals and amphibians. Three excellent streams flow through area. Certain areas contain numerous pitcher plants and sundews.
Encroachments: Minimal at this time; town dump on Chapman Pond adjoining this area. This area should be protected! State has long-range plans for acquisition, when and if funds become available.
Ownership: Many owners; 111 acres owned by the State of Rhode Island.
Data Source: John M. Cronan, Div. of Conservation, 83 Park St., Providence, R.I. 02900

Proposed by: Dr. Goodwin and Dr. Niering: Inland Wetlands Theme Study: NPS 1971

(44) Ell Pond

Acreage: 50
Location: Washington Co.; Voluntown, Conn.-R.I. Quadrangle; about 3.5 miles west of Hope Valley; reached via West Rockville Rd. from Rt. 138 at Rockville.
Description: A shallow bog pond surrounded by a floating mat with typical bog species, including sundews, pitcher plants, Woodwardia virginica, Xyris. A 20-acre Rhododendron maximum swamp shaded by coastal white cedar surrounds it on two sides; steep rocky outcrops, traversed by the Narragansett Trail on the others.
Encroachments: The white cedar has been cut over a number of years ago.
Ownership: Private; partly by Sewall Butler, Cromwell, Conn. 06416
Data Source: R. H. Goodwin, Box 1445, Connecticut College, New London, Conn. 06320
Other Knowledgeable Persons: Dr. Elmer A. Palmatier, Dept. of Botany, Univ. of Rhode Island, Kingston, R.I. 02881

Proposed by: Dr. Goodwin and Dr. Niering: Inland Wetlands Theme Study: NPS 1971

(45) Great Swamp

Acreage: 3200
Location: Washington Co.; Kingston Quadrangle: Great Swamp lies within 5 miles of the Atlantic Ocean and borders the North Shore of Wordens Pond, largest body of fresh water in the State, into which it drains. Altitude: 33 meters above sea level.
Description: Historically noted as the site of the decisive battle of the Indian Colonial Wars where the Narragansett Indians, the most powerful New England tribe, were defeated in 1675. Swamp forest covers most of the area which is underlain by shallow muck soils. Red maple, white cedar, black gum, black alder, rhododendron, sweet pepper bush, and blueberry are among the dominant species. Shrub swamp and marsh covers ten percent of the wetland. Open areas support cattail and sedge marsh. Excellent stands of American holly occur within the area. Vertebrate fauna includes the largest population of otter, mink and snowshoe hare found within the state. It is reported by USIBP-PF Task Force to be the largest swamp in New England. The area is traversed by 9.7 kilometers of brooks and streams.

Published References: Wright, K. E. The Great Swamp, Torreya, 41:145-150, 1941. Federal survey report by the Federal Aid in Restoration Act, R.I. Project 17-B.
Encroachments: Minimal, since State owns 2800 acres
Ownership: Acquired by State of Rhode Island in 1950 through participation in Federal Aid to Wildlife Restoration Act by the R.I. State Division of Fish and Game
Data Source: John M. Cronan, Div. of Conservation, 83 Park St., Providence, R.I. 02900
USIBP-PF Task Force for the Conservation of Aquatic Ecosystems, International Scientific Areas-Description and Justification.

Proposed by: Dr. Goodwin and Dr. Niering: Inland Wetlands Theme Study: NPS 1971

(46) Indian Cedar Swamp

Acreage: 1000
Location: Washington Co.; Carolina Quadrangle; 4 miles east of Bradford; reached via Rt. 91
Description: Large portions of the area consist of second growth white cedar, many large patches of mountain laurel and some rhododendron. Good habitat for deer and snowshoe hare.
Encroachments: None, due to State ownership
Ownership: 900+ acres owned by State of Rhode Island
Data Source: John M. Cronan, Div. of Conservation, 83 Park St., Providence, R.I. 02900

Proposed by: Dr. Goodwin and Dr. Niering: Inland Wetlands Theme Study: NPS 1971

NEW YORK

(47) Iona Island Marsh (Salisbury Meadow)

Acreage: About 160
Location: Rockland Co.; Peekskill Quadrangle; about 2 miles west of Peekskill on the west side of the Hudson River
Description: Listed in The Hudson Biological Resources, Hudson River Valley Commission, as a site for rare plants and rare ecological habitat
Ownership: Palisades Interstate Park Commission

Data Source: Calvin J. Heusser, Dept. of Biology, New York Univ., Sterling Forest, PO Box 608, Tuxedo, NY 10987

Proposed by: Dr. Goodwin and Dr. Niering: Inland Wetlands Theme Study: NPS 1971

(48) Nissequogue River

Acreage: 400 estimated
Location: Suffolk Co.; Saint James and Central Islip Quadrangles; one mile west of Smithtown, reached via the Jericho Turnpike and Rt. 25
Description: Wooded swamp, portions of which are slightly affected by the tides
Data Source: Richard B. Fischer, Dept. of Education, NY State College of Agriculture, Cornell Univ., Ithaca, NY 14850
Other Knowledgeable Persons: Anthony Taormina, 108 Glenwood Lane, Port Jefferson, NY 11777

Proposed by: Dr. Goodwin and Dr. Niering: Inland Wetlands Theme Study: NPS 1971

(49) Long Pond

Acreage: 45
Location: Suffolk Co.; Sag Harbor Quadrangle; 3 miles north of Bridgehampton
Description: This is a shallow pond with a sandy bottom and an abundance and variety of submerged and emergent vegetation. The pond has a substantial fringe of grass around the edge and is surrounded by oak woods. This pond is very suitable waterfowl habitat and several muskrat houses are present. Little Long Pond (25 acres), though not as attractive as Long Pond, is still unspoiled and could be incorporated in this area.
Encroachments: There are several houses on Sagg Road and further development is taking place in this area. Two houses on Toppings Path are visible from the pond as well as a power line south of the pond. There are several little-used access roads around the pond.
Ownership: The Town of Southampton owns the bottom of the pond while the surrounding upland has several private owners.
Data Source: Harold Knoch, Division of Fish & Game, Baymen's Bldg., 285 Main Street, Sayville, NY 11782

Proposed by: Dr. Goodwin & Dr. Niering: Inland Wetlands Theme Study: NPS 1971

(50) Kellis Pond

Acreage: 19
Location: Suffolk Co.; Sag Harbor Quadrangle; one mile southwest of Bridgehampton; reached via Rt. 27
Description: This pond may be classified as a kettle hole. Although not the best example of this type on Long Island it is one of the least desecrated. The pond, with its narrow wooded border is surrounded by farmland. There is some floating and emergent vegetation near the shore, but the pond itself has the appearance of being fairly deep. This pond is used extensively by migrating diving ducks and other waterfowl.
Encroachments: A development road has been built to within 250 feet of the west shore.
Ownership: Private
Data Source: Harold Knoch, Division of Fish & Game, Baymen's Bldg., 285 Main Street, Bayville, NY 11782

Proposed by: Dr. Goodwin and Dr. Niering: Inland Wetlands Theme Study: NPS 1971

NEW JERSEY

(51) Palisades of the Hudson

Located on the New Jersey side of the Hudson River. This great sill is preeminent among features of its kind in North America. It is some 70 miles long and varies in thickness from 300 feet to nearly 1,000 feet. A portion of the Palisades of the Hudson reappears as an outcrop some 50 miles to the southwest at Rocky Hill, New Jersey, about 10 miles north of Princeton. Great Snake Hills and Little Snake Hills rising out of the Newark marshes near Secaucus, New Jersey, are referred to in geologic literature as the Snake Hill plugs. (Subitsky, 1955, bottom p. 326, left column, of paper by F. B. Van Houten).

Proposed by: Dr. Robert Rose: Works of Volcanism Theme Study: NPS

ATTACHMENT 15-2 CONSERVATION PRIORITY ZONES

SOURCE: Reed and D'Andrea, 1973. Conservation priorities plan of the coast of Maine. Rare, endangered, threatened and peripheral wildlife and fish of the Maine coast. Draft report.for the Center for Natural Areas, Smithsonian Institution, Washington, D. C.

1 COBSCOOK BAY

Size: 15,806 acres Shoreline: 97 miles

Boundaries Generally, the area enclosed by a line running down Sewards Neck Road, Route 189, to Whiting, Route 1, to Fields Point, along the Lubec-Edmunds town line in Whiting Bay, but including Birch and Hallowell Islands in Dennys Bay, northwest to Leighton Neck Road to Leighton Point and across Cobscook Bay to Seward Neck. This area includes South Bay, Straight Bay, Whiting Bay, and associated coves.

Outstanding Features

1. Cobscook is the most extensive undeveloped embayment complex in Maine.
2. Active eagle nest on Birch Island (Whiting Bay).
3. Habitat of Atlantic salmon.
4. Dense breeding populations of woodcock.
5. Goose migration stopover.
6. Extensively used for scientific and educational purposes (mostly littoral and sublittoral marine investigation).
7. Several reversing falls located in the bay, including state's largest.
8. Salt marshes totaling 60 acres are located on the bay.
9. Productive mud flats totaling about 2,880 acres.
10. Because of its cold waters and some of the greatest tide variations in the United States, the area has extremely diverse and abundant marine biota.

Intrusions

The area is largely undeveloped with the exception of Coffins Point where 70 lots for summer homes have been laid out and the western shore of Whiting Bay which is the recreational area of Moosehorn National Wildlife Refuge. However, Pittston Oil Company is in the process of filing application for a refinery in Eastport. Several other companies have options in the same town. The cold water and high flushing rate of the bay make it a possible site for an atomic power plant and the Cobscook area would doubtless be affected should a tidal power plant ever be developed in Passamaquoddy Bay.

Selection Rationale Summary

The Cobscook Bay area is the largest undeveloped embayment estuary complex in the state. Only 11.2% of the mainland shoreline in the conservation zone has been developed, and none of the islands have any development. The most outstanding feature of the area is undoubtedly its great tides. At Eastport the annual mean tide is 18 feet and spring tides run to 24 feet, the highest in the United States with the exception of Alaska. The heavily indented shoreline is a "drowned river bed" formation and as a result there probably is a higher ratio of shoreline to land area than in any other mainland zone. In addition, the area is of high research value. Because of the great tides, scientists have rare opportunity for access to rich and diverse intertidal and subtidal plant and animal groups including brachiopods, extensive kelp beds, and rare priapulids. The entire Cobscook Bay zone is an area of undeveloped resources. Its complex system of salt and fresh water drains three small rivers and supports, among other species, a population of bear, moose, deer, seals, porpoise, and a large concentration of woodcock. Its value is augmented further by the fact that Cobscook Bay abuts the Moosehorn National Wildlife Refuge.

Land Use Controls/Public Preserves

Town	Zoning	Subdivision	Conser. Comm.	Reg'l. Plann.	Local Plann.	Public Preserves
Edmunds	Unorg.tnsp.LURC					Cobscook Bay State Park
Lubec				x	x	
Pembroke						
Trescott	Unorg.Tnsp.LURC					
Whiting						

2 DOWNEAST

Size: 11,644 acres **Shoreline:** 50 miles

Boundaries The coast from Quoddy Head (Lubec) to Sprague Neck (Cutler) including the offshore islands. Interior boundary is Route 191, but including drainage of Eastern and Western Marsh Brooks.

Outstanding Features

1. West Quoddy Head is the easternmost point in the United States.
2. Maine's longest stretch of undeveloped rocky headland lies in this zone.
3. Machias Seal Island is one of only two nesting sites of razorbills and puffins in United States.
4. Interesting and diverse geological features and extensive bedrock exposure in cliffs.
5. Spectacular natural scenery and picturesque villages.
6. This area contains one of the two rock arch bridges found on the coast of Maine. The bridge separates the two largest thunderholes and is located in among some of the highest mainland cliffs on the coast of Maine.

Selection Rationale Summary

The Downeast conservation zone represents the largest stretch of undeveloped rocky headlands. The easternmost section of the zone, West Quoddy Head, is in public ownership and is the easternmost section of the United States. The western end of the zone is at Western Head which is also in public ownership, supporting the Navy's transatlantic radio center. Geological features of the zone are both spectacular and diverse. Cliffs ranging between 100 and 150 feet in height are common and a 200-foot submarine contour paralleling the cliffs make this among the state's deepest inshore waters. Minor geological features which are also impressive include blowholes, thunderholes, geodes, crystalline basalt formations, and a rock-arch at Boot Head. Pond Ridge is a large moraine formation. Norse Pond is a rare elevated fresh water pond immediately adjacent to the sea. Several sphagnum bogs which are located in the area have tundra-like vegetation reminiscent of the subarctic conditions which prevailed in the glacial period. Interesting birds in the area are eagles, osprey, gannets, and puffins. Off the Downeast zone, puffins and razorbills nest on Machias Seal Island and are frequently seen offshore. Little Machias Bay is an important center of soft-shell clam production.

Land Use Controls/Public Preserves

Town	Zoning	Subdivision	Conser. Comm.	Reg'l. Plann.	Local Plann.	Public Preserves
Cutler					x	Cutler Radio Base (Fed.)
Lubec				x	x	Quoddy Head Lookout (F) 0.2 acres, Quoddy Head State Park, 572 acres
Trescott	Unorg.tnsp.LURC					Haycock Hbr. St. Park 263 acres.

4 LITTLE KENNEBEC BAY

Size: 17,829 acres Shoreline: 76 miles

Boundaries The mainland coast from Sanborn Cove (Machiasport) to Great Cove (Roque Bluffs) and most of the watershed of Little Kennebec Bay, Englishman River south of Route 1 in Machias; including offshore islands from Round Island (Machiasport) south to the Libby Islands and the Scabby Islands and northwest to Shoppee Island.

Outstanding Features

1. Little Kennebec Bay is one of the few undeveloped embayments on the coast.
2. Libby and Scabby Islands are high treeless islands of great beauty. Libby Island has a high cliff cave and one of the two natural rock bridges in Maine. Maine.
3. The felsite beach at Howard Bay is uniquely beautiful.
4. There are Indian petroglyphs on Birch Point, one of two sites in Maine.
5. There are two eagle nests and several osprey nests in the area.

Intrusions

The recent "oil scare" at nearby Machiasport has created a keen awareness of the natural beauty of the Little Kennebec area and local sentiment in favor of conservation is significant. Nevertheless, several developments were started in anticipation of the oil companies proposed success. Approximately ten houses have been constructed to date on 179 lots (appox. 1,000 acres) owned by the Dead River Company in Duck Cove. Cow Point has five houses erected on 19 lots totaling 30 acres and 40 acres on Calf Point have been sold to a potential developer. Major visual intrusions are the radio towers of Cutler and the Air Force radar station on Howard and Miller's Mountains. The possibility of another effort to locate oil in the Machias area should not be ruled out in the future.

Selection Rationale Summary

Little Kennebec Bay is a sheltered embayment with cobble, jasper, and fine sand beaches and good potential for canoeing. Clamming is significant at six or more points off Little Kennebec and Machias Bays and the salt marsh on the Englishman River is among the last of any significance east of the Pleasant River. The land area is characterized by impressive blueberry balds and a number of mature forest stands. There are two eagle nests and several osprey nests in the region. Black ducks, mallards, and teals congregate in Englishman River and the Mill Pond. Scabby Island is an important migratory stopover and, in addition, has interesting glacial features. Starboard Island has a lava flow and a natural rock bridge is located on Upper Libby Island.

Land Use Controls/Public Preserves

Town	Zoning	Subdivision	Conser. Comm.	Reg'l. Plann.	Local Plann.	Public Preserves
Machias		x	x	x	x	
Machiasport		x		x	x	Fort O'Brien Memorial 2.0 acres
Roque Bluffs					x	Roque Bluffs State Park, 274.04 acres
Whitneyville						

6 ROQUE ISLAND

Size: 2,017 acres Shoreline: 27 miles

Boundaries All of the land area and water surrounding Roque, Marsh, Bar, Little Spruce, Double Shot, Anguilla, the Brothers, Halifax, and Green Islands; also Shag and Pulpit Rocks and Green Island Ledge.

Outstanding Features

1. Roque Island Harbor is considered one of the most beautiful anchorages on the eastern seaboard.
2. Roque Island has two white sandy beaches, one half-mile and the other a mile long. Granite cliffs up to 100 feet high.
3. Green Island and Pulpit Rock are important nesting sites for eider ducks and cormorants.
4. The Brothers has a spectacular natural rock stairway and spectacular cliffs.
5. The surrounding sea is one of the most productive herring fishing regions on the Maine coast.

Intrusions

The inaccessibility and single-family ownership of the island should protect it for some years to come. However, both the Air Force radar installation on Howards Mountain and the Navy submarine radio towers in Cutler are significant intrusions on the landscape.

Selection Rationale Summary

Roque Island is a tombolo formation consisting of two rock islands joined by a glacial deposit of sand. It has been owned by the Gardner family for over 100 years during which time it has been selectively logged and farmed. Its combination of unspoiled forests, cliffs, fine sand beaches and sheltered harbor is unsurpassed in Maine. To the east of the main island, the islets of the archipelago are generally barren but are of great interest for their lichens and other vegetation and as nesting sites for marine birds. Eider ducks and cormorants nest extensively on Pulpit and Green Islands. Also, the islands are used as a migration stopover. The Brothers is of great interest for its unusual land-water geological interfaces and for its natural rock stairway which is blocked as it ascends by a huge boulder jammed between the stairway walls. Great Spruce Island has very productive mud flats and is the site of an osprey nest and a colony of seals.

Land Use Controls/Public Preserves

Town	Zoning	Subdivision	Conser. Comm.	Reg'l. Plann.	Local Plann.	Public Preserves
Jonesport				x	x	(2) lighthouses (U.S.C.G.)

7 GREAT WASS

Size: 4,932 acres Shoreline: 57 miles

Boundaries All the islands in Beals Township except Beals Island and French House Island; also all islands in Jonesport, including Mark Island, that lie south of Moosabec Reach.

Outstanding Features

1. The Great Wass Archipelago is the largest undisturbed island complex on the coast of Maine
2. Impressive stands of mature spruce fir can still be found on Great Wass, Head Harbor, and Little Hardwood Islands.
3. The area supports a significant and diverse fauna, particularly of sea birds.

Intrusions

The Department of Environmental Protection reports no recent applications for developments in the area.

Land Use Controls/Public Preserves

Town	Zoning	Subdivision	Conser. Comm.	Reg'l. Plann.	Local Plann.	Public Preserves
Beals						Moose Park, U.S.C.G. station, 4 acres
Jonesport				x	x	

Selection Rationale Summary

Great Wass Archipelago is a largely undeveloped island complex which is a paradise for boating, picnicking, hunting, and other outdoor pursuits. The archipelago is a haven for wildlife. Moose and deer inhabit many of the Great Wass islands. Seals are often seen on many islands in the eastern bay and in the eastern section of Moosabec Reach. The Cedar Cove ledges provide a valuable mating area for seals. Egg Rock, Brainey Island, and Freeman Rock are important rookeries for eider ducks and other seabirds while Mark and Sequin Islands have eagles nests and Ram Island has an osprey nest. Cummings Head, the Sands, Head Harbor Island and many other islands are important migratory bird stopovers. Black ducks, mallards, and teal concentrate at Little Pond Head on the Great Wass and around the large heath, dammed by beavers on Head Harbor Island. The geology of the area is diverse. Money Island and Sand Cove on Great Wass Island and Beals Harbor have natural sand beaches and dune complexes. There is a general abundance of pink granite in the area. On the north shore of Head Harbor Island this granite contains crystals of rapakivi and of rare antirapakivi. The smooth granite cliffs on the southeastern shore of Steele Harbor Island are very scenic. The flora is notable for several mature stand of spruce and fir. Interspersed with these are tamarack-covered lowlands, alder swamps, and open heath. Great Wass supports one of the few stands of jackpine on the coast.

9 PLEASANT BAY

Size: 23,743 acres **Shoreline:** 11 miles

Boundaries All islands, promontories, and other shore frontage in or on Pleasant, Harrington, Back, Flat, and Narraguagus Bays (except Bois Bubert Island); plus the lower reaches of Beaver Meadow Brook, Cole Creek, and Mill River; also the Harrington River from Route 1 to Harrington Bay and the Pleasant River from the Great Heath (T-18-MD and Columbia) to Pleasant Bay including the Great Heath.

Outstanding Features

1. Pleasant Bay is the most extensive complex of mudflats, salt marshes (1,383 acres total), and mature spruce-fir forests east of the Kennebec River.
2. In terms of production of organic matter, Pleasant Bay is one of the most important area on the coast of Maine.
3. The Pleasant and the Narraguagus Rivers have important runs of Atlantic salmon and other anadromous fish.
4. The Great Heath on the Pleasant River (Columbia and T-18) is the largest bog in the coastal zone.
5. The area includes 24 islands and 12 streams rated A-B1 by the Dept. of Environmental Protection.

Intrusions

There are three potential sources of stress in the area:

1. The Northeast Peat Moss Company and other companies are making efforts to mine the Great Heath for peat moss.
2. Pesticides sprayed on the extensive blueberry barrens of the region are threatening to contaminate the important fish water of the Pleasant and Narraguagus Rivers and the flats on Pleasant Bay.
3. The Atlantic Development Company has subdivided Pine Island in the Great Heath and sold it in lots to foreigners (principally in Europe). The state of the Pine Island development is uncertain.

Land Use Controls/Public Preserves

Town	Zoning	Subdivision	Conser. Comm.	Reg'l. Plann.	Local Plann.	Public Preserves
Addison						U.S.C.G. station, 4 acres
Cherryfield				x	x	
Columbia					x	
Harrington					x	U.S.C.G. station, Squirrel Pt. 4.5 a. Flint Is., Nature Conser. 134 a.
Milbridge				x	x x	Narraguagus R. Boat Launching Site, 5.0 a.
T-18-MD	Unorg.	Tnsp.	LURC			

Selection Rationale Summary

The Pleasant Bay area, encompassing the watershed of the Pleasant River, is a region remarkable for its diversity of ecosystems which include a bird island, broad worm and clam flats, extensive salt marshes, eelgrass bottoms, kelp beds, rocky sea frontage, at least a dozen beaches, in addition to upland systems that incorporate not only forest but vast heaths and blueberry barrens. The area has exceptional possibilities for outdoor recreation and for near-shore fisheries.

The mud flats adjacent to the Pleasant, Harrington, and Narraguagus River estuaries are highly productive of worms and clams. Lobsters are seasonally abundant in Harrington Bay. The area in general abounds with wildlife. Beaver flowages are common. Duck and deer hunting are reputed to be excellent.

Extensive forests of mature spruce and fir, among the last of such acreage on the coast, are to be found on Ripley Neck, Dyer Island, Flint Island, Trafton Island, and on the east shore of the Pleasant River (Addison).

The Pleasant River from the Fog Stream Bridge to Columbia Falls is an enjoyable canoe run. Salt water intrudes up the river to Columbia Falls. Foster Island in Harrington Bay is the site of a former Abenaki campground. Abenaki Indians once portaged their canoes from Carrying Place Cove to West Carrying Place Cove.

New England's northernmost naturally occurring stand of great rhododendron (Rhododendron maximum) is located in Cherryfield. Also in Cherryfield is a rare stand of mountain laurel (Kalmia latifolia).

Jordans Island is felt by some to be the most enchanting island on the coast; its rocky headland is covered with orange lichens and its uplands are with meadows and wildflowers. It also has two beaches, one jasper and one cobblestone, and a large rock bridge. Cape Split and Crow Island have sand beaches and Shipstern, Pinkhams and Dyer Island eagles nests. Other islands have osprey nests and serve as nesting sites for common and arctic terns. Brant also feed on some of these islands.

The Great Heath is possibly the largest open heath in the northeast (Maine Sunday Telegram, 12/3/72). It occupies a depression made by a glacial tongue and is over 6,000 acres in size. Its vegetation is of the "open moss-bog type" with a few acres of sedges and marsh grass. The flora is generally similar to that found in subarctic regions, although certain plants adapted from tropical climates also thrive in this wet nitrogen-deficient microenvironments. The heath was formed when organic material built up in a former lake basin with restricted drainage and thereafter was overgrown with sphagnum domes. Peat deposits are the partially decomposed plant remains derived from this heath. The overall effect of The Great Heath on the visitor is one of immenseness which creates an overwhelming aesthetic experience.

10 PETIT MANAN

Size: 16,047 acres Shoreline: 58.04 mi.

Boundaries All the land in Steuben south of Route 1; Gouldsboro Point in Gouldsboro, south of Route 1 and east of Chicken Mill Stream; Milbridge south and west of Wyman Village, including Bois Bubert Island, Little Bois Bubert, Egg Rock, Petit Manan and Green Island.

Outstanding Features

1. The Petit Manan zone is bordered by over 55 miles of undeveloped coastline.
2. It contains overall 1,120 acres of productive mudflats (almost none of which have been closed by pollution), 224 acres of salt marsh and 12 small islands.
3. In the recent past Dyer Bay provided a substantial part of the state's herring catch. It is an excellent, though some say, overfished area.
4. As many as three pair of northern bald eagles have been known to nest and hunt in the Petit Manan area. A pair of osprey are nesting on Petit Manan neck.
5. Colonies of roseate terns and laughing gulls (one of three locations in Maine) are found on Petit Manan Island. Common and arctic terns nest on nearby islands.
6. There are many bogs in the area including at least one raised bog. These contain ponds which are important feeding stations and stopovers for migrating birds.
7. Two hills in the area offer panoramic views of the coastline.

Intrusions

The area is one of thin soils and sparse population. There is, however, some pressure for development from local authorities anxious to expand their tax base. This is particularly true of Steuben which has a smaller tax base than either Milbridge or Gouldsboro. Subdivisions exist above Canes Cove on Dyers Neck and on Bar Island on Pigeon Hill Bay. Several large pieces of land are held by potential developers though the area is still generally characterized by fairly large land holdings.

Selection Rationale Summary

Dyer Neck and Petit Manan are long granitic headlands. Bois Bubert was once such a headland, too, but was cut off from the mainland when waters rose after the last ice age. The area is covered with northern hardwood and boreal forests and has many bogs, marshes, and extensive mudflats. Two large and several smaller fresh water ponds shelter great blue herons, green herons, and American bitterns. Whimbrels nest in nearby fields. Pigeon Hill which is 317 feet above sea level and Eagle Hill command sweeping views of the barren islands offshore. These islands are the breeding places of eider ducks, herring gulls, great black-backed gulls, and arctic terns. Petit Manan is the home of one of the northernmost colonies of both the laughing gull and the roseate tern. Along the shores of the whole archipelago are over 1,120 acres of salt marsh and scattered beaches of materials ranging from cobblestone to fine sand.

Inland fauna includes beaver, mink, muskrat, weasel, red fox, otters, skunk, and snowshoe hare. Beaver ponds offer shelter to many of the area's ducks, particularly in a nor'easter.

Land Use Controls/Public Preserves

Town	Zoning	Subdivision	Conser. Comm.	Reg'l Plann.	Local Plann.	Public Preserves
Gouldsboro				x	x	
Milbridge			x	x	x	U.S.C.G. station, Petit Manan I, 9 ac. Mc. I.F.&G. nesting area, Green Is., 12 acres.
Steuben						

11 TUNK LAKE

Size: 48,698 acres Shoreline: 59 miles (freshwater)

Boundaries The entire drainage system of Tunk Stream, and the Donnell Pond watershed to the pond outlet into Alder Brook.

Outstanding Features

1. Tunk one of only two fresh water conservation zones being considered in the Conservation Priorities Plan.
2. The area contains a coastal mountain range system and deep glacial lakes, providing spectacular scenic vistas. Tunk Mountain is 1,157 feet in elevation.
3. Diverse flora and fauna, a wide range of ecosystem types and extensive glacial remains are found here.
4. Mature stands of several forest types exist in the area. Notably a mature hemlock stand and an oak stand which supports a population of grey squirrels at the northernmost end of their range.
5. All the anadromous fish species found in Maine use either Tunk Stream and Lake or Donnell Pond and its drainage system. Tunk Stream runs unimpeded by dams to the ocean at Steuben Harbor.
6. It is reportedly one of the best deer hunting areas in the state.

Intrusions

There is very little development in the area and access is limited by poor roads. The soils are extremely sparse and, as such, are unsuitable for heavy development in any case. There are, however, a few sections of heavy seasonal development, notably at the north end of Tunk Lake and the western arm of Donnell Pond. The rest of Donnell Pond is undeveloped but development is presently being considered.

Land Use Controls/Public Preserves

Town	Zoning	Subdivision	Conser. Comm.	Reg'l. Plann.	Local Plann.	Public Preserves
Cherryfield				x	x	
Franklin				x	x	
Steuben						
Sullivan				x	x	
T-7-SD	Unorg.	Tnsp.		LURC		
T-9-SD	"	"		"		
T-10-SD	"	"		"		I.F&G fish hatchery 5.67 acres

Selection Rationale Summary

The Schoodic Mountains which rise around Tunk Lake are one of the three coastal mountain ranges. Tunk Mountain itself is the tallest of the group and is 1,157 feet in elevation. These mountains are characterized by bald summits (no direct relation to elevation) with sub-alpine flora communities and steep cliffs. Many offer excellent views of the surrounding land.

There is much evidence of glaciation in the area. The Rainbow Pond area is dotted with small kames and larger kames are located east of Spring River Lake. Chatter marks are in evidence on several of the mountains and Round Mountain is strewn with boulders up to 15 feet in size. Surficial glacial till is common and granite bedrock outcrops abound making the area unsuitable for any substantial development.

Tunk Lake (2,010 acres), Donnell Pond (1,120 acres), and Spring River Lake (704 acres) are the major bodies of water in the area, though there are many others. Tunk Lake and Donnel Pond are both of glacial formation and are deep cold water lakes. Tunk Lake is the second deepest lake in the state. The conservation zone contains the entire Tunk Lake watershed and the run down Tunk Stream to the ocean at Gouldsboro provides good white water canoeing. Donnell Pond and Spring River Lake have natural sand beaches which are rare for glacial ponds.

Tunk Stream is an important run for anadromous fish including Atlantic salmon, smelts, alewives, eels, sea lampreys and shad. All the water bodies of the area are inter-connected by an intricate network of streams and many of these also contain brook trout. Spawning grounds are limited but the Dept. of Inland Fish & Game actively maintains and stocks the area.

The Tunk Lake area is heavily forested. Mature stands of hemlock are located on Schoodic Mountain and an old growth of oak is located near Fox Pond which supports a colony of grey squirrels at the northern extreme of their range. There are pure stands of red cedar east of Fox Pond which are rare in eastern Maine and mountain laurel (Kalmia latifolia) grows at the northeastern end of its range. There is an undisturbed spruce-fir stand which is one of only 14 such stands documented by Davis (1966).

Wildlife abounds in the area. Black bear, moose, deer, beaver, mink, and fisher are found in the area.

Purying Island is noted for its Indian village artifacts, shell heaps, and abandoned burial ground. An additional point of historical interest is Admiral Byrd's estate which is contained within the zone.

14 MERCHANTS ROW

Size: 2,928 acres Shoreline: 17 miles

Boundaries All the islands between Stonington and Isle au Haut, the most westerly being Scraggy Island, and the most easterly being North Popple Ledges. Some scattered ledges between Swans Island and Isle au Haut are included because of their important bird populations.

Outstanding Features

1. Sixty-five named islands and ledges of diverse types are included in the zone.
2. The area is central to Maine's fishing industry.
3. The islands support a significant and diverse bird population.
4. The area is adjacent to Acadia National Park and some of the islands are included in the projected expansion of Acadia National Park.

Intrusions

The most significant development in the area is the inclusion of the islands in the much criticized Acadia Master Plan. The authorities in Stonington and Deer Isle did not feel adequately consulted in the formation of this plan and it has generated much local opposition. Acadia Park already draws 2,300,000 people a year and the plan recommended that Stonington be a staging area for access to many of the islands which would be acquired for recreation use.

Tourism and second home developments are rapidly increasing the the area. There are indications that at least six island owners considering summer home developments. However, possibly in reaction to the announced Acadia Plan, 70% of a local population poll indicated interest in support of local industry (fishing, woodwork) over the encouragement of increased tourism.

Selection Rationale Summary

The sixty-five islands of the Merchants Row group range from small rock ledges to 256-acre Merchant Island. Most lie within the towns of Stonington and Deer Isle which are famous for their maritime history and for rearing some of the world's best sailors. The granite which makes up many of these islands was once important to the local economy. This is attested to by numerous abandoned quarries and piles of block among the islands. Generally the islands conform to a pattern of low narrow plains surmounted by glacially rounded hills up to 120 feet above sea level. Many of the islands are covered with pure spruce-fir forest. At the water's edge there are many sand and cobble beaches.

The bird population of the area is diverse. Most islands support nesting cormorants and gulls but great blue herons, guillemonts, petrels, eiders, savannah sparrows, and arctic terns have also been sighted. Osprey nests are established at five locations and Southern Mark Island supports the largest double-crested cormorant rookery in Maine.

Major seal populations inhabit six islands and ledges.

Land Use Controls/Public Preserves

Town	Zoning	Subdivision	Conser. Comm.	Reg'l. Plann.	Local Plann.	Public Preserves
Deer Isle			x	x	x	U.S.C.G. station, 3.0 acres
Isle au Haut						U.S.C.G. station, Saddleback Ledge, 1.0 acres
Stonington			x	x		Nature Conser., Crockett Woods Cove, 46 ac., Round Island, 40 ac., Wreck Island, 70 acres.

19 FOX ISLAND GROUP

Size: 14,748 acres **Shoreline:** 109 miles

Boundaries All of Vinalhaven Island except the area surrounding Carvers and Roberts Harbors; all satellite islands surrounding Vinalhaven and northeast of North Haven to Butter Island; also Fish Point and Oak Hill of North Haven.

Outstanding Features

1. Bald eagles frequent the area around The Basin. This site provides very valuable feeding and possible nesting habitat.
2. Ospreys nest in several areas throughout the zone.
3. Several seabird rookeries are located in the zone. Most notable is the eider colony on Grass Ledge. This is the highest concentration eider rookery in the state.
4. Anadromous smelt and alewives run in four streams on Vinalhaven.
5. Several notable geological formations are located in the zone including lava flows, fossils, quarry sites, and examples of almost every geomorph, landform, and combination thereof that one might find anywhere on the coast of Maine.
6. There is extreme system diversity on many islands which combine striking physiographic-geological formations, plant and animal communities, and valuable production areas.
7. Archaeological excavations are presently being conducted in Fish Point (North Haven) after important discoveries dating to the "red paint" civilizations.
8. The Basin is a highly significant ecological area as a tidal flat with a high velocity constriction connecting it to the ocean and extremely diverse ecological community.

Intrusions

Two planned developments currently threaten the area. Otherwise, development is haphazard and in small bits. The first development is on Mill River with 14 one-acre lots surveyed, four sold and two built upon. Across the river 22 similar sites are rumored to be in the planning stage.

The second and, in some ways, far more serious development is on the northeastern shore of The Basin. Four hundred acres were recently sold to a developer in Bangor. The Basin is a unique valuable and virtually undeveloped Salt Pond.

A bill is currently in the legislature to construct a larger ferry for Vinalhaven. Serious car back-ups occur at the ferry on weekends and during the summer. Many islanders are opposed to the bigger ferry; many others are for it. Attitude toward further development is perhaps the real bone of contention.

Selection Rationale Summary

The Fox Islands are the dominant land masses in Penobscot Bay and have great diveristy of ecosystemic, natural, and aesthetic features of varying degrees of significance from local to national. Fully 90% of the area may be designated as natural, in a wild state, and the exceptional 10% is mostly small, usually attractive, seasonal cottages or long-established salt farms. Compared to many other conservation zones, it is relatively undeveloped, high development pressures occuring only recently and in small areas of the zone. The primary general features are central location, highly varied naturalness that is not yet compromised and is still easily protected. The area is so varied that no one significance-level designation can be accurately applied to the whole. There are many small natural areas of historic, aesthetic, and economic local importance. There are several wildlife areas, nutrient-generation zones, and geomorphological areas of significance on the state level. The area's proximity to Acadia NationalPark at Isle au Haut and the revised National Park Master Plan give some areas of the zone national importance. Special attention is called to Long Cove-Seal Cove-Mill River-Seal Bay-Winter Harbor area where natural features combine with historic and aesthetic ones to create an ideal preservation-recreation area with practical as well as ideal conditions for state-level protection and management.

Landowners have generally kept large parcels intact, but pressure is increasing for subdividing lots for seasonal homes. The visual impact of human pressure is minimal and less than in the past. The vulnerability is quite high and will become higher when the tax base of the townships are reassessed and if larger ferries are employed in human transport. The current recreation use of the island is very moderate due to the ownership pattern and the fact that tourism and camping is impractical and, in most cases, illegal. Recreation potential, however, is very high, especially if lot development gains a foothold and/or hostelry is increased. In addition, vulnerability is increased by the weak economy and short term seasonal expansion looks very appealing.

In general, the Vinalhaven area is a very valuable aggregate of natural systems and aesthetic beauty heretofore relatively unspoiled. It has great potential as a wilderness wildlife and recreation area. Its value lies also in the people and their way of life. Care must be taken to prevent destruction of any of these features in the future without jeopardizing the future of the community.

Land Use Controls/Public Preserves

Town	Zoning	Subdivision	Conser. Comm.	Reg'l. Plann.	Local Plann.	Public Preserves
Deer Isle			x	x	x	IF&G nesting isl.Sloop Island Ledge
North Haven				x	x	IF&G nesting isl.Barred Isl.,Spoon Ledge Nature Cons. Mark Isl.
Vinalhaven			x	x		USCG STA Goose Rocks State landing, IF&G nesting isl,Carvers, Leadbetters Isl,Green Ledge;Town Park:Isle au Haut Mtn; Nature Cons. Smith,Lanes,Big White, Big Garden Ils. Calderwood Land Trust

21 MUSCONGUS BAY

Size: Approx. 86 square miles

Boundaries The entire Muscongus Bay--St. George River--Muscle Ridge region including the eastern shore of Pemaquid Neck, the Medomak River to Waldoboro, the St. George River to Thomaston and the western shore of Penobscot Bay to Owls Head; also all offshore islands to Metinic Island.

Outstanding Features

1. This area contains dozens of islands and ledges which make it one of the most scenic bays along the coast.
2. The zone has several important ornithological features: a. eider nesting colonies on 29 islands; b. at least 10 pairs of ospreys nesting; c. nesting Leach's petrels, black guillemots common terns, and other sea birds; d. great blue heron rookeries on Franklin and Wreck Islands.
3. Two Bush Channel is an important schooling area for pilot whales.
4. On the southern end of Allens Island is a stand of yellow birch with diameters approaching four feet.
5. The zone is replete with cliffs, cobble and sand beaches and other geologic features.
6. The Audubon camp on Hog Island and a proposed marine research station on Mosquito Island make this zone an important area for research and education.
7. The St. George River is very scenic and often used by canoeists.
8. Both commercial and sport fisheries are important in the zone.
9. The zone is very popular with recreational boaters. The famous Friendship Sloop Days draws many visitors to the area.

Intrusions

Muscongus Bay is currently on the eastern border of the intensive coastal development section of the Maine coast. As second home development expands from the west, Musconqus Bay will be subjected to more and more pressure. There is a moderate amount of sewage pollution in some of the mainland harbors and in the St. George River.

Selection Rationale Summary

The innumerable small islands located in the zone make it a haven for many species of birds. The more common sea birds such as gulls, eiders, and comorants nest here in large numbers. More unusual birds such as ospreys, Leaches petrels, great blue herons, and black guillemonts also nest on several islands.

Coastal spruce-fir forest dominates most of the islands but deciduous stands also occur on some of the larger islands. Of particular note is the stand of yellow birch on Allen Island. Situated in meadows of hay-scented fern, these three- and four-foot diameter trees present a very impressive sight.

Marine mammals are common throughout the zone and the Two Bush Island Channel is particularly important as a schooling area for pilot whales. Metamorphic rocks dominate the geology of the area although some interesting formations of igneous rock exist on Harbor Island.

Muscongus Bay and its biota have been intensively studied since 1935 when the National Audubon Society was given Hog Island. Through this organization, thousands of people have learned about the ecology of the Maine coast. In addition, the owner of Mosquito Island is trying to develop a marine research station there.

Many of the area's boaters are also fishermen. In the inner bay, mackerel and striped bass are common, deep sea fishing for ground fish is a popular activity in the offshore area. Canoeists are often seen in both the fresh water and estuarine portions of the St. George River. Commercial clam, lobster, herring, and other fisheries are important local industries.

The numerous small harbors around the zone (e.g. New Harbor, Friendship, Tenants Harbor) are home ports for hundreds of recreational boaters. Outstanding among these is Friendship, home of the Friendship Sloops.

Land Use Controls/Public Preserves

Town	Zoning	Subdivision	Conser. Comm.	Reg'l. Plann.	Local Plann.	Public Preserves
Bremen			x			
Bristol						
Cushing				x	x	
Friendship				x	x	
Muscle Ridge						IF&G nesting island Garden Isl., 4 ac.
Owls Head	x	x		x	x	U.S.C.G. station Municipal Park
St. George			x	x	x	U.S.C.G. station Marshall Pt., Two Bsh Is., Whitehead St. Landing, Port Clyde, Fort St. Geo. Municipal Park
S. Thomaston				x	x	
Waldoboro					x	

22 UPPER SHEEPSCOT

Size: 10,747 acres **Shoreline:** 35 miles

Boundaries: East and west banks of the Sheepscot River from North Edgecomb to Whitefield excluding the developed areas around the villages of Wiscasset, Sheepscot, Alna, Head Tide and Whitefield, but including Cod Cove, the northeast half of Davis Island, Lehman, Woodbridge, and Cunningham Islands to Marsh and Dyer Rivers, Sherman Lake and Deer Meadow.

Outstanding Features

1. The Sheepscot River is one of the least polluted of the major rivers of Maine. It is the southernmost well-established Atlantic salmon run in the state. It is also an important run for alewives, glut herring, smelt, striped bass, and shad and catadromous American eel.
2. The Marsh River supports one of Maine's few remaining natural oyster populations.
3. Cod Cove is among the most prolific marine worm production areas on the coast.
4. The estuary is an exceptionally important one for nutrient production and for migrating shore birds.
5. The Sheepscot River has an area of steep cliffs above Fowle Point that is of interest to geologists since it demonstrates glacial erosion.
6. The reversing falls at Sheepscot Village, former site of a sawmill and gristmill, are among the most dramatic in the state.
7. The upper estuary is adjacent to the village of Wiscasset which is of national interest for its architecture, maritime history, and wrecked coastal schooners.

Intrusions

The Maine Yankee Atomic Power Plant at Wiscasset will raise the temperature of the upper and lower Sheepscot estuaries by 2°-3°F. in the bay as a whole and for higher within the mixing zone itself. This will have an as yet undetermined effect. There is an additional danger of radioactive pollution and particularly of its concentration in shellfish. The town of Wiscasset is considering the construction of a by-pass around the town. If the northernmost economical route is chosen, extensive ecological damage may be done to the upper estuary. Power lines already exist which are visible across the lower end of Deer Brook marsh. Additional visual intrusions are a railroad bridge over Marsh River and Deer Meadow Brook in Newcastle. There are gravel pits in South Newcastle and a large pit just below the Sheepscot Reversing Falls. Generally the Lincoln County area has been one of the fastest growing areas of the state and housing developments should probably be anticipated.

Selection Rationale Summary

The Sheepscot River originates in the low uplands between the Penobscot and Kennebec valleys and flows south to the Gulf of Maine. Where the river intersects the coast, it forms an estuarine embayment. The areas under consideration is the upper section of this river estuary, 15 miles above the mouth of the river. The upper estuary has shallow waters (30-foot maximum channel depth at mean low tide), low and variable salinity and a high tidal exchange ratio.

The Upper Sheepscot is a typical drowned river valley. It is bordered by extensive mudflats and salt marshes which are highly productive and serve as a prime habitat for many species of waterfowl. Salt marshes produce organic matter vital to the feeding of lobsters in the Sheepscot estuary. The Sheepscot is one of the few unpolluted oyster breeding areas left in Maine. As such Sheepscot oysters should be considered an important relic population from when Maine's waters were warmer and oysters were more widespread. The mudflats in the Upper Sheepscot are particularly productive and Cod Cove near Wiscasset is perhaps the most productive bloodworm area along the Maine coast.

The most important factor in the Upper Sheepscot is its estuarine ecosystems. These support vital sections of the life cycle of herring, oysters, mussels, and other molluscs and an important run of anadromous fish such as alewife, shad, and salmon. The Upper Sheepscot is the southernmost well-established salmon run in the state. It is managed jointly by the Atlantic Sea Run Salmon Commission and the Maine Dept. of Inland Fisheries and Game. A vital element in making the Sheepscot estuary so productive is its lack of pollution. This is primarily attributable to the flushing effects of the tides. Land development should be carefully controlled as the maintenance of the Sheepscot's non-polluted status is very delicate.

In the middle of the upper estuary a rock ledge formation constricts the embayment and forms a tidal fall known as Sheepscot Reversing Falls. The steep slopes on the west bank of the Sheepscot just below the falls are highly scenic and of great interest to geologists since they demonstrate glacial erosion.

Land Use Controls/Public Preserves

Town	Zoning	Subdivision	Conser. Comm.	Reg'l. Plann.	Local Plann.	Public Preserves
Alna						
Edgecomb			x	x	x	
Newcastle	x		x		x	
Wiscasset		x	x		x	

24 BACK RIVER

Size: 21,630 acres **Shoreline:** 91 miles

Boundaries East and west shores of the Sasanoa River from Hanson Bay (Woolwich) to Soldier Point (Georgetown) including Brookings, Hockomock, Fall, and Nubble Bays and all islands therein; plus the east and west shores of the Back River (Arrowsic) from Flying Point to Bald Head including Crow Island plus the east and west shore of the Kennebec River from Marr Island (Georgetown) to Bluff Head (Arrowsic) including Marr Island, Perkins Island, Mill Pond, Goat Island, Lee Island, Ram Island, and the Cutting Creek marsh (Phippsburg).

Outstanding Features

1. The Back River between Arrowsic and Georgetown contains more than 1,000 acres of salt marsh. These provide an important nutrient source at the mouth of the Kennebec.
2. Lower and Upper Hell Gate on the Sasanoa River are well known tidal rips (high velocity channels).
3. Hockomock Bay, like Merrymeeting Bay to the north, is an important migratory bird stop, notably for Canada geese.
4. The area supports large runs of anadromous striped bass and smelt.
5. The Back River zone is in close proximity to the Appalachian Mountain Club's Real Island, to the 500-acre Newman Sanctuary, to the Audubon Sanctuary, and to 900-acre Reid State Park.

Intrusions

Water pollution from the Kennebec is a continual problem in the area and has closed several clam flats. The Atomic Power Plant in Wiscasset could also have an important effect on the region but what precisely it will be is uncertain as of yet. Ecological studies are currently being carried out by the University of Maine. In the event of substantial expansion of the Bath Iron Works, which now seems possible, the area would be under great stress to develop further as a "bedroom community" for the Bath-Brunswick area. A development near Squirrel Point has been approved by the Dept. of Environmental Protection while a 500-unit proposal on Parker Head just south of the zone was denied. Summer pressures promise to continue heavy at Reid State Park and vicinity at the tip of the Georgetown peninsula.

Selection Rationale Summary

The towns of Arrowsic, Georgetown, and Westport are all islands formed from the fragmented peninsula that runs between the Kennebec and Sheepscot Rivers. While the Back River itself parallels the southerly flow of the Kennebec and Sheepscot, the Sasanoa follows an anomalous east-west route which separates Georgetown and Arrowsic from the mainland. The land in the area is typically creased with granite and schist ridges, some of which form considerable promontories like Bald Head and Tarrs Mountain. Phippsburg cliffs drop 100 feet into the Kennebec and the lower Kennebec and Back River in general are lined with impressive bluffs.

The soil in the area is shallow and impermeable. There are frequent small ponds and bogs. The terrain is highly conducive to the formation of marshes, and there are more than 1,000 acres of marsh in the area. The Swett Marsh which encompasses 845 acres on the Back River is a particularly large and productive salt marsh.

The bird population of the area is valuable for its diversity. Birch and Phoebe Islands have osprey nests and the Newman Sanctuary shelters numerous teal. Georgetown is known for its uncommon hooded mergansers. Hockomock Bay is an important feeding stopover for migrating birds in the spring and fall, especially Canada geese and black ducks.

Land Use Controls/Public Preserves

Town	Zoning	Subdivision	Conser. Comm.	Reg'l Plann.	Local Plann.	Public Preserves
Arrowsic	x	x		x		
Georgetown			x	x	x	U.S.C.G. station Perkins Isl. 4.3 ac. Sequin Isl, 20 acr., Fort Popham, 6 ac.
Phippsburg			x	x	x	State landing; Me. Audubon Society Newman Sanctuary, 400 ac.
Woolwich			x	x	x	Appalachian Mtn. Club Peals Island, 480 ac.

25 MORSE MOUNTAIN

Size: 4,076 acres **Shoreline:** 17 miles

Boundaries Bounded by a line extending from Ashdale corner southerly along Maine Highway 216, crossing Cape Small Harbor to include the Branch and Cape Small and Head Beach and offshore rocks and ledges, extending to the Phippsburg-Georgetown town line including Heron Island and Fox Islands, along that boundary up the Kennebec River to Cox Head and thence westerly to the village of Ashdale.

Outstanding Features

1. The area is characterized by great diversity, both of ecological systems and biota. This diversity is especially noteworthy because of its concentration into such a small area.
2. The beach strand from Cape Small to Popham is Maine's last major beach and dune complex remaining. It is the easternmost, large dune area in the country.
3. Bald and Small Points are among the last undeveloped rock headlands on the western coast of Maine.
4. Snowy egrets and many types of shorebirds feed in the area; many species nest in the dunes, salt marsh, and barren islands.
5. Phippsburg is the oldest colonial site in northeastern United States (1604).
6. Spirit Pond has a number of historical and archaeological features--tidal mill site, Indian middens, a recently discovered pre-Colombian site--high educational and scientific value.
7. The area is very near major educational institutions as well as the major part of the state's population.
8. Because of its proximity to Popham Beach State Park and increasing population demands, much of this area is threatened by recreational development and overuse.
9. The Morse Mountain section of the conservation zone is situated and surrounded in a manner ideally suited for preserve management.
10. The possibility exists of encompassing the Sprague River, its entire watershed and its salt marshes within the zone. This would be unique within the state and would have great research and management value.

Intrusions

Residential pressure is heavy in some parts of the zone notably at and near Popham Beach. Large numbers of tourists at Popham Beach are a threat to the delicate dunes and shoreline ecosystems on the beaches and dunes west of Morse River.

The Bath Iron Works in nearby Bath have a large backlog of work and expansion of their facilities could cause housing pressure in the Phippsburg area. A proposed 500-house development on Parker Head was recently turned down for lack of adequate sewage disposal facilities. Generally the area is unspoiled because of its large ownership patterns.

Selection Rationale Summary

The Morse Mountain region combines the most striking features of the eastern Maine coast, impressive granitic headlands, with extensive beach-dune-marsh complexes that are the greatest attributes of the southern coast. The beach that stretches from the Sprague River to the Kennebec is the northeasternmost beach-dune complex in Maine. Sheltered behind it are 727 acres of valuable salt marsh. The entire Sprague River and its watershed system is within the zone.

The Sugarloaf Islands off the coast shelter approximately 800 nesting common terns, 250 nesting roseate terns and 50 nesting arctic terns. This is the largest colony of nesting roseate terns on the coast. The mouth of the Morse River has what is perhaps the only mainland nesting common terns on the coast and a recently noted colony of nesting least terns which extended the eastern nesting range of these birds by miles.

The first English settlement in the northeastern United States was made in Phippsburg in 1604. Spirit Pond has Indian middens, colonial mill remains, and mysterious rune stones which some attribute to the Norsemen.

Land Use Controls/Public Preserves

Town	Zoning	Subdivision	Conser. Comm.	Reg'l. Plann.	Local Plann.	Public Preserves
Phippsburg			x	x	x	Popham Beach State Park, 488 acres. N. & S. Sugarloaf Islands, 3.0 acres.

28 DAMARISCOTTA RIVER

Size: 16,073 acres Shoreline: 108 miles

Boundaries Both shores of the Damarsicotta River from Salt Bay south, including Upper Pond and Marsh, Johns River, and Johns Bay in the town of South Bristol; also all islands at the mouth of the Damariscotta River to Damariscove and Pumpkin Islands.

Outstanding Features

1. Damariscotta is a largely unpolluted tidal river of about 17 miles in length.
2. The river supports the state's largest commercial alewife run.
3. The Damariscotta shell heaps represent the largest aboriginal accumulation of oyster shells in the world.
4. The University of Maine's marine lab is located on the eastern shore of the river.
5. Bald eagles and osprey nest near Great Salt Bay. Many additional osprey nests are found along the shores of the lower river.
6. Upper and Lower Ponds and the swamp through which they drain support large populations of waterfowl, beavers, and other wildlife.

Intrusions

Generally, Lincoln County is one of the state's fastest growing counties and seasonal and year-round home developments are common. Sewage pollution is a problem but Newcastle, Nobleboro, and Damariscotta are jointly constructing a sewage treatment plant. Visual intrusions include a power line across the Great Salt Bay and the fact that Route 1 passes very close to the Damariscotta shell heaps.

Land Use Controls/Public Preserves

Town	Zoning	Subdivision	Conser. Comm.	Reg'l. Plann.	Local Plann.	Public Preserves
Boothbay	x	x			x	Nature Conser. Damariscove I.
Bristol						
Edgecomb			x	x	x	Town Landing, State Memorial Shell Heaps
Newcastle	x		x		x	
Nobleboro					x	
South Bristol						Nature Conser. Plummer Point

Selection Rationale Summary

The Damariscotta is a 17-mile long tidal river whose banks are extensively farmed. The shores of this river are distinguished from the nearby Sheepscot by their gentle, gradual quality as opposed to the Sheepscot's sharp rising banks. Kettle hole ponds are a common feature particularly on the western bank of Great Salt Bay. The name Damariscotta means place of many fishes and the river still supports the state's largest commercial alewife run covering 4,463 acres at Damariscotta Mills and averaging in recent years over a million pounds annually.

Oysters of fine quality once covered the river bottom. One of the rivers most interesting aspects and certainly among the state's most important archaeological remains are the frequent oyster shell heaps. One such heap alone is estimated to contain 5 million cubic feet of shells discarded by native Indians beginning at least 2,100 years ago. It appears that at least three different peoples used these heaps. Tools and artifacts found among the shells proceed from crude on the bottom levels to more highly sophisticated ones near the surface. The oyster shells are up to 19 inches in length. However, today oysters in the Damariscotta are practically non-existant. Coastal water temperatures have cooled significantly in the past few centuries and the northeastern oyster population has decreased. In Great Salt Bay which was the principal area of oyster production, it appears that the oysters have been buried under at least three feet of sediment in the last hundred years. This is largely attributable to saw mills established early in the river's history and continual heavy farming of its banks. Experimental efforts to reestablish oysters in the area are currently underway, notably in the Great Salt Bay area by Maine Dept. of Sea & Shore Fisheries and the University of Maine.

The Damariscotta area has some 12 osprey nests and one eagles nest. North Branch Cove has a heron rookery and Seal and Foster and Hog Island are congregating points for harbor seals. Clamming is generally good in the area though many flats are closed because of pollution. Outer Heron Island is a deer sanctuary.

Upper and Lower Ponds, locally known as Half-moon and Little Muddy Ponds, and the swamp located between the ponds and the river are a nesting area for wood ducks and a migratory stopover for many other waterfowl species. At least three beaver colonies and many other species of wildlife (e.g. otter, mink, and fisher) inhabit this area. A small but interesting bog is located on one side of Little Muddy Pond.

34 MERRYMEETING BAY

Size: 23,483 acres Shoreline: 99 miles

Boundaries Generally, the shoreline of Merrymeeting Bay and its streams, the Kennebec River from the Richmond-Dresden bridge to the populated areas of Bath-Woolwich, the Abagadasset River to Baker Brook, the Cathance River to its source north of Bwodoin Center including the West Branch north of the village of Bowdoinham, the Muddy River to its source, the Androscoggin River to the railroad bridge, Wiskeag Creek to the railroad bridge, and the Eastern River in Dresden.

Outstanding Features

1. Eagles are known to nest in several areas near Swan Island.
2. The Eastern and Abagadasset Rivers are the only Maine rivers where sturgeon run annually.
3. Merrymeeting Bay is the most popular and productive waterfowl hunting area in Maine, and has the largest spring concentration of Canada geese.
4. The Kennebec River has the best potential for an anadromous fishery of any river in Maine.
5. The Kennebec River drainage contributes 58% of the total winter smelt fishery in Maine.
6. Merrymeeting Bay is one of the only areas in Maine that supports significant development of wild rice.
7. Me. Dept. of Inland Fish & Game maintains two wildlife refuges in the Bay area. The Forestry Dept. also maintains a large forest tract.
8. Several educational and recreational facilities are maintained by private groups
9. Due to present and anticipated regional pressures on its natural character and wildlife habitat, the Bay is threatened with development and overuse.

Intrusions

Aesthetic intrusions on the Bay are largely visual. There is a network of power lines around the Bay which cross the water at Abagadasset and Chops Points. In addition, Central Maine Power owns extensive rights of way in the area.

Three municipal open burning dumps which belong to the towns of Topsham, Bowdoinham, and Bath are due to be closed according to federal and state legislation (July 1973). Three mobile home parks are in the area; two near Simpson's Animal Farm and one near the SAGE base.

Water pollution is an important problem, particularly where the Kennebec and Androscoggin enter the Bay. Within the bay, tidal flushing improves the quality of the water somewhat. The Androscoggin's pollution is particularly bad. Tests (DeRoche, 1967) show virtually no dissolved oxygen and fish kills are common.

Perhaps the most significant is the construction of a section of I-95 between Brunswick and Gardiner which will skirt the western boundary of the zone and bring many still rural areas under severe development pressure.

Selection Rationale Summary

Merrymeeting Bay is a large fresh water tidal bay formed by the confluence of two major rivers (Androscoggin and Kennebec), which drain a total of 9,460 square miles,and four secondary rivers (Abagadasset, Cathance, Eastern, and Muddy). The area of the conservation zone includes nearly the complete drainages of the Cathance and Muddy Rivers and most of the upland areas involved have a direct relationship to the aquatic ecosystems of Merrymeeting Bay.

The extensive and complex aquatic ecosystems of the Bay are the most significant and interesting systems of this region with several aquatic associations involved. The wild rice tidal flats of Merrymeeting Bay proper are instrumental in attracting large numbers of migrating waterfowl which, in turn, account for the Bay's high value as a hunting area. Approximately 36% of all Maine's waterfowlers hunt in Merrymeeting Bay, and they harvest 2.53 birds per man-day or about 40% more than in any other region of the state. The zone is of high statewide significane by virtue of its wildlife population, its unusual associations, and species concentration. Nationally, the area is very important in terms of its vital position as the northernmost U.S. stopover on the Atlantic flyway.

Some fragmented development has taken place within the boundaries of the conservation zone and yet the Bay's natural character still predominates. Additional development would place a great deal of stress on the system, mostly because of the soil suitability and the detrimental effect on wildlife populations, both migratory and breeding.

The recreational potential of the area is high and recreational use, especially boating and shoreline development, is expected to increase dramatically as the water quality of the Kennebec and Androscoggin Rivers improves. According to federal guidelines, these rivers should be substantially less polluted by 1976. The area, however, is vulnerable to excessive use, especially during reproductive periods of wildlife communities.

Land Use Controls/Public Preserves

Town	Zoning	Subdivision	Conser. Comm.	Reg'l. Plann.	Local Plann.	Public Preserves
Bath	x	x		x	x	
Bowdoin						
Bowdoinham			x	x	x	Undev. State Park, Wildlife Sanc.
Brunswick	x	x	x	x	x	2 landings, 2 mun. parks, Me. Audubon, private beach
Dresden		x	x	x	x	
Richmond			x			Wildlife area
Topsham	x	x	x	x	x	Baxter Forest
Woolwich			x	x	x	Wildlife Sanc.

35 GERRISH ISLAND

Size: 2,656 ac. Shoreline: 12.4 miles

Boundaries All of Gerrish Island including both sides of Chauncey Creek and Cutts Island, Brave Boat Harbor northwest to Brave Boat Harbor Road. The northern boundary in York includes all of Raynes Neck north to Brave Boat Harbor.

Outstanding Features

1. Gerrish and Cutts Island are relatively undeveloped areas within the highly built-up shoreline between Kittery and Portland. This amount of open space in such a generally crowded area lends a value to the area in itself.
2. There is a great diversity of physiographic features and ecosystems.
3. The southernmost stand of red spruce on the eastern seaboard is located here.
4. Brave Boat Harbor is a part of the Rachel Carson National Wildlife Refuge.

Intrusions

Taxes in the area are high and rising rapidly, but many of the residents are long-term landholders in the area and appear to be partial to conservation. In any case much of the land is unsuitable for extensive development. The Navy's military observation towers on the foot of Gerrish Island are visual eyesores.

Land Use Controls/Public Preserves

Town	Zoning	Subdivision	Conser. Comm.	Reg'l. Plann.	Local Plann.	Public Preserves
Kittery	x	x		x	x	U.S.Navy (Ft. Foster), 98 acres. Rachel Carson Nat'l. Wildlife Refuge, Crescent Beach, 2 acres.
York	x	x	x	x	x	Rachel Carson Nat'l. Wildlife Refuge.

Selection Rationale Summary

The shoreline of Gerrish Island (5.9 miles), Cutts Island (3.6 miles) and Raynes Neck (2.6 miles) form the southern boundary of coastal Maine. The area is largely undeveloped partially as a result of its extensive wetlands. As a whole, it is one of southern Maine's most compact and diverse aggregate of ecological systems.

There are many superior beaches in the area. There is a sandy beach at the end of Gerrish Island and Crescent Beach is a barrier beach protecting a salt marsh. The southern peninsula at the mouth of Brave Boat Harbor is an 800-foot cobble barrier beach with a characteristic crescent shape.

About 324 acres of salt marsh are contained within the zone. Brave Boat Harbor marsh represents an extensive river marsh which has recently been included in the Rachel Carson National Wildlife Refuge system. Chauncey Creek Marsh, protected behind Crescent Beach, is also a river marsh though it is partially covered with trees and is reverting to a bog. Similarly the high marshes on Cutts Island are in the last stages of succession to forest.

The forest types of the area are as interesting as the marshes and beaches. There is a large stand of mixed oak and hickory on the seaward side of Cutts Island and large stands of pine and hemlock are scattered over both Cutts and Gerrish Islands. The stand of red spruce in the center of the island is recorded as the southernmost stand of coastal spruce-fir forest in the northeast. It was studied in detail by D. B. Davis (1966) and reported as one of the most significant examples of this type of forest ecosystem.

Geologically, an area of great interest is the one around Sewards Point which contains the "explosion breccia" which represents some of the latest igneous activity in New England.

Of historical interest are Fort McClary and the Mary Pepperell house, both of the colonial period.

In addition to Brave Boat Harbor marsh, which is in the Rachel Carson National Wildlife Refuge system, the naval reservation at Fort Foster on the southern tip of Gerrish Island is already in public ownership.

PHASE II CONSERVATION ZONES SUMMARY DESCRIPTIONS

3 CROSS ISLAND

Area: 3.88 square miles
Shore: 21.40 miles
Town: Cutler. **Location:** Mink, Scotch, Double Shot, and Cape Wash Islands; and the mainland shore from Sprague Neck to Ackley Point.

Description: The area includes a large sand beach-tombolo-spit formation (Sprague Neck) and a large clam flat (1,170 acres) at the head of Holmes Bay. Cross Island is undeveloped and has spectacular 100-foot cliffs, 24 acres of salt marsh, a large well-developed spruce-fir forest, and several beautiful, undeveloped islands surrounding it.

5 CHANDLER RIVER

Area: 9.23 square miles
Shore: 28.83 miles
Towns: Jonesboro, Jonesport. **Location:** The mouth of the river, the mainland around Mason Bay, and Pond Cove, including Rodgers, Little Mark, Fellows, and Little Ram Islands.

Description: The area just north of Rogue Island (No. 6, Phase I), encompasses four very productive clam flats, salt marsh at the head of Mason Bay, and an active eagle's nest (Little Ram Island). Most of the area is heavily wooded with little development. However, it is threatened with seasonal development, as is much of coastal Washington County.

8 INDIAN RIVER

Area: 25.14 square miles
Shore: 25.15 miles
Towns: Addison, Columbia Falls, Jonesboro, Jonesport. **Location:** The entire Indian River drainage from Columbia Falls and Jonesboro to Addison and Jonesport, Indian River estuary, Moose Island, Doyle Island, and West River estuary.

Description: This is a large, integrated coastal complex--a complete watershed/estuary system with a variety of upland meadows, swamps, bogs, heath, and blueberry barrens as well as mature upland forests. There are several scenic outlooks and a variety of shoreline features, such as cobble beaches, high bluffs, mud flats, and marshes.

12 SKILLINGS RIVER

Area: 8.82 square miles
Shore: 12.12 miles
Towns: Hancock, Lamoine. **Location:** From Route 1 to its mouth in Frenchmans Bay including Kilkenny Cove, Partridge Cove, and Youngs Bay.

Description: The river is clear, calm, and shallow, and covers a broad mud flat. The shoreline consists of several marshes with occasional rocky promontories. A thick forest borders the stream and access is limited. Wildlife is abundant: eagles and seals frequent the area; and migrating waterfowl feed extensively on the mud flats. There is little development (limited to a lobster pound and dairy) but a 70-acre development is planned on Eagle Point.

13 LONG & BARTLETT ISLANDS

Area: 13.0 square miles
Shore: 15.97 miles
Towns: Blue Hill, Mt. Desert, Tremont. **Location:** Hardwood, Tinker, and Bar Islands.

Description: Very large, undeveloped islands in Blue Hill Bay with striking shorelines, well-developed forests, and high promontories. The zone is adjacent to Acadia National Park on Mt. Desert Island and represents a beautiful, natural island system.

15 SALT POND

Area: 15.40 square miles
Shore: 5.50 miles
Towns: Blue Hill, Brooklin, Sedgewick. **Location:** Including the Pond drainage from Sedgewick to Blue Hill Bay and the chain of ponds--Frist, Second, Third, and Fourth--in Blue Hill.

Description: The area is an important migratory bird feeding area as well as a productive marine system (clams, worms, salt hay). There are reversing falls at the mouth of the pond and the area is characterized by its rural salt farm landscape with several different upland and marine ecosystems. The conservation zone is vulnerable to development because of its accessibility. Threats are in the form of development and heavy metal contamination from nearby mines.

16 BAGADUCE RIVER

Area: 7.50 square miles
Shore: 38.55 miles
Towns: Brooksville, Castine, Penobscot. Location: From Brooksville village to its mouth at Castine, also the Northern Bay area including Grindle Point, Wardwell Point and several small islands.

Description: This is a potentially rich aquacultural area with mostly rural salt farm and undeveloped shoreline. There are several eagle nests in the area and abundant wildlife. Threats are in the form of development and heavy metal contamination from nearby mines.

17 SEARS ISLAND

Area: 2.34 square miles
Shore: 13.24 miles
Towns: Searsport, Stockton Springs. Location: Sears Island and the southern shore of adjacent Cape Jellison and the northern tip of Islesboro Island.

Description: Sears is a beautiful, completely undeveloped island with a sand beach and well-developed upland forest. Cape Jellison has areas of beaches, dunes, cliffs, and palisades; in addition to an historical fort site. Turtle Head (Islesboro) has a large great blue heron rookery. Pressure in the area has been in the form of a proposed oil development on Sears Island.

18 ISLESBORO

Area: 4.59 square miles
Shore: 27.75 miles
Towns: Islesboro. Location: The islands south of Islesboro Island in Penobscot Bay--Seven Hundred Acre, Warren, Spruce, Minot, Middle, Job, Ensign, Line, Lassell, Mouse, Goose, Saddle, and Mark Islands.

Description: Throughout the islands are areas of bird nesting (including osprey and terns), sand beaches, geological formations, bogs, and lowlands. On Seven Hundred Acre Island is a large virgin forest.

23 LOWER SHEEPSCOT ESTUARY

Area: 7.78 square miles
Shore: 22.10 miles
Towns: Boothbay, Edgecomb. Location: The area surrounding Parsons Creek and Cross River, Adams Pond, Lilly Pond, and Back River to include Tibbets, Gooseberry, and Miles Islands.

Description: This zone is a scenic area of protected coastal waters. There are highly productive flats and much wildlife habitat. It is located in the rapidly expanding Boothbay Harbor area, but as yet is relatively undeveloped.

26 HARPSWELL & THE BASIN

Area: 2.70 square miles
Shore: 15.81 miles
Towns: Harpswell, Phippsburg. **Location:** The Basin--on the western shore of Phippsburg near the mouth of the New Meadows River and Doughty Cove which empties into the western side of the New Meadows River.

Description: The Basin is an enclosed salt water bay with a narrow outlet to the New Meadows River. The shoreline is highly indented with well-developed upland forest. This area has one of the longest undeveloped stretches of shoreline in Casco Bay. Doughty Cove contains about 50 acres of fresh and salt marsh and it is one of the few essentially undeveloped coves in Casco Bay.

27 WOLF NECK

Area: 1.39 square miles
Shore: 23.50 miles
Town: Freeport. **Location:** Including the western shore of Wolf Neck, the head of Harraseeket River to Mast Landing, Porter Landing, and Bartol Island.

Description: This area borders Maine Audubon's Mast Landing Sanctuary and Wolf Neck State Park. Except for a few cottages, it is mostly undeveloped. There is a large marsh at the mouth of Mast Landing Brook.

29 SPURWINK RIVER

Area: 4.45 square miles
Shore: 11.08 miles
Towns: Cape Elizabeth, Scarboro. **Location:** The area surrounding the marsh along the Spurwink River, the area around Spurwink Hill, and the Sprague farm.
Description: This is an extensive salt marsh area with many unusual species of birds common. It is under extreme pressure for development. 439 of 740 acres of marsh are slated for protection in the Rachel Carson National Wildlife Refuge. The farm represents a major open space under one ownership.

30 LITTLE RIVER

Area: 11.91 square miles
Shore: 5.58 miles
Towns: Biddeford, Kennebunkport. **Location:** The Little River Marsh and adjacent upland.

Description: This large salt marsh is also part of the Rachel Carson National Wildlife Refuge; 105.1 acres have been purchased and 139.8 acres are slated for protection of the total 261 acres in the conservation zone.

33 MACHIAS RIVER

Area: 26.32 square miles
Shore: 53.10 miles
Towns: Centerville, Machias, Northfield, Whitneyville, T-19-MD, T-25-MD.
Location: A corridor along the Machias River from Wigwam Rapids, T-25-MD, to the town of Machias.

Description: This is the only strictly fresh water zone in Phase II. The river is being managed for Atlantic Salmon and alewives by the Department of Inland Fisheries and Game. It is presently the best salmon river in Maine. The upland areas are timber areas mostly owned by St. Regis Paper Company. It is a wild area, not presently threatened by development.

Att. 15-2 (cont.)

SECOND PRIORITY CONSERVATION ZONES - DESCRIPTION

CROSS ISLAND

Area: 3.88 square miles
Shore: 21.40 miles
Town: Cutler. Location: Mink, Scotch, Double Shot, and Cape Wash Islands; and the mainland shore from Sprague Neck to Ackley Point.

Description: The area includes a large sand beach-tombolo-spit formation (Sprague Neck) and a large clam flat (1,170 acres) at the head of Holmes Bay. Cross Island is undeveloped and has spectacular 100-foot cliffs, 24 acres of salt marsh, a large well-developed spruce-fir forest, and several beautiful, undeveloped islands surrounding it.

CHANDLER RIVER

Area: 9.23 square miles
Shore: 28.83 miles
Towns: Jonesboro, Jonesport. Location: The mouth of the river, the mainland around Mason Bay, and Pond Cove, including Rodgers, Little Mark, Fellows, and Little Ram Islands.

Description: The area just north of Roque Island (No. 6, Phase I), encompasses four very productive clam flats, salt marsh at the head of Mason Bay, and an active eagle's nest (Little Ram Island). Most of the area is heavily wooded with little development. However, it is threatened with seasonal development, as is much of coastal Washington County.

INDIAN RIVER

Area: 25.14 square miles
Shore: 25.15 miles
Towns: Addison, Columbia Falls, Jonesboro, Jonesport. Location: The entire Indian River drainage from Columbia Falls and Jonesboro to Addison and Jonesport, Indian River estuary, Moose Island, Doyle Island, and West River estuary.

Description: This is a large, integrated coastal complex--a complete watershed/estuary system with a variety of upland meadows, swamps, bogs, heath, and blueberry barrens as well as mature upland forests. There are several scenic outlooks and a variety of shoreline features, such as cobble beaches, high bluffs, mud flats, and marshes.

SOURCE: Reed and D'Andrea, Draft Report, 1973.

Att. 15-2 (cont.)

SKILLINGS RIVER

Area: 8.82 square miles
Shore: 12.12 miles
Towns: Hancock, Lamoine. Location: From Route 1 to its mouth in Frenchmans Bay including Kilkenny Cove, Partridge Cove, and Youngs Bay.

Description: The river is clear, calm, and shallow, and covers a broad mud flat. The shoreline consists of several marshes with occasional rocky promontories. A thick forest borders the stream and access is limited. Wildlife is abundant; eagles and seals frequent the area; and migrating waterfowl feed extensively on the mud flats. There is little development (limited to a lobster pound and dairy) but a 70-acre development is planned on Eagle Point.

LONG & BARTLETT ISLANDS

Area: 13.0 square miles
Shore: 15.97 miles
Towns: Blue Hill, Mt. Desert, Tremont. Location: Hardwood, Tinker, and Bar Islands

Description: Very large, undeveloped islands in Blue Hill Bay with striking shorelines, well-developed forests, and high promontories. The zone is adjacent to Acadia National Park on Mt. Desert Island and represents a beautiful, natural island system.

SALT POND

Area: 15.40 square miles
Shore: 5.50 miles
Towns: Blue Hill, Brooklin, Sedgewick. Location: Including the Pond drainage from Sedgewick to Blue Hill Bay and the chain of ponds--First, Second, Third, and Fourth--in Blue Hill.

Description: The area is an important migratory bird feeding area as well as a productive marine system (clams, worms, salt hay). There are reversing falls at the mouth of the pond and the area is characterized by its rural salt farm landscape with several different upland and marine ecosystems. The conservation zone is vulnerable to development because of its accessibility. Threats are in the form of development and heavy metal contamination from nearby mines.

SOURCE: Reed and D'Andrea, Draft Report, 1973.

Att. 15-2 (cont.)

BAGADUCE RIVER

Area: 7.50 square miles
Shore: 38.55 miles
Towns: Brooksville, Castine, Penobscot. Location: From Brooksville village to its mouth at Castine, also the Northern Bay area including Grindle Point, Wardwell Point and several small islands.

Description: This is a potentially rich aquacultural area with mostly rural salt farm and undeveloped shoreline. There are several eagle nests in the area and abundant wildlife. Threats are in the form of development and heavy metal contamination from nearby mines.

SEARS ISLAND

Area: 2.34 square miles
Shore: 13.24 miles
Towns: Searsport, Stockton Springs. Location: Sears Island and the southern shore of adjacent Cape Jellison and the northern tip of Islesboro Island.

Description: Sears is a beautiful, completely undeveloped island with a sand beach and well-developed upland forest. Cape Jellison has areas of beaches, dunes, cliffs, and palisades in addition to an historical fort site. Turtle Head (Islesboro) has a large great blue heron rookery. Pressure in the area has been in the form of a proposed oil development on Sears Island.

ISLESBORO

Area: 4.59 square miles
Shore: 27.75 miles
Towns: Islesboro. Location: The islands south of Islesboro Island in Penobscot Bay--Seven Hundred Acre, Warren, Spruce, Minot, Middle, Job, Ensign, Line, Lassell, Mouse, Goose, Saddle, and Mark Islands.

Description: Throughout the islands are areas of bird nesting (including osprey and terns), sand beaches, ecological formations, bogs, and lowlands. On Seven Hundred Acre Island is a large virgin forest.

LOWER SHEEPSCOT ESTUARY

Area: 7.78 square miles

SOURCE: Reed and D'Andrea, Draft Report, 1973.

Att. 15-2 (cont.)

Shore: 22.10 miles
Towns: Boothbay, Edgecomb. Location: The area surrounding Parsons Creek and Cross River, Adams Pond, Lilly Pond, and Back River to include Tibbets, Gooseberry, and Miles Islands.

Description: This zone is a scenic area of protected coastal waters. There are highly productive flats and much wildlife habitat. It is located in the rapidly expanding Boothbay Harbor area, but as yet is relatively undeveloped.

HARPSWELL & THE BASIN

Area: 2.70 square miles
Shore: 15.81 miles
Towns: Harpswell, Phippsburg. Location: The Basin--on the western shore of Phippsburg near the mouth of the New Meadows River and Doughty Cove which empties into the western side of the New Meadows River.

Description: The Basin is an enclosed salt water bay with a narrow outlet to the New Meadows River. The shoreline is highly indented with well-developed upland forest. This area has one of the longest undeveloped stretches of shoreline in Casco Bay. Doughty Cove contains about 50 acres of fresh and salt marsh and it is one of the few essentially undeveloped coves in Casco Bay.

WOLF NECK

Area: 1.39 square miles
Shore: 23.50 miles
Town: Freeport. Location: Including the western shore of Wolf Neck, the head of Harraseeket River to Mast Landing, Porter Landing, and Bartol Island.

Description: This area borders Maine Audubon's Mast Landing Sanctuary and Wolf Neck State Park. Except for a few cottages, it is mostly undeveloped. There is a large marsh at the mouth of Mast Landing Brook.

SPURWINK RIVER

Area: 4.45 square miles
Shore: 11.08 miles

SOURCE: Reed and D'Andrea, Draft Report, 1973.

Towns: Cape Elizabeth, Scarboro. Location: The area surrounding the marsh along the Spurwink River, the area around Spurwink Hill, and the Sprague farm.

Description: This is an extensive salt marsh area with many unusual species of birds common. It is under extreme pressure for development. 439 of 740 acres of marsh are slated for protection in the Rachel Carson National Wildlife Refuge. The farm represents a major open space under one ownership.

LITTLE RIVER

Area: 11.91 square miles
Shore 5.58 miles
Towns: Biddeford, Kennebunkport. Location: The Little River Marsh and adjacent upland.

Description: This large salt marsh is also part of the Rachel Carson National Wildlife Refuge; 105.1 acres have been purchased and 139.8 acres are slated for protection of the total 261 acres in the conservation zone.

MACHIAS RIVER

Area: 26.32 square miles
Shore: 53.10 miles
Towns: Centerville, Machias, Northfield, Whitneyville, T-19-MD, T-25-MD.
Location: A corridor along the Machias River from Wigwam Rapids, T-25-MD, to the town of Machias.

Description: This is the only strictly fresh water zone in Phase II. The river is being managed for Atlantic Salmon and alewives by the Department of Inland Fisheries and Game. It is presently the best salmon river in Maine. The upland areas are timber areas mostly owned by St. Regis Paper Company. It is a wild area, not presently threatened by development.

SOURCE: Reed and D'Andrea, Draft Report, 1973.

Chapter 16 Rare, Endangered, and Threatened Species

16.0 RARE, ENDANGERED, AND THREATENED SPECIES

16.1 INTRODUCTION

This chapter presents a listing of those vertebrate species considered rare, endangered, threatened, or peripheral in the whole, or part, of the study region from Maine to Sandy Hook, New Jersey. A table for each state summarizes the species, the lists which classify it, its status, and its distribution in the state or region. A number of sources have been used to compile the list - the definitions and approaches of each of these are clarified in the section preceding the tables (see pages 16-3 to 16-14). These pages should be referred to for clarification of the terms "rare", "endangered", "threatened", and "peripheral", as each source has a slightly different mode of categorization. A list of references is included at the end of the chapter.

Information for this chapter was gathered from LaBastille (1973a) for the Atlantic coastal plain and the Maine coast, (LaBastille, 1973b), Audubon Societies and appropriate state departments for those states not included by LaBastille (Connecticut, Rhode Island, Massachusetts, New Hampshire), and when immediately available, supplementary local listings. LaBastille's two compilations (1973a & b) include data from the U.S. Department of Interior Redbook (see page 16-3) and from the International Union for the Conservation of Nature and Natural Resources (IUCN) Red Data Books (see page 18).

Sources: GENERAL REGION

author: LaBastille, Anne. Center for Natural Areas, Smithsonian Institution, Washington, D.C.

publication: Two reports by LaBastille have been cited:

Rare, Endangered, and Threatened Vertebrate Species of the Atlantic Coastal Plain and Maine Coast. 1973a

and

Rare, Endangered, Threatened, and Peripheral Wildlife and Fish of the Maine Coast. 1973b

approach: From the introductions to the two reports:

> This report summarizes much of the existing and current information on rare, endangered, and threatened species of fish, amphibians, reptiles, birds and mammals which occur on the Atlantic Coastal plain. Included are species which are recognized on the U.S. Department of Interior's federal registry of endangered animals; and also species which are apparently experiencing rapid depletion in numbers and may be threatened. No introduced, naturalized or domesticated species of wild animals are included. The data presented cover estimates of existing numbers, distributions, ecological importance, reasons for decline, and proposed conservation measures. This information is presented in much the same form as the U.S. Department of Interior's Redbook, "Threatened Wildlife of the U.S.", and the International Union for Conservation of Nature and Natural Resources (I.U.C.N.), Red Data Books.

> Generally speaking, there are few rare, endangered or threatened species of fish and wildlife along the Maine Coast. Those that occur there are dependent in part on the presence of natural and undisturbed habitats, and also on the broader aspect on uncontaminated environmental conditions. This is particularly important to fishes spawning or occurring in estuaries and rivers which may be grossly polluted; and to birds of prey dependent upon a long food chain which may be contaminated by persistent chemicals. A strong case to acquire natural areas may be built around the Northern Bald Eagle which still occurs and breeds in limited numbers in Maine, especially along the coast.

Sources: GENERAL REGION (cont.)

status categories: LaBastille combined the categories and definitions used by USDI (see notes on U.S. Department of Interior, page 16-6) and IUCN (see notes on International Union for the Conservation of Nature and Natural Resources, page 16-5):

Categories and definitions used in this report are drawn from those used by the USDI Redbook, 1970 edition, and the IUCN Red Data Books and are similar to, or identical with, them.

Endangered: An endangered species or subspecies is one whose survival and reproduction are in immediate jeopardy, hence in immediate danger of extinction. Continued survival of the species is unlikely without the aid of special protective measures. (Corresponds with IUCN pink sheets, category 1).

Rare: A rare species or subspecies is one which occurs in such small numbers throughout its range, and/or occurs in such a restricted or specialized habitat that it may become endangered and disappear if conditions worsen. (Corresponds with IUCN white sheets, category 2).

Threatened or Depleted: A species or subspecies which still occurs in numbers adequate for survival, however the species has been heavily depleted and continues to decline at a rate which seems threatening and gives cause for serious concern. (Corresponds with IUCN amber sheets, category 3.).

Peripheral: A species or subspecies whose occurence in the U.S. is at the edge of its natural range and which is rare and endangered within the U.S. but not in its range as a whole. Special attention is necessary to assure retention in the U.S. fauna.

Undetermined: A species or subspecies which is possibly or apparently endangered, but insufficient data is currently available with which to determine its status. (Corresponds with IUCN blue sheets, category 4; and with Blue List for birds, National Audubon Society.).

Sources: GENERAL REGION (Cont)

author: International Union for the Conservation of Nature and Natural Resources (IUCN), Morges 1110, Switzerland.

publication: Red Data Books, vol. 1-4; (Pisces, Amphibia and Reptilia, Aves, Mammalia)

approach: According to Isgur (1973), who refers to the IUCN listing, vertebrate species considered "endangered vulnerable, and rare" are compiled by IUCN. The list is more inclusive than that of the U.S. Department of Interior because of its less stringent criteria. (Isgur, 1973).

status categories:

Endangered, (1)

Rare, (2)

Depleted, (3)

Indeterminate, (4)

Sources: GENERAL REGION (cont.)

author: U.S. Department of Interior, Bureau of Sport Fisheries and Wildlife, Office of Endangered Species and International Activities.

publication: Threatened Wildlife of the United States, commonly called the Redbook. March, 1973.

approach: This 1973 edition summarizes knowledge of the status of native vertebrate species and subspecies whose existence is threatened in the United States. The official list of Endangered Native Fish and Wildlife Federal Register is compiled from this one.

Earlier edition of the Redbook (as used by Anne LaBastille, 1973a+b) classified animals as either "rare" or "endangered" rather than as "threatened"; this distinction is followed in the tables (Tables 16-1 to 16-7) because LaBastille's work (1973a+b) was used as the source. See notes on LaBastille for definitions of status categories.

status categories: From the introduction to the Redbook (USDI, 1973):

Endangered: The Endangered Species Conservation Act of 1969 does not set forth specific criteria for determining which species are "threatened with extinction." Instead, it directs the Secretary of the Interior to seek the counsel of specialists and agencies with expertise on the subject, and to rely upon their combined judgment. The wording of the Act is as follows:

> "A species of native fish and wildlife shall be regarded as threatened with extinction whenever the Secretary of the Interior finds, after consultation with the affected States, that its existence is endangered because its habitat is threatened with

destruction, drastic modification, or severe curtailment, or because of overexploitation, disease, predation, or because of other factors, and that its survival requires assistance. In addition to consulting with the States, the Secretary shall, from time to time, seek the advice and recommendations of interested persons and organizations, including, but not limited to, ornithologists, ichthyologists, ecologists, herpetologists, and mammalogists. He shall publish in the Federal Register the names of the species of native fish and wildlife found to be threatened with extinction in accordance with this paragraph."

Thus, actual numbers of an animal is only one criterion used to determine whether or not it is "threatened with extinction." Critically low or declining populations may be sufficient reason for determining a species or subspecies to be endangered, but some which still exist in large numbers--such as the brown pelican, the sperm whale, or the Arctic peregrine falcon--may face serious threats such as environmental degradation, overexploitation, etc., that could bring about their extirpation in the foreseeable future. When their continued existence is in peril, they may legitimately be considered as endangered species under the Act.

Sources: GENERAL REGION (cont.)

author: U. S. Department of the Interior, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife.

publication: Appendix O: Fish and Wildlife in the North Atlantic Regional Water Resources Study, (NAR) 1972, for the U. S. Army Corps of Engineers.

approach: The NAR report is a study of the coastal region from Virginia to Maine, conducted to provide information for a "broad, coordinated program to guide future resource development and management" (U. S. Army Corps of Engineers, 1972). An inventory and a discussion of rare, endangered, and peripheral fish and wildlife were included as part of the report.

status categories: Endangered: One whose prospects of survival and reproduction are in immediate jeopardy. Its peril may result from one or many causes--predation, competition, and disease. An endangered species must have help or extinction will probably follow.

Rare: One that, although not presently threatened with extinction, is in such small numbers throughout its range that it may be endangered if its environment worsens.

Peripheral: One whose occurrence in the U. S. is at the edge of its natural range and which is rare or endangered within the U. S., although not in its range as a whole. Special attention is necessary to assure retention in our nation's fauna.

Sources: MAINE

author: Hunter, Malcolm, Jr.

publication: "Notes and additions to Rare, Endangered, Threatened, and Peripheral Wildlife and Fish of the Maine Coast", Appendix A to Appendix Volume Two, Conservation Priorities Plan of the Coast of Maine by Reed and D'Andrea, July 1973.

approach: Addendum to the listing by Anne LaBastille

status categories: None used

Sources: NEW HAMPSHIRE

author: Francq, Edward N.

publication: "A Survey of the Mammals of the Proposed Nuclear Project Site, Seabrook, New Hampsnire", Appendix B in: Seabrook Station Environmental Report, Construction Permit Stage. June 1972.

approach: Over a period of 10 days, Francq compiled an inventory of all mammals known to live, or which might possibly live, in the area around Seabrook, on the New Hampshire coast. Information was collected by field observation, trapping, interviews with residents, and literature survey.

status categories: Francq's list is not intended to be a comprehensive list of threatened species; however, he does provide a general indication of status by such adjectives as "abundant", "common", "scarce", "infrequent" and "uncommon".

Sources: NEW HAMPSHIRE

author: Salber, Lee

publication: "Hard to Find Natives" New Hampshire Fish and Game Department.

approach: Salber lists vertebrates of New Hampshire which are extinct, endangered, threatened or uncommon, drawing on the U. S. Department of Interior sources for "endangered" and "threatened". He provides a brief description of location, population size, reason for decline, and occasionally other pertinent data with each species.

status categories: Extinct: Once known to exist in New Hampshire, now universally exterminated.

Endangered: Listed as "endangered" on the List of Endangered Fish and Wildlife published in the Federal Register maintained by the U. S. Department of Interior. The animal is threatened with extinction unless immediate measures are taken to preserve the population. (see Sources: General, p. 16-6).

Threatened: Listed as "threatened" by the U. S. Department of Interior in the Redbook. (see Sources: General, p. 16-6).

Uncommon: Animals in short supply in New Hampshire but not necessarily in trouble. This category encompasses animals at the periphery of their range in New Hampshire, small but stable populations, animals emigrating because of habitat loss, and animals just beginning to enter and inhabit the state--as well as declining populations that may become officially threatened.

Sources: MASSACHUSETTS

author: Isgur, Benjamin, Massachusetts State Conservationist

publication: "Rare and Endangered Plants and Vertebrate Animals of Massachusetts", October 1973. Prepared under the auspices of the Soil Conservation Service, U. S. Department of Agriculture, for Massachusetts Audubon Society.

approach: All species, both native and introduced, whose range or movement includes Massachusetts have been listed, unless their occurrence is strictly accidental or extremely irregular. The USDI and IUCN lists have been referred to (see notes on U. S. Department of Interior, and on International Union for the Conservation of Nature and Natural Resources).

status categories: Endangered: An endangered species is one whose survival in Massachusetts is in jeopardy. Its peril may result from loss of habitat, change in habitat, exploitation by man, predation, adverse inter-species competition or disease. An endangered species must receive help or extinction probably will follow.

Rare: A rare species is not presently threatened with extinction, but it occurs in such small numbers in Massachusetts that it may become endangered if its environment deteriorates further or other limiting factors develop. Careful watch of its status is essential.

Undetermined: A species whose status is undetermined but may be rare or endangered in Massachusetts. Information currently available is inadequate to evaluate its status accurately. More information is needed since the species could now exist in dangerously low numbers in the state.

Sources: CONNECTICUT

author: Connecticut Department of Environmental Protection, Wildlife Unit

publication: "Threatened Wildlife of the United States", as listed by the Office of Endangered Species and International Activities, U. S. Department of Interior, March 1974, and as annotated by DEP for species officially listed as Endangered on the Federal Register, and for species found in Connecticut.

approach: Peripheral as well as threatened species are listed, with notations made beside those which are officially endangered, and those found in Connecticut.

status categories: Endangered: Listed as Endangered on the Federal Register by the U. S. Department of Interior, Office of Endangered Species and International Activities (see page 16-6).

Threatened: Listed in the USDI Redbook (see page 16-6) but not officially listed as Endangered.

Sources: NEW JERSEY

author: Heintzelman, Donald S., ed., New Jersey State Museum

publication: "Rare or Endangered Fish and Wildlife of New Jersey Science Notes No. 4. August 1971.

approach: List includes only birds rare or endangered in New Jersey.

status categories: The status categories below are not defined on the list obtained for this report. They seem to match those of the USDI listing (see U. S. Department of Interior notes).

Endangered

Rare

Undetermined

Table 16-1 Rare, endangered, and threatened species in Maine

taxonomic group	species	list[a] status[b]	distribution
fish	Sturgeon, Atlantic* *Acipenser oxyrhynchus*	lUCN-rare Miller-threatened	Kennebec River, Merrymeeting Bay
	Salmon, Atlantic* *Salmo salar*	Miller-threatened	found in at least 8 major & several smaller coastal drainages
	Trout, Sunapee* *Salvelinus aureolus*	NAR-rare Miller-threatened USDI-rare	scattered ponds. flood ponds in Hancock County
amphibians	Salamander, Four toed*		Lake Cobbassecontee, Kennebec County, probably in bogs of Mount Desert Island
reptiles	Turtle, Leatherback*	USDI-endangered	Gulf of Maine
	Turtle, Loggerhead*		Gulf of Maine
	Turtle, Atlantic Ridley*	USDI-endangered	Gulf of Maine
birds	Eagle, Northern Bald* *Haliaectus leucocephalus alascanus*	threatened*	scattered nests over State, mostly along coastal estuaries & islands
	Falcon American Peregrine* *Falco peregrinus anatum*	USDI-endangered IUCN-rare	extirpated as breeding bird east of Rockies-occasionally sited on coastal islands far from shore.

Table 16-1 (cont.)

taxonomic group	species	list[a] status[b]	distribution
Birds	Falcon, Arctic Peregrine* *Falco peregrinus tundrius*	USDI-endangered	expirpated as breeding bird east of Rockies-occasionally sited on coastal islands far from shore
	Herons*	Hunter-unique peripheral non-endangered	southern coast of Maine
	Osprey American* *Pandion haliaetus*	threatened	nests between Sorrento and eastern Casco Bay, at least
	Puffin, Atlantic*	Hunter-unique peripheral non-endangered	Matinicus Rock-1 colony of 30-172 individuals
	Razorbill* *Alca torda*	Hunter-unique peripheral non-endangered	Matinicus Rock
	Sparrow, Ipswich* *Passerculus princeps*	USDI-rare IUCN-rare	dunes, beaches, undisturbed rock & grass patches along coast
	Tern, Roseate* *Sterna dougallii*	Hunter-depleted	
	Tern, Common* *Sterna hirundo*	Hunter-depleted	
	Tern, Least* *Sterna albifrons*	Hunter-depleted and peripheral	Webhannet River Marsh, Wells; Morse River Beach, Phippsburg
	Tern, Arctic* *Sterna paradesaea*		

Table 16-1 (cont.)

taxonomic group	species	list[a] status[b]	distribution
mammals	Cougar, Eastern (Panther)** *Felis concolor cougari*	USDI-engangered IUCN-threatened or depleted	Considered extirpated from northeastern U.S. until recent sitings. piedmont and mountainous habitat, inland
	Fisher* *Martes pennanti*	Hunter-unique peripheral non-endangered USDI-undetermined	making slow comeback in eastern Maine. population stabilized west of Penobscot and increasing in Hancock and Washington counties
	Lynx* *Lynx canadensis*	Hunter-unique peripheral non-endangered	northwestern Maine
	Seal, Gray* *Halichoerus grypus*	Hunter-peripheral and somewhat depleted	Casco Bay to New Brunswick, on particular islands and coastal areas
	Seal, Harbor** *Phoca vitulina*	status disputed-possibly declining	coast from Canada to South Carolina
	Whale, Finback* *Balaenoptera physalus*	Hunter-endangered	Gulf of Maine
	Whale, Humpback* *Megaptera novaeangliae*	Hunter-endangered	Gulf of Maine
	Whale, Right* *Eubalaena glacialis*	Hunter-endangered	Gulf of Maine

* for more complete information, see Attachment 2, Rare, Endangered, Threatened and Peripheral Wildlife and Fish of the Maine Coast, and Attachment 3, Notes and Additions.

** for more complete information, see Attachment 1, Rare, Endangered, and Threatened Vertebrate Species of the Atlantic Coastal Plain and Maine Coast

Table 16-1 (cont.)

[a] List of species compiled by the following persons or agencies

IUCN - International Union for the Conservation of Nature and Natural Resources,
- Red Data Books, as cited by La Bastille

USDI - U.S. Department of Interior, Redbook, "Threatened Wildlife of the U.S.", as cited by La Bastille.

Miller - R. R. Miller, "Threatened Freshwater Fishes of the U.S." as cited by LaBastille, 1973a and 1973b.

Hunter - Malcolm Hunter, Jr. "Notes and additions to 'Rare, Endangered, Threatened and Peripheral Wildlife and Fish of the Maine Coast'", as included with La Bastille, 1973.

NAR - U. S. Army Corps of Engineers. 1972. North Atlantic Regional Water Resources Study (NAR) Appendix O, Fish and Wildlife, prepared by F&WS, BSF&W, Interior.

[b] For explanation of status categories, see 16.1 Introduction

Sources: La Bastille, 1973a and 1973 b
U.S. Army Corps of Engineers, 1972

Table 16-2 Rare, endangered, and threatened species in New Hampshire

taxonomic group	species	list[a]	status[b]	distribution
fish	Dace, Finescale	Salber	uncommon	Meadow sprong holes along Indian Stream in Pittsburgh, Big & Little Greenough Ponds in Wentworth's Location, and Mud Pond in Dummer
	Salmon, Atlantic	Salber	uncommon	dams and pollution have virtually eliminated this fish
	Shiner, Blacknose	Salber	uncommon	Isinglass River & Greenough Pond
	Trout, Sunapee	USDI IUCN Miller	threatened endangered threatened	common locally in Connor Pond in Ossipee County; Dan Hole Pond; Sunapee Lake; Tewksbury Pond in Grafton
	Whitefish (Shad)	Salber	uncommon	N.H. is southern limit of its range. Lake Winnipesaukee, Squam and Wentworth Lakes
amphibians	Salamander, Marble	Salber	uncommon	habitat varies from dry hillsides to damp, sandy areas
	Salamander, Purple (Green or North. Spring)	Salber	uncommon	cold mountain streams in thickly wooded sites
Reptiles	Rattlesnake, Northern Timber	Salber	uncommon	pocket distribution in Allenstown, Deerfield, Candia, & Wintastiquet Mountain in Winchester

Table 16-2 (Continued)

taxonomic group	species	list[a]	status[b]	distribution
reptiles	Snake, Smooth Green	Salber	- uncommon	brushy fields and clearings
	Turtle, Blandings	Salber	- uncommon	N.H. is outer limit of this turtle's range, and population has always been small. habitat of wet, marshy areas
birds	Bluebird *Sialis sialis sialis*	Salber	- uncomon	nesting sites lost to competing sparrows & starlings. Also, habitat of semi-open land is now reverting to forest
	Curlew, Eskimo	USDI	- endangered	once traversed N.H. during migration. last siting in 1963
	Eagle, American Bald	Salber	- uncommon and declining	
	Eagle, Golden	Salber	- uncommon and declining	
	Hawks - Cooper, Marsh, Red-Shouldered, Sharpshinned	Salber	- uncommon and declining	
	Loon	Salber	- uncommon and declining	ponds, lakes, marshes
	Osprey	Salber	- uncommon	fairly stable population at Lake Umbagog, though declining nationally

Table 16-2 (Continued)

taxonomic group	species	list[a] status[b]	description
Birds	Owl, Great Guy	Salber - uncommon	rarely seen because seldom migrate south from Hudson Bay area
	Owl, Snowy	Salber - uncommon	primary range is north of N.H. and its migration into the state is only occasional
	Sparrow, Ipswich	USDI - threatened IUCN - rare	beach-dune grass habitat in coastal parks & preserves. breeds on Sable Is. off Nova Scotia, and migrates south along the Atlantic Coast
	Turkey	Salber - uncommon	once ranged throughout southern N.H. until essentially exterminated by man. N.H. Fish & Game Dept. is attempting to stock & reinstate the turkey to H.H.
Mammals	Bat, Hoary *Lasiurus cinereus*	Francq - scarce (Seabrook area) Salber - uncommon	state-wide distribution
	Bat, Indiana *Myotis sodalis*	Francq - scarce (Seabrook) USDI - endangered	state-wide distribution, associated with limestone caves
	Caribou	Salber - uncommon	very rare in N.H., migrating in only occasionally. no sitings this century

Table 16-2 (Continued)

taxonomic group	species	list[a]	status[b]	description
mammals	Cougar, Eastern (Panther, Mountain Lion, Puma, Catamount) Felis concolor cougari.	~~USDI~~ IUCN	~~- endangered~~ - threatened or depleted	considered extirpaled from northeastern U.S. until recent sitings (1971) indicated a possible return. piedmont and mountainous habitat
	Fisher (Martes pennanti)	Francq (Seabrook)	- scarce	heavily wooded areas. absent from southeastern N.H. for years, but now reappearing
	Lynx, Canada	Salber	- uncommon	suited to higher elevations of the White Mountains
	Moose	Salber	- uncommon	once plentiful, esp. in north. N.H. present population estimated at 200 and slowly rising
	Mouse, Gapper's Red-Backed	Salber	- uncommon	some in Northern Coos County
	Mouse, Prebles Lemming	Salber	- uncommon	boreal areas around Mt. Washington
	Rabbit, Cottontail, Eastern & New England	Salber	- uncommon	southern portion of N.H. habitat of cleared land, now reverting to forests
	Seal, Harbor* Phoca vitutina	LaBastille	- status disputed - possibly declining	coast from Canada to South Carolina

Table 16-2 (Continued)

taxonomic group	species	list[a]	status[b]	description
mammals	Shrew, Gray Long-Tailed	Salber	- uncommon	Mt. Washington area
	Shrew, Tompson Pigmy	Salber	- uncommon	northern New Hampshire
	Vole, Rock	Salber	- uncommon	mountains of northern New Hampshire
	Whales-Humpback, Finback, Sei, Blue, Sperm, Atlantic Right	USDI	- endangered	occasionally seen along N.H. coast
	Wolf, Eastern Timber	USDI	- endangered	numberous before settlement by man, now considered exterminated in N.H.

* for more detailed information, see Attachment 1, Rare, endangered, and threatened vertebrate species of the Atlantic coastal plain and Maine coast.

[a] Lists of species compiled by the following persons and agencies:

Francq - Edward N. Francq, "A Survey of the Mammals of the Proposed Nuclear Project Site; Seabrook, N.H."
IUCN - International Union for the Conservation of Nature and Natural Resources, Red Data Books as cited by Anne LaBastille.
Miller - R.R.Miller, "Threatened Freshwater Fishes of the U.S." as cited by Anne LaBastille.
La Bastille- Anne LaBastille. 1973a. Rare, Endangered and Threatened Vertebrate Species of the Atlantic Coastal Plain and Maine Coast.
Salber - Lee Salber. "Hard to Find Natives" from the N.H. Fish and Game Department.
USDI - U.S.Department of the Interior. Redbook,"Threatened Wildlife of the United States" as cited by Anne LaBastille.

[b] For explanation of the status categories, see text.

Sources: Francq (1972), LaBastille (1973a), and Salber (1974?).

Table 16-3 Rare, endangered, and threatened species in Massachusetts

taxonomic group	species	list** status***	distribution
Fish	Chub, Lake Hybopsis plumbea	Isgur - rare	cold water streams & lakes, Westfield River drainage
	Dace, Northern Redbelly Chrosomus eos	Isgur - rare	Deerfield River
	Darter, Swamp Etheostoma fisiforme	Isgur - rare	eastern coastal lowland ponds & streams
	Lamprey, American brook* Lampetra lamottei (non-parasitic)	Isgur - rare	brackish & fresh waters of Connecticut River
	Shiner, Emerald Notropis atherinoides	Isgur - rare	ponds & streams, Otis Reservoir
	Stickleback, Brook Eucodia inconstans	Isgur - rare	Swift River, fresh water
	Stickleback, Fourspine Apeltes quadracus	Isgur - undetermined	coastal streams & brackish marine waters
	Stickleback, Ninespine Pungitius pungitius	Isgur - undetermined	coastal streams and brackish marine waters
	Stickleback, Threespine Gasterosteus aculeatus	Isgur - undetermined	coastal streams and brackish marine waters
	Sturgeon, Atlantic Acipenser oxyrhynchus	Isgur - endangered ~~USDI - endangered~~ IUCN - rare NAR - rare	Connecticut and Merrimack Rivers

Table 16-3 (cont.)

taxonomic group	species	list** status ***	distribution
	Sturgeon, Shortnose* Acipenser brevirostris	Isgur - endangered USDI - endangered IUCN - endangered	coastal brackish waters
	Sucker, Longnose Catastomus catastomus	Isgur - undetermined	Connecticut River and a few other streams
	Trout - Perch Percopsisomiscomaycus	Isgur - rare	Housatonic River
Amphibians	Salamander, Blue-spotted Ambystoma laterale	Isgur - rare	spotty, wooded swampy areas, moist woods
	Salamander, Four-toed Hemidactylium scutatum	Isgur - rare	sphagnum areas by woods, bogs, boggy ponds. More common in eastern Massachusetts
	Salamander, Jefferson Ambystoma jeffersonianum (hybridizes with Blue-Spotted)	Isgur - rare	spotty, wooded moist sites, moist pasture near woods.
	Salamander, Spring Gyrinaphilus porphyriticus	Isgur - rare	cool springs, mountain streams wet depressions beneath logs, stones, leaves, more common Hampshire County.
Reptiles	Snake, Copperhead Agkistrodon contortrix mokeson	Isgur - rare	wooded dry uplands, rocky ledges, hillsides. Norfolk County; Connecticut River Valley between Greenfield and Springfield; Mt. Tom.

Table 16-3 (cont.)

taxonomic group	species	list** status***	distribution
	Rattlesnake, Timber Crotalus horridus horridus	Isgur - endangered	wooded dry uplands, rocky ledges with southern exposures Hampden, Berkshire, Hampshire, Norfolk County Hills Reservation and Mt. Tom.
	Skink, Five-Lined Eumeces fasciatus	Isgur - undetermined (maybe peripheral)	damp, cutover woodlots of many decaying stumps and logs. usual range west of N.Y. and south of Connecticut
	Snake, Black Rat Elaphi obsoleta obsoleta	Isgur - rare	rocky mtns & field and forest edges. Hampshire and Hampden County, southern Berkshire County
	Snake, Eastern Worm Carphophis amoenus amoenus	Isgur - rare	Connecticut River Valley of Westfield
	Turtle, Blandings Emydoidea blandingi	Isgur - rare	lakes, streams, moist land Essex, Middlesex County, Blue Hills Reservation in Norfolk County
	Turtle, Bog Clemmys muklenbergi	Isgur - endangered USDI - rare IUCN - rare NAR - rare	sphagnum bogs, swamps, slow streams with muddy bottoms, Berkshire County
	Turtle, Plymouth Pseudemys rebriventris bangsi	Isgur - rare	Plymouth County

Table 16-3 (cont.)

taxonomic group	species	list** status***	distribution
	Turtle, Redbellied *Pseudemys rubriventris*	Isgur - endangered	Plymouth and Naushon Co.
	Turtle, Hawksbill *Eretmoehelys imbricata*	Isgur - endangered IUCN -	Rare in N.E. oceans. shells in demand.
	Turtle, Leatherback *Dermocheloy coriacea*	Isgur - endangered IUCN -	New England ocean in summers. egg-collecting & fishing have reduced population.
	Turtle, Loggerhead *Caretta caretta*	Isgur - endangered IUCN -	New England ocean in summer.
	Turtle, Ridley *Lepidochelys kempi*	Isgur - endangered IUCN -	Massachusetts coast in summer.
	Turtle, Green *Chelonia mydas*	IUCN - still populous, but breeding grounds being reduced	occasionally off New England coast. most exploited turtle for soup, cosmetics, soap, shoes.
Birds	Bluebird, Eastern *Sialis sialis sialis*	Isgur - undetermined	orchards, woods, roadsides, farmlands. suffers from competition with House Sparrow
	Curlew, Eskimo *Numenius borealis*	USDI - rare IUCN - endangered	few sitings in Cape Cod area

Table 16-3 (cont.)

taxonomic group	species	list** status***	distribution
	Eagle, Southern Bald Haliaectus leucocephalus leucocephalus	Isgur - endangered USDI - endangered IUCN - rare	probably occurs in Mass. in fall. pesticides & habitat reduction endanger eagle
	Falcon, American Peregrine* Falco peregrinus anatum	Isgur - endangered USDI - endangered IUCN - rare	ranges throughout U.S. no longer breeds on east coast, but migrates through Massachusetts. seen at Monomoy National Wildlife Refuge, & Parker River National Wildlife Refuge. Propagation program at Cornell is underway. Major cause of decline is pesticide interference with breeding.
	Grosbeak, Southeastern Pine Pinicola emucleator eschatosus	NAR - peripheral	breeds northern New England north to Quebec and Newfoundland. winters in breeding range & south to Virginia
	Hawk, Marsh Circus cyaneus hudsonius	Isgur - undetermined	meadows and marshes
	Heron, Black Crowned Night Nycticorax nycticorax hoactli	Isgur - undetermined	ponds, lakes, rivers, bays and marshes-fresh & salt
	Martin, Purple Progne subis	Isgur - undetermined	seashore, meadow, wide river valleys

Table 16-3 (cont.)

taxonomic group	species	list** status***	distribution
	Osprey Pandion haliaetus carolinensis	Isgur - undetermined	lakes & rivers throughout Massachusetts
	Sparrow, Ipswich* Passerculus princeps	USDI - rare IUCN - rare	Massachusetts beaches, sand dunes, saltmarshes. breeds only on Sable Island off Nova Scotia, being eroded by sea and possibly developed for oil. undisturbed dunes along east coast needed for wintering.
	Terns, Common, Arctic, Roseate, Least* Sterna hirundo, paradisaea, dougallii, albifrons	LaBastille - steadily declining, not yet on USDI or IUCN lists	seen along Cape Cod and coastal areas.
	Turkey Mileagris gallopavo	Isgur - undetermined	mature woodlands. Once extinct in Mass.; non reintroduced.
Mammals	Bat, Indiana Myotis sodalis	Isgur - endangered USDI - undetermined IUCN - undetermined	limestone caves and nearby areas. probably confined to Berkshire County.
	Cougar, Eastern (Panther)* Felis concolor cougar subspecies of mountain lion	Isgur - undetermined ~~USDI - endangered~~ IUCN - endangered	once inhabited most of eastern U.S.; now a few remain in Canada & may be returning to U.S. scattered records in Massachusetts.

Table 16-3 (cont.)

taxonomic group	species	list**	status***	distribution
	Coyote, Northeastern Canis latrans thamnos	Isgur - undetermined		open woodland brush and boulder-strewn areas. extending its range into Mass.
	Fisher Martes pennanti	Isgur - undetermined		mixed hardwood forests and out over woodland. once extirpated; now extending range back into Mass.
	Lemming, Southern Bog Synaptomys cooperi	Isgur - undetermined		low damp bogs and meadows with heavy negetation
	Otter, River Lutra canadensis	Isgur - undetermined		streams and lake borders. seems to be decreasing throughout its range
	Seal, Gray* Halichoerus grypus	LaBastille - range and numbers limited and declining		Cape Cod is southernmost breeding region of seal. Found on Muskeget Island, Tuckernut Island, Nantucket Islands, Monomoy Wilderness area, Martha's Vineyard.
	Seal, Harbor* Phoca vitulina	LaBastille - disputed status - possibly declining		Canada to South Carolina along coast
	Shrew, Gray Longtail Sorix dispar	Isgur - undetermined		damp rocky coniferous forests, Berkshire County.

Table 16-3 (cont.)

taxonomic group	species	list** status ***	distribution
	Vole, Beach Meadow* Microtus breweri	Isgur - rare USDI - endangered IUCN - rare	known only on Muskeget Island, Massachusetts habitat of grassy dunes
	Vole, Yellownose (Rock Vole) Microtus chrotorrhinus	USDI - rare Isgur - undetermined	rocky woodland of western Massachusetts
	Whale, Atlantic Right Eubalaena glacialis	NAR - endangered	Iceland to Bermuda along coast. commercially sought. a few hundred exist. International Whaling Commission recommends conservation.
	Woodrat, Northeastern Neotonia floridana	Isgur - undetermined	rocky cliffs of Berkshire County

* for more detailed information, see Attachment 1, Rare, Endangered and Threatened Vertebrate Species of the Atlantic Coastal Plain and Maine Coast.

** Lists compiled by the following people or agencies:
Isgur - Benjamin Isgur, for Massachusetts Audubon Society
USDI - U.S.Department of Interior Federal Registry of Endangered Animals
IUCN - International Union for the Conservation of Nature and Natural Resources
NAR - U.S.Army Corps of Engineers. 1972. North Atlantic Regional Water Resources Study, Appendix O, Fish and Wildlife, prepared by the BSF&W, F&WS of Interior.
LaBastille - Anne LaBastille, Smithsonian Center for Natural Areas, Washington D.C.

*** For Explanation of status categories, see text.

Sources: Labastille (1973), Isgur (1973), U.S.Army Corps of Engineers (1972)

Table 16-4 Rare, endangered, and threatened species in Rhode Island

taxonomic group	species	list[a] status[b]	distribution
fish	Sturgeon, Atlantic *Acipenser oxyrhynchus*	NAR - rare	rivers & estuaries used as spawning grounds
	Sturgeon, Shortnose *Acipenser brevirostrum*	NAR - endangered	formerly Atlantic seaboard, now maybe limited to Hudson River
amphibians	Salamander, Marbled		
reptiles	Snake, Common Black		
	Snake, Pilot Black		
	Snake, Timber Rattler		
	Terrapin, Diamond-backed		
	Turtle, Blandings		
	Turtle, Box		
	Turtle, Wood		

Table 16-4 (cont.)

taxonomic group	species	list[a] status[b]	distribution
birds	Curlew, Eskimo *Numenius borealis*	USDI - rare IUCN - endangered	East Coast
	Falcon, American Peregrine *Falco peregrinus amatum*	NAR - endangered	formerly bred in eastern U.S., now only west of Rockies. seen in Newport County 1971, 1972
	Grosbeak, Southeastern pine *Pinicola enucleator eschatosus*	NAR - peripheral	breeds northern New England to Quebec; winter as far south as Virginia
	Osprey, American* *Pandion haliaetus*	USDI- undetermined	nesting sites on south shore near Massachusetts border, in 1971, not in 1972. reports of 3 pair near Westerly
	Sparrow, Ipswich* *Passerculus princeps*	NAR - rare USDI - rare IUCN - rare	breed on Sable Island off Nova Scotia. winter in beach sand dune habitat in coastal parks and preserves
	Terns, Common, Arctic, Roseate, Least* *Sterna hirundo, paradisaea, dougallii, albifrons*	LaBastille-steadily declining	Pt. Judith an important gathering place for migrating terns
mammal	Cougar, Eastern (Panther)* *Felis concolor cougari*	USDI-endangered IUCN-threatened or depleted	considered exterpated from N.E. United States until recent sitings. hilly and mountainous habitat
	Seal, Harbor* *Phoca vitulina*	LaBastille-status disputed possibly declining	coast, from Canada to South Carolina

Table 16-4 (cont.)

taxonomic group	species	list[a]	status[b]	distribution
mammal	Vole, Block Island Meadow *Microtus pennsylvanicus provectus*	USDI - rare IUCN - undetermined		restricted to Block Island, population stable. habitat of beachgrass and scrub.
	Whale, Atlantic right *Eubalaena glacialis*	NAR - endangered		offshore from Iceland to Bermuda. conservation recommended by International Whaling Commission

*for more detailed information, see Attachment 1, Rare, Endangered, and Threatened Vertibrates of the Atlantic Coastal Plain and Maine Coast.

[a] Lists of species compiled by the following persons and agencies

NAR - U.S.Army Corps of Engineers , North Atlantic Regional (NAR) Water Resources Study, Appendix O: Fish and Wildlife prepared by F&WS,BSF&W, Dept. Interior.

USDI - U. S. Department of Interior, Redbook, "Threatened Wildlife of the United States," as cited by Anne LaBastille

IUCN - International Union for the Conservation of Nature and Natural Resources, Red Data Books, as cited by Anne LaBastille

[b] For explanation of status categories, see 16.1 Introduction

Sources: LaBastille, 1973a
U.S. Department of Interior, 1972

Table 16-5 Rare, endangered, and threatened species in Connecticut

taxonomic group	species	list[a]	status[b]	distribution
fish	Salmon, Atlantic* *Salmo salar*	Miller - threatened		may never have been indigenous. restoration being attempted in Connecticut River
	Sturgeon, Atlantic *Acipenser oxyrhynchus*	NAR - rare		rivers and estuaries sites for breeding. Connecticut River and Long Island Sound sitings reported.
	Sturgeon, Shortnose *Acipenser brevirostrum*	USDI - endangered		formerly all Atlantic seaboard, now found only in Hudson River
reptiles	Turtle, Bog *Clemmys muhlenbergi*	USDI - threatened NAR - rare		freshwater marshes, bogs meadows
	Turtle, Green *Chelonia mydas*	USDI - endangered		
	Turtle Loggerhead *Caretta caretta*	USDI - endangered		
birds	Curlew, Eskimo *Numenius borealis*	USDI - rare IUCN - endangered		East Coast
	Eagle, Southern Bald *Haliaeetus l. leucociphalus*	USDI-endangered		nests in estuarine areas
	Falcon, American Peregrine* *Falco peregrinus anatum*	USDI-rare IUCN-rare		

Table 16-5 (cont.)

taxonomic group	species	list[a] status[b]	distribution
birds	Grosbeak, Southeastern Pine *Pinicola enucleator eschatosus*	USDI - peripheral(US)	
	Osprey, American* *Pandion haliaetus*	USDI-undetermined	southeastern coast - Old lyme, Niantic-as nesting sites. migration along Connecticut River & Long Island shores
	Sparrow, Ipswich* *Passerculus princeps*	DEP- threatened USDI-rare IUCN-rare	breeds on Sable Island off Nova Scotia. winters on beaches and sand dunes along Atlantic coast.
	Terns, Common Roseak Arctic,Least* *Sterna hirundo, dougalli, paradisaea albifrons*	steadily declining	Falkner's Island, Housetonic marshes & sand bars near Milford, Saybrook, New London
mammals	Bat, Indiana *Myotis sodalis*	USDI-endangered	
	Cougar, Eastern* *Felis concolor cougar*	USDI-endangered IUCN-3 (threatened or depleted	considered extirpated until recent sitings, so may be coming back. piedmont and mountainous areas
	Seal, Harbor* *Phoca vitulina*	status disputed possibly declining	coast from Canada to South Carolina
	Whale, Humpback *Megaptera novalangliac*	DEP-threatened	
	Whale, Right *Eubalaena glacialis*	DEP-threatened	

Table 16-5 (cont.)

*for more detailed information, see Attachment 1, Rare, Endangered, and Threatened Vertebrate Species of the Atlantic Coastal Plain and Maine Coast

[a] Lists of species compiled by the following persons or agencies

Miller - R. R. Miller. "Threatened Freshwater Fishes of the U.S." as cited by Anne LaBastille

NAR - U.S.Army Corps of Engineers , North Atlantic Regional (NAR) Water Resources Study. Appendix O. Fish and Wildlife, prepared by U.S BSF&W.

USDI - U. S. Department of Interior, Redbook. "Threatened Wildlife of the United States," as cited by Anne LaBastille

IUCN - International Union for the Conservation of Nature and Natural Resources, Red Data Books, as cited by Anne LaBastille

DEP - Connecticut Department of Environmental Protection

[b] Explanation of status categories: see text

Sources: Connecticut Department of Environmental Protection, 1974
LaBastille, Anne, 1973
U. S. Department of Interior, 1972

Table 16-6 Rare, endangered, and threatened species in New York

taxonomic group	species	list[a] status	distribution
fish	Salmon, Atlantic* *Salmo salar*		occasionally found in Long Island Sound. may never have been native
	Shad, American * *Alosa sapidissima*	Miller-threatened Raney - common	disputed. possibly restricted to Delaware, New Jersey, and New York coast
	Sturgeon, Atlantic* *Acipenser oxyrhynchees*	IUCN-rare	spotty distribution along Atlantic coast
	Sturgeon, Shortnose* *Acipenser brevirostrum*	USDI-endangered IUCN-rare Miller-threatened Raney-common	Hudson River, possibly along coast
reptiles	Turtle, Bog* Clemmys muhlenberg	USDI-rare IUCN-rare	old records report existence on Staten Island.
	Turtle, Sea*		
birds	Curlew, Eskimo *Numenius borealis*	USDI-rare IUCN-endangered	East Coast
	Eagle, Northern Bald* *Haliaeetus leucocephalus alascanus*	threatened and depleted	still probably nests in New York
	Falcon, American peregrine *Falco peregrinus amatus*	USDI-endangered IUCN-rare	Long Island-occasional sitings

Table 16-6 (cont.)

taxonomic group	species	list[a] status[b]	distribution
birds	Falcon, American peregrine *Falco peregrinus amatus*	USDI-endangered IUCN-rare	Long Island-occasional sitings
	Osprey, American* *Pandion haliaetus*	USDI-undetermined	9 locations*
	Sparrow, Ipswich* *Passerculus princeps*	USDI-rare IUCN-rare	beach-dune grass habitat in coastal parks and preserves
	Terns, Common, Arctic, Roseate, Least* *Sterna hirundo paradisaea, dougallii, albifrons*	steadily declining	Great Gull Island; Robins Island; Shinnecock Bay; Jones Beach, Long Island; Huntington, Long Island; Cedar Beach, Long Island.
mammals	Cougar, Eastern (Panther)* *Felis concolor cougari*	USDI-endangered IUCN-threatened or depleted	considered extirpated from northeastern U.S. till recent sitings. may be coming back from Canada. piedmont and mountainous habitat.
	Seal, Harbor* *Phoca vitulina*	Status disputed-possibly declining	coast. Canada to South Carolina

*for more detailed information, see Attachment 1, Rare, Endangered, and Threatened Vertebrate Species of the Atlantic Coastal Plain and Maine Coast

Table 16-6 (cont.)

[a] List of species compiled by the following persons or agencies:

Miller - R. R. Miller "Threatened Freshwater Fishes of the U.S." as cited by Anne LaBastille, 1973a

Raney - E. Raney, Ichthyological Associates, as cited by Anne LaBastille, 1973a

IUCN - International Union for the Conservation of Nature and Natural Resources, Red Data Books, as cited by Anne LaBastille, 1973a

USDI - U.S. Department of Interior, Redbook, "Threatened Wildlife of the United States", as cited by Anne LaBastille, 1973a

[b] For explanation of status categoreis, see 16.1 Introduction

Sources: LaBastille, Anne, 1973a

Table 16-7 Rare, endangered, and threatened species in New Jersey

taxonomic group	species	list[a]	status[b]	distribution
	Shad, American* Alosa sapidissima	Miller - threatened Raney - common		disputed. may be restricted to Delaware, New Jersey, New York coast.
	Sturgeon, Atlantic* Acipenser oxyrhyncus	NAR-rare		estuaries and rivers used for spawning
	Sturgeon, Shortnose* Acipenser brevirostrum	NAR-endangered		all recent records from Hudson River. formerly, distributed along Atlantic seaboard
	Tomcod, Atlantic* Microgadus tomcod	Miller		status as threatened disputed
reptiles	Turtle, Bog Clemmys muhlenbergi	NAR-rare USDI-rare IUCN-rare		freshwater marshes, meadows & bogs Monmouth County.
birds	Bittern, Least Ixobrychus exilis exilis	Heintzlman-undetermined		freshwater marshes. secretive habits make it difficult to study and classify
	Bluebird, Eastern Sialia sialia sialia	Heintzelman-rare		declined because of nesting site competition from Starlings and House Sparrows

Table 16-7(cont)

taxonomic group	species	list[a] status[b]	distribution
birds	Curlew, Eskimo* *Numenius borealis*	USDI-rare IUCN-endangered	East coast
	Chuck Will's-Widow *Caprimulgus carolinensis*	Heintzelman-rare	northern edge of breeding range in Cape May County. limited but increasing in numbers
	Duck, Harlequin *Histrionicus histrionicus*	Heintzelman-rare, peripheral	coastal areas in New Jersey, especially rock jetties. appearing with increasing regularity, but New Jersey is southern border of its winter range, and therefore it remains peripheral
	Eagle, Bald *Haliaeetus leucocephalus leucocephalus*	Heintzelman-endangered	once nested in many locations in New Jersey; now only 2 nests are known, neither of which have fledged since 1966. Decline due to pesticides (DDT), human interference in nesting, shooting, and habitat destruction.
	Falcon, American Peregrine* *Falco peregrinus anatum*	Heintzelman-endangered	Drastically reduces as an autumnal migrant, and eliminated as breedbird in eastern U.S. Possible extinction in a few decades.
	Hawk, Cooper's *Accipiter cooperii*	Heintzelman-endangered	Autumnal migration along coastal and inland along Kittatinny Ridge. woodlot nesting sites used. decreasing from disturbances from nest site destruction, hunting, and pesticides.

Table 16-7(cont.)

taxonomic group	species	list[a] status[b]	distribution
birds	Hawk, Marsh Circus cyanius hudsonius	Heintzelman-undetermined	Autumnal migrant, still populous, but breeding status is declining.
	Hawk, Pigeon Falco columbarius columbarius	Heintzelman-undetermined	status undetermined and being watched. pesticide pollution is causing thin-shelled eggs.
	Hawk, Red-shouldered Buteo lineatus lineatus	Heintzelman-undetermined	Autumnal migration. Breeds in wet woodlands and bottom lands in northern New Jersey and on coastal plain. Breeding habitat decreasing.
	Heron, Yellow-crowned Night Nyctanassa violacea violacea	Heintzelman-rare	has always been rare and local in New Jersey. may be increasing slightly. precarious because nesting sites endangered.
	Oriole, Orchard Icterus spurius	Heintzelman-undetermined	declining in numbers but still common locally
	Osprey Pandion haliaetus carolinensis	Heintzelman-rare endangered	nests along New Jersey in past decade, a drastic reduction in breeding has occurred due to pesticides, human disturbance, and habitat and nest site destruction.
	Plover, Piping Charadrius melodus melodus	Heintzelman-rare	migrates through and nests in sandy beaches and barrier islands

Table 16-7 (cont.)

taxonomic group	species	list[a] status[b]	distribution
birds	Plover, Upland *Bartramia longiccuda*	Heintzelman-rare	nests in grasslands and around airports
	Rail, King *Rallus elegans elegans*	Heintzelman-rare	local breeder in large fresh-water marshes.
	Rail, Yellow *Coturnicops novebaracensis novebaracensis*	Heintzelman-rare	freshwater marshes and coastal meadows.
	Rail, Black *Laterallus jamaicensis jamaicensis*	Heintzelman-rare	breeds in coastal salt marshes and grassy areas
	Sparrow, Henslow's *Passerherbulus henslowii susurrans*	Heintzelman-rare	old fields and meadows with scattered bushes and herbaceous vegetation
	Sparrows, Ipswich* *Passerculus princeps*	USDI-rare IUCN-rare	beach-sand dune habitat in coastal parks & preserves
	Terns, Common, Least* *Sterna herundi, albifrons*	steadily declining not yet on USDI or IUCN lists	Cape May, Stone Harbor, Brigantine National Wildlife Refuge, Island Beach State Park
	Turkey *Meleagris gallopava* (subspecies)	Heintzelman-endangered	occasionally in Sussex County
	Warbler, Cerulean *Dendroica cerulea*	Heintzelman-undetermined	rare and local breeder
	Woodpecker, Red-headed *Melanerpes l. erythrocephalus*	Heintzelman-rare	serious decline. Starling competes for nesting sites.

Table 16-7 (cont.)

taxonomic group	species	list[a] status[b]	distribution
birds	Wren, Short-billed Marsh Cistothorus platensis stellaris	Heintzelman-rare	damp grassy meadowlands and marshes used as breeding ground
mammals	Cougar, Eastern (Panther)* Felis concolor cougari	USDI-endangered IUCN-threatened or depleted	considered extirpated from northeastern U.S. until recent sitings. may be coming back. piedmont and mountainous habitat.
	Seal, Harbor* Phoca vitulina	status disputed possibly declining	coast from Canada to South Carolina
	Whale, Atlantic Right Eubabaena glacialis	NAR-endangered	along coast from Iceland to Bermuda. International Whaling Commission recommends conservation

*for more detailed information, see Attachment 1, Rare, Endangered, and Threatened Vertebrate Species of the Atlantic Coastal Plain and Maine Coast.

[a] Lists of species compiled by the following persons or agencies:

Miller - R. R. Miller "Threatened Freshwater Fishes of the U.S." as cited by Anne LaBastille

Raney - E. Raney, Ichthyological Associates, as cited by Anne LaBastille

NAR - U.S. Army Corps of Engineers. North Atlantic Regional (NAR) Water Resources Study . Appendix O: Fish and Wildlife by U.S.BSF&W, Interior.

USDI - U.S. Department of Interior, Redbook, "Threatened Wildlife of the United States", as cited by Anne LaBastille

IUCN - International Union for the Conservation of Nature and Natural Resources, Red Data Books, as cited by Anne LaBastille

Hientzelman - Donald S. Heintzelman, "Rare or Endangered Fish and Wildlife of New Jersey"

Table 16-7 (cont.)

[b] For explanation of status categories see 16.1 Introduction

Sources: Heintzelman, Donald S., 1972
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Attachment 16-1

Selections from

REPORT

RARE, ENDANGERED, AND THREATENED VERTEBRATE SPECIES OF THE ATLANTIC COASTAL PLAIN AND MAINE COAST

by

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RARE, ENDANGERED, AND THREATENED VERTEBRATE SPECIES OF THE ATLANTIC COASTAL PLAIN AND THE MAINE COAST

INTRODUCTION

This report is part of a larger series of reports dealing with the Atlantic Coastal Plain and the Maine Coast as part of a coordinated effort to identify and analyze conservation priorities along the East Coast of the United States.

The Atlantic Coastal Plain study was undertaken for the National Park Service to explore this area for potential natural landmarks. The topic of rare, endangered and threatened vertebrate species is an adjunct to this research since the presence of such species can have considerable bearing on the value of natural areas.

Geographically, the area is delineated by the Atlantic Ocean, the Fall Line or roughly Interstate 95 on the west, the northeastern-most tip of Maine to an east-west line about 25 miles south of Jacksonville, Florida, (latitudes 45^{o} to 30^{o}).

Base Maps have been developed showing significant ecological data and natural areas along the Atlantic Coastal Plain. Special sets exist for the Maine Coast and for the Chesapeake Bay region, indicating detailed data and areas.

ACKNOWLEDGEMENTS

Special appreciation is extended to the Office of Endangered Species of the United States Department of the Interior's Bureau of Sport Fisheries and Wildlife for its cooperation and willingness to share information contained in the files and "Redbook" of threatened wildlife. In addition, gratitude is expressed to the many Government biologists at Patuxent Wildlife Research Center and at the Bird and Mammal Laboratories in Smithsonian Institution for information and data offered.

A number of individual scientists at Universities and Cooperative Wildlife Research Units, National Park supervisors and biologists, National Wildlife Refuge managers, and State fish and game supervisors and agents were contacted personally, or by telephone and letter. To each of them who responded with pertinent data, sincere thanks is given.

SCOPE OF REPORT

This report summarizes much of the existing and current information on rare, endangered, and threatened species of fish, amphibians, reptiles, birds and mammals which occur on the Atlantic Coastal plain. Included are species which are recognized on the U. S. Department of Interior's federal registry of endangered animals; and also species which are apparently experiencing rapid depletion in numbers and may be threatened. No introduced, naturalized or domesticated species of wild animals are included. The data presented cover estimates of existing numbers, distributions, ecological importance, reasons for decline, and proposed conservation measures. This information is presented in much the same form as the U. S. Department of Interior's Redbook, "Threatened Wildlife of the U. S.", and the International Union for Conservation of Nature and Natural Resources (I.U.C.N.), Red Data Books.

The reader is also referred to two supplementary reports, or appendices: Rare, Endangered, and Threatened Vertebrate Species in the Chesapeake Bay Region; and Rare, Endangered and Threatened Vertebrate Species of the Maine Coast by the same author for additional and detailed information on certain species.

METHODOLOGY

Data were assembled by contacting competent persons known to be experts on particular species or subspecies. Contact was made by personal interview, telephone or by a letter and three-page questionnaire asking for specific information on rare, endangered, or threatened vertebrate species. This material was then compiled on the following data sheets.

A good part of the significant literature was reviewed, with emphasis placed on more recent papers and books (from 1960 to the present). Since a time lag exists between gathering of data and its publication, the most current information was obtained through personal communication as described above. Persons are cited in the report in the same manner as literature cited, and may be located under References.

CURRENT CLASSIFIED LIST OF RARE, ENDANGERED, AND THREATENED VERTEBRATE SPECIES ON THE ATLANTIC COASTAL PLAIN AND THE MAINE COAST

Species Name	Status U.S.D.I.	Status I.U.C.N.	Status Other
FISH			
American Brook Lamprey	-	-	Miller (1972)
Shortnose Sturgeon	E	2(a), 4(a)	Miller (1972)
Atlantic Sturgeon	-	2(a)	Miller (1972)
American Shad	-	-	Miller (1972)
Atlantic Salmon	-	-	Miller (1972)
Sunapee Trout	R	1(6)	Miller (1972)
Atlantic Tomcod	-	-	Miller (1972)
Waccamaw Killifish	UD	-	Miller (1972)
Waccamaw Silverside	UD	4(a)	Miller (1972)
Suwannee Bass	R	4(a)	Miller (1972)
Waccamaw Darter	UD	4(a)	Miller (1972)
Maryland Darter	E	2(a)S	Miller (1972)
AMPHIBIANS			
Pine Barrens Tree Frog	R	1(a)R	-
REPTILES			
American Alligator	E	1(a)***PT	-
Bog Turtle	R	2(a)	-
Green Turtle	P	3(a)PT	Carr (1972)
Loggerhead Turtle	-	3(a)PT	Carr (1972)
Hawksbill Turtle	E	1(a)PT	Carr (1972)
Atlantic Ridley Turtle	E	1(a)T	Carr (1972)
Pacific Ridley Turtle	-	-	Carr (1972)
Leatherback Turtle	-	-	Carr (1972)
BIRDS			
Brown Pelican	E	-	-
Florida Great White Heron	R	-	-
Southern Bald Eagle	E	2(b)P*	-
Osprey	UD	-	Amer. Bds. (1973)
American Peregrine Falcon	E	2(b)P**	-
Northern Bald Eagle			

Arctic Peregrine Falcon	E	-	-
Florida Sandhill Crane	R	2(b)P*	-
Eskimo Curlew	R	1(a)P***	-
Common Tern	-	-	Amer. Bds. (1973)
Arctic Tern	-	-	Amer. Bds. (1973)
Roseate Tern	-	-	Amer. Bds. (1973)
Least Tern	-	-	Amer. Bds. (1973)
Ivory-billed Woodpecker	E	1(a)P***	-
Red-cockaded Woodpecker	E	-	-
Bachman's Warbler	E	3(a)PM***	-
Kirtland's Warbler	E	3(a)PM*	-
Ipswich Sparrow	R	2(a)P*	-

MAMMALS

Dismal Swamp Shorttail Shrew	-	-	Handley (1972)
Delmarva Peninsula Fox Squirrel	E	1(b)R	-
Eastern Fox Squirrel	UD	4(b)	-
Cumberland Island Pocket Gopher	-	-	Hillestad (1972)
Gray Seal	-	-	Ray (1972)
Harbor Seal	-	-	Ray (1972)
Block Island Meadow Vole	R	4(b)	-
Beach Meadow Vole	R	4(a)	-
Eastern Panther	E?	3(b)	-
Florida Panther	E	1(b)P	-
Florida Manatee	E	4(b)PR	-

Categories and Definitions:

Categories and definitions used in this report are drawn from those used by the USDI Redbook, 1970 edition, and IUCN Red Data Books, and are similar to, or identical with, them.

ENDANGERED: An endangered species or subspecies is one whose survival and reproduction are in immediate jeapardy, hence in immediate danger of extinction. Continued survival of the species is unlikely without the aid of special protective measures. (Corresponds with IUCN pink sheets, category 1).

RARE: A rare species or subspecies is one which occurs in such small numbers throughout its range, and/or occurs in such a restricted or specialized habitat that it may become endangered and disappear if conditions worsen. (Corresponds with IUCN white sheets, category 2).

THREATENED or DEPLETED: A species or subspecies which still occurs in numbers adequate for survival, however the species has been heavily depleted and continues to decline at a rate which seems threatening

and gives cause for serious concern. (Corresponds with IUCN amber sheets, category 3).

PERIPHERAL: A species or subspecies whose occurrence in the U. S. is at the edge of its natural range and which is rare and endangered within the U. S. but not in its range as a whole. Special attention is necessary to assure retention in U. S. fauna.

STATUS UNDETERMINED: A species or subspecies which is possibly or apparently endangered, but insufficient data is currently available with which to determine its status. (Corresponds with IUCN blue sheets, category 4; and with Blue List for birds, National Audubon Society).

* * * * * * * *

Key to IUCN Classifications on List:

(a) = Full species (b) = Subspecies

M = Under active management in a national park or other reserve

P = Legally protected, at least in some parts of its range

R = Included because of its restricted range

T = Subject to substantial export trade

S = Secrecy still desirable

1 = Endangered
2 = Rare
3 = Depleted
4 = Indeterminate

***Species or subspecies critically endangered

References given on list:

Miller, R. R. 1972. Threatened freshwater fishes of the U.S. Trans. American Fish Society, vol. 101(2): 239-252

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Handley, Chas., Jr. Curator of Mammals, Natural History Building, Smithsonian Institution, Washington, D. C.

Hillestad, H. O. Research associate. Institute of Natural Resources, University of Georgia, Athens, Georgia.

Ray, C. Research scientist. Division of Marine Mammals. Natural History Building, Smithsonian Institution, Washington, D. C.

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-----. 1973 (Rev.). Threatened wildlife of the U.S. Office of Endangered Species, U. S. Dept. of Interior, Washington, D. C.

I.U.C.N. 1971 (Rev.). Red Data Books, vol. 1-4: Pisces, Amphibia and Reptilia, Aves, Mammalia. Morges 110, Switzerland.

FISH

Rare, Endangered and Threatened Fish of the Atlantic Coastal Plain and Maine Coast

American Brook Lamprey	*Lampetra lamottei*
Shortnose Sturgeon	*Acipenser brevirostrum*
Atlantic Sturgeon	*Acipenser oxyrhynchus*
American Shad	*Alosa sapidissima*
Atlantic Salmon	*Salmo salar*
Sunapee Trout	*Salvelinus alpinus aureolus*
Atlantic Tomcod	*Microgadus tomcod*
*Waccamaw Killifish	*Fundulus waccamensis*
*Suwannee Bass	*Micropterus notius*
*Waccamaw Silverside	*Menidia extensa*
*Waccamaw Darter	*Etheostoma perlongum*
*Maryland Darter	*Etheostoma sellare*

*Indicates species that do not occur within the study area; therefore they are not discussed in the following section.

AMERICAN BROOK LAMPREY — Lampetra Lamottei

Order: HYPEROARTIA — Family: PETROMYZONTIDAE

Considered threatened by Miller (1972), and occurring mainly in Connecticut and Massachusetts on Atlantic Coast. Raney (1973) considers the species scarce, but not rare. It has a wide distribution and is hard to find since it spawns in small tributaries. In addition, the non-parasitic larvae dig into sand for 6 to 7 years and are not evident to casual observer. Main threat could be pollution spreading into spawning tributaries.

References: See list at end of section on Fish.

Literature: See list at end of section on Fish.

SHORTNOSED STURGEON — Acipenser brevirostrum

Order: ACIPENSERIFORMES — Family: ACIPENSERIDAE

Estimated Numbers: Not known

Present Distribution: The most recent records are from the Hudson River plus one specimen from Florida in the St. John's River, according to IUCN and USDI data sheets. However, Raney (1973) states they are still common along the coast and are seen regularly in the Delaware River. He feels they are probably found in every big river on the Atlantic coast unless grossly polluted.

Connecticut - none seen in Connecticut for over 10 years (Hames, 1972).

New York - recent records for Hudson River.

Delaware - seen regularly in Delaware River (Raney, 1973).

Status: Rare, according to IUCN; endangered, USDI; threatened (Miller, 1972); fairly common (Raney, 1973). Since old timers do not fish for sturgeon much any more, few specimens are reported.

Reasons for Decline:

1. Pollution of waterways is major factor.
2. Overfishing, using shad gill nets in coastal rivers and fishing on spawning grounds.

Protective measures taken: none other than 20-inch size limit.

References: See list at end of section on Fish.

Literature: See list at end of section on Fish.

ATLANTIC STURGEON — Acipenser oxyrhyncus

Order: ACIPENSERIFORMES — Family: ACIPENSERIDAE

Refer to Maine Coast report for detailed information.

Additional Information

Present Distribution: Along Atlantic coast from St. Lawrence River to northern Florida (plus Gulf coast in northern part). There is a spotty distribution of this anadromous fish because of pollution of rivers and estuaries, and obstructions to their spawning sites up streams.

Connecticut - reported from Connecticut River and Long Island Sound, but no recent reports of numbers (Hames, 1972).

Status: Rare as listed by IUCN and some states.

Reasons for Decline:

1. Pollution of waterways
2. Obstructions to spawning.
3. Overfishing for many years. No fish under six feet should be kept.

References: See list at end of section on Fish.

Literature: See list at end of section on Fish.

AMERICAN SHAD — Alosa sapidissima

Order: ISOSPONDYLI — Family: CLUPEIDAE

Listed as threatened by Miller (1972), and occurring only in Delaware, New Jersey, and New York. Raney (1973) does not consider it rare or endangered in any part of its range. He states hundreds of thousands are caught each year, and species occurs up to New Brunswick, Canada. Pollution is major threat. Meister (1973) considers the shad as a commercial and sport fish, although the annual catch has dropped considerably. Sixty thousand to 70,000 are taken each year in Connecticut River, and the species is found in almost every coastal river in Maine.

References: See list at end of section on Fish.

Literature: See list at end of section on Fish.

ATLANTIC SALMON — Salmo salar

Order: SALMONIFORMES — Family: SALMONIDAE

Refer to Maine Coast report for detailed information.

Additional Information:

Present Distribution:

Connecticut - salmon smolts have been stocked in the Salmon River tributary to the Connecticut River. An occasional adult is taken in Long Island Sound, but no numbers of adults are known. A four-state/federal cooperative salmon restoration project for the Connecticut River is attempting restoration of species. There are probably 5,000 fingerlings and 50,000 fry in Connecticut state hatcheries (Hames, 1972). Raney (1973) feels species may never have been native to Connecticut.

References: See list at end of section on Fish.

Literature: See list at end of section on Fish.

SUNAPEE TROUT — Salvelinus alpinus aureolus

Order: SALMONIFORMES — Family: SALMONIDAE

Refer to Maine Coast report for detailed information.

Additional Information

Present Distribution:

New Hampshire - known from Conner Pond, Ossipee County; Dan Hole Pond; Sunapee Lake - abundant or common in these bodies of water. (Kircheis, 1972).

References: See list at end of section on Fish.

Literature: See list at end of section on Fish.

ATLANTIC TOMCOD — Microgadus tomcod

Order: GADIFORMES — Family: PERCOPSIDAE

Listed as threatened by Miller (1972) and as occurring only in New Jersey.

Raney (1973) considers the fish neither rare nor endangered and lists its range as a winter spawner in lower Hudson River up to Poughkeepsie, New York, within the salt wedge. Commercial fishing of the species is prohibited between December 15 to February 15. It is possible to collect 2,000 specimens in winter if done professionally.

References: See list at end of section on Fish.

Literature: See list at end of section on Fish.

List of References and Literature for Fish

References:

1. Mr. R. Hames. Fishery biologist. Department of Environmental Protection, State Office Building, Hartford, Connecticut.

2. Mr. F. W. Kircheis, Research biologist. Maine Dept. Inland Fisheries and Game, 34 Idaho Avenue, Bangor, Me. 04401.

3. Mr. A. Meister. Dept. Inland Fish and Game, Idaho Ave., Bangor, Me. (also c/o Maine Sea Run Atlantic Salmon Comm.) (207) 947-8627.

4. Dr. E. Raney. Ichthyological Associates, 301 Forest Drive, Ithaca, New York 14850. (607) 272-2455.

Literature:

1. Miller, R. F. 1972. Threatened freshwater fishes of the U. S. Trans. Amer. Fish Soc. vol. 101(2): 239-252.

REPTILES

Rare, Endangered and Threatened Reptiles of the Atlantic Coastal Plain and the Maine Coast

*American Alligator	*Alligator mississipensis*
Bog Turtle	*Clemmys muhlenberg*
Green Turtle	*Chelonia mydas*
Loggerhead Turtle	*Caretta caretta*
Hawksbill Turtle	*Eretmochelys imbricata*
Atlantic Ridley Turtle	*Lepidochelys kempi*
Pacific Ridley Turtle	*L. olivacea*
Leatherback Turtle	*Dermochelys coriacea*

*Indicates species that do not occur within the study area; therefore they are not discussed in the following section.

BOG TURTLE — Clemmys muhlenberg

Order: TESTUDINATA — Family: TESTUDINIDAE

Estimated Numbers: Very difficult to estimate - perhaps several hundred.

Present Distribution: Ranges in isolated and disjunct colonies from Connecticut to southwestern North Carolina, mostly in piedmont and mountainous areas where swamp and bogs are undisturbed.

Massachusetts - inland, not found on coastal plain.

Connecticut - inland, not found on coastal plain.

Rhode Island - dubious records from 1902 and 1919 around Newport area. In all probability, species is extirpated from area.

New York - Long Island: no records (Zappalorti, 1973); Staten Island: several old records (Zappalorti, 1973).

New Jersey - only found in southern area of Pine Barrens and Great Swamp. Counties where known: Daretown, Salem County; Gloucester County; Edgewater Park and Larchmont Farms, Burlington County; Mercer County; Ocean County; Monmouth County; Camden County; Cape May County.

Status: Classified as rare on Office of Endangered Species' official list and by IUCN. It may not be as rare as presently thought due to extreme secretiveness of this turtle and its difficult habitat (Arndt, 1973). Greatest threat is from man destroying its localized habitat, therefore will undoubtedly become rarer rapidly as human population increases.

Note: Persons involved with the Bog Turtle are extremely reticent about disclosing locations and numbers because of the danger of information leaking out to collectors. (It is not uncommon for collectors to travel many miles from out-of-state over a weekend to capture a few turtles and earn a considerable sum). Therefore, detailed locations will have to be obtained directly and in confidence from the References listed in this report.

Reasons for Decline:

1. Reduction and destruction of habitat, especially in the megalopolis between Mass. and Va., as marshy areas are

drained, filled, and/or polluted, for housing and shopping developments, highways, agriculture, etc.

2. Removal of large numbers of specimens from their colonies by collectors. Big turtles bring $100 to $150 apiece in pet stores and from individual sales.

3. Drying up or pollution of cold, clear ground water and seepage water source above bogs can change bog habitat and drive out turtles.

4. Flooding, both natural (especially Hurricane Agnes), and man-made (by dams), destroys bogs and colonies of turtles.

Protective Measures Taken:

1. Protected by state law in N.Y., Pa., N.J., and Maryland (Oct. 1972). Illegal to take, sell, transport or hold these turtles; $1,000 fine in Maryland; no enforcement or fines in N.J., $10 fine in Pa.

2. A single swamp has been bought by a naturalist to save one colony of bog turtles.

3. Extreme secrecy among Bog Turtle investigators and conservationists to prevent information about locales from leaking out to public.

Protective Measures Proposed:

1. Acquire known Bog Turtle bogs and swamps with adjacent drainage basins to save from development. Possibly introduce turtles to prime habitat in hopes of establishing new colonies.

2. Set up state Bog Turtle sanctuaries.

3. Strict fines and enforcement against purchase and sales by pet dealers and collectors.

4. Public education about value of bogs and wetlands and their unique fauna.

5. Continue censusing and life history studies to determine localities, numbers and distribution, (may be undertaken in 1973 by Jim Weaver, for Smithsonian Institution).

Ecological significance and general value:

1. Of little specific ecological importance, but does add to diversity of wetland fauna and is a very old relic, boreal, species of evolutionary interest.

2. Aesthetically pleasing reptile of remarkable intelligence and adaptability to captivity.

3. Scientific and natural appeal of wetlands area.

4. Great concern and interest to many turtle lovers.

References: (personal communication)

1. Dr. Rudolf Arndt. Senior Research biologist. c/o Ichthyological Associates, 100 S. Cass Street, Middletown, Delaware 19709. (302) 378-9881/2.

2. Mr. Robert Zappalorti. Herpetologist. Staten Island Zoo, Staten Island, New York 10310.

SEA TURTLES

1. Leatherback Turtle - Dermochelys coriacea
2. Loggerhead Turtle - Caretta caretta
3. Pacific Ridley - Lepidochelys olivacea
4. Atlantic Green - Chelonia mydas
5. Atlantic Ridley - Lepidochelys kempi
6. Hawksbill Turtle - Eretmochelys

(In order of decreasing security) (Carr, 1972)

Order: CHELONIA Family: CHELONIIDAE

Estimated Numbers: (based on estimates by Rainey and Pritchard, 1972)

Leatherback - only sporadic and rare appearances along coast from Florida to New England during summer months.

Loggerhead - Up to 50,000 females per year nesting along Atlantic coast, especially between Florida keys and North Carolina. May be seen as far north as New England.

Pacific Ridley - could be an extremely rare but possible visitor to Atlantic Coast. Species has been found in western Cuba after apparently travelling around tip of Africa into Atlantic Ocean. (Conant, 1973;

Brongerman, 1972); (Carr, 1957; Aguayo, 1953, not cited), also from Puerto Rico (Caldwell, 1969). Watch should be kept for this species in Florida region.

Atlantic Green - a rare but regular wanderer along Atlantic coast, Forida to New England. Probably 20 to 30 nests made on U.S. beaches per year. Young range as far as Cape Fear, S.C. They are known as "Lady" turtles and may number in hundreds.

Atlantic Ridley - Commonly captured as immatures as far north as Massachusetts, including 7 specimens from Sag Harbor, N. Y. (Schmid, 1972) Perhaps 100± adults may work way up east coast of U.S.A. in the summer.

Hawksbill - very rarely occurs along coastal waters as far as Massachusetts. Formerly nested in Florida.

Present Distribution: Only the Loggerhead is considered here because the other species are too sporadic in appearance to warrant a careful survey of sightings.

New Jersey - one new record, 1972, July 9, at Ocean City, New Jersey, at 11th Street Bridge; 124 eggs laid (Bowler, 1973).

Note: Females may make 2 to 3 dry runs up beaches to nest but if disturbed, abort in ocean. They normally nest 2 to 5 times per season on same beach. This factor must be considered in estimating actual number of turtles present (May, 1973). Turtles show preference for beaches backed by high dunes or vegetation, providing a broken and dark horizon instead of a flat, light, watery one (Caldwell, 1959). They may nest individually several times on same stretch of beach in one season; or nest in groups together several times; or return successive nights if interrupted until successful. Twelve to 15 days usually elapse between nestings within one season (Caldwell, 1962).

Status: Each species has a different degree of danger. USDI lists only the Green Turtle as threatened despite fact it is practically extirpated as a breeding entity from U.S.A. waters and beaches. IUCN lists the Green and Loggerhead as potentially endangered; and the Hawksbill and Atlantic Ridley as endangered. All species (8 of 5 genera) of sea turtles should be considered endangered as there is no international program protecting any species throughout its range and all are declining rapidly.

Reasons for Decline:

1. Egg and turtle poaching even where protected by law (as on National Wildlife Refuges); or open seasons still in existence for turtles and eggs (as in Florida, St. Johns Co., had open season until 1972 as long as turtle was killed in water).

2. Excessive killing and harvesting of Leatherback in Caribbean area for food, eggs and "trunk oil" which is considered potent medicine for infections, etc.

3. In 1969 a turtle freezing plant financed by INFONAC under A.I.D. program in Nicaragua was developed which caused the collapse of a treaty between Costa Rica and Panama and Nicaragua to protect Green Turtles off Caribbean coast for 3 years.

4. Decentralized fisheries, poor conservation programs, and few enforcement techniques in general throughout Caribbean, Central American and Mexican countries. Also a lack of good management data and regulations for proper exploitation.

5. Increase of human populations along coasts in above-mentioned developing countries with accompanying need for more protein, etc.

6. Greater use of outboard motors in sea transportation is increasing range and effectiveness of turtle hunters and poachers.

7. Tourists pay for turtle curios and souvenirs and also displace turtles from prize beaches due to vacation development and human use.

8. Mass marketing campaigns in well-developed nations for turtle products: turtle soup, fancy canned meats, oil for cosmetics, leather as replacement source for reptile leathers, and beautiful shells (in case of hawksbill) as souvenirs and shell products.

9. Coastal highway traffic kills thousands of hatchlings by blinding and confusing them with lights. May lure young turtles away from ocean and towards land.

10. Exotic Australian pine is replacing coastal vegetation on beaches in some areas, making them unsuitable for nesting.

11. Depredation of nests by predators, especially raccoons, which are increasing around human habitations, as well as feral hogs, skunks, sand crabs, gulls, crows.

12. Leatherbacks are occasionally taken for bait by shark fishermen.

13. Sudden inversions of cold water may kill straggler turtles in northern waters during late summer and fall months.

14. Turtles caught in fishermen's nets or shrimpers' trawling nets either drown, are killed by humans, or have their flippers cut off so they won't foul nets again. However, some shrimpers save netted turtles and release them.

15. Annoyance or spearing by turtle watchers or scuba divers. In the case of most sea turtles, including Loggerhead, riding on the back can damage the lungs since the two shells are not separated by a bony section for support.

Note: An excellent review of these problems found in Johnson et al (1971).

Ecological Significance and General Values:

1. Navigational ability is extremely interesting and worthy of study by scientists.

2. Economically important for food, oil, shell, etc., especially among primitive peoples. Could become like semidomesticated meat animal if properly protected and nurtured.

3. Important members of marine fauna by adding to diversity of ocean and beach ecosystems, and cycling of nutrients and energy.

4. Tremendous emotional, aesthetic, and naturalistic appeal of these huge turtles laying eggs.

5. Possible medical use since many native people believe oil is good for respiratory and other infections.

6. Traditional and historical nesting along U.S.A. coastline should be maintained as unique phenomena for tourism purposes and natural history value.

References: (personal communication)

1. Mr. Kenneth Bowler. Asst. Curator of Reptiles. Philadelphia Zoo, Philadelphia, Pa. (215) 222-5300.

2. Dr. R. Conant, Chief Herpetologist (retired). c/o Philadelphia Zoo, Philadelphia, Pa. (215) 222-5300.

3. Dr. P. Pritchard. Dept. of Zoology, University of Florida, Gainesville, Florida 32601. (904) 378-7957.

4. Mr. William Rainey, Researcher. Caribbean Research Institute, College of the Virgin Islands, St. Thomas, USVI 00801.

5. Mr. F. C. Schmid, Refuge Manager. Morton National Wildlife Refuge, R.D. #359, Noyac Road, Sag Harbor, N.Y. 11963.

Literature:

1. Brongersman, L.D. 1972. European Atlantic turtles. Zoologische Verhandelingen, #121, 2 vols. E.J. Bryll Publ., Lyden, Netherlands.

2. Caldwell, D. K. 1959. The Loggerhead Turtles of Cape Romain, South Carolina. Bull. Fla. State Mus. 4(10):319-348.

3. Caldwell, D. K. 1962. Comments on the nesting behavior of the Atlantic Loggerhead Sea Turtles, based primarily on tagging returns. Quart. Journal Fla. Acad. Sci. 25(4):287-302.

4. Rainey, W. E. and P. C. Pritchard. 1972. Distribution and management of Caribbean sea turtles. Contribution No. 105. 17 p., Caribbean Research Institute, College of the Virgin Islands, St. Thomas, V.I. 00801.

5. Johnson, A. S., H. O. Hillestad, F. A. Fanning and J. F. Shanholtzer. 1971. Ecological survey of the coastal region of Georgia. Prepared for USDI, National Park Services, #13-10-7: 991-037. University of Georgia, Athens, Georgia.

BIRDS

Rare, Endangered and Threatened Birds of the Atlantic Coastal Plain and Maine Coast

*Eastern Brown Pelican	Pelicanus occidentalis carolinensis
*Florida Great White Heron	Ardea occidentalis occidentalis
Southern Bald Eagle	Haliaeetus leucocephalus leucocephalus
Northern Bald Eagle	Haliaeetus leucocephalus alascanus
American Osprey	Pandion haliaetus
American Peregrine Falcon	Falco peregrinus anatum
Arctic Peregrine Falcon	Falco peregrinus tundrius
*Florida Sandhill Crane	Grus canadensis pratensis
Eskimo Curlew	Numenius borealis
Common Tern	Sterna hirundo
Arctic Tern	Sterna paradisaea
Roseate Tern	Sterna dougallii
Least Tern	Sterna albifrons
*American Ivory-billed Woodpecker	Campephilus principalis principalis
*Red-cockaded Woodpecker	Dendrocopos borealis
*Bachman's Warbler	Vermivora bachmanii
*Kirtland's Warbler	Dendroica kirtlandii
Ipswich Sparrow	Passerculus princeps

*Indicates species that do not occur within the study area; therefore they are not discussed in the following section.

NORTHERN BALD EAGLE — Haliaeetus leucocephalus alascanus

SOUTHERN BALD EAGLE — Haliaeetus leucocephalus leucocephalus

Order: FALCONIFORMES — Family: ACCIPITRIDAE

Estimated Numbers: Probably between 125 to 195 pairs, according to National Audubon Society (1972). The approximate numbers of bald eagles in U.S.A. (Atlantic Coast) are as follows:

Maine	40 breeding pairs
Chesapeake Bay	40 breeding pairs
North and South Carolina	25 breeding pairs
Florida	200 breeding pairs (most of these located outside range of this report)

Present Distribution and Numbers:

Maine - No more than 100 eagles of all ages and sexes, with a total of 32 active nests, identified in 1972. Forty active nests are estimated for the entire state, with 22 or more found along coastal strip. The areas of Blue Hill, Deer Isle, Dyer Island, East Machias, Eastport, Ellsworth, Mt. Desert, Schoodic Pt., and Castine have reported eagles in winter (American Birds 1970-71).

See Maine Coast report for further detailed information on breeding birds (northern subspecies).

New Hampshire - None reported nesting; none reported on Christmas counts 1970 and 1971 (American Birds 1970-71)

Massachusetts - No nesting birds on coast for many years. Only one or two unconfirmed sightings in winter (Howard, 1973). Few immature southern subspecies seen in summer, and few northern subspecies in winter on Cape Cod National Seashore (Cunningham, 1973).

Connecticut - Very few recent reports. 1972 at Stratford, Conn. River (Billard, 1973); none nesting now. 1971 at Stamford (American Birds, 1970). New Haven in 1972 (American Birds, 1971).

New York - The Bald Eagle probably still nests in the state in very limited numbers, but no information is available (Hall, 1973). Wintering birds have been reported on Christmas counts from Central Suffolk County, Montauk Point, Quogue,

and South Nassau County on Long Island (Amer. Bds., 1970, 1971).

New Jersey - Only 1 or 2 active nests are known and no young have been fledged since 1966 (Heintzelman, 1971). Reported on Christmas counts from Bridgeton, Ramsey, and Ocean-ville, New Jersey (American Birds, 1970, 1971). Brigantine National Wildlife Refuge usually has a few sightings.

Status: Southern Subspecies: Endangered - on U. S. Department of Interior federal list of endangered species. Seriously threatened and declining. A long term trend downwards in numbers; for example, a 1936 survey indicated about 250 active nests in Chesapeake Bay region. In the 1950's only 120 remained (Abbott, 1965).

Northern Subspecies: Not presently listed as rare or endangered; however, the subspecies appears threatened and depleted and is evoking considerable concern.

Reasons for Decline:

1. Encroaching civilization and disturbance, especially the development of inland lakes and coastal areas for "vacation" homes, utilizing nesting habitat of eagles; construction of highways.

2. Removal of habitat around the bay by farming and real estate development. Also, by encroachment on habitat by power transmission lines.

3. Concentrations of pesticides and their metabolites which are probably major factors causing decrease in Bald Eagle populations through egg-shell thinning from non-lethal amounts of DDE and other metabolites; or by direct mortality by lethal amounts. Heavy pesticide use along southeastern coastal plain, for example, on cotton and tobacco, is also blamed for serious decrease of southern subspecies. (See literature references on contamination).

4. Decreased reproductive success. (Please refer to Maine Coast report, and to Chesapeake Bay report for details).

5. High mortality due to gunshot wounds and irresponsible shooting, despite federal laws to protect species. Trauma, primarily from shooting, is one of the greatest, if not the greatest, cause of mortality among eagles (Coon et al, 1970).

6. Less abundant food supply, due to decrease in the migratory fish population in polluted waterways.

7. Electrocution on power lines.

8. Large-scale acquisition of coastal and tidewater forests by big timber companies and subsequent logging destroys habitat and food supplies, but also removes traditional old eagle nest trees.

Protective Measures Taken:

1. The Bald Eagle (both subspecies) is protected by Federal Law. In addition, in Maine, cooperative agreements are being made with landowners for sites where eagle nests are located to be treated as sanctuaries. Maine also has $500 reward to turn in eagle killers.

2. Intensive investigations into pesticide and other chemical contamination of eagles and eagle eggs, biology, distribution, behavior, etc., are being conducted by the Bureau of Sport Fisheries and Wildlife of USDI, National Audubon Society, Patuxent Wildlife Research Center, etc.

3. Censusing made annually by Bureau of Sport Fisheries and Wildlife in Maine, with Maine Audubon Society and Fish and Wildlife Service personnel. Censusing also carried out twice annually in Chesapeake Bay region, and is being started in some areas of Carolinas and Georgia coasts.

4. Cooperative agreements with landowners to protect nest sites, and continued protection on federal and state and private refuges.

Protective Measures Proposed:

1. Continued protection and acquisition of all known nest sites as sanctuaries.

2. Continued research on, and control of, environmental contaminants, especially pesticides and PCB's which can affect eagle reproduction.

3. Increased public education and involvement to save species.

4. Continued research on eagle behavior and reproduction, plus emphasis on captive breeding programs.

5. Increased enforcement of eagle laws and increased punishment to offenders.

6. Water pollution abatement so as to render it less prone to contaminate eagles and increase food supply.

7. Proper safe-guards on power lines to prevent electrocution.

8. Arrange with large paper companies to protect eagle nests, trees and nest sites, and to use this conservation effort for their good public image.

Ecological Significance and General Values:

1. U.S. National symbol with all its accompanying traditional cultural, aesthetic, historical, symbolic and inspirational qualities which this bird is imbued with.

2. Important indicator species to monitor effects of pesticides and other environmental contaminants.

3. Predation and maintenance of healthy prey populations.

4. Bird-watching as a popular pastime, plus wildlife photography.

5. Political expediency to "save" the species.

6. Excellent educational tool to teach conservation attitudes to children.

References: (personal communication)

1. Dr. Ruth Billard. Wildlife biologist. Wildlife Unit, Conn. Department Environmental Protection, Hartford, Conn.

2. Mr. D. Cunningham. Chief Naturalist. Cape Cod National Seashore, South Wellfleet, Mass. (617) 349-3785.

3. Mr. F. Gramlich. Bureau of Sport Fisheries and Wildlife, 40 Western Avenue, Augusta, Me. (207) 622-6171.

4. Mr. A. G. Hall, Director, Division Fish and Wildlife, N. Y. State Dept. Environmental Conservation, Albany, N.Y. 12201.

5. Ms. Deborah Howard, Researcher. Natural History Services, Massachusetts Audubon Society, Lincoln, Mass. 01773.

Additional References for Maine Coast Report:

1. Mr. Richard Anderson, Director. Maine Audubon Society, 57 Baxter Blvd., Portland, Maine.

2. Mr. Will F. Douglas. Park Naturalist. Acadia National Park, Rt. 1, Box 1, Bar Harbor, Maine 04609.

3. Mr. William Snow. Pilot and Game Management Agent. U.S. Bureau of Sport Fisheries and Wildlife, Federal Building, Augusta, Maine 04106. (207) 622-6171.

4. Ms. Linda Wright. Research biologist. Maine Audubon Society, 57 Baxter Blvd., Portland, Maine.

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AMERICAN OSPREY — Pandion haliaetus

Order: FALCONIFORMES — Family: PANDIONIDAE

Estimated Numbers and Present Distribution:

Maine - estimated 300 pairs for coastal waters (Johnston, 1973). Reference should be made to Maine Coast report on rare and endangered wildlife. Between 1957-64, the average number of young fledged from 239 active nests was 0.27 per nest. Need 0.95 to 1.30 young per nest to maintain stable population and offset mortality (Henny and Wight, 1969). Johnston (1973) reported 73 active nests in May, 1972, between Sorrento and East Casco Bay. Sixty-eight young produced, yielding 0.98 young per nest. In 1971, 0.95 young per nest was estimated.

New Hampshire - no data

Massachusetts - Possibly 20 pairs along coastal area. Uncommon migrant in fall and spring. About 20 maximum seen around Concord area (Heck, 1973) on migration. None seen in winter. Rare and local breeding bird. On Cape Cod National Seashore has almost completely disappeared. Only one nesting pair reported recently (Cunningham, 1973). This nest destroyed in 1972 (Fernandez, 1973). Westport area is best breeding area on Massachusetts Coast. Spitzer (1972) reported 15 pairs there in salt marshes along East Branch. Fernandez (1973) reported 23 pairs from 1963 to 1968, then only 15 1/2 pairs in 1972. They also reported two breeding pairs at Martha's Vineyard in 1971 and 1972; 1 pair at Mattaposett in 1972. May be very rare individual pairs breeding around North Falmouth, Waquoit, Mashpee, and Harwich (University of Rhode Island, 1973). Fernandez (1973) reported 2.3 young per nest in 1968; 1.5 in 1972 at Westport area.

Rhode Island - Breeding up until 1971 (5 nests) on the south shores near Massachusetts border, but none found in 1972 (Fernandez, 1973). Spitzer (1972) reported 3 pairs at Misquamicut near Westerly in a white cedar swamp 2 miles from coastal ponds.

Connecticut - Spitzer (1972) reported active nests from southeastern Connecticut in 1971. Three nests from Old Lyme in

1971; and 5 from Niantic in 1971. About 20 Ospreys are seen per year on migration mainly along Connecticut River and shores of Long Island (Billard, 1973). Henny and Wight (1969) found only 0.27 young per nest fledged from 239 active nests between 1957-1964.

Boston to New York City - Estimated 117 Osprey nests in 1972. Twenty-five years ago had about 1,300 nests. Between Long Island, New York and southern New England had 91 nests in 1969; 800 nests in 1941 (Spitzer, 1972).

New York - Estimate 65 to 70 pairs along coast. Data below from Spitzer (1972).

Gardiners Island - Main nesting area and largest colony at present. Three hundred pairs in 1945; 20 in 1965. This represents a decline of 12.9 percent over 20 years (Henny and Wight, 1969). Spitzer (1972) found 23 Osprey nests which produced 5 young, mostly located in Boswick Meadows. This area of 300 acres once had the largest concentration of Ospreys in world (75 nests on 300 acres) but is now down to 5 nests. Gardiners Island is 3,300 acres in private ownership and has been in private trust for decades, if not centuries. Area also noted for its heronry, waterfowl concentrations, northernmost Oystercatcher breeding colony.

American Birds (1971) recorded 25 nests which produced 17 young in summer of 1971.

Orient Point, near Orient Village, Long Island has 8 nests south of main road. Very good mixed habitat for Osprey.

Mashomick Forest, 2,000 acres, L.I., on south Shelter Island has 8 nests and undisturbed habitat.

Robin's Island in Peconic Bay, L.I., 700 acres, is a privately-owned, undeveloped island with 3 pairs of Ospreys. (Owner is Mr. John Mackay).

Cow's Neck, in Peconic Bay, 700 acres of good diverse habitat, has 2 Osprey nests.

Fischers Island has 4 nests which were reported in 1971.

Plum Island, near end of Orient Point, has 300 acres, with 8 Osprey nests. Island is run by USDA, but only small portion is used as an animal disease control center for strict quarantines. There is no human interference and few predators. This island should be given highest priority for acquisition or agreement to protect. Contact: Dr. J. J. Callis, Animal Disease Lab., USDA.

Carmens River, near Brookhaven, had 1 nest in 1971.

Morton National Wildlife Refuge has reported 1 pair on refuge (187 acres), and 3 pairs within 13 miles of refuge (Schmid, 1972). Also report that reproduction is down to 0.5 young per nest.

New Jersey - About 45 pairs; over half the population is found chiefly at Seven Mile Beach area; from Sea Isle City to Wildwood, Cape May County. Estimate 0.33 young per nesting pair (Jacobs, 1973). Spitzer (1972) reported 28 to 29 active nests from Avalon in 1971 with 10 young hatched (.31-.32 young per active nest). Sandy Hook area, now the Gateway National Recreation area, has 6 pairs of Ospreys on Ft. Hancock area. Seven nests, producing 2 young, were reported in 1972; 8 nests, 5 young, in 1971. The Fort Hancock area is fairly undisturbed and has limited human use. The right set of priorities for this area should be established to protect nesting birds (Spitzer, 1972). Raritan Estuary reported 1 bird at Christmas count, 1970 (American Birds, 1970).

Status: Not officially classified as rare or endangered; however, is declining in specific regions and may be seriously threatened. Hickey (1969) has predicted that the Osprey will be wiped out from New Jersey to Maine in a short time.

Reasons for Decline:

1. It has been estimated that the annual production of Ospreys must be between 0.95 and 1.30 young fledged/breeding female to maintain a stable population (Henny and Wight, 1969); however, this may be underestimated by 5 to 10 percent if nests with no eggs are excluded from original figures (Henny and VanVelzen, 1972) and only the productive nests used, rather than active nests.

2. The use of pesticides and other environmental contaminants is causing contamination in Ospreys from accumulation of chlorinated hydrocarbons through the food chain, which in turn are responsi-

ble for egg failure in active nests. Reproductive decline in Ospreys has been reported from many sections of the U. S. (Ames, 1966; Hickey, 1969).

3. Less food supply due to pollution of waterways.

4. High mortality rate among fledglings during 1st month, and immature birds during first year, of life. Rates of survival for the first year ranged from 48.5 percent to 42.7 percent (Henny and Wight, 1969).

5. Destruction of nests by high tides, waves and winds.

6. Destruction of nests by U. S. Coast Guard personnel when they are found on top of lighted navigational markers. For example, 43 nests were removed in Talbot Co. between 1963-1969 (Reese, 1970), and may be as high as 15 nests per year in the central Chesapeake Bay Region (Reese, 1965).

7. Increased use of boats and disturbance around Osprey nest sites.

8. Encroaching civilization and disturbance around Osprey nesting sites (same as for Bald Eagle), especially increased numbers and usage of boats.

9. Predators, such as raccoons and rats, destroying eggs and young.

Protective Measures Taken and Proposed:

1. Protected by Federal law and state law.

2. Research on-going at Patuxent Wildlife Research Center and other laboratories towards effects of pesticides and other environmental contaminants on Osprey reproduction and productivity.

3. Artificial nesting platforms have been erected and maintained annually to enhance Osprey nesting success.

4. Discontinued use of pesticides and other chemicals so as to increase chances of reproductive success; also abatement of water pollution so as to increase fish (food) supply.

5. Continued continental censusing and evaluation of populations.

6. Placement of signs around nesting areas asking people and boaters to remain at a distance. Also stationing animal guards on nest trees and platforms.

7. Rapid acquisition or private landowners' agreements on all Osprey nesting areas mentioned above where land could be threatened by future development.

8. Public education, especially in schools, to save species.

9. Enforced bann on electronic and paint firms which pollute rivers with PCB's.

10. Urge large timber companies and landowners to protect species' nests and nest trees.

11. Transfer of healthy (viable) eggs from Chesapeake Bay to areas in southern New England to substitute in endangered populations.

References: (personal communication)

1. Dr. Ruth Billard. Wildlife biologist. Wildlife Unit, Dept. of Environmental Protection, Hartford, Conn.

2. Mr. D. Cunningham. Chief Naturalist. Cape Cod National Seashore, South Wellfleet, Mass. 02663. (617) 349-3785.

3. Mr. and Mrs. J. Fernandez. Box 53, Dartmouth, Mass. 02714.

4. Mr. B. A. Heck. Asst. Refuge Manager. Great Meadows National Wildlife Refuge, 191 Sudbury Road, Concord, Mass. 01742.

5. Mr. J. A. Jacobs. 1928 Hillcrest Avenue, Pennsauken, New Jersey 08110.

6. Mr. J. A. Johnston. (graduate student), Box 319 York, University of Maine, Orono, Maine 04473. (207) 581-7573.

7. Mr. F. C. Schmid. Refuge Manager. Morton National Wildlife Refuge, R.D. 359, Noyac Road, Sag Harbor, New York 11963.

8. Mr. P. Spitzer. (graduate student), c/o Lab. of Ornithology, Cornell University, Ithaca, New York 14850.

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AMERICAN PEREGRINE FALCON — Falco peregrinus anatum

ARCTIC PEREGRINE FALCON — Falco peregrinus tundrius

Order: FALCONIFORMES — Family: FALCONIDAE

Estimated Numbers: Very difficult to estimate. Mattox (1973) estimated 2,000 individuals passing through Assateague during migration; possibly 1,200 (Ruos, 1972); 500± (Ward, 1973). Berry (1969) and Shor (1970) reported 200± falcons on Atlantic beaches, fall 1969, and estimated a production of 500 birds. The American Peregrine probably does not occur along the Atlantic Coastal plain at present (except in rare instances); although former breeding distribution included eastern U. S. south to Georgia. Not one single breeding pair known east of Rockies (Cade, 1972). The Arctic Peregrine occurs in limited numbers as a scattered migrant from Arctic Alaska, Canada and western Greenland. Southward migration along Atlantic coast may be chiefly from breeding areas in western Greenland (Shor, 1970). There has been no obvious drastic decline in migrants or in ratio of young to adults along Atlantic coast (Ruos, 1970); however, subspecies generally seems to be headed for same decline as American Peregrine because of reproductive failures.

Present Distribution: Falcons prefer barrier beaches, coastal islands and peninsulas. Few special sites are used and these can be seen anywhere on coast. Assateague Island in Maryland and Virginia (36 mi. x 1+ mi.) is the most significant nesting and feeding site for Arctic Peregrines anywhere in continental U.S.A. (Ward, 1973). A few choice sites are mentioned below. Sightings from American Birds (1970, 1971).

Maine - Coastal islands are important sites. Matinicus Rock is a good falcon migration resting site. One to five peregrines seen by Nisbet in fall, 1972. Wells Harbor, 1 seen, 1971, fall and June. See Maine Coast Report.

Massachusetts - 43 seen in 1971, fall migration for entire state, American Birds. Average of five pass through Monomoy National Wildlife Refuge each migration. Maximum of ten in a good year (Heck, 1973). Parker River National Wildlife Refuge had four in 1968. Cape Cod had one, Christmas count, 1970. Newburyport had one, Christmas count, 1970.

Rhode Island - One on Christmas bird count, 1971-1972, at Newport County; one on spring migration, 1971 (American Birds, 1971, 1972).

Connecticut - A few observed by Connecticut Department of Environmental Protection (Billard, 1973). One near New Haven, Christmas count, 1971 and 1970. One at Westport, Christmas count, 1970 (American Birds, 1971).

New York - Long Island is a good place. One near Brooklyn, Christmas count, 1971. Two at Montauk Point, Christmas count, 1971, 1970. One in south Nassau County, Christmas count, 1971. One in north Nassau County, Christmas count, 1970 (American Birds, 1970, 1971).

New Jersey - Cape May during peak migration period had approximately 6 to 7 per day between 1968-1970. No significant change noted annually over a period of 40 years in fall migration counts made by wardens and while trapping and banding falcons. Five on October 3rd, a peak day, 1971. Brigantine National Wildlife Refuge; two in 1968. Passaic Co. - 2 winter, 1971-1972. Great Swamp - 1 May, 1971. Oceanville - 1 in 1970, winter.

Status: Both subspecies considered threatened and are classified as endangered by the U. S. Department of Interior. No appreciable recent decline in general abundance of migrants along Atlantic coast (Ruos, 1972; Ward and Berry, 1972; 92nd Congress); in addition, the age ratios of immatures to adults in 1970-1971 seemed similar to those recorded since 1938 (Ward and Berry, 1972; Ruos, 1970). Nevertheless, there is a strong implication that a substantial population decline took place after 1947 (Nye, 1969; Ward and Berry, 1972).

Reasons for Decline:

1. Shooting of birds, especially migrants.

2. Destruction of nests by natural catastrophes.

3. Stealing of eggs, young and adults by trapping, by falconers and collectors.

4. Breeding failure resulting from cumulative effects of pesticides and other environmental contaminants which affect the reproductive and egg shell mechanisms. In addition, there is occasional direct poisoning from pesticides, etc. There is reason to believe that, based on experience with the American Peregrine Falcon, the Arctic subspecies will go into the same pattern of decline even though many migrants seem to come from Greenland where there is low contamination. The problem resulting from cumulative effects of pesticides and other environmental contaminants is very well presented by Ward and Berry (1972), p. 484-485.

5. Periodic short-term adverse effects of weather on reproduction, for example, summer of 1972 (Ruos, 1970).

6. Encroaching civilization and disturbance of nesting areas.

7. Trichomoniasis and botulism diseases occurring in the wild population.

Protective Measures Taken:

1. Federal and most State laws protect the species.

2. Research investigations into artificial propagation techniques at Cornell University's Lab for Ornithology, Patuxent Wildlife Research Center, and possibly other research centers in Canada, plus by 20 or more falconer-aviculturalists.

3. Protection by Denmark, and its colony, Greenland.

4. Surveillance and protection of known nest sites in western United States, Canada and Alaska.

5. Cooperative program between the Canadian Wildlife Service and U. S. wildlife agencies.

6. Continued monitoring of pesticide and effects on birds of prey.

7. Maintenance of scientific working relations with falconers who are concerned with peregrine falcon.

Protective Measures Proposed:

1. An immediate and forceful recommendation against the proposed hardtop road which is to be built between the Chesapeake Bay bridge in Maryland to the Virginia bridge, following along Assateague Island National Seashore. This development would destroy a significant wilderness area which falcons presently utilize for feeding and resting on migration.

2. Further acquisition and protection of barrier beaches and islands along the Atlantic to provide additional safe resting sites for falcons on migration.

3. Reduced use of persistent pesticides and other environmental contaminants in the U. S. and Canada and Europe.

4. Continued research on reproductive failure reasons and artificial breeding in captivity.

5. Increased legal protection and enforcement in all countries where Peregrine Falcons breed and winter.

6. Limit use by surf fishermen and motor vehicles along barrier beaches during time of migration of falcons, because resting should not be disturbed. (This added stress factor may be more deleterious than normal if birds are loaded with DDT, DDE, DDD, etc. as they appear to have less tolerance to disturbances when in this condition).

7. Strengthen efforts to monitor flyways and obtain accurate annual migration numbers and any changes which might signal decline of populations.

8. Encourage competent falconers to trap immature birds and handle them with controlled diets (free of chemicals), exercise, artificial incubation of eggs to prevent breakage, etc.

9. Refrain from planting erosion grasses, and forbid camping on Peregrine traditional resting sites so as not to obstruct view or disturb birds unnecessarily.

10. Encourage diplomatic agreements and international patrol with Canada, Denmark, Greenland, etc., toward regulating and protecting their peregrine populations.

Ecological Importance and General Importance:

1. Aesthetic appeal as a magnificent bird of prey.

2. Bird-watching, photography, nature lovers.

3. Important indicator species to use in monitoring effects of pesticides, etc.

4. Predator which helps maintain a healthy population of prey species.

5. Traditional, historical and scientific use of falcons by falconers.

References: (personal communication)

1. Dr. R. S. Billard. Wildlife biologist. Wildlife Unit, Dept. Environmental Protection, Hartford, Conn. 06115.

2. Dr. Tom Cade. Professor. Lab of Ornithology, or Div. of Ecology and Systematics, Langmuir Lab, Cornell University, Ithaca, New York 14850.

3. Mr. B. A. Heck. Refuge Manager. Monomoy National Wildlife Refuge, Chatham, Mass.

4. Dr. Ian Nisbet. Biologist. Massachusetts Audubon Society, Lincoln, Mass. (617) 259-9500.

5. Mr. Jim Ruos. Research biologist. Patuxent Wildlife Research Laboratory, Laurel, Maryland.

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ESKIMO CURLEW — *Numenius borealis*

Order: CHARADRIIFORMES — Family: SCOLOPACIDAE

Estimated Numbers: No way to estimate accurately. Occasional birds sighted on spring migration.

Present Distribution: Spotty migrational sight records (Weston and Williams, 1965) include: Charleston, S.C. - July, 1956 - 1 bird; Cape May, New Jersey - 1959 - 1 bird; Chatham, Mass. - 1969 - 1 bird; Martha's Vineyard, Mass. - Aug. 6 and 7, 1972 - 2 birds (American Birds, 1972).

Status: Classified as Endangered by USDI and IUCN. Species is extremely rare in comparison with former abundance which numbered probably in tens of thousands. Most probably headed for extinction.

Reasons for Decline:

1. Excessive shooting for food and sport.
2. Bird's unwary and gregarious nature endangered its survival.
3. No protection on breeding grounds in Canada or on wintering area in South America.
4. Loss of life during very long migration route.

Protective Measures Taken:

1. Complete legal protection from hunting in U. S. and Canada.
2. The Canadian Wildlife Service is paying special attention to curlew life history and movements.

Protective Measures Proposed:

1. Protect on breeding grounds and on wintering areas.
2. Research into limiting factors on summer and winter range.
3. Tracking and censusing migrating birds as far as possible.
4. Public education and alert in case curlews are seen on migration, so they will be reported and protected.

Ecological Significance and General Values:

1. Unique shorebird with incredibly long and complex migration route.

2. Might offer good physiological studies on adaptability to long arduous flight.

3. Bird-watching as popular pastime.

4. Diversity of avifauna.

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COMMON TERNS	Sterna hirundo
ARCTIC TERNS	S. paradisaea
ROSEATE TERNS	S. dougallii
LEAST TERNS	S. albifrons

Order: CHARADRIFORMES

Family: STERNINAE

Estimated Numbers: Very difficult to estimate since no complete surveys have been made. See some details below. Only major colonies and areas are considered. Breeding Least Terns may number only 2,500 or less (Downing, 1972).

Present Distribution:

Maine - Please refer to Maine Coast report for details.

Note: Area from Cape Cod to Cape May is main breeding and gathering area for terns.

Massachusetts - According to Nisbet (1972, 1973) the total number of terns nesting in Massachusetts has decreased since they were at peak numbers between 1920-1950. Results of the 1972 census are as follows (± 25% confidence limit):

Common Terns	1920	= 30,000 - 40,000 pairs
	1972	= 7,500 ± pairs
Arctic Terns	1940	= 300-400 pairs
	1972	= 110 pairs
Roseate Terns	1935	= 5,000 pairs
	1972	= 2,300 pairs
Least Terns	1950	= 1,500 pairs
	1972	= 950 pairs

Hays (1973) and Nisbet (1970) feel that a large percentage of Common and Least Terns in the U.S.A. now breed mainly on Long Island and Massachusetts. On the Cape Cod area and offshore islands, they report a total of 8,000 pairs (6,000 Commons, 2,000 Roseates, 100 Arctics). The following estimated number of pairs of terns in Massachusetts colonies is taken from Nisbet (1973):

Buzzards Bay Area	600 Commons, 0 Arctic 1,270 Roseates
Martha's Vineyard	1,160 Commons, 35 Artics 400 Roseates, 230± Leasts
Nantucket	3 Commons, 6 Arctics, 0 Roseates, 180± Leasts
Cape Cod Area	4,030 Commons, 39 Arctics, 579 Roseates, 360± Leasts
South Shore Area	1,470 Commons, 0 Arctics, 30 Roseates, 95± Leasts
Boston Harbor	275 Commons, 0 Arctics 0 Roseates
Essex County	100 Commons, 0 Arctics 0 Roseates, 75± Leasts
Muskegat Island	0 Commons, 0 Roseates

The following information is taken from Nisbet (1973) and Hays (1973).

New Hampshire - none reported.

Rhode Island - 200 pairs of Common Terns, 0 Roseates and small numbers of Least Terns. Pt. Judith is an important gathering place for migrating terns (Hays, 1973).

New York - Great Gull Island, following efforts to create artificial beaches in 1949 and 1950, now supports a fair number of breeding birds. 3,000 pairs of both species occurred in 1966; 7,000 (1,000 Roseates, 6,000 Commons) in 1971 (Hays and Risebrough, 1971). Today Great Gull Island, owned by the American Museum of Natural History is one of the largest colonies in Long Island Sound for Common Terns, and probably the largest for Roseates nesting in eastern North American noth of the Caribbean region.

- Robins Island, owned privately by Mr. Mackay and maintained as a semi-sanctuary, has a breeding colony (small and sporadic) of Roseates and Commons (Hays, 1973).

- Shinnecock Bay - important gathering place for terns before migration.

- Jones Beach, L.I. - Common (and a few Roseates) Terns nesting - probably 2,000 pairs.

- Huntington area near Lloyd Neck, L.I. (being watched and protected during nesting time by townspeople) has colony of Least Terns - 300 pairs.

- Cedar Beach, near Babylon south shore, L.I., has Roseates, Commons, Leasts nesting there - total 5,000 birds, (Hays, 1973).

In summary, there are roughly 5,000 pairs of Commons in western Long Island and 6,000-7,000 pairs in eastern Long Island (Hays, 1970; Nisbet, 1973). Also 1,500+ pairs of Leasts in 20 colonies on Long Island (Nisbet, 1973). See Note [1].

Note[1] : The total number of Common Terns between New York City and eastern Maine is about 22,000 pairs or less then 1/2 the number reported in the 1930's.

Connecticut - Falkner's Island - 500 pairs of Common Terns (Nisbet, 1973) and 200 to 300 pairs of Roseate Terns (Hays, 1973). Presently has a manned lighthouse on it, but island is for sale since lighthouse will soon be automatic. (Is recommended that Nature Conservancy try to acquire the island if not already aware of this natural area. An aerial survey in 1972 showed 500-700 pairs of Commons in 9 colonies apart from Falkner's Island plus small numbers of Least Terns (Nisbet, 1973).

The Housetanic marshes and sand bars near Milford have a small group of Least Terns nesting and are an important gathering place for Common and Roseate Terns from Nova Scotia and northeastern U. S. (It should be kept wild and undeveloped as an area). Saybrook and New London, are also important gathering places (Hays, 1973).

New Jersey - Cape May is probably the most important site, especially around Seven Mile Beach and Avalon area. Stone Harbor has Common and few Least Terns - 200 to 300± nesting. Causeway from mainland to Avalon with new fill - approximately 800 to 1,000 Commons using this new area. (No Roseate or Arctic Terns nesting in New Jersey). Holgate Point on Brigantine National Wildlife Refuge; Island Beach State Park; and other protected areas have nesting colonies of Common Terns (Choate, 1973).

Status: None are considered rare or endangered; however, several species of Terns have experienced a long, steady decline and are showing deformities in young more recently. Specifically, only certain species in certain localities are considered threatened at this time, according to references presented.

Reasons for Decline:

1. Encroachment by human developments and recreational uses upon habitat, i.e. vacation homes, beach hotels and condominiums, resort use, dune buggies, beach drag racing, picnickers and domestic pets, camp grounds, coastal stabilization bulwarks, groins and seawalls.

2. Increase in numbers of Herring and Blackbacked Gulls taking over beaches for breeding where Terns had nest sites. Increase is due to water pollution and garbage dumps supplying extra winter food to gulls. In Maine, where gull control programs were in effect (Matinicus Rock and Petit Manan), nests averaged 1.0 chick/pair of terns. When stopped control in 1972, breeding success dropped to 0.2 chicks/pair of terns.

3. Washed-out nests and damage from severe sea storms (wind, waves, blowing sand, etc.).

4. Change of nesting locations because of above pressures to places where terns are threatened by human disturbance, pollution, predation, and decreased food supply as on inshore islands and mainland sites.

5. Possible recent increase of deformities in young (Hays and Risebrough, 1972) such as twisted bills, imperfect wings and eyes, loss of feathers, etc. which seem to be associated with high levels of chemical pollution.

6. Decreased predation by rats, raccoons, etc.

Protective Measures Taken or Proposed:

1. Gull control programs on threatened seabird islands and coastal beaches.

2. Protect and acquire all possible sand bars, river mouths, estuary areas and barrier beaches where terns nest.

3. Place volunteers on site of tern nests during breeding season to watch over them and prevent disturbance or crushing by passers-by.

4. Monitor tern breeding success and check for abnormalities and deformities in chicks caused possibly by pesticides.

Ecological Importance and General Values:

1. Use as quality indicators for the marine environment as terns show responses to changes in feeding areas, nest sites, contaminants, other subtle stresses.

2. Maintain diversity and stability of marine coastal avifauna.

3. Aesthetic appeal and artistic beauty of terns.

4. Guano useful as nutrient fertilizers and natural enrichment where deposited in sea or on beaches.

5. Predation and maintenance of healthy fish populations.

References:

1. Dr. M. Byrd. Professor and Chairman. Department of Biology, College of William and Mary, Williamsburg, Virginia.

2. Mr. E. A. Choate. Cape May Pt. (former Director N. J. Audubon Society), Box 277, New Jersey (609) 884-8201.

3. Ms. Helen Hays. Researcher. Division of Birds, American Museum of Natural History, 79th Street and Central Park West, New York City, New York.

4. Dr. H. Mendall. Unit Leader. Cooperative Wildlife Research Unit, University of Maine, Orono, Maine.

5. Dr. Ian Nisbet. Associate Director, Scientific Staff, Massachusetts Audubon Society, Lincoln, Massachusetts 01733. (617) 259-9500.

6. Mr. Chris Packard, (Editor, Maine Nature), Box 509, Brunswick, Maine.

Literature:

1. Downing, R. L. 1972. Least Tern nesting success in the Middle and South Atlantic States during 1972. Bureau of Sport Fisheries and Wildlife, 104 Hubbard, Blacksburg, Va. 24060.

2. Fiske, E. 1972. A search for nesting Least Terns. Lab. of Ornithology Newsletter. No. 66, p. 3-4.

3. Hays, H. 1970. Great Gull Island report on nesting species 1967-1968. Proc. Linn. Society, New York 71:105-118.

4. Hays, H. and R. W. Risebrough. 1971. The early warning of the Terns. Natural History 80(1):39-46.

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6. Nisbet, I. 1970. Mass. Audubon Society Research on Terns, 1966-1970. Research Dept. Nov. 3, 1970. Lincoln, Mass.

7. _____ 1972. Disaster year for terns. Man and Nature, Dec. 1972. Contrib. #97, Mass. Audubon Society, Lincoln, Mass.

8. _____ 1973. Terns in Massachusetts: present numbers and historical changes. Bird-Banding 44(1):27-55.

9. Packard, C. M. 1970. Maine's Seabird Nesting Colonies. Maine Fish and Game, Winter, 1969-1970: 16-19.

IPSWICH SPARROW — Passerculus princeps

Order: PASSERIFORMES — Family: FRINGILLIDAE

Estimated Numbers: McLaren (1968) estimated 4,000 adult birds nesting on Sable Island, Canada, in 1967; and 2,400 in 1971 (McLaren, 1973). Population fluctuates and has been on increase along coast during last five years. Estimated total population, adults and young, 10,800 in fall, 1970; 11,500 in fall, 1972. There is an average 20-40 percent normal annual loss).

Present Distribution: Generally found in coastal parks and preserves where suitable beach-dune grass habitat occurs. Narrow, broken or built-up dunes around beach resort areas may be used in migration, but not for winter residence.

Maine - May occur almost anywhere along Maine Coast where dunes, beaches and patches of rocks and grass occur in undisturbed state. Usually noted in fall and spring migrations plus occasional winter sightings. The following locations of sightings have been taken from Maine Nature, (Audubon Field Notes) American Birds, and Maine Audubon Field notes. Also see Maine Coast report for details.

1972	Kittery Point, Maine - 2 unknown - October
1972	Clam Harbor - 2 females - June
1971	Seabrook, New Hampshire, near Kittery, Maine - 12 mixed - November
1970	Smutty Nose Island - 3 unknown - October
	Bidderford Pool - 1 unknown - October
	Kittery Point - 1 unknown - October
1969	Reid State Park - 1 unknown - ?
	Popham State Park - 1 unknown - ?
	Oakland - 1 pair - ?
1968	
1967	Scarborough - 1 unknown - April
	Kittery Point - 2 - April
	Kittery Point - 2 - ?
1966	Vinal Haven Island - 1 unknown - ?
1965	York - 1 unknown - November

New Hampshire - Dec., 1971, coast, one sparrow (American Birds, 1971).

Massachusetts - Monomoy National Wildlife Refuge reports estimate of 100 birds per migration period (Heck, 1971).

Noman's Land Island considered important area for birds. No longer to be used in military training exercises, but will be protected under agreement between U. S. Navy and Bureau of Sport Fisheries and Wildlife. (Office of Endangered Species, 1970). The following 1971 census figures taken from Stobo and McLaren (1971):

No. Truro, Cape Cod - 1; Gurnet Point - 1; Plum Island - 0;
*Martha's Vineyard - 1 - 1970 (American Birds, 1970).

New Hampshire - none reported

Rhode Island - none reported

New York - *Bronx, N.Y. - 2 - 1970 (American Birds, 1970)
Smith Point Coastal Park - 7
Gilgo State Park - 1
Jones Beach State Park - 1

New Jersey - Island Beach State Park (no. & so.) - 3
Beach Haven Hts. - 2
Brigantine Beach, north - 4
Brigantine Beach, south - 2
Seven Mile Beach - 9
Cape May - 1

Status: Listed as rare by USDI and IUCN.

Reasons for Decline:

1. Decrease in the size of only breeding site which is Sable Island, Nova Scotia, Canada, because of erosion from sea and wind.

2. Winter habitat from Maine to Georgia is decreasing along coast due to human development, especially real estate.

Protective Measures Taken:

1. Establishment of several national wildlife refuges (south of Maine) along Atlantic coast, and additional national seashore parks and private preservation of natural sand dunes, Spartina marshes and beaches to assure continuation of wintering habitat for the species.

Protective Measures Proposed:

1. Obtain protection or acquire additional coastal islands

especially between New Jersey and Virginia for wintering birds.

2. Protection of breeding area, Sable Island, by Canadian Government and possible restoration of land from sea.

3. Further study of migration patterns and habitat requirements.

4. Maintenance of dune and grassland areas plus protection from fire.

Ecological Significance and General Values:

1. Diversity of coastal avifauna.

2. Recreation by bird-watching; scientific interest in censuses.

3. Unique specimens for museums and zoos.

4. Opportunity for research in behavioral studies, taxonomic comparisons, and evolutionary trends.

5. Maintenance of gene pool.

6. Another good reason for preserving coastal areas in natural state.

References:

1. Mr. B. A. Heck. Assistant Refuge Manager. Monomoy National Wildlife Refuge, Chatham, Mass.

2. Dr. Ian McLaren. Professor. Dept. of Biology, Dalhousie University, Halifax, Nova Scotia.

Additional References:

1. Mr. Richard Anderson, Research Division, Maine Audubon Society, Baxter Blvd., Portland, Maine.

2. Dr. D. Huntington, Dept. of Biology, Bowdoin College, Brunswick, Maine. (207) 725-8731, ext. 584.

3. Mr. Chris Packard, Box 509, Brunswick, Maine 04011 (Editor of Maine Nature). (207) 729-3832.

Literature:

1. American Birds. 1970, 1971. National Audubon Society, New York City, New York 25(2); 26(2).

2. McLaren, I. A. 1968. Censuses of Ipswich Sparrow on Sable Island. Can. Nat. 82:148-150.

3. Stobo, W. T. and I. A. McLaren. 1971. Late-winter distribution of the Ipswich Sparrow. American Birds 25(b): 941-944.

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MAMMALS

Rare, Endangered, and Threatened Mammals of the Atlantic Coastal Plain and Maine Coast

*Dismal Swamp Shorttail Shrew	Blarina telmalestes
*Eastern Fox Squirrel	Sciurus niger (vulpinus) (vicinus)
*Delmarva Fox Squirrel	Sciurus niger cinereus
*Cumberland Island Pocket Gopher	Geomys cumberlandius
Gray Seal	Halichoerus grypus
Harbor Seal	Phoca vitulina
Block Island Meadow Vole	Microtus pennsylvanicus provectus
Beach Meadow Vole	Microtus breweri
*Florida Panther	Felis concolor corvi
Eastern Panther	Felis concolor cougari
*Florida Manatee	Trichechus manatus latirostris
*Wood Ibis	Mycteria americana

*Indicates species that do not occur within the study area; therefore they are not discussed in the following section.

GRAY SEAL — Halichoerus grypus

Order: PINNIPEDIA — Family: PHOCIDAE

Estimated Numbers: Approximately 100 ± in Maine (Richardson, 1973). In Massachusetts about 12 to 17 animals in areas around Nantucket Island, according to Schurman (1973), see below. The Western Atlantic population totals about 5,000 animals centered in the Gulf of St. Lawrence (Rough, 1968).

Place	Year	Maximum Counted	New Acquisition
N.E. Shoal Muskeget Isl.,Mass.	1967	15	1 pup
S.W. Point Muskeget Isl.	1968	14	1 male
N.E. Shoal Muskeget Isl.	1969	9	0
Shoal south of Tuckerman Isl.	1970	11	2 (1 female) pups
N.W. Shoal Muskeget Isl.	1971	11	2 (1 pup, 1 yearling)
Shoal south of Tuckerman Isl.	1972	9	1 pup

Present Distribution:

Maine - the Gray Seal inhabits temperate waters of the North Atlantic, and is relatively common north of Maine (Nova Scotia, European coast, etc.) Its presence in Maine and Massachusetts (about 25 resident seals) represent peripheral southerly animals. In pre-colonial times, Gray Seals were apparently more common and had a more extensive range, judging from bones found in Indian middens and from fossil deposits along the Atlantic coast, namely from Mt. Desert, LaMoine, and Calf Island in Maine. Presently Gray Seals occur in Maine from Casco Bay East to Grand Manan, New Brunswick, on the following islands and coastal areas (Drury, 1972):

Minergreen Island, Casco Bay	1
Metinic Green Island, near Penobscot Bay	4

Brig Ledge Matinicus, Penobscot Bay	1
Green Island Seal Ledge, Penobscot Bay	5
Seal Island, Penobscot Bay	1
Black Ledge, near Swan's Island	4
Spirit Ledge, near Swan's Island	1
Long Ledge, Casco Passage, Jericho Bay - Blue Hill Bay	2
John Island Dry Ledges, near Swan's Island	20
Dry Money Ledge, near Johns Island	1
Swan's Outer Green Island near Swan's Island	1
Dawes Ledge, Black Island, north of Mt.Desert	2
Little Duck South of Mt. Desert	1
Gut Ledges, s.e. of Mt. Desert	2

In vicinity of Mt. Desert Island, an estimated 40 seals (Richardson, 1973).

Massachusetts - Muskeget Island and vicinity (7 miles by 3 miles) mainly found on Southwest Point, Muskeget Island, a low sandy spit 300-400 yards long. Also found around Tuckernuck and Nantucket Islands. Gray Seals have been seen around Monomoy Wilderness area, Elizabeth Islands, West Chop on Martha's Vineyard and Eel Point, Nantucket, in the 1960's (Andrews and Mott, 1967). Gray Seals may make rare and sporadic appearances somewhat further south, but Muskeget Island and vicinity is the southernmost breeding site known in U.S.A. Formerly occurred as far south as the Connecticut coast (A.P.I., 1973), but have abandoned New England waters for decades.

Status: Not listed as rare or endangered by USDI or IUCN; however, range and numbers in United States are very limited and declining. Is considered threatened or in need of watching (Schurman, 1973; Ray, 1973).

Reasons for Decline: Based on archeological evidence, there has been a decline in Gray Seal numbers and range since Colonial days, but there is no evident reason for this. Possible limiting factors could include the bounty placed on seals by the State of Massachusetts until 1962 ($25 each). Also fishermen have traditionally killed this species when it destroyed their weirs and nets. Possibly, greater use of boats and boating recreation has an effect, plus shooting for fun from boat and plane by indiscriminate "sportsmen".

Protective Measures Taken:

1. Protection by removing seal bounty in Massachusetts and Maine, and enacting protective legislation in 1965.

2. Increased recent research on species.

Ecological Importance and General Values:

1. Scientific and aesthetic interest in these animals.
2. Subjects of many books, pictures, films, reports.
3. Formerly food for coastal Indians and early settlers.
4. Diversity of marine mammal fauna.

References: (personal communication)

1. Dr. W. H. Drury. Biologist, Massachusetts Audubon Society, Lincoln, Mass.
2. Dr. Carlton Ray. Division of Marine Mammals, Smithsonian Institution, Washington, D. C. (202) 381-5363.
3. Mr. David Richardson, c/o Wiscasset, Maine. (207) 882-6824; or c/o Maine Department of Sea and Shore Fisheries, West Boothbay Harbor, Maine 04575.
4. Ms. Valerie Schurman, 20 Louisville Square, Boston, Massachusetts 12108. (617) 723-6578.

Literature:

1. American Petroleum Institute. 1973 in press. Report on the Mid-Atlantic Bight. Univ. of Rhode Island by contract to A.P.I., 1801 K Street, N.W. Washington, D.C.
2. Andrews, J. C. and P. R. Mott. 1967. Gray Seals at Nantucket, Massachusetts. Jnl. Mammalogy 48(4):657-658.
3. Rough, V. S. 1968. Gray Seals in New England. Massachusetts Audubon 52:20-27.

HARBOR SEAL — Phoca vitulina

Order: PINNIPEDIA — Family: PHOCIDAE

Estimated Numbers: Richardson estimates 1,600 seals around Acadia National Park (Isle au Haut to Petit Manan), based on boat and aerial

surveys (Richardson, 1972). Western Atlantic population totals 40,000 (Rough, 1968).

Present Distribution: Range from Ellsmere Island, Canada, to South Carolina, being most abundant from Greenland through Maine. One specimen came ashore alive on South Island, Winyah Bay, Georgetown County, South Carolina, in February, 1970 (Caldwell et al., 1971). Harbor seals are reported from Biddleford Pool, from Saco River to Small Pt., and from Kennebec River to Ram Island, Maine. For detailed sightings and haul-out areas, reference should be made to Richardson's semi-annual progress reports to National Park Service and Maine Department Sea and Shore Fisheries (quotes are not permitted until publication).

Status: Not classified as endangered or rare by USDI or IUCN. Richardson (1972) states that population in Maine is stable. Ray (1973) feels species is threatened and declining as compared to former numbers and breeding distribution as far south as the Carolinas. Also, he is concerned by threat of water pollution and coastal development.

Reasons for Decline:

1. Shooting for "sport".
2. Persecution by fishermen.
3. Bounty in Canada.
4. Hunted for food formerly.
5. Lesions and sores in pups.

Protective Measures Taken:

1. Repeal of bounties in Maine and Massachusetts.
2. Federal Marine Mammal Protection Bill, October 1972.

Protective Measures Proposed:

1. Protect traditional haul-out areas.
2. Stop harvest for specimens, research needs, etc.
3. Continue monitoring and tagging seals.
4. Public education.

References: (personal communication)

1. Dr. Carlton Ray. Associate Professor. Johns Hopkins University, Baltimore, Maryland, or c/o Division of Marine Mammals, Smithsonian Institution, Washington, D. C. (202) 381-5363.

2. Mr. David T. Richardson, c/o Department of Sea and Shore Fisheries, West Boothbay Harbor, Maine 04575; or c/o Wiscasset, Maine. (207) 882-6824.

Literature:

1. Caldwell, D. K., H. Neuhauser, M. C. Caldwell, and H. W. Coolidge. 1971. Recent records of marine mammals from the coasts of Georgia and South Carolina. Cetology 5:1-12.

2. Richardson, D. T. 1972. Distribution and abundance of Harbor and Gray Seals, Acadia National Park Area. Semi-annual report to National Park Service and Maine Department Sea and Shore Fisheries.

3. Rough, V. S. 1968. Gray Seals in New England. Massachusetts Audubon, 52:20-27.

BLOCK ISLAND MEADOW VOLE — Microtus pennsylvanicus provectus

Order: RODENTIA — Family: CRICETIDAE

Estimated Numbers: Fluctuating population with an annual cycle and probably a 3-4 year cycle. Low population numbers approximately 2,600 mice. High numbers approximately 26,000, calculating 60 voles/acre on optimum habitat and 25 voles/acre on marginal habitat (Clough and Fulk, 1971); see below.

1965	high peak	0.89 voles per 100 trap-hours
1967	declining	0.50 voles/100 trap-hours
1969	declining	0.27 voles/100 trap-hours

Present Distribution: Restricted to Block Island, Rhode Island, (8 miles long by 2-5 miles wide) on about 602 acres (9% of the island). Approximately 335 acres are optimum habitat of beachgrass (Ammophila), other grasses and herbs; and 271 acres are of marginal habitat of low coastal scrub (Bayberry, Myrica) or coniferous cover (Clough and Fulk, 1971). This subspecies is extremely prolific producing several litters of 4 to 8 young per year.

Status: Rare, as listed by USDI Redbook, and apparently endangered (indeterminant) by IUCN Red Data Book. Clough and Fulk (1971) report that there exists a secure reservoir population. Clough (1973) and Rhode Island Division of Fish and Wildlife (1972) report the population in good shape.

Reasons for Decline:

1. Hurricanes and storms change or destroy habitat.

2. Increasing number of buildings, cottages, and roads on island which are encroaching on habitat and altering it.

3. Decreasing amount of agriculture (dairy farms, etc.) on island. Succession is altering habitat from open fields and grass cover to low scrub and in some places, coniferous plantations, which are poor habitat for the voles.

Protective Measures Taken:

1. Forty acres of land given to town of Block Island (New Shoreham) in 1972 to be preserved. It contains some good vole habitat with grass and dunes near north end (Clough, 1972).

2. Small breeding colony in captivity (Clough, 1972).

Protective Measures Proposed:

1. Thirty to forty acres near above 40-acre tract may soon be presented to State Fish and Game Department as a preserve; also another tract of 100 acres near south end of island may be preserved by private group of Block Island landowners.

2. Careful surveillance against introduced predators which could wipe out voles.

3. Conversion of scrub land to grass land, either as habitat improvement for woodcock and pheasant, and/or to benefit voles.

4. Conversion of bayberry to grass by State Fish and Game Department to provide alternate food supply for introduced white-tailed deer (nuisance to farms and gardens). If continued, this will be favorable habitat for voles (Clough, 1972).

5. In general, practice maintenance and protection of existing perennial grass, dunes and marshlands on Block Island.

6. Discourage zoological collectors from over-collecting vole population.

7. Guard against mixing with mainland subspecies.

Ecological Significance and General Values:

1. A unique subspecies of great value for scientific research on evolution, speciation, population dynamics, and behavioral ecology.

2. Diversity of island fauna.

References: (personal communication)

1. Dr. Garrett Clough. Associate Professor. University College, University of Rhode Island, Kingston, R. I. 02881.

2. Rhode Island Audubon Society, 40 Bowen Street, Providence, R.I.

3. Rhode Island Division of Fish and Game, 83 Park Street, Providence Rhode Island 02903.

4. Dr. D. Q. Thompson. Unit Leader. Cooperative Wildlife Research Unit, Cornell Univ., Ithaca, N. Y. 14850. (607) 256-2014.

Literature:

1. Clough, G. C. and G. Fulk. 1971. Current status of the Block Island Meadow Vole, Rhode Island. Biological Conservation. 3:151-152.

BEACH MEADOW VOLE — *Microtus breweri*

Order: RODENTIA — Family: CRICETIDAE

Estimated Numbers: Population fluctuating on roughly a 2+ year cycle; varied from "no trace" in 1890-01 to "very abundant" in 1869 and 1972. Usually between 3,000 and 10,000 mice existing (Tamarin, 1973; Clough,

1972). Historical summary by Wetherbee et al. (1972) indicates:

1869	excessively abundant
1891	no trace on Muskeget Island, only on South West Point Island and Adams Island
1893	26 mice re-introduced by Miller to Muskeget (Miller, 1896)
1965	high peak
1970-1973	monthly trapping by Tamarin indicates 24 mice/2-acre plot is a low population; and 75 mice/2-acre plot is a high one
1972	high peak
Jan. 1973	40 to 55 mice/2-acre plot

Present Distribution: Known only from Muskeget Island, a 307-acre island located 5 miles from Nantucket Island and 17 miles from Cape Cod. Maximum elevation is 20 feet, length 1 1/3 miles, width 1/2 mile. Muskeget Island has about 250 acres of grassy dunes which mice inhabit. The rest is marshy land or freshwater ponds. Species is recently derived from Microtus pennsylvanicus stock (Maurer, 1969); and is possibly a relic species once inhabiting a sand plain (now vanished) from New Jersey to Newfoundland (Starrett, 1958).

Note: Muskeget Island is half owned privately by Mr. Crocker Snow, a conservationist, of Boston; and half owned by the town of Nantucket since 1895. It has two cabins on it, 1 boat house, a shellfish warden camp, and 1 tiny airstrip. Visitation is sporadic from fishermen, waterfowl hunters and casual visitors. No permanent inhabitants.

Status: Rare, according to USDI classification. Probably not in danger of extinction unless cats or other predators are introduced, beach buggies are imported, and/or Herring and Black-backed Gulls continue population explosion.

Reasons for Decline:

1. Exposure to elements (burrows are difficult to make in loose sand) and to hurricanes which could inundate island.

2. Predation by feral cats, Short-eared Owls, possibly Marsh Hawks.

3. Loss of grassy habitat from Herring and Black-backed Gulls. Since gulls are undergoing a population explosion due to the abundance of human garbage as winter food, this constitutes a serious erosion factor. An estimated 24,000 Herring and Black-backed Gulls occur on Muskeget Island, making it the largest breeding colony in U.S.A.

4. If allowed, damage may occur along dunes from people and vehicles.

5. Ditching marshes for mosquito control harms estuarine ecology.

Protective Measures Proposed:

1. Make refuge for mice as well as terns.

2. Eliminate introduced dogs and cats or other feral predators of mice. (Gulls are not thought to prey on mice except rarely).

3. Discourage or decrease huge gull colony on Muskeget.

4. Replant and protect existing perennial grasses both for habitat and for mouse food.

5. Prohibit all beach vehicles and other motorized transportation on island.

6. Educate people who visit island about this rare and unique species.

7. Protect from researchers who may overdo collecting.

Ecological Significance and General Values:

1. A unique genetic strain of tremendous scientific interest for evolutionary, ecological and behavioral studies. There is no way to reduplicate the rapid genetic changes which have produced this species on this isolated geographical area.

References: (personal communication)

1. Dr. Garrett C. Clough, University College, Univ. of Rhode Island, Kingston, R.I. 02881.

2. Dr. Robert Tamarin, Dept. Biology, Boston University, Boston, Massachusetts. (617) 353-2462.

3. Dr. K. K. Weatherbee. Unit Leader. Massachusetts Cooperative Wildlife Unit, Univ. of Massachusetts, Amherst, Massachusetts.

Literature:

1. Maurer, F. W., Jr. 1969. Variation of the Plasma transferrin protein in the Meadow Vole, Microtus pennsylvanicus. American Midland Naturalist 82(2):471-489.

2. Miller, G. S., Jr. 1896. The beach mouse of Muskeget Island. Proc. Boston Society Natural History 27:75-87.

3. Starrett, A. 1958. Insular variation in mice of the Microtus pennsylvanicus group in southeastern Massachusetts. Dissert. Abstr.; 19:917.

4. Weatherbee, D., R. Coppinger, and R. Walsh. 1972. Time lapse ecology, Muskeget Island, Nantucket, Massachusetts. MSS Information Corp., 19 East 48th Street, New York.

EASTERN PANTHER — Felis concolor cougari

Order: CARNIVORA — Family: FELIDAE

Estimated Numbers: Unknown, very few. Considered extirpated from northeastern U.S.A. until recently when repeated sightings have been made. Refer to information held by Dr. Nowak, Dr. Wright and Dr. Paradiso.

Present Distribution: From North Carolina north the Eastern Panther is not generally found on the Atlantic coastal plain. Sightings from Virginia, Pennsylvania, New York, Massachusetts, Vermont, New Hampshire, and Maine are almost all from inland piedmont and mountain areas. Those on coastal plain include the following:

Maine - doubtful if would be found along coast, but wild area between Rt. 2 and Rt. 1 and Canadian border (2,000+ square miles) might be good habitat.

Attachment 16-2

RARE, ENDANGERED, THREATENED AND PERIPHERAL WILDLIFE AND FISH OF THE MAINE COAST

BY

ANNE LaBASTILLE, Ph.D.

Submitted to Reed and D'Andrea for inclusion in "Conservation Priorities Plan of the Coast of Maine", unpublished draft, 1973.

Ecology Program
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Washington, D. C.

January 29, 1973

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G. Organochlorine and Heavy Metal Residues in Bald Eagle Eggs by Krantz, Mulhern, Bagley, Sprunt, Ligas and Robertson

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RARE AND ENDANGERED SPECIES OF WILDLIFE AND FISH ON THE COAST OF MAINE

This report summarizes much of the existing and current information on rare and endangered species of fish, amphibians, reptiles, birds and mammals which occur on the coastal plain of Maine. Included are species which are recognized on the U. S. Department of Interior's federal registry of endangered animals; but also species which are apparently experiencing rapid depletion in numbers and may be threatened. The data presented cover estimates of existing numbers, distributions, the ecological importance, and threats to existence. This information is presented in much the same form as the U. S. Dept. of Interior's Redbook, "Rare and Endangered Fish and Wildlife of the U. S., " 1970 (Rev.), and the International Union for Conservation of Nature and Natural Resources (I.U.C.N.), Red Data Books.

Generally speaking, there are few rare, endangered, or threatened species of fish and wildlife along the Maine Coast. Those that occur there are dependent in part on the presence of natural and undisturbed habitats, and also on the broader aspect of uncontaminated environmental conditions. This is particularly important to fishes spawning or occurring in estuaries and rivers which may be grossly polluted; and to birds of prey dependent on a long food chain which may be contaminated by persistent chemicals. A strong case to acquire natural areas may be built around the Northern Bald Eagle which still occurs and breeds in limited numbers in Maine, especially along the coast.

List of Species Included in Report and Current Status

Species Name	Status U.S.D.I.	Status I.U.C.N.	Other
FISH			
Atlantic Sturgeon		2(a)	Threatened (Miller, 1972)
Atlantic Salmon			Threatened (Miller, 1972)
Sunapee Trout	Rare		Threatened (Miller, 1972)
AMPHIBIANS			
None			
REPTILES			
None			

Species Name	Status U.S.D.I.	Status I.U.C.N.	Other
BIRDS			
Osprey			Threatened (see ref. on sheets)
Bald Eagle, northern			Threatened (see ref.)
Peregrine Falcon			
Arctic	Endangered		
American	Endangered	2(b)P**	
Terns			
Roseate			Depleted (see ref.)
Common			Depleted (see ref.)
Least			Depleted & Peripheral
Arctic			
Ipswich Sparrow	Rare	2(a)P*	
MAMMALS			
Gray Seal			Peripheral & somewhat depleted

Key to Classification on List

(a) = full species
(b) = subspecies
P = legally protected
*** = denote species of subspecies critically endangered
1 = endangered
2 = rare

References to List

Miller, R. R., 1972. Threatened freshwater fishes of the United States. Trans. Amer. Fish. Soc., vol. 101 (2): 239-252.

U.S.D.I., 1970 (Rev.), (to be revised in 1973). Rare and endangered fish and wildlife of the United States. Office of Endangered Species, Washington, D. C.

I.U.C.N., 1971 (Rev.) Red Data Books, vol. 1-4: (Pisces, Amphibia and Reptilia, Aves, Mammalia) Morges 1110, Switzerland.

ATLANTIC STURGEON - Acipenser oxyrhynchus

Order: Acipenseriformes Family: Acipenseridae

Estimated Numbers: Several hundred (Dow, 1973)

Present Distribution in Maine: Chiefly found in Kennebec River almost as far up as Augusta dam, and in mouth and estuary; also in Merrymeeting Bay (Dow, 1973). Atlantic Sturgeon is still fished commercially in the St. Lawrence River, but has not been fished commercially in Maine for about 70 years. Only a few White Russian emigrants (1908) exploit this fishery and catch an unknown number (Meister, 1973). Occasional sturgeons are taken by smelt fishermen in bag nets (5 to 7 pound class); by ice fishermen with hook and line; and rarely in sample gill nets used for testing fish populations.

Status: Considered Rare and Endangered (Meister, 1973). Uncommon in Maine. Largest size known probably 300+ pounds and 5 to 6 ft. long (Raney, 1973); probably a relic population of fish left since pre-Colonial days.

Reasons for decline:

1. Pollution of rivers and estuaries.
2. Man-made obstructions to spawning grounds. Sturgeon, because of size, do not use fish-ways easily, or at all.

Protective measures taken: Nothing done directly for this species at this time (Hatch, 1973).

Protective measures proposed:

1. Abatement of water pollution will benefit species.
2. Procurement of funds and personnel to establish improved fish passage facilities to increase spawning.
3. Control of stream flow and fluctuation.
4. Protection and acquisition of any existing spawning streams.
5. Elimination of man-made obstructions where and if possible along spawning rivers.

Ecological importance and general values:

1. Adds to diversity of anadromous fish fauna and to estuarine, ocean and river ecosystems.
2. Excellent food fish for humans.
3. Recreational opportunity for fishermen.
4. Commercial opportunity for commercial fishermen.
5. Living specimens for aquaria.
6. Aesthetic pleasure of large, powerful fish.
7. Maintain gene pool for potential future values of fisheries.

References: (personal communication)

Mr. Robert Dow, Research Director, Dept. Sea & Shore Fisheries, State House Annex, Augusta, Maine (207) 289-2291.

Mr. Alfred Meister, Dept. Inland Fish & Game, Idaho Ave., Bangor, Me. (207) 947-8627. (also) c/o Maine Sea Run Atlantic Salmon Commission.

Dr. Edward Raney, Ichthyological Associates, 301 Forest Dr., Ithaca, N. Y. (607) 272-2455.

Dr. Richard Hatch, Unit Leader, Maine Cooperative Fishery Unit, University of Maine, Orono, Maine 04473.

ATLANTIC SALMON - Salmo salar

Order: Salmoniformes Family: Salmonidae

Estimated Numbers: Possibly 5000+ fish in Maine.

Present Distribution in Maine: Found in at least 8 major coastal drainages plus several smaller drainages and probably will reoccur in 1973 in 1 restored drainage (Meister, 1973) (Bond, 1973).

(In order North to South)

1. St. Croix River plus 2 tributaries and estuary: (polluted)

   annual run = 100
   rod catch = ?

2. Dennys River:

   annual run = 500 to 600
   rod catch = 50 to 60/year

3. East Machias River

   annual run = 200 to 300
   rod catch = 40/year

4. Machias River

   annual run = 300 to 500
   rod catch = 60 to 70/year
   (in 1948 = 0)

5. Pleasant River (small watershed)

   annual run = (no count)
   rod catch = 100/year

6. Narraguagus River

   annual run = 500 (incomplete count)
   rod catch = 70 to 80/year

7. Union River (restoration program)

   annual run = 0, expect first adults in 1973
   rod catch = 0

8. Pennobscot River (polluted but gradually restoring through $1 million anadromous fish program)

   annual run = 300 (1972) to 500
   rod catch =
   once a huge commercial fishery here 1955-65 = 0; 1967 began stocking = 12

9. Sheepscot River

   annual run = 300 to 400
   rod catch = 40 to 50/year

10. Smaller streams with watersheds under 50 square miles and small self-sustaining populations

    total annual run = 500+
    rod catch = ?

11. Kennebec River and tributaries - very few and only when water and O_2 content suitable

Misc. Note: rod catch reports from anglers generally reflect 17% of the annual ascending run in numbers of salmon. There is no compulsory reporting. Fishermen are allowed 2 fish/day, April - September 15.

Status: Considered rare and peripheral only in USA, but not considered endangered (Meister, 1973). Species is still found in Quebec, Labrador, Greenland, Norway, etc. Even in earlier pristine conditions, Atlantic Salmon were rare in northeastern USA, and are now rare in Maine due to human development and disturbances and pollution.

Reasons for decline:

1. Pollution of rivers and estuaries.
2. Dams and obstructions on spawning rivers.
3. Overfishing on the high seas (Davis Strait between Canada and Greenland and the Newfoundland fisheries) by foreign countries.

Protective measures taken and proposed:

1. Water pollution abatement.
2. Dam removal.
3. Anadromous fish programs for propagation, restocking and increasing spawning (millions of dollars being spent in U.S. and Canada).
4. Continued fishery research.
5. International cooperation in quota system among countries fishing for Atlantic Salmon.
6. Careful season and catch limits among Maine anglers.
7. New Atlantic Salmon hatchery at Green Lake which will double number of smolt-sized fish available for annual restocking.

Ecological Importance and General Values:

1. Adds to diversity of anadromous fish fauna and to estuarine, ocean and river ecosystems.
2. Excellent food fish for humans.

3. Recreational opportunity for fishermen.

4. Commercial opportunity for commercial fishermen.

5. Living specimens for aquaria.

6. Aesthetic splendor of spawning salmon leaping upstream.

7. Maintain gene pool for potential future values of fisheries.

References: (personal communication)

Mr. Robert Dow, Research Director, Dept. Sea & Shore Fisheries, State House Annex, Augusta, Maine (207) 289-2291.

Mr. Alfred Meister, Dept. Inland Fish & Game, Idaho Ave., Bangor, Me. (207) 947-8627. (also) c/o Maine Sea Run Atlantic Salmon Commission.

Dr. Edward Raney, Ichthyological Associates, 301 Forest Dr., Ithaca, N. Y. (607) 272-2455.

Dr. Richard Hatch, Unit Leader, Maine Cooperative Fishery Unit, University of Maine, Orono, Maine 04473.

Mr. L. Bond, Dept. Inland Fish and Game, 34 Idaho Ave., Bangor, Me. (207) 289-3651.

SUNAPEE, OR GOLDEN TROUT - Salvelinus alpinus aureolus

Order: Salmoniformes Family: Salmonidae

Estimated Numbers: 9,000± (Kircheis, 1972)

Floods Pond, Otis, Hancock Co. = 5,000+
Coffee Pond, Casco, Cumberland Co. introduced = 2,000±
Upper South Branch Pond, T5 R9, Piscataquis Co. (introduced) = 1,000±
Lower Piscataquis Co. (introduced) = 1,000±
±100,000 eggs in hatcheries as security (Meister, 1973)
35,000 will be released as fry in fall 1973 (Kircheis, 1972)

Distribution in Maine: as above

Status: Rare. Exists in hybrid form in all original waters where not extinct except Floods Pond where thrives in its original form.

Reasons for decline:

1. Extensive hybridization occurred after introductions of other chars to the native waters of these species.

Protective measures taken:

1. Experimental rearing of species in hatcheries (as above).

2. Extending range of native species into several deep-water ponds reclaimed specifically for this purpose.

3. Efforts to prevent future introduction of and hybridization with lake trout Salvelinus namaycush and others in lakes where stocked.

4. Flood's Pond closed to fishing as a public water supply of Bangor; a 5 fish limit and 12" minimum size limit in effect on other waters.

Misc. Note: Traditional way of fishing for Sunapee Trout by anglers was with lobstermeat, and this is now too expensive to buy for bait.

Protective measures proposed:

1. As above.

2. Continued research and surveillance of ponds where introduced so as to monitor success or failure of project.

Ecological Importance and General Values:

1. One of the most beautiful of our native fishes.

2. Recreational enjoyment by fishermen.

3. A "trophy" fish and relic of the glacial period in Maine, therefore of possible evolutionary importance and gene pool.

References: (personal communication)

Frederick W. Kircheis, Research Biologist, Maine Department Inland Fish and Game, 34 Idaho Avenue, Bangor, Maine.

BALD EAGLE, NORTHERN - Hallaeetus leucocephalus alascanus

Order: Falconiformes Family: Accipitridae

Estimated Numbers: No more than 100 of all ages and sexes (Gramlich, 1973) 40 breeding pairs in Maine (National Audubon, 1972).

Present Distribution: A total of 32 active nests have been positively identified by Gramlich, Snow, and Wright (1972) during their aerial inventory, April through June, 1972, in Maine. They estimate a total of 40 active nests in the entire state. The majority (22 or more) are found along coastal estuaries and islands.

*For exact locations, contact should be made with:

Francis Gramlich
Bureau of Sport Fisheries & Wildlife
40 Western Avenue
Augusta, Maine
(207) 622-6171

*Census figures, maps and information are available, but only in person at his office.

At present, Maine is the only state north of the Chesapeake Bay (southern subspecies) area where eagles are breeding and nesting in any numbers along the Atlantic coast. 8 to 10 individuals are known at Mt. Desert Isl., (Douglas, 1972) plus a few individuals in vicinity of Whiting and Perry, Me.

Status: Not presently listed as rare or endangered; however, the subspecies appears threatened and depleted and is evoking considerable concern.

Reasons for decline:

1. Encroaching civilization and disturbance, especially the development of inland lakes and coastal areas for "vacation" homes, often utilizing nesting habitat of eagles; and construction of highways.

2. High use of pesticides and environmental contamination. Maine has high levels of DDT, DDD, DDE, Dieldrin, and PCB's in eagle eggs as compared with Alaska, Michigan, Minnesota, Florida eggs. (See literature references at end). In the 1960's DDT was used on Maine forests to control spruce budworm. Decline in eggshell thickness - Maine eggs 3 to 20% thinner than pre-1946 norms (see literature references).

3. Decreased reproductive success. According to Gramlich (1973), of 13 eggs found in 1972, 8 young hatched and 5 fledged. Wright (1972) reports 1.0 young/successful nest and 0.26 young/active nest. This suggests that reduction is due to the almost total lack of production from certain pairs of eagles. Along the coast, only 1 young produced/20 active nests on average.

4. High mortality due to gun shot wounds and irresponsible shooting despite federal laws to protect species. Three eagles were killed by gunshot in 1971; two eagles were killed by gunshot in 1972.

5. Less abundant food supply, due to decrease in the migratory fish population in polluted waterways.

6. Electrocution on power lines.

Protective measures taken:

1. The Bald Eagle (both subspecies) are protected by Federal law. In addition, in Maine, cooperative agreements are being made with landowners for sites where eagle nests are located to be treated as sanctuaries. Maine also has $500 reward to turn in eagle killers.

2. Intensive investigations into pesticide and other chemical contamination of eagles and eagle eggs, biology, distribution, behavior, etc., are being conducted by the Bureau of Sport Fisheries and Wildlife of U.S.D.I., the National Audubon Society, Patuxent Wildlife Research Center, etc.

3. Censusing made annually by Bureau of Sport Fisheries and Wildlife in Maine, with Maine Audubon Society and Fish and Wildlife Service personnel.

Protective measures proposed:

1. Continue protecting and acquiring of all known nest sites as sanctuaries.

2. Control and investigate effects of persistent pesticides and other limiting factors.

3. Increased public education and involvement.

4. Continue to expand research on breeding success and failure, and captive rearing programs.

5. Increase enforcement against shooting birds of prey.

6. Water pollution abatement.

Ecological Significance and General Values:

1. U.S. National symbol - with all the accompanying traditional cultural, aesthetic, historical, symbolic, and inspirational qualities which this bird is imbued with.

2. Important indicator species to monitor effects of pesticides and other environmental contaminants.

3. Predation and maintaining health of prey populations.

4. Bird-watching as a popular recreation.

5. Political expediency to "save" species.

Pertinent Literature:

Pesticide Monitoring Jnl. - "Organochlorine and heavy metal residues in Bald Eagle eggs, " by W. C. Krantz, et al. 1970. Vol. 3(3):136-140. "Residues of organochlorine pesticides, polychlorinated biphenyls, and mercury in Bald Eagle eggs and changes in shell thickness - 1969 and 1970." 1972. Vol. 6(1):50-55.

Maine Fish and Game Magazine, article in winter issue, 1972-73.

National Audubon Society Bald Eagle Studies - 1960-1966 - Research Department, Tavernier, Florida.

References: (personal communication)

Gramlich, F. 1973. (see address given above)

Wright, Linda, Research biologist. 1972. Maine Audubon Society, 57 Baxter Blvd., Portland, Me.

Snow, William, pilot and game mgt. agent, U. S. Bureau of Sport Fisheries and Wildlife, Federal Building, Augusta, Me. 04106 (207) 622-6171

Anderson, Richard, Director, Maine Audubon Society, 57 Baxter Blvd., Portland, Me.

Douglas, Will. F. 1972. Park Naturalist, Acadia National Park, Rt. 1, Box 1, Bar Harbor, Me. 04609

AMERICAN OSPREY - Pandion haliaetus

Order: Falconiformes Family: Pandionidae

Estimated Numbers: several hundred.

Present distribution: Along Maine coast where suitable habitat and nest sites still occur. Moosehorn National Wildlife Refuge reports 10 Ospreys at peak use. For several key locations and exact nest sites, contact should be made with:

Mr. William Snow, pilot and game management agent
Bureau Sport Fisheries and Wildlife
Federal Building - Box 800
Augusta, Maine 04106
(207) 622-6173

Also see Drury and/or Nisbet, 1971, Seabird Censuses - Mass. Audubon Society, Lincoln, Mass. (617) 259-9500

Status: Still fairly common and not presently classified as rare or endangered, but increasingly declining and probably threatened.

Reasons for decline:

1. Accumulation and contamination by pesticides same as occurs in Bald Eagles.

2. An annual production of 1.22-1.30 young per female of breeding age is necessary, at least in N.Y., N.J. and Florida populations of Ospreys to maintain populations (Henny and Ogden, 1970). When applied to Maine populations, only 0.38 young per female was fledged per active nest (Kury, 1966), thus giving an estimated decline annually of 12-13% in Maine. Hickey (1969:68) reported that the Osprey will probably be wiped out shortly from N.J. to Maine.

3. Less food supply due to pollution of waterways.

4. High mortality rate among fledglings during 1st month, and immature birds during first year of life. Rates of survival for the first year ranged from 48.5% to 42.7% (Henny and Wight, 1969).

5. Encroaching civilization and disturbance around Osprey nesting sites, (same as for Bald Eagle) especially increased numbers and usage of boats.

Protective Measures Taken and Proposed:

1. Protected by Federal law and state law.

2. Research on-going at Patuxant Wildlife Research Center and other laboratories towards effects of pesticides and other environmental contaminants on Osprey reporduction and productivity.

3. Installation of artificial nest stands.

4. Abatement of water pollution.

Ecological significance and general values:

1. Aesthetic value as fine bird of prey.

2. Important indicator species to monitor effects of pesticides and other environmental contaminants.

3. Predation and maintaining health of prey populations.

4. Bird-watching as a popular recreation.

Literature:

Proceedings of 1st Conference on Status of North American Osprey. (due in summer 1973).

Dr. W. Byrd, Dept. Biol. College of William and Mary, Williamsburg, Va. 23185.

Henny, D. J. & H. M. Wight. 1969. An endangered osprey population: estimates of mortality and production.

Henny, C. J. & J. C. Ogden. 1970. Estimated status of Osprey populations in the United States. J. Wildlife Mgt. 34(1): 214-217.

Kury, C. R. 1966. Osprey nesting survey. Wilson Bull. 78 (4):470.

Peterson, R. T. 1969. Population trends of Ospreys in the northeastern U.S. pp. 332-337. In J. J. Hickey (Editor) Peregrine Falcon Populations: Their biology and decline, Univ. of Wisc. Press, Madison, Wisc. 596 pp.

References: (personal communication)

William Snow - address as above

Stan Weimeyer, Research Biologist
Patuxent Wildlife Research Lab.
Laurel, Maryland

Mr. Robert Watson, Jr. (possible graduate student working on osprey)
560 Concord Ave.
Belmont, Mass. 02178

PEREGRINE FALCON - Falco peregrinus anatum
Falco peregrinus tundrius

Order: Falconiformes Family: Falconidae

Estimated Numbers: Unknown, but probably only scattered individuals of Falco peregrinus tundrius migrating through Maine.

Present Distribution: No special sites used annually; however migrants seem to prefer outer coastal islands, the farther from shore, the better. Matinicus Rock is a good site - 1 to 5 Peregrines seen here during migration (Nisbet, 1973). 1 bird seen attacking terns at Wells Harbor in 1971 (Patrick Grace, Me. Audubon Soc.). Not one single active breeding pair of Falco peregrinus anatum anywhere in the eastern U.S. (east of Rocky Mts.) (Cade, 1972).

Status: Both subspecies endangered (southern) F. p. anatum declining drastically and extirpated as breeding bird east of Rockies; (arctic) F. p. tundrius no appreciable decline in migrants along Atlantic coast (Ruos, 1970); however, significant thinning of eggshells (Hickey, et al. 1969).

Reasons for decline:

1. Breeding failure - all field and laboratory evidence points to accumulated effects of pesticides which are reducing reproduction and increasing adult mortality. Eggs are becoming thin-shelled or are otherwise nonviable (see literature references).

2. Shooting of migrants.

3. Encroaching civilization and disturbance of nesting areas.

4. Formerly occasional robbing of nests or eggs and young by collectors and falconers.

5. Severe weather conditions may affect reproduction and possibly young.

6. Trichomoniasis and botulism diseases occurring in the wild population.

Protective Measures Taken:

1. Protected by federal and state laws.

2. Captive rearing and breeding projects around the country (Patuxent Wildlife Research Center, Cornell University Lab. of Ornithology, etc.) to promote survival of the species.

3. Habitat protection of known nest sites.

4. A cooperative program between the Canadian Wildlife Service and United States agencies may produce beneficial results for falcons.

5. Continued pesticide monitoring and surveillance of known peregrine populations.

6. Maintenance of scientific working relations with falconers who are concerned with the peregrine falcon.

Protective Measures Proposed:

1. Protection of barrier beaches and coastal islands where migrating falcons may find safety.

2. Continue censusing and searching for migrants and active nest sites.

3. Cease using persistent pesticides.

4. Encourage diplomatic agreements and international patrol with Canada, Denmark, Greenland, etc., toward regulating and protecting their peregrine populations.

Ecological Importance and General Values:

1. Aesthetic appeal as magnificent bird of prey.

2. Important indicator species to monitor effects of pesticides and other environmental contaminants.

3. Predation and maintaining health of prey populations.

4. Bird-watching as a popular recreation.

5. Traditional and historical use by falconers as trained hunting bird.

References: (personal communication)

Dr. Tom Cade, Lab of Ornithology, or Div. of Ecology and Systematics, Langmuir Lab, Cornell Univ., Ithaca, N.Y. 14850

Mr. Jim Ruos, Research Biologist, Patuxent Wildlife Research Lab, Laurel, Md.

Raptor Research Foundation, Inc., c/o Dept. Biology, Univ. So. Dak., Vermillion, S.D. 57069

Dr. Ian Nisbet, Biologist, Mass. Audubon Soc.
Lincoln, Mass. (617) 259-9500

Literature References:

Fish and Wildlife Legislation, Pt. 2, 92nd Congress, Hearings of Subcommittee on Fish and Wildlife Conservation: Hawks, Owls, Eagles, 792-14. Sept. 1971. "Trends in Populations of Raptors in No. America."

Hickey, J. J. (Editor) 1969. Peregrine falcon populations, their biology and decline. University of Wisc. Press, Madison, Wisc. 596 pp.

Shor, W. 1970. Banding recoveries of Arctic migrant peregrines of the Atlantic coast and Greenland populations. Raptor Research News 4(4): 125-127.

Cade, T. & R. Fife 1970. The No. Amer. peregrine survey, 1970. Canadian Field Naturalist 84:231-245.

COMMON TERN - Sterna hirundo

ARCTIC TERN - Sterna paradisaea

ROSEATE TERN - Sterna Dougallii

LEAST TERN - Sterna albifrons

Order: Charadriformes Family: Sterninae

Estimated Numbers: Common = 3,000+
Arctic = 8,000 to 1,000±
Roseate = 260
Least = 70 to 80
(based on censuses by Drury and/or Nisbet, 1971, and information from Maine Audubon Society)

Present Distribution: For Common, Arctic and Roseate Terns, see 1971 Seabird censuses by Drury and/or Nisbet, Massachusetts Audubon Society. Essentially the same number in 1972, although breeding success dropped. For Least Terns, only two known nesting colonies in Maine, both of recent origin (last 10 years). One near Scarborough town on Pine Point was unproductive in 1972, due to housing development which caused disturbances to birds. The other is found at Wells Harbor. Seventy birds were counted in July, 1972, and a total of 53 nest sites discovered. Of these, 45 were completed and 32 were used for incubation of eggs. (Patrick Grace, report for Maine Audubon Society). There may have been a total of 100 birds nesting (Packard, 1973). These colonies of Least Terns are in precarious and peripheral condition in Maine. The Wells Harbor population nests on a Soil Conservation Service stabilization area (landfill) and is protected, but Pine Point is threatened.

Status: None are considered rare or endangered; however, several species of Terns have experienced a long, steady decline and are showing deformities in young more recently.

Reasons for Decline:

1. Encroachment by human developments and recreational uses: vacation homes, beach hotels and condominiums, resort use, dune buggies, beach drag racing, picnickers and domestic pets, camp grounds, coastal stabilization bulwarks, groins, and seawalls.

2. Increase in numbers of Herring and Blackbacked Gulls taking over beaches for breeding where Terns had nest sites. Increase because of water pollution and garbage dumps supplying extra winter food to gulls. (See graph)

3. Washed-out nests and damage from severe sea storms (wind, waves, blowing sand, etc.)

4. Change of nesting locations because of above pressures to places where Terns are threatened by human disturbance, pollution, predation, decreased food supply, etc.

5. Possible recent increase of deformities in young (Hayes and Risebrough, 1972). (see literature attached)

6. In Maine, where gull control programs were in effect (Matinicus Rock and Petit Manan), nests averaged 1.0 chick/pair of Terns. When stopped in 1972, breeding success dropped to 0.2 chicks/ pair of terns.

Protective Measures Taken or Proposed:

1. Gull control programs on threatened seabird islands and coastal beaches.

2. Protect and acquire all possible sand bars, river mouths, estuary areas and barrier beaches where Terns nest.

3. Place volunteers on site of Tern nests during breeding season to watch over them and prevent disturbance or crushing by passers-by.

4. Monitor Tern breeding success and check for abnormalities and deformities in chicks caused possibly by pesticides (Hayes, 1972, pers. comm.)

Ecological Importance and General Values:

1. Use as quality indicators for the marine environment--responses to changes in feeding areas, nest sites, contaminants, other stresses.

2. Maintain diversity and stability of marine coastal avifauna.

3. Aesthetic appeal and artistic beauty of Terns.

4. Guano useful as nutrient fertilizers and natural enrichment where deposited in sea or on beaches.

5. Predation and maintenance of healthy fish populations.

References: (personal communication)

Mr. Chris Packard, (Editor, Maine Nature), Box 509, Brunswick, Maine.

Dr. Ian Nisbet, Associate Director, Scientific Staff, Massachusetts Audubon Society, Lincoln, Massachusetts 01733. (617) 259-9500

Dr. Drury, Biologist, (as above)

Ms. Helen Hayes, Researcher, Division of Birds, American Museum of Natural History, 79th Street and Central Park West, New York, New York.

Dr. H. Mendall, Unit Leader, Cooperative Wildlife Research Unit, University of Maine, Orono, Maine.

Literature:

Report on Seabirds - due early in 1973 - by Nisbet and Drury, Mass. Audubon Society.

Packard, C. M. 1970. Maine's Seabird Nesting Colonies. Maine Fish and Game, Winter, 1969-70:16-19.

Hayes, H. and R. W. Risebrough. 1971. The early warning of the Terns. Natural History, Vol. 80(9):39-46.

Hayes, H. and R. W. Risebrough. 1972. Pollutant Concentrations in Abnormal Young Terns from Long Island Sound. Auk, Vol. 89(1): 19-35.

IPSWICH SPARROW - Passerculus princeps

Order: Passeriformes Family: Emberizidae

Estimated Numbers: Unknown in Maine; probably only a few individuals or paired migrants passing along coast. McLaren (1968) estimated 4,000 adult birds nesting on Sable Island, Canada, in 1967; and 2,400 in 1971 (MacLaren, 1973). Population fluctuates and has been on increase along coast during last 5 years. No real evidence that species is declining.

Present Distribution: May occur almost anywhere along Maine Coast where dunes, beaches and patches of rocks and grass occur in undisturbed state, usually in fall and spring migration plus occasional winter sightings. The following locations of sightings have been taken from Maine Nature, (Audubon Field Notes) American Birds, and Maine Audubon field notes.

1972 - Kittery Point, Maine - 2 unknown - October
1972 - Clam Harbor - 2 females - June
1971 - Seabrook, New Hampshire, near Kittery, Maine - 12 mixed - Nov.
1970 - Smutty Nose Island - 3 unknown - Oct.
Biddeford Pool - 1 unknown - Oct.
Kittery Pt. - 1 unknown - Oct.
1969 - Reid State Park - 1 unknown - ?
Popham State Park - 1 unknown - ?
Oakland - 1 pair - ?
1968 -
1967 - Scarborough - 1 unknown - April
Kittery Pt. - 2 - April
Kittery Pt. - 2 - ?

1966 - Vinal Haven Island - 1 unknown - ?
1965 - York - 1 unknown - Nov.

Status: Rare - only seen once or twice a year during fall migration. No real evidence that population is drastically decreasing (MacLaren, 1973); however, Maine bird-watchers report gradual decrease over last 25 years.

Reasons for decline:

1. Decrease in the size of only breeding site which is Sable Island, Nova Scotia, Can., because of erosion from sea and wind.

2. Winter habitat from Maine to Georgia is decreasing along coast due to human development, especially real estate.

Protective measures taken:

1. Establishment of several national wildlife refuges (south of Maine) along Atlantic coast, and additional national seashore parks and private preservation of natural sand dunes, Spartino marshes and beaches will assure continuation of wintering habitat for the species.

Protective measures proposed:

1. Need more coastal refuges; however, Ipswich Sparrow does not overwinter in Maine except very occasionally.

2. Closer cooperation with Canadian Government in management and conservation.

Literature:

Stubb, W. T. & I. A. McLaren, 1971. Late-winter distribution of the Ipswich Sparrow. American Birds, vol. 26(b); 941-944.

Ecological Importance and General Values:

1. Diversity of coastal avifauna.

2. Recreation by bird-watching.

3. Unique specimens for museums and zoos.

4. Opportunity for research in behavioral studies, taxonomic comparisons, and evolutionary trends.

5. Maintenance of gene pool.

6. Another reason for preserving coastal areas in natural state.

References:

Dr. Ian MacLaren, Dept. Biol., Dalhousie University, Halifax, Nova Scotia

Dr. D. Huntington, Dept. Biology, Bowdoin College, Brunswick, Me. (207) 725-8731, ext. 584

Mr. Richard Anderson, Research Div., Maine Audubon Soc., Baxter Blvd., Portland, Me.

Mr. Chris Packard, Box 509, Brunswick, Me. 04011 (Editor of Maine Nature), (207) 729-3832

GRAY SEAL - Halichoerus grypus

Order: Pinnipedia Family: Phocidae

Estimated Numbers: Approximately 100± (Richardson, 1973)

Present Distribution: The gray seal inhabits temperate waters of the North Atlantic, and is relatively common north of Maine (Nova Scotia, European coast, etc.). Its presence in Maine (&Massachusetts, about 25 resident seals) represent peripheral southerly animals. In pre-colonial times, gray seals were apparently more common and had a more extensive range, judging from bones found in Indian middens and from fossil deposits along the Atlantic coast, namely from Mt. Desert, LaMaine, and Calf Island in Maine. Presently Gray Seals occur in Maine from Casco Bay East to Grand Manan, New Brunswick, on the following islands and coastal areas:

Minergreen Island, Casco Bay - 1
MeLinic Green Island, near Penobscot Bay - 4
Brig Ledge Matinicus, Penobscot Bay - 1
Green Island Seal Ledge, Penobscot Bay - 5
Seal Island, Penobscot Bay - 1
Black Ledge, near Swan's Island - 4
Spirit Ledge, near Swan's Island - 1
Long Ledge, Casco Passage, Jericho Bay - Blue Hill Bay - 2
John Island Dry Ledges, near Swan's Island - 20
Dry Money Ledge, near Johns Island - 1
Swan's Outer Green Island near Swan's Island - 1
Dawes Ledge, Black Island, north of Mt. Desert - 2
Little Duck South of Mt. Desert - 1
Gut Ledges, s.e. of Mt. Desert - 2
East Bunker Ledge, s.e. Mt. Desert - ?
Old Bull and Bar Ledge, Petit Manan

(from letter by Will. Drury, 1972)

In vicinity of Mt. Desert Island, an estimated 40 seals (Richardson, 1973)

Status: Peripheral and scarce.

Reasons for decline: Based on archeological evidence, there has been a decline in Gray Seal numbers and range since Colonial days, but there is no evident reason for this. Possible small limiting factors could include the bounty placed on seals by the State of Mass. until 1962 ($25 each). Also fishermen have traditionally destroyed this species when it destroyed their weirs and nets. Possibly, too, greater use of boats and boating recreation has an effect, plus shooting for fun from boat and plane by indiscriminate "sportsmen."

Protective measures taken:

1. Protection by removing seal bounty in Mass. and enacting legislation in 1965.

2. Increased recent research on species.

Ecological importance and general values:

1. Scientific and aesthetic interest in these animals.

2. Subjects of many books, pictures, etc.

3. Formerly food for coastal Indians.

4. Diversity of marine mammal fauna.

References: (personal communication)

Dr. William Drury, Dir. Scientific Staff, Mass. Audubon Soc., Lincoln, Mass.

Dr. D. Richardson, research biologist, Marine Dept. of Sea & Shore Fisheries, c/o Wiscassett, Maine (207) 882-6824

Ms. Valerie Schurman, 20 Louisville Square, Boston, Mass. (617) 723-6578

UNIQUE PERIPHERAL NON-ENDANGERED SPECIES IN MAINE

Atlantic Puffin -

Only 1 colony in USA on Matinicus Rock, Maine, estimated at betwen 30 to 172 individuals (seabird census from Drury and/or Nisbet, 1971).

Razorbill -

6 to 27 pairs known only on Matinicus Rock, Maine (and 10 pairs on Machias Seal Isl., Canada). Species is very vulnerable to oil pollution at sea. (Reference as above).

Herons -

A number of species of herons occur in limited numbers in isolated heronries along the south coast of Maine. The Audubon Naturalists Council of Maine (Box 509, Brunswick, Me.) is keeping an eye out for their status. These heronries should be protected if at all possible. (See seabird count notes by Drury and/or Nisbet, 1971).

Fisher -

Status is undetermined according to Office of Endangered Species, U.S.D.I., and numbers are low. However, species seems to be making a slow comeback in eastern Maine. (A. Nidecker, III, Asst. Refuge Mgr., Moosehorn National Wildlife Refuge, Calais, Me. 04619)

Lynx -

Species also scanty, but making slow comeback over former range in Maine (reference as above).

ADDITIONAL INFORMATION ON OSPREY (Jan. 29, 1973) (from Johnston, 1973)

Estimated Numbers:

Coastal waters - 300 pairs ±
(Inland probably more, possibly 500 pairs)

Distribution: 73 known active nests between Sorrento, Maine, and eastern Casco Bay, Maine; and definitely more than that present but not located.

Status: Still common though exact numbers are unknown. Population may be stable.*

*Henny and VanVelzen, 1972. Migration Patterns and Wintering Localities of American Ospreys. Jnl. Wildlife Mgt. vol. 36(4):1133-1141.

1972 73 active nests known in May, 1972
69 nests with known outcome
0.9 young produced/nesting attempt
= 68 young total produced
2.0 young produced/successful nest

1971 0.95 young produced/nesting attempt

Protective measures: Signs erected in nest areas asking people to remain at distance. People generally seem to be aware of Osprey's plight and do not disturb nests.

Reference: (personal communication)

Mr. James A. M. Johnston
Box 319 York
University of Maine
Orono, Me. 04473
(207) 581-7573

ATTACHMENT 3

ADDENDUM to Rare, Endangered, Threatened and Peripheral Wildlife and Fish of the Maine Coast

Four-toed salamander -

This species has been recorded once for Maine, at Lake Cobbossecontee in Kennebec County (Fowler, 1942). It is rumored to occur in some of the bogs on Mount Desert Island (Lee Davis, Orono, Maine).

Turtles -

Three species of marine turtles, the leatherback, loggerhead, and Atlantic ridley, have been recorded in Maine. Scattergood and Packard (1960) reported 15 authenticated and 15 probable records of leatherbacks and one record each for loggerhead and Atlantic ridley. The leatherback and the Atlantic ridley are on the U.S.D.I. list of endangered species.

Least Terns -

These birds nest in the Webhannet River Marsh, Wells, and on the beach at the mouth of the Morse River, Phippsburg. The latter represents the northern breeding limit of this species. (Bradford Sterl, Ogunquit, Maine, and personal observation).

Ciconiiformes -

A number of species of wading birds occur in isolated heronries along the coast of Maine. Great blue herons and black-crowned night herons are fairly common but breed in only a few locations. Stratton Island (Saco Bay) has a significant population of nesting snowy egrets and possibly some nesting cattle egrets, little blue herons, and glossy ibises as well. Thus this island probably represents the northern breeding limit of these species. These heronries should be protected if at all possible by reducing human intrusion (See Seabird Count Notes by Drury and/or Nisbet, 1971).

Fishers -

For many years a very uncommon species in coastal Maine, the fisher has staged a dramatic comeback beginning in the mid-1950s. Populations along the western coast peaked around the mid-1960s. In the winter of 1962-63 1,100 fisher pelts were tagged in York and Cumberland counties; this is the highest density ever reported anywhere. Populations now seem to have stabilized west of the Penobscot River and are continuing to increase in Hancock and Washington counties (Dr. Coulter, 1973).

Canada lynx -

The range of this species in Maine is confined to the northwestern part of the state. It probably hasn't occurred in the coastal zone in over 20 years (Reference as above).

Whales -

Although none of the larger cetaceans are common in the Gulf of Maine a number of species which are considered endangered have been recorded for the Gulf. These include the finback whale, the humpback whale, and the Atlantic right whale (Peterson, 1966).

Literature:

Coulter, Dr. Malcolm. School of Forest Resources, University of Maine, Orono, Maine 04473.

Fowler, J. A. 1942. Herpetological notes from Lake Cobbosseecontee and vicinity, Kennebec County, Maine. Copeia, 3:185-186.

Peterson, R. L. 1966. The Mammals of Eastern Canada. Oxford University Press, Toronto. 465 pp.

Scattergood, L. W. and C. Packard. 1960. Records of Marine turtles in Maine. Maine Field Naturalist, 16:46-50.

Written by Malcolm Hunter, Jr.
1973