

NEARSHORE WILDLIFE HABITATS AND POPULATIONS  
IN THE NEW YORK/NEW JERSEY HARBOR ESTUARY

by

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## CONTENTS

Introduction.....	1
Concept of urban wildlife resources.....	2
Purpose and limitations of report.....	3
Definitions.....	3
Study area.....	3
Wildlife.....	4
Information.....	5
 Nearshore habitats in the New York/New Jersey Harbor	
Estuary.....	7
Description of the study area.....	7
Geography.....	8
Geology.....	9
Modification of nearshore habitats.....	11
Modifications resulting from port and port- related development.....	11
Modifications resulting from urbanization.....	14
Summary.....	19
Future Trends.....	24
Impacts of physical alteration on nearshore habitats.....	27
 Methods.....	31
Atlas of documented natural areas.....	31
Mapping.....	36
Habitat modification recommendations.....	39
Wildlife populations.....	39
Data.....	39
Bird surveys.....	41
 Results and discussion.....	44
Time frame and data.....	44
Wildlife habitats.....	44
Natural areas.....	44
Parks and open space.....	46
Wildlife populations.....	47
Matrix of wildlife species.....	48
Amphibians and reptiles.....	50
Birds.....	55
Mammals.....	84
Wildlife values.....	86
 Conclusions and recommendations.....	87
Habitat.....	88
Recommendations 1-3.....	88
Habitat modification.....	91
Wildlife populations.....	92

Recommendations 4-8.....	92
Wildlife habitats.....	93
Recommendations 9-16.....	93
People.....	94
Recommendations 18-20.....	94
Wildlife.....	94
Recommendations 21-22.....	94
People.....	95
Recommendations 23-28.....	95
References Cited.....	97
Appendices	
A. List of vertebrate species cited in this report.....	102
B. Atlas of parks and natural areas within the vicinity of the New York/New Jersey Harbor Estuary.....	108
C. Species matrix for birds, mammals, amphibians and reptiles for natural areas within the vicinity of the New York/New Jersey Harbor Estuary .....	182
D. Maps of wetlands and open space in the New York/New Jersey Harbor Estuary.....	251
E. The influence of urban structure and human settlement on birdlife in the New York/New Jersey Harbor Estuary area.....	265
F. A bibliography of the habitats and wildlife within the vicinity of the New York/New Jersey Harbor Estuary.....	298

## FIGURES

1. The New York/New Jersey Harbor Estuary study area.....	6
2. Growth of settled areas of New York City from 1800 through 1934.....	13
3. Growth of human population in the New York/New Jersey metropolitan region.....	17
4. Status of made lands and infilled wetlands as of 1900.....	21
5. Status of made lands and infilled wetlands as of 1966.....	22
6. Status of made lands and infilled wetlands as of 1989.....	23
7. Map of 39 major natural areas for which wildlife habitat and/or population data were obtained.....	32
8. Map of eleven Christmas Bird Count circles whose data were included in the analyses of winter bird populations as described in this report.....	43
9. Population trends from Christmas Bird Counts: Red-throated Loon; Horned Grebe; Northern Gannet; Great Cormorant; Double-crested Cormorant; Great Blue Heron.....	57
10. Population trends from Christmas Bird Counts: Black-crowned Night Heron; Mute Swan; Snow Goose; Brant; Canada Goose; Green-winged Teal.....	58
11. Population trends from Christmas Bird Counts: Black Duck; Mallard; Northern Pintail; Northern Shoveler; Gadwall; American Wigeon.....	59
12. Population trends from Christmas Bird Counts: Canvasback; Redhead; Ring-necked Duck; Greater Scaup; Lesser Scaup; Old Squaw.....	60
13. Population trends from Christmas Bird Count: Black Scoter; Surf Scoter; White-winger Scoter; Common Goldeneye; Bufflehead; Hooded Merganser.....	61
14. Population trends from Christmas Bird Count: Common Merganser; Red-breasted Merganser; Ruddy Duck; Northern Harrier; Red-tailed Hawk; American Kestral.....	62
15. Population trends from Christmas Bird Counts: Ring-necked Pheasant; Ruffed Grouse; Northern Bobwhite; American Coot; Black-bellied Plover; Killdeer.....	63
16. Population trends from Christmas Bird Counts: Ruddy Turnstone; Sanderling; Purple Sandpiper; Dunlin; Laughing Gull; Common Black-headed Gull.....	64
17. Population trends from Christmas Bird Counts: Bonapart's Gull; Ring-billed Gull; Herring Gull; Great Black-backed Gull; Black-legged Kittiwake; Rock Dove.....	65
18. Population trends from Christmas Bird Counts: Monk Parakeet; Short-eared Owl; Downy Woodpecker; Hairy Wood- pecker; Northern Flicker.....	66
19. Population trends from Christmas Bird Counts: Horned Lark; Blue Jay; American Crow; Fish Crow; Black-capped	

	Chickadee; Carolina Chickadee.....	67
20. Population	trends from Christmas Bird Counts: Tufted Titmouse; White-breasted Nuthatch; Golden-crowned Kinglet; American Robin; Northern Mockingbird; Water Pipit....	68
21. Population	trends from Christmas Bird Counts: Cedar Waxwing; European Starling; Yellow-rumped Warbler; Northern Cardinal; American Tree Sparrow; Chipping Sparrow....	69
22. Population	trends from Christmas Bird Counts: Field Sparrow; Savannah Sparrow; Fox Sparrow; Song Sparrow; Swamp Sparrow; White-throated Sparrow.....	70
23. Populations	trends from Christmas Bird Counts: White-crowned Sparrow; Dark-eyed Junco; Lapland Longspur; Snow Bunting; Red-winged Blackbird; Eastern Meadowlark....	71
24. Population	trends from Christmas Bird Counts: Rusty Blackbird; Common Grackle; Brown-headed Cowbird; Purple Finch; House Finch; Common Redpoll.....	72
25. Population	trends from Christmas Bird Counts: Pine Siskin; American Goldfinch; Evening Grosbeak; House Sparrow.....	73
26. Autumn migrating shorebird population trends on Jamaica Bay, NY, 1981-1988: Black-bellied Plovers; Semipalmated Plover; Greater Yellowlegs; Ruddy Turnstone; Red Knot.....		77
27. Autumn migrating shorebird population trends on Jamaica Bay, NY, 1981-1988: Sanderling; Semipalmated Sandpiper; Least Sandpiper; Dunlin; Short-billed Dowitcher.....		78
28. Spring migrating hawk population trends at Sandy Hook, NJ, 1979-1987: Osprey and Northern Harrier.....		79
29. Spring migrating hawk population trends at Sandy Hook, NJ, 1979-1987: Sharp-shinned Hawk and Cooper's Hawk.....		80
30. Spring migrating hawk population trends at Sandy Hook, NJ, 1979-1987: Red-shouldered Hawk and Broad-winged Hawk.....		81
31. Spring migrating hawk population trends at Sandy Hook, NJ, 1979-1987: Red-tailed Hawk and American Kestrel.....		82
32. Spring migrating hawk population trends at Sandy Hook, NJ, 1979-1987: Merlin.....		83

## TABLES

1. Political subdivisions of the New York/New Jersey Harbor Estuary.....	9
2. Demography of the New York/New Jersey Harbor Estuary.....	15
3. Acreage of tidal wetlands loss, New York/New Jersey Harbor Estuary.....	16
4. New York/New Jersey Harbor Estuary tidal marsh and underwater lands landfilled, 1609 to present.....	19
5. Numbers of dwelling units scheduled for construction/completion on the New Jersey shore of the Hudson River.....	25
6. Amount of office space scheduled for construction/completion on the New Jersey shore of the Hudson River.....	25
7. Amount of commercial retail space scheduled for construction/completion on the New Jersey shore of the Hudson River.....	26
8. Key to figure 7 for the 39 natural areas and subsites with geographic coordinates and USGS quadrangles, for which wildlife habitat and/or population data were obtained.....	33
9. US Geological Survey 7 1/2 minute quadrangles included in the study area.....	38
10. Data sets obtained for evaluation of wildlife populations, population trends and habitats within the New York/New Jersey Harbor Estuary.....	40
11. Key to place names, coordinates and survey years for the eleven Christmas Bird Count circles depicted in figure 8.....	42
12. Summary of documented natural areas, specific sites and reported acreages by management authority in the Harbor region.....	45
13. Distribution and size of major park areas in New York City.....	46
14. Park land as a percentage of total land and in relation to population in New York City.....	47
15. Composite list of natural areas by county and number of vertebrate species reported by class.....	49
16. Status summary based on reports by 26 natural areas in the Estuary region for 50 amphibian and reptile species.....	51
17. Total species, average per site, and estimated percent of possible species of amphibians and reptiles as reported for 26 natural areas within the Estuary.....	53
18. Summary of Table 16 area report frequencies depicting the status as extinct/extirpated, rare, uncommon, occasional, present, common, introduced, or established for 50 amphibian and reptile species in 26 natural areas of the Estuary.....	54
19. Bird species richness as a measure of seasonal and annual status for 21 natural areas in New York and New Jersey.....	55

20.	Linear regression probabilities for the 100 most common Christmas Bird Count species in the project area, 1961-1968, taxonomically by trend class.....	74
21.	Summary of the population trends for 100 wintering bird species in the Estuary by feeding strategy.....	75
22.	Summary of autumn migrating shorebird population trends plus minimal and peak years for 11 species observed within the Jamaica Bay National Wildlife Refuge, Brooklyn, 1981-1988.....	76
23.	List of mammal species reported from 31 natural areas in the Estuary, in order of frequency reported.....	85



# NEARSHORE WILDLIFE HABITATS AND POPULATIONS IN THE NEW YORK/NEW JERSEY HARBOR ESTUARY

## INTRODUCTION

by

D. F. Squires and J. S. Barclay

This report is a part of the New York/New Jersey Harbor Estuary Program, whose goal it is to establish and maintain a healthy, productive ecosystem together with its full beneficial use. Among the program's objectives related to wildlife and habitat addressed in this report are: the restoration and maintenance of an ecosystem which supports an optimum diversity of living resources on a sustained basis; the preservation and restoration of ecologically important habitats; and the restoration and enhancement of the aesthetic quality of the New York/New Jersey Harbor Estuary ("Estuary").

In this report we review the present status of nearshore habitats and wildlife, assess the changes in wildlife and habitat which have occurred, and make some preliminary observations and recommendations which contribute to the objectives of conservation and restoration.

The general objectives identified for this program module were to provide a baseline of information on the present condition of the Estuary with regard to living terrestrial vertebrate resources and their habitats; and to identify valued wildlife habitats for future preservation or enhancement. Subsequent to the start of the project, another "objective" was suggested: to make recommendations for the improvement of the aesthetic qualities of the Estuary through marginal habitat enhancement.

Our involvement in the New York/New Jersey Harbor project began in October, 1989. Co-investigator Robert Craig resigned from the program in June 1990 to accept a position with the U.S. Fish and Wildlife Service. Our team was responsible for Task 5.3 - habitat mapping (Squires) and wildlife resources assessment (Craig and Barclay). In order to fulfill the above objectives, the goals of our portion of the project were to:

1. characterize the species composition of wildlife presently inhabiting the harbor area;
2. determine the population trends and current status of wildlife species;
3. survey the composition and extent of wildlife habitat in the Harbor area; and
4. evaluate shifts in habitat location and coverage within the Harbor.

These goals were fulfilled within the body of the report and by means of the following special report components:

## Goal 1 (wildlife: species composition) -

- A. Christmas bird count species tabulations.
- B. Species matrix (bird, mammal, amphibian and reptile relative abundance by site by season), Appendix C.

## Goal 2 (wildlife: trends and current status) -

- A. Trend analysis, 100 most frequent Christmas Bird Count species, 1961-1988.
- B. Short-term trend summary (autumn shorebird and raptor migrations.
- C. Status evaluation, species matrix data (Appendix C).

## Goal 3 (habitat: composition and extent)

- A. Atlas of Natural Areas - description, features, management authority and information sources (Appendix B).
- B. Maps of wetlands, open space and similar potential and existing wildlife habitat (Appendix D).

## Goal 4 (habitat: status and trends)

- A. Project area description - historical overview of changes in land use, alteration and current status.

The additional objective (habitat enhancement) is addressed as Goal 5 (habitat: modification recommendations) based on information utilized in this study, personal observations and professional experience:

- A. Aesthetic benefits via marginal habitat enhancement.
- B. Important, unique and critical habitats for wildlife and plants.

## Concepts of urban wildlife resources

Awareness, acceptance and management of wildlife resources in the context of urban environments are becoming widespread. As human modification of the environment expands as a consequence of population growth, development for human housing, commerce and industry leave fewer areas of unmodified habitat, while those remaining are more distant from urban centers. A recent phenomenon has been the notion of establishing some as yet quantitatively undefined modicum of wildlife resource even within the environs of a major metropolis such as New York City and its surrounding urban core areas. Human fascination with "things alive," even in such obviously artificial settings, has evolved into some conscious efforts to preserve those representative indigenous species which have managed to survive; and to encourage the presence of other, often more appealing species less likely to prosper otherwise. To accomplish this in a geographically widespread and highly modified urban environment is a commendable, if somewhat formidable, challenge.

In one sense, this interest in retaining wildlife values in the urban setting is a further evolution of the same instincts which led to the preservation of extensive wildlife habitats almost within the core of the city, such as Central Park, the New York Botanical Gardens, and even the Bronx Zoo. A notable example in the New York/New Jersey Harbor Estuary region is the preservation of the vast array of marshes and mudflats which constitutes the Jamaica Bay Wildlife Refuge of Gateway National Recreation Area. For over 50 years various individuals and groups have fought off efforts to utilize Jamaica Bay for, among other purposes, a deep water port, an extension of an international airport, a locus for petrochemical industry, and a sanitary landfill. Similar efforts on both larger and smaller scale elsewhere in the urban area have resulted in an accumulation of habitats extending from Palisades Interstate Park at the northern terminus of the Estuary to Sandy Hook, Gateway National Recreation Area, at its southern boundary. One cost of maintaining these habitats and their associated wildlife, both in large and small areas, is eternal vigilance on the part of their keepers. The economic pressures brought upon the body politic for rights to develop these perceived "unused lands", for one or another purpose, are always enormous.

### Purpose and limitations

This report has been prepared for use by regulatory agencies and as an educational resource for organizations and individuals advocating enhanced quality of this Estuary's environment. The information contained herein is based upon data and studies reported by others, in keeping with the specifications in the original Scope of Work, because neither funding nor time were available in sufficient quantity to permit primary investigations. No warranty can be given for the validity of the data presented, although a conscientious attempt has been made to use only those data which seemed of the highest quality. Trend data were found only for birds. No trend data were found for reptiles and amphibians nor for mammals. The existence of some data on invertebrates, particularly butterflies, was reported -- but their use was beyond the mandated scope and resources of this project component. In the spirit of its educational function, the report should be supplemented with field verification.

### Definitions

*Study area.* The study area defined by the New York/New Jersey Harbor Estuary Program is the complex area often simply called New York Harbor. The area includes the lower reaches of the Hudson and Raritan Rivers and other tributary rivers emptying into the Estuary. The northern boundary of the study area is the Piermont Marshes in the Tappan Zee of the Hudson River; the eastern boundary is the narrows which define the East River; the western boundary is defined by the head-of-tide of the Raritan and Passaic Rivers in north-central New Jersey; the southern boundary is south of the Shrewsbury and Navesink Rivers and is extended by the Transect line delimiting the demarcation between the Hudson and Raritan Estuaries and the New York Bight.

Definition of the study area in respect to wildlife habitat was intended to incorporate all of those aquatic and adjacent upland areas which are under the influence of, or are impacted by, the waters of the New York Harbor or the Lower Hudson and Raritan Estuaries. Whether the study area encompasses a natural biological area as might once have been constituted is not relevant, as the natural environment of the area has been so extensively modified by human activities as to have become a kind of ecosystem of its own. The New York Metropolitan Area is a subset of the extensively urbanized coastal corridor between Boston, Massachusetts and Washington, D.C. The study area contains portions of two states, many counties and minor civil divisions and is larger in geographic extent than the Standard Metropolitan Statistical Area defining the metropolis for the U.S. Census. The study area is discussed in greater detail in the following chapter and is depicted in Figure 1.

*Wildlife.* The terms "wildlife" and "wildlife resource" may be construed to apply to all living plants and animals indigenous to a particular locale. However, for a variety of largely historic reasons, most professional resource managers regard "wildlife" per se as the warm-blooded vertebrates (mammals and birds). More recently, the cold-blooded vertebrate groups of amphibians and reptiles have been included in the term "wildlife" because of the growing recognition of their importance to balanced ecosystems. In this study we have given emphasis to the birds, in part because they are particularly sensitive bioindicators, and in part because of the large body of reliable data about their distribution and abundance. Because birds are able to respond quickly to favorable or adverse changes in their environment, they reflect those changes more quickly both in diversity and abundance than do other vertebrates. The availability of a large body of reliable information on distribution and abundance of species, gathered by dedicated and expert observers over the past 30 years, also makes the birds of critical significance to a study of wildlife and habitats in the New York /New Jersey Estuary region.

Although this report deals with nearshore habitats and wildlife, the fishes were not included. The fish resources of the Estuary were the subject of a separate report by Dr. Peter Woodhead entitled "Inventory and Assessment of Habitat and Fish Resources and Assessment of Toxic Effects in the New York-New Jersey Harbor Estuary." Therefore, only terrestrial vertebrates were included in this paper.

*Habitat.* Wildlife habitats, in this study, were recognized as those places, both aquatic and terrestrial, where any given species could reasonably be expected to be found fulfilling its requirements at different times of day or season, under "normal" environmental conditions. The urban context and process typically, and we suspect progressively, inhibits many of the specialized species, such as the wood thrush, while encouraging more opportunistic "generalists" such as the crow and pigeon.

On the maps incorporated in this report (Appendix D) we include any "open space" areas which might be expected to meet some of the needs of one or more wildlife species. Because the program constraints incorporated within this study stressed synthesis of existing information and precluded field verification, these "open space" areas are those which appeared on the latest series of the U.S.D.I. National Wetlands Inventory maps and the

U.S. Geological Survey's topographical maps of the study area and may not reflect current conditions. We conducted several reconnaissance surveys within the Estuary to validate our observations and conclusions.

Lands which appeared from our map sources to be untraditional wildlife habitats but probably capable of supporting or producing indigenous animal communities were mapped. Thus, extensive mowed areas or weedy vacant lots might well be mapped as "potential wildlife habitat." However, in virtually all cases, a minimal 50 meter buffer zone was depicted between all such open space areas and urban development such as utilities, industrial or commercial areas and residential precincts. While this buffer reduced the total area of park, wetland and potential habitats, its purpose was to recognize, provide for and accomodate the social dislocations between humans and wildlife. We have not attempted to depict those habitats frequented by the ubiquitous "wild" exotics such as pigeons, rats, mice and other commonplace urban species.

### Information

The accuracy of this report depended largely on the quality and accessibility of available information. Even to an experienced student of the metropolitan New York region it is surprising to find the depth and richness of existing information. This is not to suggest that the distribution of information is even, for it is not. That information dealing with the core of the Estuary region, Manhattan Island, is the richest. That dealing with northern New Jersey is the sparsest. Information about wildlife of general interest to humankind is not easily accessed for it is scattered among agencies and other sources. Many promising studies of habitat and wildlife have been initiated, but have fallen victim to financial exigencies and remain incomplete. Turnover among park department technical staff results in loss of corporate memory about existing information gathered by the agency, or of studies initiated but unfinished. In the latter instance methodological details are often lost so that renewal or completion of those projects is not possible.

To have gathered all the information on Estuary habitat and wildlife, and to have analyzed it fully, would have been the work of several years. Because of constraints of time, we have been limited to those data sets which came promptly to our hands. Some promised data sets did not reach us in time for analysis. It is evident that data gathering of the sort undertaken here requires nearly a year to complete. Nearly three quarters of the time allocated for this project was spent in the data acquisition and editorial work preparatory to data analysis.

Data on the occurrence of wildlife and of the distribution of habitats represent a snapshot of a temporal continuum of change. For many purposes it would be desirable to have these data in a format which would allow for regular updating. Such systems do exist under the general rubric of geographic information systems, but neither time nor funding was available for use of such a system.

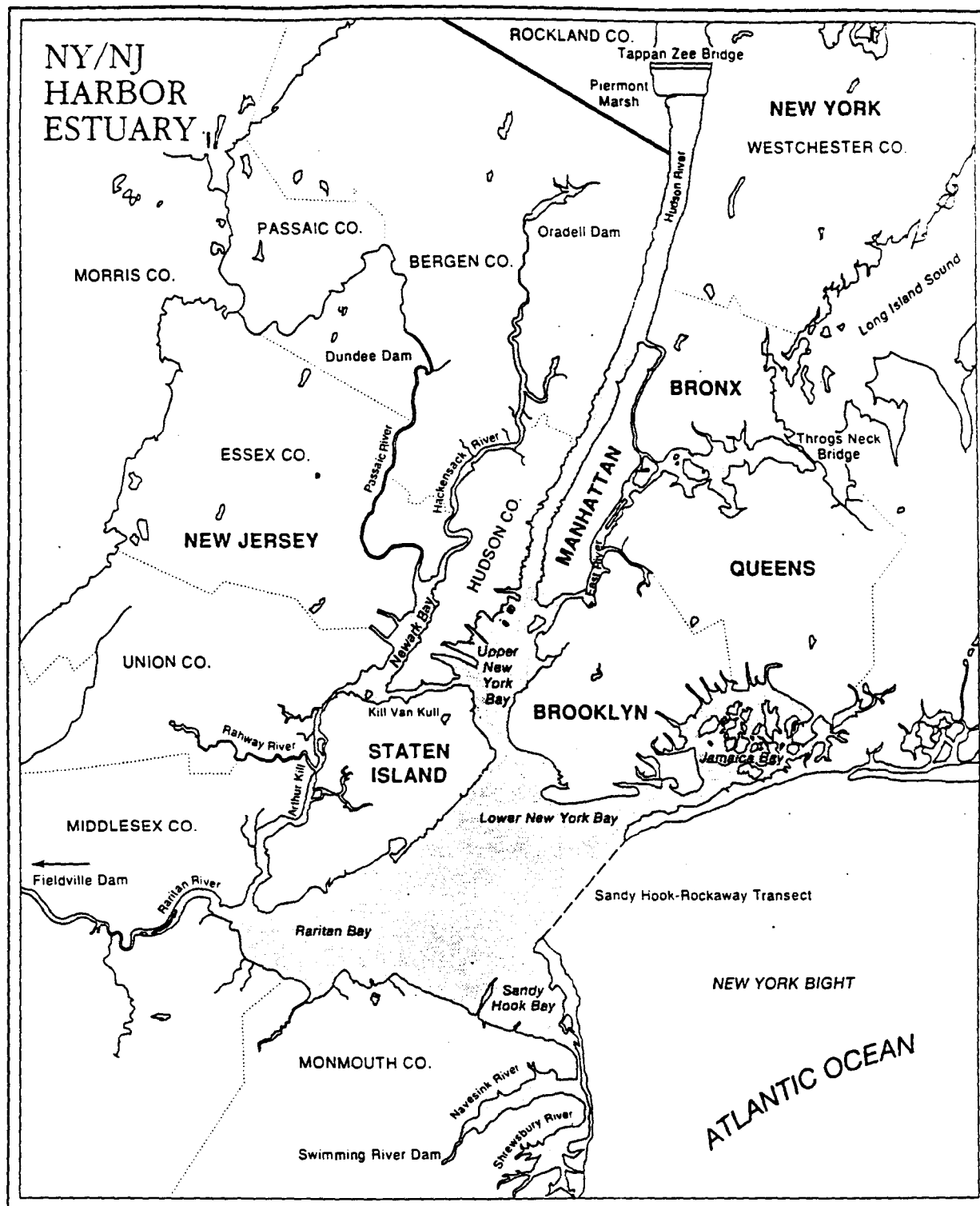


Figure 1. The New York/New Jersey Harbor Estuary Study Area.

# NEARSHORE HABITATS IN THE NEW YORK/NEW JERSEY HARBOR ESTUARY

by

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## Description of the Study Area

The New York/New Jersey Harbor Estuary is central to one of the largest metropolitan areas of the United States. The study area is dominated by the activities and presence of one species, *Homo sapiens*. While the geologic history of the Estuary and the larger surrounding region worked to create a physiography rich in habitat diversity, that physiography was also one particularly suited for exploitation by humans. The metropolitan area owes its rich heritage, its central position as the financial capital of the Nation, and its recognition as the Nation's largest city to the success of the Estuary, for many decades, as the Nation's largest port. The excellence of that port, in turn, depended upon the geologic framework of the Estuary and the ability of the European colonists to turn the port into an economic asset (Albion, 1970). Two major factors which have worked to deleteriously affect nearshore habitats of the Estuary have been the construction of port and port-related facilities and the urbanization of the upland area. The effects stemming from port development and urbanization are many, and among them are the partial or total destruction of habitats and an accelerated conflict between human activities and those of wild species to the detriment of the latter.

This report is only one of several which deal with the aquatic habitats of the Estuary. In addition to this study, the interested reader should consult Woodhead (1991) for a discussion of fish and of immediate shoreline modification (i.e. bulkheading, pier construction, etc.). Thatcher and Mendoza (1991) examines the modification of the Estuary floor by dredging and dumping and considers the hydrologic significance of those modifications.

For an understanding of the present status of nearshore habitat in the Estuary it is necessary to appreciate its setting and the way in which human activities have altered original conditions. It is also important to recognize the rapidity with which those changes have occurred. Although humans have been present in the Estuary region for millennia, for much of that time their relationship to the environment was benign. Only in the last 150 years was there an acceleration of physical and biological change resulting from human activity and population growth. While the last two decades have seen a diminished rate of impact upon habitat and wildlife, and in some instances improved conditions, there is constant pressure to utilize nearshore habitat for human purposes. In the following material physical alteration of the Estuary and nearshore habitat will be discussed. Following that discussion will be a brief discussion of human demographics and the effect of population growth on habitat.

*Geography.* The New York/New Jersey Harbor Estuary is a complicated marine system surrounded by an urban complex having a high density human population. From the perspective of wildlife and habitat, the region has had a daunting history of industrial and commercial development with concomitant pollution. Measured by some standards, it might be said that a remarkable diversity of habitats and wildlife has survived: by others, that the Estuary is a human-dominated environment with only straggling assemblages of habitat and wildlife remaining.

The core of the aquatic Estuary is New York Harbor, an area of about 1500 square miles with over 770 miles of waterfront. New York Harbor itself is subdivided into the North River, the Upper Bay and the Lower Bay (Figure 1). The North River may be taken as the area extending from the southern tip of Manhattan Island to the Piermont Marshes of the Tappan Zee, Hudson River, New York. Those marshes are the northern extent of marine-rooted-aquatic vegetation in the Estuary, and the southern extent of freshwater-submerged-aquatics in the Hudson River. The actual head-of-tide of the Hudson River is about 140 miles to the north at the Federal Dam at Troy, New York. The Upper and Lower Bays of the Harbor are separated by The Narrows, a short strait (0.3 miles) formed by eastern Staten Island and western Brooklyn. New York Harbor empties into the New York Bight of the Atlantic Ocean. The artificial boundary between the Bight and Harbor, defined only for geographic convenience, is usually termed the "transect", that is, a line drawn from the northern tip of Sandy Hook to the western tip of Rockaway Point.

In addition to the Harbor and its interconnecting waterways the Estuary includes Raritan, Newark and Jamaica Bays. Raritan Bay, a large, shallow waterbody enclosed by the recurved spit of Sandy Hook on the east and Staten Island to the north, is the estuary of the Raritan, Shrewsbury and Navesink Rivers. The latter two conjoin and empty into Raritan Bay behind Sandy Hook Spit. Newark Bay is now a largely artificial waterbody immediately south of the Hackensack Meadowlands and west of the Bayonne Peninsula. Once a broad, shallow, tidal-marsh-rimmed embayment, it is now the focus of commercial port activities in the region. Also included in the Estuary is Jamaica Bay, a complex of tidal mudflats and wetlands, long preserved as a wildlife area by the City of New York, and now the centerpiece of Gateway National Recreation Area. It is bordered on the east by John F. Kennedy International Airport, Queens County, New York, and on the north and west by sanitary landfills or urban housing built on landfill. On the south, the Bay is separated from the New York Bight by Rockaway Spit.

Dominating the aquatic system is the Hudson River, which arises in New York State's Adirondack Mountains about 315 miles north of The Narrows, and which drains an area of 13,370 square miles. Entering the Estuary through Newark Bay are the Hackensack and Passaic Rivers. The Hackensack, about 45 miles in length, arises in Rockland County, New York, and flows south to the Oradell Reservoir, New Jersey. At its lower end, the Hackensack River flows through the Hackensack Meadowlands, about 50 square miles of highly disturbed and altered marsh. The Passaic River arises south of Morristown, New Jersey, and flows about 80 miles to Newark Bay. The head of navigation in the Passaic River are the rapids above Passaic, New Jersey. The Shrewsbury and the Navesink Rivers, both about 8 miles in length, are located south of Raritan Bay but reach



the Bay through a common outlet west of Sandy Hook, New Jersey.

On the eastern side of the Estuary, there are no true rivers within the study area. The Harlem River, a tidal channel -- now a ship channel -- connects the former Spuyten Duyvil Creek at the northern end of Manhattan Island with the East River. The Harlem River has been highly altered by marginal landfill and by dredging of its channel. The East River is not properly a river, but rather is a tidal strait connecting the Upper Bay with Long Island Sound. Similarly, the Arthur Kill and Kill van Kull which separate Staten Island from the mainland are narrow tidal straits which are, for practical purposes, ship channels. The former connects the Lower Bay with Newark Bay, the latter connects Newark and Raritan Bay. Both are highly trafficked waterways, perhaps the busiest in the Port of New York.

Politically, the Estuary contains the Boroughs of Manhattan (New York County) and Staten Island (Richmond County) in New York State, and The Bayonne Peninsula (Hudson County) in New Jersey, among others. Bordering the Estuary are: Borough of Queens (Queens County), New York; Borough of Brooklyn (Kings County), New York; Borough of The Bronx, New York; Westchester County, New York; Bergen County, New Jersey; Essex County, New Jersey; Union County, New Jersey; Middlesex County, New Jersey; and Monmouth County, New Jersey. In addition to the Boroughs and Counties, there are smaller subdivisions which contribute to the political complexity of the coastal region of the Estuary (Table 1).

Table 1. Political subdivisions\* of the New York/New Jersey Harbor Estuary.

Governmental Units	State of New York	State of New Jersey
Counties	6	9
Townships	17	63
Municipalities	30+	140
Total Political Units	54	212

\* Based on data from U.S. Bureau of Census.

+ The City of New York, comprised of five counties, which are also the Boroughs of the city, is counted as one municipality in this table.

*Geology.* The hydrologic and biologic richness and intricacy of the Estuary, as well as its excellence as a port, derives from its geological complexity. That complexity arises from the geologic framework which underlies the region, a framework which produces in close proximity: rocky shores, enormous shallow marshes and a network of tidal channels and islands. There is no other estuary on the eastern coast of the United States which possessed a comparable array of different nearshore habitats. The underlying bedrock

provides the structure of the Estuary, but its "final statement" was provided by Pleistocene glaciation, the southern boundary of which extends across the Estuary from northern New Jersey to Long Island, New York. Excellent geologic descriptions of the region may be found in Schuberth (1968), Sanders (1974), and Coch and Bokuniewicz (1968).

The region's core is formed by southward extending prongs of hard igneous and metamorphic rocks of the New England Province. One prong forms Manhattan Island, the other the Hill and Valley Province of northeastern New Jersey. Extending in a northeasterly direction between these two prongs is a continuation of the Piedmont Plateau Province sometimes called the New Jersey lowland. This lowland is underlain by soft Triassic sandstones and shales. At its eastern margin is a diabase basalt intrusion which forms the Palisades, the dramatic western shore of the Hudson River. As this sill dips down to the south it also forms Bergen Hill and the spine of the Bayonne Peninsula. Although the diabase continues on to Staten Island, its continuity as a highland is breached by the Arthur Kill. The seaward side of the Piedmont Plateau slopes relatively sharply downward to the Coastal Plain Province. This boundary, the Fall Line, is marked by various rapids and waterfalls which form the head of navigation of the New Jersey rivers entering the Estuary. Young Coastal Plain Province sediments lie as a fringe within the harbor, including the margins of Newark Bay and the Hackensack Meadowlands but are most conspicuous on Long Island.

The spine of Manhattan Island is made of Fordham Schist, Manhattan Gneiss and Inwood Marble. The former two are exposed along the length of Manhattan Island, which rises in elevation irregularly and gradually from south to north. The Inwood Marble, a metamorphic dolomite, is soft and easily eroded. Its outcroppings along north and northeastern Manhattan were early eroded to form the channel of Spuyten Duyvil Creek and the Harlem River. A sag in Manhattan's spine in which bedrock dips to about 100 feet below the surface is conspicuously displayed in the the City skyline. Between the tallest buildings clustered at the southern tip and the skyscrapers of mid-town are noticeably less tall buildings. Because the tough rocks of the spine are too deep here to be reached by even the longest pilings, as well as presence of buried marsh and streams, this area does not provide good construction sites. In historic times, at the southern tip of the island, the Battery was separated by tidal marsh, and by water at spring high tides, from the rest of Manhattan.

Pleistocene glacial ice shaped much of the Estuary region, but the blanket of glacial moraine formed as the ice melted back is more conspicuous. Important in the geologic history of the region are the deposits which formed in the huge post-glacial lakes Passaic, Hackensack, Flushing and Long Island. Pushed up by the glacial ice was a terminal moraine extending from northern New Jersey across Staten Island to Long Island and eventually to Cape Cod. Behind that dam-like terminal moraine accumulated the melt water of the glaciers, and in those lakes formed thick sequences of varved, i.e. lake-deposited, sediments. The great Hackensack Meadowlands and Newark Bay are remnants of former Lake Hackensack.

New York Harbor is a drowned estuary, the result of post-glacial sea level rise. During the periods when glacial ice extended over the region, sea level was much lower,

exposing the continental shelf. The proto-Hudson River flowed across that shelf, eroding the Hudson Shelf Canyon. As sea level was restored by the melting of the glaciers, the steep canyon formed by the Hudson River and its tributaries was filled by sediment. As the sea level rose, sea water replaced the freshwater in the glacial lakes. About 5,000 years ago, sea level rise slowed to its present rate of about 1.5 mm per year. Tidal marshes became established in many of the shallow embayments. Westward sediment transport along the south shore of Long Island, resulting from wave impact on the beaches, formed the Rockaway Peninsula which, as it grew westward, increasingly isolated Jamaica Bay from the ocean.

The diverse geological history of the Estuary contributes extensively to the diversity of its habitat types, differentiating the western, or New Jersey, portion from the eastern, or New York, portion. Lying mostly in the Piedmont Province and the low-lying lands of the Triassic, the New Jersey portion of the Estuary was characterized in pre-European colonization times by extensive tidal and freshwater marshes extending up each river for a considerable distance. The lower Hackensack and Passaic Rivers emptied into the huge tidal, brackish and freshwater marsh complex of the Meadowlands and thence into the shallow, broad, tidal marsh-rimmed Newark Bay. West of Staten Island, the New Jersey shore of the Kill van Kull was also extensive marsh. East of the Bayonne Peninsula were broad, shallow mudflats extending over a mile offshore, terminating in a long series of oyster reefs aligned parallel to the shore. In contrast, the New York shore was in large part rocky or bluff: deeper water was found close to the shoreline, particularly on the western shore of Manhattan. Tidal marshes were present, especially on lower Manhattan and on the northern shore of Brooklyn. The largest eastern shore tidal wetlands were probably those of the Hutchinson River system in The Bronx.

#### Modification of Nearshore Habitats

For reasons more explicitly stated later (p.20) the term "tidal marsh" is used in the following sections to connote a variety of nearshore habitats not always defined more precisely in historical documents. While many other nearshore habitats are of equal importance to tidal marsh, documentation, particularly quantitative documentation, of change in their occurrence is sorely missing. It is necessary therefore to use "tidal marsh" as a representative term in measuring of all nearshore habitat changes. In the following, reference is made to nearshore habitat types as referred to in the literature, but the reader should be acutely conscious of potential omissions of habitat types other than marsh.

*Modification resulting from port and port-related development.* The European colonists were quick to discover those geological attributes which made New York Harbor one of the finest. However, this did not deter them from initiating "improvements." Their need to establish commerce expeditiously with their "home" countries resulted in docks being built and cribs and bulkheads emplaced to permit land to encroach on the Harbor. Behind those bulkheads and cribs, fill was emplaced -- some containing household refuse, but most being soil and rocks resulting from the levelling of the land and from excavations for basements. The traditions of European port development emphasizing bulkheaded wharves resulted in the establishment of a sharp, steep interface between land and water

replacing the shelving beaches or rocky shores of pre-Colonial time.

Manhattan was the first portion of the Harbor to develop, particularly along the East River which was more protected from winter ice floes. Public policy dictated the creation of new lands by filling of the waterfront, and by 1800 most of the southern tip of Manhattan was bulkheaded and landfilled, about 729 acres of new land having been formed (Buttenwieser, 1987). Development extended slowly northward on Manhattan as land transportation permitted the City to spread. Figure 2 shows that growth from 1900 through 1934. As the City spread northward, both fresh and tidal marsh areas were filled and the shoreline bulkheaded and filled to make space for the growing number of piers, wharves and other facilities of commerce. The once existing large marshy areas north of Corlears Hook on the East River and at about 14th Street on the North River, reputed to almost bisect Manhattan Island at highest tides, were filled. The East River shoreline developed more rapidly, but by the beginning of the 18th Century, the deeper, rocky western shore of Manhattan saw increased numbers of piers. Concern about pierhead filling and extension of land further and further into the East River led to the establishment of the U.S. Army Corps of Engineers as the regulatory agency responsible for establishing lines beyond which piers, wharves and landfilling could not extend without a permit from that agency (Klawoon, 1977).

Brooklyn's waterfront developed more slowly but by the early 1800's extensive modification had taken place as the high bluffs of northern Brooklyn were pushed outward into the East River to form new land. The shoreline from Brooklyn Bridge south to Bay Ridge was the first to develop. Three major constructions anchored the Brooklyn waterfront: Atlantic Basin (construction begun in 1841), Erie Basin (begun in 1864) and the Brooklyn Navy Yard in Wallabout Bay (begun in 1867). They obliterated extensive marsh complexes and, finally, connected Red Hook Island to the mainland (Stiles, 1870; Raber, et al 1984). These massive masonry constructions filled " ...broad areas of seemingly useless territory, nor was there any prospect that this property would ever be more than a pestilent swamp, receiving the sewerage and waste of adjacent high grades" (Stiles, 1870, p.581)

The New Jersey coast was much later to develop port facilities. In part this lateness of development resulted from the extensive tidal marshes which rimmed the Bayonne Peninsula, Newark Bay and the west bank of the Arthur Kill. Additionally, broad mudflats lying behind oyster reefs required extensive dredging to permit any but the smallest vessels to approach the coast. Because of this, while Manhattan's waterfront was developing as a commercial center, the Bayonne shore awaited the construction of railroads before its development could begin. Once started, however, the magnitude of construction was enormous. By the mid-19th Century, several rail lines had succeeded in crossing the Hackensack Marshlands and in tunneling through the Bergen Ridge. The narrow eastern shore of the Peninsula was not amenable to the construction of the necessary railroad marshalling yards, so extensive landfilling was undertaken. Between 1860 and 1920 the Communipaw Yards were constructed in the area between Paulus Hook and Black Tom Rock, in large part with excavation materials from construction on Manhattan. In all, tens of thousands of acres of tidal marsh were covered, tens of thousands of mudflats dredged, and the oyster reefs destroyed.

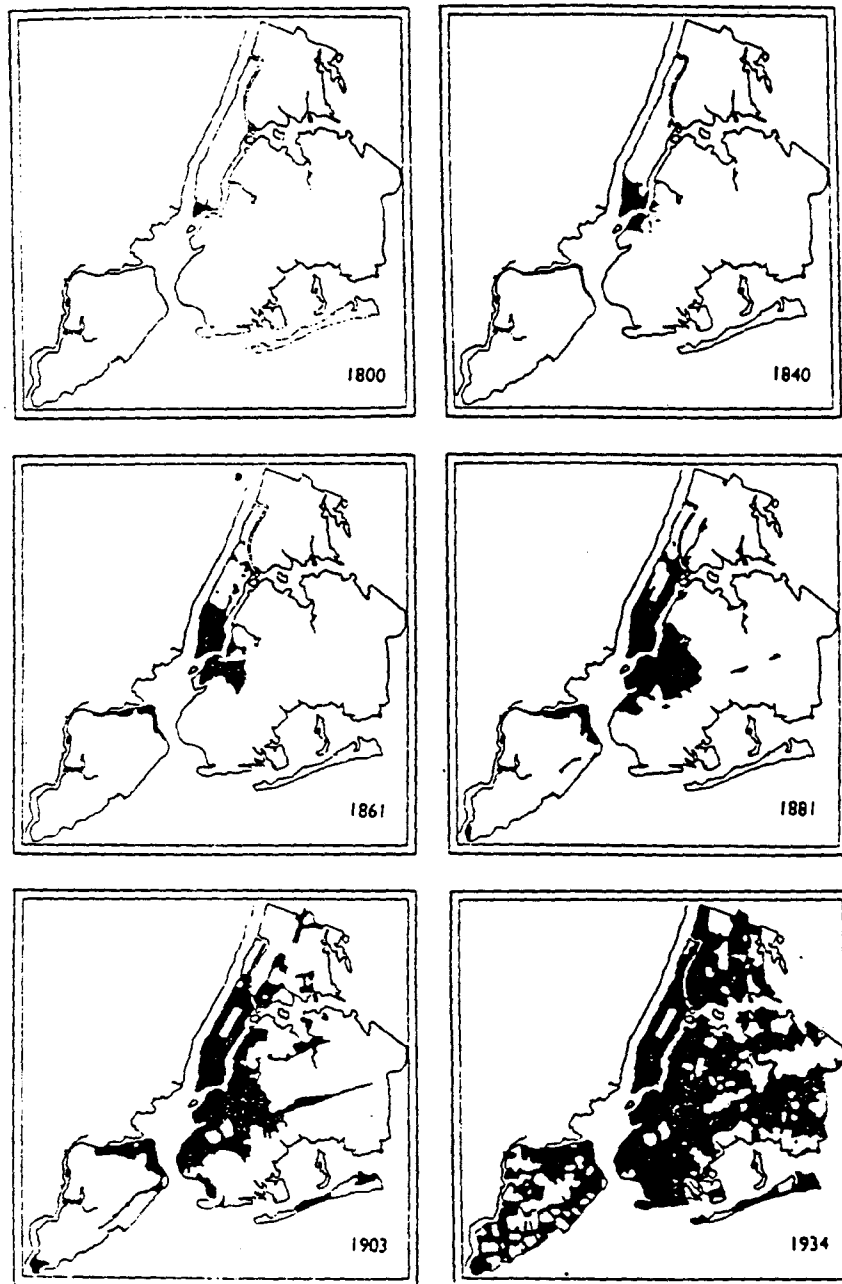


Figure 2. Settled areas of New York City, 1800 - 1934  
After Hoyt (1939)

Beginning in the late 19th Century, accelerating with the 20th Century's growing dependency upon petroleum, the tidal wetlands complex of southern Constable Hook developed into the petroleum center of the Harbor. As the requirement for oil increased, refining and oil storage facilities developed both in the southern Hackensack Meadows (Kearny) and along the Arthur Kill, particularly on the New Jersey side. Tidal wetlands in both areas were filled to provide space for storage facilities.

With the development of the suction dredge (Edwards, 1893) dredge spoil became a new tool for landfill operations. Dredging made possible the extensive landfills of Port Newark and Port Elizabeth, Newark Airport and John F. Kennedy Airport -- each well over 1000 acres in extent. Dredging also modified the bottom of the Harbor. The impacts of Harbor dredging upon nearshore habitats are discussed in Thatcher and Mendoza (1991).

In summary, port and port-related development resulted in extensive change to nearshore habitats through the steepening of the land/water interface by shoreline armoring (e.g. rip-rap, bulkhead) and nearby dredging. Landfilling to create space for facilities destroyed marshlands and dredging of channels for navigation or for spoil resulted in progressive narrowing and deepening of waterways and bays, affecting not only habitat but also water circulation.

*Modification resulting from urbanization.* The demographics of the Estuary region have direct and profound consequences on its wildlife resources. To quote one research team, "Just as there is more to urbanization and metropolitanization than population growth, the relationship between a growing population and environmental decline is not a simple one... Population expansion, a concomitant factor of urbanization, requires higher economic productivity, responding to greater consumption and resulting in more pressure on natural resources... Even if the population were to stabilize in the twenty-first century, the environment [of the New York Bight] would still have to bear the burden of heavier consumption." (Koebel and Krueckeberg, 1975, p.37)

Surrounding the Estuary are some of the most densely settled human populations in the United States. Table 2 summarizes population and population density data for 1980 and 1990. The core area of the Estuary region in general is experiencing either level growth or a decrease in population, while the surrounding areas are increasing in population. This is not shown as pointedly as would be the case if the suburban counties were included in the table. The complete demographic metropolitan area extends well up into New York State, western and central New Jersey, eastern Pennsylvania and western Connecticut for it is from those areas that the working population is drawn. In general, the population of the 12 counties of the study area is also a population of persons employed in these same counties substantially enlarged by commuters from points outside the study area. Thus the Estuary region experiences sharp increases in population during work periods and a proportionate decrease during non-working periods -- the ebb and flow of the commuter population.

**Table 2. Demography of the New York/New Jersey Harbor Estuary Region.**

Compiled from U.S. Department of Census reports.

County /State	Area (sq.mi.)	Individuals 1980	Density 1980+	Individuals 1990*	Density 1990*	% Growth	% Density Change
<b>NEW YORK</b>							
Bronx	42	1168972	27833	1203789	28662	+3.0	+3.0
Kings	70	2231026	31872	2300664	32404	+3.1	+1.7
New York	22	1428285	64922	1487536	67615	+4.1	+4.1
Queens	109	1891325	17352	1951598	18070	+3.2	+4.1
Richmond	59	352029	5967	378977	6649	+7.7	+11.4
Westchester	439	866599	1974	874866	1993	+1.0	+1.0
<b>NEW JERSEY</b>							
Bergen	237	845385	3567	825380	3542	-2.4	-0.7
Essex	127	851304	6703	778208	6080	-8.6	-9.3
Hudson	45	556972	12377	553099	12291	-0.7	-0.7
Middlesex	316	595893	1886	671780	2153	+12.7	+14.2
Monmouth	471	503173	1066	553124	1160	+9.9	+8.8
Union	103	504094	4894	493819	4794	-2.0	-2.0
<b>REGION</b>	<b>2041</b>	<b>11795057</b>	<b>5779</b>	<b>12072840</b>	<b>5915</b>	<b>+2.3</b>	<b>+2.4</b>

+ Population density is given in thousands of people per square mile.

\* 1990 data are from preliminary U.S. Census reports and are subject to change.

The highest population densities are found in the center of the Estuary, Manhattan Island, and in The Bronx and Brooklyn. New Jersey counties closest to the center of the Estuary are comparatively less dense and seem to be losing population. Dispersal of population from the core of the Estuary to its margins probably has a negative effect upon remaining habitat as the spread reduces the amount of undeveloped land and adds to the pressures on indigenous wildlife.

Of all the biological features of the Estuary region, it is the abundance of the species *Homo sapiens* which is most notable. Humans dominate the region through their works, through their activities, through their very presence. Possibly, among all of the factors affecting wildlife in the region, it is the density of humans which has the greatest effect. Only those species tolerant of human activities can persist, for there is no wilderness here.

As important as the density of human population is the rapidity of its growth. As a consequence of climatic change resulting from glacial retreat, the Estuary region has

experienced a sequence of biologic changes occurring over relatively long periods of time - time measured in thousands of years. By contrast, in the last 150 years since its settlement by European colonists, the region has undergone as dramatic an alteration of its terrestrial habitats as that which preceded it in the previous epoch. This alteration is due to the rate at which human population has increased in the area (Figure 3).

Much of the recent loss of tidal marsh, mudflats and other nearshore habitats results from housing, retail and mixed-use office construction, most of which occurred since the Second World War. In the period between 1954 and 1964, the New York shore of the Estuary lost over 5,000 acres of tidal wetlands while the New Jersey shore lost nearly 12,000 acres (Table 3). Restated, over one-fifth of the Estuary's tidal marsh losses occurred in the period between 1953 and 1973. The magnitude of that loss in the Estuary, and elsewhere in the nation, inspired the enactment of protective legislation in the early 1970's. Since then, the rate of loss has been stemmed if not stopped (Squires, 1990).

**Table 3. Acreage of tidal wetlands loss, New York/New Jersey Harbor Estuary.**

Computed for New Jersey 1953 - 1973, and New York 1954 - 1973.\*

County/State	1953 Acres	1973 Acres	Change	Loss/Year	% Loss
<b>/NEW JERSEY</b>					
Bergen	4986	2438	2548	127	51
Hudson	4171	1623	2548	127	61
Essex	613	0	613	31	100
Union	2420	0	2420	121	100
Middlesex	5355	3374	1981	99	37
Monmouth	3811	2021	1790	90	47
<b>/TOTALS</b>	<b>21356</b>	<b>9456</b>	<b>11900</b>	<b>595</b>	<b>56</b>
<b>/NEW YORK</b>					
	<b>1954 ACRES</b>	<b>1973 ACRES</b>			
The Bronx	1860	331	1529	76	82
Kings	2400	957	1443	72	60
Queens	4235	1758	2477	124	58
Richmond	unknown	922	--	--	
Westchester	unknown	352	--	--	
New York	unknown	1	--	--	
<b>/TOTALS</b>	<b>8495+</b>	<b>4321</b>	<b>5449+</b>	<b>272+</b>	<b>67+</b>

\* New York data from K. Koetzner, Bureau of Marine Habitat Protection, New York Department of Environmental Protection; New Jersey from Tiner, 1984.



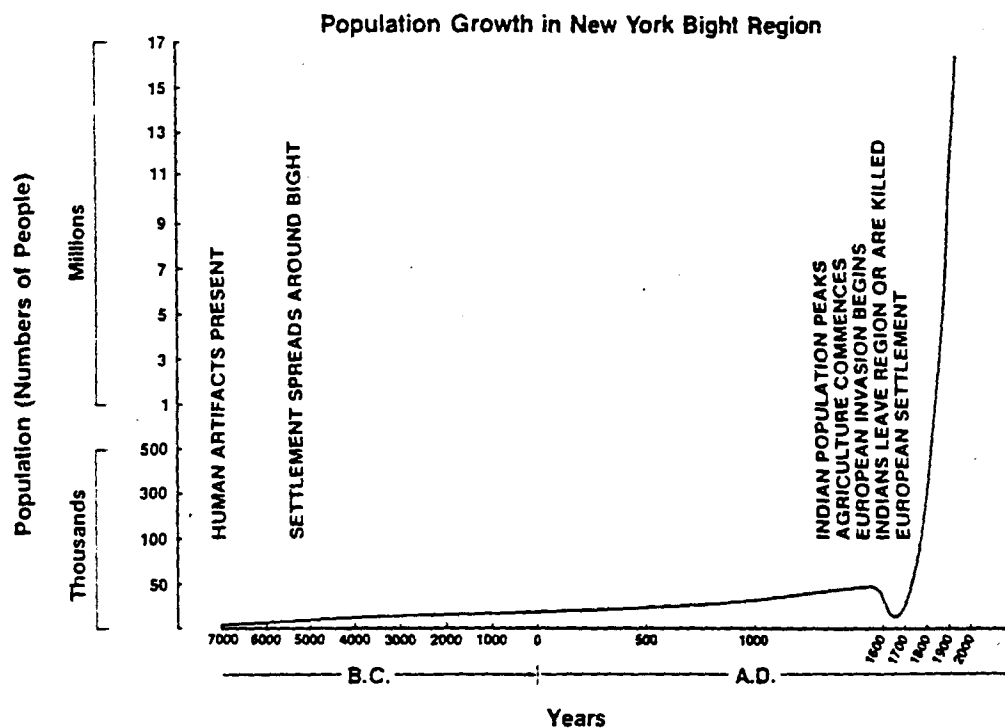


Figure 3. Population growth in the New York/ New Jersey metropolitan area. Indian artifacts date to at least 7,000 B.C. Indian populations grew slowly to a maximum until just before European settlement. Then disease, wars and out-migration resulted in greatly diminished populations. Explosive population growth of the European settlers followed. Note changes in scale. After Squires (1983)

Landfilling of the shore areas of the Estuary, briefly touched on in the preceding paragraphs, was accomplished initially with soil and rock resulting from excavation for building construction and the levelling of the City's surfaces. Garbage (food wastes, refuse and coal ash) was always a disposal problem for the growing city. For some time, these wastes were dumped at pierheads, or in low-lying (i.e. wetland) areas. As the volume increased, islands were used as dump sites, as were the waters of the Harbor. As such dumping became a nuisance, recycling programs were established for the food wastes and refuse (Barren Island, Jamaica Bay was the site of several "reduction" plants) -- but coal ash disposal remained a problem. Riker's Island was identified as the site of the first "major" landfill for the metropolitan region in 1894. It was enlarged from an original size of 88 to 400 acres by disposal of ash, refuse and garbage. Much of that fill was later moved from Riker's Island and used to create LaGuardia Airport in Flushing Bay (for a good summary of waste disposal practices in New York City see Corey, 1991).

While "sanitary landfills" were not used in the Estuary region until the mid-1930's (Walsh, 1989), they assumed an importance beyond the simple expedient of getting rid of solid wastes. As late as 1958, the New York City Department of Health was urging "...establishment of a plan and of an orderly program for filling in these offending marsh areas" (City of New York, 1958). The problem was one of diseases, particularly encephalitis, borne by biting insects. Spraying had not proven to be an effective control mechanism. By 1954, nearly 8,000 acres of parkland had been created from marshes and another 10,000 acres of underwater lands made into parkland by use of sanitary landfills. Eventually, sanitary landfills ringed Jamaica Bay, filled 1300 acres of marsh in Great Kills, Staten Island and, finally, created at Fresh Kills, Staten Island, one of the highest elevations on the eastern seaboard.

Other changes to nearshore habitats were the result of a variety of misuses. An example is the great Hackensack Meadowlands, at 20,000+ acres once the largest tidal wetland in the Estuary, which suffered greatly from burning, diking and damming during the Colonial period. While these abortive attempts to establish agriculture in the salt meadows were largely failures, they did result in large scale replacement of salt meadows and in the decimation of "huge flocks" of cedar waxwings. For most of the later 1800's and early 1900's determined planning by State officials sought to "reclaim" these marshes:

"Notwithstanding the phenomenal growth of this part of the State, these marshes have consequently had a retarding influence upon its progress."  
(Vermeule, 1896, p.290)

Vermeule was, however, prescient about the future of the Hackensack Meadowlands:

"Owing to its trifling value this marshy area is gradually becoming, and is likely to, in the future, become more and more a site for offensive manufacturing industries, manure piles, and other nuisances." (Ibid, p.289)

For whatever reasons, in the early 20th Century northern New Jersey became a disposal site for New York's unwanted: garbage, noxious and otherwise offensive industries,

petrochemical plants and refineries and petroleum storage facilities. Post-World War II consumerism, with its enhanced waste stream, saw the Meadowlands as convenient sites for sanitary landfills. Highway complexes built across the meadows absorbed millions of cubic yards of Newark Bay's bottom as dredging deepened that waterway. Relatively little remains of the original marsh area of nearly 20,000 acres and of those 6,000 acres surviving, almost all have been altered in some major way.

Progressive urbanization of the region has resulted in extensive modification of habitat through deforestation, agricultural practices, relocation of waterbodies and drainages, and by the obliteration of habitat by paving it over. More importantly, perhaps, is the growing proximity of people to wildlife habitat and the complex of interactions in that interface which prevent or interfere with those activities of wildlife required to sustain a functional ecosystem.

*Summary.* Thus by the end of the 20th Century the New York/New Jersey Estuary has experienced major changes in its shoreline -- and major losses of habitat for nearshore aquatic and terrestrial animals and plants (Table 4). In New York Harbor waters, about 47,000 acres of tidal marsh had disappeared. In New Jersey, 29,000 acres of tidelands between the Raritan and the George Washington Bridge had been filled and a staggering 293,000 acres of underwater lands had been filled -- mostly the shallow mudflats and oyster

**Table 4. New York/New Jersey Harbor\* tidal marsh and underwater lands landfilled, 1609 to present. +**

	New York acreage	New Jersey acreage	Total Harbor acreage
Estimated original tidal marsh	28,000	42,000	70,000
Tidal marsh landfilled	18,000	29,000	47,000
Tidal marsh dredged	3,000	1,000	4,000
Tidal marsh remaining	4,000	11,000	15,000
Underwater lands landfilled	9,000	293,000	302,000

\* New York/New Jersey Harbor is here defined as the area from the George Washington Bridge south to The Narrows including Hackensack Meadowlands, Newark Bay, Jamaica Bay, Kill van Kull, Arthur Kill to mouth of Raritan River, East River and the Harlem River. The south shore of Raritan Bay is not included.

+ Data from D.F. Squires, in preparation and Squires, 1990. Area data are subject to large error and should be treated as approximations.

reefs of the western shore of the North River. On the New York side, a smaller 9000 acres of new land had been created. Of the once existing tidal marsh in the core of the Estuary, only about 20% remains today (Squires, in prep.).

The extent of shorezone modification within the Estuary is depicted in Figures 4 - 6. It is necessary to introduce cautionary guidance about the information contained in these maps. The term "tidal marsh" has been adopted, in this report and elsewhere (Squires, in prep.) as a generic term referring to tidally flooded, vegetated, underwater lands. Because one is hostage to long gone map makers in the compilation of this type of data, we can only in a general way transfer information onto present day maps. We have no way of knowing, except in rare instances, the biological composition of areas mapped as "marsh" or some other general term. It is, accordingly, difficult to impute "quality" of such tidal marsh in this report, except to assume that large tracts, such as those depicted and quantified in this report, possessed a variety of habitat values similar to those which might be encountered in a similar setting today. Vegetated underwater lands, not tidally flooded but usually underwater, are less apt to have been reported by map makers past. Hydrographers did, in general, a better job of recognizing such areas than geologists -- perhaps a matter of perspective. Finally, unvegetated tidal flats and unvegetated underwater lands are most neglected of all. Where present as possible navigational hazards, their mapping is good, but their absence from maps is not to be taken as an absence in reality. "Mudflat" or "tidal flat" seems to have been the preferred terminology for unvegetated underwater lands on historic maps and we have continued that usage here. Agencies will privately admit that from the late 1960's onwards, tidal wetlands (among other types of wetlands) have had good protection and much quantitative data exists on areal extent, but that unvegetated underwater lands have not received commensurate attention or protection. As a consequence, tidal marsh, inferred tidal wetlands, or reported tidal wetlands must serve as a proxy for all tidal habitats in a historical context.

Figure 4, the status of infilled wetlands and made land as of 1900 shows the pattern discussed above with reference to port development and urbanization: i.e. most of the Manhattan and Brooklyn waterfronts already altered. (As a consequence of the use of a "modern" map as a base, marginal made lands are not always represented). By 1966 (Figure 5) the margins of the New York City boroughs have been almost completely altered, with the exception of western Staten Island. Jamaica Bay's margin has been landfilled and the construction of the three major metropolitan airports completed. Ports Elizabeth and Newark are being constructed on the western shore of Newark Bay and landfills providing the space for petroleum storage on the western bank of the Arthur Kill are underway. The eastern side of the lower Bayonne Peninsula has been filled, and many of the railroad marshalling yards constructed on the landfill have already become redundant. Importantly, however, the dissection of the Hackensack Meadowlands by landfilling has not proceeded very far. Those maps, drawn from work by the Regional Planning Association (Bower, et al, 1968), have been verified and amplified by subsequent

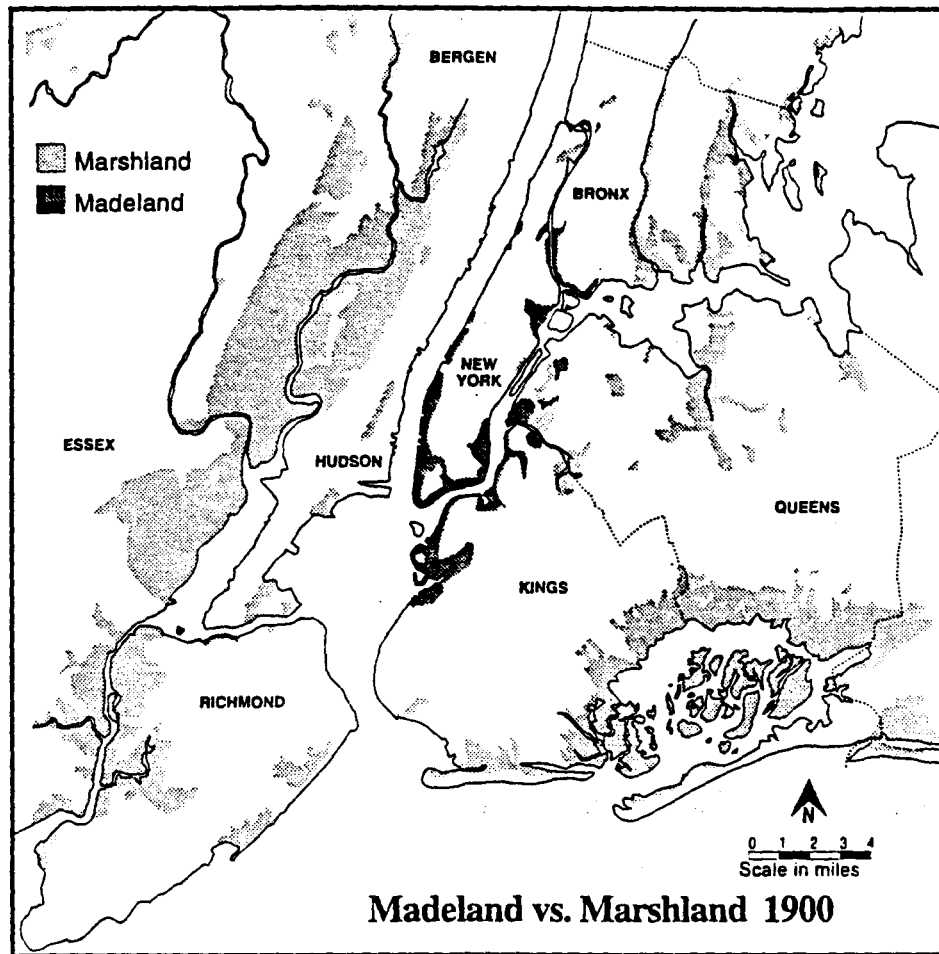


Figure 4. Status of made lands and infilled wetlands in the New York/New Jersey Harbor Estuary as of 1900.

Modified from Bower et al (1968)

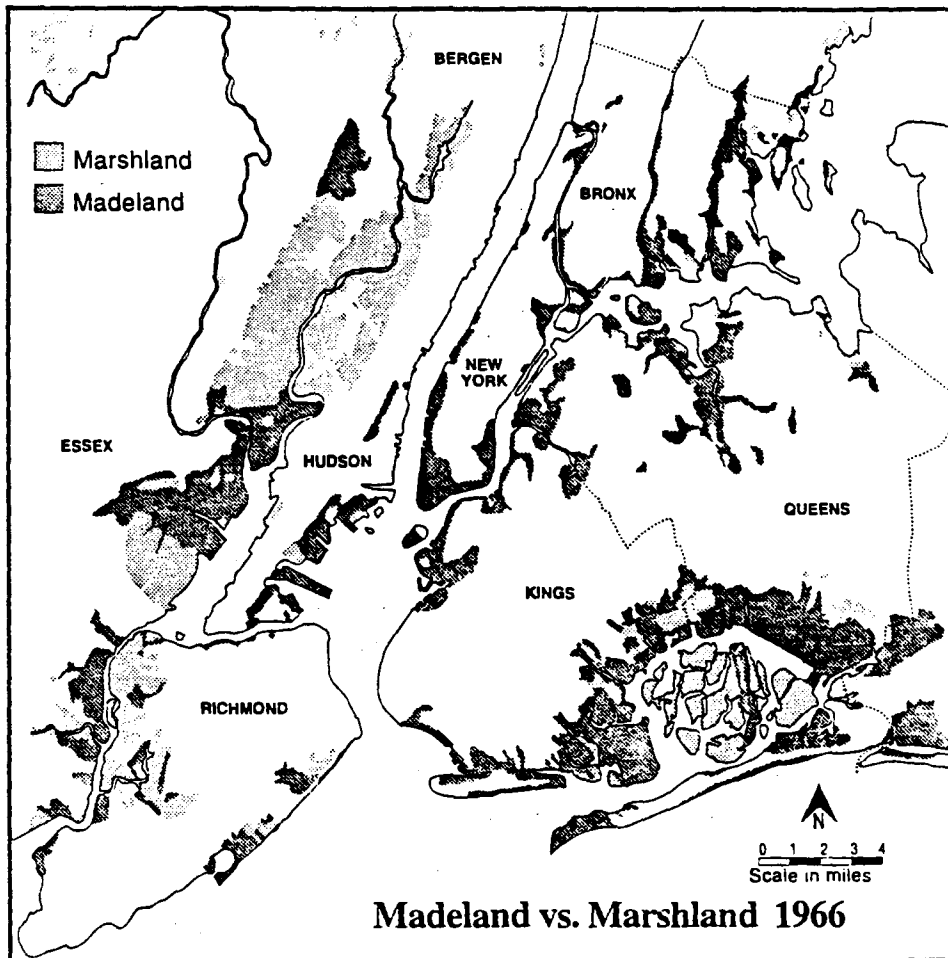


Figure 5. Status of made lands and infilled wetlands in the New York/New Jersey Harbor Estuary as of 1966.  
Modified from Bower et al (1968)

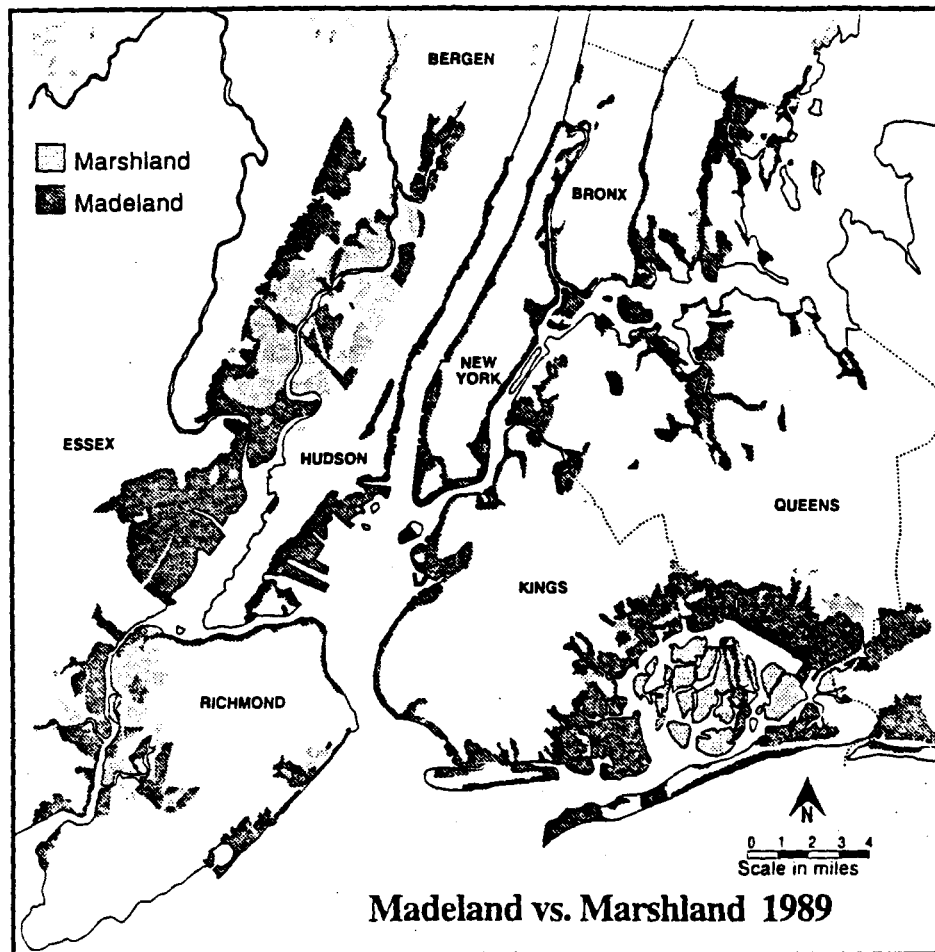


Figure 6. Status of made lands and infilled wetlands in the New York/New Jersey Harbor Estuary as of 1989.

research (Squires, 1990). A compilation representing the status as of 1989 has been prepared and is shown as Figure 6 (Squires, 1990; Squires, in prep.). Here is shown the essential completion of shoreline modification of the Boroughs of New York City, the dissection of the Hackensack Meadowlands by landfills, completion of landfills for Ports Newark and Elizabeth, and landfills for petroleum storage on the Arthur Kill.

Further modification of the nearshore environment, not represented in the data presented here, has resulted from the bulkheading, riprapping or other treatment of the land/water interface. These modifications have been mapped and are reported on in Section 4 of the inventory and characterization report on habitat and fish resources of the Estuary (Keller IN Woodhead, 1991). Keller identified about 25% of the Estuary shoreline which has not been steepened and modified. While most of the shoreline which has been modified has also been landfilled, some of that which has not been landfilled has been otherwise modified. Further, in unused portions of the Estuary, prior modifications have come to be obscured by recent sedimentation and/or growth of fringing marshes. It is probably fair to estimate that almost 90% of the core areas of the Estuary (the port area) has been modified in one fashion or another, at one time or another. As one leaves the core area and moves up tributary rivers, or around the western and southern shores of Raritan Bay, the extent of modification decreases rapidly.

Urbanization has been speeded by recent redevelopment of the waterfront. Large tracts of land, the former industrial and rail facilities along the Bayonne Peninsula, having been made redundant and become vacant, then became attractive to developers of mixed-use housing, retail, and commercial space. Activity on the west side of the Hudson River became sufficiently intense that the Port Authority of New York and New Jersey found it useful to publish annual reports summarizing development plans on "the Gold Coast." Tables 5, 6 and 7 summarize those data for the numbers of dwelling units, office floor space and commercial retail space planned or scheduled for construction. While substantial amounts of that projected development have occurred, much more is planned. Because of the long lead time involved in such large developments, reliable estimates of what finally will be constructed are impossible to make.

Projected construction on the Manhattan shoreline has not been as extensive as on the Bayonne Peninsula, largely because of the already extensive waterfront development. Some of the projects having future implications for the shoreline of Manhattan are:

The Hudson River Center - a 1500+ room hotel to be built on existing Hudson River piers adjacent to the Javits Convention Center. Marina and retail facilities are to be a part of the complex. This project has focused attention upon the building of structures out over the river on pilings and the environmental impact such structures may have.



**Table 5. Numbers of dwelling units scheduled for construction/completion on the New Jersey shore of the Hudson River.**

Port Authority of New York and New Jersey, 1990.

Waterfront Sector	Scheduled Completion Date					Other
	1986-1989	1990	1991-1995	1996-2000	After 2000	
Northern	327	424	1564	3088	3412	6090
Hoboken	104	--	850	1600	--	1173
Downtown J.C.	2425	112	525	--	--	19033
Southern	363	0	1348	--	--	1887
<b>TOTAL</b>	<b>3129</b>	<b>536</b>	<b>4287</b>	<b>4688</b>	<b>3412</b>	<b>28183</b>

**Table 6. Amount\* of office space scheduled for construction/completion on the New Jersey shore of the Hudson River.**

Port Authority of New York and New Jersey, 1990.

Waterfront Sector	Scheduled Completion Date					Other
	1986-1989	1990	1991-1995	1996-2000	After 2000	
Northern	1485	330	1300	1000	45	1450
Hoboken	93	--	28	1287	--	1280
Downtown J.C.	2027	0	3964	--	--	16636
Southern	0	0	0	--	--	1100
<b>TOTAL</b>	<b>3605</b>	<b>330</b>	<b>5292</b>	<b>2287</b>	<b>45</b>	<b>20466</b>

\* in thousands of square feet

**Table 7. Amount of commercial retail space scheduled for construction/completion on the New Jersey shore of the Hudson River.**

Port Authority of New York and New Jersey, 1990.

Waterfront Sector	Scheduled Completion Date					
	1986-1989	1990	1991-1995	1996-2000	After 2000	Other
Northern	220	0	112	245	0	660
Hoboken	0	--	0	300	--	0
Downtown J.C.	0	0	0	--	--	2032
Southern	0	0	24	--	--	173
<b>TOTAL</b>	<b>220</b>	<b>0</b>	<b>136</b>	<b>545</b>	<b>0</b>	<b>2865</b>

\* in thousands of square feet

The Penn-Central Yards, West 59th to 72nd Streets - a large parcel of abandoned railroad yards has attracted many proposals including Donald Trump's "Trump City", and its attempt to return to New York City the record for building height.

The West Side Long Island Railroad Yard - a 30 acre site being the focus of proposals for mixed use development.

Riverwalk, on the East River between 16th and 24th Streets - proposed as a mixed use development, including a marina

Battery Park City - continued development on the filled land on the Hudson River including a variety of office space and dwelling units.

South Ferry Plaza - a mixed use development incorporating renovation of a number of Battery structures of historical interest. This project has been abandoned recently because of the sluggish real estate market.

Legislation designed to slow the rate of loss of shoreline to development is not always successful. Regulators will admit that wetlands protective regulations work against development of large parcels, but not against small wetlands acreages being altered. Coastal zone management regulations often tied coastal development to "water dependent uses." One obvious "water dependent use" is the construction of marinas, now often incidental to extensive housing development.

Two studies of requirements for recreational boating marina slips in New York Harbor conducted in 1979 and 1980 concluded that 10,000 slips constituted the latent demand by recreational boaters (Yankelovich, Skelly and White, Inc., 1979; West and Heatwole 1981). Yet in the decade of the 1980's, over 6500 new boat slips have been proposed for the Bayonne Peninsula, about 6000 of which were in conjunction with condominium development. Of that number, somewhat less than 10% have been actually created with the remainder tied to projects of unknown completion date. While it is undoubtedly true that upper priced housing and marina slips go hand-in-hand, it is equally possible that marina slips and coastal zone development permit approvals are natural associates in establishing "water dependent" justifications.

A major issue arising from continued development pressures on the shoreline of the Estuary concerns the use of pile-built structures. Because of resistance by regulators to permit further landfilling of underwater lands, developers have come to propose buildings constructed on existing or new pile fields. The concept is not new, for the Waterside complex on the East River, built in the early 1970's, is constructed, partially, on 6.1 acres of pilings. The largest pile structure in the Estuary is the North River Sewage Treatment Facility which extends on 30 acres of pilings over the Hudson River between 137th and 145th Streets, Manhattan. The controversy about pile-built structures concerns the effects of shadowing of the aquatic margin of the harbor, the effects of pile fields upon circulation in the nearshore region, and the general further encroachment of urban development upon the Harbor's waters.

#### Impacts of Physical Alteration on Nearshore Habitats and Wildlife

This report deals with nearshore aquatic and terrestrial habitats and wildlife. We have been challenged to deal with that terrestrial area having a direct influence upon the nearshore zone -- an area of differing dimensions in the views of others. As described in the pages above, the focus in this discussion of habitat and habitat alteration has been on the physical modifications -- other reports deal with the effects of toxics and other "chemical" effects. Our focus is appropriate because the effect of human activities upon nearshore habitat is often its obliteration or severe disruption as functional habitat. Further, as described above, historical information on nearshore habitat is focussed on marshes which must, perforce, serve as proxy for the entire suite of nearshore habitats.

Earliest written records of the Estuary comment lavishly upon the abundance of fish and wildlife and upon extensive marshes and forests found there. While some of those records were undoubtedly written for the purpose of enticing colonists to the region, they also represent true reactions to what the early settlers found. The lands they left had been largely deforested and their wildlife decimated. The land into which they moved was one which had been little altered by the extant Native American population. While the Estuary is believed to have had a higher population density of Native Americans than surrounding areas--a density attributed by Salwen (1975) to the abundance of marine foods available through all seasons of the year--it was not a settled population. Movement of Native American villages about the region from time to time allowed vegetation and wildlife to regenerate.

However, soon after colonization, naturalists were noting the changes in wildlife resulting from human developments. Agriculture, particularly the husbandry of European cattle, caused the elimination of larger predators and herbivores (Cronon, 1983). Predation and habitat loss were not the only factors involved in wildlife change, for by the late 1800's regulations on pollution of the Harbor were promulgated to protect its marine life (New York State, 1887). Colonists brought more than themselves and their families to the New World. Agricultural plants were imported, and when introduced as living plants, also introduced their exotic soil microflora and fauna. Kieran (1959) estimated "...that 40 percent of the plant life in New York City and vicinity is of European origin." Many of the introduced species flourished under the new agricultural practices and overwhelmed domestic types. Numbers of introduced cattle soon exceeded the numbers of humans. Their numbers and feeding requirements modified terrestrial pastures, as well as grazed and mowed salt marsh, and altered the chemistry of ponds and streams.

Excessive use of wood for construction and firewood led to rapid deforestation and soon to importation of wood from far up the Hudson and Raritan Rivers. As much as 20,000 cords of firewood were required annually by New York City (Squires, 1981) and, as noted by Kardas and Larrabee (1979, p.1) "In the New York Harbor in general, and most specifically on the Jersey City waterfront...abandoned pier facilities and rotting pilings are the vestiges of...[a] technology of massive industrial construction using the apparently inexhaustible lumber of North American forests."

Destruction of habitat and wildlife in the developing urban region was not a simple process of elimination of all but the most tolerant species. For example, Kieran (1959) notes that "...the destruction or elimination of plant and animal life...through the blanketing of the ground by buildings and pavements is largely a matter of quantity and not of kind." While absence of transport systems initially kept human populations closely concentrated about the workplace, the development of rail transport, and then of the automobile, greatly expanded the reach of humans. This expanded reach, together with the development of leisure time, has had a continuing impact upon wildlife measured beyond habitat destruction. The history of the region is one of progressively more distant human "playgrounds." Initially the Elysian Fields of Hoboken were where the leisured class went to enjoy nature and to recreate. Bayonne and Bergen Point were for almost a century a favored resort. Newark Bay was dotted with yacht clubs. Coney Island, Jamaica Bay and other spots around the Estuary were progressively favored as recreational retreats whose principal assets were often clean air, water and abundant wildlife.

As the metropolitan area has grown, its human population density increased and the suburban fringe extended by transportation systems, strenuous efforts have been made to preserve and protect open space in recognition of the high value placed upon that attribute by our society. However, as the character of urban population has changed and as the "open perimeter" of the urban complex has disappeared, upland open space has come under heavy human pressures from active or passive use. More and more such open space, whether designated as recreational space or as quasi-natural areas, will be subjected to human disturbance. Nearshore habitats such as marshes may become the last bastions for species not tolerant of human presence. In particular, marsh areas in proximity to

activities not considered desirable by humans may prove to have the greatest potential. Examples of such relatively undisturbed areas are the marshes of Jamaica Bay in proximity to John F. Kennedy International Airport or to the landfills on the margin of the Bay; the remaining marsh areas along the Arthur Kill isolated by petroleum storage facilities or by landfills; and marsh areas adjacent to landfills in the Hackensack Meadowlands.

A desirable objective of a study examining historical alteration of habitats and associated wildlife would be the establishment of a body of information about pre-existing habitats and wildlife which commented upon the quality of the habitats and the composition of the flora and fauna. However, serious problems exist with such a goal. One is immediately confronted with such questions as:

\*What period of time should be chosen as a baseline? Pre-glacial? Post-glacial? Pre-Colonization? Post-Colonization? Post-Colonial-Impact?

\*At this distance in history, can the effects of climatic change be differentiated from the effects of human occupation upon habitat and wildlife?

\*How may accounts of historical habitat and wildlife be effectively verified? Have species reported in the vernacular been appropriately identified? How have the vernacular names changed?

\*Has the construct for non-quantitative measures of abundance altered through time?

Response to those questions, and others, is possible: but not within the constraints of the present project. An illustration of the challenges of the task may be drawn from the comprehensive work of Kevin Wright (1988). The Wright report is unpublished and is available only through the Hackensack Meadowlands Development Commission.

Around 1400 AD, the Hackensack Meadowlands were invaded by southern bog species including the white cedar, turning "thousands of acres into a boreal swampland." Many accounts of the Meadowlands report the white cedar marsh and the "clouds" of cedar waxwings which also occurred there (e.g. Clayton, 1881; Van Winkle, 1902). Few of those accounts possess much more detail. The cedar marsh persisted into the "historic" period, covering an area of about one-third of the Meadowlands. An often recounted version of the demise of the cedar swamp tells of efforts in the late 18th Century to clear the Meadowlands of pirates and other villains. Burning of the swamp and other destructive tactics were used, the implication being that all, or substantial portions of the white cedar swamp was destroyed. Wright cautions acceptance of these accounts allowing that while they may contain a "core of truth," deeds of property are known which convey rights to the harvesting of cedar and other wood from the cedar swamp area well into the early 1800's.

A snapshot of nearshore habitats taken at the period of Colonial development by which time reasonable written records had been compiled, would reveal a biota still slowly adjusting to post-glacial climate change, and beginning to show the effects of human disturbance.

# METHODS

by

J.S. Barclay

Our efforts to locate information materials were enhanced by use of computerized reference lists and services and especially by personal contacts with individuals in governmental agencies and private organizations. The latter were particularly fruitful in the development of site-specific data, much of which is unpublished. Almost as much wildlife information exists in unpublished form as in published. Complete assembly of this kind of literature exceeded the time framework of this project. Personal interviews, two boat trips within the harbor, periodic group meetings and searches of institutional library collections were also conducted to attain project objectives.

The existing literature, including books, journal publications, project completion reports, local, state and federal documents, area management plans, and special regional assessments by private organizations or consulting firms were screened for use in this project. Those containing information on species, their status and trends, habitats and management in particular were used to prepare the components contained in this report.

## Atlas of Documented Natural Areas

Documentation on the 39 natural areas (62 sites) within the project boundaries or determined to be relevant to the Harbor ecosystem was obtained in the course of preparing this report (Figure 7). We concluded that much of that information, particularly that contained in unpublished reports, brochures and management plans, should be available to future researchers. Included are such matters as: ownership or management authority of the natural area; physical and biological characteristics; size and geographic location; nature, status and management concerns of natural, modified or created habitats; and sources of additional information. This material was compiled as fact sheets, following a standardized format, for each of the natural areas and is included as Appendix B of this report (Atlas of Selected Natural Areas for the New York/New Jersey Harbor Estuary). This Atlas was intended to be as inclusive as we could make it in the time available but we were unable to verify current status beyond the dates shown.

Personal contacts with local authorities, management plans, maps, special reports ("Buffer the Bay", "Harbor Herons", etc), brochures, leaflets and some published information were among the many helpful sources consulted in compiling the Atlas. These areas were primarily ones which have received some statutory protection and, in most cases, have been designated as parks, preserves, or other forms of special area management, e.g. Jamaica Bay National Wildlife Refuge. In some cases, e.g. "Northwest Staten Island", 24 additional geographic locations ("sub-sites") were identified within larger areas as ecologically significant but not always protected via statute.

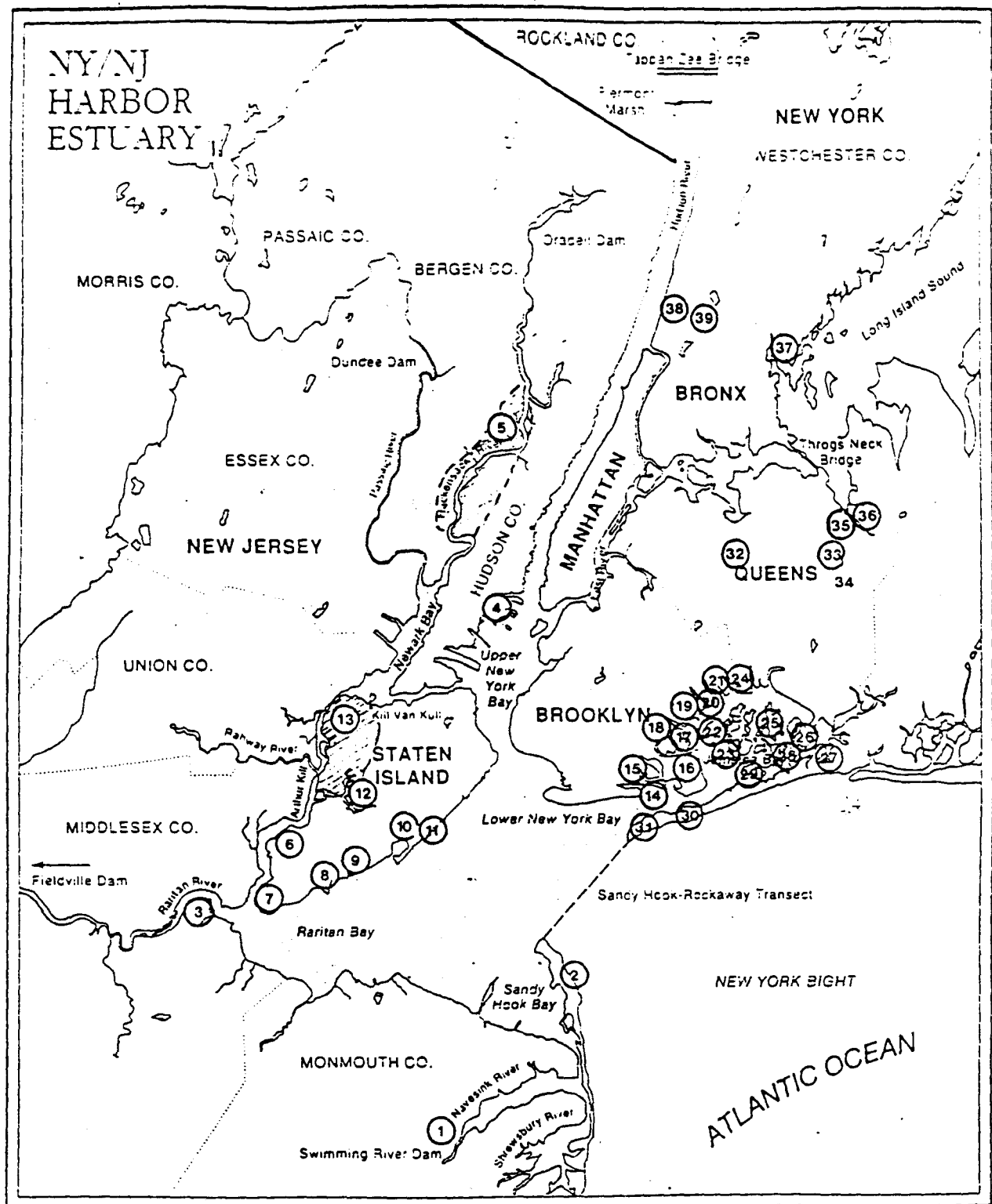


Figure 7. Map of 39 major natural areas for which wildlife habitat and/or population data were obtained.



**Table 8. Key to Figure 7 for the 39 major natural areas (numbers) and subsites (letters) with their geographic coordinates and USGS Quadrangle for which wildlife habitat (Atlas) and/or population data (Matrix) were obtained for use in this report.**

No.	Area/Site	Longitude/Latitude	USGS Quadrangle
1.	Swimming River N.A.*, NJ	40 19'18"N/75 05'45"W	Long Branch NJ
2.	Sandy Hook, NJ	40 28'N/74 00'W	Sandy Hook NJ-NY
3.	Cheesequake N. A., NJ	40 26'00"N/74 16'30"W	South Amboy NJ-NY
4.	Liberty Park N.A./State Pk.	40 42'08"N/74 03'15"W	Jersey City NJ-NY
5.	Hackensack Meadowlands, NJ	40 47'30"N/74 05'00"W	most Weehawkin NJ
6.	Clay Pits Pond State Park Preserve, NY	40 32'30"N/74 13'45"W	Arthur Kill NY-NJ
7.	Conference House Park, NY	40 29'45"N/74 15'00"W	Arthur Kill NY-NJ
8.	Lemon Creek Park, NY	40 31'00"N/74 12'00"W	Arthur Kill NY-NJ
9.	Poillon Ave. Wetlands, NY	40 32'00"N/74 10'38"W	Arthur Kill NY-NJ
10.	Great Kills, NY	40 33'00"N/74 07'45"W	The Narrows NY-NJ
11.	Millers Field, NY	40 34'08"N/74 06'00"W	The Narrows NY-NJ
12.	Staten Island Greenbelt, NY	40 35'15"N/74 07'45"W	Arthur Kill NY-NJ/ The Narrows NY-NJ
13.	A Shooters Island, NY	40 38'38"N/74 09'38"W	Elizabeth NJ-NY
	B Arlington, NY	40 38'15"N/74 10'30"W	Elizabeth NJ-NY
	C Bridge Creek NY	40 38'15"N/74 11'15"W	Elizabeth NJ-NY
	D Goethals Bridge Pond, NY	40 37'45"N/74 10'30"W	Elizabeth NJ-NY
	E Old Place Creek, NY	40 37'30"N/74 10'53"W	Arthur Kill NY-NJ/ Elizabeth NJ-NY
	F Graniteville Swamp, NY	40 37'30"N/74 10'15"W	Arthur Kill NY-NJ Elizabeth NJ-NY
	G Staten Isl. Corporate Pk, NY	40 36'30"N/74 10'30"W	Arthur Kill NY-NJ
	H Gulfport Marsh, NY	40 37'15"N/74 11'30"W	Arthur Kill NY-NJ/ Elizabeth NJ-NY

Table 8, continued.

No.	Area/Site	Longitude/Latitude	USGS Quadrangle
	I Sawmill Creek Marsh, NY	40 36'30"N/74 11'30"W	Arthur Kill NY-NJ
	J Prall's Island, NY	40 36'30"N/74 12'08"W	Arthur Kill NY-NJ
	K Neck Creek Marsh, NY	40 35'53"N/74 11'15"W	Arthur Kill NY-NJ
	L Fresh Kills, NY	40 35'00"N/74 11'30"W	Arthur Kill NY-NJ
	M Isle of Meadows, NY	40 34'30"N/74 12'15"W	Arthur Kill NY-NJ
14.	Plumb Beach, NY	40 35'00"N/73 55'30"W	Coney Island NY-NJ
15.	Marine Park, NY	40 36'00"N/73 55'15"W	Coney Island NY-NJ
16.	Floyd Bennett Field, NY	40 35'30"N/73 53'30"W	Coney Island NY-NJ
17.	Bergen Beach, NY	40 36'30"N/73 53'45"W	Coney Island NY-NJ
18.	A Mill Basin Wetlands and Four Sparrow Marsh, NY	40 36'00"N/73 54'30"W	Coney Island NY-NJ
	B Paerdegat Basin, NY	40 37'30"N/73 54'00"W	Brooklyn, NY/ Coney Isl. NY-NJ
	C Fresh Creek Basin, NY	40 38'30"N/73 53'00"W	Brooklyn, NY
19.	Canarsie Pier Area, NY	40 37'45"N/73 53'15"W	Brooklyn, NY
20.	Pennsylvania Ave. Landfill, NY	40 38'30"N/73 52'30"W	Brooklyn, NY Jamaica, NY
21.	Fountain Ave. Landfill, NY	40 38'45"N/73 51'45"W	Jamaica, NY
22.	Canarsie Pol, NY	40 37'15"N/73 52'15"W	Far Rockaway, NY/ Coney Isl. NY-NJ
23.	Ruffle Bar, NY	40 36'00"N/73 51'30"W	Far Rockaway, NY
24.	Spring Creek, NY	40 38'45"N/73 52'15"W	Jamaica, NY
25.	Ruler's Bar Hassock, NY	40 37'00"N/73 49'30"W	Far Rockaway, NY Jamaica, NY
26.	JoCo Marsh, NY	40 37'00"N/73 47'30"W	Far Rockaway, NY
27.	A Mott Basin, NY	40 36'40"N/73 45'48"W	Far Rockaway, NY
	B Bayswater Peninsula, NY	40 36'47"N/73 46'08"W	Far Rockaway, NY
	C Norton Basin, NY and Southern Norton Basin, NY	40 36'00"N/73 46'08"W	Far Rockaway, NY

Table 8, continued.

No.	Area/Site	Longitude/Latitude	USGS Quadrangle
	D Conch's Basin, NY	40 35'48"N/73 46'50"W	Far Rockaway, NY
	E Edgemere Landfill/Park, NY	40 36'15"N/73 46'47"W	Far Rockaway, NY
	F Sommerville Basin, NY	40 35'45"N/73 47'30"W	Far Rockaway, NY
	G Dubos Point, NY	40 36'15"N/73 47'15"W	Far Rockaway, NY
	H Brant Point, NY	40 35'56"N/73 48'13"W	Far Rockaway, NY
	I Vernam/Barbados Peninsula NY	40 35'45"N/73 48'26"W	Far Rockaway, NY
	J Beach-to-Bay Link, NY	40 35'30"N/73 47'32"W	Far Rockaway, NY
28.	Subway Island, NY	40 36'05"N/73 48'45"W	Far Rockaway, NY
29.	Little Egg Island, NY	40 35'37"N/73 50'33"W	Far Rockaway, NY
30.	Fort Tilden, NY	40 33'38"N/73 53'30"W	Coney Island, NY
31.	Breezy Point Tip, NY	40 32'52"N/73 56'00"W	Coney Island, NY
32.	Forest Park, NY	40 42'15"N/73 51'00"W	Jamaica, NY
33.	Kissena Park, NY	40 44'45"N/73 48'30"W	Jamaica, NY
34.	Cunningham Park, NY	40 44'00"N/73 46'15"W	Jamaica, NY
35.	Alley Pond Park, NY	40 45'30"N/73 45'30"W	Flushing, NY ?
36.	Udall's Cove and Ravine, NY	? ? ? ?	Flushing, NY ?
37.	Pelham Bay Park, NY	40 52'30"N/73 48'30"W	Flushing, NY/ Mt. Vernon, NY
38.	Van Cortland Park, NY	40 54'00"N/73 53'00"W	Yonkers, NY
39.	Riverdale Park, NY	40 53'45"N/73 55'00"W	Yonkers, NY

\* N.A.= natural area

Public management authority for the sites identified included New Jersey Department of Environmental Protection (NJ/DEP) - Swimming River Natural Area, Cheesequake Natural Area, and Liberty State Park Natural Area; U.S. Department of the Interior (USDI)/Gateway National Recreation Area - 18 areas plus 12 sub-sites; and the New York City Department of Parks and Recreation (NYC/DPR) - 14 areas.

Three areas (Spring Creek; 3 "basins" west of Jamaica Bay; and 11 subsites of eastern Jamaica Bay) were identified in the 1987 "Buffer the Bay" report by the Trust for Public Lands (TPL) and the NYC Audubon Society (NYCAS). "The Harbor Herons Report" (TPL and NYCAS 1990) detailed northwest Staten Island (including Governor's Island and 12 other sub-sites) features. A Functional Assessment Report on the Hackensack Meadowlands by the Environmental Protection Agency, Region II and species information from the Hackensack Meadowlands Development Commission (Kraus et al 1987) completed the designated site inventory.

The area reports were used primarily to construct a matrix of species and their occurrence by site and is included as Appendix C, Tables 1 - 3. Once the matrix was assembled we were able to develop some interpretation of status based on presence, absence, abundance, rarity and extirpation.

## Mapping

An exhaustive array of materials, including maps depicting development and habitat modification of the Harbor region since the 1600's were used to reconstruct a quantitative and pictorial history of physical changes within the project area (Figures 3-5).

Portrayal of contemporary natural areas and open space which could serve as wildlife habitat within the Harbor region was accomplished by means of a series of 12 maps contained in Appendix D. We examined most, if not all, available map sets which might in some way depict current wildlife habitats for the area. The resulting maps were necessarily labor intensive but are reasonably accurate and appropriate portrayals of wildlife habitats by major type. The maps are unique to this project and should prove useful as a quick reference for responding to or assessing species/habitat management needs.

Quantification of "habitats" per se has been accomplished via compilation of acreages reported for individual sites plus detailed documentation of changes in lands and waters by dredging, filling, creation of land and construction. Further quantification based on hydrology, soils or vegetation was not carried out but can be done if needed using the habitat maps shown in Appendix D. Sources such as those shown in the References section provide many more useful local details than could be included in the body of this report.

Maps of potential wildlife habitats in the project area included all lands and waters within the specified project area boundaries. A rough approximation of the perimeter included the Hudson River to Tappan Zee Bridge plus the Palisades and/or slopes to the

top of the watershed paralleling the river (or to adjoining parkways) on both sides; east along the Westchester County boundary to Pelham Bay on Long Island Sound; across the Throgs Neck Bridge and Long Island to include Jamaica Bay and the Rockaway Peninsula; across the New York Bight to the base of Sandy Hook, New Jersey; inland west and northwest to include estuarine portions of the Navesink River, Cheesequake natural area, the Raritan estuary, and the Hackensack Meadows. All of the boroughs or other land areas which comprise New York City proper were contained within the mapped boundaries. However, not all natural areas within the inner "landward" city were depicted because of distance (>0.5 - 1.0 mile) and lack of association with the harbor environment.

A color-coded depiction of "wildlife habitats" was made on mylar copies of National Wetlands Inventory maps, which themselves are based upon the U.S. Geological Survey topographic map series. This analysis included any "open space" areas which could reasonably be expected to meet some or all of the needs of one or more wildlife species. Additionally, lands which appeared from the existing map sources to be capable of supporting or producing indigenous plant and animal communities were mapped as well. Thus extensive grassed areas or weedy vacant lots might well be mapped as (potential) wildlife habitat. We did not attempt to depict habitats frequented by ubiquitous "wild" exotics such as pigeons, rats and mice. All natural areas for which we had obtained information on wildlife populations or habitats were included in the overall mapping.

The topographic quadrangles which depict the study area are listed in Table 9. For the final presentation of data we used maps prepared by the American Geographical Society for the Hudson-Raritan Estuary Program of the National Oceanic and Atmospheric Administration. Those maps, scaled at 1/40,000, do not contain the cultural detail of the topographic sheets and so serve more clearly as base sheets. They were, however, prepared for the display of water bodies in the Estuary region and, as a result, do not fully depict the land area of the Estuary. As necessary, those missing terrestrial areas are shown on supplemental topographic sheets reproduced at a scale of 1/40,000 and are included in the Appendix.

As is evident from an examination of Table 9, the study area is represented on maps now 10 years old or more. This decadal gap presented a dilemma for the task of mapping habitats, which was intensified by the dates of the wetlands inventories available from the States of New York and New Jersey, which were prepared in 1972 and 1970, respectively. Because the project was specifically designed to utilize existing information and did not call for field verification of data, we resolved the problem of a dated information base in the next best way. We utilized the cultural information on the topographic maps and the biological information from the wetlands inventory sheets in the development of our habitat and potential habitat charts, recognizing that the information presented is, for some areas, out of date. This procedure did, however, allow us to present a survey based on a widely available data base. Alternatives to this procedure, such as

**Table 9. U.S. Geological Survey 7 1/2 minute quadrangles included in the study area.**

Quadrangle Name	Date of Base Map	Date of Most Recent Map
Arthur Kill	1966	1966 photorevised 1981
Bound Brook	1967	1955 photorevised 1970 photoinspected 1977
Brooklyn	1967	1967 photorevised 1979
Central Park	1966	1966 photorevised 1979
Coney Island	1966	1966 photorevised 1979
Elizabeth	1967	1967 photorevised 1981
Far Rockaway	1969	1969
Flushing	1966	1966 photorevised 1979
Hackensack	1955	
	rev. 1970	1955 photorevised 1981
Jamaica	1966	1966 photorevised 1979
Jersey City	1967	1967 photorevised 1981
Keyport	1954	
	rev. 1970	1954 photorevised 1977
Long Branch	1954	
	rev. 1970	1954 photorevised 1981
Mount Vernon	1966	1966 photorevised 1979
The Narrows		1966 photorevised 1981
New Brunswick	1954	
	rev. 1970	1954 photorevised 1981
Nyack	1967	1967 photorevised 1979
Orange	1955	
	rev. 1970	1955 photorevised 1981
Paterson	1955	
	rev. 1970	1955 photorevised 1981
Perth Amboy	1956	
	rev. 1970	1956 photorevised 1981
Plainfield	1955	
	rev. 1970	1955 photorevised 1981
Sandy Hook	1954	
	rev. 1970	1954 photorevised 1981
South Amboy	1954	
	rev. 1970	1954 photorevised 1981
Weehawken	1967	1967 photorevised 1981
White Plains	1967	1967 photorevised 1979
Yonkers	1966	1966 photorevised 1979

updating the topographic maps by the use of aerial photographs or other mapped information was far beyond the capacity of this project. To have attempted to upgrade the information on the topographic maps based on personal knowledge would have made the data base uneven in its content and hence unreliable.

The landward extent of estuarine waters, whether open or vegetated marsh, was always mapped, but not necessarily to the head-of-tide. Estuarine water boundaries were normally placed at watershed boundaries unless heavily urbanized areas or highways came between the watershed line and the estuary.

In nearly all cases a minimal 50 meter wide buffer zone was allowed between all open space areas and urban development such as roads, utilities, industrial, commercial and residential structures (e.g. roads, railroads, powerlines, water towers, storage tanks, houses and other buildings). The exception to the buffer zone was made in the case of certain military features. While this buffer zone reduced the total areas for parks, wetlands and other potential habitats, it is our experience that this buffer, although likely to harbor some wild animals, is the minimum practical transition between human dominated areas and natural areas and should be incorporated in preservation efforts.

Color photocopies of the 1:24,000 scale hand colored mylar maps were made at a reduced scale of 1:40,000. The color copies, when placed under the black and white 1:40,000 scale project maps on a light table, provided a means for rendering the wildlife habitat types by applying black/white cross hatching "zip-a-tone" to acetate overlays cut to size. The acetates, with their black/white backgrounds, were then photocopied to report format.

#### Habitat Modification Recommendations

Recommendations for habitat modifications were developed from conclusions from our field reconnaissance activities in the study area, insights based on data analyses, and professional experience.

#### Wildlife populations

*Data.* Seven wildlife data files were obtained for use in this study, an eighth was compiled from natural area lists, and all are shown in Table 10. The U.S. Fish and Wildlife Service (USFWS) Breeding Bird Survey file and the Colonial Nesting Bird file from Cornell University were deferred to other investigators who were charged with their analysis. The annual National Audubon Society Christmas Bird Count (CBC) data (Butcher 1989) provided most of the information on winter wildlife populations presented in this report. Data gleaned from various specific area management plans and descriptive reports (e.g. Cook, 1989a, b) provided tabulations on species richness, relative abundance and seasonal information for amphibians, reptiles, mammals and birds (see "Matrix", Appendix C).

The volume of bird banding and recovery files and mid-winter waterfowl inventory data exceeded resources available for analysis. The banding data could provide some insight as to geographic wintering or breeding grounds and the migration routes followed by a variety of species banded or recovered in the New York metropolitan area.

The U.S. Fish and Wildlife Service's Jamaica Bay shorebird migration data provided the only systematic survey information on bird migrations that we were able to obtain other than spring raptor migration data for the period 1977-1988 (Bouton 1987; Major, 1988).

**Table 10. Data sets obtained for evaluation of wildlife populations, population trends and habitats within the New York/New Jersey Harbor Estuary.**

Name	Source	Years Included	Used in Report
Christmas Bird Count Database	Cornell University Lab. of Ornithology	1961 - 1988	yes
Bird Band Recoveries	Migratory Bird Banding Lab, USFWS, Laurel, MD	?	no
Midwinter Waterfowl Trend Data	USFWS Steiner (1984) Reference	1954 - 1984	yes
Cooperative Breeding Bird insufficient Survey Data	Migratory Bird Banding Lab. USFWS, Laurel, MD	1969; 1988	no
Colonial Nesting Bird Registry	Cornell University Lab. of Ornithology	?	no
Natural Area Lists	Misc. state/private	various	yes
Shorebird Migratory Survey Data	Jamaica Bay Nat'l. Wildl. Refuge, USFWS Jamaica Bay, NY	1981 - 1988	yes
Sandy Hook Hawk Migration Data	Boutin, 1987 Major, 1988	1979 - 1988	yes



*Bird Surveys.* The depiction of wildlife populations in this report was based on our analyses of data sets, including periodic bird surveys (Christmas Bird Count [CBC]; Midwinter Waterfowl Inventory [MWI]; autumn raptor migrations; autumn shorebird migrations) and reports of species from natural areas throughout the region. Only the bird surveys provided data which could be used to portray or analyze actual wildlife population trends. Similar data for mammals or herps were not located and may not exist as such, at least on a regional scale. The bird data are presented in a series of graphs and, for the Christmas Counts, tables based on simple linear regressions to clarify trend directions and importance.

The midwinter waterfowl inventory data were the result of nationwide systematic aerial surveys conducted by state and federal waterfowl biologists in mid-January each year. The results of these surveys over the 30 year period 1954-1984 for the Atlantic Flyway in general, and individual states such as New York and New Jersey in particular, were reported by Steiner (1984). The mid-winter count trends are similar to trends exhibited by waterfowl (ducks, geese and swans) in the CBC 1961-1988 (our analysis).

The annual CBC data were obtained from the Ornithological Laboratory at Cornell (Butcher 1989). The data are the results of efforts by knowledgeable volunteers in each of 11 count areas (Figure 8), including one area of open ocean located approximately 10 km east of Sandy Hook. The exact locations are detailed in Table 11. Each count area is within a 15 mile diameter circle and each group of participants follows specific count guidelines. The ten mainland areas comprise substantial coverage (roughly 1,700 sq.mi.) of the metropolitan region, although some overlap in count areas was apparent when mapped by their geographic coordinates. These overlaps are considered minor and occur mostly over large expanses of open water.

The bird counts from the 11 count areas (circles) were averaged for each of the 277 species reported. The 100 species found to be most frequently encountered over the 27 year period were selected for graphic display and trend analysis (linear regression) (Butcher et al, 1990). Only two species (Ruffed Grouse, Monk Parakeet) out of the 100 fell below one individual per 100 party hours in more than 50 percent of the 27 CBC years.

Because of variations in bird behavior, distribution and count effort from area-to-area and year-to-year, the data for 66 species were "normalized" (i.e. transformed to a standard basis) by dividing the total number observed by the total number of observer ("party") hours each year. This was done for species whose count is a function of hours spent in census effort. The 34 species whose numbers were not likely to be a function of effort were those known to be found in groups in familiar habitats (e.g. some duck & gull species). Since birds in the latter category were likely to be counted accurately, the results were used without transformation (i.e. non-normalized).

"Oracle" software on a Zenith 386 PC was used to compile the CBC data averages, while "Quattro Pro" was used in the preparation of the spreadsheet and graphs of CBC results. A "SAS" program on the UCONN mainframe computer provided the regression analyses of annual CBC totals.

Annual surveys of breeding bird populations have been conducted throughout the United States under the auspices of the U.S. Fish and Wildlife Service since the 1960's. Although FWSSurvey plans called for at least two of the 50-stop 25-mile routes to be surveyed in the area (Route 17 Passaic and Route 24 Gillette) only three runs were made, of which two (1969-Passaic, 1988-Gillette) were usable (S. Droege, pers. comm. 11-3-89). However, the limited data contained in the surveys were of little relevance to this project.

**Table 11. Key to place names, coordinates and survey years for the eleven Christmas Bird Count circles depicted in Figure 8 and included in the analyses of New York Harbor winter bird population trends as provided by the Cornell Ornithological Laboratory, Ithaca, NY.**

Map Symbol	Location Name	Coordinates		Years Surveyed (N)
		Longitude	Latitude	
A	Atlantic Ocean	40 14' N x 73 28' W		1975-86, '88 (13)
B	Long Branch (NJ)	40 14' N x 74 04' W		1961 - 1988 (28)
C	Sandy Hook (NJ)	40 28' N x 74 00' W		1976 - 1988 (13)
D	Raritan Estry.(NY/NJ)	40 31' N x 74 21' W		1963 - 1988 (26)
E	Staten Island (NY/NJ)	40 35' N x 74 09' W		1961 - 1988 (28)
F	Brooklyn (NY)	40 36' N x 73 56' W		1961-69,'71-88(27)
G	Queens (NY)	40 42' N x 73 45' W		1965 - 1988 (24)
H	Lower Hudson (NY/NJ)	40 47' N x 73 59' W		1961 - 1988 (28)
I	Bronx-Westchester(NY)	40 53' N x 73 45' W		1961 - 1988 (28)
J	Hackensack (NJ/NY)	40 56' N x 74 02' W		1961 - 1988 (28)
K	Rockland Co. (NJ/NY)	41 08' N x 73 58' W		1961-73,'75-88(27)

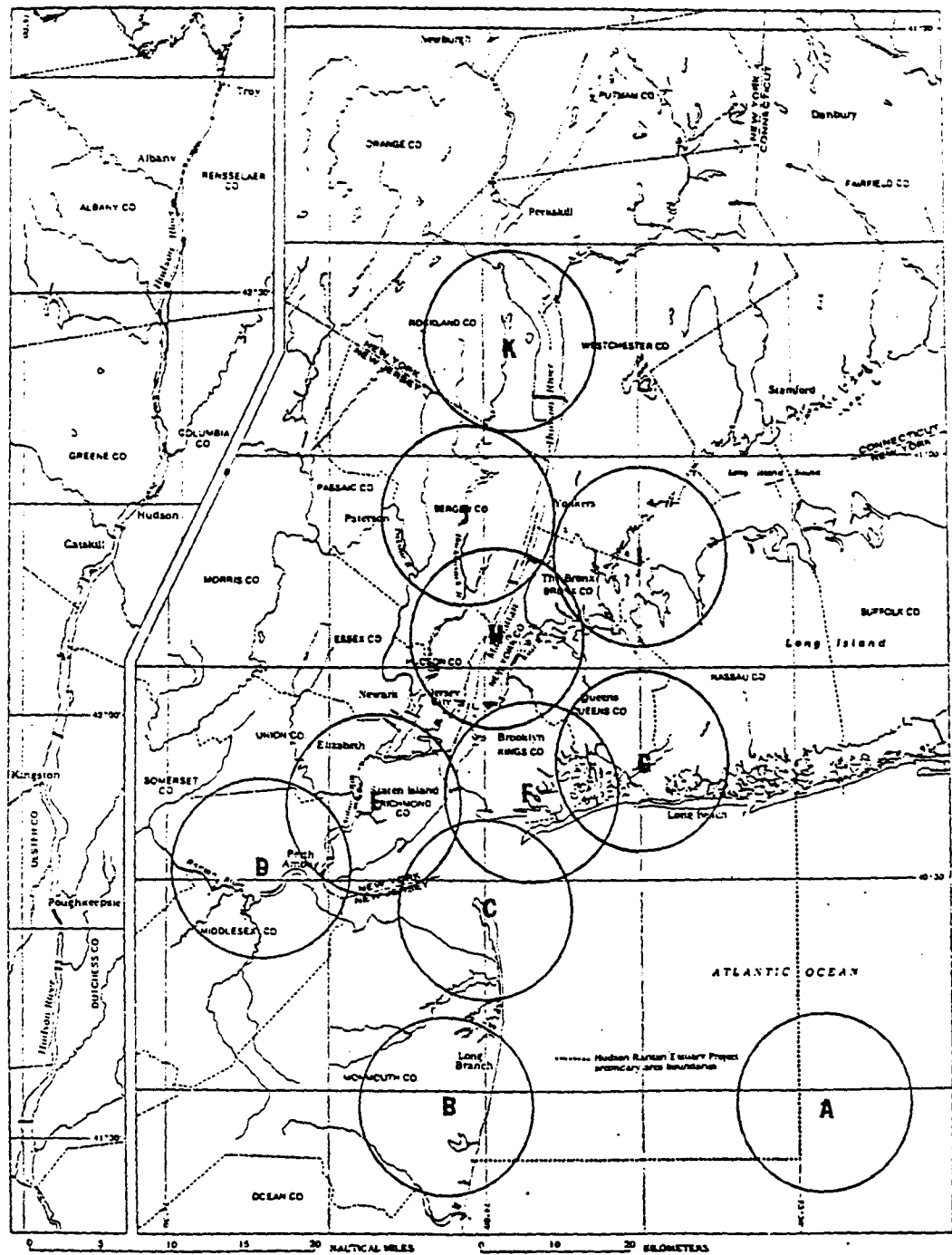


Figure 8. Map of 11 Christmas Bird Count circles whose data were included in the analyses of winter bird populations as described in this report

# RESULTS AND DISCUSSION

by

J. S. Barclay

## Time Frame and Data

The one year total project time was sufficient to assess the kinds and availability of published information and data bases. However, it was insufficient for conducting analyses of all available data. For example, an extensive file of approximately 10,000 bird band recoveries was obtained from the USFWS but has not been utilized due to time and financial constraints. We found that the identification and acquisition of data sets, followed by the development of appropriate software for analysis, required considerably more time than was available.

What has not come to our attention yet are reliable estimates of biomass diversity, breeding population size and success by species, production rates and wildlife resource values as compared to pre-development levels. Since estuarine wetlands are considered by ecologists to be especially productive, crucial to some wildlife, and essential for viable shellfish and finfish populations in coastal waters (Odum 1971), remnants of any pre-settlement wetlands which might remain should qualify for high priority preservation status.

## Wildlife habitats

The earliest known written accounts of European explorers from the late 1400's through more complete texts surviving from the eighteenth and nineteenth centuries depict a rich biota and highly productive estuarine complex in and around the New York/New Jersey Estuary and environs. Its location at the mouth of a major river, plus large islands, interlacing waterways, deep waters and close proximity to major ocean currents, combined to create a remarkably productive environment.

The process of urban development which began so innocently in the early 1700's continues today, presumably less innocently and with greater cost. Regardless, what remains represents a nearly complete alteration of the original habitats as organically productive components of the estuarine ecosystem. Surprisingly little of the original habitats remain: we have not been able to identify any. Much of the acreage that provides open space as well as habitat for wildlife today is the result of human disturbance. Therefore, any original natural areas which might remain, plus designated parks and preserves, must be considered of high priority in future planning and preservation. These areas are increasingly important as habitats and as sources of native plants and animals (Swift 1987).

*Natural areas.* The 39 natural areas indicated in Figure 6 represent a total of 62 specific sites scattered throughout the New York/New Jersey Harbor region. One such area designation (No. 13) on Staten Island included 13 sites (including Shooters' Island)

mammals, reptiles and amphibians were prepared and reported by The Trust for Public Lands and the New York City Audubon Society (1990). Site number 27 includes 10 sites within Jamaica Bay for which one Jamaica Bay master list was identified (TPL/NYCAS, 1987). However, National Park Service and Fish and Wildlife Service publications provided data for a variety of National Wildlife Refuge and National Recreation Area locations in and near Jamaica Bay (Appendix B).

Excluding the unique Hackensack Meadowlands areas (about 8,000 acres) 43 of the 62 sites reported 17,475 acres (406 A/site). Extrapolating to 61 sites (excluding the Hackensack Meadowlands) provides an estimate of 24,790 acres of natural areas, of which approximately 95% (16,601 acres) is under municipal, state or federal authority. The Hackensack Meadowlands is under the authority of the Hackensack Meadowlands Development Commission and 60% of the original 20,000 acres reportedly have been developed (Table 12).

**Table 12. Summary of documented natural areas, specific sites and reported acreages by management authority in the Harbor region. NJ DEP=New Jersey Dept. of Environmental Protection; NYS/OPRHP = New York State Office of Parks, Recreation and Historic Preservation; NYC/DPR = New York City Dept. of Parks and Recreation; USDI(NPS) = U.S.Dept. of Interior National Park Service.**

Management Authority	Total Sites	Sites Reporting Acreage	(%)	Acres Reported	x Acres per Site
NJ DEP	3	3	(100)	1,719	573
NYS/OPRHP	1	1	(100)	260	260
NYC/DPR	15	15	(100)	9,462	631
NYC/Private	21	13	(62)	712	55
USDI (NPS)	15	8	(53)	4,430	554
USDI/NYC/Private	3	2	(67)	730	365
Private (NJ)	1	1	(100)	20,000 (Hackensack Meadows)	
Private (NY)	3	1	(33)	162	162
	62	44	(71)	37,475	852*
Excluding Hackensack Meadows:		43		17,475	406

\*including Hackensack Meadows

*Parks and open space.* Federal, state and city parks and parkways appear to constitute the single most important protected source of "wildlife habitats" throughout the metropolitan region of New York, accounting for 26,304 acres of which 13 percent (3,337 acres) is parkway or expressway (Zisser 1988) (Table 13). Not all of these lands are likely to qualify as wildlife habitat per se but any sizable open area has some potential. For example, if some structural modifications (e.g. openings through barriers) and management adjustments (e.g. reduced mowing) were incorporated into expressway "open space", such corridors could become safer and more productive habitat. Suggestions for more habitat modifications are given in the next chapter.

Federal government lands, 7,043 acres within the study area, including both the Jamaica Bay National Wildlife Refuge and Gateway National Recreation Area, comprise a partial but strategic coastal buffer between the marine and urban environments. The State of New York parkland, at 324 acres, includes some biotically important areas.

Five relatively large New Jersey natural areas (Swimming River, Sandy Hook, Cheesequake, Liberty, and Hackensack Meadows) are significant ecological remnants of formerly extensive ecosystems. Each area has been encroached upon by intensive development and presumably remains vulnerable to further modification. Each has some bearing upon the Estuary environment, particularly from hydrological, water quality and organic nutrient perspectives. However, these areas also serve as important reservoirs of native plant and animal species.

Table 13. Distribution and size of major park areas in New York City.\*

Borough	Parks	Acres	Parkways	Acres
The Bronx	Flushing Meadow	718	Bronx River	202
	Pelham Bay	2,764		
	Van Cortlandt	1,146		
Brooklyn	Pritchard Square	2	Leif Erickson Ocean	760 140
	Grand Army Plaza	11		
	Plaza Street	4		
	Prospect Park	526		
Manhattan	Central	840	Cross Island Interborough Grand Central Gr. Cent. Pkwy. Extn. Willowbrook Richmond	326 73 180 370 307 979
	Riverside	318		
Queens	Flushing Meadow	1,258		
	Forest	538		
Staten Island				
TOTAL		8,125		3,337

\* Derived from Zisser 1988. Board of Education open space and Housing Authority open space are not included.

Together the five New York boroughs encompass 315 square miles (201,404 acres) of land area (Zisser 1988) of which nearly 17 percent (33,671 acres) is designated city, state or federal parks or other open space. Impressive as these numbers are, they assume added importance when viewed from the perspective of human population densities (Odum 1971) and, by inference, pressure upon the natural plant and animal communities which the parks sustain. For example, based on data from the 1980 census (Zisser 1988), there are only five acres of open space per thousand people versus 24 acres of non-park per thousand people (Table 14). The open space "allocations" range from 1.8 acres per thousand persons in Brooklyn to 16.2 acres per thousand people on Staten Island. The overall open space plus non-park land resource allocation is calculated at 0.028 acres per person, or a hypothetical plot of land 35 feet by 35 feet square for each person. According to Odum (1971), it takes an average of five acres (somewhere) per person to provide all of the necessities which "make man something more than an 'organic machine.'"

Except for New York City Department of Parks and Recreation sites which were represented by detailed management plans, few sites listed acreages for major habitat types. Therefore, except for 9 city parks, plus Floyd Bennett Field, Liberty Natural Area Park, and Sandy Hook National Seashore area, details on the extent of habitat types, their characteristics and composition were not found.

**Table 14. Park land as a percentage of total land and in relation to population in New York City.\***

Borough Name	Total Land Area (Acres)	Park (Acres)	% Total	Acres per Thousand People
The Bronx	27,925	6,821	24.425	5.8
Brooklyn	47,647	4,090	8.585	1.8
Manhattan	15,185	2,655.6	17.489	1.859
Queens	72,210	7,046.17	9.758	3.726
Staten Island	38,432	5,691.273	14.807	16.163
<b>TOTALS</b>	<b>201,404</b>	<b>26,304</b>	<b>13.06</b>	

\* Derived from Zisser 1988.

#### Wildlife Populations

Status and trend data require long term systematic monitoring of populations and yield data sets requiring large computer capacities. The presence of wildlife species on

natural areas throughout the project area, as reported on faunal lists supplied by cooperators, in addition to repeated surveys of bird populations (e.g. Christmas Bird Counts), provided the data for assessing the status and trends of wildlife populations. We did not locate any other data files which could help fulfill the module objectives for ascertaining population status or trends, particularly for mammals, reptiles and amphibians. The coverage we did obtain was reasonably even, although some areas may have been overlooked.

*Matrix of Wildlife Species.* Not all of the 39 natural areas included in the Atlas provided complete listings of all wildlife. Birds were reported in species lists from 21 sites, mammals from 33 sites, and amphibians and reptiles from 26 sites. The lists themselves varied from casual listing of species observed over some unspecified time interval to comprehensive detailed listing as to abundance by season and, occasionally, habitat type. Because the fauna lists provided several means of comparison from one site to another, a matrix of reported vertebrate species was prepared for each site by state (Table 15). The matrix (Appendix C) enables comparison of faunas in the somewhat different ecosystems (Piedmont vs. glaciated, riverine vs. coastal, etc.) presented, including those encountered on either side of the Hudson River, itself a natural hindrance to population movements.

The matrix constructed from natural area reports is a compilation by area and state to facilitate comparisons and to construct composite lists of species. Although the degree of completeness varied, the lists appear to provide a reasonable chronicle of species likely to be encountered in the region in recent years. Area size, location (e.g. coastal vs interior), habitat diversity, management effort and appeal to birders or other outdoor enthusiasts are chronicled. All are presumed to have had a strong bearing on the total species reported.

Sixteen of the 39 natural areas are within or close to Jamaica Bay and two additional areas are located on the coastal side of the Rockaway barrier beach. Only four areas are "inland" and apart from a major stream, estuarine or coastal environment. Central Park, Manhattan, was not included among the "inland" areas, as it is outside of the designated project area boundaries.

A total of 411 "terrestrial" vertebrate species were reported from the 39 natural areas included in this study. This total includes two dozen "established" exotic introductions, a dozen ubiquitous urban "generalists", several abundant avian and mammalian herbivores, and a substantial number (+135) of uncommon-to-rare species whose appearance at any time may be more accidental than indicative.



**Table 15. Composite list of natural areas by county and number of vertebrate species reported by class (see Table 8).**

Map Number	Symbol	Name	County	Number of Species Reported			
				Amphib.& Rep	Birds	Mammals	Total
New Jersey							
1	SR	Swimming River	Monmouth	22	118	211	61
2	SH	Sandy Hook	Monmouth	12	242	18	272
3	CH	Cheesequake	Middlesex	ni*	193	16	---
4	LP	Liberty Park NA	Hudson	4	190	6	200
5	HM	Hackensack Mdw.	Bergen	23	258	24	305
New York							
6		Clay Pits Pond	Richmond				
7		Conf. House Park	"				
8		Lemon Cr. Park	"				
9		Poillon Ave. Wetl.	"	15	91	ni	---
10		Great Kills	"	11	ni	12	---
11		Millers Field	"	7	ni	6	---
12		SI Grnblt(High Rock)	"(20 sites)	14	48	9	71
13		NorWst Staten Isl.	"(13 sites)	ni	123	12	---
14		Plum Beach	Kings (Bklyn)	ni	ni	2	---
15		Marine Park	"	1	171	4	---
16	FB	Floyd Bennett Fld.	"	7	171	4	---
17	BB	Bergen Beach	"	3	ni	5	---
18		N. Jamaica Bay	" (3 sites)				
19	CA	Canarsie Pier	"	1	ni	4	---
20	PE	Penn. Ave. Landfill	"	ni	ni	4	---
21	FA	Fountain Ave.	"	"	ni	ni	4
22	CR	Canarsie Pol	"	ni	ni	2	---
23		Ruffle Bar	"	ni	ni	1	---
24	SC	Spring Creek (K&Q overlap)	"	1	ni	10	---
25	RB	Rulers Bar Hass.	"	6	ni	17	---
26	JO	JoCo Marsh	Queens	ni	ni	7	---
27	SE	Jamaica Bay	" (10 sites)				
28	SU	Subway Island	"	ni	ni	1	---
30		Fort Tilden	"	5	ni	12	---
31	BP	Breezy Point Tip	"	3	ni	12	---
32	FP	Forest Park	"	3	143	16	152
33	KP	Kissena Park	"	4	136	6	146
34	CP	Cunningham Park	"	3	128	11	142
35	AP	Alley Pond Park	"	13	86	16	115
36	UC	Udall's Cove/Ravine	"	5	56	9	70
37	PB	Pelham Bay Park	The Bronx	10	238	24	272
38	VC	VanCortland Park	"	6	108	12	126
39	RP	Riverdale Park	"	3	130	13	146
Total Areas Reporting (columns not additive)				26	21	33	39
Total Number of Species Reported				51	326	39	416
*ni= none indicated							

The unusual degree of intermingled terrestrial, marine and estuarine ecosystems, with their extensive transitional edge between aquatic and upland habitats, has contributed to the reported occurrence of many species. This appears to be borne out in both the winter bird data and the natural areas matrix of species, both of which include roughly equal portions of aquatic and terrestrial species. Many of the aquatic types reported are uncommon marine species including cetaceans, turtles, and birds not likely to be encountered inland or at more southern or northern latitudes.

Most natural area lists did not provide information on trends, current status or breeding status of species and there is no assurance that complete species surveys have been conducted. However, it is likely that some species which were reported do not occur with regularity. Our impression is that the larger natural areas (e.g. Hackensack Meadows, Jamaica Bay) have been thoroughly and systematically inventoried and contribute the great majority of species, including the less common inland and marine types.

*Amphibians and Reptiles.* Forty six species of amphibians and reptiles, including five species of marine turtle (Table 16) were reported from one or more of 26 natural areas. The highest number of species (31) was reported for Staten Island, followed by Hackensack Meadows (23 spp.) and Swimming River State Park (22 spp). The mean number of species per site was 8, compared to the median of 4. The percent of species "possible" (based on the mean number of species per order per site divided by the total species reported for that order for all sites) ranged from 11 percent for salamanders to 27 percent for turtles (Table 17). We believe this "possibility index" may provide a useful rating of reported species richness or, conversely, impoverishment within the overall project area.

Three sites in Queens and one in Brooklyn have had a number of species reintroduced by the National Park Service to reestablish or augment declining populations. In most cases the reintroduced populations had not definitely been established at the time

**Table 16. Status summary based on reports by 26 natural areas in the New York/New Jersey Harbor study region for 50 amphibian and reptile species.**

(i)=introduced by National Park Service to establish/restore/augment population; (ip)=transplanted population not definitely established; (e)=recently extirpated; (e<sup>1</sup>)=unconfirmed extirpation; (c/)=locally extinct; (r)=rare; (u)=uncommon; (x)=reported present; (x1)=unconfirmed; (x2)=past; (xs)=identification unconfirmed; (O)=occasional individuals recorded, no evidence of breeding population; (P)=viable resident population; (C)=common; (b)=pelagic, marine species, oceans and bays.

AMPHIBIANS															Total Reports	
(22 areas)	i	ip	e	e <sup>1</sup>	c/	r	u	x	x <sup>1</sup>	x <sup>2</sup>	xs	O	P	C	Extant	Introd.
<b>Salamanders (7 spp.)</b>																
(12 areas)																
Marbled				1											0	
Spotted	1			1				1							1	+ 1
Red "							1	2				1			4	
N. Dusky													1		1	
R. Backed	1	1						6					2	1	9	+ 2
4-Toed				1				2							2	
N. Red								2							2	
N.2-Lined								2						1	3	
Subtotal	2	1	0	0	3	0	1	15	0	0	0	1	2	3	22	3
<b>Toads (3 spp.)</b>																
(18 areas)																
E. Spdft	1					1									1	+ 1
American								4							4	
Fowler's	1	2					1	7				1	4		13	+ 3
Subtotal	2	2	0	0	0	1	1	11	0	0	0	1	4	0	18	4
<b>Frogs (11 spp.)</b>																
(16 areas)																
N. Crikt							1	2							3	
N.Sp.Ppr	3	1						5	1				1	1	8	+ 4
Gry. Tree	1						1	3							4	+ 1
S. Chorus											1(past)					
NJ "								2							2	
Bullfrog							1	8							9	
Green	1							6	1			1		1	9	+ 1
N. Leoprd								2							2	
S. Leoprd (diff. areas from above)								3			1				4(?)	
Pickerel								2						1	3	
Wood								3						1	4	
Subtotal	5	1	0	0	0	0	3	36	2	1	1	1	1	4	49	6
<b>TOTAL</b>																
(22 spp.)	9	4	0	0	3	1	5	62	2	1	1	4	7	7	89	13

Table 16 - continued

REPTILES: TURTLES															Total Reports		
2 Terrestrial	i	ip	e	e <sup>1</sup>	c/	r	u	x	x <sup>1</sup>	x <sup>2</sup>	xs	O	P	C	B	Extant	Introd.
<hr/>																	
(13 areas)																	
Wood								1						1		2	
E. Box	2							7				3					
7 Freshwater																	
(16 areas)																	
Snapping	1							9				4	1	1		15	+ 1
Musk								2						1			
E. Mud								7								3	
Spotted							1	2					1			4	
Bog						1										1	
E. Paintd	1							10				1	1	1		13	+ 1
R-E. Sldr												2					
1 Brackish																	
(12 areas)																	
N. Diamond-backed terrapin							1	7					4			12	
4 Marine																	
(3 areas)																	
Atl. Green																1	
" Lggrhd																3	
" Ridley																1	
" Lthrbk																1	
14 Subtotal	4	0	0	0	0	1	2	45	0	0	0	10	7	4	6	50	2
<hr/>																	
REPTILES: LIZARDS																	
2 (2 areas)																	
E. Fence								1								1	
N.5-L Sk								1								1	
2 Subtotal	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0
<hr/>																	
REPTILES: SNAKES																	
(22 areas)																	
N. Water								5						1		6	
N. Brown	2							6					4	1		11	+ 2
N. R-bld								1									
E. Garter								8	1				6	1		16	
E. Ribbon				1				1									
E. Hognos	1		1	1				2								2	+ 1

continued - next page

Table 16 - continued

## REPTILES: SNAKES - continued

																Total	
Reports																	
	i	ip	e	e <sup>1</sup>	c/	r	u	x	x <sup>1</sup>	x <sup>2</sup>	xs	O	P	C	B	Extant	Introd.
N. Ringnk	<hr/>																
E. Worm						1											
N. BlkRcr	2			1			1	5									6 + 2
E. SmthGr	2							1									2
E. King								1									1
E. Milk	1						1	3				1					5 + 1
12 Subtotal	8	0	1	3	0	1	3	32	1	0	0	1	10	3	0	47	8
TOTAL																	
(28 Sp.)	12	0	1	3	0	2	5	79	1	0	0	11	17	7	6	99	10
ALL SPECIES (50)																	
TOTALS	21	4	1	3	3	3	10	141	3	1	1	15	24	14	6	188	25

Table 17. Total species, average per site, and estimated percent of possible species of amphibians and reptiles as reported for 26 natural areas with the New York/New Jersey Estuary project area.

	Total Secies	x/area	% Possible
TURTLES	10	2.69	27
LIZARDS	2	—	—
SNAKES	12	1.96	16
SALAMANDERS	8	.85	11
TOADS	3	.65	22
FROGS	11	1.88	17
TOTAL	46	1.77	

of reporting. However, it appears that a number of sites have not conducted amphibian and reptile surveys per se and some species may be under-represented. One notable exception is the Staten Island area where 5 species were listed as locally extinct or recently extirpated, 3 rare, 10 uncommon, and 15 common. Possibly the most striking finding from these lists is the lack of common, easily detected species (e.g. frogs and toads) from many sites (Table 18).

Table 18. Frequency of area reports on the status as extinct/extirpated (X), rare (R), uncommon (U), occasional (O), present (P), common (C), introduced (I) or established (E) for 50 amphibian and reptile species for 26 natural areas in the New York/New Jersey Harbor area.

Group	Areas**	Species	No. of Areas and Status* Reported								Total
			X	R	U	O	P	C	I	E	
Amphibians											
salamand.	12	8	3	0	1	2	17	3	3	1	29
toads	18	3	0	1	1	1	15	0	4	2	22
frogs	16	11	0	0	3	1	41	4	6	1	55
Reptiles											
turtles (inland)***	21	10	0	1	2	10	52	4	4	0	73
turtles (marine)	3	4	0	0	0	0	6	0	0	-	6
lizards	2	2	0	0	0	0	2	0	0	-	2
snakes	22	12	7	3	10	1	43	3	8	0	75
—	—	—	—	—	—	—	—	—	—	—	—
TOTAL	26	50	10	5	17	15	176	14	25	4	262
% of total reports (row):			4	2	6	6	67	5	10		100

*Birds.* Sources for 21 natural areas (5 in New Jersey, 16 in New York) reported a combined year round total of 341 species of birds. The New York sites listed 333 species including 39 species not listed for New Jersey. New Jersey listed 300 species including 8 not listed by New York. A total of 50 New York species and 33 New Jersey species were listed as rare, while 7 NJ birds and 17 NY birds were rated as "accidental". Many other species received mixed ratings of "rare", "uncommon", and/or "present" but we did not attempt to analyze them. Virtually identical proportions (42%) of the reported species for each state were obligate aquatic types of marsh, shore and open water environs (Oegraal & Rudis 1986; Terres 1987). The median number of species per site was 218 in NJ with a range of 118 (Swimming River) to 258 (Hackensack Meadows). The New York median of 133 species was based on a range from 48 (High Rock Park, SI) to 316 (Jamaica Bay, 13 management areas inclusive)(Table 19).

Table 19. Bird species richness as a measure of seasonal and annual status for 21 natural areas in New York and New Jersey.

Map I.D.	Letter Code	Number of Species by Season				Annual
		Spring	Summer	Fall	Winter	
New Jersey						
1	SR	--	--	--	--	118
2	SH	223	72	--	--	242
3	CH	127	103	156	103	193
4	LP	182	107	172	106	190
5	HM	222	138	224	110	258
Average		191	105	184	106	177
New York						
6,7,8	SI	151	151	95	73	245
9	PA	--	--	--	--	91
12	HR	--	--	--	--	48
13	NS	--	--	--	--	123
14,17	JB	259	155	280	146	316
15	MP	123	87	147	93	171
16	FB	80	67	73	63	165
32	FP	90	96	42	17	143
33	KP	110	89	114	91	136
34	CP	124	57	99	29	128
35	AP	73	50	78	63	86
36	UC	34	51	35	20	56
37	PB	54	115	56	154	238
38	VC	57	91	50	38	108
39	RP	103	47	103	38	130
High		259	155	280	154	316
Low		34	47	35	20	48
Average		74	87	101	66	145
Combined						
N		16	16	15	15	20
High		259	155	280	154	316
Low		34	47	35	20	48
Average		102	92	117	74	153

**a) Seasonal Variations.** Thirteen New York areas provided data for each season. Average species richness was greatest in spring (105.6 spp), followed by autumn (94.0 spp), summer (87.4 spp) and winter (60.9 spp). Three New Jersey areas (Cheesequake, Hackensack Meadows, Liberty State Park) with complete seasonal data averaged 177 species in spring, 191 species in autumn, 116 species in summer and 106 species in winter (Appendix). Clearly, the areas represented are particularly important to migrating species, but most areas serve as breeding habitat to a diverse avifauna as well. More variation is evident between natural areas in the winter species lists, ranging from 17 (Forest Park, Queens) to 154 species (Pelham Bay Park, Brooklyn). A turnover in avifauna takes place between breeding and wintering populations, particularly along the coast. However, Jamaica Bay (13 areas) lists a total of 86 species that have been recorded in all four seasons, although not necessarily as nesting in the area. Winter species may be more numerous at coastal or estuarine sites where the salt water is less likely to freeze and marine invertebrates are available as food in the intertidal and shallow water zones.

Information on colonial nesting birds (e. g. herons, gulls, terns) has been collected and archived nationwide for approximately 15 years by the Colonial Bird Registry program at the Cornell University Laboratory of Ornithology, Ithaca, NY. The data sets for colonies within the study area have been utilized by Burger et al (1990) in evaluating contaminants in birds.

**b) Wintering Populations.** Ten mainland and one offshore Christmas Bird Count areas (177 sq.mi. circles) (Figure 6) provided a comprehensive data set for evaluating the nature of the winter avifauna and the status of various species (Robbins et al 1990). A total of 277 species (an estimated 2-3 million individuals) had been reported for these count areas for the 27 year period 1961-1988. We selected the 100 species which had been recorded most frequently over the 27 year interval for our trend analysis. Forty-seven of the top 100 winter birds were aquatic species, reflecting an influx of wintering ducks, gulls and miscellaneous other species, plus the departure of neotropical migrants. Most of the remaining 177 species were relatively infrequently observed and quite variable in number each year.

The population for each species was graphed by year (Figures 9- ) and a regression line fitted to the data to facilitate trend evaluation. By sorting species on the basis of the P value and  $r^2$  value the species were placed in groups judged to be increasing, decreasing or showing no persistent trend over the 27 year period (Table 20) (Burdick et al, 1989; Butcher et al, 1990). We observed that 81% of the terrestrial species were either declining significantly (41%) or showing no clear long term trend (40%). Although some aquatic species show significant long term declines (e.g. greater scaup), 81% were either increasing significantly (38%) or showing no statistically significant trend (43%). Literally twice as many aquatic winter species were increasing (18 spp.) as were declining (9), while just the opposite (10 incr. vs 22 decr.) was occurring with the terrestrial winter species.



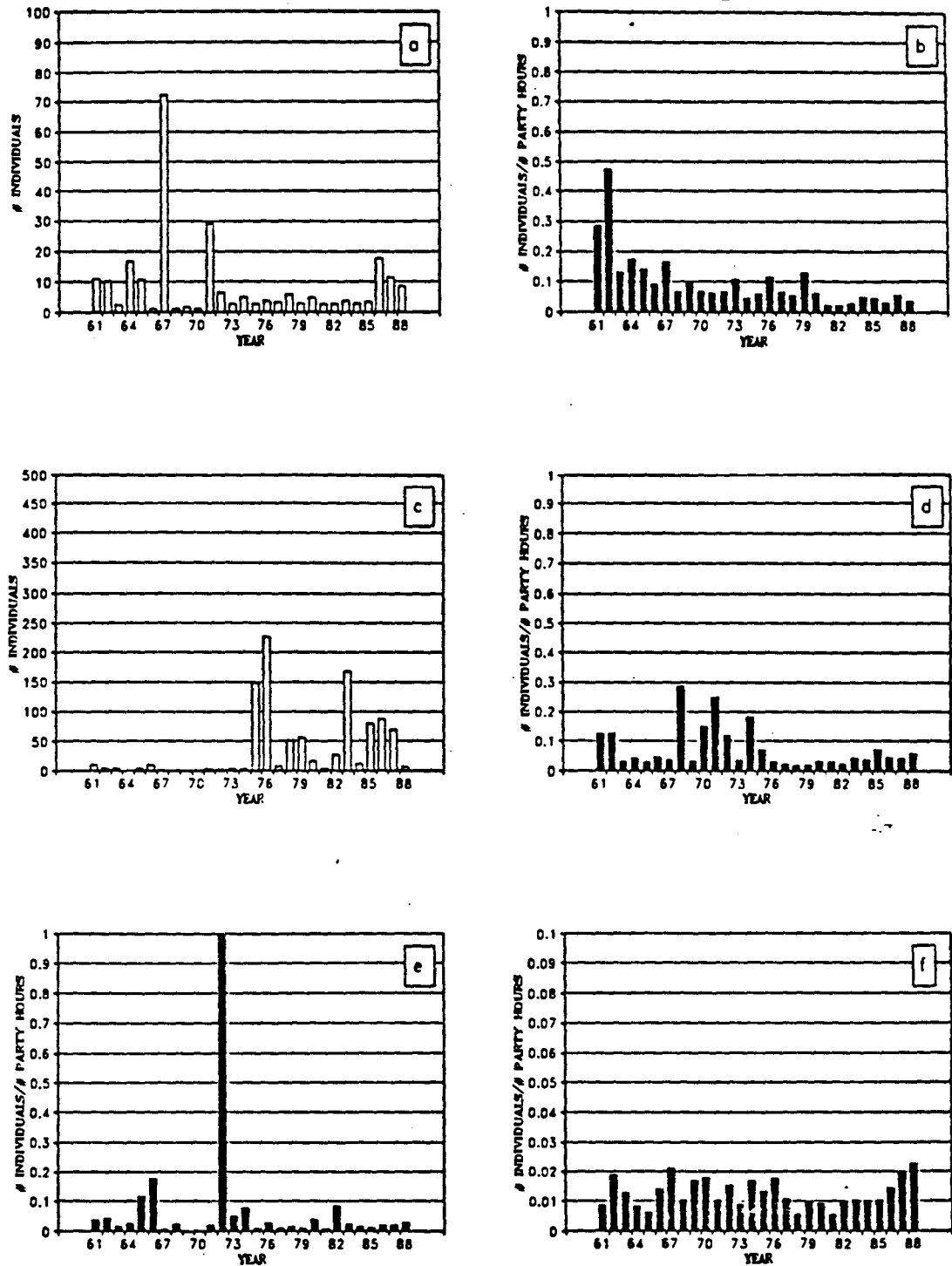


Figure 9 . Population trends of the (a) Red-throated Loon, (b) Horned Grebe, (c) Northern Gannet, (d) Great Cormorant, (e) Double-crested Cormorant and (f) Great Blue Heron generated from National Audubon Society Christmas Bird Count data for the New York-New Jersey Harbor region. Solid bars indicate normalized data; open bars indicate non-normalized data.

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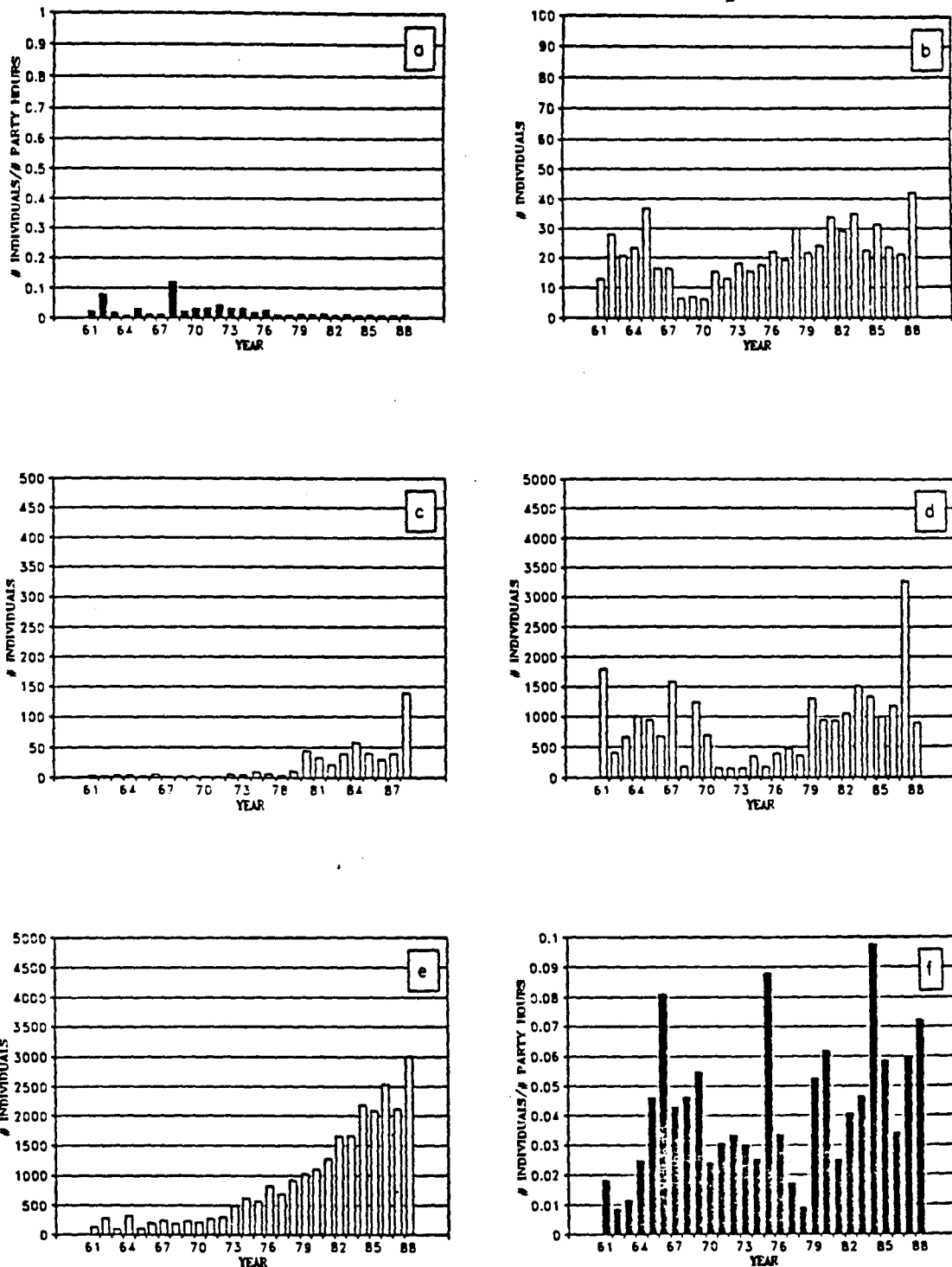


Figure 10. Population trends of the (a) Black-crowned Night Heron, (b) Mute Swan, (c) Snow Goose, (d) Brant, (e) Canada Goose and (f) Green-winged Teal generated from National Audubon Society Christmas Bird Count data for the New York-New Jersey Harbor region. Solid bars indicate normalized data; open bars indicate non-normalized data.

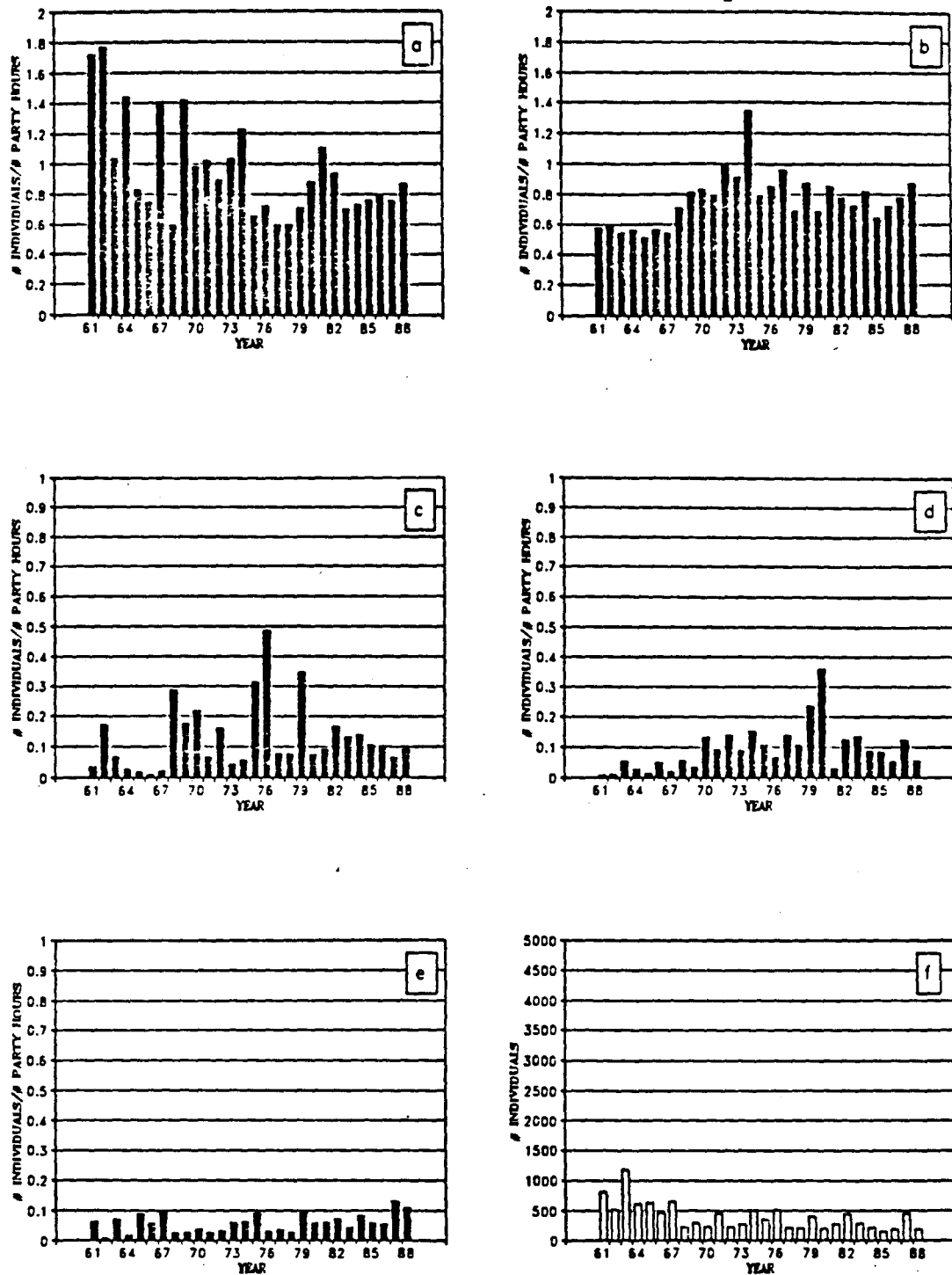


Figure 11. Population trends of the (a) American Black Duck, (b) Mallard, (c) Northern Pintail, (d) Northern Shoveler, (e) Gadwall and (f) American Wigeon generated from National Audubon Society Christmas Bird Count data for the New York-New Jersey Harbor region. Solid bars indicate normalized data; open bars indicate non-normalized data.

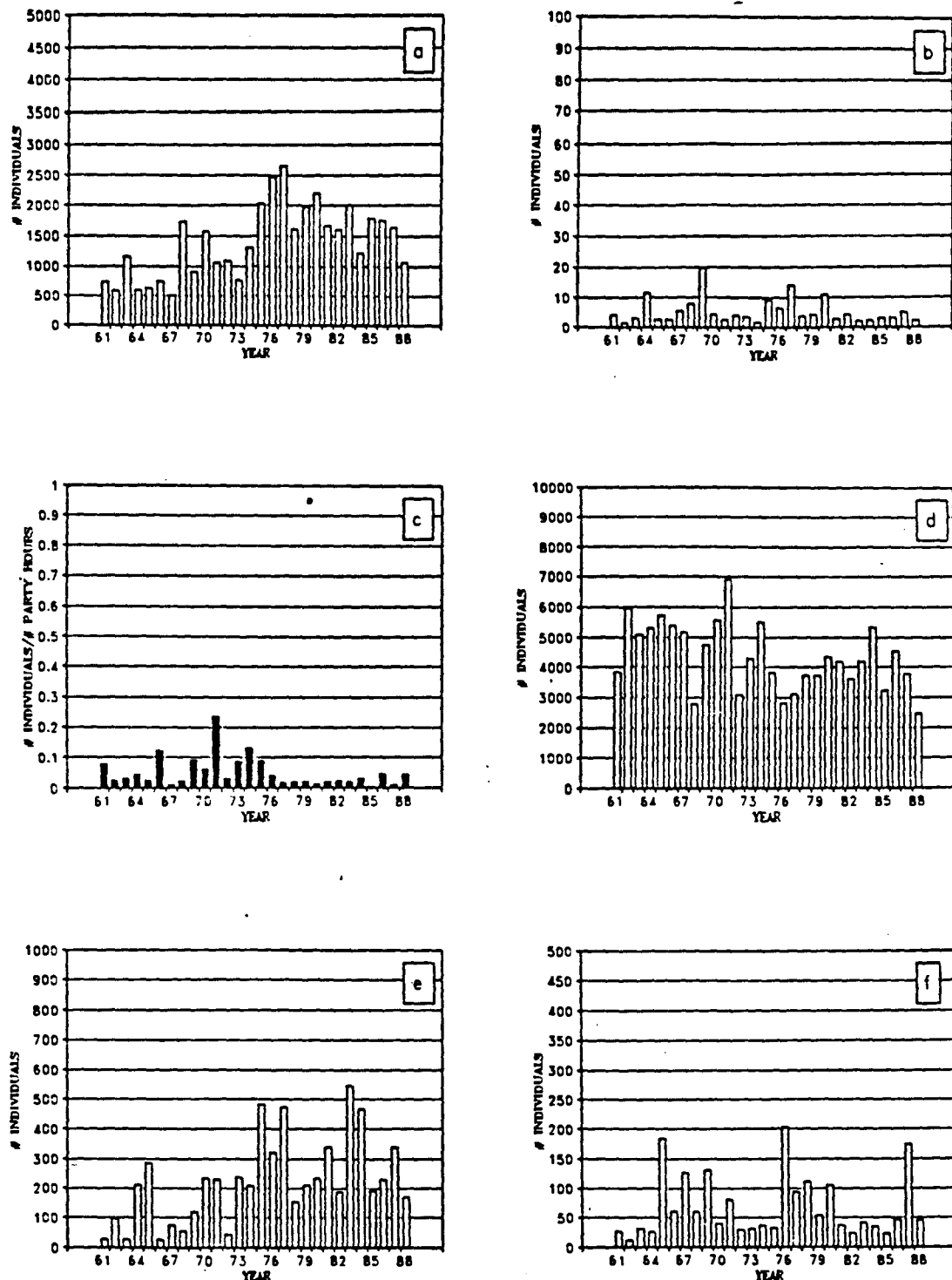


Figure 12. Population trends of the (a) Canvasback, (b) Redhead, (c) Ring-necked Duck, (d) Greater Scaup, (e) Lesser Scaup and (f) Oldsquaw generated from National Audubon Society Christmas Bird Count data for the New York-New Jersey Harbor region. Solid bars indicate normalized data; open bars indicate non-normalized data.

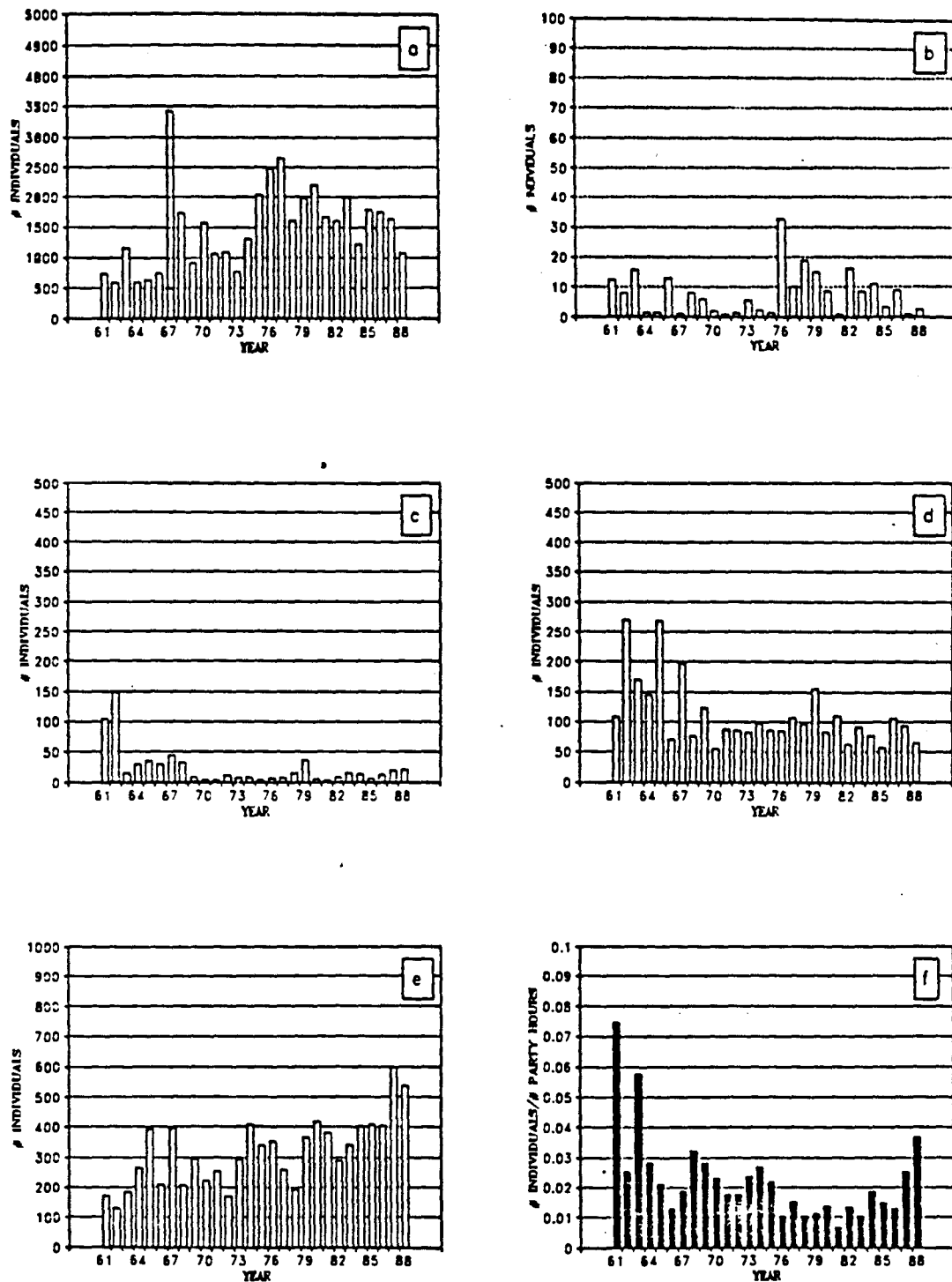


Figure 13. Population trends of the (a) Black Scoter, (b) Surf Scoter, (c) White-winged Scoter, (d) Common Goldeneye, (e) Bufflehead and (f) Hooded Merganser from National Audubon Society Christmas Bird Count data for the New York-New Jersey Harbor region. Solid bars indicate normalized data; open bars indicate non-normalized data.

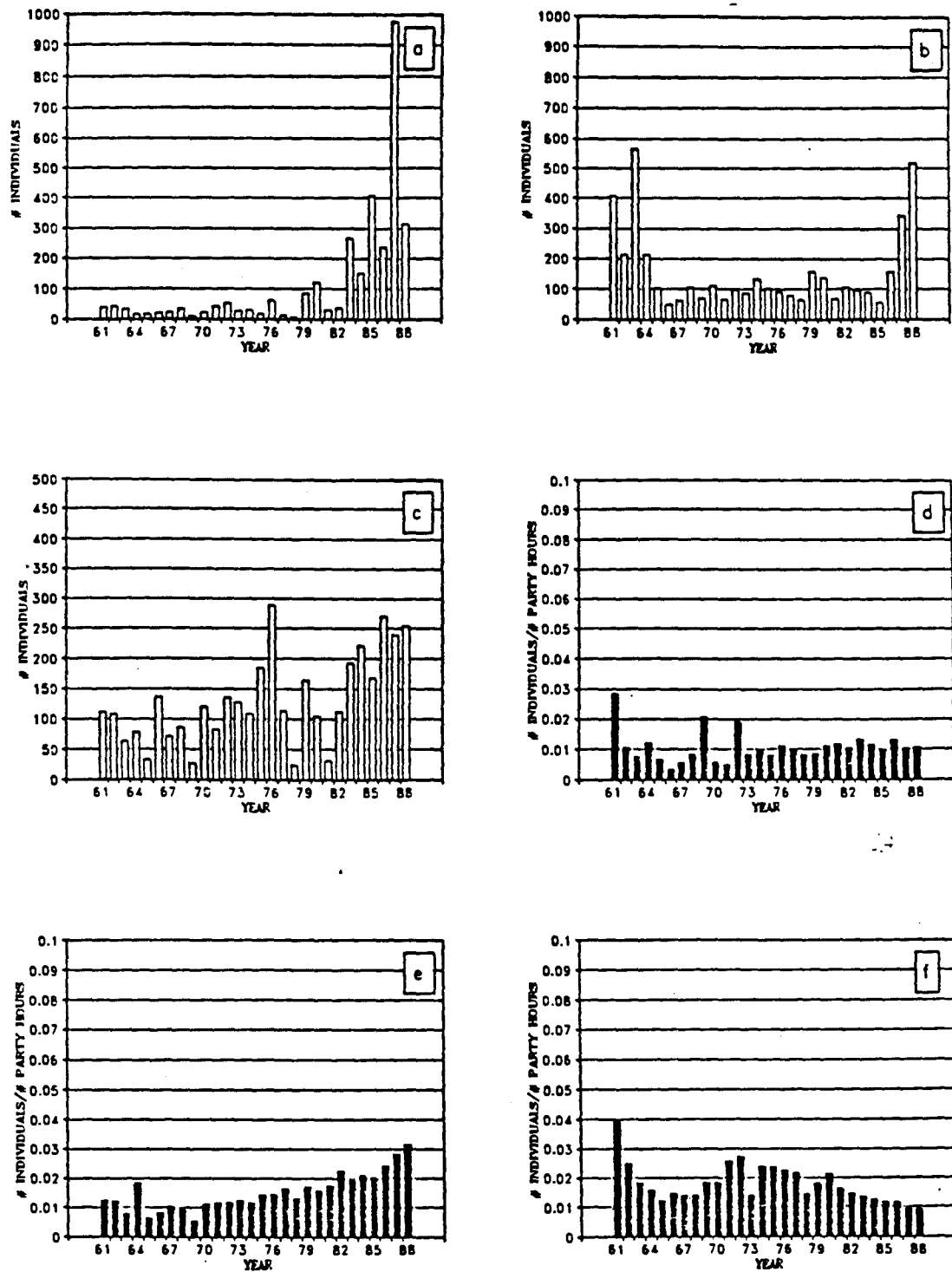


Figure 14. Population trends of the (a) Common Merganser, (b) Red-brested Merganser, (c) Ruddy Duck, (d) Northern Harrier, (e) Red-tailed Hawk and (f) American Kestrel generated from National Audubon Society Christmas Bird Count data for the New York-New Jersey Harbor region. Solid bars indicate normalized data; open bars indicate non-normalized data.

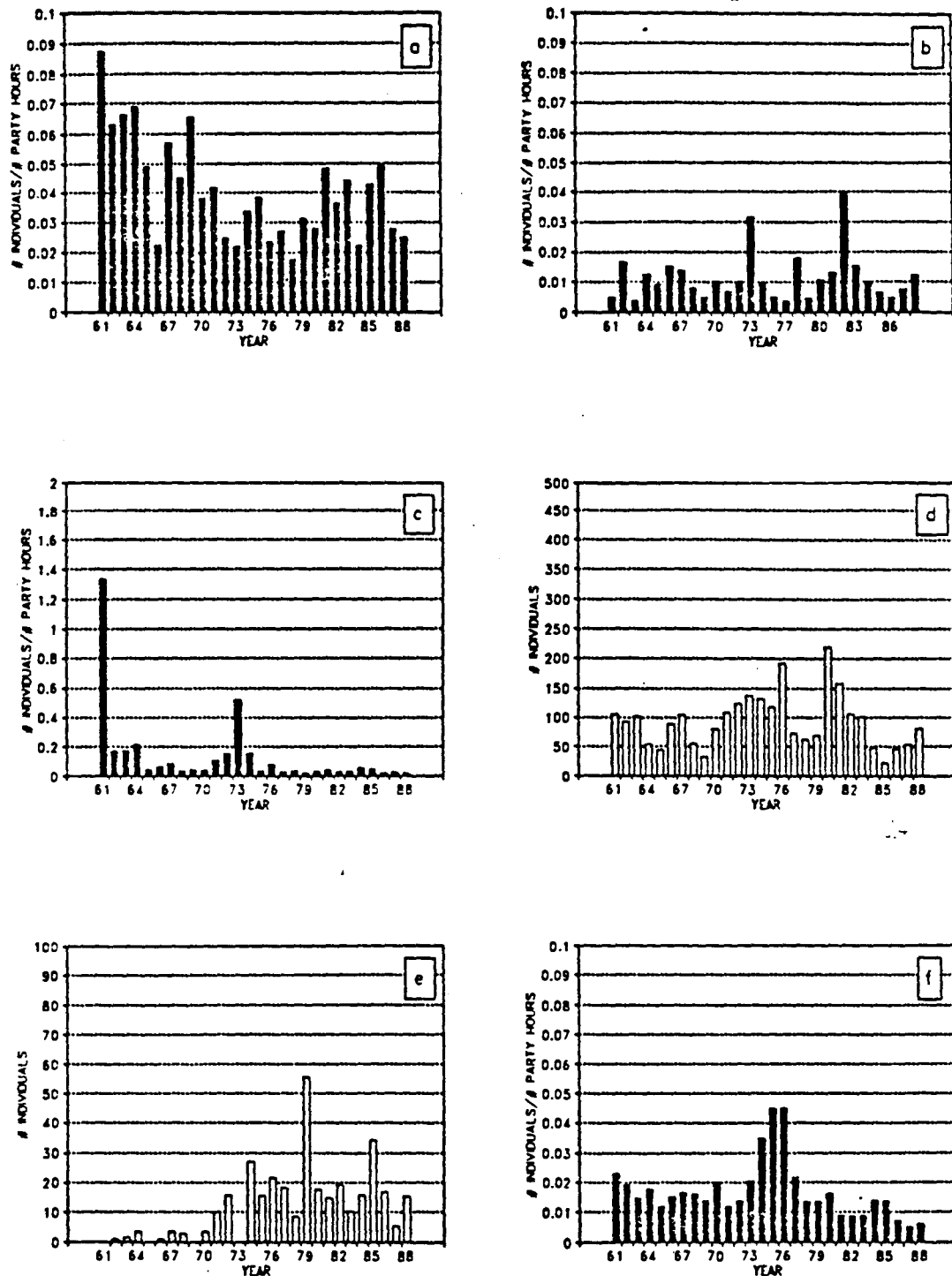


Figure 15 Population trends of the (a) Ring-necked Pheasant, (b) Ruffed Grouse, (c) Northern Bobwhite, (d) American Coot, (e) Black-bellied Plover and (f) Killdeer generated from National Audubon Christmas Bird Count data for the New York-New Jersey Harbor region. Solid bars indicate normalized data; open bars indicate non-normalized data.

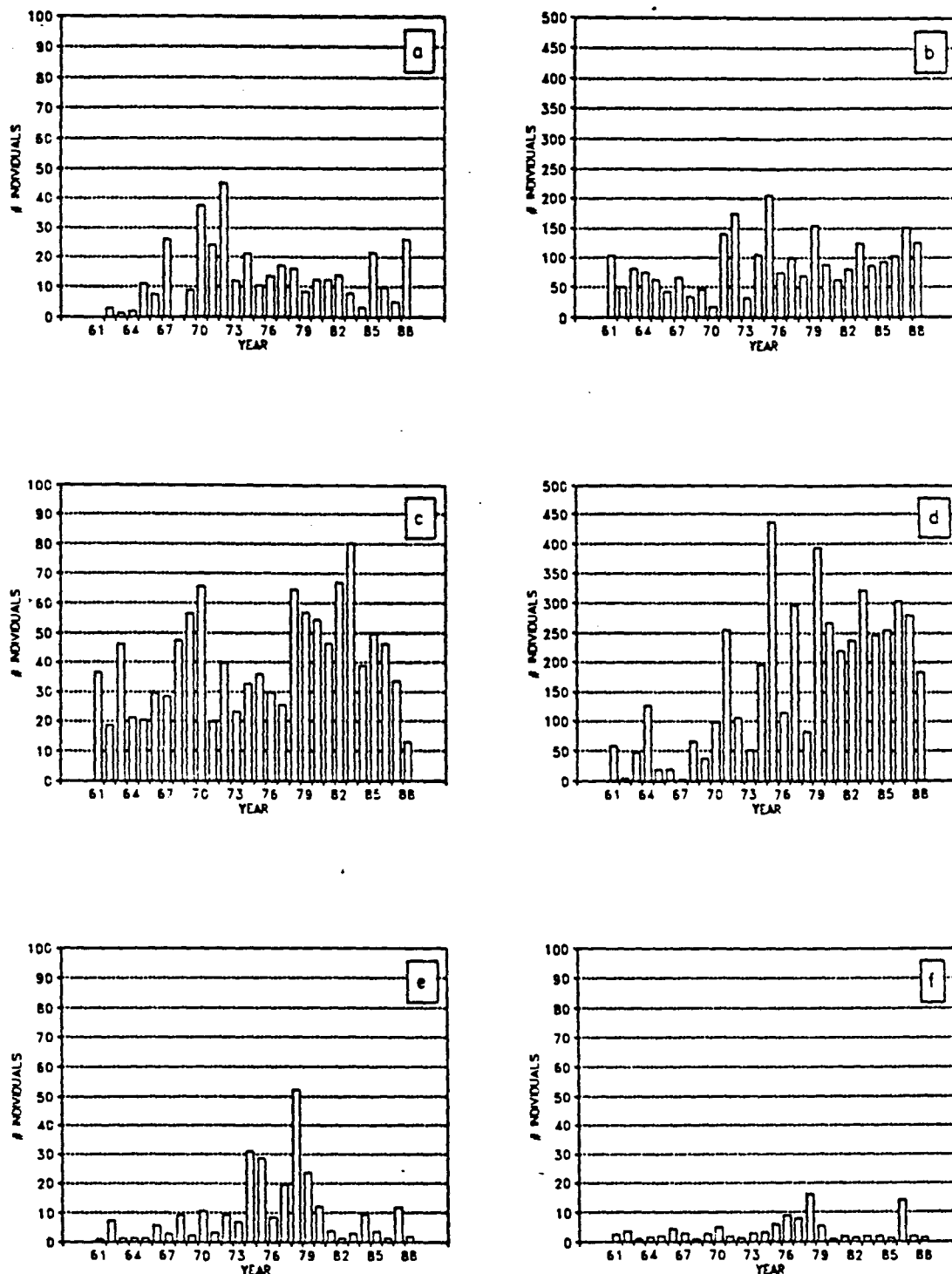


Figure 16. Population trends of the (a) Ruddy Turnstone, (b) Sanderling, (c) Purple Sandpiper, (d) Dunlin, (e) Laughing Gull and (f) Common Black-headed Gull generated from National Audubon Society Christmas Bird Count data for the New York-New Jersey Harbor region. Solid bars indicate normalized data; open bars indicate non-normalized data.



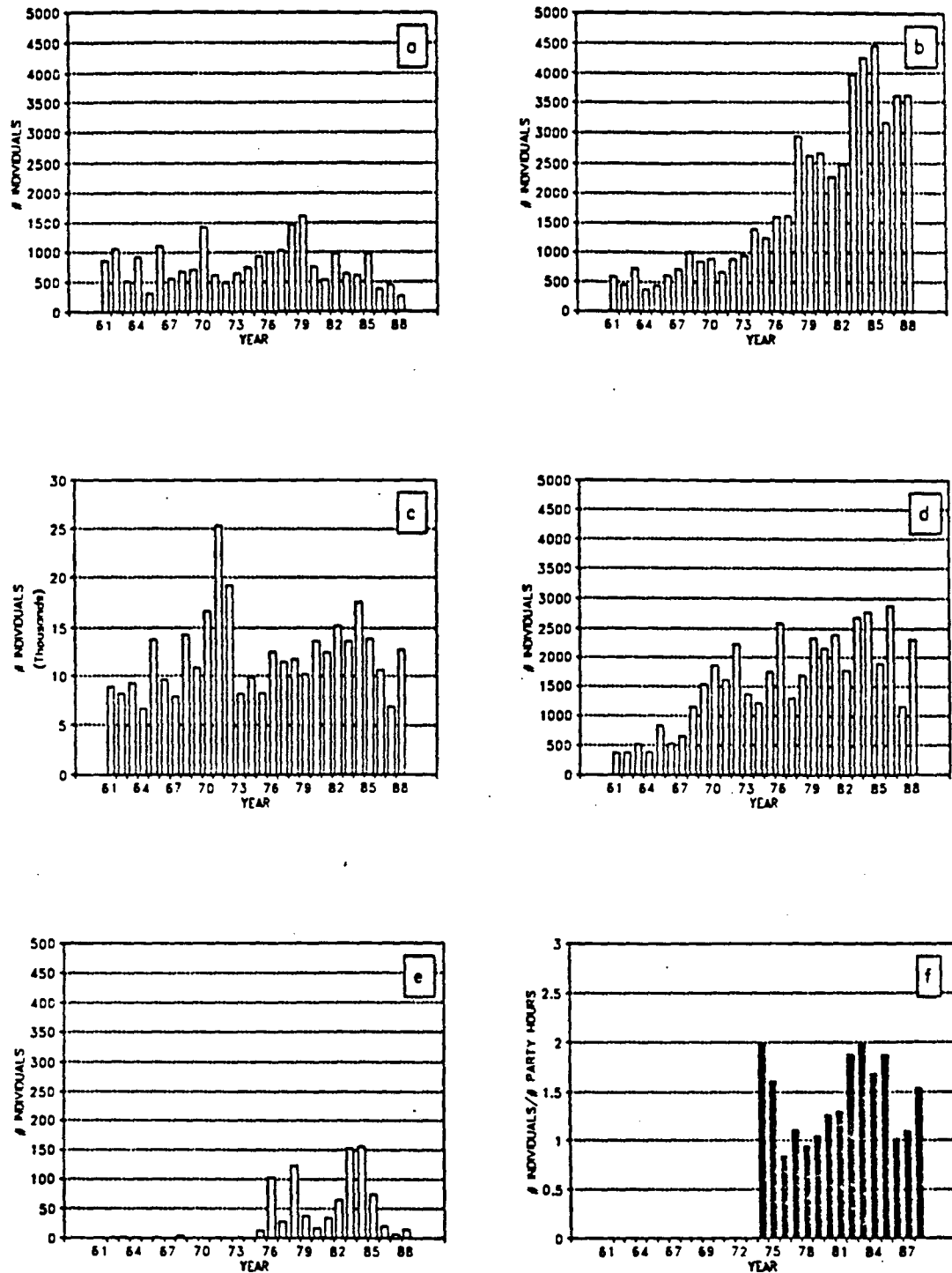


Figure 17. Population trends of the (a) Bonapart's Gull, (b) Ring-billed Gull, (c) Herring Gull, (d) Great Black-backed Gull, (e) Black-legged Kittiwake and (f) Rock Dove generated from National Audubon Society Christmas Bird Count data for the New York-New Jersey Harbor region. Solid bars indicate normalized data; open bars indicate non-normalized data.

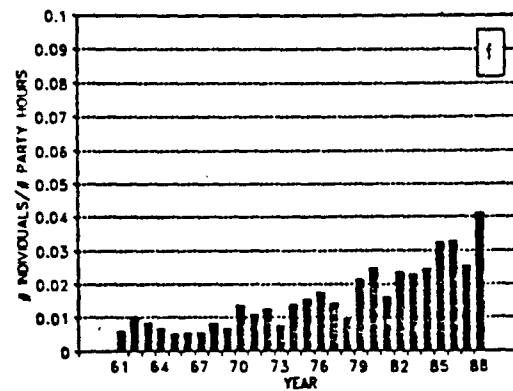
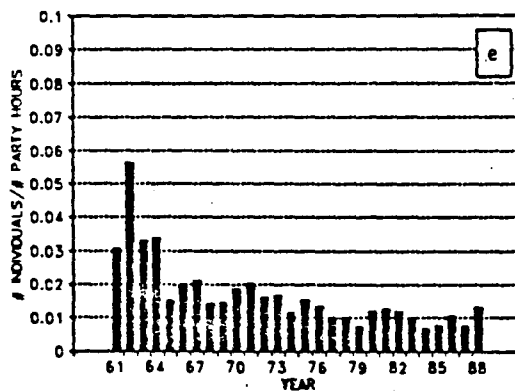
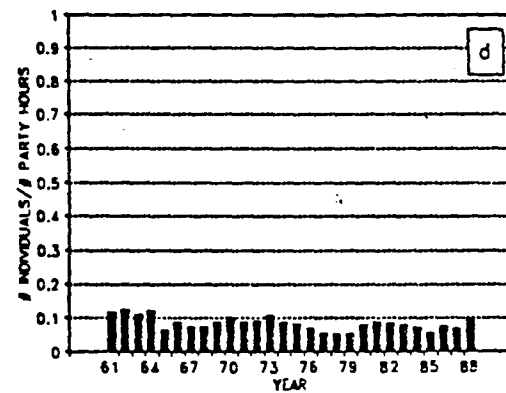
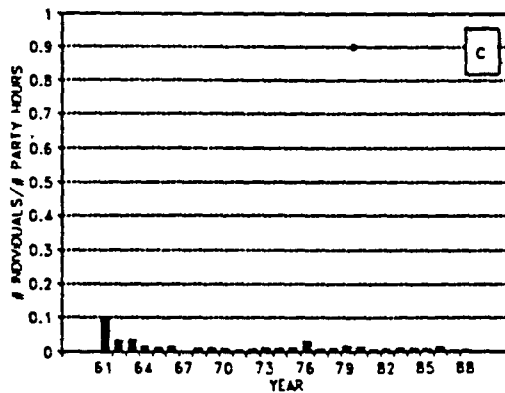
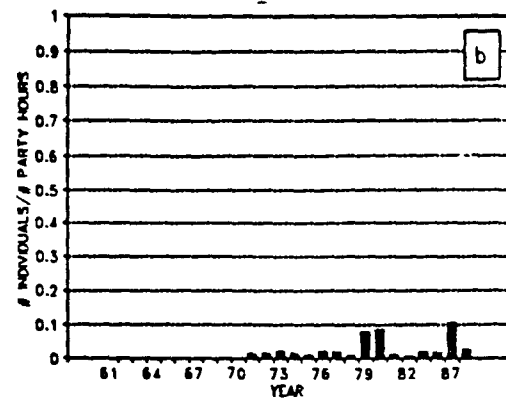
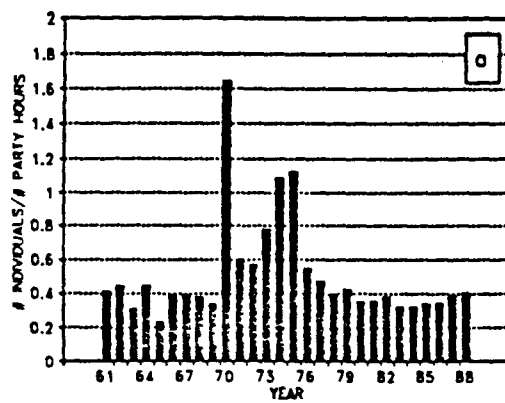


Figure 1 & Population trends of the (a) Mourning Dove, (b) Monk Parakeet, (c) Short-eared Owl, (d) Downy Woodpecker, (e) Hairy Woodpecker and (f) Northern Flicker generated from National Audubon Society Christmas Bird Count data for the New York-New Jersey Harbor region. Solid bars indicate normalized data; open bars indicate non-normalized data.

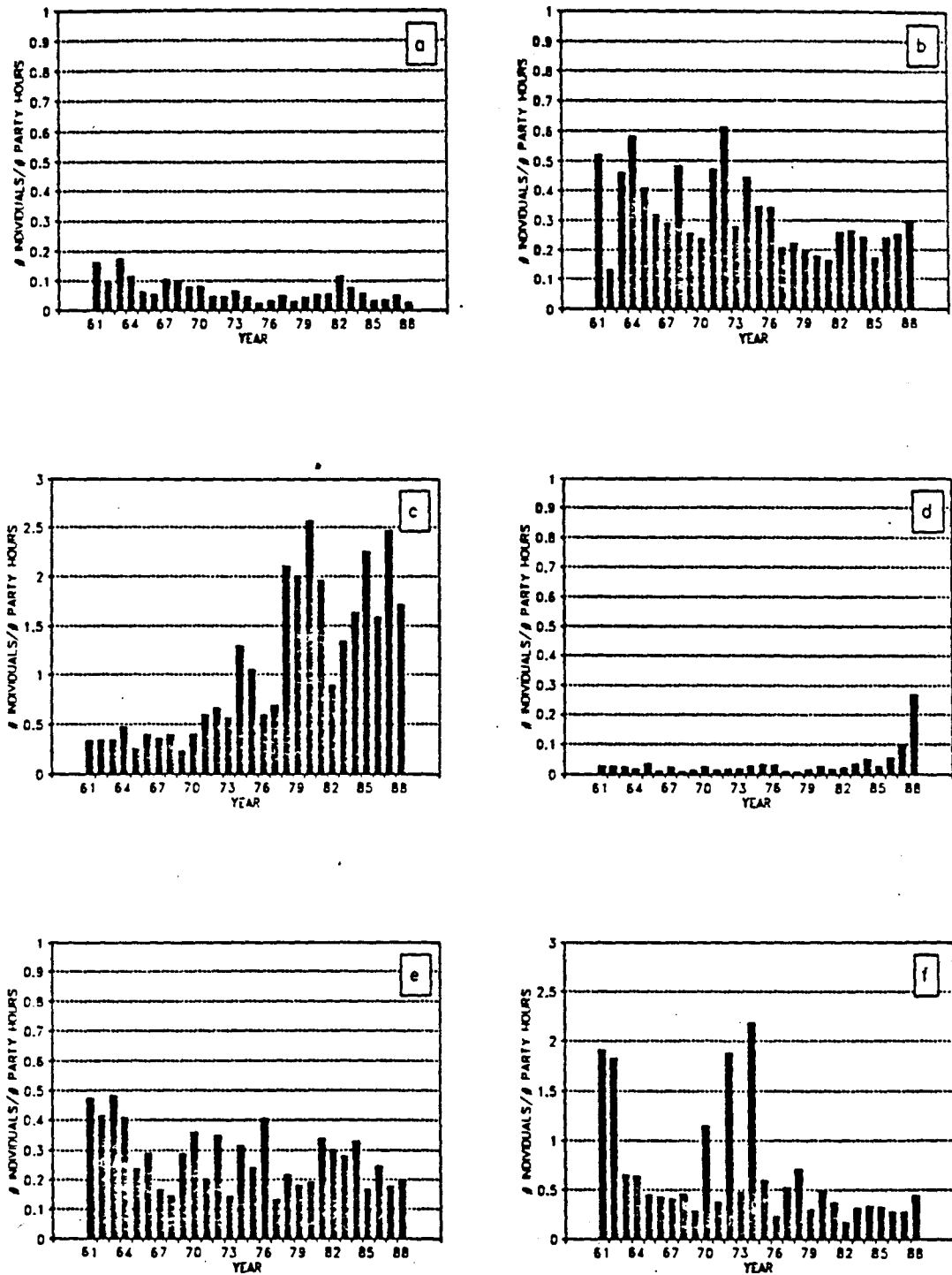


Figure 19. Population trends of the (a) Horned Lark, (b) Blue Jay, (c) American Crow, (d) Fish Crow, (e) Black-capped Chickadee and (f) Carolina Chickadee generated from National Audubon Society Christmas Bird Count data for the New York-New Jersey Harbor region. Solid bars indicate normalized data; open bars indicate non-normalized data.

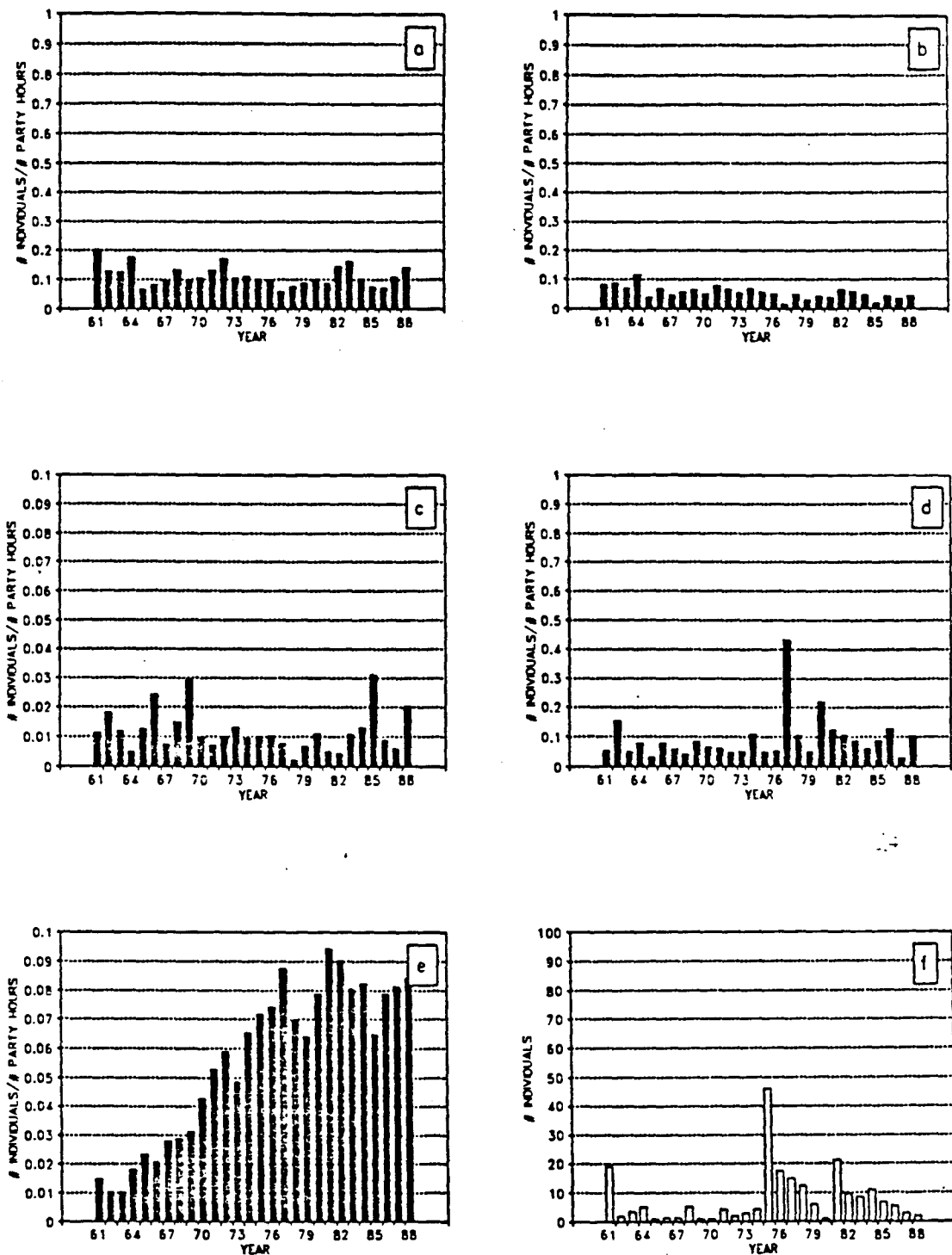


Figure 20 Population trends of the (a) Tufted Titmouse, (b) White-breasted Nuthatch, (c) Golden-crowned Kinglet, (d) American Robin, (e) Northern Mockingbird and (f) Water Pipit generated from National Audubon Society Christmas Bird Count data for the New York-New Jersey Harbor region. Solid bars indicate normalized data; open bars indicate non-normalized data.

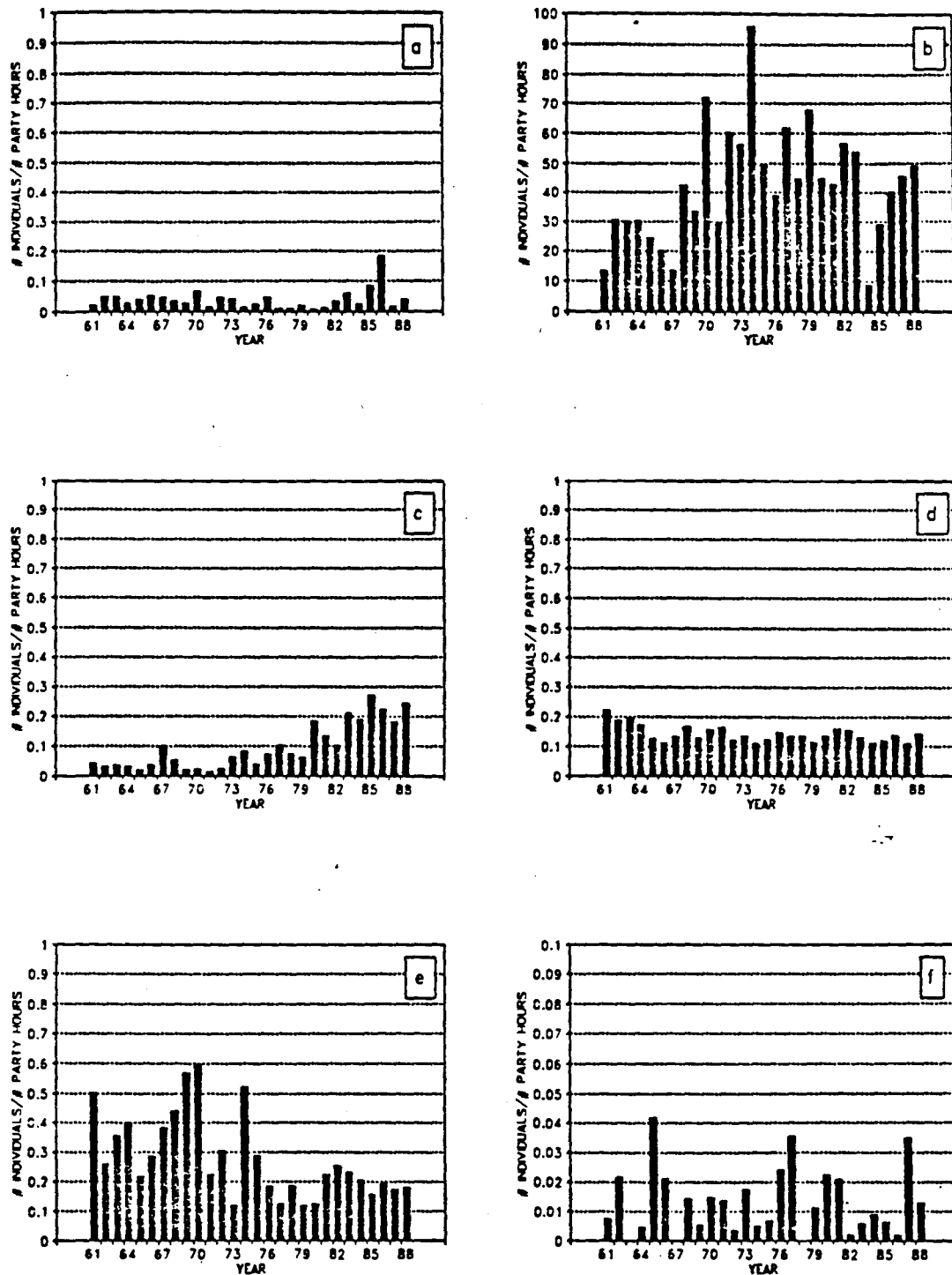


Figure 21. Population trends of the (a) Cedar Waxwing, (b) European Starling, (c) Yellow-rumped Warbler, (d) Northern Cardinal, (e) American Tree Sparrow and (f) Chipping Sparrow generated from National Audubon Society Christmas Bird Count data for the New York-New Jersey Harbor region. Solid bars indicate normalized data; open bars indicate non-normalized data.

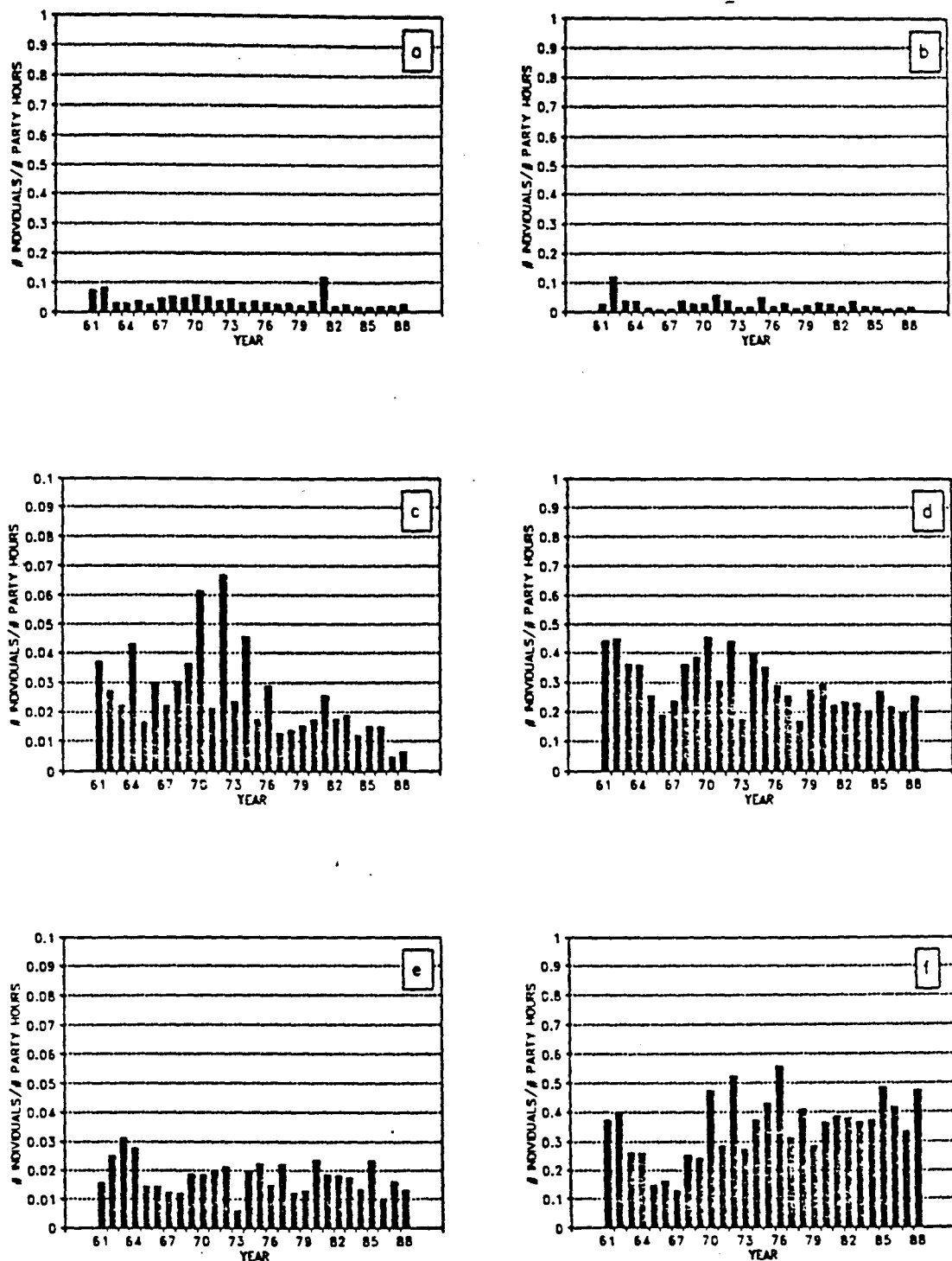


Figure 22. Population trends of the (a) Field Sparrow (b) Savannah Sparrow, (c) Fox Sparrow, (d) Song Sparrow, (e) Swamp Sparrow and (f) White-throated Sparrow generated from National Audubon Society Christmas Bird Count data for the New York-New Jersey Harbor region. Solid bars indicate normalized data; open bars indicate non-normalized data.

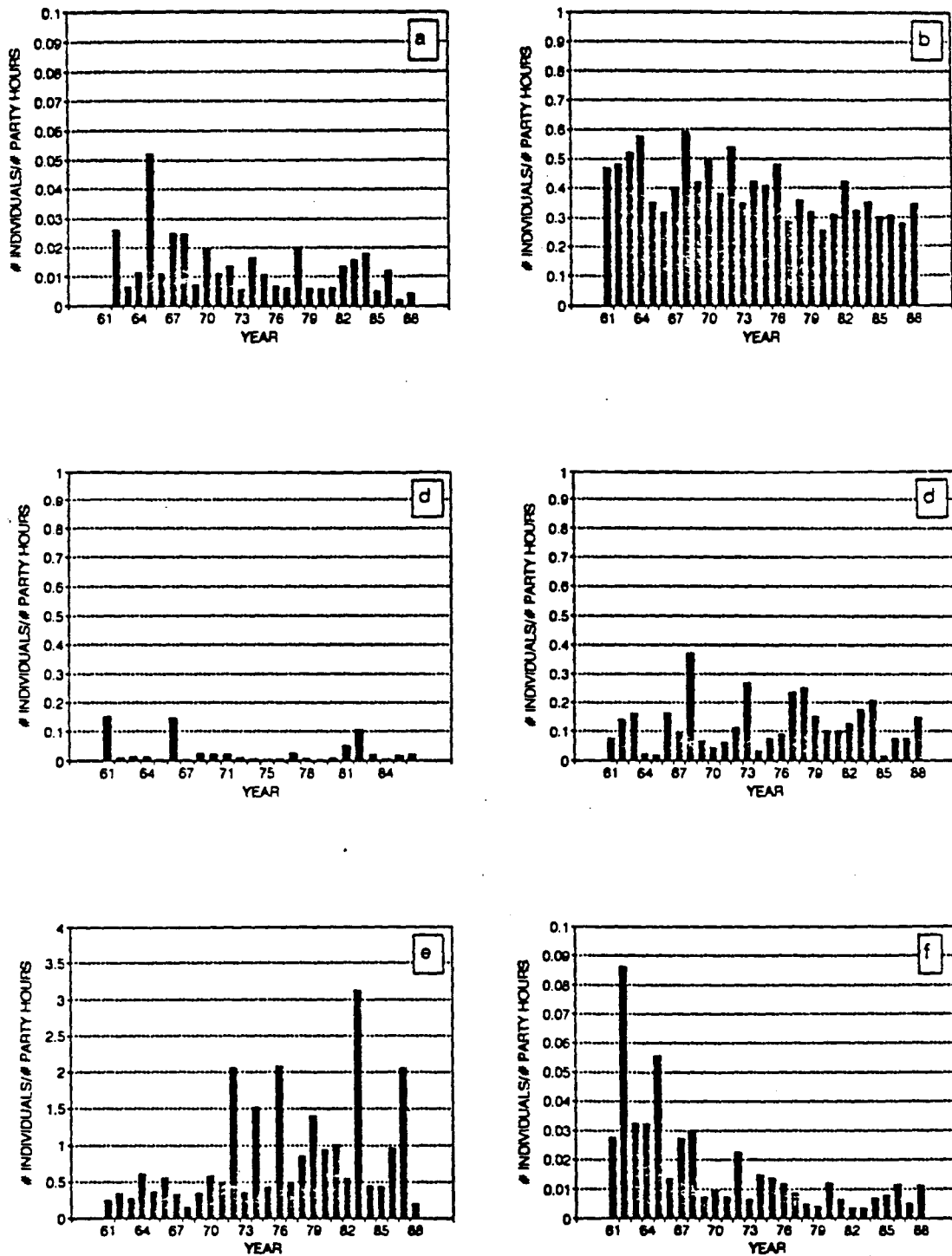


Figure 23 Population trends of the (a) White-crowned Sparrow, (b) Dark-eyed Junco, (c) Lapland Longsupr, (d) Snow Bunting, (e) Red-winged Blackbird and (f) Eastern Meadowlark generated from National Audubon Society Christmas Bird Count data for the New York-New Jersey Harbor region. Solid bars indicate normalized data; open bars indicate non-normalized data.

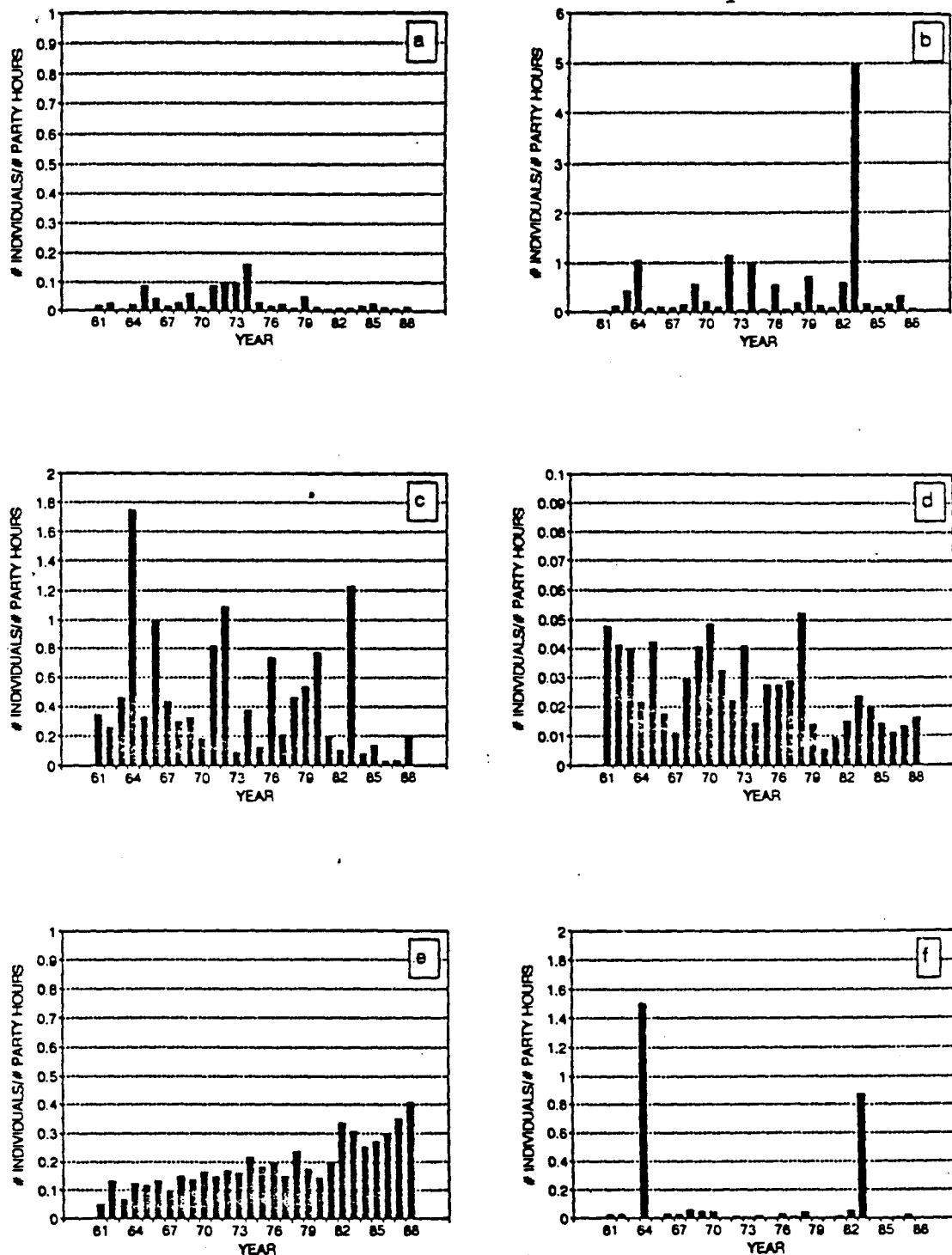


Figure 24. Population trends of the (a) Rusty Blackbird, (b) Common Grackle, (c) Brown-headed Cowbird, (d) Purple Finch, (e) House Finch and (f) Common Redpoll generated from National Audubon Society Christmas Bird Count data for the New York-New Jersey Harbor region. Solid bars indicate normalized data; open bars indicate non-normalized data.



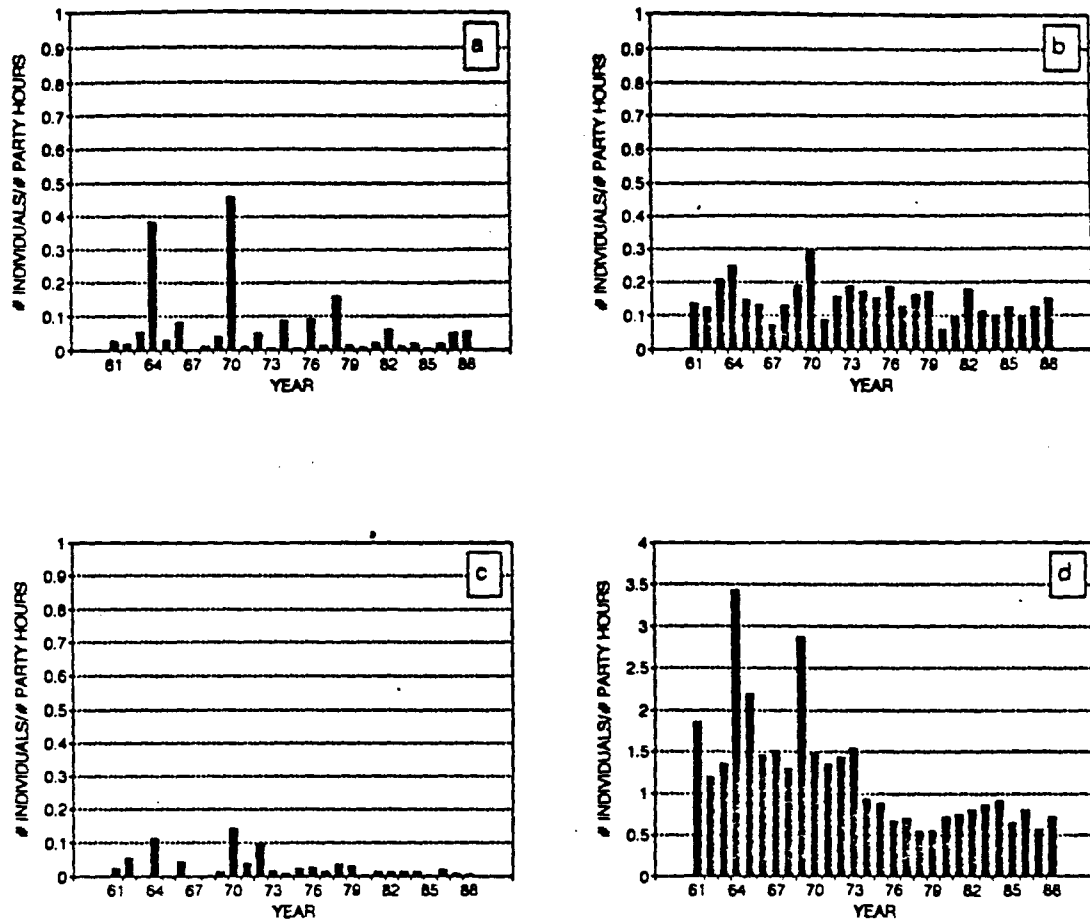


Figure 25. Population trends of the (a) Pine Siskin, (b) American Goldfinch, (c) Evening Grosbeak and (d) House Sparrow generated from National Audubon Society Christmas Bird Count data for the New York-New Jersey Harbor region. Solid bars indicate normalized data; open bars indicate non-normalized data.

Table 20. Linear regression probability (P)\* values and correlation coefficients ( $r^2$ ) for the 100 most common Christmas Bird Count species (names abbreviated) in the New York/New Jersey project area, 1961- 1988, taxonomically by trend class. See Appendix A for scientific names.

INCREASING			VARIABLE			DECREASING		
Species	P	$r^2$	Species	P	$r^2$	Species	P	$r^2$
Nor.Gannet	.0362	.1580	D.C.Cormor	.4205	.0251	Hrmd.Grebe	.0001	.4430
Mute Swan	.0111	.2231	Rd.Th.Loon	.3168	.0385	Bk.Cr.N.Her	.0157	.2046
Snow Goose	.0001	.4772	Grt.Cormor	.1022	.0994	Am.Bk.Duck	.0010	.2046
Can.Goose	.0001	.8322	Grt.Bl.Her	.8505	.0014	Am.Wigeon	.0003	.4076
Gr.Wg.Teal	.0326	.1639	Brant	.1204	.0902	Grtr.Scaup	.0122	.2182
Mallard	.0440	.1470	Nor.Pntail	.5016	.0176	Wht.Wg.Sctr	.0049	.2669
Gadwall	.0301	.1684	Redhead	.5067	.0171	Com.Gldneye	.0035	.2840
Canvasback	.0009	.3493	Rngnk.Duck	.1420	.0811	Hdd.Mergnsr	.0069	.2486
Lssr.Scaup	.0028	.2953	Oldsquaw	.8603	.0012	Am.Kestrel	.0063	.2533
Nor.Shovlr	.0289	.1707	SurfScoter	.8999	.0006	Rngd.Pheasnt	.0001	.3442
Com.Mrgnsr	.0009	.3497	Rd.Br.Mergr	.6950	.0060	Nor.Bobwhite	.0193	.1930
Bufflehead	.0001	.4995	Bk.Scoter	.2565	.0492	Sht.Eard.Owl	.0114	.2219
Ruddy Duck	.0009	.3497	Nor.Harrier	.7290	.0047	Dwny Wdpkr	.0020	.3118
Rd.Tld.Hawk	.0001	.6670	Rufd.Grouse	.6427	.0084	Hairy Wdpkr	.0001	.5470
Sanderling	.0480	.1417	Am. Coot	.9029	.0006	Wht.Br.Nthch	.0003	.4021
Dunlin	.0010	.5006	Killdeer	.1394	.0821	Caro.Chkdee	.0159	.2037
Rng.Bd.Gull	.0010	.8349	Rud.Trnstr	.4204	.0251	Bk.Cp.Chkde	.0140	.2107
Grt.Bk-B.Gl	.0010	.6198	Pur.Sandppr	.1215	.0897	Blue Jay	.0047	.2690
Bk.Lgd.Ktwk	.0036	.2823	Laugh.Gull	.4215	.0250	Horned Lark	.0003	.4021
Bk.Bel.Plvr	.0022	.2823	ComBkhdGull	.3443	.0345	Fox Sparrow	.0038	.2801
Nor.Mkngbrd	.0001	.8392	Bnprts Gull	.5536	.0151	Svnah.Spar	.0263	.1760
Fish Crow	.0139	.2112	Herrng Gull	.3505	.0336	Field Spar	.0338	.1619
Am. Crow	.0001	.6733	Rock Dove	.7407	.0087	Dk-eydJunco	.0002	.4147
Nor.Flicker	.0001	.7844	Water Pipit	.5242	.0158	Wht.Cr.Spar	.0160	.2106
WhtThr.Spar	.0114	.2221	Mourng.Dove	.5388	.0232	Song Spar	.0011	.3423
Rd-Wg Bkbrd	.0406	.1515	Tftd.Ttms	.1474	.0790	Purp.Finch	.0014	.3285
Yl-Rmp Warb	.0001	.6962	Am. Robin	.3719	.0308	Eastn Mdwlk	.0001	.4312
House Finch	.0001	.7746	GldCr.Knglt	.6640	.0074	House Spar	.0001	.4788
			Monk Prkeet	.3767	.0491	Am. Tr. Spar	.0012	.3367
			Chpng. Spar	.9761	.0000	Nor.Cardinal	.0030	.2921
			Swamp Spar	.1417	.0790			
			Snw Bunting	.8179	.0021			
			Com.Grackle	.4253	.0246			
			Rusty Bkbrd	.2093	.0599			
			Brnhd Cowbd	.1022	.0994			
			Am. Gldfnch	.1045	.0982			
			Evng.Grsbk	.1021	.0995			
			Pine Siskin	.2376	.0532			
			LplndLngspr	.2217	.0569			
			Com. Rdpoll	.5138	.0166			
			Cdr. Wxwing	.4155	.0257			
			Eurp.Strlng	.1255	.0879			

Key  
 $r^2$  correlations  
 0 - .3 = weak  
 .3 - .7 = moderate  
 .7 - 1 = strong

\*P = probability that estimate of population change is not different from 0

74

82

Our efforts to achieve a clearer understanding of factors which might be influencing these trends by stratifying species on the basis of habitat and feeding strategies were only partially successful. For example, many species which winter in the area (e.g. black duck) shift from summer plant diets to winter animal diets but the proportions and timing reported in the literature are often ambiguous. However, we did find that all four insectivorous and 10 of 23 granivorous (i.e. ground-feeding sparrow-types) species exhibit significant long-term declines. Species with other feeding strategies (DeGraaf and Rudis, 1986) are nearly equal in numbers of declining versus those increasing: picivores(2:2), carnivores(6:5), and omnivores(10:9); and one of two frugivore and 6 of 12 herbivores are increasing versus only one declining (Table 21). Perhaps the one declining herbivore, American wigeon, actually feeds more heavily on invertebrates when wintering at these latitudes than is generally recognized (Terres, 1987; Bellrose, 1976; Martin, et al, 1951; Fassett, 1957).

These trends may portend real consequences or merely provide a glimpse of "normal" long term vertebrate population dynamics. Without data based on more complete monitoring of species, populations, habitats and influencing factors it is difficult to arrive at a clear understanding of trends. These data tell only of the status of birds which have been observed while wintering in the New York Harbor area. They may reveal little about the status of members of the same species wintering elsewhere, effects of summer habitat conditions upon reproduction, weather encountered during migration, local movements within the wintering area, and adaptation to local food conditions. Backyard bird feeders (or domestic house cat populations), for

Table 21. Summary of the population trends for 100 wintering bird species in the New York/New Jersey Harbor Estuary project area by feeding strategy.\*

STRATEGY**	SPECIES	PERCENT		
		INCREASING	DECLINING	VARIABLE
Insectivore	5	0	80	20
Picivore	6	33	33	34
Carnivore	19	32	26	42
Omnivore	32	31	28	41
Frugivore	2	50	0	50
Herbivore	12	50	8	42
Granivore	24	12	42	46

\* Based on Christmas Bird Count data for 11 count sites, 1961-1988, and simple linear regression analyses. \*\* DeGraaf and Rudis, 1986; Terres, 1987.

example, may play more important roles, pro or con, than is generally recognized. However, the CBC data are the only known source of comprehensive information on population trends for any terrestrial vertebrate groups at any season in the New York/New Jersey Harbor region.

c) **Autumn Migrations.** Jamaica Bay National Wildlife Refuge autumn shorebird migration data cover the period 1981 through 1988 and include 11 species (Figures 26 - 27). The annual average number per species per site was plotted along with the annual peak number divided by number of sites reporting the species. The results indicate relative abundance and some apparent short term trends, i.e. all seem to exhibit seemingly rhythmic highs and lows. However, the time span and the actual number of birds are insufficient for drawing major conclusions about the local populations. Ten of the 11 species reached a decadal peak in either 1983 (N=5) or 1984 (N=5), immediately followed by a decade low in 1985 (N=9), then another lesser peak in 1986 (N=4) or 1987 (N=5). The graphs suggest that the locally observed populations of three species were in gradual decline, five were apparently stable, and three were gradually increasing (Table 22). The three species averaging most numerous during the period were semi-palmated sandpiper, short-billed dowitcher, and black-bellied plover.

A scan of the similarly rhythmic Sandy Hook hawk count data (Bouton 1987; Majors, 1988) indicates that the years of minimal shorebird numbers coincided with peak years for raptors and vice versa (Figure 28-32).

**Table 22. Summary of autumn migrating shorebird population trends plus minimal and peak years for 11 species observed within the Jamaica Bay National Wildlife Refuge, Brooklyn, 1981-1988\*.**

Species	Rank	Population Trend	Mim	Years, 19		Peak
				Peak	Min	
Semi-palmated Sandpiper	1	?	'81	'83	'86	'87
Short-billed Dowitcher	2	?	'81	'83	'84	'85
Black-bellied Plover	3	+	'81	'83	'85	'87
Semi-palmated Plover	4	?	'82	'83	'85	'88
Dunlin	5	-	'82	'84	'85	'86
Red Knot	6	+	'81	'84	'85	'87
Greater Yellowlegs	7	-	'81	'83	'85	'86
Least Sandpiper	8	?	'81	'82	'85	'87
Ruddy Turnstone	9	+	'81	'84	'85	'86
Sanderling	10	-	'81	'83	'86	'87
Lesser Yellowlegs	11	?	'81	'84	'85	'86

\* Based on data from U.S. Fish & Wildlife Service, Jamaica Bay National Wildlife Refuge.

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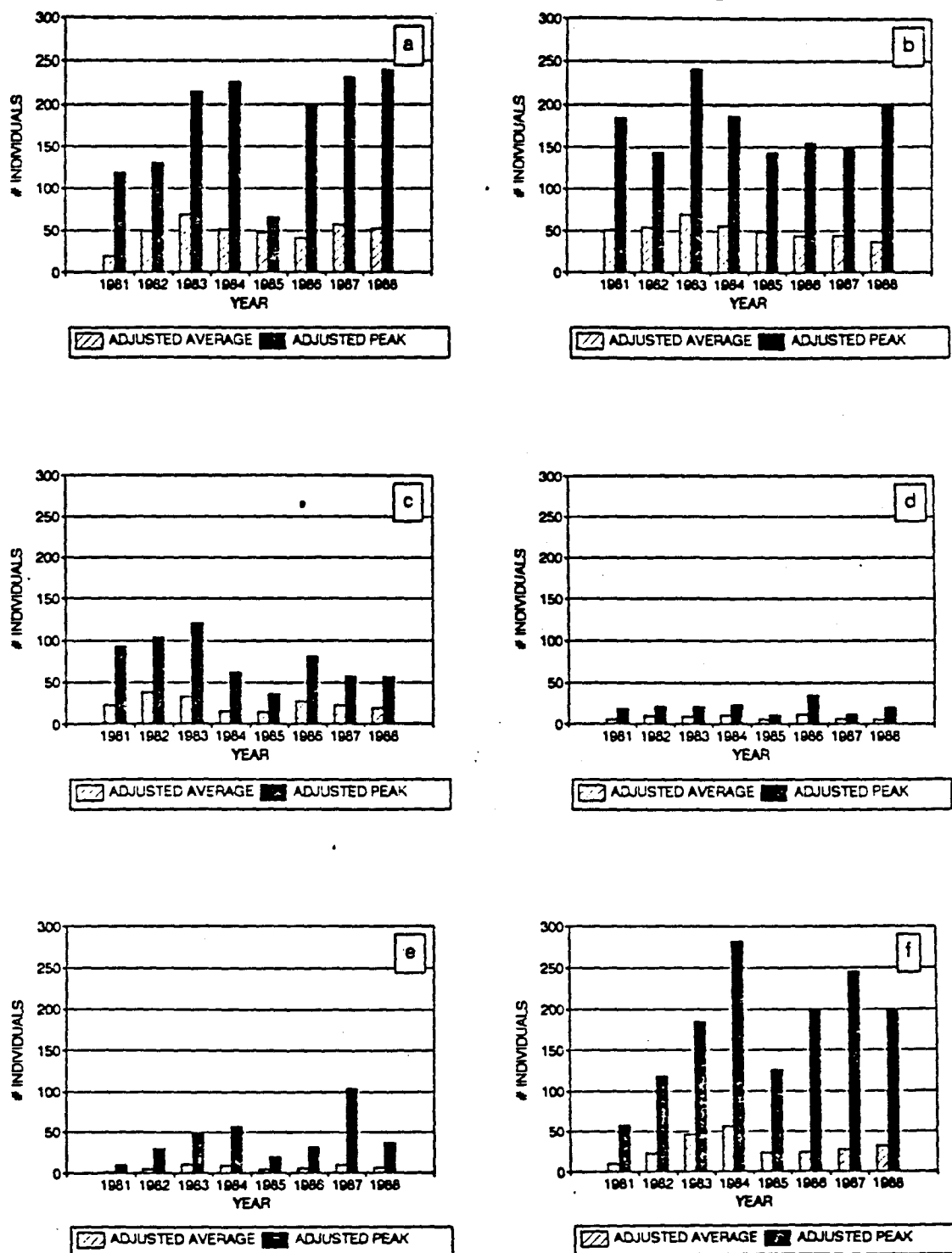


Figure 2.6. Population trends of the (a) Black-bellied Plover, (b) Semipalmated Plover, (c) Greater Yellowlegs, (d) Lesser Yellowlegs, (e) Ruddy Turnstone and (f) Red Knot at Jamaica Bay Wildlife Refuge, NY.

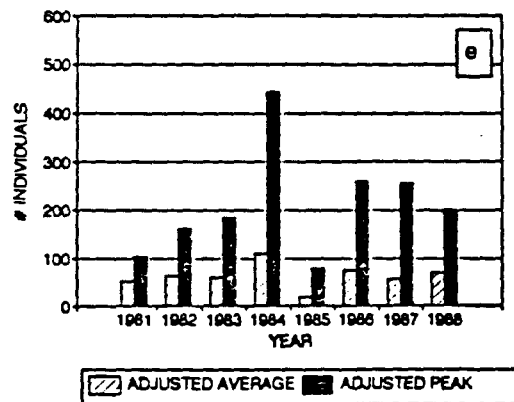
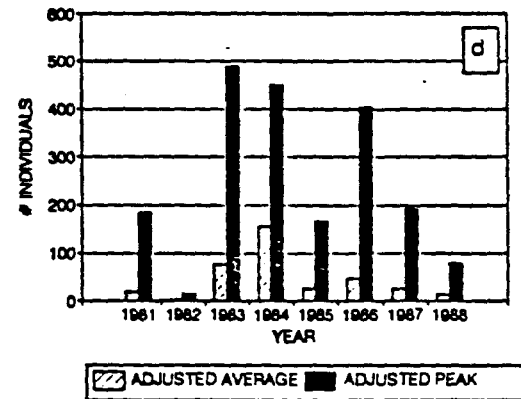
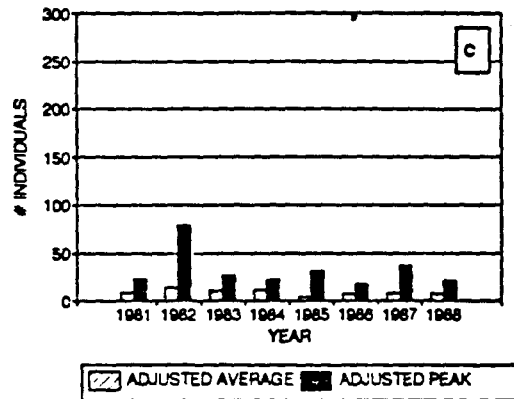
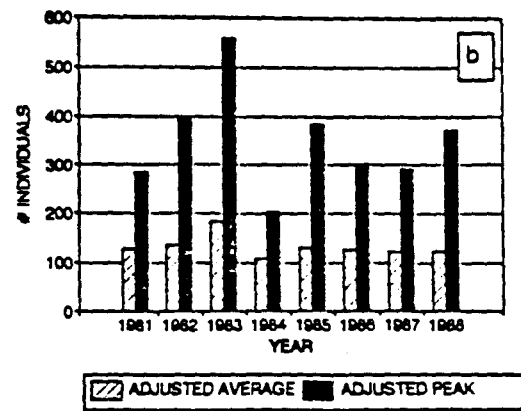
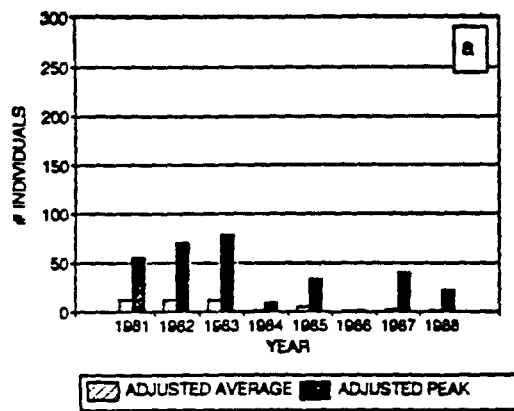


Figure 2-7-. Population trends of the (a) Sanderling, (b) Semipalmated Sandpiper, (c) Least Sandpiper, (d) Dunlin and (e) Short-billed Dowitcher at Jamaica Bay Wildlife Refuge, NY.

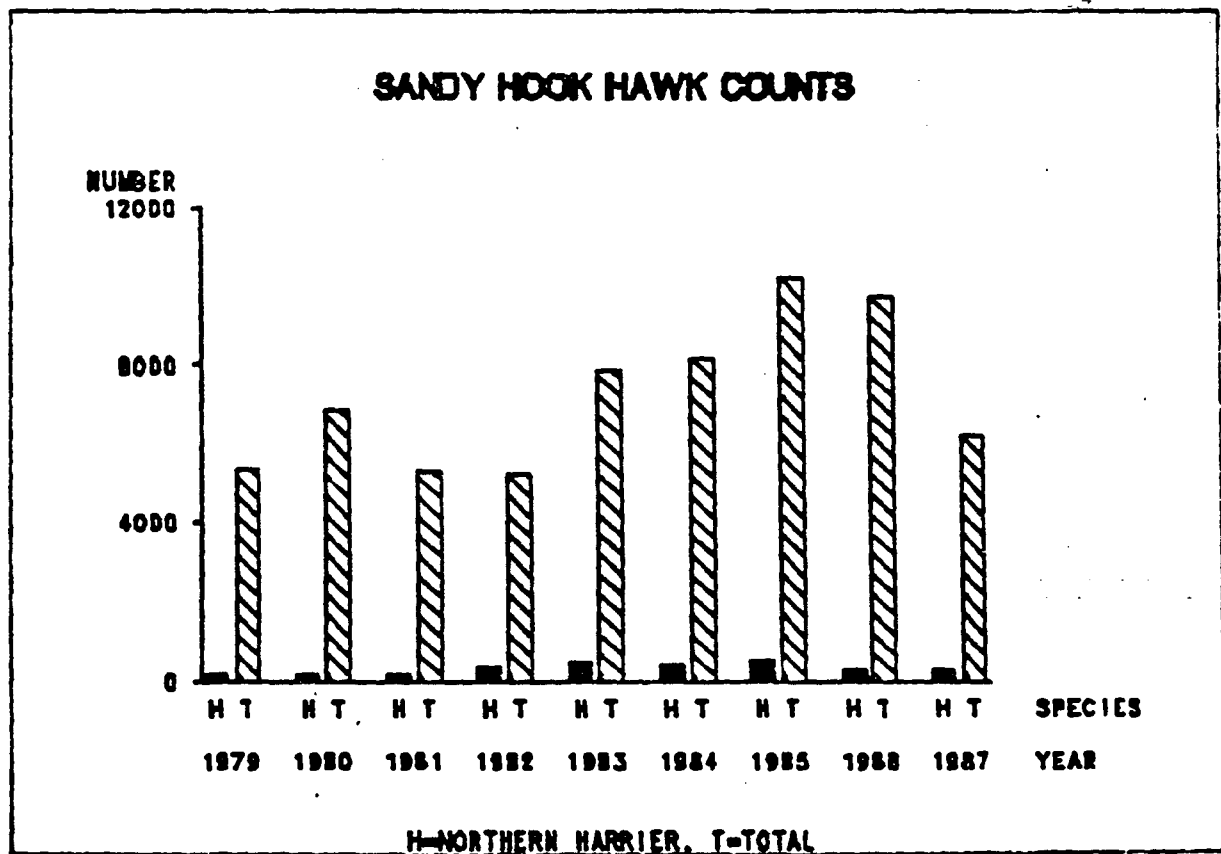
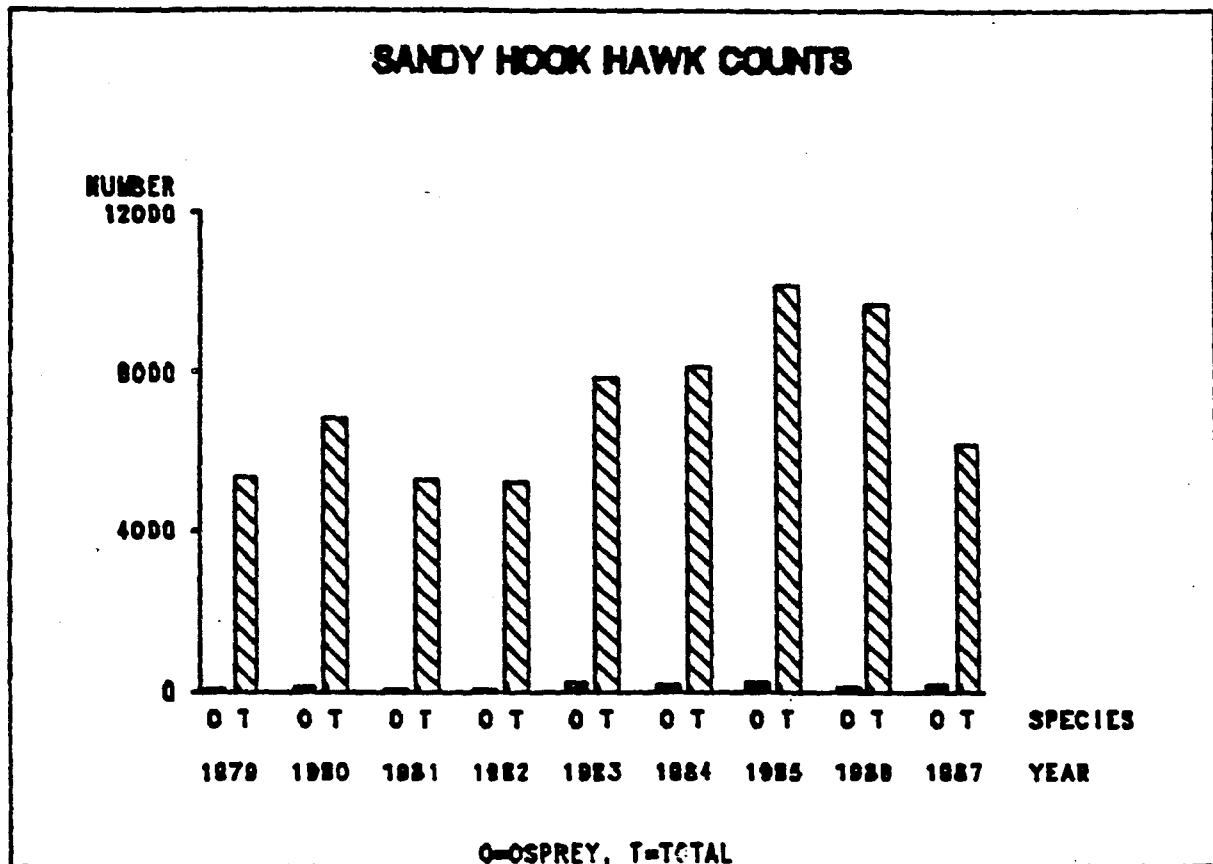


Figure 29. Spring migrating hawk population trends at Sandy Hook, NJ

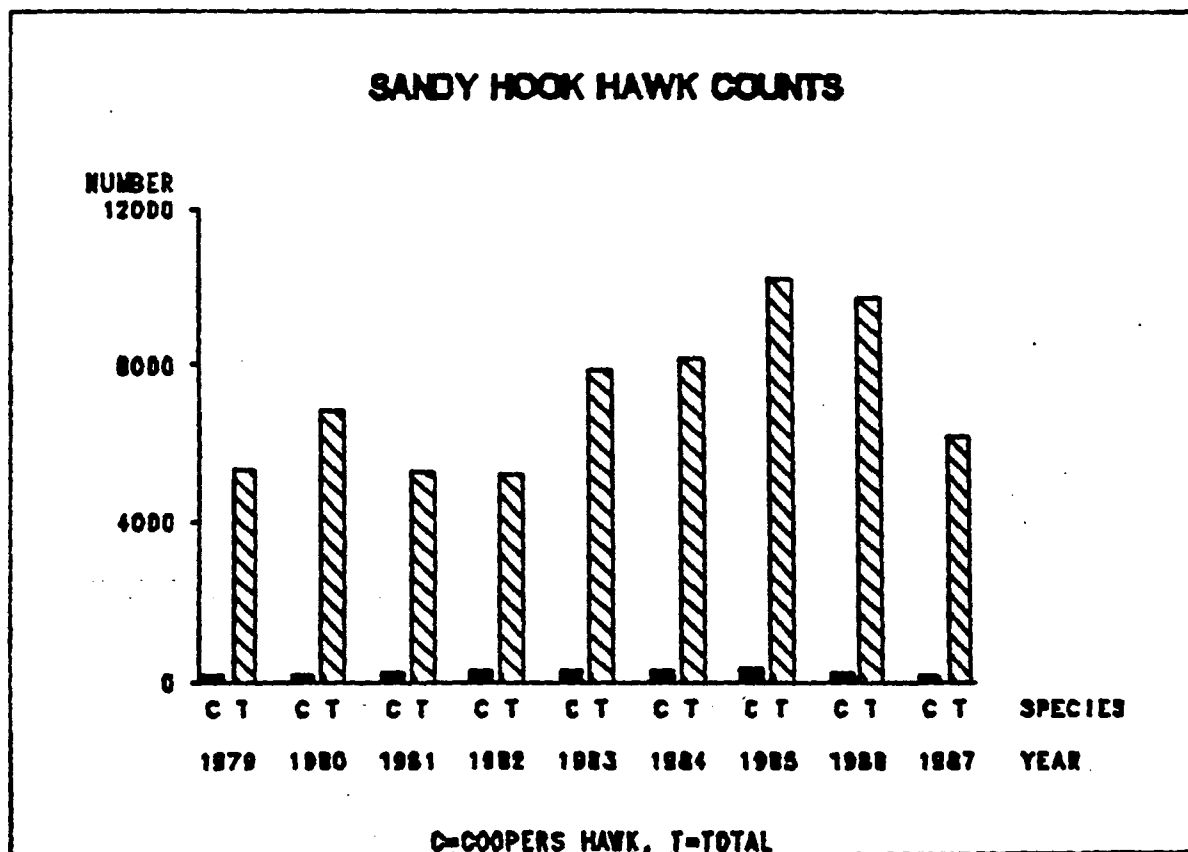
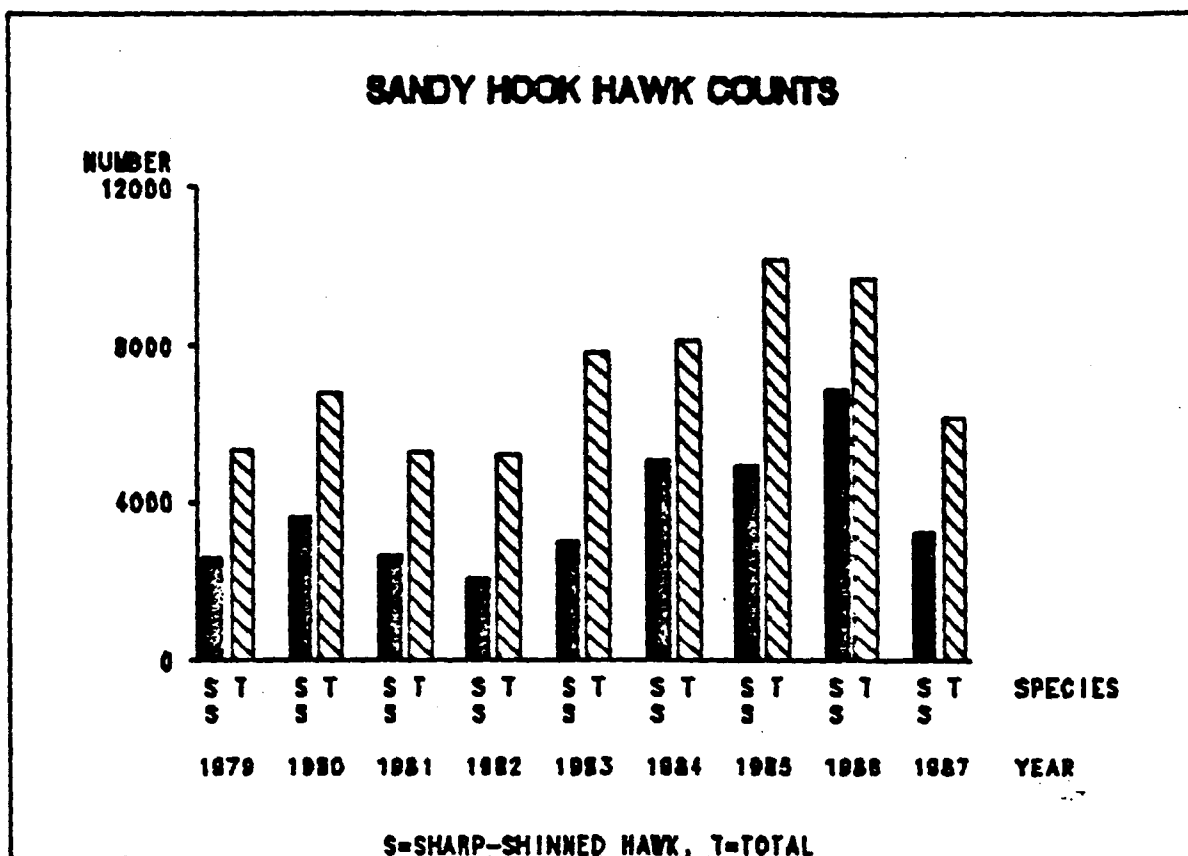




Figure 30. Spring migrating hawk population TRENDS AT Sandy Hook, NJ

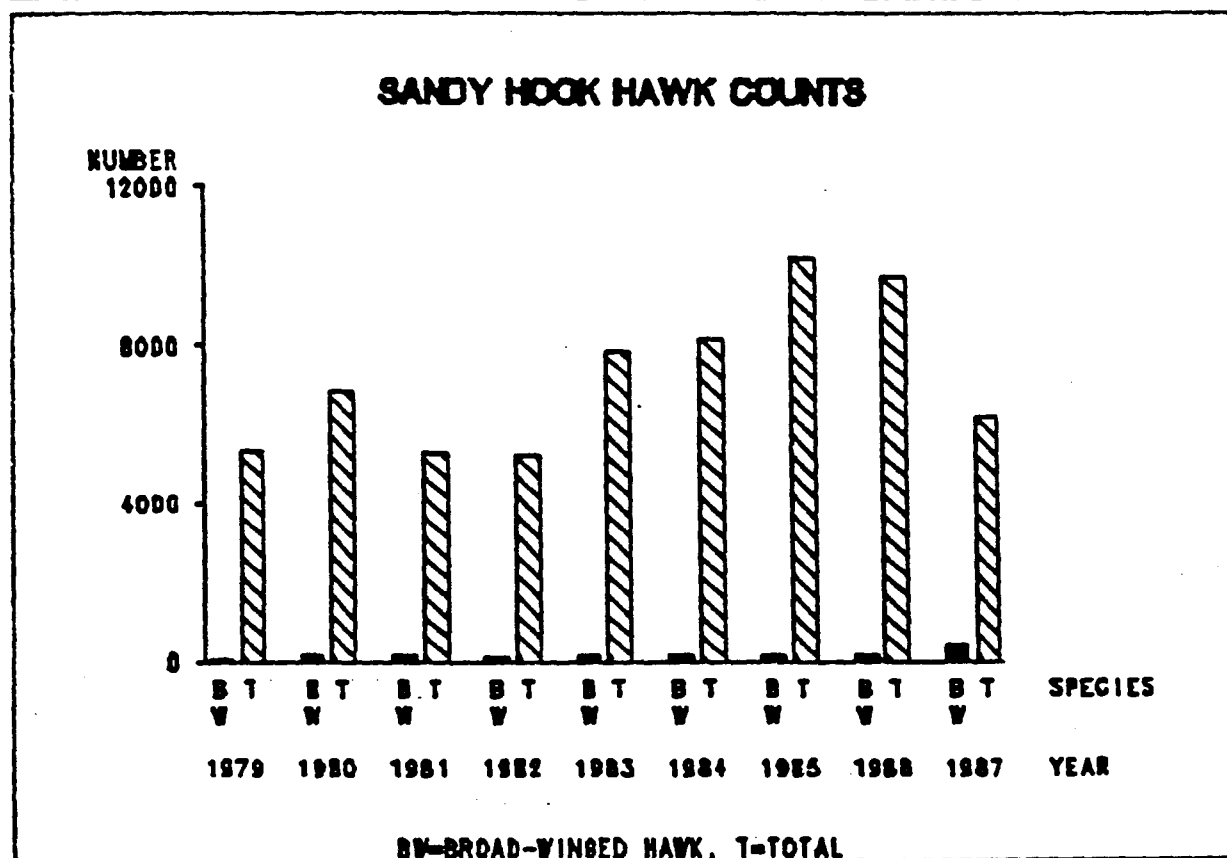
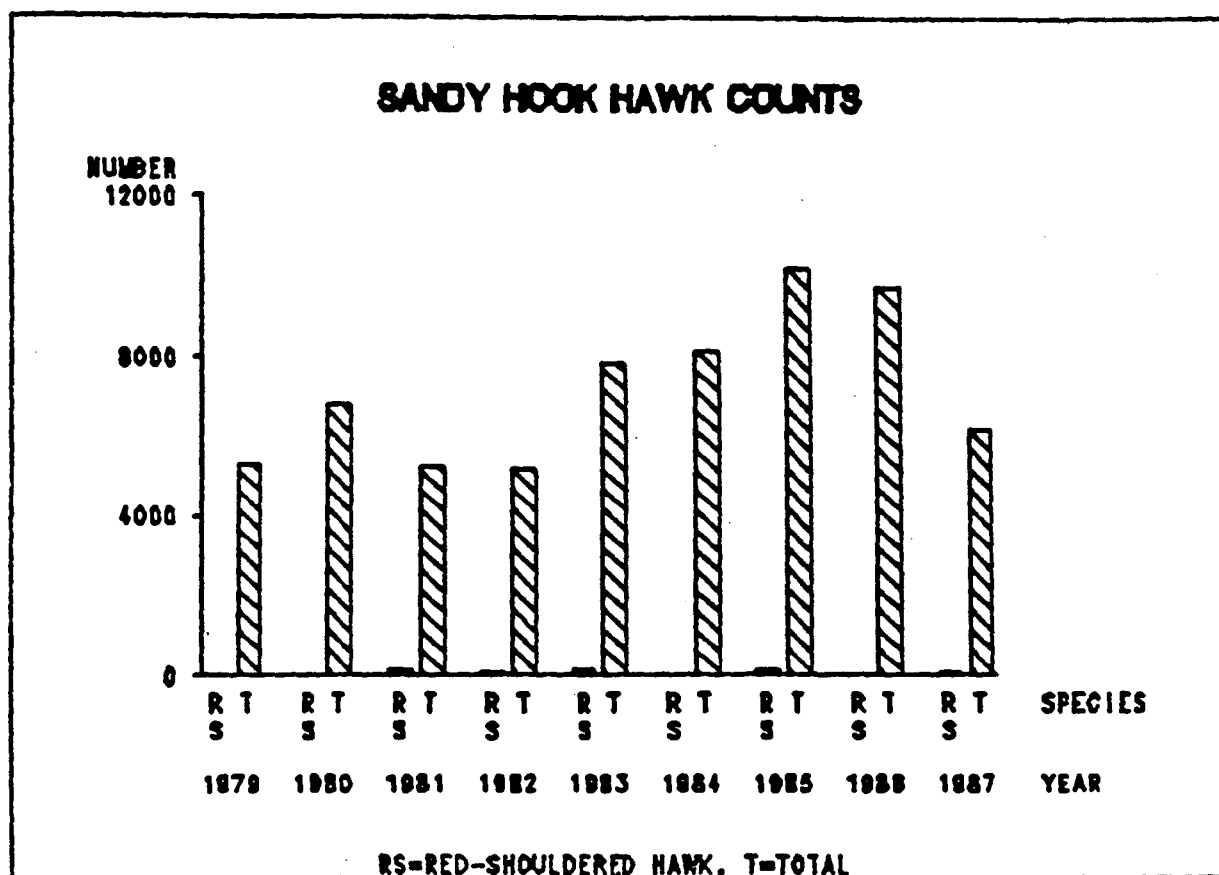


Figure 31. Spring migrating hawk population trends at Sand Hook, NJ

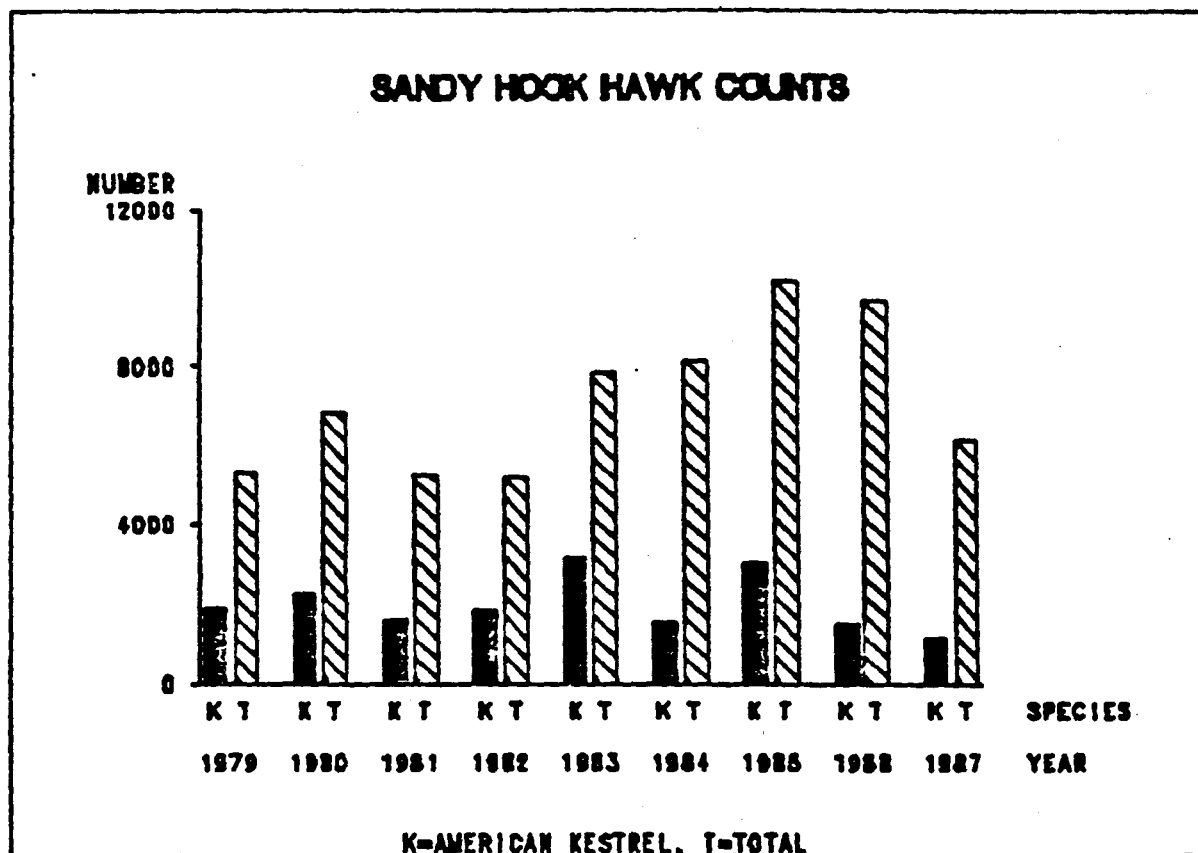
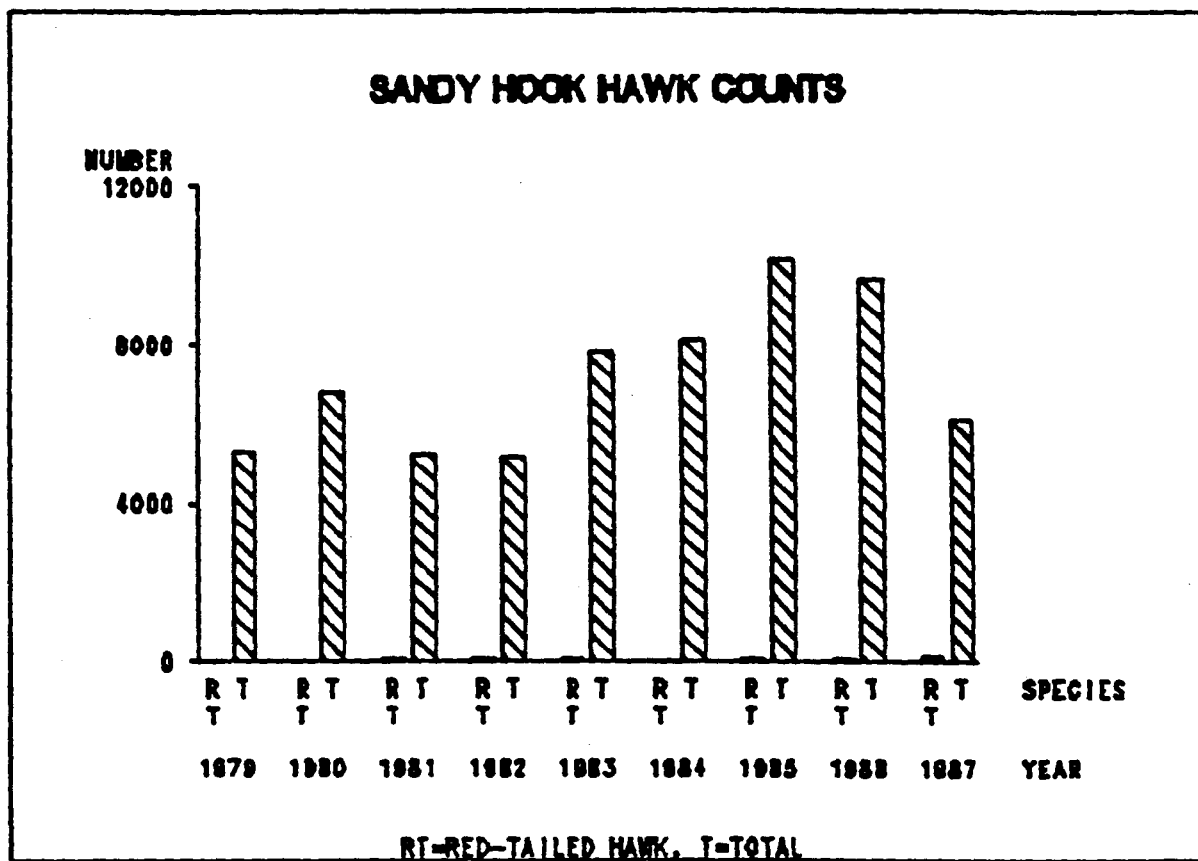
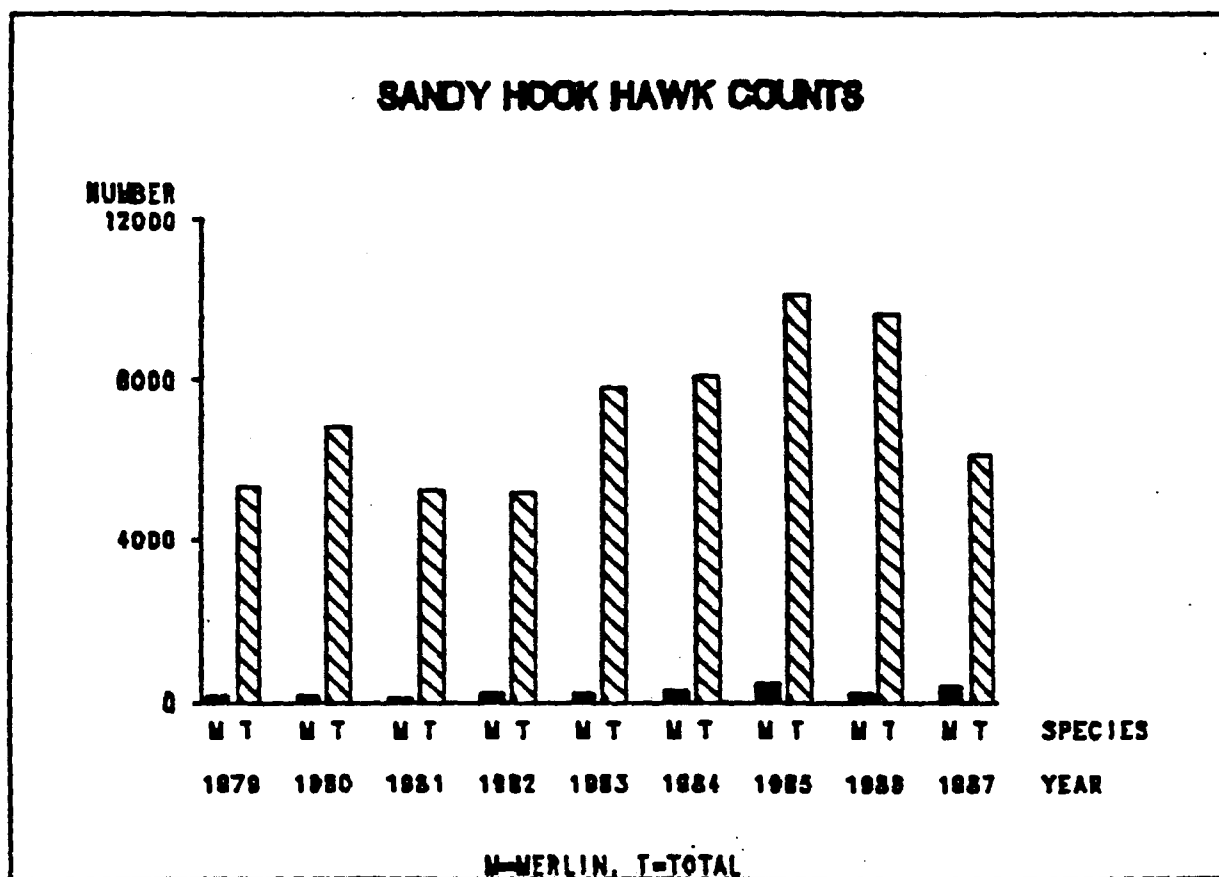


Figure 32. Spring migrating hawk population trends at Sandy Hook, NJ



**Mammals.** A total of 39 mammal species, including 4 marine species, were reported from 31 natural areas. The maximum number of species reported (24) occurred both on Hackensack Meadows and Pelham Bay Park, New York (Appendix B, Table 2). The most ubiquitous species was the meadow vole, found on 26 sites and may help explain the increasing trend in wintering redtail hawks (see Bart 1977). Two sites reported only one species, the muskrat, which also occurred on 16 other sites as well. The average number for all sites was 10.3 with the median standing at 9 species. An estimated 11 non-marine species shown in field guides (Burt and Grossenheider 1976, DeGraf and Rudis 1986), occurring in historic times and still occurring elsewhere in the region, failed to materialize on the list. If the 11 were added to the 35 non-marine species reported, 24% of the 46 probable have not yet been accounted for. Only 5 native species (16%) were listed by more than half (15) of the 31 reporting sites.

Included in the overall list of mammals (Table 23) were 6 (15%) exotic species (house cat, domestic dog, house mouse, Norway rat, black rat and black-tailed jackrabbit); 4 marine species (harbor seal, Atlantic bottle-nosed dolphin, sperm whale, and hooded seal); and 3 freshwater species (muskrat, beaver and mink). The total list included 10 herbivores, 9 omnivores, 10 insectivores and 10 carnivores. Generally, the more secretive (e.g. shrews, bats, weasels, foxes) were not widely reported compared to the more familiar urban "generalists" (e.g. cottontail, raccoon, gray squirrel). Some surprises in terms of relatively minimal distribution included eastern mole (10 sites), striped skunk (6), southern flying squirrel (6), woodchuck (3), white-tailed deer (2) and beaver (1 site). Undoubtedly some species occur which are not being observed or reported, but overall the omnipresent influence of human populations would appear to suppress the distribution, variety and abundance of mammals in the Harbor region.

No data file was obtained which could be used to develop insight as to trends in mammalian populations. Some area lists indicated some species as unconfirmed, occasional but non-breeding, extirpated or introduced but these ratings were not used consistently. Systematic inventories to monitor the status and trends of mammal populations apparently do not exist in the region.

**Table 23. List of mammal species reported from 31 natural areas in the New York/New Jersey Harbor region, in order of frequency reported (Appendix C, Table 2).**

Rank	Common Name	Trophic Type*	Habitat Type**	Sites Reporting
1	Meadow vole	H	G	26
2	Eastern cottontail	H	S	25
3	Norway rat	O	U	24
4	Raccoon	O	R(U)	19
"	Eastern gray squirrel	H(G,O)	F(U)	19
5	Muskrat	H	W	18
6	House cat	C	V(U)	17
7	House mouse	O	U	16
8	Opossum	O	R(U)	14
"	White-footed mouse	O(G)	S(F)	14
"	Domestic dog	C(O)	U(V)	14
9	Eastern chipmunk	O(G)	F	12
10	Eastern mole	I	G	10
11	Shorttail shrew	I(C)	G	8
"	Little brown myotis	I	R(U)	8
12	Red bat	I	F	6
"	Southern flying squirrel	O(G)	F	6
"	Striped skunk	O(C)	V(U)	6
13	Mink	C	W	5
"	Red fox	C(O)	G(V)	5
14	Grey fox	C	F	4
"	Harbor seal	C(P)	M	4
"	Masked shrew	I(C)	W(F)	4
15	Black rat	O	U	3
"	Woodchuck	H	G	3
"	Atlantic bottlenose dolphin	P	M	3
"	Longtail weasel	C	V	3
16	White-tailed deer	H	F(V)	2
"	Sperm whale	C(?)	M	2
"	Silver-haired bat	I	F	2
"	Big brown bat	I	V(U)	2
"	Star-nosed mole	I	R	2
17	Keen's myotis	I	V	1
"	Small-footed myotis	I	V(?)	1
"	Hooded seal	P(?)	M	1
"	Red squirrel	H(O)	F	1
"	Beaver	H	W(S)	1
"	Meadow jumping mouse	H(?)	G	1
"	Black-tailed jackrabbit	H	G	1

\*Trophic Type: H=herbivore, O=omnivore, C=carnivore, P=piscivore, I=insectivore, G=granivore, ?=questionable

\*\*Habitat Type: F=forest, G=open forb or grass, S= shrub, M=marine, W=water or wetland, R= riparian, U= urban, V= variable, ?= uncertain

## Wildlife Values

The inclusion of the status and trends of wildlife populations and their habitats in the New York/New Jersey Estuary as a component of this project implies some perceived values for the resources. However tangible the wildlife resource itself may be, many of the associated values are often seen as intangible and lacking in definition. Ascertaining specific wildlife values was not within the scope of this project, yet it seems inappropriate to ignore some elements of these aspects given our association and experience to this point.

Unlike wildlife populations in rural areas, their urban counterparts have little to offer within commercial or utilitarian contexts (furs, meat, etc.) or even in respect to the funds expended for recreational use of the resource (licenses, permits, fees, meals, lodging, transportation by hunters & trappers, etc.). We recognize that some urban wildlife populations, such as flocks of birds in coastal habitats, provide significant recreational enjoyment. However, it would appear at this point that the outstanding value of this resource is the extent to which the presence, abundance, location and health of birds, mammals, amphibians and reptiles convey some realistic sense, understanding of, and commitment to the wellbeing of the urban environment which they share with humans.

## CONCLUSIONS AND RECOMMENDATIONS

by

D. Squires and J. Barclay

Consideration of wildlife and habitats within this particular urban context is tempered by the realization that the former ecosystems have been, for the most part, irretrievably committed to other functions and human use. The fragments should respond well to thoughtful management. The cadre of professionals and public supporters who have managed to underwrite the preservation of natural ecosystems (Robinson and Bolen, 1989:360) within the harbor environment have laid the groundwork for a comprehensive and farsighted approach which will be necessary to address wildlife conservation needs within the Estuary well into the next century. The remnants of natural landscapes which function as wildlife habitat in and around this metropolitan complex could become a web of natural environments, corridors, greenbelts, buffer zones and creative management activities interlacing the urban with the natural worlds to the betterment of both (Regional Plan Association 1990a,b; New York City Dept. of Planning 1983).

The information reviewed in this study documents the loss of near shore habitat. The remaining habitats have been altered, stressed by impacts of human activity such as noise, chronic and acute episodes of chemical pollution (Olsen 1984, Farrow 1986), and introduction of exotic species. Most wildlife populations which remain are likely to be stressed, existing in simplified ecosystems, and vulnerable. The presence of large populations of "adaptable generalists" such as gulls, crows and pigeons, are among the indicators of habitat simplification. Further, there is evidence (Table 20) of an increase of those species which to some extent are actively managed by humans (e.g. Canada geese, mallards, raccoons) or which are normally commensal with humans (e.g. pigeons, rats). Through habitat protection, enhancement or creation, increasing numbers of similar species are present, possibly competing with the species which are less likely to coexist with humanity.

Additionally, some species of wildlife are exhibiting behavioral changes which indicate increasing tolerance of or even dependence on human activity for sustenance of their large populations (Conover and Chasko, 1985). Thus the large, ubiquitous population of the herring gull found in the Estuary may in some measure now be dependent upon landfills or other sources of human wastes for survival in present numbers. These behaviors, when taken in concert with changes in the diversity of "natural" wildlife populations in the Estuary, suggest that some resident species are not only surviving in the urban environment, but are adapting to it. These residents may be the pioneers of emerging urban wildlife populations differing from their "wild" or migrating counterparts in their use of food and cover and their resistance to stresses peculiar to the urban setting, including interspecific interaction with humans, noise, traffic and disease.

Human development has had the effect of progressively deleting large tracts of habitat from the core of the Estuary progressively outward to the margins of the study

area. Deletion of habitat may be catastrophic -- that is, by obliteration -- or may be progressive. Progressive deletion occurs by internal division of the habitat area into smaller and smaller pieces, ever reducing the core habitat and increasing the edge habitat (also see Van Druff, 1979). Such a progression of habitat degradation or destruction should, in our view, have the effect of increasing the proportion of edge habitats to core habitat, thus increasing the populations of edge species at the expense of the core species. However, increases in edge may reach some threshold level at which the interaction between wildlife and humans, with their dependent dogs and cats and rats, begins to be of greater importance than the amount of edge per se. If this is occurring, and some of our data suggest that it is, then a new urban wildlife system could be emerging -- one independent of traditionally understood relationships and uniquely adapted to the urban habitat.

The following conclusions and recommendations, in keeping with the project goals, are categorized as recommendations dealing with "habitat", "habitat modification", and "wildlife." To these we have added the category "people," since the effectiveness of natural resource management depends chiefly upon effective communication with the owners.

## Habitat

While existing habitat in the New York/New Jersey Harbor Estuary supports a surprisingly diverse fauna and flora, the available remaining upland habitat is being increasingly fragmented or threatened by development. As fragmentation of habitat occurs, the proportion of edge zone habitat relative to core increases with an adverse effect upon the diversity and abundance of core wildlife the habitat will support. A 50 meter buffer zone in which no further development is permitted should be maintained around natural areas and any other potential habitat to prevent further erosion of core habitat areas. Although not as valuable as the habitat areas themselves, buffer zones are vital for their protection and usefulness to wildlife.

This study identified 39 natural areas for preservation. The additional 14 rookery sites for gulls and herons, terns and skimmers, are also worthy of preservation. Under some definitions, no original habitat remains in the New York/New Jersey Harbor Estuary. Those areas not physically modified in the past have been, to some degree, otherwise affected by the presence of humans. Such impacts include: chemical pollution of water, soil or atmosphere; introduction of exotic predators or pathogens; introduction of mechanical noise and hazards; introduction of structure; or by intrusion of humans upon the environment.

**Recommendation 1.** A priority effort should be made to identify, document and preserve those sites which most closely approximate a natural state. While it is unreasonable to expect that a pre-Colonial habitat can be maintained in a 21st Century setting, such quasi-natural sites may serve as loci for benchmark assemblages of plants and animals.

The following examples of wildlife habitat categories (Recommendation 2) in the Lower Hudson Estuary include those which we determined were particularly important to wildlife. It is intended to serve as a catalyst for identifying other possibilities, as a stimulus to enhancing or implementing management plans, and as a guide for establishing



priorities. Most of these categories will most often apply to small localized coastal areas whose existence is known by local residents and some area specialists. Others may apply to upland buffer zones within the harbor influence.

**Recommendation 2. Natural resource management agencies and support groups should inventory and characterize specific habitats on each designated natural area. The inventory efforts should consider:**

- a. Any remnant area of essentially original landscape which is dominated by natural vegetation, e.g. marsh, swamp, beach, riparian zone, in the coastal buffer zone;
- b. Any natural stand of mature(75+ years) or old growth(150+ years) trees; landscape plantings of similar vintage are indeed significant, i.e. historically or botanically, but may lack indigenous biotic relevance;
- c. All natural wetlands (swamps, marshes, bogs, vernal pools), fresh water ponds and lakes, perennial streams and springs. Some artificial or manmade wetlands may be important as well, particularly from an historic/cultural perspective (e.g. canals, ice ponds, quarries, borrow pits, mill ponds etc.) and for maintaining current populations of species;
- d. Buffer zones, particularly between natural areas and developed properties. A minimum of 50 meters is recommended whenever feasible in which no incompatible development would be permitted and which should be included in the total area to be protected. An additional 100 m (or more) regulated zone in which some low impact activities and development might be accommodated is also recommended for riparian situations (i.e. along streams, wetlands, ponds, vernal pools);
- e. Contiguous coastal/riparian corridors of open space vegetation, natural or planted and preferably including native woody species, which serve to connect larger open space tracts such as existing waterfront parks and preserves. Optimal suggested corridor width is 300 m (100 m minimal) per kilometer (1000 m) of length, but each circumstance (topography, existing development or buffers, cost, objectives, etc.) will dictate actual dimensions. Corridors function as buffer strips and permit movement of plant materials (e.g. seeds) as well as animals, but may be even more important in preventing isolation of remnant populations. Corridors will be especially functional as habitat during seasonal migrations;
- f. All areas containing populations of officially listed threatened or endangered species of plants or animals as designated by state and/or federal authorities. Areas containing species of special concern to local, state, or federal authorities, as well as to conservation organizations, should be surveyed and/or have their management status reviewed, to ascertain biological significance and status of the site;
- g. Coastal areas of unusual, unique, prehistoric (i.e. relict) indigenous

vegetation, or that which is of some historical significance (e.g. tidal grist mill sites). Consideration should also be given to identifying or retaining tracts of representative plant communities within the region for use as reference sites (e.g. long term ecological monitoring of salt marsh vegetation);

h. Strategic scenic vistas such as coastal overlooks and/or public access points may, in themselves, have little to offer as wildlife habitat, but afford special recreational and educational opportunities for observing wildlife in natural surroundings which might not be available otherwise;

i. Nesting habitats for communal nesting species such as herons, gulls and terns, and swallows (especially bank and cliff swallows). Communal nesting areas are as diverse as islands, stands of trees, gravel banks, bridges and cliffs. Protection should include adequate buffer zones whenever possible and/or restrictions on human access;

j. Brackish wetlands and other significant (numbers or species) amphibian breeding habitats, particularly where upland brooks enter estuarine habitats. Deeper, longer lasting pools in otherwise intermittent or ephemeral streams can also be important wildlife habitat during dry periods;

k. Principal feeding and resting areas for wintering ducks (greater and lesser scaup, goldeneye, bufflehead, black duck, scoters, mergansers, old squaw etc.), geese (Canada, snow, brant etc) and other water birds (purple sandpiper, grebes, loons) to the extent that such areas are identified with certainty by local authorities;

l. Nocturnal roosts or other key concentration sites for migrating, wintering or feeding populations of such diverse groups as marine mammals (e.g. harbor seals), eagles, vultures, shorebirds, neotropical migrants, butterflies, bats, etc. (Blackbird, crow and starling roosts present special management problems and are not included in this designation);

m. Coastal or estuarine spawning, breeding or nesting habitats such as those used by horseshoe crabs, marine turtles (including diamondback terrapin), fish etc.;

n. Areas of special environmental significance or concern, particularly those identified by state natural history survey programs, should be respected and not compromised without careful scrutiny, inter-agency communication and informed decision-making;

o. Isolated nest sites, roosts, and principal feeding areas of large or unusual birds such as hawks (including peregrine falcon, red-shoulder, etc) owls, ospreys, herons etc.;

p. Beaver dams and lodges, although not permanent and apparently uncommon in the New York/New Jersey Harbor Estuary region. Where these animals are found (in fresh water primarily), they will often provide a variety of benefits for many

other species of wildlife and their habitats. Beaver impoundments also help to store flood waters, slow and filter runoff, and create new habitats. Such benefits may be reduced where the beaver pose a real threat to roadways, adjoining properties, or habitats/vegetation/areas of special concern or significance;

q. Mature mast-producing trees and shrubs, hollow den trees, so-called "wolf" trees, bee trees, large snags and limbs with cavities take years to develop and usually provide habitat values far in excess of often misconceived fears of risks to people. They should be protected and maintained whenever feasible if not already part of broader riparian management programs or objectives.

r. Undeveloped spits, promontories and headlands afford favorable feeding and resting areas for waterfowl and other aquatic birds which are less inclined to frequent such habitats where they are built up or people are present in large numbers. These sites afford excellent opportunities for viewing wildlife as well as for enjoying the vistas provided.

s. Uninhabited marsh islands (e.g. within Jamaica Bay), natural as well as manmade, or other structures surrounded by water (e.g. tank farms), are particularly attractive to wildlife by virtue of their isolation. If sufficient area projects above high water, islands are likely to be important sites for communal nesting birds. They are also frequented by birds during migration or during inclement weather. Exotic introductions of such species as cottontail rabbits, meadow mice, domestic rabbits, foxes, house cats, and other species can have disastrous consequences for indigenous resident species as well as, eventually, for the introduced species as well.

While there has been success in the conservation of existing tidal wetlands or tidelands through legislation at federal and state levels, such success has often been gained at cost to other important nearshore habitats. For example, efforts to compile data on the loss of mudflat habitats in the Estuary failed because of the absence of documentation of their destruction. Similarly, almost every category of shorezone habitat is not being aggressively protected from alteration except through acquisition of title by a public agency or private organization. In the final analysis, while this kind of protection may be the best, it is impractical for the conservation of extensive habitats in an urbanized situation. The regulatory effort devoted to those other types should be commensurate with that dedicated to the tidal wetlands.

**Recommendation 3. "Government agencies and private support groups should broaden their efforts to document size, location and wildlife use of shorezone habitats other than tidal wetlands, and either enact where missing or stringently enforce protective legislation for these habitats.**

#### Habitat modification

One of the objectives of this study was to present recommendations for enhancing the aesthetic aspects of the estuarine environment through modifications, i.e.

"improvements", to the many marginal wildlife habitat features which exist. By marginal habitats we are referring in part to such elements as abandoned piers, wharves, transportation and industrial facilities; relatively unused filled land created from dredge spoils or other fills; and unmanaged riparian zones adjacent to urban wetlands, streams or other water resources.

Our collective experience and familiarity with New York City, New Jersey, and the associated environs there, as well as in other coastal and urban situations, leads us to be cautiously optimistic as to the habitat improvement opportunities. Cautious because of the need for municipal support financially and administratively, coupled to public support and volunteerism. Optimistic because many strategies and techniques can be undertaken which in themselves are relatively simple and inexpensive, but have far reaching benefits for society, wildlife and the environment.

The suggestions which we offer below are a sampling of the possibilities, intended to be expanded upon or to stimulate additional ideas rather than be an end in themselves. Where assistance in implementation may be needed, knowledgeable individuals will be found in private conservation organizations, area colleges and universities, state or local environmental, recreation or planning agencies, or in a number of private environmental consulting firms. Many sources of information on urban wildlife, wildlife management and conservation, and wildlife habitat improvement in urban or rural settings can be found at local libraries. The backyard wildlife habitat program sponsored by the National Wildlife Federation in Washington, D.C. can provide information upon request. The New Jersey or New York Departments of Environmental Conservation, New York Parks Department and other agencies have non-game wildlife programs and specialists able to provide guidance. Cooperative Extension Programs at Rutgers, Cornell and other institutions can assist in locating specialists. All of the above should be able to assist in local wildlife habitat improvements which will yield aesthetic and other benefits.

These habitat modification recommendations are grouped as to their emphasis on (A) wild animal populations, (B) the habitats in which the animals live, or (C) the people who desire the improvements, will benefit from them, and will be involved in bringing them about.

#### *Wildlife populations.*

**Recommendation 4.** Improve wildlife access, where appropriate, to natural areas isolated (cut off) by highways, walls, jetties or other forms of shoreline development to permit passage and achieve more natural, complete assemblages of plants and animals. Vegetated corridors, openings in fences, culverts, timbers, overpasses, and ramps may have possibilities for given coastal situations;

**Recommendation 5.** Modify "Jersey barriers" and other obstructions to wildlife, particularly on divided roadways, to permit passage and protection at regular intervals rather than entrapment;

**Recommendation 6.** Block, where necessary, wildlife passage through fences, under or into buildings, onto power lines, roadways or other hazardous situations as appropriate. Storm drains may permit safe passage, or lead to problems. Creative use or prevention

depends on the situation;

**Recommendation 7.** Provide wildlife escape routes, dense cover, or even small, one way(outward) swinging gates through fences and other barriers on rights-of-way;

**Recommendation 8.** Sanitary landfills, given the large size, number and proximity to coastal wetlands wildlife habitat, can be an excellent opportunity for developing aesthetically pleasing wildlife habitats via planting and contouring into desired configurations such as swales and shallow perched ponds;

#### *Wildlife habitats.*

**Recommendation 9.** To rejuvenate barren filled land sites, halt erosion, filter and slow runoff, apply compost, mulch, wood chips or similar materials and plant low management/stress tolerant species such as black locust, vetch, clover, broom sedge etc. Employ experienced habitat restoration specialists as consultants;

**Recommendation 10.** Defer (until mid-June or later) or eliminate grassland mowing (parking, medians, roadsides, etc.) where there are buffering shore zones and mowing not essential for human health, safety. Maintaining the grass community itself (mow/burn every other year, etc.) is important for open land wildlife species, especially where mature tree cover otherwise dominates large areas. Meadow voles use unmowed grasslands and provide food to wintering raptors;

**Recommendation 11.** Remove malfunctioning, dilapidated, or unessential flow control structures/barriers/tidal gates in tidal creeks and ditches to restore normal salinity levels to wetland areas, reduce phragmites intrusion, and encourage indigenous fish, wildlife and plant populations;

**Recommendation 12.** Remove obstructions and blockages from streams entering estuarine areas. Use suitable materials such as rocks, gabions, and anchored logs to modify currents and enhance fish and wildlife habitats;

**Recommendation 13.** Maintain open grasslands, meadows, marshes and large mowed areas (especially adjacent to water) for their significance to open land species as well as their panoramic virtues, biotic productivity and other functional attributes;

**Recommendation 14.** Utilize natural vegetation in manmade swales, sediment basins, energy dissipators and other surface runoff facilities to enhance wildlife populations, aesthetic values and water quality.

**Recommendation 15.** Reduce or eliminate use of herbicides, pesticides and fertilizers in routine area management- reserve for special situations.

**Recommendation 16.** Implement open marsh management strategies where not already underway (as is well demonstrated elsewhere in New Jersey, New York and Connecticut). Restored salt water access to low and high salt marsh sites can reduce mosquito problems, create improved feeding for birds, and result in more attractive marshes. This is

particularly true where ditching and ponding seek to recreate original drainage channel networks and avoids rigid, linear excavation techniques which are less attractive and have less photosynthetically productive aquatic habitat.

### *People.*

**Recommendation 17. Develop and maintain strategic scenic vistas which maintain or enhance opportunities for viewing wildlife in natural habitats;**

**Recommendation 18. Encourage formation of neighborhood wildlife habitat support groups to monitor, enhance, restore and assume some responsibility for local habitats and populations;**

**Recommendation 19. Promote wildlife enhancement programs which draw birds and other wildlife closer to where elderly citizens, school children, hospital patients or others with limited mobility/opportunity may learn, enjoy, and be entertained. Feeders, nest boxes, waterers, and plantings are among the techniques which can be used to aesthetic (and emotionally beneficial) advantage, even in marginal habitats. Local clubs, scouts, and other volunteer groups may become involved to construct, install and maintain these resources at minimal cost and maximum personal pleasure and satisfaction;**

**Recommendation 20. Document what is being done in local areas, and determine what the needs may be. Implement educational programs on the virtues, techniques, and necessary precautions for "coastal wildlife" enhancement programs as appropriate.**

### *Wildlife*

Lists of fauna obtained for this study suggest that the populations of amphibians and reptiles are slight and diminished in variety. If this indication is accurate, a serious weakening of the food chain within the Estuary's environment is indicated. However, not all respondents for this study included data on these groups.

**Recommendation 21. A coordinated attempt should be mounted to compile species lists for all natural areas and parks. These should document presence and relative abundance seasonally and by habitat type, and highlight conservation needs and success.**

Among the many effects of urbanization on wildlife are those resulting from the introduction of vigorous populations of exotic and commensal species. Among these urban keystone species are the house cat, rat, pigeon and starling. Some gulls, geese and crows are not exotic, but are becoming commensal. Not evaluated in this study, but suspected to be a major factor in the diminution of many species and the absence of others, is the large population of exotic predators. For example, certain areas of likely habitat such as offshore islands and abandoned land along the Harlem River might well support a diverse fauna. Casual observation, however, did not indicate that such a fauna is present, suggesting that an aggressive predator population (e.g. house cat, rat) might be at work.

There are wildlife species increasing in the Estuary without clear evidence of why

they are being successful. Some of these may be called "resident species." Examples include the American crow and again the Canada goose. It is possible that these species are exhibiting an adaptability to human contact not previously detected in their usual, "wild" behaviors. Studies of these species could focus on the niches of these animals in this environment.

**Recommendation 22.** Studies of the role of managed, exotic and commensal species whose populations have been vastly increased by the urbanized environment should be initiated. These should include the role of newly emerging, dominant species, whose success is a function of human intervention, and their long-term effect on the diversity of wildlife in the Estuary. Many species now becoming abundant in the Estuary appear to owe their reproductive success to the consequences of human management and development practices. Among those species are the Canada goose, red-tailed hawk, mute swan and meadow vole. The success of these species may be at cost to others and have adverse consequences to the diversity of wildlife in the Estuary.

#### People

**Recommendation 23.** A higher priority should be given to the creation, where necessary, and maintenance of teams (units) of wildlife/habitat specialists at all levels of government. Experience has shown that wildlife/habitat specialists are often "the first to go" in times of financial exigency. However, without a more secure and continuing effort to develop a more complete information base by both the public and private sectors, conservation, preservation and restoration efforts will be fragmented and less productive.

Efforts to develop more sophisticated levels of information about wildlife and habitat by private organizations, as well as governmental agencies, are to be applauded. In the Estuary area, these are often marked by high levels of professionalism and serve as unique and valued resources. The National Audubon Christmas Bird Count data set is an excellent example, but there are many other examples of dedicated effort by groups of individuals to characterize, count and otherwise document resources. All effort should be made to encourage, stimulate and expand these activities, for, until public funding permits development of an information base, these private activities are the best source of knowledge about wildlife in the urban area. Further, it is doubtful that public funding will ever be adequate, or could replace, the dedication of wildlife enthusiasts.

**Recommendation 24.** Development of a "professional association" of wildlife and habitat professionals and non-professional groups should be stimulated. Such an organization would serve as a means of enhancing information flow among such workers, now too often somewhat isolated. By such information exchange, common, standardized methods of data collection and preservation would be developed, rather than imposed.

Scientifically based information about the flora and fauna of the urban area as a whole is not well developed, nor is the documentation of such knowledge adequate. Without a more complete inventory of wildlife and habitats, efforts towards conservation, preservation and restoration will be incomplete.

**Recommendation 25.** A formal information network should be established among wildlife

**and habitat specialists.** Such a network should increase awareness of similar activities throughout the Estuary region, would encourage data exchange and development of standardized data sets, and would serve to encourage use of the established information centers as common data repositories. A case in point is the Natural Heritage database, about which we were unaware until after the study was completed.

Urban youngsters often lack structured opportunities to become aware of and knowledgeable about communities of plants, animals and processes. However, many people respond positively to such opportunities and often become willing participants in information gathering and monitoring, and management activities.

**Recommendation 26.** Awareness of the personal satisfaction of participation in wildlife or habitat study/conservation/restoration activities should be stimulated through existing youth education programs. Through linkages with existing organizations, a greater future public participation in wildlife/habitat awareness would be achieved.

Because of constraints of time and funding, it was not possible in the context of this study to completely analyze all existing data sets, particularly those of birds. That analysis should proceed expeditiously to more fully document the present status and the trends of populations.

**Recommendation 27.** Funding for the analysis and/or development of other data sets should be sought. Priority should be given to a) analysis of the U. S. Fish and Wildlife Service banding data and to b) activation of the FWS Breeding Bird Survey, especially in urban areas.

Finally, while the goal and objectives set for the wildlife and habitat components of the New York/New Jersey Harbor Estuary Study are praiseworthy, they are couched in broad terms lacking definition. Without precision in the statement of those objectives, progress towards achievement of the goal will be difficult to measure. Further, attainment of the goal might be impossible if it is accepted in the broadest interpretation. Such an interpretation would reduce the value of the goal statement and call into question the validity of the objectives. Therefore:

**Recommendation 28.** Both the goal statement and its component objectives should be carefully reviewed by the Wildlife/Habitat Working Group, the Scientific/Technical Committee and the Management Committee. Effort should be made to quantify the objectives and to state both goal and objectives in more definitive terms.



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APPENDIX A

List of Common and Scientific Names  
of  
Bird, Amphibians, Reptiles and Mammals  
Reported from the Study Area

Compiled by

J.S. Barclay  
Department of Natural Resource Management and Engineering  
The University of Connecticut

# APPENDIX A LIST OF REPORTED SPECIES:

## AMPHIBIANS

Marbled salamander	<i>Ambystoma opacum</i>
Spotted salamander	<i>Ambystoma maculatum</i>
Red-spotted newt (salamander)	<i>Notophthalmus v. viridescens</i>
Northern dusky salamander	<i>Desmognathus f. fuscus</i>
Redback salamander	<i>Plethodon cinereus</i>
Four-toed salamander	<i>Hemidactylum scutatum</i>
(Northern) Red salamander	<i>Pseudotriton ruber</i>
Northern two-lined salamander	<i>Eurycea b. bislineata</i>
Eastern spadefoot toad	<i>Scaphiopus h. holbrookii</i>
Eastern American toad	<i>Bufo a. americanus</i>
Fowler's toad	<i>Bufo woodhousii fowleri</i>
(Northern) Cricket frog	<i>Acris gryllus</i>
Northern spring peeper	<i>Hyla c. crucifer</i>
Gray treefrog	<i>Hyla versicolor</i>
Southern chorus frog	<i>Pseudacris nigrita</i>
New Jersey chorus frog	<i>Pseudacris spp.</i>
Bullfrog	<i>Rana catesbeiana</i>
Green frog	<i>Rana clamitans melanota</i>
Northern leopard frog	<i>Rana pipiens</i>
Southern leopard frog	<i>Rana spp.</i>
Pickerel frog	<i>Rana palustris</i>
Wood frog	<i>Rana sylvatica</i>

## REPTILES

Common snapping turtle	<i>Chelydra s. serpentina</i>
Musk turtle (Stinkpot)	<i>Stemotherus odoratus</i>
Spotted turtle	<i>Clemmys guttata</i>
Bog turtle	<i>Clemmys muhlenbergii</i>
Wood turtle	<i>Clemmys insculpta</i>
Eastern box turtle	<i>Terrapene c. carolina</i>
(Eastern) Mud turtle	<i>Kinosternon subrubrum</i>
Red-eared slider	<i>Pseudemys scripta elegans</i>
Eastern painted turtle	<i>Chrysemys picta</i>
Northern diamond-backed terrapin	<i>Malaclemys t. terrapin</i>
(Atlantic) Green turtle	<i>Chelonia mydas</i>
Atlantic Loggerhead turtle	<i>Caretta caretta</i>
(Atlantic) Kemp's Ridley turtle	<i>Lepidochelys kempi</i>
Atlantic leatherback turtle	<i>Dermochelys coriacea</i>
Eastern fence lizard	<i>Sceloporus undulatus</i>
(Northern) Five-lined skink	<i>Eumeces fasciatus</i>
Northern water snake	<i>Nerodia s. sipedon</i>
Northern brown snake	<i>Storeria d. dekayi</i>
Northern red-bellied snake	<i>Storeria o. occipitomaculata</i>
Eastern garter snake	<i>Thamnophis s. sirtalis</i>
Eastern ribbon snake	<i>Thamnophis s. sauritus</i>

## REPTILES - cont'd

Eastern hognose snake  
Northern ringneck snake  
Eastern worm snake  
Northern black racer  
Eastern smooth green snake  
Eastern king snake  
Eastern milk snake

*Heterodon platyrhinos*  
*Diadophis punctatus edwardsii*  
*Carphophis a. amoenus*  
*Coluber c. constrictor*  
*Opheodrys v. vernalis*  
*Lampropeltis g. getulus*  
*Lampropeltis t. triangulum*

## BIRDS

Common loon  
Red-throated loon  
Horned grebe  
Eared grebe  
Pied-billed grebe  
Red-necked grebe  
Northern gannet  
Double-crested cormorant  
Great cormorant  
American bittern  
Least bittern  
Great blue heron  
Great egret  
Snowy egret  
Little blue heron  
Tricolored heron  
Cattle egret  
Green-backed heron  
Black-crowned night heron  
Yellow-crowned night heron  
White ibis  
Glossy ibis  
Tundra swan  
Mute swan  
Snow goose  
Brant  
Canada goose  
Fulvous whistling duck  
Wood duck  
Green-winged teal  
American black duck  
Mallard  
Northern pintail  
Blue-winged teal  
Northern shoveler  
Gadwall  
Eurasian wigeon

*Gavia immer*  
*Gavia stellata*  
*Podiceps auritus*  
*Podiceps nigricollis*  
*Podylimbus podiceps*  
*Podiceps grisegena*  
*Morus bassanus*  
*Phalacrocorax auritus*  
*Phalacrocorax carbo*  
*Botaurus lentiginosus*  
*Ixobrychus exilis*  
*Ardea herodias*  
*Casmerodius albus*  
*Egretta thula*  
*Florida caerulea*  
*Hydranassa tricolor*  
*Bubulcus ibis*  
*Butorides striatus*  
*Nycticorax nycticorax*  
*Nycticorax violaceus*  
*Eudocimus albus*  
*Plegadis falcinellus*  
*Cygnus columbianus*  
*Cygnus olor*  
*Chen caerulescens*  
*Branta bernicla*  
*Branta canadensis*  
*Dendrocygna bicolor*  
*Aix sponsa*  
*Anas crecca*  
*Anas rubripes*  
*Anas platyrhynchos*  
*Anas acuta*  
*Anas discors*  
*Anas chryseata*  
*Anas strepera*  
*Anas penelope*



## BIRDS - cont'd

American wigeon  
Canvasback  
Redhead  
Ring-necked duck  
Greater scaup  
Lesser scaup  
King eider  
Harlequin duck  
Oldsquaw  
Black scoter  
Surf scoter  
White-winged scoter  
Common goldeneye  
Bufflehead  
Hooded merganser  
Common merganser  
Red-breasted merganser  
Ruddy duck  
Northern harrier  
Red-tailed hawk  
American kestrel  
Ruffed grouse  
Northern bobwhite  
Ring-necked pheasant  
American coot  
Killdeer  
Ruddy turnstone  
Black-bellied plover  
Sanderling  
Dunlin  
Purple sandpiper  
Ring-billed gull  
Herring gull  
Greater black-backed gull  
Black-legged kittiwake  
Laughing gull  
Common blackheaded gull  
Bonaparte's gull  
Rock dove  
Mourning dove  
Monk parakeet  
Short-eared owl  
Downy woodpecker  
Hairy woodpecker  
Northern flicker  
Horned lark  
Blue jay

*Anas americana*  
*Aythya valisineria*  
*Aythya americana*  
*Aythya collaris*  
*Aythya marila*  
*Aythya affinis*  
*Somateria spectabilis*  
*Histrionicus histrionicus*  
*Clangula hyemalis*  
*Melanitta nigra*  
*Melanitta perspicillata*  
*Melanitta deglandi*  
*Bucephala clangula*  
*Bucephala albeola*  
*Lophodytes cucullatus*  
*Mergus merganser*  
*Mergus serrator*  
*Oxyura jamaicensis*  
*Circus cyaneus*  
*Buteo jamaicensis*  
*Falco sparverius*  
*Bonasa umbellus*  
*Colinus virginianus*  
*Phasianus colchicus*  
*Fulica americana*  
*Charadrius vociferus*  
*Arenaria interpres*  
*Pluvialis squatarola*  
*Calidris alba*  
*Calidris alpina*  
*Calidris maritima*  
*Larus delawarensis*  
*Larus argentatus*  
*Larus marinus*  
*Rissa tridactyla*  
*Larus atricilla*  
*Larus ridibundus*  
*Larus philadelphia*  
*Columba livia*  
*Zenaida macroura*  
*Myiopsitta monachus*  
*Asio flammeus*  
*Picoides pubescens*  
*Picoides villosus*  
*Colaptes auratus*  
*Eremophila alpestris*  
*Cyanocitta cristata*

## MAMMALS - cont'd

Meadow vole  
House mouse  
Black rat  
Norway rat  
Red squirrel  
Eastern chipmunk  
Eastern gray squirrel  
Southern flying squirrel  
Woodchuck  
Beaver  
Muskrat  
Black-tailed Jackrabbit  
Eastern cottontail  
Little brown myotis  
Keen's myotis  
Small-footed myotis  
Silver-haired bat  
Big brown bat  
Red bat  
White-tailed deer  
Striped skunk  
Longtail weasel  
Mink  
House cat  
Raccoon  
Domestic dog  
Red fox  
Grey fox  
Hooded seal  
Harbor seal  
Atlantic Bottlenose Dolphin  
Sperm whale

*Microtus pennsylvanicus*  
*Mus musculus*  
*Rattus rattus*  
*Rattus norvegicus*  
*Tamiasciurus hudsonicus*  
*Tamias striatus*  
*Sciurus carolinensis*  
*Glaucomys volans*  
*Marmota monax*  
*Castor canadensis*  
*Ondatra zibethicus*  
*Lepus californicus*  
*Sylvilagus floridanus*  
*Myotis lucifugus*  
*Myotis keenii*  
*Myotis subulatus*  
*Lasionycteris noctivagans*  
*Eptesicus fuscus*  
*Lasiurus borealis*  
*Odocoileus virginianus*  
*Mephitis mephitis*  
*Mustela frenata*  
*Mustela vison*  
*Felis domesticus*  
*Procyon lotor*  
*Canis familiaris*  
*Vulpes vulpes*  
*Urocyon cinereoargenteus*  
*Cystophora cristata*  
*Phoca vinulina*  
*Tursiops truncatus*  
*Physeter catodon*

APPENDIX B

Atlas of Parks and Natural Areas within the  
Vicinity of the  
New York/New Jersey Harbor Estuary

Compiled by

Christina Kalafus-Kaucinger and J. S. Barclay

Department of Natural Resources Management and Engineering  
The University of Connecticut

SWIMMING RIVER NATURAL AREA, NJ FACT SHEET

LATITUDE AND LONGITUDE: 40° 19' 18" N 75° 5' 45" W ID#: 1  
COUNTY: Monmouth TOTAL ACREAGE: 109 acres  
(ONLM 1989)

HABITAT FEATURES: (ONLM 1984)

Old Field  
Mature mixed hardwood forest  
Palustrine wetland forest  
Freshwater marshes  
Brackish marshes  
Pond

FLORA AND FAUNA SPECIES LISTS: (ONLM 1984)

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

Physical management:  
Allaire State Park  
P.O. Box 220  
Farmington, NJ 07727

Overall administration:  
New Jersey DEP  
Division of Parks and Forestry  
Office of Natural Lands Management  
CN 404  
Trenton, NJ 08625

REFERENCES:

Office of Natural Lands Management. 1989. Natural Areas System directory of Natural Areas. New Jersey Department of Environmental Protection, Division of Parks and Forestry. Trenton, NJ. 12pp.

Office of Natural Lands Management. 1984. Swimming River Natural Area management plan. draft. New Jersey Department of Environmental Protection, Division of Parks and Forestry. Trenton, NJ. 36pp.

AVAILABLE MAP INFORMATION: (ONLM 1984)

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Long Branch, NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Long Branch, NJ	

Compiled 1990

104 116

## SANDY HOOK, NJ FACT SHEET

LATITUDE AND LONGITUDE: 40° 28' N 74° 00' W

ID#: 2

COUNTY: Monmouth

TOTAL ACREAGE: 1674 acres  
(NPS 1988)

HABITAT FEATURES: (Wander 1977)

Backdune (includes Fort Hancock)	600 acres
Oceanside Holly	250 acres
Bayside Holly	100 acres
Foredune	150 acres
Ocean beach	130 acres
Freshwater marsh	80 acres
Salt marsh	80 acres
Brackish ponds	20 acres

FLORA AND FAUNA SPECIES LISTS: (Cook 1989a&b, Salter 1979, Wander 1977)

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

U.S. Department of the Interior  
National Parks Service  
Gateway National Recreation Area  
Floyd Bennett Field  
Brooklyn, NY 11234

REFERENCES:

Bouton, J. J. Sandy Hook Hawk Watch-Spring 1987. 1987. Peregrine Observer 10(2):4.

Cook, R. 1989a. Mammals. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

Please see following page for additional references

AVAILABLE MAP INFORMATION: (NPS 1988, Wander 1977)

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Sandy Hook, NJ-NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Sandy Hook, NJ-NY	

Compiled 1990

HO 117

SANDY HOOK, NJ FACT SHEET (continued)

ID#: 2

REFERENCES (continued):

Cook, R. 1989b. Reptiles and amphibians. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

O'Connell, A. 1980. The relationship of mammals to the major vegetation communities in Gateway National Recreation Area (Jamaica Bay Wildlife Refuge, Breezy Point and Sandy Hook) including a soil analysis of selected areas. N-012-II. Gateway Institute for Natural Resources Science. Brooklyn, NY. 81pp.

National Park Service, Gateway National Recreation Area. 1988. General management plan amendment, development concept plan and interpretive prospectus: Sandy Hook Unit Gateway National Recreation Area, New York/New Jersey - draft. U.S. Department of the Interior. 40pp.

Stalter, R. 1979. The plant communities of Sandy Hook, New Jersey with emphasis on Ilex opaca. N-008-I. Gateway Institute for Natural Resources Science. Brooklyn, NY. 22 pp.

Wander, W. 1977. Breeding birds of Sandy Hook 1976. New Jersey Audubon Society 3(5,6):84-90.

Sandy Hook Bird Club. 1974-1989. Sandy Hook March 26 bird count records, unpublished. (Contact: Mike Fahay, Sandy Hook Marine Laboratory, Highlands, NJ 07732).

Sandy Hook Bird Club. 1984-1989. Sandy Hook onlies - world series of birding days, unpublished. (Contact: Mike Fahay, Sandy Hook Marine Laboratory, Highlands, NJ 07732).

There are numerous other references cited in these documents.

HT 118

## CHEESEQUAKE NATURAL AREA FACT SHEET

LATITUDE AND LONGITUDE: 40° 26' 00" N 74° 16' 30" W ID#: 3

COUNTY: Middlesex

TOTAL ACREAGE: 450 acres  
(ONLM 1989)

HABITAT FEATURES: (ONLM 1985)

Salt marsh  
Freshwater marsh  
Freshwater swamp  
Bog  
Various forest communities

FLORA AND FAUNA SPECIES LISTS: (ONLM 1985)

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input type="checkbox"/> Amphibians	<input type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

Physical Management:  
Cheesequake State Park  
Matawan, NJ 07747

Overall administration:  
New Jersey DEP  
Division of Parks and Forestry  
Office of Natural Lands Management  
CN 404  
Trenton, NJ 08625

REFERENCES:

Office of Natural Lands Management. 1989. Natural Areas System directory of Natural Areas. New Jersey Department of Environmental Protection, Division of Parks and Forestry. Trenton, NJ. 12pp.

Office of Natural Lands Management. 1984. Cheesequake Natural Area management plan. New Jersey Department of Environmental Protection, Division of Parks and Forestry. Trenton, NJ. 53pp.

AVAILABLE MAP INFORMATION: (ONLM 1985)

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input checked="" type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles South Amboy, NJ-NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles South Amboy, NJ-NY	

Compiled 1990

HE 119

LIBERTY PARK NATURAL AREA/LIBERTY STATE PARK FACT SHEET

LATITUDE AND LONGITUDE: 40° 42' 08" N 74° 03' 15" W

ID#: 4

COUNTY: Hudson

TOTAL ACREAGE: 36 acres-Natural  
Area\*, 1,100 acres-Park\*\*

HABITAT FEATURES: (Cartica 1988)

Remnant tidal salt marsh  
Upland

FLORA AND FAUNA SPECIES LISTS: (Cartica 1988, NJDEP ca. 1986)

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input checked="" type="checkbox"/> Invertebrates***
<input checked="" type="checkbox"/> Fishes***	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

Physical management:  
Liberty State Park  
Morris Pesin Drive  
Jersey City, NJ 07304

Overall administration:  
New Jersey DEP  
Division of Parks and Forestry  
Office of Natural Lands Management  
CN 404  
Trenton, NJ 08625

REFERENCES:

Office of Natural Lands Management. 1989. Natural Areas System directory of Natural Areas. New Jersey Department of Environmental Protection, Division of Parks and Forestry. Trenton, NJ. 12pp.\*

Cartica, R. J., Office of Natural Lands Management. 1988. Liberty Park Natural Area management plan. New Jersey Department of Environmental Protection, Division of Parks and Forestry. 27pp.\*\*

Please see following page for additional references.

AVAILABLE MAP INFORMATION: (Cartica 1988)

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input checked="" type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Jersey City, NJ-NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Jersey City, NJ-NY	

Compiled 1990

415 120



LIBERTY PARK NATURAL AREA/LIBERTY STATE PARK (continued)

ID#: 4

REFERENCES (continued):

New Jersey Department of Environmental Protection, Division of Parks and Forestry.  
ca. 1986. The birds of Liberty State Park. Pamphlet.

New Jersey Department of Environmental Protection, Division of Parks and Forestry.  
ca. 1988. Liberty State Park. Pamphlet.

Cartica (1988) does not include full lists of invertebrate or fish species in the management plan but cites Texas Instruments, Inc. (1976) as a source of an invertebrate list and Boyko (1980) and Dresdner Associates, Inc. (1984) as sources of fish species lists. The citations are as follows: \*\*\*

Boyko, O. 1980. Liberty Park Natural Area Management Plan. Draft plan prepared for the Division of Parks and Forestry, New Jersey Department of Environmental Protection.

Dresdner, Associates, Inc. 1984. Environmental Assessment for the Port Liberte Project, Jersey City, New Jersey. Consultant's report prepared for The Sperry Group, Developers, and The Ehrenkrantz Groups, Architects.

114 121

## HACKENSACK MEADOWLANDS, NJ FACT SHEET

LATITUDE AND LONGITUDE: 40° 47' 30" N 74° 05' 00" W ID#: 5  
COUNTY: Bergen and Hudson TOTAL ACREAGE: over 8,000 acres wet-  
land, 12,000 acres non-wetland (developed)\*

HABITAT FEATURES: (Maguire Group, Inc. 1989)

Fresh water marsh  
Salt water marsh  
Wet meadow  
Forested Wetlands  
Rock outcroppings  
Hardwood forest

FLORA AND FAUNA SPECIES LISTS: (HMEC 1983, HMDC 1987)

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input checked="" type="checkbox"/> Invertebrates
<input checked="" type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

The Hackensack Meadows Development Commission  
One DeKorte Park Plaza  
Lyndhurst, NJ 07071

REFERENCES:

Hackensack Meadows Development Commission. 1987. Species lists of organisms found in the Hackensack Meadows: vascular plants - mammals.

Maguire Group, Inc. 1989. Final report functional assessment of wetlands in New Jersey's Hackensack Meadows. Consultant's report prepared for the U.S. Environmental Protection Agency, Region II.\* (also contains HMDC 1987)

Hackensack Meadows Environmental Center. 1983. Birds of the Hackensack Meadows, New Jersey. Pamphlet.

AVAILABLE MAP INFORMATION: (Maguire Group, Inc. 1989)

<input checked="" type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input checked="" type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles	
Elizabeth, NJ	Elizabeth, NJ	
Jersey City, NJ	Jersey City, NJ	
Orange, NJ	Orange, NJ	
Weehawkin, NJ	Weehawkin, NJ	

Compiled 1990

HS 122

CLAY PITS POND STATE PARK PRESERVE, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 32' 30" N 74° 13' 45" W ID#: 6

COUNTY: Richmond

TOTAL ACREAGE: 260 acres  
(P. Gentile, pers. comm.)

HABITAT FEATURES: (TPL and Jackson and Kihn 1986)

Small ponds  
Wet meadow  
Bog  
Meadow  
Upland woods  
Pine-oak scrub  
Wet woods, swamp

FLORA AND FAUNA SPECIES LISTS: (Clay Pits Pond State Park Preserve 1985-1989)

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

Clay Pits Pond State Park Preserve  
83 Nielsen Avenue  
Staten Island, NY 10309

New York State Office of Parks,  
Recreation and Historic Preservation  
New York City Region  
1700 Broadway  
New York, New York 10019

REFERENCES:

Clay Pits Pond State Park Preserve. 1985-1988. Species lists, unpublished.

Gentile, P. 1990. Personal communication. (P. Gentile is a Park Recreation Activities Specialist for Clay Pits Pond State Park Preserve)

Trust for Public Land and Jackson and Kihn. 1986. Clay Pits Pond State Park Preserve, management plan, Staten Island, NY.

AVAILABLE MAP INFORMATION: (TPL and Jackson and Kihn 1986)

<input type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input checked="" type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Arthur Kill, NY-NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Arthur Kill, NY-NJ	

Compiled 1990

116 123

# CONFERENCE HOUSE PARK, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 29' 45" N 74° 15' 00" W ID#: 7

COUNTY: Richmond

TOTAL ACREAGE: 5 acres  
(Conf. Hsc. Assc., pers. comm.)

HABITAT FEATURES: (Jackson and Kihn 1988)

Woodland  
Swamp  
Small open meadows  
Dune/beach

FLORA AND FAUNA SPECIES LISTS: (Jackson and Kihn 1988)

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input type="checkbox"/> Amphibians	<input type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

Conference House Association  
7455 Hylan Blvd  
Staten Island, NY 10307

NYC Department of Parks and Recreation  
135<sup>th</sup> Avenue  
New York, New York 10021

REFERENCES:

Jackson and Kihn. 1988. Analysis of existing conditions, Conference House Park, Staten Island, draft report. Consultant's report prepared for the New York City Department of Parks and Recreation.

AVAILABLE MAP INFORMATION: (Jackson and Kihn 1988)

<input type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Arthur Kill, NY-NJ Keyport, NJ-NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Arthur Kill, NY-NJ Keyport, NJ-NY	

Compiled 1990

#7124

## LEMON CREEK PARK, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 31' 00" N 74° 12' 00" W ID#: 8

COUNTY: Richmond

TOTAL ACREAGE: 75.70 acres

HABITAT FEATURES: (Louis Berger & Associates, Inc. 1989)

High marsh  
Intertidal zone  
Beach front  
Woodland  
Vacant upland  
Spoil berms

### FLORA AND FAUNA SPECIES LISTS:

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input type="checkbox"/> Amphibians	<input type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

NYC Department of Parks and Recreation  
135<sup>th</sup> Avenue  
New York, New York 10021

### REFERENCES:

Louis Berger & Associates, Inc. 1989. Lemon Creek Park: preliminary design investigation, final report. Consultant's report prepared for the New York City Department of Parks and Recreation.

### AVAILABLE MAP INFORMATION: (Louis Berger & Associates, Inc. 1989)

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input checked="" type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Arthur Kill, NY-NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Arthur Kill, NY-NJ	

Compiled 1990

HE 125

BLUE HERON POND, SPRING POND, AND THE POILLON AVENUE  
WETLANDS, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 32' 00" N 74° 10' 38" W ID#: 9

COUNTY: Richmond

TOTAL ACREAGE: 70 acres  
(60% city ownership) (PPOW 1979)

HABITAT FEATURES: (PPOW 1979)

Swamp  
Ponds  
Grassland  
Woodland

FLORA AND FAUNA SPECIES LISTS: (PPOW 1979, McHarg and Thorne 1988)

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

NYC Department of Parks and Recreation  
135<sup>th</sup> Avenue  
New York, New York 10021

Also private ownership

REFERENCES:

McHarg, I. and J. Thorne. 1988. Schematic design for Blue Heron Park, Staten Island: natural resources inventory.

Protectors of Pine Oak Woods, Inc. 1979. A report on Blue Heron Pond, Spring Pond, and the Poillon Avenue Wetlands, Annadale, Staten Island, New York City. Mimeo. 27pp.

AVAILABLE MAP INFORMATION: (McHarg and Thorne 1988)

<input type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input checked="" type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Arthur Kill, NY-NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Arthur Kill, NY-NJ	

Compiled 1990

449 126

## GREAT KILLS, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 33' 00" N 74° 07' 45" W

ID#: 10

COUNTY: Richmond

TOTAL ACREAGE:

HABITAT FEATURES: (NWI, USGS topographic maps)

Palustrine emergent marsh  
Beach  
Tidal flat  
Upland

FLORA AND FAUNA SPECIES LISTS: (Cook 1989a&b)

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

U.S. Department of the Interior  
National Park Service  
Gateway National Recreation Area  
Floyd Bennett Field  
Brooklyn, NY 11234

REFERENCES:

Cook, R. 1989a. Mammals. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

Cook, R. 1989b. Reptiles and amphibians. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

AVAILABLE MAP INFORMATION:

<input type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Arthur Kill, NY-NJ The Narrows, NY-NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Arthur Kill, NY-NJ The Narrows, NY-NJ	

Compiled 1990

+20 127

MILLER'S FIELD , NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 34' 08" N 74° 06' 00" W

ID#: 11

COUNTY: Richmond

TOTAL ACREAGE:

HABITAT FEATURES: (NWI, USGS topographic maps)

Upland - open and wooded

FLORA AND FAUNA SPECIES LISTS: (Cook 1989a&b)

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

U.S. Department of the Interior  
National Park Service  
Gateway National Recreation Area  
Floyd Bennett Field  
Brooklyn, NY 11234

REFERENCES:

Cook, R. 1989a. Mammals. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

Cook, R. 1989b. Reptiles and amphibians. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

AVAILABLE MAP INFORMATION:

<input type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles The Narrows, NY-NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles The Narrows, NY-NJ	

Compiled 1990

425 128



## STATEN ISLAND GREENBELT, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 35' 15" N 74° 07' 45" W

ID#: 12

COUNTY: Richmond

TOTAL ACREAGE: appx 2500 acres  
(S. Bonagura, pers. comm.)

HABITAT FEATURES: (NYC Department of City Planning 1983)

Upland forest  
Marsh  
Swamp  
Open water  
Maintained field, old field, young forest

FLORA AND FAUNA SPECIES LISTS: List for High Rock Park\*

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles**
<input checked="" type="checkbox"/> Birds**	<input checked="" type="checkbox"/> Mammals**	

MANAGEMENT AUTHORITY:

NYC Parks and Recreation Greenbelt  
200 Nevada Avenue  
Staten Island, NY 10306

NYC Department of Parks and Recreation  
135<sup>th</sup> Avenue  
New York, New York 10021

REFERENCES:

Louis Berger & Associates, Inc. 1989. High Rock Park schematic design, Staten Island, NY. Consultant's report for the City of New York, Parks and Recreation.\*

NYC Department of City Planning. Feb. 1983. The Staten Island Greenbelt Study, Final Report Phase I: data analysis and recommendations. NYCDEP 83-03. City of New York, NYC Planning Commission. 87pp.

Please see following page for additional references.

AVAILABLE MAP INFORMATION: (NYC Department of City Planning 1983)

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input checked="" type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Arthur Kill, NY-NJ The Narrows, NY-NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Arthur Kill, NY-NJ The Narrows, NY-NJ	

Compiled 1990

122 129

STATEN ISLAND GREENBELT, NY FACT SHEET (continued)

ID#: 12

REFERENCES (continued):

Staten Island Greenbelt lists are reported to be in progress for these organisms (Bonagura, S. 1990. Personal communication. (S. Bonagura is a wildlife biologist for the Staten Island Greenbelt))\*\*

The Staten Island Greenbelt encompasses the following sites:

William T. Davis Wildlife Refuge  
Willowbrook Park  
Carson's Brook Woods  
Great Swamp  
Blood Root Valley  
High Rock Park  
Buck's Hollow  
LaTourette Park  
Deere Park  
Reeds Basket Willow Swamp

## SHOOTERS ISLAND, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 38' 38" N 74° 09' 38" W

ID#: 13 A

COUNTY: Richmond

TOTAL ACREAGE: 51 A (appx. 40 A fill)

### HABITAT FEATURES:

Upland - with mature trees  
Rotting wooden drydocks and barges

### FLORA AND FAUNA SPECIES LISTS: Lists for northwest Staten Island

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

The land is currently owned by the NYC Department of Ports and Trade. It is being transferred to the NYC Department of Parks and Recreation and will be managed by the NYC Audubon Society.

### REFERENCES:

Trust for Public Land and New York City Audubon Society. 1990. The harbor herons report: a strategy for preserving a unique urban wildlife habitat and wetland resource in northwestern Staten Island. New York. 56pp.

### AVAILABLE MAP INFORMATION: \*

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Elizabeth, NJ-NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Elizabeth, NJ-NY	

\* Vegetation and land use maps are for the overall study area, not individual sites.

Compiled 1990

124 131

## ARLINGTON, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 38' 15" N 74° 10' 30" W

ID#: 13 B

COUNTY: Richmond

TOTAL ACREAGE:

### HABITAT FEATURES:

Coastal shoals, sandbars, mudflats  
Intertidal marsh  
High marsh  
Man-made beach  
Fresh water marsh  
Ponds

### FLORA AND FAUNA SPECIES LISTS: List for northwestern Staten Island

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

NYC Department of Ports and Trade and private ownership

### REFERENCES:

Trust for Public Land and New York City Audubon Society. 1990. The harbor herons report: a strategy for preserving a unique urban wildlife habitat and wetland resource in northwestern Staten Island. New York. 56pp.

### AVAILABLE MAP INFORMATION: \*

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Elizabeth, NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Elizabeth, NJ	

\* Vegetation and land use maps are for the overall study are, not individual sites.

Compiled 1990

425 132

## BRIDGE CREEK, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 38' 15" N 40° 11' 15" W

ID#: 13 C

COUNTY: Richmond

TOTAL ACREAGE:

### HABITAT FEATURES:

Intertidal marsh  
Coastal shoals, bars, mudflats  
Grassland

### FLORA AND FAUNA SPECIES LISTS: Lists for northwest Staten Island

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

The land is owned by the NYC Department of Ports and Trade. It is leased to the Port Authority of New York and New Jersey.

### REFERENCES:

Trust for Public Land and New York City Audubon Society. 1990. The harbor herons report: a strategy for preserving a unique urban wildlife habitat and wetland resource in northwestern Staten Island. New York. 56pp.

### AVAILABLE MAP INFORMATION: \*

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Elizabeth, NJ-NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Elizabeth, NJ-NY	

\* Vegetation and land use maps are for the overall study area, not individual sites.

Compiled 1990

126 133

## GOETHALS BRIDGE POND, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 37' 45" N 74° 10' 30" W

ID#: 13 D

COUNTY: Richmond

TOTAL ACREAGE:

### HABITAT FEATURES:

Pond	33 acres
Tidal wetlands	
Freshwater wetlands	

### FLORA AND FAUNA SPECIES LISTS: Lists for northwestern Staten Island

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

NYC and private ownership

### REFERENCES:

Trust for Public Land and New York City Audubon Society. 1990. The harbor herons report: a strategy for preserving a unique urban wildlife habitat and wetland resource in northwestern Staten Island. New York. 56pp.

### AVAILABLE MAP INFORMATION: \*

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Elizabeth, NJ-NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Elizabeth, NJ-NY	

\* Vegetation and land use maps are for the overall study area, not individual sites.  
Compiled 1990

129 134

## OLD PLACE CREEK NY, FACT SHEET

LATITUDE AND LONGITUDE: 40° 37' 30" N 74° 10' 53" W

ID#: 13 E

COUNTY: Richmond

TOTAL ACREAGE:

### HABITAT FEATURES:

Coastal shoals, bars, mudflats  
Tidal wetlands  
Intertidal marsh  
High marsh  
Freshwater wetlands

### FLORA AND FAUNA SPECIES LISTS: Lists for northwestern Staten Island

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

NYC Department of Ports and Trade and private ownership.

### REFERENCES:

Trust for Public Land and New York City Audubon Society. 1990. The harbor herons report: a strategy for preserving a unique urban wildlife habitat and wetland resource in northwestern Staten Island. New York. 56pp.

### AVAILABLE MAP INFORMATION: \*

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Arthur Kill, NY-NJ Elizabeth, NJ-NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Arthur Kill, NY-NJ Elizabeth, NJ-NY	

\* Vegetation and land use maps are for the overall study area, not individual sites.

Compiled 1990

120 135

## GRANITEVILLE SWAMP, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 37' 30" N 74° 10' 15" W ID#: 13 F  
COUNTY: Richmond TOTAL ACREAGE: 30 acres

### HABITAT FEATURES:

Small ponds  
Salt marsh  
Swamp forest  
Upland forest  
Cattail marsh

### FLORA AND FAUNA SPECIES LISTS: Lists for northwestern Staten Island

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

Predominantly private ownership

### REFERENCES:

Trust for Public Land and New York City Audubon Society. 1990. The harbor herons report: a strategy for preserving a unique urban wildlife habitat and wetland resource in northwestern Staten Island. New York. 56pp.

### AVAILABLE MAP INFORMATION: \*

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Arthur Kill, NY-NJ Elizabeth, NJ-NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Arthur Kill, NY-NJ Elizabeth, NJ-NY	

\* Vegetation and land use maps are for the overall study area, not individual sites.  
Compiled 1990



# STATEN ISLAND CORPORATE PARK, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 36' 30" N 74° 10' 30"

ID#: 13 G

COUNTY: Richmond

TOTAL ACREAGE:

## HABITAT FEATURES:

Cattail bog  
Swamp woodland  
Shrub swamp  
Acidic marsh  
Freshwater marsh

## FLORA AND FAUNA SPECIES LISTS: Lists for northwestern Staten Island

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

## MANAGEMENT AUTHORITY:

NYC Public Development Authority

## REFERENCES:

Trust for Public Land and New York City Audubon Society. 1990. The harbor herons report: a strategy for preserving a unique urban wildlife habitat and wetland resource in northwestern Staten Island. New York. 56pp.

## AVAILABLE MAP INFORMATION: \*

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Arthur Kill, NY-NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Arthur Kill, NY-NJ	

\* Vegetation and land use maps are for the overall study area, not individual sites.

Compiled 1990

130137

GULFPORT MARSH, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 37' 15" N 74° 11' 30" W

ID#: 13 H

COUNTY: Richmond

TOTAL ACREAGE:

HABITAT FEATURES:

Fresh water wetland complex                      162 acres  
Small tidal wetlands  
Open water

FLORA AND FAUNA SPECIES LISTS: Lists for northwestern Staten Island

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

Private ownership

REFERENCES:

Trust for Public Land and New York City Audubon Society. 1990. The harbor herons report: a strategy for preserving a unique urban wildlife habitat and wetland resource in northwestern Staten Island. New York. 56pp.

AVAILABLE MAP INFORMATION: \*

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Arthur Kill, NY-NJ Elizabeth, NJ-NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Arthur Kill, NY-NJ Elizabeth, NJ-NY	

\* Vegetation and land use maps are for the overall study area, not individual sites.  
Compiled 1990

+3+ 138

## SAWMILL CREEK MARSH, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 36' 30" N 74° 11' 30" W

ID#: 131

COUNTY: Richmond

TOTAL ACREAGE:

### HABITAT FEATURES:

Intertidal marsh  
High marsh  
Freshwater wetlands  
Small ponds  
Freshwater-brackish marsh 25 acres  
Tidal flat

### FLORA AND FAUNA SPECIES LISTS: Lists for northwestern Staten Island

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

NYC Public Development Authority and private ownership.

### REFERENCES:

Trust for Public Land and New York City Audubon Society. 1990. The harbor herons report: a strategy for preserving a unique urban wildlife habitat and wetland resource in northwestern Staten Island. New York. 56pp.

### AVAILABLE MAP INFORMATION: \*

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Arthur Kill, NY-NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Arthur Kill, NY-NJ	

\* Vegetation and land use maps are for the overall study area, not individual sites.

Compiled 1990

152 139

## PRALL'S ISLAND, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 36' 30" N 74° 12' 08" W ID#: 13 J

COUNTY: Richmond

TOTAL ACREAGE: 88 acres

HABITAT FEATURES: (TPL and NYCAS 1990, NWI map)

Estuarine emergent marsh  
Tidal flat  
Upland

FLORA AND FAUNA SPECIES LISTS: Lists for northwestern Staten Island

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

Owned by the NYC Department of Parks and Recreation  
Managed by the NYC Audubon Society

REFERENCES:

Trust for Public Land and New York City Audubon Society. 1990. The harbor herons report: a strategy for preserving a unique urban wildlife habitat and wetland resource in northwestern Staten Island. New York. 56pp.

AVAILABLE MAP INFORMATION: \*

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Arthur Kill, NY-NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Arthur Kill, NY-NJ	

\* Vegetation and land use maps are for the overall study area, not individual sites.

Compiled 1990

133 140

## NECK CREEK MARSH, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 35' 53" N 74° 11' 15" W

ID#: 13 K

COUNTY: Richmond

TOTAL ACREAGE: 60 acres of wetlands

### HABITAT FEATURES:

Intertidal marsh  
High marsh  
Fresh water wetlands  
Upland

### FLORA AND FAUNA \*SPECIES LISTS: Lists for northwestern Staten Island

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

Public and private ownership

### REFERENCES:

Trust for Public Land and New York City Audubon Society. 1990. The harbor herons report: a strategy for preserving a unique urban wildlife habitat and wetland resource in northwestern Staten Island. New York. 56pp.

### AVAILABLE MAP INFORMATION: \*

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Arthur Kill, NY-NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Arthur Kill, NY-NJ	

\* Vegetation and land use maps are for the overall study area, not individual sites.

Compiled 1990

739141

FRESH KILLS, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 35' 00" N 74° 11' 30" W

ID#: 13 L

COUNTY: Richmond

TOTAL ACREAGE:

HABITAT FEATURES:

Intertidal marsh  
High marsh  
Mudflats

FLORA AND FAUNA SPECIES LISTS: Lists for northwestern Staten Island

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

NYC Department of Sanitation and private ownership

REFERENCES:

Trust for Public Land and New York City Audubon Society. 1990. The harbor herons report: a strategy for preserving a unique urban wildlife habitat and wetland resource in northwestern Staten Island. New York. 56pp.

AVAILABLE MAP INFORMATION: \*

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Arthur Kill, NY-NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Arthur Kill, NY-NJ	

\* Vegetation and land use maps are for the overall study area, not individual sites.

Compiled 1990

135 142

## ISLE OF MEADOWS, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 34' 30" N 74° 12' 15" W

ID#: 13 M

COUNTY: Richmond

TOTAL ACREAGE: 101 acres

### HABITAT FEATURES:

Intertidal marsh  
High marsh

### FLORA AND FAUNA SPECIES LISTS: Lists for northwestern Staten Island

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

NYC Department of Sanitation

### REFERENCES:

Trust for Public Land and New York City Audubon Society. 1990. The harbor herons report: a strategy for preserving a unique urban wildlife habitat and wetland resource in northwestern Staten Island. New York. 56pp.

### AVAILABLE MAP INFORMATION: \*

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Arthur Kill, NY-NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Arthur Kill, NY-NJ	

\* Vegetation and land use maps are for the overall study area, not individual sites.

Compiled 1990

136 143

PLUMB BEACH, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 35' 00" N 73° 55' 30" W

ID#: 14

COUNTY: Kings

TOTAL ACREAGE:

HABITAT FEATURES: (NWI, USGS topographic maps)

Upland  
Beach  
Tidal flat

FLORA AND FAUNA SPECIES LISTS: (Cook 1989a&b)

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

U.S. Department of the Interior  
National Park Service  
Gateway National Recreation Area  
Floyd Bennett Field  
Brooklyn, NY 11234

REFERENCES:

Cook, R. 1989a. Mammals. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

Cook, R. 1989b. Reptiles and amphibians. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

AVAILABLE MAP INFORMATION:

<input type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Coney Island, NY-NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Coney Island, NY-NJ	

Compiled 1990

139 144



MARINE PARK, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 36' 00" N 73° 55' 15" W

ID#: 15

COUNTY: Kings

TOTAL ACREAGE: 798 acres (130 under-water)

HABITAT FEATURES:

Closed forest	10.40 acres
Desert	30.23 acres
Herbaceous	399.53 acres
Scrub	25.78 acres
Vineland	4.01 acres
Woodland	39.41 acres
Intertidal	33.70 acres

FLORA AND FAUNA SPECIES LISTS:

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input checked="" type="checkbox"/> Invertebrates
<input checked="" type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

NYC Department of Parks and Recreation  
135<sup>th</sup> Avenue  
New York, New York 10021

REFERENCES:

New York City Department of Parks and Recreation, Natural Resources Group. 1988.  
Natural areas management plan: Marine Park, Brooklyn.

AVAILABLE MAP INFORMATION:

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input checked="" type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input checked="" type="checkbox"/> Active management	<input checked="" type="checkbox"/> Proposed management	<input checked="" type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Coney Island, NY-NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Coney Island, NY-NJ	

Compiled 1990

138 145

FLOYD BENNETT FIELD, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 35' 30" N 73° 53' 30" W ID#: 16

COUNTY: Kings

TOTAL ACREAGE: 1,488.40 acres  
(NPS 1979)

HABITAT FEATURES: (NPS 1979)

Clam bed	284.20 acres
Sand flat	212.90 acres
Sand (bare sand, beach)	41.78 acres
Grassland	339.37 acres
Shrubland	98.27 acres
Woodland	28.47 acres
Marsh	453.24 acres
Manmade or altered land	484.7 acres

FLORA AND FAUNA SPECIES LISTS: (Borque and Borque ca. 1978, Cook 1989a&b, Greller 1984, Rogers 1982)

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

U.S. Department of the Interior  
National Park Service  
Gateway National Recreation Area  
Floyd Bennett Field  
Brooklyn, NY 11234

REFERENCES:

Borque, R. and J. Borque. ca. 1987. Birds of Floyd Bennett Field, unpublished.

Cook, R. 1989a. Mammals. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

Cook, R. 1989b. Reptiles and amphibians. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

Please see the following page for additional references.

AVAILABLE MAP INFORMATION:

<input type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Coney Island, NY-NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Coney Island, NY-NJ	

Compiled 1990

139146

FLOYD BENNETT FIELD, NY FACT SHEET (continued)

ID#: 16

REFERENCES (continued):

Greller, A. M. 1984. Additions to the flora of Gateway National Recreation Area, Floyd Bennett Field Division and recommendations for floral management. N-001-l. Gateway Institute for Natural Resource Sciences. Brooklyn, NY.

Hartig, E. K. and G. F. Rogers. 1984. Phragmites fire ecology. N-014-ll. Gateway Institute for Natural Resource Sciences. Brooklyn, NY. 3pp.

National Park Service, Gateway National Recreation Area. 1979. The final environmental statement general management plan. U.S. Department of the Interior. 256pp.

Rogers, G. F. 1982. Vegetation survey of Floyd Bennett Field in Gateway National Recreation Area, Brooklyn, NY. N-001-l. Gateway Institute for Natural Resource Science. Brooklyn, NY.

440-147

BERGEN BEACH, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 36' 30" N 73° 53' 45" W ID#: 17

COUNTY: Kings

TOTAL ACREAGE:

HABITAT FEATURES: (NWI, USGS topographic maps)

Estuarine emergent marsh  
Tidal flat  
Upland

FLORA AND FAUNA SPECIES LISTS: (Cook 1989a&b)

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

U.S. Department of the Interior  
National Park Service  
Gateway National Recreation Area  
Floyd Bennett Field  
Brooklyn, NY 11234

REFERENCES:

Cook, R. 1989a. Mammals. U.S. Department of the Interior, National Park Service. Gateway National Recreation Area. Pamphlet.

Cook, R. 1989b. Reptiles and amphibians. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

AVAILABLE MAP INFORMATION:

<input type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Coney Island, NY-NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Coney Island, NY-NJ	

Compiled 1990

144 148

MILL BASIN WETLANDS (FOUR SPARROW MARSH), NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 36' 00" N 73° 54' 30" W

ID#: 18 A

COUNTY: Kings

TOTAL ACREAGE: appx 75 acres wetland,  
14 acres fill\*

HABITAT FEATURES: (TPL and NYCAS 1987, NWI and USGS topographic maps)

Marsh (estuarine emergent)  
Intertidal zone  
Upland

FLORA AND FAUNA SPECIES LISTS:

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input type="checkbox"/> Amphibians	<input type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

Land owned by NYC, leased to a private individual

REFERENCES:

Trust for Public Land and New York City Audubon Society. 1987. Buffer the bay: a survey of Jamaica Bay's unprotected open shoreline and uplands.\*

AVAILABLE MAP INFORMATION: (TPL and NYCAS 1987)

<input checked="" type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Coney Island, NY-NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Coney Island, NY-NJ	

Compiled 1990

142 149

PAERDEGAT BASIN, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 37' 30" N 73° 54' 00" W ID#: 18 B  
COUNTY: Kings TOTAL ACREAGE: 80+ acres upland  
(TPL and NYCAS 1987)  
HABITAT FEATURES: (TPL and NYCAS 1987, NWI and USGS topographic maps)  
Intertidal wetland  
Salt marsh  
Tidal flat  
Upland (disturbed, early stage of revegetation)

FLORA AND FAUNA SPECIES LISTS:

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input type="checkbox"/> Amphibians	<input type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

Public and private ownership

REFERENCES:

Trust for Public Land and New York City Audubon Society. 1987. Buffer the bay: a survey of Jamaica Bay's unprotected open shoreline and uplands.

AVAILABLE MAP INFORMATION: (TPL and NYCAS 1987)

<input checked="" type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Brooklyn, NY Coney Island, NY-NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Brooklyn, NY Coney Island, NY-NJ	

Compiled 1990

443-150

## FRESH CREEK BASIN, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 38' 30" N 73° 53' 00" W

ID#: 18 C

COUNTY: Kings

TOTAL ACREAGE: 50 acres  
(TPL and NYCAS 1987)

HABITAT FEATURES: (TPL and NYCAS 1987, NWI and USGS topographic maps)

Riparian zone  
Salt marsh  
Tidal flat  
Upland

### FLORA AND FAUNA SPECIES LISTS:

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input type="checkbox"/> Amphibians	<input type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

Public and private ownership

### REFERENCES:

Trust for Public Land and New York City Audubon Society. 1987. Buffer the bay: a survey of Jamaica Bay's unprotected open shoreline and uplands.

### AVAILABLE MAP INFORMATION: (TPL and NYCAS 1987)

<input checked="" type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Brooklyn, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Brooklyn, NY	

Compiled 1990

144151

CANARSIE PIER AREA, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 37' 45" N 73° 53' 15" W

ID#: 19

COUNTY: Kings

TOTAL ACREAGE:

HABITAT FEATURES: (NWI, USGS topographic maps)

Tidal flat  
Estuarine emergent marsh  
Upland

FLORA AND FAUNA SPECIES LISTS: (Cook 1989a&b)

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

U.S. Department of the Interior  
National Park Service  
Gateway National Recreation Area  
Floyd Bennett Field  
Brooklyn, NY 11234

REFERENCES:

Cook, R. 1989a. Mammals. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

Cook, R. 1989b. Reptiles and amphibians. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

AVAILABLE MAP INFORMATION:

<input type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Brooklyn, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Brooklyn, NY	

Compiled 1990

145 152



PENNSYLVANIA AVENUE LANDFILL, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 38' 30" N 73° 52' 30" W ID#: 20

COUNTY: Kings

TOTAL ACREAGE: 110 acres  
(R. Cook, pers. comm.)

HABITAT FEATURES: (NWI, USGS topographic maps)

Upland  
Estuarine emergent marsh  
Tidal flat

FLORA AND FAUNA SPECIES LISTS: (Cook 1989a&b)

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

U.S. Department of the Interior  
National Park Service  
Gateway National Recreation Area  
Floyd Bennett Field  
Brooklyn, NY 11234

REFERENCES:

Cook, R. 1989a. Mammals. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

Cook, R. 1989b. Reptiles and amphibians. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

AVAILABLE MAP INFORMATION:

<input type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Brooklyn, NY Jamaica, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Brooklyn, NY Jamaica, NY	

Compiled 1990

146-153

# FOUNTAIN AVENUE LANDFILL, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 38' 45" N 73° 51' 45" W ID#: 21

COUNTY: Kings

TOTAL ACREAGE: 250 acres  
(R. Cook, pers. comm.)

HABITAT FEATURES: (NWI, USGS topographic maps)

Upland  
Tidal flat  
Estuarine marsh

## FLORA AND FAUNA SPECIES LISTS: (Cook 1989a&b)

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

## MANAGEMENT AUTHORITY:

U.S. Department of the Interior  
National Park Service  
Gateway National Recreation Area  
Floyd Bennett Field  
Brooklyn, NY 11234

## REFERENCES:

Cook, R. 1989a. Mammals. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

Cook, R. 1989b. Reptiles and amphibians. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

## AVAILABLE MAP INFORMATION:

<input type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Jamaica, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Jamaica, NY	

Compiled 1990

449 154

## CANARSIE POL. NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 37' 15" N 73° 52' 15" W

ID#: 22

COUNTY: Kings

TOTAL ACREAGE: 250 acres  
(R. Cook, pers. comm.)

HABITAT FEATURES: (O'Connell 1980, NWI, USGS topographic maps)

Estuarine emergent marsh  
Upland-mixed grassland  
Beachgrass dune  
Woodland

FLORA AND FAUNA SPECIES LISTS: (Cook 1989a&b, O'Connell 1980)

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

U.S. Department of the Interior  
National Park Service  
Gateway National Recreation Area  
Floyd Bennett Field  
Brooklyn, NY 11234

REFERENCES:

Cook, R. 1989a. Mammals. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

Cook, R. 1989b. Reptiles and amphibians. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

Please see following page for additional references.

AVAILABLE MAP INFORMATION:

<input type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Coney Island, NY-NJ Far Rockaway, NY Jamaica, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Coney Island, NY-NJ Far Rockaway, NY Jamaica, NY	

Compiled 1990

148-155

CANARSIE POL. NY FACT SHEET (continued)

ID#: 22

REFERENCES (continued):

O'Connell, A. 1980. The relationship of mammals to the major vegetation communities in Gateway National Recreation Area (Jamaica Bay Wildlife Refuge, Breezy Point, Sandy Hook) including a soil analysis of selected areas. N-012-11. Gateway Institute for Natural Resource Sciences. Brooklyn, NY. 81pp.

149-156

## RUFFLE BAR, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 36' 00" N 73° 51' 30" W

ID#: 23

COUNTY: Kings

TOTAL ACREAGE: 150 acres  
(R. Cook, pers. comm.)

HABITAT FEATURES: (NWI, USGS topographic maps)

Emergent estuarine marsh  
Mudflat  
Upland

FLORA AND FAUNA SPECIES LISTS: (Cook 1989a&b)

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

U.S. Department of the Interior  
National Park Service  
Gateway National Recreation Area  
Floyd Bennett Field  
Brooklyn, NY 11234

REFERENCES:

Cook, R. 1989a. Mammals. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

Cook, R. 1989b. Reptiles and amphibians. U.S. Department of the Interior, Gateway National Recreation Area. Pamphlet.

AVAILABLE MAP INFORMATION:

<input type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Far Rockaway, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Far Rockaway, NY	

Compiled 1990

150157

## SPRING CREEK, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 38' 45" N 73° 52' 15" W ID#: 24  
COUNTY: Kings, Queens TOTAL ACREAGE: appx 130 acres of  
unprotected land\* (TPL&NYCAS 1987)

### HABITAT FEATURES: (TPL and NYCAS 1987)

Intertidal salt marsh  
Fresh water marsh

### FLORA AND FAUNA SPECIES LISTS: (Cook 1989a&b)

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

U.S. Department of the Interior      Also NYC and private ownership  
National Park Service  
Gateway National Recreation Area  
Floyd Bennett Field  
Brooklyn, NY 11234

### REFERENCES:

Cook, R. 1989a. Mammals. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet  
Cook, R. 1989b. Reptiles and amphibians. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.  
Trust for Public Land and New York City Audubon Society. 1987. Buffer the bay: a survey of Jamaica Bay's unprotected open shoreline and uplands.

### AVAILABLE MAP INFORMATION: (TPL and NYCAS 1987)

<input checked="" type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Jamaica, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Jamaica, NY	

\* Area south of the beltway is a protected part of Gateway National Recreation Area.  
Compiled 1990

454 158

# RULER'S BAR HASSECK, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 37' 30" N 73° 49' 30" W

ID#: 25

COUNTY: Kings, Queens

TOTAL ACREAGE: 600 acres  
(R. Cook, pers. comm.)

HABITAT FEATURES: (NWI, USGS topographic maps)

Estuarine emergent marsh  
Palustrine emergent marsh  
Tidal flats  
Upland, both open and wooded  
Ponds

FLORA AND FAUNA SPECIES LISTS: (Cook, 1989a&b, O'Connell 1980)

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

U.S. Department of the Interior  
National Park Service  
Gateway National Recreation Area  
Floyd Bennett Field  
Brooklyn, NY 11234

REFERENCES:

Cook, R. 1989a. Mammals. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

Cook, R. 1989b. Reptiles and amphibians. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

Please see following page for additional references.

AVAILABLE MAP INFORMATION:

<input type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Far Rockaway, NY Jamaica, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Far Rockaway, NY Jamaica, NY	

Compiled 1990

456 159

RULERS'S BAR HASSOCK, NY FACT SHEET (continued)

ID#: 25

REFERENCES (continued):

O'Connell, A. 1980. The relationship of mammals to the major vegetation communities in Gateway National Recreation Area (Jamaica Bay Wildlife Refuge, Breezy Point, Sandy Hook) including a soil analysis of selected areas. N-012-II. Gateway Institute for Natural Resource Sciences. Brooklyn, NY. 81pp.

753 160



# JOCO MARSH, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 37' 00" N 73° 46' 30" W

ID#: 26

COUNTY: Queens

TOTAL ACREAGE:

HABITAT FEATURES: (NWI topographic map)

Estuarine emergent marsh  
Tidal flat

FLORA AND FAUNA SPECIES LISTS: (Cook 1989a&b, O'Connell 1980)

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

U.S. Department of the Interior  
National Park Service  
Gateway National Recreation Area  
Floyd Bennett Field  
Brooklyn, NY 11234

REFERENCES:

Cook, R. 1989a. Mammals. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

Cook, R. 1989b. Reptiles and amphibians. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area.

Please see following page for additional references.

AVAILABLE MAP INFORMATION:

<input type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Far Rockaway, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Far Rockaway, NY	

Compiled 1990

154 | 6/

JOCO MARSH, NY FACT SHEET (continued)

ID#: 26

REFERENCES (continued):

O'Connell, A. 1980. The relationship of mammals to the major vegetation communities in Gateway National Recreation Area (Jamaica Bay Wildlife Refuge, Breezy Point, Sandy Hook) including a soil analysis of selected areas. N-012-11. Gateway Institute for Natural Resource Sciences. Brooklyn, NY. 81pp.

155162

## MOTT BASIN, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 36' 40" N 73° 45' 48" W

ID#: 27 A

COUNTY: Queens

TOTAL ACREAGE: 15 acres  
(TPL and NYCAS 1987)

HABITAT FEATURES: (NWI map, TPL and NYCAS 1987)

Beach  
Tidal flat  
Estuarine emergent marsh

### FLORA AND FAUNA SPECIES LISTS:

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input type="checkbox"/> Amphibians	<input type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

NYC and private ownership

### REFERENCES:

Trust for Public Land and New York City Audubon Society. 1987. Buffer the bay: a survey of Jamaica Bay's unprotected open shoreline and uplands.

### AVAILABLE MAP INFORMATION: (TPLand NYCAS 1987)

<input checked="" type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Far Rockaway, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Far Rockaway, NY	

Compiled 1990

156163

BAYSWATER PENINSULA, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 36' 47" N 73° 46' 08" W ID#: 27 B

COUNTY: Queens

TOTAL ACREAGE: 25 acres  
(TPL and NYCAS 1987)

HABITAT FEATURES: (NWI maps, TPL and NYCAS 1987)

Upland, open and wooded  
Tidal flat

FLORA AND FAUNA SPECIES LISTS:

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input type="checkbox"/> Amphibians	<input type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

NYC and private ownership

REFERENCES:

Trust for Public Land and New York City Audubon Society. 1987. Buffer the bay: a survey of Jamaica Bay's unprotected open shoreline and uplands.

AVAILABLE MAP INFORMATION: (TPL and NYCAS 1987)

<input checked="" type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Far Rockaway, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Far Rockaway, NY	

Compiled 1990

157/64

## NORTON BASIN, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 36' 00" N 73° 46' 08" W

ID#: 27 C

COUNTY: Queens

TOTAL ACREAGE: 25 acres when added  
to the southern basin (next page)\*

HABITAT FEATURES: (NWI map, TPL and NYCAS 1987)

Beach  
Tidal flat  
Estuarine emergent marsh

### FLORA AND FAUNA SPECIES LISTS:

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input type="checkbox"/> Amphibians	<input type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

NYC and private ownership

### REFERENCES:

Trust for Public Land and New York City Audubon Society. 1987. Buffer the bay: a survey of Jamaica Bay's unprotected open shoreline and uplands.\*

### AVAILABLE MAP INFORMATION: (TPL and NYCAS 1987)

<input checked="" type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Far Rockaway, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Far Rockaway, NY	

Compiled 1990

158165

SOUTHERN NORTON BASIN-CONCH'S BASIN, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 36' 48" N 73° 46' 50" W

ID#: 27 D

COUNTY: Queens

TOTAL ACREAGE: 25 acres when added  
to the northern basin (preceeding page)\*

HABITAT FEATURES: (NWI map, TPL and NYCAS 1987)

Estuarine emergent marsh

FLORA AND FAUNA SPECIES LISTS:

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input type="checkbox"/> Amphibians	<input type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

NYC and private ownership

REFERENCES:

Trust for Public Land and New York City Audubon Society. 1987. Buffer the bay: a survey of Jamaica Bay's unprotected open shoreline and uplands.\*

AVAILABLE MAP INFORMATION: (TPL and NYCAS 1987)

<input checked="" type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Far Rockaway, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Far Rockaway, NY	

Compiled 1990

159/66

## EDGEMERE LANDFILL/PARK, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 36' 15" N 73° 46' 47" W ID#: 27 E

COUNTY: Queens

TOTAL ACREAGE: 200 acres  
(TPL and NYCAS 1987)

### HABITAT FEATURES: (NWI maps)

Upland  
Estuarine emergent marsh  
Tidal flat

### FLORA AND FAUNA SPECIES LISTS:

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input type="checkbox"/> Amphibians	<input type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

NYC and private ownership

### REFERENCES:

Trust for Public Land and New York City Audubon Society. 1987. Buffer the bay: a survey of Jamaica Bay's unprotected open shoreline and uplands.

### AVAILABLE MAP INFORMATION: (TPL and NYCAS 1987)

<input checked="" type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Far Rockaway, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Far Rockaway, NY	

Compiled 1990

160167

## SOMMERVILLE BASIN, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 35' 45" N 73° 47' 30" W ID#: 27 F

COUNTY: Queens

TOTAL ACREAGE: 20 acres  
(TPL and NYCAS 1987)

HABITAT FEATURES: (NWI map, TPL and NYCAS 1987)

Upland  
Emergent estuarine marsh  
Estuarine scrub/shrub

### FLORA AND FAUNA SPECIES LISTS:

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input type="checkbox"/> Amphibians	<input type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

NYC and private ownership

### REFERENCES:

Trust for Public Land and New York City Audubon Society. 1987. Buffer the bay: a survey of Jamaica Bay's unprotected open shoreline and uplands.

### AVAILABLE MAP INFORMATION: (TPL and NYCAS 1987)

<input checked="" type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Far Rockaway, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Far Rockaway, NY	

Compiled 1990

tot 168



## DUBOS POINT, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 36' 15" N 73° 47' 15" W ID#: 27 G

COUNTY: Queens

TOTAL ACREAGE: 25 acres  
(TPL and NYCAS 1987)

HABITAT FEATURES: (NWI map, USGS topographic maps)

Tidal flat  
Emergent estuarine marsh  
Upland, open and wooded

### FLORA AND FAUNA SPECIES LISTS:

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input type="checkbox"/> Amphibians	<input type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

NYC and private ownership

### REFERENCES:

Trust for Public Land and New York City Audubon Society. 1987. Buffer the bay: a survey of Jamaica Bay's unprotected open shoreline and uplands.

### AVAILABLE MAP INFORMATION: (TPL and NYCAS 1987)

<input checked="" type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Far Rockaway, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Far Rockaway, NY	

Compiled 1990

162/169

## BRANT POINT, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 35' 56" N 73° 48' 13" W

ID#: 27 H

COUNTY: Queens

TOTAL ACREAGE: 10 acres  
(TPL and NYCAS 1987)

HABITAT FEATURES: (NWI map, TPL and NYCAS 1987)

Tidal flat  
Emergent estuarine marsh

### FLORA AND FAUNA SPECIES LISTS:

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input type="checkbox"/> Amphibians	<input type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

NYC and private ownership

### REFERENCES:

Trust for Public Land and New York City Audubon Society. 1987. Buffer the bay: a survey of Jamaica Bay's unprotected open shoreline and uplands.

### AVAILABLE MAP INFORMATION: (TPL and NYCAS 1987)

<input checked="" type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Far Rockaway, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Far Rockaway, NY	

Compiled 1990

165/70

VERNAM/BARBADOES PENINSULA, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 35' 45" N 73° 48' 26" W ID#: 27 I

COUNTY: Queens

TOTAL ACREAGE: 12 acres  
(TPL and NYCAS 1987)

HABITAT FEATURES: (NWI maps, TPL and NYCAS 1987)

Beach dune  
Upland

FLORA AND FAUNA SPECIES LISTS:

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input type="checkbox"/> Amphibians	<input type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

NYC and private ownership

REFERENCES:

Trust for Public Land and New York City Audubon Society. 1987. Buffer the bay: a survey of Jamaica Bay's unprotected open shoreline and uplands.

AVAILABLE MAP INFORMATION: (TPL and NYCAS 1987)

<input checked="" type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Far Rockaway, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Far Rockaway, NY	

Compiled 1990

154172

BEACH TO BAY LINK (SOMMERVILLE BASIN TO ATLANTIC OCEAN) NY  
FACT SHEET

LATITUDE AND LONGITUDE: 40° 35' 30" N 73° 47' 32" W ID#: 27 J

COUNTY: Queens

TOTAL ACREAGE: 250 ft wide  
(TPL and NYCAS 1987)

HABITAT FEATURES:

FLORA AND FAUNA SPECIES LISTS:

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input type="checkbox"/> Amphibians	<input type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

NYC and private ownership

REFERENCES:

Trust for Public Land and New York City Audubon Society. 1987. Buffer the bay: a survey of Jamaica Bay's unprotected open shoreline and uplands.

AVAILABLE MAP INFORMATION: (TPL and NYCAS 1987)

<input checked="" type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input checked="" type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Far Rockaway, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Far Rockaway, NY	

Compiled 1990

165 173

# SUBWAY ISLAND, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 36' 05" N 73° 48' 45" W

ID#: 28

COUNTY: Queens

TOTAL ACREAGE:

HABITAT FEATURES: (NWI map)

Palustrine emergent marsh  
Estuarine emergent marsh  
Tidal flat

FLORA AND FAUNA SPECIES LISTS: (Cook 1989a&b)

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

U.S. Department of the Interior  
National Park Service  
Gateway National Recreation Area  
Floyd Bennett Field  
Brooklyn, NY 11234

REFERENCES:

Cook, R. 1989a. Mammals. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet

Cook, R. 1989b. Reptiles and amphibians. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

AVAILABLE MAP INFORMATION:

<input type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Far Rockaway, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Far Rockaway, NY	

Compiled 1990

166174

# LITTLE EGG ISLAND, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 35' 37" N 73° 50' 33" W ID#: 29

COUNTY: Queens

TOTAL ACREAGE:

## HABITAT FEATURES: (NWI map)

Estuarine emergent marsh  
Upland  
Tidal flat

## FLORA AND FAUNA SPECIES LISTS: (Cook 1989a&b)

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

## MANAGEMENT AUTHORITY:

U.S. Department of the Interior  
National Park Service  
Gateway National Recreation Area  
Floyd Bennett Field  
Brooklyn, NY 11234

## REFERENCES:

Cook, R. 1989a. Mammals. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

Cook, R. 1989b. Reptiles and amphibians. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

## AVAILABLE MAP INFORMATION:

<input type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Far Rockaway, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Far Rockaway, NY	

Compiled 1990

117/75

## FORT TILDEN, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 33' 38" N 73° 53' 30" W

ID#: 30

COUNTY: Queens

TOTAL ACREAGE: 31.1 acres  
(R. Cook, pers. comm.)

HABITAT FEATURES: (NPS 1988)

Dunes  
Grassland  
Scrub/shrub  
Woodland  
Wetland - Phragmites and scrub/shrub

FLORA AND FAUNA SPECIES LISTS: (Cook 1989a&b, O'Connell 1980)

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

U.S. Department of the Interior  
National Park Service  
Gateway National Recreation Area  
Floyd Bennett Field  
Brooklyn, NY 11234

REFERENCES:

Cook, R. 1989a. Mammals. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

Cook, R. 1989. Reptiles and amphibians. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

Please see following page for additional references.

AVAILABLE MAP INFORMATION:

<input type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Coney Island, NY Far Rockaway, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Coney Island, NY Far Rockaway, NY	

Compiled 1990

468 176

FORT TILDEN, NY FACT SHEET (continued)

ID#: 30

REFERENCES (continued):

National Park Service. 1988. Development concept plan/environmental assessment: Jacob Riis Park/Fort Tilden Breezy Point District, Gateway National Recreation Area, NY - draft. U.S. Department of the Interior. 167pp.

O'Connell, A. 1980. The relationship of mammals to the major vegetation communities in Gateway National Recreation Area (Jamaica Bay Wildlife Refuge, Breezy Point, Sandy Hook) including a soil analysis of selected areas. N-012-II. Gateway Institute for Natural Resource Sciences. Brooklyn, NY. 81pp.

169/77



## BREEZY POINT TIP, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 32' 52" N 73° 56' 00" W ID#: 31

COUNTY: Queens

TOTAL ACREAGE: 200 acres  
(R. Cook, pers. comm.)

HABITAT FEATURES: (NWI map, O'Connell 1980)

- Beach
- Beachgrass dune
- Palustrine emergent marsh
- Palustrine scrub/shrub
- Mixed grassland

FLORA AND FAUNA SPECIES LISTS: (Cook 1989a&b, O'Connell 1980)

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

U.S. Department of the Interior  
National Park Service  
Gateway National Recreation Area  
Floyd Bennett Field  
Brooklyn, NY 11234

REFERENCES:

Cook, R. 1989a. Mammals. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

Cook, R. 1989b. Reptiles and amphibians. U.S. Department of the Interior, National Park Service, Gateway National Recreation Area. Pamphlet.

Please see the following page for additional references.

AVAILABLE MAP INFORMATION:

<input type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Coney Island, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Coney Island, NY	

Compiled 1990

176 | 78

BREEZY POINT TIP, NY FACT SHEET (continued)

ID#: 22

REFERENCES (continued):

O'Connell, A. 1980. The relationship of mammals to the major vegetation communities in Gateway National Recreation Area (Jamaica Bay Wildlife Refuge, Breezy Point, Sandy Hook) including a soil analysis of selected areas. N-012-11. Gateway Institute for Natural Resource Sciences. Brooklyn, NY. 81pp.

17+179

## FOREST PARK, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 42' 15" N 73° 51' 00" W

ID#: 32

COUNTY: Queens

TOTAL ACREAGE: 538 acres

### HABITAT FEATURES:

Closed forest	266.47 acres
Desert	31.83 acres
Herbaceous	87.51 acres
Scrub	3.81 acres
Vineland	7.61 acres
Woodland	144.21 acres
Aquatic plant	0.24 acres

### FLORA AND FAUNA SPECIES LISTS:

<input checked="" type="checkbox"/> Plants	<input checked="" type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

NYC Department of Parks and Recreation  
135<sup>th</sup> Avenue  
New York, New York 10021

### REFERENCES:

New York City Department of Parks and Recreation, Natural Resources Group. 1990.  
Natural areas management plan: Forest Park, Queens.

### AVAILABLE MAP INFORMATION:

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input checked="" type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input checked="" type="checkbox"/> Active management	<input checked="" type="checkbox"/> Proposed management	<input checked="" type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Jamaica, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Jamaica, NY	

Compiled 1990

172/80

## KISSENA PARK, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 44' 45" N 73° 48' 30" W

ID#: 33

COUNTY: Queens

TOTAL ACREAGE: 282 acres

### HABITAT FEATURES:

Closed forest	35.29 acres
Desert	10.95 acres
Herbaceous	182.49 acres
Scrub	1.53 acres
Vineland	0.62 acres
Woodland	42.57 acres
Aquatic plant	8.57 acres

### FLORA AND FAUNA SPECIES LISTS:

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

NYC Department of Parks and Recreation  
135<sup>th</sup> Avenue  
New York, New York 10021

### REFERENCES:

New York City Department of Parks and Recreation, Natural Resources Group. 1988.  
Natural areas management plan: Kissena Park, Queens.

### AVAILABLE MAP INFORMATION:

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input checked="" type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input checked="" type="checkbox"/> Active management	<input checked="" type="checkbox"/> Proposed management	<input checked="" type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Jamaica, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Jamaica, NY	

Compiled 1990

198/81

## CUNNINGHAM PARK, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 44' 00" N 73° 46' 15" W

ID#: 34

COUNTY: Queens

TOTAL ACREAGE: 358 acres

### HABITAT FEATURES:

Closed forest	158.78 acres
Desert	19.71 acres
Herbaceous	73.95 acres
Scrub	11.66 acres
Vineland	8.84 acres
Woodland	129.04 acres

### FLORA AND FAUNA SPECIES LISTS:

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

NYC Department of Parks and Recreation  
135<sup>th</sup> Avenue  
New York, New York 10021

### REFERENCES:

New York City Department of Parks and Recreation, Natural Resources Group. 1990.  
Natural areas management plan: Cunningham Park, Queens.

### AVAILABLE MAP INFORMATION:

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input checked="" type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input checked="" type="checkbox"/> Active management	<input checked="" type="checkbox"/> Proposed management	<input checked="" type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Jamaica, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Jamaica, NY	

Compiled 1990

174182

# ALLEY POND PARK, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 45' 30" N 73° 44' 45" W

ID#: 35

COUNTY: Queens

TOTAL ACREAGE: 635 acres

## HABITAT FEATURES:

Closed forest	212.76 acres
Desert	35.87 acres
Herbaceous	199.37 acres
Scrub	6.31 acres
Vineland	38.45 acres
Woodland	61.12 acres
Intertidal	38.44 acres
Aquatic plant	3.12 acres

## FLORA AND FAUNA SPECIES LISTS:

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input checked="" type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

## MANAGEMENT AUTHORITY:

NYC Department of Parks and Recreation  
135<sup>th</sup> Avenue  
New York, New York 10021

## REFERENCES:

New York City Department of Parks and Recreation, Natural Resources Group. 1988.  
Natural areas management plan: Alley Pond Park, Queens.

## AVAILABLE MAP INFORMATION:

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input checked="" type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input checked="" type="checkbox"/> Active management	<input checked="" type="checkbox"/> Proposed management	<input checked="" type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Flushing, NY Sea Cliff, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Sea Cliff, NY	

Compiled 1990

175183

# UDALL'S COVE AND RAVINE, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 46' 45" N 40° 44' 45" W

ID#: 36

COUNTY: Queens and Nassau

TOTAL ACREAGE: 50 acres

## HABITAT FEATURES:

Closed forest	11.63 acres
Desert	0.72 acres
Herbaceous	16.01 acres
Scrub	0.54 acres
Vineland	8.08 acres
Woodland	2.46 acres
Aquatic plant	0.47 acres

## FLORA AND FAUNA SPECIES LISTS:

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input checked="" type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

## MANAGEMENT AUTHORITY:

NYC Department of Parks and Recreation  
135<sup>th</sup> Avenue  
New York, New York 10021

## REFERENCES:

New York City Department of Parks and Recreation, Natural Resources Group. 1990.  
Natural areas management plan: Udall's Cove and Ravine, Queens.

## AVAILABLE MAP INFORMATION:

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input checked="" type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input checked="" type="checkbox"/> Active management	<input checked="" type="checkbox"/> Proposed management	<input checked="" type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Sea Cliff, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Sea Cliff, NY	

Compiled 1990

176184

PELHAM BAY PARK, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 52' 30" N 73° 48' 30" W

ID#: 37

COUNTY: Queens

TOTAL ACREAGE: 2,764 acres  
(660 acres underwater)

HABITAT FEATURES:

Salt marsh	195 acres
Fresh water marsh	3 acres
Salt flats	161 acres
Forest	782 acres
Meadow	83 acres

FLORA AND FAUNA SPECIES LISTS:

<input checked="" type="checkbox"/> Plants	<input checked="" type="checkbox"/> Assorted insects	<input checked="" type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

MANAGEMENT AUTHORITY:

NYC Department of Parks and Recreation  
135<sup>th</sup> Avenue  
New York, New York 10021

REFERENCES:

New York City Department of Parks and Recreation, Natural Resources Group. 1988.  
Natural areas management plan: Pelham Bay Park, Queens.

AVAILABLE MAP INFORMATION:

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input checked="" type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input checked="" type="checkbox"/> Active management	<input checked="" type="checkbox"/> Proposed management	<input checked="" type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Flushing, NY Mt. Vernon, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Mt. Vernon, NY	

Compiled 1990

177/85



# VAN CORTLANDT PARK, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 54' 00" N 73° 53' 00" W

ID#: 38

COUNTY: Bronx

TOTAL ACREAGE: 1,146 acres

## HABITAT FEATURES:

Closed forest	397.15 acres
Desert	24.07 acres
Herbaceous	308.23 acres
Scrub	14.15 acres
Vineland	40.52 acres
Woodland	283.59 acres
Aquatic plant	25.06 acres

## FLORA AND FAUNA SPECIES LISTS:

<input checked="" type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

## MANAGEMENT AUTHORITY:

NYC Department of Parks and Recreation  
135<sup>th</sup> Avenue  
New York, New York 10021

## REFERENCES:

New York City Department of Parks and Recreation, Natural Resources Group. 1990.  
Natural areas management plan: Van Cortlandt Park, The Bronx.

## AVAILABLE MAP INFORMATION:

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input checked="" type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input checked="" type="checkbox"/> Active management	<input checked="" type="checkbox"/> Proposed management	<input checked="" type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Mt. Vernon, NY Yonkers, NY-NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Mt. Vernon, NY Yonkers, NY-NJ	

Compiled 1990

178/86

## RIVERDALE PARK, NY FACT SHEET

LATITUDE AND LONGITUDE: 40° 53' 45" N 73° 55' 00" W

ID#: 39

COUNTY: Bronx

TOTAL ACREAGE: 97 acres (66 acres mapped, 40 acres under water)

### HABITAT FEATURES:

Closed forest	21.55 acres
Desert	7.25 acres
Herbaceous	13.43 acres
Scrub	0.11 acres
Vineland	13.06 acres
Woodland	10.65 acres

### FLORA AND FAUNA SPECIES LISTS:

<input checked="" type="checkbox"/> Plants	<input checked="" type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input checked="" type="checkbox"/> Amphibians	<input checked="" type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input checked="" type="checkbox"/> Mammals	

### MANAGEMENT AUTHORITY:

NYC Department of Parks and Recreation  
135<sup>th</sup> Avenue  
New York, New York 10021

### REFERENCES:

New York City Department of Parks and Recreation, Natural Resources Group. 1990.  
Natural areas management plan: Riverdale Park, The Bronx.

### AVAILABLE MAP INFORMATION:

<input checked="" type="checkbox"/> Location/boundaries	<input checked="" type="checkbox"/> Vegetation	<input checked="" type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input checked="" type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input checked="" type="checkbox"/> Active management	<input checked="" type="checkbox"/> Proposed management	<input checked="" type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Yonkers, NY-NJ	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Yonkers, NY-NJ	

Compiled 1990

179187

# HASTINGS-ON-HUDSON, NY FACT SHEET

LATITUDE AND LONGITUDE: 39° 59' 45" N 73° 52' 00" W

ID#: 40

COUNTY: Westchester

TOTAL ACREAGE: 45 acre study site

## HABITAT FEATURES:

Woodland  
Thicket  
Old Field  
Swamp  
Ponds

## FLORA AND FAUNA SPECIES LISTS:

<input type="checkbox"/> Plants	<input type="checkbox"/> Assorted insects	<input type="checkbox"/> Invertebrates
<input type="checkbox"/> Fishes	<input type="checkbox"/> Amphibians	<input type="checkbox"/> Reptiles
<input checked="" type="checkbox"/> Birds	<input type="checkbox"/> Mammals	

## MANAGEMENT AUTHORITY:

Private  
Town

## REFERENCES:

McIntyre, D. 1983. A year-round census. The Kingbird 33(4):232- 243.

## AVAILABLE MAP INFORMATION:

<input type="checkbox"/> Location/boundaries	<input type="checkbox"/> Vegetation	<input type="checkbox"/> Land use
<input type="checkbox"/> Water resources	<input type="checkbox"/> Soil conditions	<input type="checkbox"/> Ownership
<input type="checkbox"/> Active management	<input type="checkbox"/> Proposed management	<input type="checkbox"/> Wildlife habitat evaluation
<input checked="" type="checkbox"/> USGS Topographic quadrangles Mount Vernon, NY	<input checked="" type="checkbox"/> National Wetlands Inventory quadrangles Mount Vernon, NY	

Compiled 1990

180 188

SITE NAME FACT SHEET

LATITUDE AND LONGITUDE:  
BER:

IDENTIFICATION NUM-

COUNTY:

TOTAL ACREAGE:

HABITAT FEATURES:

FLORA AND FAUNA SPECIES LISTS:

- |                                 |   |  |
|---------------------------------|---|--|
| <input type="checkbox"/> Plants | <input type="checkbox"/> Assorted insects | <input type="checkbox"/> Invertebrates |
| <input type="checkbox"/> Fishes | <input type="checkbox"/> Amphibians       | <input type="checkbox"/> Reptiles      |
| <input type="checkbox"/> Birds  | <input type="checkbox"/> Mammals          |  |

MANAGEMENT AUTHORITY:

REFERENCES:

AVAILABLE MAP INFORMATION:

- |  |  |
|--|--|
| <input type="checkbox"/> Location/boundaries             | <input type="checkbox"/> Vegetation <input type="checkbox"/> Land use                  |
| <input type="checkbox"/> Water resources                 | <input type="checkbox"/> Soil conditions <input type="checkbox"/> Ownership            |
| <input type="checkbox"/> Active management<br>evaluation | <input type="checkbox"/> Proposed management <input type="checkbox"/> Wildlife habitat |
| <input type="checkbox"/> USGS Topographic quadrangles    | <input type="checkbox"/> National Wetlands Inventory quadrangles                       |

181 189

APPENDIX C

Species Matrix for  
Birds, Mammals, Amphibians and Reptiles  
for Natural Areas within the Vicinity of  
the New York/ New Jersey Harbor Estuary

Compiled by

Christina Kalafus-Kaucinger and Robert Craig

Department of Natural Resources Management and Engineering  
The University of Connecticut

182/90

Table 1. Seasonal occurrence of birds at natural areas in the New York-New Jersey Harbor region.

Species:	Season:	New Jersey Sites																	
		SR	SH				CH				HM				LP				
			S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	
Red-throated Loon			u					r			u		u			x		x	x
Common Loon			c								u	u	u	u		x		x	x
Pied-billed Grebe			u				u	u	u	u	c	c*	c	u		x		x	x
Horned Grebe			c						u		u		u	u		x		x	x
Red-necked Grebe			u										r?			x		x	x
Eared Grebe																a		a	a
Northern Gannet			c																
Great Cormorant			c													x		x	x
Double-crested Cormorant			c								u	u	u	u		x	x	x	x
American Bittern			r				u	u	u	u	c	u*	c	u		x	x	x	
Least Bittern			r	r	*1				r		c	c*	u	r		x	x	x	
Great Blue Heron		x	c	u*			u	u	u	u	c	u	c	u		x	x	x	x
Great Egret		x	c	x			u	u	u	u	c	c	c			x	x	x	
Snowy Egret		x	c	x			u				c	c	c			x	x	x	
Little Blue Heron		x	u						r		c	u	c			x	x	x	
Tricolored Heron			c					r	r		u	u	u			x	x	x	
Cattle Egret			r					r	r		c	c	c			x	x	x	
Green-backed Heron		x	c	u*			u	c	u		c	c*	c			x	x	x	
Black-crowned Night Heron		x	c	u	*1		u	u	u	u	c	c*	c	u		x	x	x	x
Yellow-crowned Night Heron			u								r	r*	r						
Fulvous Whistling-Duck											a	a	a	a					
White Ibis												a?							
Glossy Ibis			r	r				r	r		c	c	c			x	x	x	
Tundra Swan											u			u					
Mute Swan			r								c	c*	c	u		x		x	x
Snow Goose			r								u			u		x	x	x	x

# New Jersey Sites

Species:	Season:	SR	SII				CII				HM				LP			
			S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Brant			c	r							u	u			x	x	x	
Canada Goose		x	c				u	u	u	u	c	c*	c	c	x	x	x	x
Wood Duck		x	u				u	u	u		c	c*	u		x		x	
Green-winged Teal		x					r				c	u*	c	u	x	x	x	x
American Black Duck		x	c	u*			u	u	u	u	c	c*	c	c	x	x	x	x
Mallard		x	c	u*			u	u	u	u	c	c*	c	c	x	x	x	x
Northern Pintail			r				u				c		c	c	x		x	x
Blue-winged Teal		x	u				r				c	u*	c	r	x	x	x	x
Northern Shoveler			c						r		c		c	c	x	x	x	x
Gadwall									u		c	c*	c	u	x	x	x	x
Eurasian Wigeon															a?			
American Wigeon			c						r		c		c	u	x		x	x
Canvasback			u				u		u	u	c		u	c	x		x	x
Redhead									r		u		u	u	x		x	x
Ring-necked Duck			r								c		u		x		x	x
Greater Scaup			c						u	u	u		u	u	x		x	x
Lesser Scaup			u								c		u	c	x		x	x
King Eider			r												x		x	x
Harlequin Duck			r															
Oldsquaw			c								r		r	r	x		x	x
Black Scoter			c												x		x	x
Surf Scoter			u								r		r	r	x		x	x
White-winged Scoter			u								r		r	r	x		x	x
Common Goldeneye			c						r		u		u	u	x		x	x
Bufflehead			c						u		u		u	u	x		x	x
Hooded Merganser			u						u		c		u	u	x		x	x
Common Merganser											u		r	r	x		x	x

104/92

New Jersey Sites

Species:	Season:	SR	SH				CH				HM				LP			
			S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Red-breasted Merganser			c	r							u		r	u	x		x	x
Ruddy Duck										u	c	c*	c	u	x	x	x	x
Black Vulture				r														
Turkey Vulture		x	c				u	u	u	u	u	u	u	u			r?	
Osprey		x	c	r*					x?		r		r		x	x	x	
Bald Eagle			r				r	r	r	r	r		r					
Northern Harrier			c				u	u	u	u	c	u*	c	c	x	x	x	x
Sharp-shinned Hawk		x	c				u		u	u	r		r	r	x		x	x
Cooper's Hawk			c							r	r		r	r	x		x	x
Northern Goshawk													r				r?	
Red-shouldered Hawk			c								r		r					
Broad-winged Hawk		x	c				u	r	u		r		r		x		x	
Red-tailed Hawk		x	c				u	u	u	u	u		u	c	x		x	
Rough-legged Hawk										r	u			c	x		x	x
Golden Eagle										x?								
American Kestrel		x	c	r*			u	u	u	u	c	c*	c	c	x	x	x	x
Merlin			c								u		u	u				
Peregrine Falcon			u						r		r		r	r	x	x	x	x
Ring-necked Pheasant			r				r	r	r	r	c	c*	c	c	x	x	x	x
Ruffed Grouse							u	u	u	u			r?					
Bobwhite		x	c	u*			u	u	u	u								
Yellow Rail											r		r	r				
Clapper Rail		x	c	u*			u	u	u	u	u	u*	u	u	x	x	x	x
King Rail			u								u	u	u	u				
Virginia Rail			r							r	u		u	u	x	x	x	x
Sora		x	u								u		u					
Common Moorhen											c	c*	c	u	x	x	x	



New Jersey Sites

Species:	Season:	SR	SH				CH				HM				LP			
			S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
American Coot			u								c	c*	c	c	x		x	x
Black-bellied Plover			c								c		c		x		x	
Lesser Golden-Plover											r		u					
Semipalmated Plover		x	c				u	u	r	r	u	c	c		x		x	
Piping Plover			c	r*											x	x	x	
Killdeer		x	c	u*			u	u	u	u	c	c*	c	u	x	x	x	x
American Oystercatcher			c															
Black-necked Stilt											r		r					
American Avocet												r	r					
Greater Yellowlegs		x	c				u	u	u		c	c	c	u	x	x	x	
Lesser Yellowlegs			c								c	c	c	u	x	x	x	x
Solitary Sandpiper			c								c	c	c		x		x	
Willet			c								r		r		x		x	x
Spotted Sandpiper		x	c	x			u	u			c	c*	c		x	x	x	
Upland Sandpiper													u					
Whimbrel											r	r	r					
Hudsonian Godwit													r					
Marbled Godwit													r					
Ruddy Turnstone			c								r		u		x		x	
Red Knot			u								r		r		x	x	x	x
Sanderling			c									r	r		x		x	x
Semipalmated Sandpiper			c				r	r			u	c	c					
Western Sandpiper													u	u				
Least Sandpiper			c				u	u			c	c	c		x		x	x
White-rumped Sandpiper											u	u	u		x		x	
Baird's Sandpiper													r					
Pectoral Sandpiper			r								u	u	u		x		x	

186/194

New Jersey Sites

Species:	Season:	SR	SH				CH				HM				LP			
			S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Purple Sandpiper															x		x	x
Dunlin			c								c		c	u	x		x	x
Curlew Sandpiper													r					
Stilt Sandpiper													c	c				
Buff-breasted Sandpiper													u	u	u			
Ruff													r	r			r?	
Short-billed Dowitcher			c										u	c	u	x		x
Long-billed Dowitcher													u	u	u	x		x
Common Snipe			u	r									c		c	x		x x
American Woodcock			c	c*			u		u	r			c	u*	c	x	x	x
Wilson's Phalarope													u	u	u			
Red-necked Phalarope														u	u			
Red Phalarope														r	r			
Laughing Gull		x	c	c			c	c	c	r			u	c	c	x	x	x
Franklin's Gull														a?				
Little Gull			r													x		x x
Common Black-headed Gull			r										r		r r	x		x x
Bonaparte's Gull			c						r	r r			u		u u	x		x x
Ring-billed Gull		x	c				c	c	c	c			c	c	c c	x	x	x x
Herring Gull		x	c	u*			c	c	c	c			c	c	c c	x	x	x x
Thayer's Gull														a?				
Iceland Gull			u										r		r			
Lesser Black-backed Gull													r	r r	r r		r?	
Glaucous Gull			c										r		r	x	x	x x
Great Black-backed Gull		x	c	c			u	u	u	u			c	c	c c			
Ivory Gull																	a?	
Gull-billed Tern			r										r	r r	r			

187/95

# New Jersey Sites

Species:	Season:	SR	SII				CII				HM				LP			
			S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Caspian Tern											r	r	r		x	x	x	
Royal Tern			r								r	r						
Roscate Tern				r								r						
Common Tern		x	c	c*			u	u	u		c	u	u		x	x	x	
Forster's Tern			u								u	u	u		x	x	x	
Least Tern			c	c*			x?				c	c	c		x	x	x	
Black Tern			u								u	u	u					
Black Skimmer			c	u*			r				u	u	u		x	x	x	
Rock Dove			c	x*			u	u	u	u	c	c*	c	c	x	x	x	x
Mourning Dove		x	c	u*			c	c	c	c	c	c*	c	c	x	x	x	x
Black-billed Cuckoo		x	r				u	u	u		u		u					
Yellow-billed Cuckoo		x	c	u*			u	u	u		u	r*	u		x		x	
Common Barn-Owl				r *			x?				u	u*	u	u	x	x	x	x
Eastern Screech-Owl							r	r	r	r	r	r*	u	u				
Great Horned Owl			c	r*			u	u	u	u			r					
Snowy Owl													r				r?	
Long-eared Owl													u	u	x	x	x	x
Short-eared Owl			r								u		u	u	x	x	x	x
Northern Saw-whet Owl										u								
Common Nighthawk			c	r *			u	u	u		u	u*	u		x	x	x	
Chuck-will's-widow			r									r?						
Whip-poor-will			c	u*			u	u	u									
Chimney Swift		x	c	u*			u				u		u		x	x	x	
Ruby-throated Hummingbird			c				u	u	u				u		x	x	x	
Belted Kingfisher		x	c				u	u	u	u	u	u*	u	r	x	x	x	x
Red-headed Woodpecker				r							u		u	u				
Red-bellied Woodpecker			u				x?											

188, 196

New Jersey Sites

Species:	Season:	SR	SH				CH				HM				LP			
			S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Yellow-bellied Sapsucker							u		u		u		u					
Downy Woodpecker		x	c				c	c	c	c	c	c*	c	c	x	x	x	x
Hairy Woodpecker		x	u				u	u	u	u	u	u*	u	u				
Northern Flicker		x	c	r*			c	c	c	u	c	u*	c	u	x		x	
Eastern-Wood Pewee			c				u	u	u		r		u					
Yellow-bellied Flycatcher											r		r					
Acadian Flycatcher			r												x		x	
Alder Flycatcher									u									
Willow Flycatcher			r				u	r	r		u	u*	u		x	x	x	
Least Flycatcher		x	c						u		u		u					
Eastern Phoebe		x	c				u		u		u	u*	u		x	x	x	x
Great Crested Flycatcher			c				u	u	u		u		u					
Western Kingbird													r					
Eastern Kingbird		x	c	u*			u	u	u		c	u	c		x	x	x	x
Horned Lark			u								c	u*	u	u	x	x	x	x
Purple Martin			c	r			u		u		r		r					
Tree Swallow		x	c				c	c	c	u	c	c	c		x	x	x	x
Northern Rough-winged Swallow			c								u	u*	u		x		x	
Bank Swallow		x	c				u	u	u		u		u		x		x	
Cliff Swallow			c								r		r					
Barn Swallow		x	c	u*			c	c	c		c	c*	c		x	x	x	x
Blue Jay		x	c	u*			c	c	c	c	c	c	c	u	x	x	x	x
American Crow		x	c	u*			c	c	c	c	c	c*	c	c	x	x	x	x
Fish Crow		x	c	u*			u	u	u	u	c	c*	c	u	x	x	x	x
Black-capped Chickadee			c	u*			u	u	u	c	c		c	u	x	x	x	x
Carolina Chickadee		x	r	r			u	u	u	u								
Boreal Chickadee															x	x	x	x

189/97

# New Jersey Sites

Species:	Season:	SR	SH				CH				HM				LP			
			S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Tufted Titmouse		x	r				u	u	u	c	u		u	u	x	x	x	x
Red-breasted Nuthatch		x	c				u		u	r	u		u	u	x	x	x	x
White-breasted Nuthatch		x	r				u	u	u	u	u	r*	u	u				
Brown Creeper		x	u				u		u	u	u		u		x		x	x
Carolina Wren		x	e	x	*	1			r	r	u		u					
House Wren		x	c	c	*		c	c	c		u	u	*	u	x	x	x	
Winter Wren									r		u		u	u				
Sedge Wren													r					
Marsh Wren		x	c				c	c	c	u	c	c	*	c	u			
Golden-crowned Kinglet		x	u						u	r	u		c		x		x	x
Ruby-crowned Kinglet		x	c				u		u	u	c		c		x		x	
Blue-gray Gnatcatcher		x	c				u	u	u		u		u					
Eastern Bluebird			u				r	r	r	r								
Veery		x	c				u		u		u		u					
Gray-checked Thrush		x	c						x?		r		r					
Swainson's Thrush			c				u		u		u		u		x		x	
Hermit Thrush		x	c				r		r	r	u		u		x		x	
Wood Thrush		x	c				u		u		u		u					
American Robin		x	c	u	*		c	c	c	u	c	c	*	c	x	x	x	x
Gray Catbird		x	c	c	*		c	c	c	c	u	r	*	u	x	x	x	
Northern Mockingbird		x	c	u	*		c	c	c	c	c	c	*	c	x	x	x	x
Brown Thrasher		x	c	c	*		c	c	c	u	c	c	*	c	x	x	x	
Water Pipit			r								u		u	u	x		x	x
Cedar Waxwing		x	c	u	*		u	u	u	u	c		c	u	x		x	
Loggerhead Shrike													r		x		x	x
European Starling		x	c	x	*		c	c	c	c	c	c	*	c	x	x	x	x
White-eyed Vireo		x	c	c	*		u	u	u		u		u					

110/198

New Jersey Sites

Species:	Season:	SR	SH				CH				HM				LP			
			S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Solitary Vireo			c								u	r*	u					
Yellow-throated Vireo		x	u								r							
Warbling Vireo			u								u		u					
Philadelphia Vireo									r									
Red-eyed Vireo		x	c	c*					u		c	c*	c		x		x	
Blue-winged Warbler		x	c				u		u		u		u					
Golden-winged Warbler							r											
Tennessee Warbler			u						u		u		u		x		x	
Orange-crowned Warbler			c						r				u					
Nashville Warbler			c						u		u		u					
Northern Parula		x	c				u		u		u		u		x		x	
Yellow Warbler		x	c				u	u	u	u	u	u*	u		x		x	
Chestnut-sided Warbler		x	c				u		u		u		u					
Magnolia Warbler		x	c				u		u	u	u		u					
Cape May Warbler		x	c						u		u		u		x		x	
Black-throated Blue Warbler		x	c				u		u	u	u		u					
Yellow-rumped Warbler		x	c				u		c	u	c		c	u	x		x	
Black-throated Green Warbler		x	c				u		u		u		u					
Blackburnian Warbler		x	c				u		u		u		u					
Yellow-throated Warbler																		
Pine Warbler		x	r						u						x		x	
Prairie Warbler		x	c						u		u	r	u		x		x	
Palm Warbler		x	u				u		u		u		u		x		x	
Bay-breasted Warbler		x	c				u		u		u		u					
Blackpoll Warbler		x	c				u		u		c		c					
Cerulean Warbler			c															
Black-and-white Warbler		x	c				u		u		c		u		x		x	

191199

New Jersey Sites

Species:	Season:	SR	SII				CII				HM				LP			
			S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
American Redstart		x	c	c*			u	u	u		c	u	c		x		x	
Worm-eating Warbler		x					r											
Ovenbird		x	c				u	u	u		c		c					
Northern Waterthrush		x	c				u		u		u		u					
Louisiana Waterthrush											u		u					
Connecticut Warbler									r		r		r					
Mourning Warbler			r						r									
Common Yellowthroat		x	c	c*			u		u		c	c*	c		x	x	x	
Hooded Warbler									u									
Wilson's Warbler			c				u		u		u		u		x		x	
Canada Warbler		x	c				u		u		u		u		x		x	
Yellow-breasted Chat		x	u	r*			u	u	u								r?	
Summer Tanager			r				r											
Scarlet Tanager		x	c				u	u	u		u		u					
Northern Cardinal		x	c	c*			c	c	c	c	c	c*	c	c	x	x	x	x
Rose-breasted Grosbeak		x	c				u		u		u		u		x		x	x
Blue Grosbeak			r										u*	u				
Indigo Bunting			c	r*			u		u		u	u*	u		x	x	x	
Dickcissel									r	r			r					
Rufous-sided Towhee		x	c	c*			c	c	c	u	u		u		x	x	x	
American Tree Sparrow		x	c				u		u	u	u		u	u	x		x	x
Chipping Sparrow		x	c				u	u	u	u	u		u	u	x		x	
Clay-colored Sparrow			c						r									
Field Sparrow		x	c	u*			u		u	u	u		u	u	x	x	x	
Vesper Sparrow									r		u		u					
Lark Sparrow													r?					
Savannah Sparrow		x	c				u		u	u	c	r*	c	c	x	x	x	x

142 200

New Jersey Sites

Species:	Season:	SR	SH				CH				HM				LP			
			S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Grasshopper Sparrow									r									
Le Conte's Sparrow			a															
Sharp-tailed Sparrow			u						r		u	u*	u		x	x	x	
Seaside Sparrow			c	r	*1						u	u*	u		x	x	x	x
Fox Sparrow		x	c				u		u	u		u	u	u	x		x	
Song Sparrow		x	c	c*			c	c	c	c	c	c*	c	u	x	x	x	x
Lincoln's Sparrow			c						r				u		x		x	
Swamp Sparrow		x	c	r	*1		u	u	u	u	c	c*	c	u	x		x	
White-throated Sparrow		x	c				c		c	c	c		c	u	x		x	x
White-crowned Sparrow			c						r		u		u		x		x	
Dark-eyed Junco		x	c				u		u	c	c		c	u	x		x	x
Lapland Longspur													r	r	x		x	x
Snow Bunting			r										u	u	x		x	x
Bobolink			c						r		u	u	c					
Red-winged Blackbird		x	c	c*			c	c	c	c	c	c*	c	u	x	x	x	x
Eastern Meadowlark		x	c				u	u	u	u	u		u		x		x	x
Yellow-headed Blackbird									r				r					
Rusty Blackbird		x	u						r		u		u		x		x	
Boat-tailed Grackle			c												x		x	
Common Grackle		x	c	c*			c	c	c	c	c	c*	c	c				
Brown-headed Cowbird		x	c	u*			c	c	c	c	c	c	c		x	x	x	x
Orchard Oriole			c				u	u										
Northern Oriole		x	c				u	u	u		u	u*	u		x	x	x	
Purple Finch		x	u				u		u	u	u		u	u	x	x	x	x
House Finch		x	c	c*			u	u	u	u	u	u*	u	u	x	x	x	x
Red Crossbill									r						x		x	x
Common Redpoll									r				r					



# New Jersey Sites

Species:	Season:	SR	SH				CH				IIM				LP			
			S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Pine Siskin		x	r						u		u		u	u	x		x	
American Goldfinch		x	c	u*			u	u	u	u	c	c	c	c	x	x	x	x
Evening Grosbeak			r						r									
House Sparrow		x	c	x*			c	c	c	c	c	c*	c	c	x		x	
Sum: Spring/Fall		N/A	223	0			127	156			222	244			182	172		
Sum: Summer/Winter				72	0		103	103			138	110			107	106		
Grand sum:		118		242			193				258				190			

194202

Species:	Season:	New York Sites											
		IIR	PA	SI				JB				NS	
				S	S	F	W	S	S	F	W		
Red-throated Loon						x			r		r	r	
Common Loon						x			u		u	r	
Pied-billed Grebe			x			x*	x		u	u*	u	u	x
Horned Grebe				x	r	x	x		c		c	c	
Red-necked Grebe												r	
Eared Grebe							a		a		a		
Sooty Shearwater										r?			
American White Pelican										a?			
Great Cormorant											r	r	
Double-crested Cormorant			x				x		c	r	c		x
American Bittern			x		x		x *2		u	r*2	u	u	x
Least Bittern					x		x *2		r	r*	r		x
Great Blue Heron		x	x		x		x	x	u	r	c	u	x
Great Egret			x		x		x*		c	c*	c	r	x
Snowy Egret					x		x*		c	c*	c	r	x
Little Blue Heron			x		x		x *1		u	u*1	u		x
Tricolored Heron									u	u *1	u		x
Cattle Egret					x		x*		u	u*	u		x
Green-backed Heron		x		x *1	x		x*		c	c*	c	r	x
Black-crowned Night Heron			x *1		x		x*	x	c	c*	c	c	x
Yellow-crowned Night Heron									u	u *1	u		x
Fulvous Whistling-Duck										a?			
White Ibis										a?			
Glossy Ibis			x		x		x*		c	c*	c	r	x
White-faced Ibis										a?			a
Wood Stork										a?			
Tundra Swan											r	r	x

495 203

Species:	Season:	New York Sites											
		HR	PA	SI				JB				NS	
				S	S	F	W	S	S	F	W		
Mute Swan									r	r			
Greater White-fronted Goose									a?				
Snow Goose							x		c	r	c	u	
Brant							x		c	r	c	c	x
Canada Goose					x*	x			c	c*	c	u	x
Wood Duck		x	x* <sup>1</sup>	x	x*		x		u	r	u		x
Green-winged Teal				x	x*	x			c	u* <sup>2</sup>	c	u	x
American Black Duck			x*	x	x*	x			c	c*	c	c	x
Mallard		x	x*	x	x*	x	x		c	c*	c	c	x
Northern Pintail				x		x			u	r* <sup>2</sup>	c	c	x
Blue-winged Teal			x	x	x*	x			c	u* <sup>2</sup>	c	r	x
Cinnamon Teal									a?				
Northern Shoveler				x		x			c	r*	c	u	x
Gadwall				x	x* <sup>1</sup>	x			c	c*	c	u	x
Eurasian Wigeon									r		r	r	
American Wigeon			x	x		x			c	r* <sup>2</sup>	c	c	x
Canvasback						x	x		c	r	c	c	x
Redhead						x	x		u	u*	u	r	
Ring-necked Duck						x			u	r	u		
Greater Scaup				x			x		c	u	c	c	x
Lesser Scaup				x			x		u		u	u	x
Common Eider									r	r	r	r	
King Eider									r	r		r	
Harlequin Duck									r?				
Oldsquaw							x				u	u	
Black Scoter							x				r	r	
Surf Scoter							x				r	r	

116204

Species:	Season:	New York Sites											
		HIR	PA	SI				JB				NS	
				S	S	F	W	S	S	F	W		
White-winged Scoter						x				r	r		
Common Goldeneye						x		r		u	c		
Bufflehead				x	r	x	x	c	r	c	c	x	
Hooded Merganser						x	x	u	r	u	r	x	
Common Merganser						x				u	u		
Red-breasted Merganser						x		c	u	c	c	x	
Ruddy Duck						x		c	c*	c	c	x	
Turkey Vulture								r		r			
Osprey			x			x *1,2		u	r	u		x	
American Swallow-tailed Kite									a?				
Bald Eagle									r	r	r		
Northern Harrier			x			x *2	x	u	u*	u	u	x	
Sharp-shinned Hawk			x			x *1,2		r		u	r	x	
Cooper's Hawk						x *2		r		r			
Northern Goshawk										r	r		
Red-shouldered Hawk			x			x *2	x	r		r			
Broad-winged Hawk						x *1	x	r		r			
Red-tailed Hawk		x	x			x *1	x	r		r	r	x	
Rough-legged Hawk			x				x			r	u	x	
Golden Eagle									a?				
American Kestrel		x	x			x	x*	x	x	u	r *2	u	c
Merlin							x			r	u	r	
Peregrine Falcon										r	r	r	
Gyr Falcon												r	
Ring-necked Pheasant		x	x *1			x*				u	u*	u	u
Bobwhite						x *2				c	c*	c	c
Yellow Rail										r		r	

197 205

Species:	Season:	New York Sites											
		HR	PA	SI				JB				NS	
				S	S	F	W	S	S	F	W		
Black Rail								r	r	r			
Clapper Rail				x	x *			c	c*	c	r	x	
King Rail					x *1,2			r		r	r	x	
Virginia Rail					x*			u	r	u	r	x	
Sora					x *2	x		u	r	u		x	
Purple Gallinule									a?				
Common Moorhen				x	x*			u	u*	u	r	x	
American Coot				x	x*			u	u*	c	c	x	
Black-bellied Plover				x	x	x	x	c	u	c	c	x	
Lesser Golden-Plover						r		r		u			
Wilson's Plover									a?				
Semipalmated Plover				x				c	r	c	r		
Piping Plover				x	x *2	x		r	r*	r			
Killdeer				x	x*	x	x	c	c*	c	u	x	
American Oystercatcher								u	u*	u			
Black-necked Stilt								r	r				
American Avocet					r					r			
Greater Yellowlegs				x	x			c	c	c	u	x	
Lesser Yellowlegs				x	x			c	r	c		x	
Solitary Sandpiper				x				u		u		x	
Willet				x				u	r *1	u			
Spotted Sandpiper				x	x*			c	u*	c		x	
Upland Sandpiper								r		r			
Whimbrel				x				r	r	u	r		
Hudsonian Godwit										u			
Marbled Godwit				r				r	r	r	r		
Ruddy Turnstone				x		x	x	c	r	c	r		

148206

Species:	Season:	New York Sites											
		IIR	PA	SI				JB				NS	
				S	S	F	W	S	S	F	W		
Red Knot				x		x			c	r	c	r	x
Sanderling				x		x	x		c	u	c	u	x
Semipalmated Sandpiper				x					c	u	c		x
Western Sandpiper									r		c	r	
Least Sandpiper				x					c	u	c		
White-rumped Sandpiper									u		c		
Baird's Sandpiper											r		
Pectoral Sandpiper									u		c		x
Sharp-tailed Sandpiper										a?			
Purple Sandpiper				x			x			r?			
Dunlin				x			x		c		c	c	
Curlew Sandpiper									r		r		
Stilt Sandpiper									r		c		
Buff-breasted Sandpiper											r		
Ruff									r	r	r		
Short-billed Dowitcher				x	x*				c	u	c		x
Long-billed Dowitcher									r		c	r	
Common Snipe							x		u		u	r	x
American Woodcock		x	x *	x	x*				u	u*	u	r	x
Wilson's Phalarope					x				r	r	u		x
Red-necked Phalarope									r		r		
Red Phalarope									r		r		
Pomarine Jaeger										r?			
Parasitic Jaeger										r?			
Laughing Gull				x					c	u*	c		x
Little Gull					r				r	r	r	r	
Common Black-headed Gull					r				r	r	r	r	

199207

Species:	Season:	New York Sites											
		IIR	PA	SI				JB				NS	
				S	S	F	W	S	S	F	W		
Bonaparte's Gull				x			x	u	r	u	u	x	
Ring-billed Gull				x				c	u	c	c	x	
Herring Gull				x	x*	x	x	c	c*	c	c	x	
Iceland Gull							x	r		r	r		
Lesser Black-backed Gull							x	r		r	r		
Glaucous Gull							x	r	r	r	r		
Great Black-backed Gull				x	x*			c	c*	c	c	x	
Black-legged Kittiwake					r?								
Gull-billed Tern								r	r*	r			
Caspian Tern								r	r	r			
Royal Tern						x			r	r			
Roseate Tern								r		r		x	
Common Tern				x		x		c	c*	c		x	
Arctic Tern									r?				
Forster's Tern								r	r	u			
Least Tern				x	x *2			c	c*2	c		x	
Sooty Tern									a?				
Black Tern					x			r		u			
Black Skimmer					x			c	c*	c		x	
Rock Dove								c	c*	c	c	x	
Mourning Dove		x	x*			x*		c	c*	c	c	x	
Monk Parakeet						x *2							
Black-billed Cuckoo		x				x*		r	r *1	r			
Yellow-billed Cuckoo		x	x *1			x*		r	r *1	r			
Common Barn-Owl						x *2	x	r	r*	r	r	x	
Eastern Screech-Owl		x	x *1	x	x*	x	x					x	
Great Horned Owl			x	x	x*		x		r?			x	

200 208

Species:	Season:	New York Sites											
		HR	PA	SI				JB				NS	
				S	S	F	W	S	S	F	W		
Snowy Owl							x			r	r		x
Barred Owl					x *2								
Long-eared Owl			x		x *2			r		r	r		
Short-eared Owl					x *1,2		x	r	r*1	u	u		x
Northern Saw-whet Owl										r	r		
Common Nighthawk					x *1			r		u			
Chuck-will's-widow				r	x *1								
Whip-poor-will				x	x*			r		r			
Chimney Swift			x	x	x*			u	r	u			
Ruby-throated Hummingbird		x			x *2	x		r		r			x
Belted Kingfisher			x	x	x*	x	x	r		u	r		x
Red-headed Woodpecker				r	x *2			r	r	r			
Red-bellied Woodpecker					x*			r		r			
Yellow-bellied Sapsucker						x		u		u			
Downy Woodpecker		x	x *1	x	x*	x	x	u	r	u	u		
Hairy Woodpecker		x	x *1		x*		x	r		r	r		x
Northern Flicker		x	x *1	x	x*	x	x	c	r	c	u		x
Olive-sided Flycatcher								r		r			
Eastern-Wood Pewee		x	x *1	x	x*			u		u			x
Yellow-bellied Flycatcher								r		r			
Acadian Flycatcher					x *2			r					
Alder Flycatcher								r		u			
Willow Flycatcher					x*			r	u *1				
Least Flycatcher				x	x *2			u		u			
Eastern Phoebe				x	x *2			u		c			
Great Crested Flycatcher		x	x *1	x	x*			r	r	r			x
Western Kingbird										r			

201 209



New York Sites

Species:	Season:	HR	PA	SI				JB				NS
				S	S	F	W	S	S	F	W	
Eastern Kingbird		x	x *1		x*			u	r	u		x
Horned Lark				x	x*	x	x	u	r *2	c	c	
Purple Martin			x	x	x*			r		r		
Tree Swallow			x*	x	x*	x		c	c*	c	r	x
Northern Rough-winged Swallow			x	x	x*			r		r		
Bank Swallow				x				u	u	u		x
Cliff Swallow					x *2			r		r		
Barn Swallow				x	x*			c	c*	c		x
Blue Jay		x	x*		x*		x	u		u		x
American Crow		x	x *1		x*		x	u	u*	u	u	x
Fish Crow			x *1		x*			u	u*	u	u	x
Black-capped Chickadee		x	x *1	x	x*	x	x	r		u	r	x
Boreal Chickadee					r?							
Tufted Titmouse		x	x*	x	x*		x		r?			
Red-breasted Nuthatch			x			x	x	u		u	u	
White-breasted Nuthatch		x	x		x*	x	x	r		r		
Brown Creeper			x			x		u		c		
Carolina Wren		x	x *1		x*		x	r		r		
House Wren		x	x*	x	x*			u	r*	u		x
Winter Wren			x			x		r		u		
Sedge Wren					x *2			r		r		
Marsh Wren				x	x*			c	c*	c	r	x
Golden-crowned Kinglet				x		x		c		c		x
Ruby-crowned Kinglet				x		x		c		c		
Blue-gray Gnatcatcher			x	x				u		r		
Eastern Bluebird				x	x *2	x		r		r		
Veery				x	x *2	x		u		u		x

202 210

Species:	Season:	New York Sites												NS
		HR	PA	SI				JB						
				S	S	F	W	S	S	F	W			
Gray-cheeked Thrush						x			u		u			
Swainson's Thrush				x		x			u		u	r		
Hermit Thrush				x					u		c	r		
Wood Thrush		x	x *1	x	x*	x			u		u			
Redwing										a?				
American Robin		x	x*		x*				c	u*	c	u	x	
Varied Thrush						a?								
Gray Catbird		x	x*	x	x*				c	c*	c	r	x	
Northern Mockingbird			x *1	x	x*		x		u	u*	u	u	x	
Sage Thrasher										a?				
Brown Thrasher			x*		x*	x			c	u*	c	r	x	
Water Pipit				x		x			r		u	r		
Cedar Waxwing		x	x	x	x *2				u	r*	c	r		
Northern Shrike											r	r		
Loggerhead Shrike						r			r		r	r		
European Starling		x	x*	x	x*	x	x		c	c*	c	c	x	
White-eyed Vireo				x	x*				r		r			
Solitary Vireo				x					u		u			
Yellow-throated Vireo				x	x *2				r		r			
Warbling Vireo					x *2				r		r			
Philadelphia Vireo				r		x			r		r			
Red-eyed Vireo		x	x *1	x	x*				u		c		x	
Blue-winged Warbler			x *1	x	x*2				u		r		x	
Golden-winged Warbler									r					
Tennessee Warbler				x					u		u			
Orange-crowned Warbler											r			
Nashville Warbler				x					u		u			

New York Sites

Species:	Season:	HR	PA	SI				JB				NS
				S	S	F	W	S	S	F	W	
Northern Parula			x	x				c		u		
Yellow Warbler		x	x	x	x*			c	c*	c		
Chestnut-sided Warbler			x	x				u		u		
Magnolia Warbler				x				u		u		x
Cape May Warbler				x				u		c		
Black-throated Blue Warbler			x	x	x	x		u		u		
Yellow-rumped Warbler			x	x		x	x	c		c	c	x
Townsend's Warbler									a?			
Black-throated Green Warbler			x	x				u		u		
Blackburnian Warbler			x	x				u		u		
Yellow-throated Warbler								r				
Pine Warbler				x	x	x		r		r		
Prairie Warbler				x	x <sup>*2</sup>			u		u		
Palm Warbler				x			r	u		c		
Bay-breasted Warbler			x	x		x		u		u		
Blackpoll Warbler				x	x	x		c		u		
Cerulean Warbler				x				r				
Black-and-white Warbler			x <sup>*1</sup>	x	x <sup>*2</sup>			u		u		x
American Redstart			x <sup>*1</sup>	x	x <sup>*2</sup>	x		u		c		x
Prothonotary Warbler			x	x				r				
Worm-eating Warbler				x				r		r		
Ovenbird		x		x	x*			u		u		
Northern Waterthrush			x	x	x			u		u		
Louisiana Waterthrush				x				r				
Kentucky Warbler				x				r				
Connecticut Warbler										r		x
Mourning Warbler			x		x			r		r		

204212

Species:	Season:	New York Sites												
		HR	PA	SI				JB				NS		
				S	S	F	W	S	S	F	W			
Common Yellowthroat		x	x *1	x	x*		r		c	c*	c	r		x
Hooded Warbler				x					r		r			
Wilson's Warbler			x	x					u		u			
Canada Warbler				x	x *1,2	x			u		u			
Yellow-breasted Chat			x	x	x*		r		r		r			
Summer Tanager									r					
Scarlet Tanager				x	x *1				u		u			
Western Tanager									a		a			
Northern Cardinal		x	x *1	x	x*	x	x		u	u*	u	u		x
Rose-breasted Grosbeak				x	x *1	x			u		u			
Blue Grosbeak									r		r			
Indigo Bunting			x *1	x	x*				u		u			
Dickcissel									r		r			
Rufous-sided Towhee		x	x *1	x	x*	x			c	c*	c	u		x
American Tree Sparrow			x			x	x		r		u	c		x
Chipping Sparrow			x	x	x *2				u		c	r		
Clay-colored Sparrow											r			
Field Sparrow				x	x*				u		u	u		
Vesper Sparrow					x *2				r		r			
Lark Sparrow											r			
Lark Bunting										a?				
Savannah Sparrow				x	x*				c	r *2	c	c		
Grasshopper Sparrow				x	x*						r	r		
Henslow's Sparrow									r		r			
Sharp-tailed Sparrow				x	x *2				u	u*	c	u		x
Seaside Sparrow					x *2				c	c*	c	u		
Fox Sparrow				x		x			r		u	u		

205-213

New York Sites

Species:	Season:	IIR	PA	SI				JB				NS
				S	S	F	W	S	S	F	W	
Song Sparrow		x	x *1	x	x*	x	x	c	c*	c	c	x
Lincoln's Sparrow								u		u	r	
Swamp Sparrow		x		x	x*			u	u *1	c	u	x
White-throated Sparrow			x	x		x	x	c	r	c	c	x
White-crowned Sparrow						x		u		u	r	
Dark-eyed Junco		x	x			x	x	c		c	c	
Lapland Longspur							x			r	r	
Snow Bunting							x			r	r	
Bobolink				x	x *2	x		u		c		x
Red-winged Blackbird		x	x *1	x	x*	x	x	c	c*	c	c	x
Eastern Meadowlark				x	x*			u		u	r	
Yellow-headed Blackbird										r		
Rusty Blackbird				x		x		r		r	r	
Boat-tailed Grackle								r	r *1	r	r	
Common Grackle		x	x*	x	x*	x	x	c	c*	c	r	x
Brown-headed Cowbird		x			x*		x	c	u *1	c	u	
Orchard Oriole				x	x *2			r		r		
Northern Oriole		x	x*	x	x*			u		u		x
Pine Grosbeak										r	r	
Purple Finch			x	x		x		u		u	r	
House Finch		x	x *1	x	x*	x	x	c	c*	c	c	
Red Crossbill						x	x			r	r	
White-winged Crossbill						x	x			r	r	
Common Redpoll							x			r	r	x
Hoary Redpoll							x					
Pine Siskin					x*	x	x	r		u	u	

206214

Species:	Season:	New York Sites										NS
		HR	PA	SI				JB				
				S	S	F	W	S	S	F	W	
American Goldfinch		x	x * <sup>1</sup>	x	x*		x	u	r* <sup>1</sup>	c	u	x
Evening Grosbeak		x		r			x	r		r	r	
House Sparrow		x	x*		x*	x		c	c*	c	c	x
Sum: Spring/Fall		N/A	N/A	151	95			259	280			N/A
Sum: Summer/Fall					151	73			155	146		
Grand sum:		48	91		245				316			123

2012/15

New York Sites

Species:	Season:	FB				MP				CP				UC				FP			
		S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Red-throated Loon					u				x												
Common Loon					u				x	r		r								r?	
Pied-billed Grebe					u	x															
Horned Grebe					c				x												
Great Cormorant					• c																
Double-crested Cormorant		c	c	c		x	x	x	x	r		r		x	x	x	x			r?	
American Bittern					u				x												
Great Blue Heron		u	u	u		x	x	x	x					x	x	x	x			r?	
Great Egret		c	c	c		x	x	x						x	x	x					
Snowy Egret		c	c	c		x	x	x						x	x	x					
Little Blue Heron		r		r					x												
Tricolored Heron						x															
Cattle Egret			u			x	x	x													
Green-backed Heron			c			x	x	x		x										x?	
Black-crowned Night Heron			c	c		x	x	x	x											r?	
Glossy Ibis		c	c	c		x	x	x													
Mute Swan						x	x	x	x												
Snow Goose						x		x	x			r?									
Brant		c		c	c	x		x	x											r?	
Canada Goose		c	c	c		x*	x	x	x	x	x	x	x							r?	
Wood Duck			r?			x		x	x	x	*	x								r?	
Green-winged Teal						x		x	x												
American Black Duck			c*			x*	x	x	x	x*	x			x	*	x	x	x		r?	
Mallard			c*			x*	x	x	x	x*	x	x	x	x*	x	x	x	x			
Northern Shoveler		u																			
Gadwall					u	x		x	x												
Eurasian Wigeon					r																

208 216

Species:	Season:	New York Sites																			
		FB				MP				CP				UC				FP			
		S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
American Wigeon				c	x		x	x													
Canvasback						x		x	x												
Redhead						x		x	x												
Greater Scaup					c	x		x	x												
Lesser Scaup						x		x	x												
Oldsquaw					u																
Common Goldeneye						x		x	x												
Bufflehead		c		c	c	x		x	x							x	x				
Red-breasted Merganser					c	x		x	x												
Ruddy Duck					u	x		x	x												
Turkey Vulture		r		r																	
Osprey					u		x	x	x						x		x				
Northern Harrier		x	u*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		r?	
Sharp-shinned Hawk				c	c	x		x	x	x		x	x	x						x	
Cooper's Hawk				c	u			x	x	x		x		x							
Northern Goshawk						x		x	x	x		x		x	x						
Red-shouldered Hawk					r															r?	
Broad-winged Hawk				r						x	*x									x	
Red-tailed Hawk					u	x		x	x	x	x	x		x		x	x	x	x	x	x
Rough-legged Hawk					c			x	x												
American Kestrel		c	c*	c	x	x*	x	x	x	x*	x	x	x							x	
Merlin				c		x		x	x											r?	
Peregrine Falcon				u	u	x	x	x	x												
Ring-necked Pheasant		c	c*	c	c	x*	x	x	x	x*	x	x	x	x*	x	x	x	x	x*	x	x
Clapper Rail		u				x								x*	x	x	x				
Sora						x															
Common Moorhen						x	x														

209217



New York Sites

Species:	Season:	FB				MP				CP				UC				FP			
		S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
American Coot						x		x	x												
Black-bellied Plover				c	u	x	x	x						x		x	x				
Lesser Golden-Plover				u																	
Semipalmated Plover				c		x	x	x						x	x	x					
Piping Plover						x*	x							x	x	x					
Killdeer		c	c*			x*	x	x	x					x*	x	x	x				
American Oystercatcher		x	u*			x	x	x													
Greater Yellowlegs		c		c		x	x	x						x	x	x	x				
Lesser Yellowlegs				u		x	x	x	x								x				
Solitary Sandpiper		r				x	x	x												r?	
Willet				u																	
Spotted Sandpiper				c*		x*	x	x						x	x	x					
Upland Sandpiper		x			x																
Ruddy Turnstone				u	u	x	x	x													
Sanderling		c		c				x	x	x											
Semipalmated Sandpiper		c		c				x	x												
Least Sandpiper		u		u				x	x												
Pectoral Sandpiper		u		u																	
Purple Sandpiper					r																
Dunlin					u			x	x	x											
Stilt Sandpiper					r																
Short-billed Dowitcher				x	x																
Common Snipe		u				x	x	x	x	x		x		x		x					
American Woodcock		c	c*	c		x	x	x	x	x		x								x	
Laughing Gull		c	c	c		x	x	x		x	x	x	x	x?					x	x	x
Bonaparte's Gull					u				x												
Ring-billed Gull		c		c		x	x	x	x	x	x	x	x	x?						r?	

-210 218

New York Sites

Species:	Season:	FB				MP				CP				UC				FP			
		S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Herring Gull		c	c	c	c	x	x	x	x	x	x	x	x	x?				x			
Lesser Black-backed Gull					r																
Great Black-backed Gull		c	c	c		x		x	x	x	x	x	x	x?				x			
Caspian Tern														x	x						
Common Tern		c				x	x	x						x	x	x					
Forster's Tern						x		x													
Least Tern		c				x	x	x													
Black Tern														x?							
Black Skimmer		u	u			x	x														
Rock Dove		c	c*	c	c	x*	x	x	x	x*	x	x	x	x?				x*	x	x	x
Mourning Dove		c	c*	c	c	x*	x	x	x	x*	x	x	x	x?				x*	x	x	x
Budgerigar						x	x	x	x												
Black-billed Cuckoo		r*								x		x						r?			
Yellow-billed Cuckoo		u				x	x	x		x		x						x*	x		
Common Barn-Owl		u*		u		x	x	x	x												
Eastern Screech-Owl																x					
Great Horned Owl																		r?			
Snowy Owl					r			x	x												
Long-eared Owl					r																
Short-eared Owl		u*		u		x	x	x	x												
Northern Saw-whet Owl					r																
Common Nighthawk		r						x		x?								x			
Whip-poor-will																		x			
Chimney Swift		u*						x		x?								x*	x	x	
Ruby-throated Hummingbird								x		x		x						x			
Rufous Hummingbird														x?							
Belted Kingfisher		c	r*	c		x	x	x	x					x	x	x					

# New York Sites

Species:	Season:	FB				MP				CP				UC				FP			
		S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Red-headed Woodpecker						x		x						x?				r?			
Red-bellied Woodpecker										x*	x	x	x					x*	x	x	x
Yellow-bellied Sapsucker		u				x		x		x		x						x			
Downy Woodpecker		u		u	u	x*	x	x	x	x*	x	x	x	x?				x*	x	x	x
Hairy Woodpecker						x	x	x	x	x*	x	x	x					x*	x	x	x
Northern Flicker				u*	♂					x	x	x	x	x?				x*	x	x	
Olive-sided Flycatcher										x			x					r		r	
Eastern-wood Pewee		u								x*	x							x*	x	x	
Yellow-bellied Flycatcher																				r?	
Acadian Flycatcher																				r?	
Willow Flycatcher				c*		x	x	x													
Least Flycatcher						x				x			x								
Eastern Phoebe		c		c		x	x	x		x			x							r?	
Great Crested Flycatcher		u				x				x	*	x						x*	x	x	
Eastern Kingbird		c		u*		x*	x	x		x	*	x						x*	x	x	
Horned Lark				u*	u	x	x	x	x												
Purple Martin						x			x												
Tree Swallow				c*		x	x	x												r?	
Northern Rough-winged Swallow																				r?	
Bank Swallow					r																
Barn Swallow				c*		x	x	x		x	x	x						x			
Blue Jay		c				x*	x	x	x	x*	x	x	x	x?				x*	x	x	x
American Crow		c		c*	c	c		x	x	x	x	x	x	x?				x*	x	x	x
Fish Crow		c		c*	c	c		x	x	x	x	x	x	x?				x*	x	x	
Black-capped Chickadee					x			x	x	x	x	x	x					x*	x	x	x
Tufted Titmouse									x	x*	x	x	x					x*	x	x	x
Red-breasted Nuthatch				x	x			x		x		x								r?	

218 220

New York Sites

Species:	Season:	FB				MP				CP				UC				FP			
		S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
White-breasted Nuthatch										x*	x	x	x					x*	x	x	x
Brown Creeper		x		x						x		x	x					x	*x	x	
Carolina Wren																				r?	
House Wren						x		x		x	*	x						x	*	x	x
Winter Wren								x		x		x						x			
Marsh Wren			u*			x*	x	x	x					x*	x	x					
Golden-crowned Kinglet		u				x		x	x	x		x								x?	
Ruby-crowned Kinglet		u				x		x	x	x		x								x?	
Blue-gray Gnatcatcher						x				x		x								x?	
Eastern Bluebird						x		x													
Veery						x				x		x						x			
Gray-checked Thrush										x		x								x?	
Swainson's Thrush						x				x		x						x			
Hermit Thrush		u				x		x		x		x								x?	
Wood Thrush						x				x	*	x								x*	x
American Robin		c	c*	c		x*	x	x	x	x	*	x		x*	x	x				x*	x
Gray Catbird		c	c*	c		x*	x	x	x	x	*	x		x*	x	x	x			x*	x
Northern Mockingbird						x*	x	x	x	x	*	x	x	x	*	x	x	x		x*	x
Brown Thrasher			c*			x*	x	x		x	*	x		x*	x	x				x*	x
Water Pipit					r					x		x									
Cedar Waxwing			c			x*	x	x	x	x		x								x?	
Northern Shrike					r																
Loggerhead Shrike								x													
European Starling		c	c*	c	c	x*	x	x	x	x	*	x	x	x	*	x	x			x*	x
White-eyed Vireo			u			x				x		x								x?	
Solitary Vireo										x		x								x?	
Yellow-throated Vireo																				x?	

213 221

New York Sites

Species:	Season:	FB				MP				CP				UC				FP				
		S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	
Warbling Vireo										x		x								x?		
Red-eyed Vireo	r					x		x		x	*	x								x*	x	x
Blue-winged Warbler										x		x								x	*	x
Golden-winged Warbler										x		x										
Tennessee Warbler	u			*		x		x		x		x								x		
Orange-crowned Warbler				r																r?		
Nashville Warbler										x		x								x		
Northern Parula	u									x		x								x		
Yellow Warbler				c*		x*	x	x		x	*	x				x*	x	x			x?	
Chestnut-sided Warbler	r									x		x								x		
Magnolia Warbler	u					x		x		x		x								x		
Cape May Warbler	u					x		x		x		x								x		
Black-throated Blue Warbler	u					x		x		x		x								r?		
Yellow-rumped Warbler					c	x		x	x	x		x									x?	
Black-throated Green Warbler	u					x		x		x		x								x		
Blackburnian Warbler	u					x		x		x		x								x		
Yellow-throated Warbler																				r?		
Pine Warbler										x		x								r?		
Prairie Warbler										x		x								x		
Palm Warbler	c							x		x		x								x		
Bay-breasted Warbler	r					x				x		x								x		
Blackpoll Warbler	u					x		x		x		x								x		
Cerulean Warbler																				r?		
Black-and-white Warbler	u			u		x		x		x		x								x	x	x
American Redstart	u							x?		x		x								x		
Prothonotary Warbler										x		x										
Worm-eating Warbler										x		x								x		

214 222

New York Sites

Species:	Season:	FB				MP				CP				UC				FP			
		S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Swainson's Warbler																				r?	
Ovenbird						x				x	x							x	*		
Northern Waterthrush										x	x							x			
Louisiana Waterthrush		r								x	x							x			
Kentucky Warbler																				x?	
Mourning Warbler																		x			
Common Yellowthroat			c*			x*	x	x		x	x							x*	x	x	
Hooded Warbler										x	x							x			
Wilson's Warbler										x	x							x			
Canada Warbler		u				x	x			x	x							x			
Yellow-breasted Chat										x	x										
Summer Tanager																				r?	
Scarlet Tanager						x	x			x	x							x*	x	x	
Northern Cardinal		c	c*	c	c	x*	x	x	x	x*	x	x	x	x*	x	x	x	x*	x	x	x
Rose-breasted Grosbeak						x	x											r			
Blue Grosbeak																				r?	
Indigo Bunting		u	u			x	x			x	*x							x	x	x	
Rufous-sided Towhee			c*			x*	x	x	x	x	*x							x*	x	x	
American Tree Sparrow				c	c			x		x	x									r?	
Chipping Sparrow		u		u				x		x	*x							x			
Clay-colored Sparrow																				r?	
Field Sparrow			u*	u		x	x	x		x	*x							x*	x		
Vesper Sparrow		u				x	x	x		x	x										
Lark Sparrow				r																	
Savannah Sparrow		c		c	c	x*	x	x	x	x	x										
Grasshopper Sparrow			c*			x*	x	x	x												
Sharp-tailed Sparrow			u*			x	x	x	x												

215 223

# New York Sites

Species:	Season:	FB				MP				CP				UC				FP			
		S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Seaside Sparrow		u				x	x	x	x					x?							
Fox Sparrow		x		x	x	x		x	x	x		x				x		x			
Song Sparrow		c	c*	c	c	x*	x	x	x	x*	x	x	x	x*	x	x	x	x			
Lincoln's Sparrow										x		x							r?		
Swamp Sparrow		x	x	x		x	x	x	x	x	*x			x?				x			
White-throated Sparrow				c	c	x		x	x	x		x						x			
White-crowned Sparrow				u				x		x		x							r?		
Dark-eyed Junco				c					x	x		x						x			
Lapland Longspur				r																	
Snow Bunting				u				x	x								x				
Bobolink		u		u				x		x	*x			x		x			r?		
Red-winged Blackbird			c*		u	x*	x	x	x	x	*x			x*	x	x		x	x	x	
Eastern Meadowlark		c	c*	c	c	x	x	x	x	x		x									
Rusty Blackbird										x		x									
Boat-tailed Grackle				r																	
Common Grackle			c*			x*	x	x	x	x	*x			x?				x*	x	x	
Brown-headed Cowbird			u*	u		x*	x	x	x	x	*x							x*	x	x	
Orchard Oriole																			r?		
Northern Oriole		u				x	x	x		x	*x			x*	x	x		x*	x	x	
Purple Finch						x		x		x		x						x			
House Finch		c	c*	c	c	x*	x	x	x	x*	x	x	x					x*	x	x	
Common Redpoll																			r?		
Pine Siskin										x		x							r?		
American Goldfinch		u	u*	u	u	x*	x	x	x	x	*x			x*	x	x	x	x		x	
Evening Grosbeak																			r?		
House Sparrow		c	c*	c	c	x*	x	x	x	x*	x	x	x					x*	x	x	x
Black-hooded Parakeet						x	x	x	x												

216 224

New York Sites

Species:	Season:	FB				MP				CP				UC				FP								
		S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W					
<hr/>																										
Sum: Spring/Fall		80		73		123		147		124		99		34		35		90		42						
Sum: Summer/Winter			67		63		87		93		57		29		51		20		96		17					
Grand sum:			165					171					128					56					143			

217225



New York Sites

Species:	Season:	KP				RP				VC				PB				AP			
		S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Red-throated Loon																u					x
Common Loon																u					
Pied-billed Grebe				x?								x?			r	u		x			
Horned Grebe																c					x
Red-necked Grebe																r					
Wilson's Storm Petrel				.											r						
Great Cormorant																c					
Double-crested Cormorant				x?			x	x	x			x?			x	u		x	x	x	x
American Bittern			x	x	x							x?			r	r					
Least Bittern																x <sup>*2</sup>					
Great Blue Heron								x	x			x	x		x	c		x	x	x	x
Great Egret												x?			x	r	r		x	x	x
Snowy Egret			x	x	x							x			x				x	x	x
Little Blue Heron															r	r					
Tricolored Heron																r					
Cattle Egret															r		r				
Green-backed Heron			x	x	x							x <sup>*1</sup>	x			x <sup>*</sup>			x	x	x
Black-crowned Night Heron			x	x	x			x	x			x <sup>*1</sup>	x			x <sup>*2</sup>	c		x	x	x
Yellow-crowned Night Heron																x					
Glossy Ibis																r					
Mute Swan									x	x		x <sup>*1</sup>	x	x	x	x <sup>*</sup>	c				
Greater White-fronted Goose																					
Snow Goose										x	x					r			u		
Brant																			u		
Canada Goose					x		x	x	x			x <sup>1</sup>	x	x	x		x <sup>*</sup>	c		x <sup>*</sup>	x
Wood Duck								r				x <sup>*1</sup>		x <sup>1</sup>			r				
Green-winged Teal					x		x	x						x				u		x	x

218 226

New York Sites

Species:	Season:	KP				RP				VC				PB				AP			
		S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
American Black Duck		x	x	x	x		x	x	x	x		x		x*	c			x*	x	x	x
Mallard		x*	x	x	x	x	x	x	x	x	x*	x	x	x*	c			x*	x	x	x
Northern Pintail		x		x	x												u				
Blue-winged Teal												x		r		r					
Northern Shoveler		x		x	x					x		x	x <sup>1</sup>				r				
Gadwall																	u	x		x	x
American Wigeon												x					c				
Canvasback								x									c	x		x	x
Redhead																	u				
Ring-necked Duck										x		x					r				
Greater Scaup											x?			r	r	c		x		x	x
Lesser Scaup										x		x					u				
Oldsquaw																	u				
Black Scoter																	u				
White-winged Scoter							x										u				
Common Goldeneye																	c	x		x	x
Bufflehead								x									c	x		x	x
Hooded Merganser										x		x <sup>1</sup>					u				
Common Merganser										x		x <sup>1</sup>					u				
Red-breasted Merganser																	c	x		x	x
Ruddy Duck											x?						u	x		x	x
Turkey Vulture						x	x			r	r			r		r					
Osprey						r	r				x?						r				
American Swallow-tailed Kite																a					
Bald Eagle								r		r		r		r		r					
Northern Harrier								x		x	x	x	x		x	c		x	x	x	x
Sharp-shinned Hawk		x		x	x	x		x		x		x		c		c	u	x		x	x

219.227

# New York Sites

Species:	Season:	KP				RP				VC				PB				AP			
		S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Cooper's Hawk									x					r	u			x	x		
Northern Goshawk															u						
Red-shouldered Hawk		x		x	x			x	x					r	c						
Broad-winged Hawk						x		x		x	x			x	x						
Red-tailed Hawk		x		x	x	x		x	x	x		x	x	x*	c			x		x	x
Rough-legged Hawk								x							c						
American Kestrel		x*	x	x	x	x		x		x?				x	c			x*	x	x	x
Merlin		x		x										r		r					
Peregrine Falcon		x		x				r						r	r	u					
Ring-necked Pheasant		x*	x	x	x	x*	x	x	x	x*	x	x	x	x*	c			x*	x	x	x
Northern Bobwhite															x	*2					
Yellow Rail														r							
Clapper Rail														x*	u			x			
King Rail																		x <sup>2</sup>			
Virginia Rail		x		x	x									x		r					
Sora																r					
American Coot				x?						x?						u					
Black-bellied Plover														x		x					
Semipalmated Plover														x		x					
Piping Plover														r							
Killdeer		x*	x	x	x					x	x	x		r*	c			x*	x	x	x
American Oystercatcher															r						
Greater Yellowlegs		x	x	x										x		x	u	x	x	x	
Lesser Yellowlegs				x?										x		x	r	x	x	x	x
Solitary Sandpiper		x		x						x	x	x		x		x					
Spotted Sandpiper		x		x				x		x	x	x			x						
Upland Sandpiper														r							

220 228

New York Sites

Species:	Season:	KP				RP				VC				PB				AP			
		S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Ruddy Turnstone														r		r					
Sanderling																c					
Semipalmated Sandpiper					x?									x		x					
Least Sandpiper														x		x					
White-rumped Sandpiper														x		x	r				
Purple Sandpiper																	u				
Dunlin														x		x	u				
Short-billed Dowitcher														r							
Common Snipe		x	x	x										r		u		x	x	x	x
American Woodcock		x	x	x						x	* <sup>1</sup> x	x		x*		u		x	x	x	x
Wilson's Phalarope														r							
Laughing Gull		x	x	x		x	x							x		r		x	x	x	
Bonaparte's Gull					x									r		u					x
Ring-billed Gull		x	x	x	x	x	x	x	x	x	x	x	x	x		c		x	x	x	x
Herring Gull		x	x	x	x	x	x	x	x	x	x	x	x	x		c		x	x	x	x
Iceland Gull														r <sup>2</sup>		u					
Lesser Black-backed Gull																r					
Glaucous Gull																u					
Great Black-backed Gull					x	x	x	x	x	x	x	x	x	x		c		x		x	x
Common Tern														x		x					
Forster's Tern																r					
Least Tern																r <sup>1</sup>					
Black Skimmer														x							
Razorbill																	r <sup>2</sup>				
Rock Dove		x*	x	x	x	x	x	x	x	x	* <sup>1</sup> x	x	x	x*		c		x*	x	x	x
Mourning Dove		x*	x	x	x	x	x	x	x	x	* <sup>1</sup> x	x	x	x*		c		x*	x	x	x
Budgerigar																r					

224 229

# New York Sites

Species:	Season:	KP				RP				VC				PB				AP			
		S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Monk Parakeet						r								r			r				
Black-billed Cuckoo		x	x	x																	
Yellow-billed Cuckoo						r		r						x*							
Common Barn-Owl														r*	u		x	x	x	x	
Eastern Screech-Owl						x*	x							x	u						
Great Horned Owl				x	x			x	x			x?		x*	c						
Snowy Owl																	r				
Barred Owl																	u				
Long-eared Owl				x	x							x					u				
Short-eared Owl				x	x									r			u				
Northern Saw-whet Owl																	u				
Common Nighthawk								x						x	x*	x					
Chimney Swift		x	x	x		x	x					x?		x*							
Ruby-throated Hummingbird		x	x	x		x		x				x?		r	r						
Belted Kingfisher		x	x	x	x			x				x + x		x*	c		x	x	x	x	
Red-headed Woodpecker														r		r	r				
Red-bellied Woodpecker		x		x	x	x	x	x	x			x?		x*	u		x	x	x	x	
Yellow-bellied Sapsucker		x		x	x	x		x	x						r	r					
Downy Woodpecker		x*	x	x	x	x*	x*	x	x			x + x	x	x	x*	c		x*	x	x	x
Hairy Woodpecker		x		x	x	x			x					x*	c		x	x	x	x	
Northern Flicker		x*	x	x	x	x*	x*	x	x			x + x	x		x*	c		x	x	x	x
Pileated Woodpecker												x	x		r	r					
Eastern-Wood Pewee		x	x	x		x		x				x?					x*				
Yellow-bellied Flycatcher		x			x																
Willow Flycatcher		x			x							x + x					x*				
Least Flycatcher		x			x												x*				
Eastern Phoebe		x	x	x		x		x				x?					x + r				

222 230

New York Sites

Species:	Season:	KP				RP				VC				PB				AP			
		S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Great Crested Flycatcher		x		x		x		x		x?				x*							
Eastern Kingbird		x*	x	x		x	x	x		x	*x			x*							
Horned Lark		x	x	x	x												u				
Purple Martin						x															
Tree Swallow		x	x	x						x?				x							
Northern Rough-winged Swallow										x?				x*							
Bank Swallow														x		x					
Barn Swallow			x?			x		x		x?				x*							
Blue Jay		x	x	x	x	x*	x*	x	x	x	*x	x	x	x*	c			x*	x	x	x
American Crow		x	x	x	x	x*	x*	x	x	x	*x	x	x	x*	c			x	x	x	x
Fish Crow		x	x	x	x	x	x	x	x		x?			x*	c			x	x	x	x
Black-capped Chickadee					x	x*	x*	x	x	x	*x	x	x	x*	c			x	x	x	
Tufted Titmouse					x	x*	x*	x	x		x?			x*	c						x
Red-breasted Nuthatch					x	x		x						x		x	u			x	
White-breasted Nuthatch					x	x*	x*	x	x		x?			x*	c					x	
Brown Creeper					x	x		x	x					x	r*	x	u			x	
Carolina Wren						x		x								r	r				
House Wren						x*	x*	x		x?				x*		r					
Winter Wren					x	x		x									u				
Sedge Wren														x	*2	r					
Marsh Wren														x*		u		x*	x	x	x
Golden-crowned Kinglet		x		x	x	x		x		x?							u				
Ruby-crowned Kinglet		x		x	x	x		x		x?							r				
Blue-gray Gnatcatcher		x		x		x		x		x?				r	r						
Eastern Bluebird										x	x			r							
Veery		x		x		x		x								r?					
Gray-checked Thrush			x?											x		x					

New York Sites

Species:	Season:	KP				RP				VC				PB				AP			
		S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Swainson's Thrush		x?				x		x						x		x					
Hermit Thrush				x		x		x									c				
Wood Thrush		x		x		x		x		x*	x	x	x	x*		r		x			
American Robin		x*	x	x	x	x*	x*	x		x	*	x		x*		c		x*	x	x	x
Gray Catbird		x*	x	x	x	x*	x*	x		x	*	x		x*		u		x*	x	x	x
Northern Mockingbird		x*	x	x	x	x	x	x	x	x	!	x		r*		c		x*	x	x	x
Brown Thrasher		x*	x	x	x	x*	x*	x		x	*	x		x*		u		x*	x	x	
Water Pipit		x?															u		x	x	x
Cedar Waxwing		x		x	x	x		x		x	*	x		x		x	u				
European Starling		x*	x	x	x	x*	x*	x	x	x*	x	x	x	x*		c		x*	x	x	x
White-eyed Vireo		x	x	x	x	x								x*							
Solitary Vireo		x	x	x	x	x		x						x		x					
Yellow-throated Vireo		x	x	x	x																
Warbling Vireo		x	x	x	x	x				x*	x	x	x	x*							
Red-eyed Vireo		x	x	x	x	x		x		x*	x	x	x	x*							
Blue-winged Warbler		x	x	x	x	x								x*							
Golden-winged Warbler														x		x					
Tennessee Warbler		x	x	x	x	x								x		x					
Nashville Warbler		x	x	x	x			x		x?							r				
Northern Parula						x		x						x		x					
Yellow Warbler		x*	x	x	x	x*	x	x		x*	x	x	x	x*				x*	x	x	
Chestnut-sided Warbler		x	x	x	x	x		x						r?							
Magnolia Warbler		x	x	x	x	x		x						x		x					
Cape May Warbler		x	x	x	x	x															
Black-throated Blue Warbler		x	x	x	x	x		x						x		x		x		x	
Yellow-rumped Warbler		x	x	x	x	x		x		x?							c	x		x	x
Black-throated Green Warbler		x	x	x	x	x		x						x		x					

224 232

Species:	Season:	New York Sites																					
		KP				RP				VC				PB				AP					
		S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W		
Blackburnian Warbler		x	x	x	x		x		x					x		x							
Pine Warbler		x	x	x	x		x		x								r						
Prairie Warbler		x	x	x	x		x		x					x		x							
Palm Warbler		x	x	x	x		x		x		x?			x		x	r			x			
Bay-breasted Warbler		x	x	x	x		x		x					x		x							
Blackpoll Warbler		x	x	x	x		x		x					x		x							
Black-and-white Warbler		x	x	x	x		x		x		x?					r							
American Redstart		x	x	x	x		x		x		x?			x		x							
Worm-eating Warbler							x																
Ovenbird		x	x	x	x		x		x		x?					x*							
Northern Waterthrush		x	x	x	x		x				x?					r							
Louisiana Waterthrush		x	x	x	x											r							
Kentucky Warbler											x?												
Mourning Warbler							x																
Common Yellowthroat		x*	x	x	x		x*	x*	x		x?					x*		r		x*	x	x	
Hooded Warbler							r																
Wilson's Warbler		x	x	x	x		x		x					x		x							
Canada Warbler		x	x	x	x		x		x					x		x							
Yellow-breasted Chat									r														
Scarlet Tanager		x			x		x		x					x		x	r						
Northern Cardinal		x*	x	x	x		x*	x*	x	x	x	x	x	x		r*		c		x*	x	x	x
Rose-breasted Grosbeak		x			x	x	x*	x	x		x?					x*							
Indigo Bunting		x*	r		x		x				x?					x*							
Rufous-sided Towhee		x			x		x		x		x	x				x*		c					
American Tree Sparrow		x			x	x							x					c			x		
Chipping Sparrow		x*	x	x	x				x		x*	x	x	x		x*		u			x		
Field Sparrow			x?															c		x		x	x

225 233



New York Sites

Species:	Season:	KP				RP				VC				PB				AP			
		S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W
Vesper Sparrow														r *1,2	u						
Savannah Sparrow		x		x	x			x						r		c					
Grasshopper Sparrow														x *2							
Sharp-tailed Sparrow														x*	r						
Seaside Sparrow					.									x *2	r						
Fox Sparrow		x		x	x				x							c	.	x		x	x
Song Sparrow		x*	x	x	x	x*	x*	x	x	x *	x			x*	c			x*	x	x	x
Lincoln's Sparrow															x						
Swamp Sparrow				x?		x		x		x?				x*	c			x	x	x	x
White-throated Sparrow		x		x	x	x		x	x	x?						c		x		x	x
White-crowned Sparrow								r								r <sup>2</sup>					
Dark-eyed Junco					x			x	x			x				c					x
Lapland Longspur																r					
Snow Bunting																r	r				
Bobolink		x		x										r	r						
Red-winged Blackbird		x*	x	x	x	x*	x	x		x *	x			x*	c			x*	x	x	x
Eastern Meadowlark		x	x	x	x											c					
Rusty Blackbird				x?						x?						u		x		x	
Common Grackle		x	x	x		x*	x*	x		x *	x	x	x	x*	c			x*	x	x	x
Brown-headed Cowbird		x	x	x		x	x*	x		x*	x	x	x	x*	c			x*	x	x	x
Orchard Oriole						x								x*							
Northern Oriole		x*	x	x		x*	x*	x		x*	x	x	x	x*	r			x	x	x	
Pine Grosbeak																r					
Purple Finch					x				r			x?				u		x		x	
House Finch		x	x	x	x	x	x	x	x	x *	x	x		x*	c			x*	x	x	x
Common Redpoll									x							r		x		x	
Pine Siskin					x											u		x		x	

220 234

Species:	Season:	New York Sites																			
		KP				RP				VC				PB				AP			
		S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W	S	S	F	W

---

American Goldfinch		x	x	x	x	x	x	x	x	x	*	x			x	*	c		x	*	x	x	x	
European Goldfinch																	r <sup>2</sup>							
Evening Grosbeak																	r							
House Sparrow		x	*	x	x	x	x	x	x	x	*	x	x	x		x	*	c		x	*	x	x	x
Black-hooded Parakeet																	r							
Sum: Spring/Fall		110		114		103		103		57		50		54		56		73		78				
Sum: Summer/Winter		89		91		47		38		91		38		115		154		50		63				
Grand sum:		136				130				108				238				86						

227 235

# New York Sites

Species:      Season:      III

                         S   S   F   W

Common Loon	x	x	x	
Double-crested Cormorant	x		x	
Great Blue Heron	x	x		
Green-backed Heron		x		
Mute Swan	x			
Canada Goose	x	x	x	x
Wood Duck	x	x	x	
Am. Black Duck	x	x	x	
Mallard	x	x	x	x
Ring-necked Duck	x			
Bufflehead			x	
Turkey Vulture			x	
Osprey			x	
Northern Harrier	x		x	
Sharp-shinned Hawk	x		x	
Red-shouldered Hawk			x	
Broad-winged Hawk	x		x	
Red-tailed Hawk			x	x
American Kestrel	x		x	x
Merlin			x	
Ring-necked Pheasant	x		x	x
Lesser Yellowlegs			x	
Solitary Sandpiper	x			
Spotted Sandpiper	x	x		
Common Snipe			x	x
American Woodcock			x	x
Ring-billed Gull	x	x	x	x

~~228~~ 236

New York Sites

Species:	Season:	HH			
		S	S	F	W
Herring Gull		x	x		
Rock Dove		x	x	x	x
Mourning Dove		x	x	x	x
Black-billed Cuckoo		x	x	x	
Yellow-billed Cuckoo		x	x	x	
Eastern Screech-Owl			x	x	
Great Horned Owl				x	x
Common Nighthawk			x		
Chimney Swift		x	x	x	
Ruby-throated Hummingbird		x	x	x	
Belted Kingfisher		x	x	x	
Red-bellied Woodpecker		x		x	x
Yellow-bellied Sapsucker				x	
Downy Woodpecker		x	x	x	x
Hairy Woodpecker		x	x	x	x
Northern Flicker		x	x	x	x
Pileated Woodpecker		x		x	
Olive-sided Flycatcher		x		x	
Eastern-Wood Pewee		x	x	x	
Least Flycatcher			x		
Eastern Phoebe		x		x	
Great Crested Flycatcher		x	x	x	
Eastern Kingbird		x	x		
Tree Swallow		x	x	x	
Northern Rough-winged Swallow			x		
Barn Swallow		x	x		
Blue Jay		x	x*	x	x

229 237

# New York Sites

Species:	Season:	III			
		S	S	F	W
American Crow		x	x	x	x
Fish Crow		x			
Black-capped Chickadee		x	x	x	x
Tufted Titmouse		x	x*	x	x
White-breasted Nuthatch		x	x	x	x
Brown Creeper		x		x	x
House Wren		x	x*	x	
Winter Wren		x		x	
Golden-crowned Kinglet		x		x	
Ruby-crowned Kinglet		x		x	
Blue-gray Gnatcatcher		x	x	x	
Eastern Bluebird		x		x	
Veery		x	x*	x	
Gray-checked Thrush		x		x	
Swainson's Thrush		x	x	x	
Hermit Thrush		x		x	x
Wood Thrush		x	x	x	
American Robin		x	x*	x	x
Gray Catbird		x	x*	x	
Northern Mockingbird		x	x	x	x
Brown Thrasher		x	x*	x	x
Cedar Waxwing		x	x	x	x
European Starling		x	x*	x	x
White-eyed Vireo				x	
Solitary Vireo		x		x	
Yellow-throated Vireo		x			
Red-eyed Vireo		x	x	x	

230 238

New York Sites

Species:	Season:	Hill			
		S	S	F	W
Blue-winged Warbler		x	x*	x	
Tennessee Warbler		x	x	x	
Nashville Warbler		x	x	x	
Northern Parula		x	x	x	
Yellow Warbler		x	x		
Chestnut-sided Warbler		x	x	x	
Magnolia Warbler		x	x	x	
Cape May Warbler		x		x	
Black-throated Blue Warbler		x		x	
Yellow-rumped Warbler		x		x	
Black-throated Green Warbler		x	x	x	
Blackburnian Warbler		x	x	x	
Pine Warbler				x	
Prairie Warbler		x	x	x	
Palm Warbler		x		x	
Bay-breasted Warbler		x		x	
Blackpoll Warbler		x	x	x	
Black-and-white Warbler		x	x*	x	
American Redstart		x	x	x	
Prothonotary Warbler		x			
Worm-eating Warbler		x	x		
Ovenbird		x	x	x	
Northern Waterthrush		x	x	x	
Mourning Warbler		x	x		
Common Yellowthroat		x	x	x	
Hooded Warbler		x			
Wilson's Warbler		x		x	

271 239

New York Sites

Species:	Season:	HH			
		S	S	F	W
Canada Warbler		x	x	x	
Yellow-breasted Chat				x	
Summer Tanager		x			
Scarlet Tanager		x	x	x	
Northern Cardinal		x	x*	x	x
Rose-breasted Grosbeak		x	x*	x	
Indigo Bunting		x	x		
Rufous-sided Towhee		x	x*	x	
American Tree Sparrow				x	x
Chipping Sparrow		x		x	
Field Sparrow		x	x	x	x
Vesper Sparrow				x	
Fox Sparrow		x		x	
Song Sparrow		x	x*	x	x
Lincoln's Sparrow				x	
Swamp Sparrow		x		x	
White-throated Sparrow		x	x	x	x
Dark-eyed Junco		x		x	x
Bobolink		x			
Red-winged Blackbird		x	x	x	x
Rusty Blackbird				x	
Boat-tailed Grackle					
Common Grackle		x	x*	x	x
Brown-headed Cowbird		x	x	x	
Northern Oriole		x	x*	x	
Purple Finch				x	x
House Finch		x	x	x	x

232 240

New York Sites

Species:      Season:      H H H  
                                 S   S   F   W

Common Redpoll	x			
Pine Siskin	x			
American Goldfinch	x	x	x	x
Evening Grosbeak	x		x	x
House Sparrow	x	x	x	x
Sum: Spring/Fall	115		145	
Sum: Summer/Winter		80		40
Grand sum:			139	

~~222~~ 241



## Sites:

SR- Swimming River Natural Area, NJ  
SH- Sandy Hook, NJ  
CH- Cheesquake Natural Area, NJ  
HM- Hackensack Meadows, NJ  
LP- Liberty State Park, NJ  
HR- High Rock Park, Staten Island  
PA- Poillon Avenue Wetlands, Staten Island  
SI- Staten Island  
JB- Jamaica Bay, Brooklyn  
NS- Northwestern Staten Island  
FB- Floyd Bennett Field, Brooklyn  
MP- Marine Park, Brooklyn  
CP- Cunningham Park, Queens  
UC- Udall's Cove and Ravine, Queens  
FP- Forest Park, Queens  
KP- Kissena Park, Queens  
RP- Riverdale Park, Bronx  
VC- Van Cortland Park, Bronx  
PB- Pelham Bay Park, Bronx  
AP- Alley Pond Park, Queens  
HH- Hastings-on-Hudson, NY

## Occurrence:

x- present  
c- common  
u- uncommon  
r- rare  
a- accidental  
\*- breeding  
x<sup>1</sup> - unconfirmed  
x<sup>2</sup> - past

234 242

Occurrence:

?- no season information

Status:

SR- no information

SH- spring data: number of years recorded

March

c = 8-16/16 years

u = 3-7/16 years

r = 1-2/16 years

May

c = 3-6/6 years

u = 2/6 years

r = 1/6 years

summer data: number of nesting pairs

c = 70-575 pairs

u = 8-40 pairs

r = 1-5 pairs

Where data were present on non-breeders they were also listed.

CH- c = "very numerous species" and "certain to be seen in suitable habitat"

u = "present but not certain to be seen" and "seen only a few times per season"

r = "seen only once every 1-5 years"

HM- c = "should see"

u = "might see"

r = "seldom see"

LP- no information

HR- no information

PA- no information

SI- "r" used for "rarities"

JB- c = "more than 50 individuals recorded every visit" and "10-50 individuals usually recorded every visit"

u = "1-9 individuals per visit, often missed"

r = "only a few individuals recorded throughout the season, often missed"

FB- some status information given but no category explanation provided

225 243

Status:

MP- no information

CP- mark used to denote rare or one time sighting transcribed as 'r'

UC- no information

FP- see CP, rare sighting notation without seasonal information transcribed as 'r?'

KP- no information

RP- see CP

VC- see CP

AP- no information

PB- winter data: Christmas Bird Count

c = 15-31/31 years

u = 5-14/31 years

r = 1-4/31 years

other seasons: 'r' used for one time sighting

230 244

Species	New Jersey and New York Sites							
	SR	SH	CH	HM	LP	HR	MF	GK
Opossum	x	p	x	x		x		o
Short-tailed Shrew	x	p		x				p
Masked Shrew				x		x		
Star-nosed Mole	x							
Eastern Mole	x			x				
Little Brown Myotis	x	m		x				m
Keen's Myotis				x				
Small-footed Myotis				x				
Big Brown Bat				x				
Red Bat		m						
Raccoon	x	p	x	x	x	x	p	o
Longtail Weasel	x		x	x				
Mink	x		x					
Striped Skunk	x		x	x				
Red Fox		o	x	x				
Grey Fox	x		x	x				
Dog		p		x			p	p
Cat		p		x			p	p
Harbor Seal		b						
Woodchuck	x		x					
Eastern Chipmunk	x		x	x		x		
Eastern Gray Squirrel	x	p	x	x		x	p	p
Red Squirrel			x					
Southern Flying Squirrel	x		x					
Beaver	x							
White-footed Mouse	x	p		x	x	x		p

237 245

Species	New Jersey and New York Sites							
	SR	SH	CH	HM	LP	HIR	MF	GK
Meadow Vole	x	p	x	x	x	x		p
Muskrat	x	p	x	x	x	x	p	p
Norway Rat	x	p		x	x			
House Mouse	x	p		x				p
Meadow Jumping Mouse				x				
Eastern Cottontail	x	p	x	x	x	x	p	p
White-tailed Deer			x					
Sperm Whale		b <sup>#</sup>						
Atlantic Bottlenose Dolphin		b						
Sum:	21	18	16	24	6	9	6	12

~~238~~ 246

## Species

## New York Sites

	BP	FT	FB	PL	BB	CA	PE	FA
Little Brown Myotis	m	m						
Red Bat		m						
Raccoon		o	o					
Dog	p	p	p	p	p	p	p	p
Cat	p	p	p	p	p	p	p	p
Harbor Seal	b							
Eastern Gray Squirrel		p	p					
White-footed Mouse		p			p			
Meadow Vole	p	p	p		p		p	p
Muskrat			p					
Norway Rat	p	p	p			p	p	p
Black Rat		x <sup>1</sup>						
House Mouse	p	p	p					
Eastern Cottontail		p	p		p	p		
Sperm Whale			b <sup>#</sup>					
Sum:	7	12	10	2	5	4	4	4

239 247

## Species

## New York Sites

	SC	RB	CR	RU	SU	JO	MP	NS
Opossum		o						x
Masked Shrew	o							
Eastern Mole								x
Little Brown Myotis		m						x
Silver-haired Bat		m						
Red Bat		m						x
Hoary Bat		m						x
Raccoon		o						x
Mink		e						
Dog	p	p						
Cat	p	p						
Harbor Seal						b		
Eastern Chipmunk		i						
Eastern Gray Squirrel	p	p						x
White-footed Mouse	p	p						x
Meadow Vole	p	p				p	x	x
Muskrat	p	p		p		p		x
Norway Rat	p	p	p			p	x	x
House Mouse	p	p	p			p	x	
Black-tailed Jackrabbit						p		
Eastern Cottontail	p	p				p	x	x
Atlantic Bottlenose Dolphin					b			
Sum:	10	17	2	1	1	7	4	12

240 248

Species	New York Sites							
	CP	UC	FP	KP	AP	RP	VC	PB
Opossum	x	x	x		x		x	x
Short-tailed Shrew	x		x			x		x
Masked Shrew					x			
Star-nosed Mole					x			
Eastern Mole	x		x	x	x	x	x	x
Little Brown Myotis			x					x
Silver-haired Bat								x <sup>1</sup>
Big Brown Bat								x
Red Bat			x			x		
Raccoon	x	x	x		x	x	x	c
Mink					x			x
Striped Skunk			x				x	x
Red Fox					x			x
Gray Fox								x <sup>1</sup>
Cat	x		x			x		
Harbor Seal								b
Hooded Seal								r <sup>2</sup>
Woodchuck							x	
Eastern Chipmunk	x	x	x		x	x	x	u
Eastern Gray Squirrel	x	x	x	x	x	x	x	c
Southern Flying Squirrel			x		x	x		x
White-footed Mouse			x	x	x	x		x
Meadow Vole	x	x	x	x	x	x	x	x
Muskrat		x			x		x	x
Norway Rat	x	x	x	x	x	x	x	x
Black Rat		x	x					
House Mouse	x				x	x		x
Eastern Cottontail	x	x	x	x	x	x	x	x

241-249



## Species

## New York Sites

CP

UC

FP

KP

AP

RP

VC

PB

White-tailed Deer

x

x<sup>2</sup>

Atlantic Bottlenose Dolphin

r<sup>2</sup>

Sum:

11

9

16

6

16

13

12

24

242 250

Sites:

SR- Swimming River Natural Area, NJ  
 SH- Sandy Hook, NJ  
 CH- Cheesapeake Natural Area, NJ  
 HM- Hackensack Meadows, NJ  
 LP- Liberty State Park, NJ  
 IIR- High Rock Park, Staten Island  
 MF- Miller Field, Staten Island  
 GK- Great Kills, Staten Island  
 BP- Breezy Point Tip, Queens  
 FT- Fort Tilden, Queens  
 FB- Floyd Bennett Field, Brooklyn  
 PL- Plum Beach, Brooklyn  
 BB- Bergen Beach, Brooklyn  
 CA- Canarsie Pier area, Brooklyn  
 PE- Pennsylvania Avenue Landfill, Brooklyn  
 FA- Fountain Avenue Landfill, Brooklyn  
 SC- Spring Creek, Brooklyn  
 RB- Ruler's Bar Hassock, Queens/Brooklyn  
 CR- Canarsie Pol, Brooklyn  
 RU- Ruffle Bar, Brooklyn  
 SU- Subway Island, Queens  
 LE- Little Egg Island, Queens  
 JO- JoCo Marsh, Queens  
 MP- Marine Park, Brooklyn  
 NS- Northwestern Staten Island  
 CP- Cunningham Park, Queens  
 UC- Udall's Cove and Ravine, Queens  
 FP- Forest Park, Queens  
 KP- Kissena Park, Queens  
 AP- Alley Pond Park, Queens

243 251

RP- Riverdale Park, Bronx

VC- Van Cortland Park, Bronx

PB- Pelham Bay Park, Bronx

Occurrence:

x- reported present

p- viable, resident population present

m- occurs as a migrant

b- pelagic marine species, occurs in ocean and bays

c- recently extirpated

i- introduced by National Park Service to establish/restore a population or augment a declining population.

Unless accompanied by a "p", the transplanted population has not definitely been established.

o- occasional individuals recorded, possibly released, no evidence of established breeding population

#- this and other whale species occur in ocean waters off Gateway

x<sup>1</sup> - unconfirmed

x<sup>2</sup> - past

244 252

Table 2. Occurrence of reptiles and amphibians at natural areas in the New York-New Jersey Harbor region.

Species	New Jersey and New York Sites								
	SR	SH	HM	LP	HR	PA	MF	SI	NS
Snapping Turtle	x	p	x		x	x	o	c	x
Stinkpot (Musk Turtle)	x		x					c	
Eastern Mud Turtle	x	x <sup>1</sup>	x			x		x	
Spotted Turtle		p	x			x		u	
Bog Turtle								r	
Wood Turtle						x		c	
Eastern Box Turtle	x	o			x	x		c	
Northern Diamondback Terrapin		p	x	x				u	x
Eastern Painted Turtle	x	p	x	x	x	x		c	x
Atlantic Green Turtle		b							
Atlantic Loggerhead		b							
Atlantic Ridley		b							
Atlantic Leatherback		b							
Eastern Fence Lizard									x
Northern Five-lined Skink			x						
Northern Water Snake	x		x		x	x		c	
Northern Brown Snake		p	x			x	p	c	
Northern Red-bellied Snake	x								
Eastern Garter Snake	x		x		x		x <sup>1</sup>	c	x
Eastern Ribbon Snake			x					e <sup>1</sup>	
Eastern Hognose Snake	x	e	x					e <sup>1</sup>	
Northern Ringneck Snake					x			u	
Eastern Worm Snake								r	
Northern Black Racer	x	e <sup>1</sup>	x		x	x		u	x
Eastern Smooth Green Snake			x					e <sup>1</sup>	
Eastern King Snake	x								
Eastern Milk Snake	x	o	x			x		u	

245 253

Species	New Jersey and New York Sites								
	SR	SH	HM	LP	IIR	PA	MF	SI	NS
Marbled Salamander								c	
Spotted Salamander								c	
Red-spotted Newt					x			u	
Northern Dusky Salamander								c	
Red-backed Salamander	x				x		p	c	x
Four-toed Salamander	x							c	x
Northern Red Salamander	x							x	
Northern Two-lined Salamander					x			c	
Eastern Spadefoot								r	
American Toad			x						x
Fowler's Toad	x	e,i	x	x		x	p	u	x
Northern Cricket Frog			x			x		u	
Northern Spring Peeper	x		x		x		x <sup>1</sup>	c	x
Gray Treefrog			x					u	x
Southern Chorus Treefrog								x <sup>2</sup>	
New Jersey Chorus Treefrog	x		x						
Bullfrog	x		x		x	x		u	x
Green Frog	x		x		x		x	c	x
Northern Leopard Frog	x							c	
Southern Leopard Frog			x		x	x <sup>3</sup>			x
Pickered Frog			x			x		c	
Wood Frog	x				x			c	
Sum:	22	15	25	3	15	15	7	38	15

246254

Species	New York Sites							
	GK	BP	FT	FB	BB	CA	SC	RB
Snapping Turtle	o			o		o		i
Eastern Box Turtle	o		o	i				i
Northern Diamondback Terrapin	p			p				p
Eastern Painted Turtle	o							i
Red-eared Slider	o							o
Atlantic Loggerhead			b					b
Northern Brown Snake	p		i	i	p			i,p
Eastern Garter Snake	p		p	p	p		p	p
Eastern Hognose Snake		i						
Northern Black Racer				i				i
Eastern Smooth Green Snake				i				i
Eastern Milk Snake								i
Spotted Salamander								i
Red-spotted Newt								o
Red-backed Salamander	p			i				i,p
Eastern Spadefoot								i
Fowler's Toad	p	p	p	p,i	o			i
Northern Spring Peeper	p	i	i	i				i,p
Gray Treefrog								i
Green Frog	o							i
Sum:	11	3	6	10	3	1	1	19

247 255

Species	New York Sites								
	MP	CP	UC	FP	KP	AP	RP	VC	PB
Snapping Turtle					x	x		x	x
Eastern Mud Turtle			x			x			
Eastern Box Turtle		x		x		x			x
Northern Diamondback Terrapin			x		x	x			x
Eastern Painted Turtle			x		x	x		x	
Northern Water Snake			x						
Northern Brown Snake	x				x		x		x
Eastern Garter Snake						x	x	x	x
Spotted Salamander						x			
Red-spotted Newt									x
Red-backed Salamander				x			x		x
Two-lined Salamander						x			
American Toad				x					x
Fowler's Toad			x			x			
Northern Spring Peeper		x				x			
Gray Treefrog		x				x			
Bullfrog						x		x	x
Green Frog								x	x <sup>1</sup>
Northern Leopard Frog						x			
Wood Frog								x	
Sum:	1	3	5	3	4	13	3	6	10

248 256

# KEY TO TABLE 3

## Sites:

SR- Swimming River Natural Area, NJ  
SII- Sandy Hook, NJ  
HM- Hackensack Meadows, NJ  
LP- Liberty State Park, NJ Natural Area  
HR- High Rock Park, Staten Island  
PA- Poillon Avenue Wetlands, Staten Island  
MF- Miller Field, Staten Island  
SI- Staten Island  
NS- Northwestern Staten Island  
GK- Great Kills, Staten Island  
BP- Breezy Point Tip, Queens  
FT- Fort Tilden, Queens  
FB- Floyd Bennett Field, Brooklyn  
BB- Bergen Beach, Brooklyn  
CA- Canarsie Pier area, Brooklyn  
SC- Spring Creek, Brooklyn  
RB- Ruler's Bar Hassock, Queens/Brooklyn  
MP- Marine Park, Brooklyn  
CP- Cunningham Park, Queens  
UC- Udall's Cove and Ravine, Queens  
FP- Forest Park, Queens  
KP- Kissena Park, Queens  
AP- Alley Pond Park, Queens  
RP- Riverdale Park, Bronx  
VC- Van Cortland Park, Bronx  
PB- Pelham Bay Park, Bronx

## Occurrence:

x- reported present

p- viable, resident population present

249 257



Occurrence:

c- common

u- uncommon

r- rare

b- pelagic marine species, occurs in ocean and bays

e- recently extirpated

i- introduced by National Park Service to establish/restore a population or augment a declining population.

Unless accompanied by a "p", the transplanted population has not definitely been established

o- occasional individuals recorded, possibly released, no evidence of established breeding population

ç- locally extinct

x<sup>1</sup> - unconfirmed

x<sup>2</sup> - past

x<sup>s</sup> - species identification unconfirmed

250 258

APPENDIX D

Maps of Wetlands and Open Space in the  
New York/New Jersey Harbor Estuary

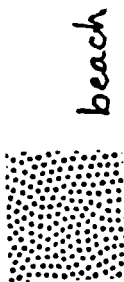
Compiled by

Christina Kalafus-Kaucinger

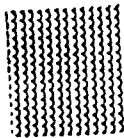
Department of Natural Resources Management and Engineering  
The University of Connecticut

Key to Symbols Used on Habitat Maps

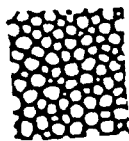
MAPS



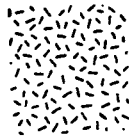
beach



water



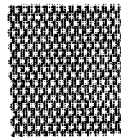
tidal flat



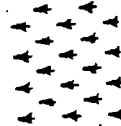
estuarine wetland



palustrine wetland



non wooded open land



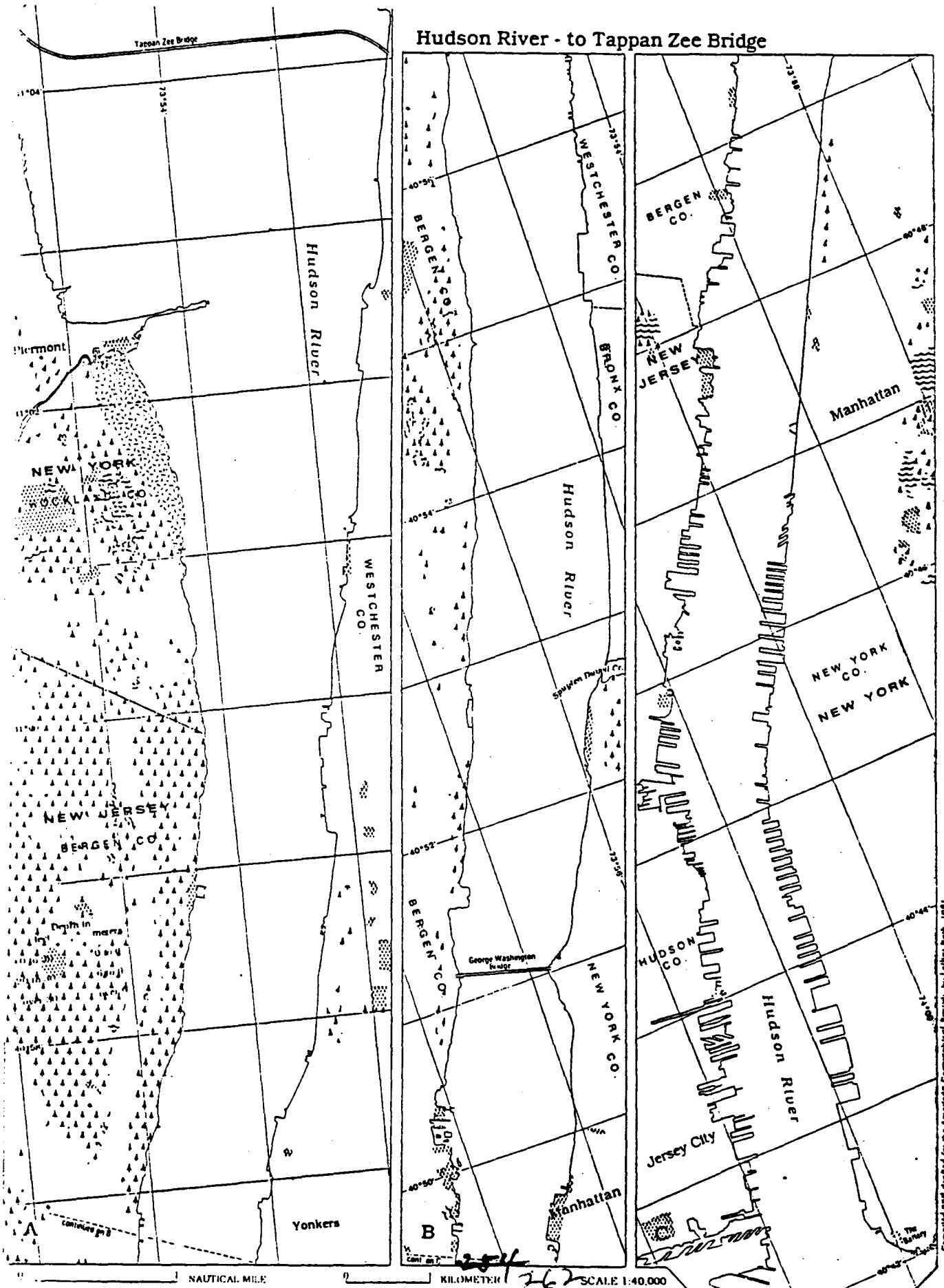
wooded land

1. Hudson River to Tappan-Zee Bridge
2. Upper Bay, New York Harbor
3. Newark Bay - Arthur Kill
4. East River
5. Jamaica Bay
- 6a. Southwestern Staten Island
- 6b. Southern Raritan Bay
- 6c. Sandy Hook Bay
- 6d. Brooklyn, Lower Bay, New York Harbor
7. South Amboy, NJ (topographic sheet)
8. Weehawken, NJ (topographic sheet)
9. Elizabeth, NJ (topographic sheet)



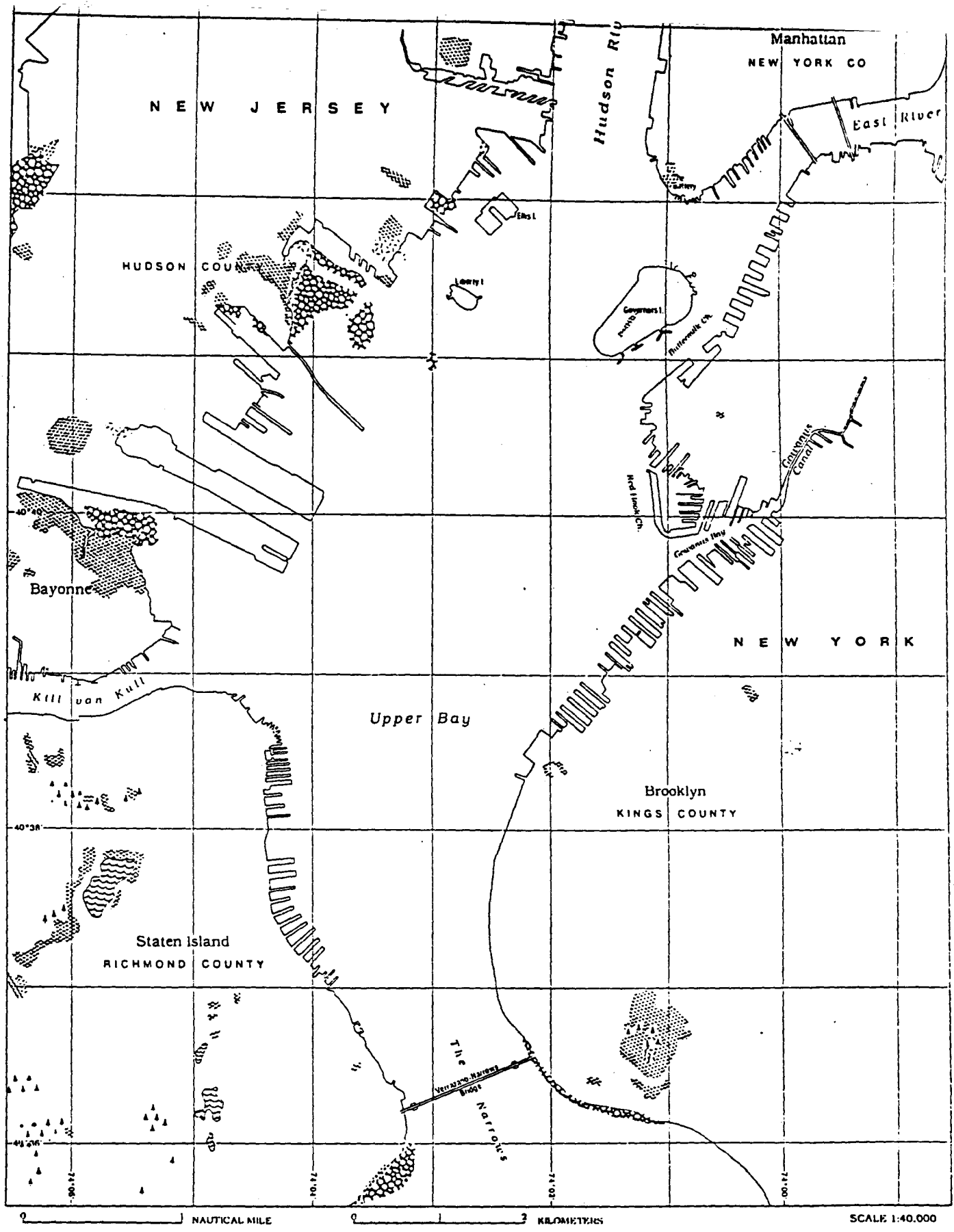
Map 9. Elizabeth, NJ - Based on Elizabeth, NJ Topographic sheet

253 261

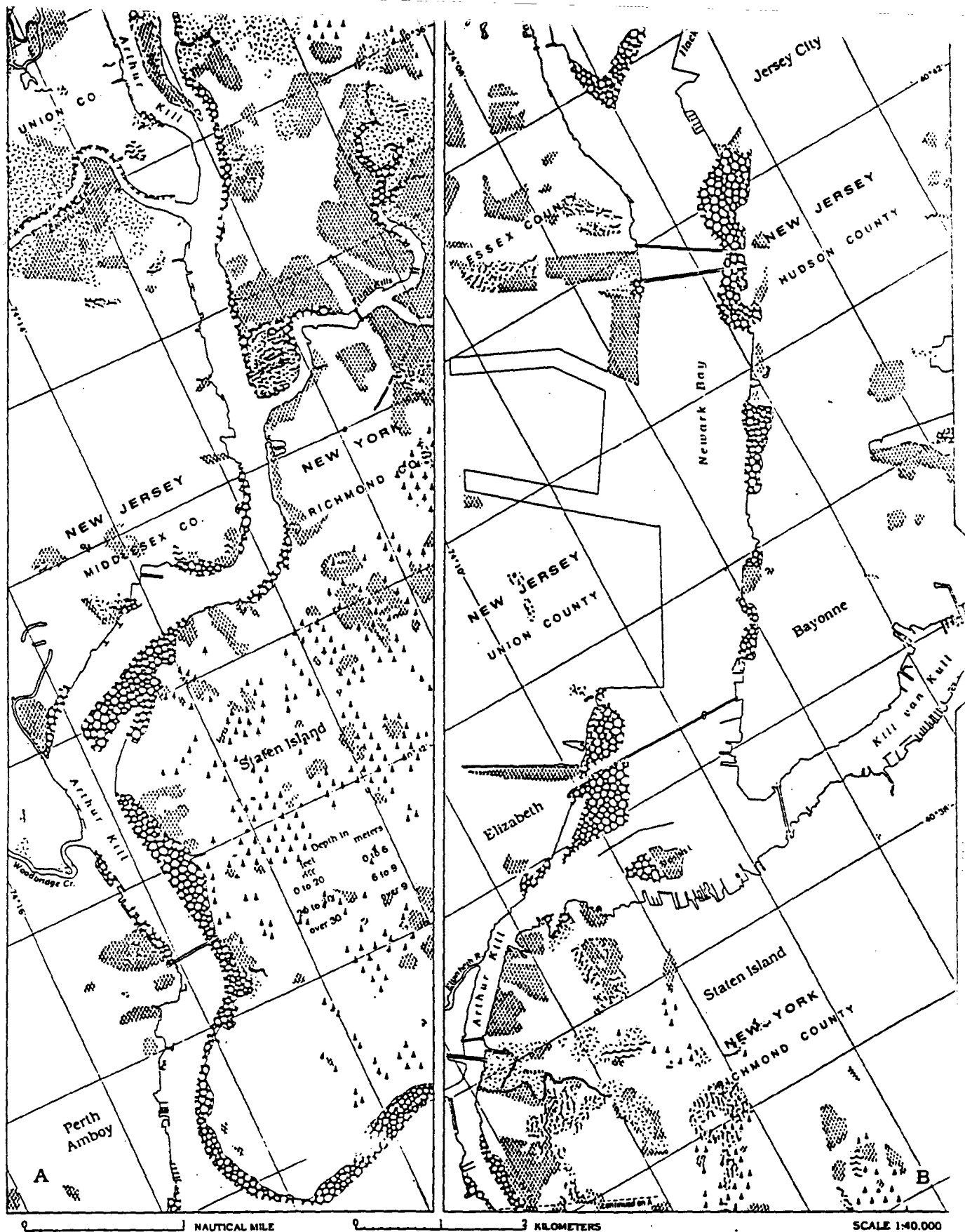


Hudson River - to Tappan Zee Bridge

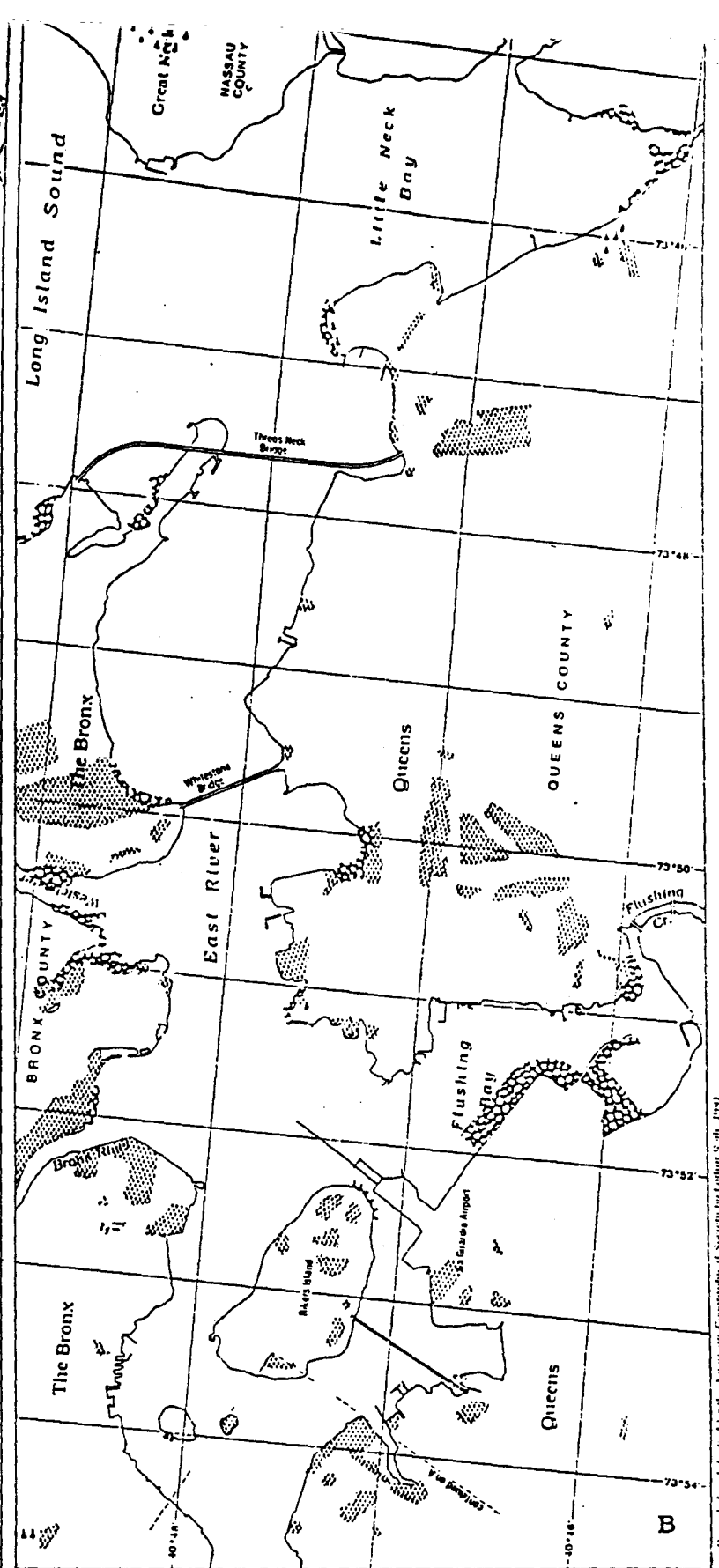
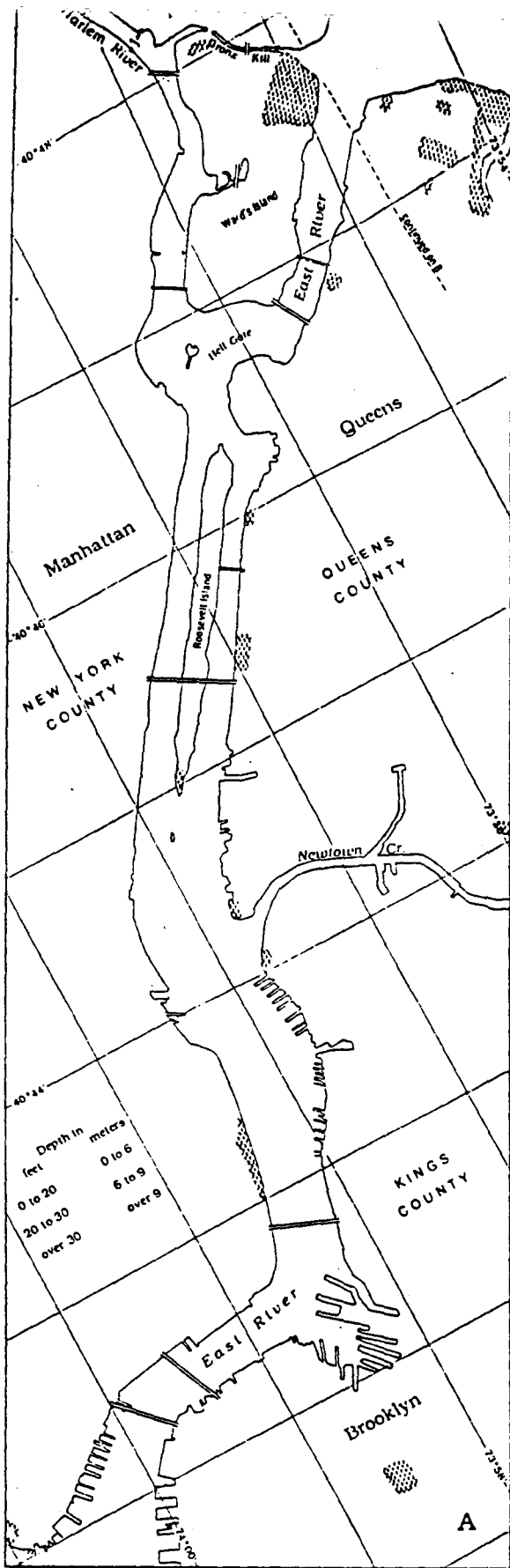
Computed and drafted for the American Geographical Society by Luther Roth 1961.



255 263



256264

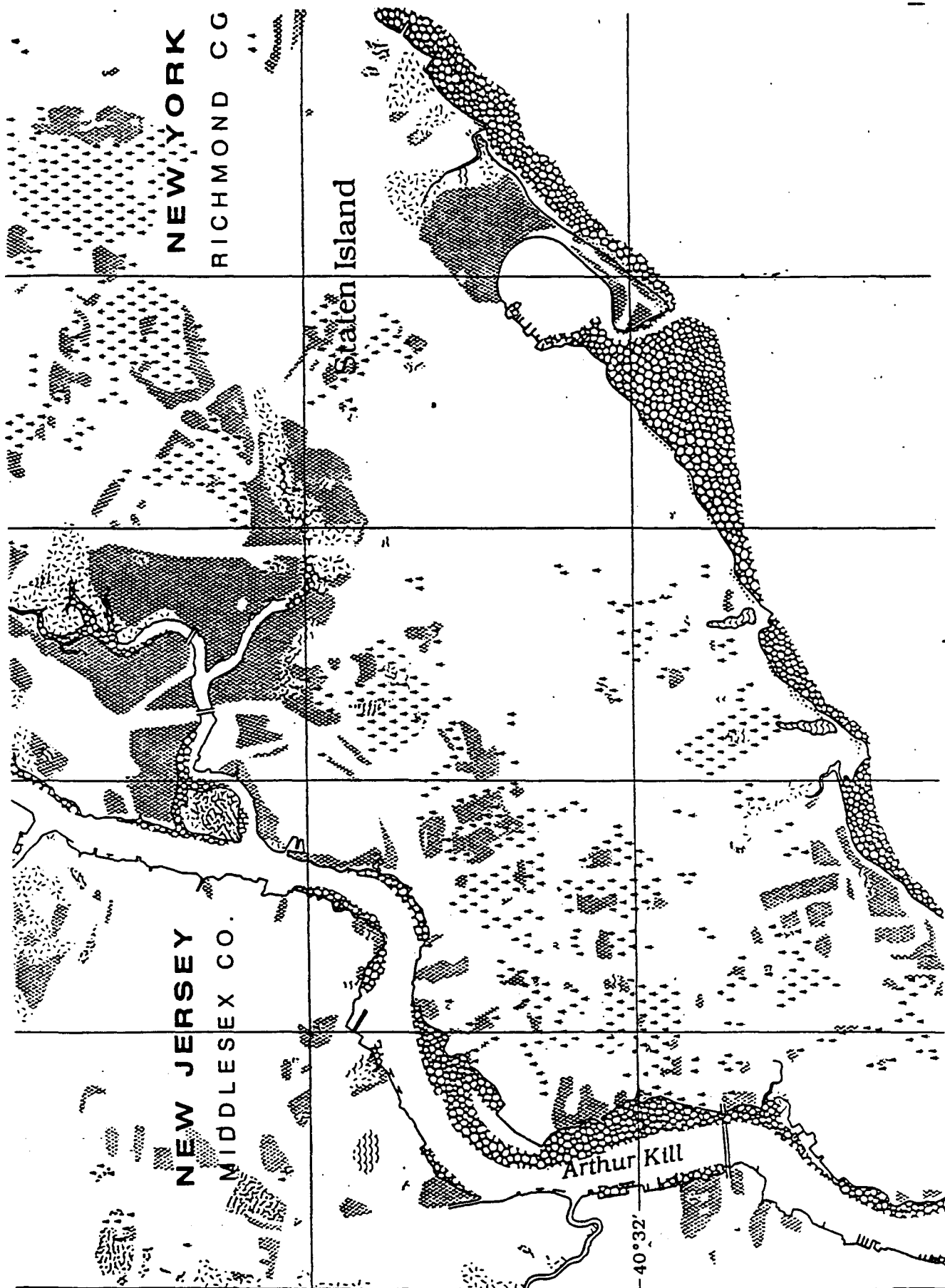


259 265



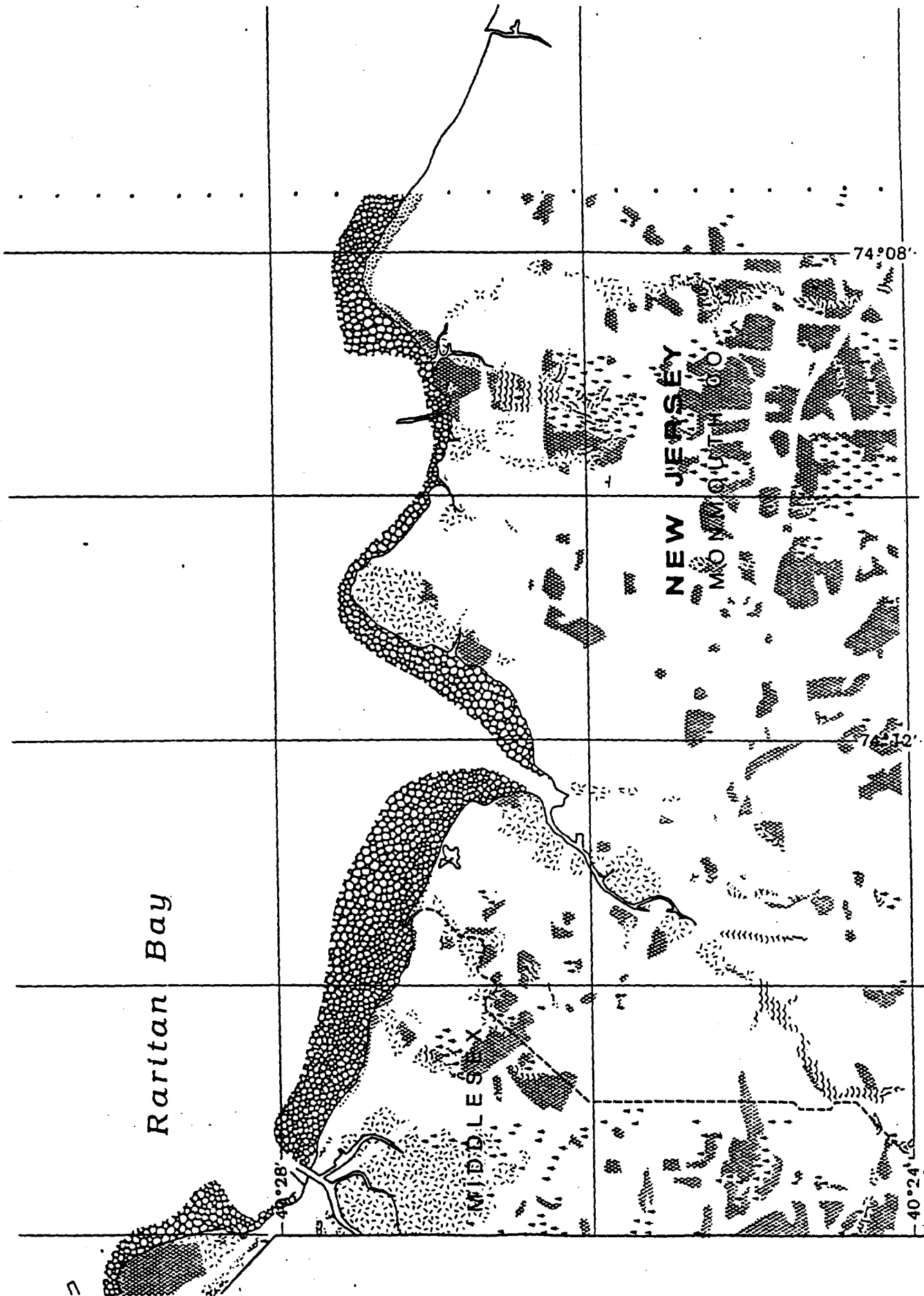
Jamaica Bay





Map 6a. Southwestern Staten Island

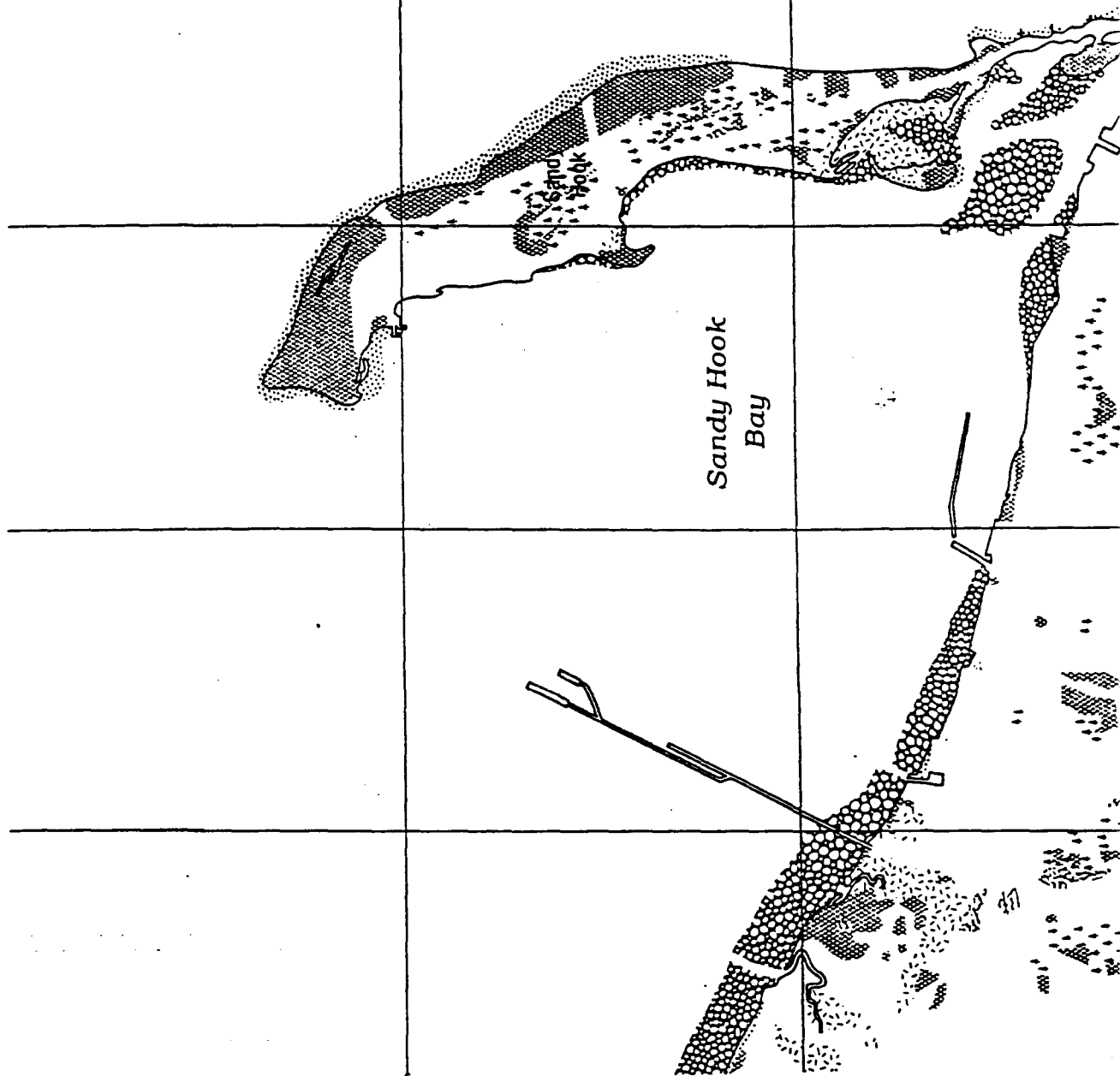
259 267



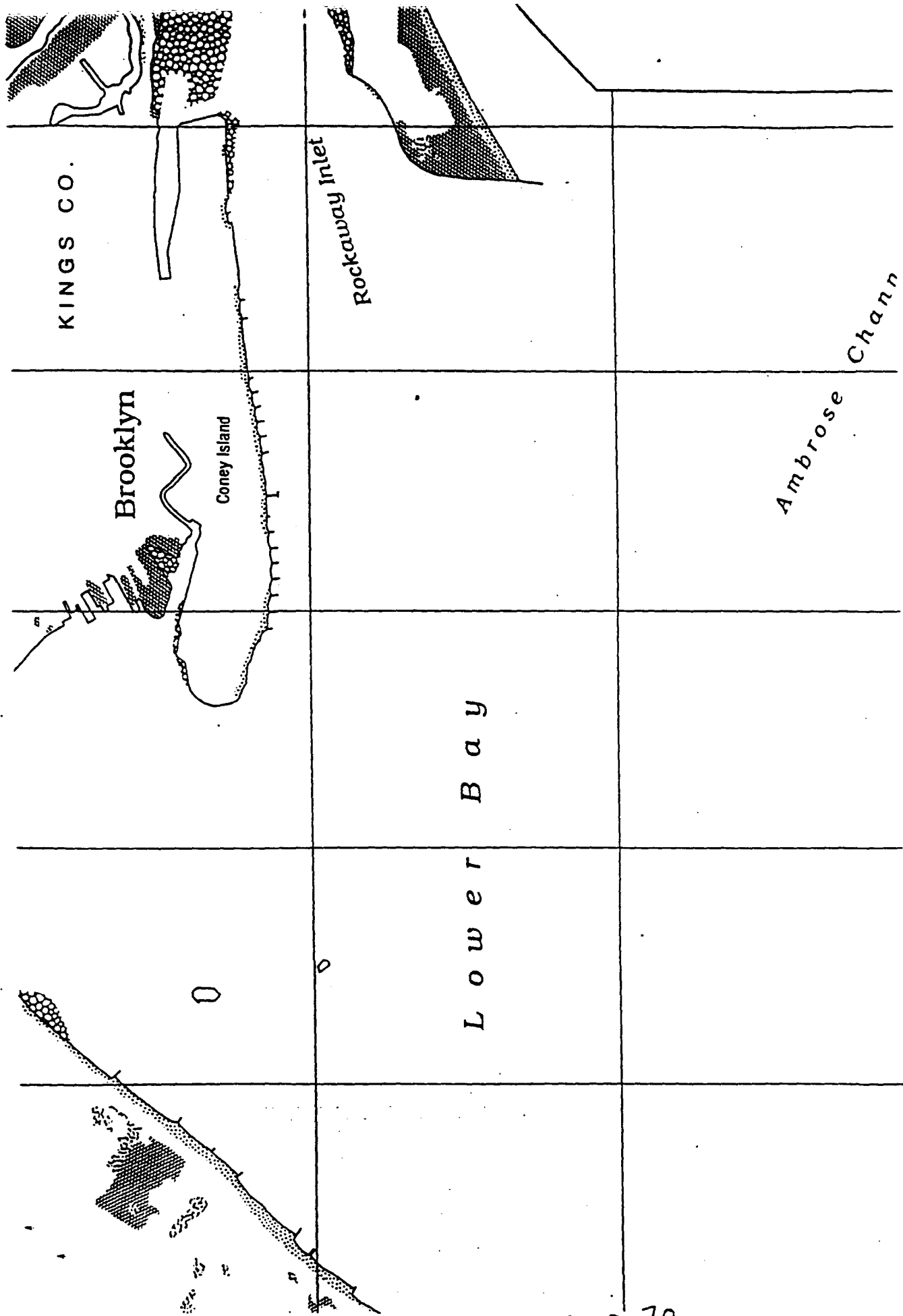
Map 6b. Southern Raritan Bay

260268

Map 6c. Sandy Hook Bay



261 269



Map 6d. Brooklyn - Lower Bay

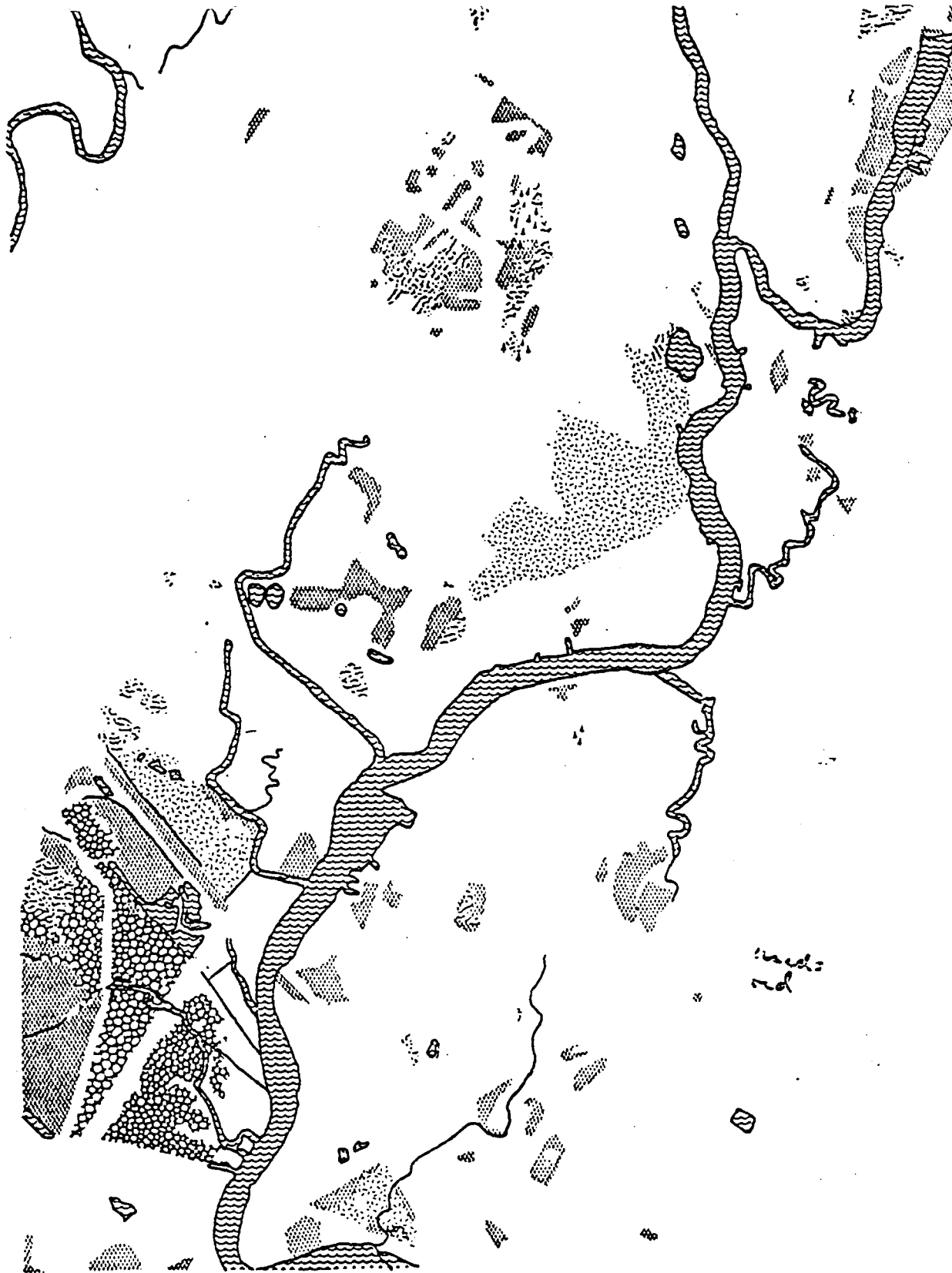
262 270



Next =  
yellow

South Amboy, NJ - Based on South Amboy topographic map

263 271



Map 8. Weehawken NJ - Based on Weehawken, NJ topographic sheet

264 272

APPENDIX E

The Influence of Urban Structure and Human Settlement  
on Birdlife in the  
New York/New Jersey Harbor Estuary

by

Nels Barrett

Department of Ecology and Evolutionary Biology  
The University of Connecticut



**THE INFLUENCE OF URBAN STRUCTURE AND HUMAN SETTLEMENT  
ON BIRDLIFE IN THE NEW YORK/NEW JERSEY HARBOR ESTUARY  
AREA**

Nels Barrett

Ecology and Evolutionary Biology  
The University of Connecticut

266 274

# THE INFLUENCE OF URBAN STRUCTURE AND HUMAN SETTLEMENT ON BIRDLIFE IN THE NEW YORK/NEW JERSEY HARBOR ESTUARY AREA

by

Nels Barrett

Ecology and Evolutionary Biology  
The University of Connecticut

## INTRODUCTION

Urban environments in the New York/New Jersey Harbor Estuary Program (NY/NJ HEP) region vary widely from built-up, densely populated areas, *e.g.* New York County, 64,922 persons/square mile (1990 census) to less built-up, unsettled, and more natural areas, like Jamaica Bay. Urbanization is characterized by extensive modification of the landscape by human design and the dispersion of people in such landscapes. Therefore, depending on the degree of urbanization, a wide spectrum of 'habitats' is produced. These urban habitats may represent original cover, such as, wetlands, woodlands, and parks, or more modified habitats, like gardens, city parks, cemeteries, schoolyards, golf courses, derelict lands, landfills, railyards, petroleum storage areas, commercial/industrial sites, and residential areas.

Of equal importance as the range in the types of habitats, is the scale of the habitat mosaic as imposed by humans. In more rural areas, habitat heterogeneity is influenced by topography, geomorphology, and less intensive land use, often yielding more uniform habitat cover sometimes over a considerable area. In stark contrast, cities, owing to the effects of human culture and technology, exhibit dramatic habitat changes over short distances, creating a small scale habitat mosaic. Therefore, the occupancy of urban habitats by wildlife varies not only with the suitability of a specific habitat to provide essential needs for wildlife in specific habitats, but also upon the influence of the surrounding habitat mosaic.

The analog of island biogeography (MacArthur and Wilson 1967) has been forwarded to explain species distributions on 'habitat islands' of urban ecosystems, but has met with mixed success. Problems with the concept include identifying outside reservoirs for recruitment, separating pseudo-turnover from colonization, and addressing the impacts of human disturbance (Davis and Glick 1978). However, it is clear that the range and

number of habitats must be considered as interrelated, not as separate units. This study examines the influence of the urban landscape on birdlife from a broad, regional perspective. Birds were chosen as the subject of study because more information existed on their distribution in the NY/NJ HEP region than for other organisms.

Birdlife status and habitat suitability for birds of the NY/NJ HEP region were evaluated using an extensive, comparative approach. The aim of this approach was to measure the effects of urban landscape patterns on geographical patterns of bird use and infer a general explanation. To characterize the urban landscape pattern in a manner ecologically meaningful for birds, the 'representativeness' of the habitats were assessed as the measure of the contribution of different habitats to each geographic site. Representativeness is defined as the range in variation of habitats that contribute to the landscape mosaic at each site. Note that representativeness does not simply refer to the notion of typicalness or common occurrence (Austin and Margules 1986). Therefore, changes in habitat representativeness may be used to identify how the surrounding habitat mosaic affects constituent bird communities. Assuming that the distribution of birds is associated with changes in habitat representativeness reflecting bird use, a functional 'guild' approach was used (Root 1967). Although the usefulness of guilds is debated (Bayer and Porter 1988), the results here were expected to be more interpretable and generalizable when the studies conducted at broad scales.

The specific objectives of this study were:

- (1) to characterize the habitat representativeness of selected geographic sites throughout the NY/NJ HEP region,
- (2) to characterize the guild spectrum of those geographic sites according to various ecological bird classifications,
- (3) to evaluate structural habitat categories as determinants of the bird guilds, and
- (4) to determine the influence of urbanization on birdlife.

## METHODS

### Selection of geographical sites:

Twenty sites were selected throughout the NY/NJ HEP region. Sites with adequate information on birds were selected from sources identified in the *Atlas of Parks and Natural Areas Within the Vicinity of NY/NJ Harbor Estuary* (Appendix). These sites collectively represented an adequate geographical coverage of the NY/NJ HEP Study Area.

### Habitat categories:

The relevant habitat attributes had to be chosen to reflect the limits imposed by the broad, regional scale of the study and the need to somehow evaluate wildlife/bird use of habitat. In this study, the working definition of habitat is based on the notion of 'place.' As landscape units, these categories of habitat are defined in broad physiognomic terms. Habitat 'structure' is both ecologically meaningful to birds and wildlife in general and can easily be determined from the field or the literature. Habitat categories were adapted from subclasses of the National Wetland Inventory of the U. S. Fish and Wildlife Service (Cowardin *et al.* 1979) conducted in 1976 and U.S.G.S. 7.5' quadrangle series (Kalafus unpublished maps). Map references, reliability, and dates are listed in the *Atlas* (Appendix). Nine habitat categories were recognized: water, flats, shores, estuarine, palustrine, nonforest, forest, semi-natural, and urban areas (built-up areas that can not be defined by other structural categories of habitat).

### Habitat representativeness

Habitat representativeness is a measure of the range of different habitats found within each site. Throughout the NY/NJ HEP region, habitat representativeness was evaluated using physiognomic criteria. The representation of areal coverage of habitat categories was determined within a circular area of 100 km<sup>2</sup>, centered on each of the designated natural areas (5.6 km radius). Habitat categories were determined at a scale of 1:24000 (0.61 km/inch) at a resolution of 0.023 km<sup>2</sup> (approx. 4200 units/site). Geographical sites chosen at this size adequately describe the larger landscape mosaic surrounding the natural area. At this scale, the geographical sites collectively covered most of the area of the NY/NJ HEP region with some overlap. Units for representativeness are expressed by proportion, where the total equals

one. Areal coverages of habitat may be obtained by multiplying by 100 since all samples are of equal size.

#### Birds: composition, species richness, and guild structure

The presence/absence of bird species at each geographic site were provided by sources identified in the *Atlas* (Appendix). These sources were largely checklists compiled by park personnel or compiled by local birding clubs. Such checklists provide a cumulative list of bird occurrences within each site. While the reliability of these checklists is assumed to be adequate, not all geographic sites have had bird records collected for equal amounts of time. Species richness of birds was calculated as the total of all occurrences of bird species for each geographic site.

The guild structure of the bird communities was used to combine individual species into ecologically meaningful groups that respond in a similar fashion to changes in habitat (DeGraaf and Rudis 1986). The guild structure was based on four ecological classifications, standardized in recent publications (DeGraaf and Rudis 1986, DeGraff *et al.* 1985, Freemark and Merriam 1986, Bull 1964), *i.e.* (1) migratory status, (2) foraging stratum, (3) breeding status and, (4) breeding stratum, .

#### Site similarity (cluster analysis)

Cluster analysis was used to evaluate the dissimilarity among sites across the NY/NJ HEP region. Average linkage cluster analysis (SAS 1985) was performed to evaluate dissimilarity among groups (*i.e.* a hierarchical measure of degradation). To determine the appropriate number of clusters and groupings, the total peak value of Pseudo F scores and simultaneous dip of Pseudo  $t^2$  scores were used as the diagnostic criteria (SAS 1985).

Two cluster analyses were performed separately, (1) on the basis of habitat and (2) on guild structure of a site. Areal coverages of habitats were log transformed to better approximate a normal distribution. Comparisons between the results of the separate cluster analyses were made.

#### Habitat differences as indicators of wildlife use (regression analysis) and effects of urbanization

Multiple linear regressions were used to determine the relationships between each bird guild and habitat categories. Regressions were done using

270 278

stepwise backward elimination (SAS 1985). The relative importance of each variable was considered significant at  $p < 0.1$  (SAS 1985).

Changes in bird species richness with respect to increasing urbanization were noted. Also, trends of total species richness with respect to the degree of urbanization for each site were ranked and summarized.

## RESULTS

### Study sites within the region

The geographical locations of the study sites show the extent of coverage throughout the NY/NJ HEP region (Figure 1).

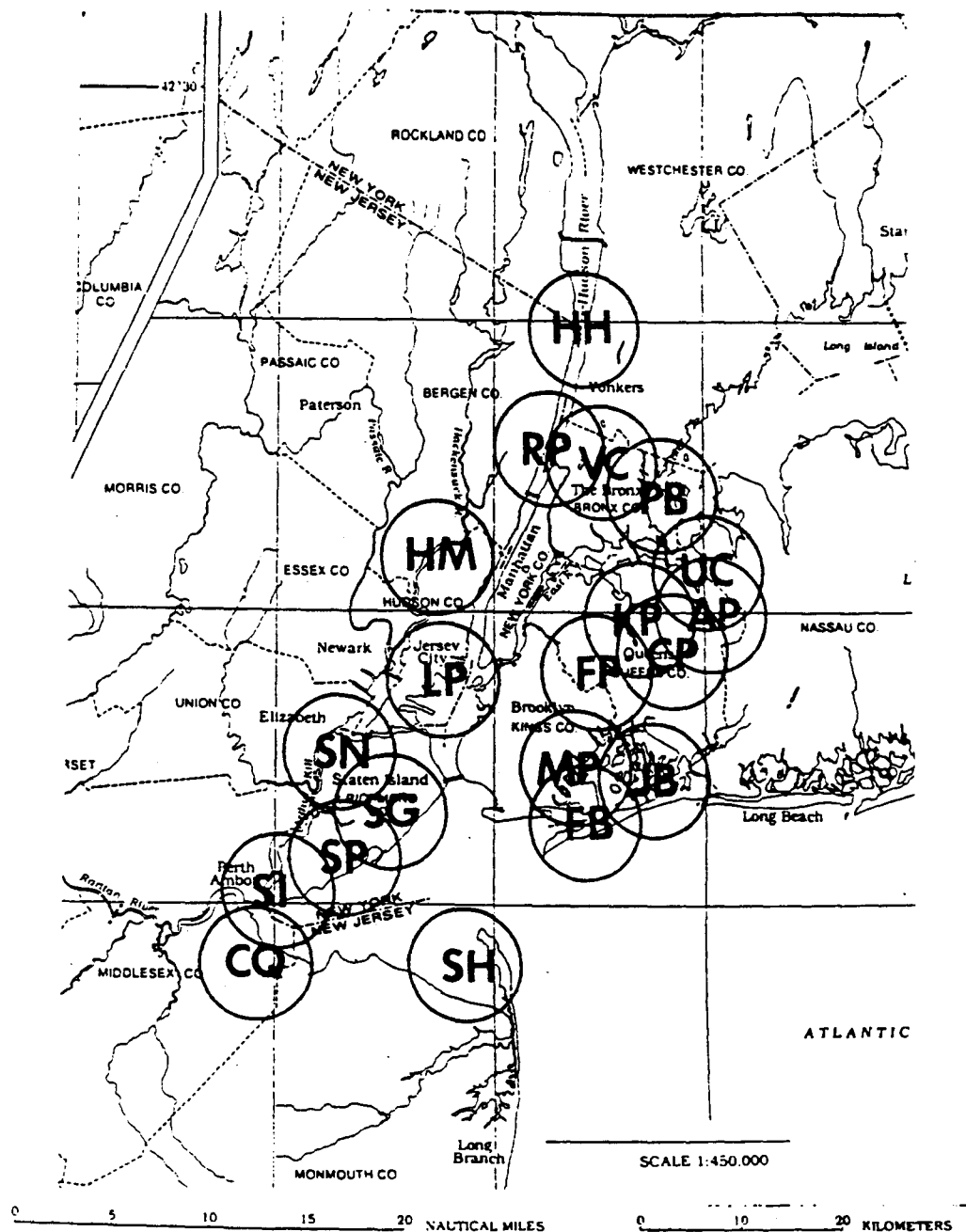
### Habitat representativeness

Habitat representativeness summarizes the surrounding areal coverage of nine different habitat categories within a circle of 100 km<sup>2</sup> area centered on a specific natural area or park site (Table 1). The range in area of different habitats among sites shows just how variable the habitats are in the NY/NJ HEP area from a regional perspective. The most variable habitat category is urban area. The range in the amount of urban area may be visualized as the degree of urbanization across the NY/NJ HEP region. A gradient of urbanization is suggested in the rank order of sites by increasing urbanization (Figure 2).

### Birds

A total of 316 bird species was tallied for all sites. The number of bird species occurring at each site varied throughout the NY/NJ HEP region. Generally, bird species richness tends to decline with increasing urbanization according to sites ranked in order of increasing urbanization (Figure 3). Note that exceptions to this inverse trend are evident (Figure 4;  $R^2 = 0.294$ )

The ecological classification of bird species into guilds based on (1) migratory status, (2) foraging stratum, (3) breeding status, and (4) breeding stratum is summarized in Table 2. The guild structure for each site is summarized in Table 3.



**Figure 1. Geographic locations of 20 study sites representing the greater NY/NJ HEP region. Key to site abbreviations (for additional information see *Atlas* (Appendix): SH, Sandy Hook; CQ, Cheesequake; HM, Hackensack Meadowlands; LP, Liberty Park; SG, Staten Island Greenbelt; SP, Staten Island Poillon Avenue Wetlands; SI, Staten Island South; SN, Staten Island Northwest; JB, Jamaica Bay; FB, Floyd Bennett Field; MP, Marine Park; CP, Cunningham Park; UC, Udall's Cove; FP, Forest Park; KP, Kissena Park; RP, Riverdale Park; VC, VanCortlandt Park; PB, Pelham Bay Park; AP, Alley Pond; HH, Hastings-on-Hudson.**

## Comparisons among sites

A dendrogram showing dissimilarity among sites based on habitat criteria (Figure 5) shows six major groupings (average linkage distance of 0.75). A dendrogram showing dissimilarity among sites based on guild criteria (Figure 6) shows six major groupings (average linkage distance of 0.53).

The geographical representation of each cluster analysis (Figure 7a and 7b) shows that the grouping of sites based on habitats has strong geographic affinities among sites, *i.e.* adjacent sites tended to be grouped together. This same trend is not evident in the groupings of sites based on bird guild structure (with the possible exception of HH, RP, VC, FP, AP, CP, and KP). Clusters based on bird guild structure appear more strongly related to trends in species richness.

## Effects of habitat categories on bird species:

Regression analysis shows how the importance of habitat categories as determinants of each bird guild varied among the 18 guilds defined. Those habitat categories that could contribute significantly ( $p < 0.10$ ) in predicting each ecological class of birds are listed in Table 4. As an example, consider the migratory status of birds. Short term migrants were largely associated with water and urban areas. These results suggest large concentrations of waterbirds and perhaps edge species more tolerant of human settlement. Similarly, long distance migrants were associated with estuarine and forest categories, reflecting shorebirds and neotropical migrants, respectively. Resident birds, most tolerant of human presence, were predicted by the urban category. Estuarine, palustrine, water, urban area, and forest were the most common habitat categories selected.

Conversely, habitat categories which did not contribute significantly toward predicting any particular guild may be informative. For example, different guilds of birds listed by breeding stratum were largely determined by two wetland habitats, estuarine and palustrine habitats, and to a lesser degree nonforested areas. Breeding activity was not predicted by other habitat categories as expected. Assuming that guild assignments and habitat categories were appropriate, these results suggest absent habitat categories were not important to that particular guild and/or the influence of confounding factors not considered in the model.



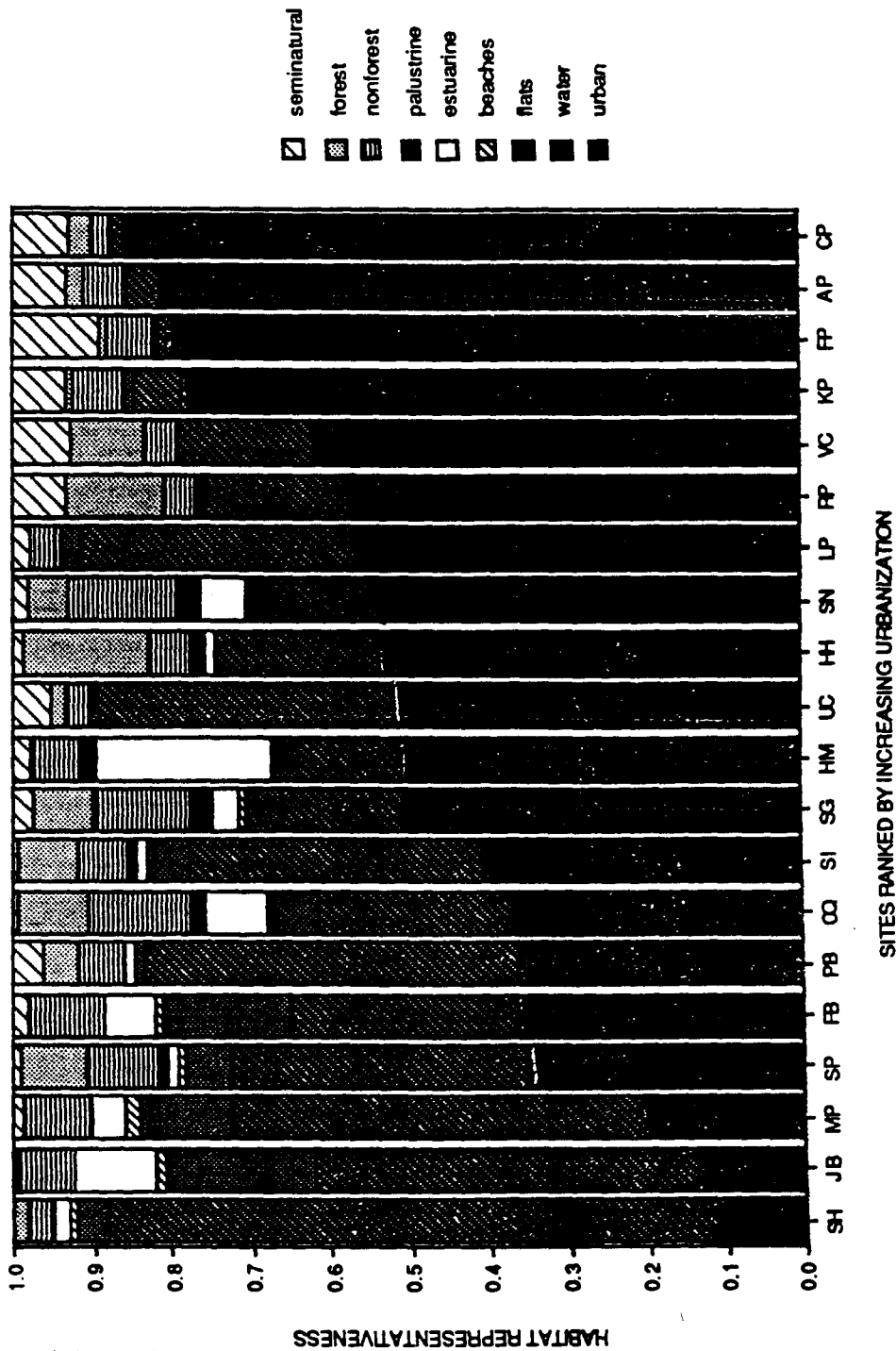


Figure 2. Habitat representativeness of 20 study sites in the NJ/NY HEP region evaluated on the basis of 9 habitat categories. Sites are ranked according to increased urbanization. The key to geographic site abbreviations are from Figure 1. The actual areal coverages are listed in Table 1.

274 282

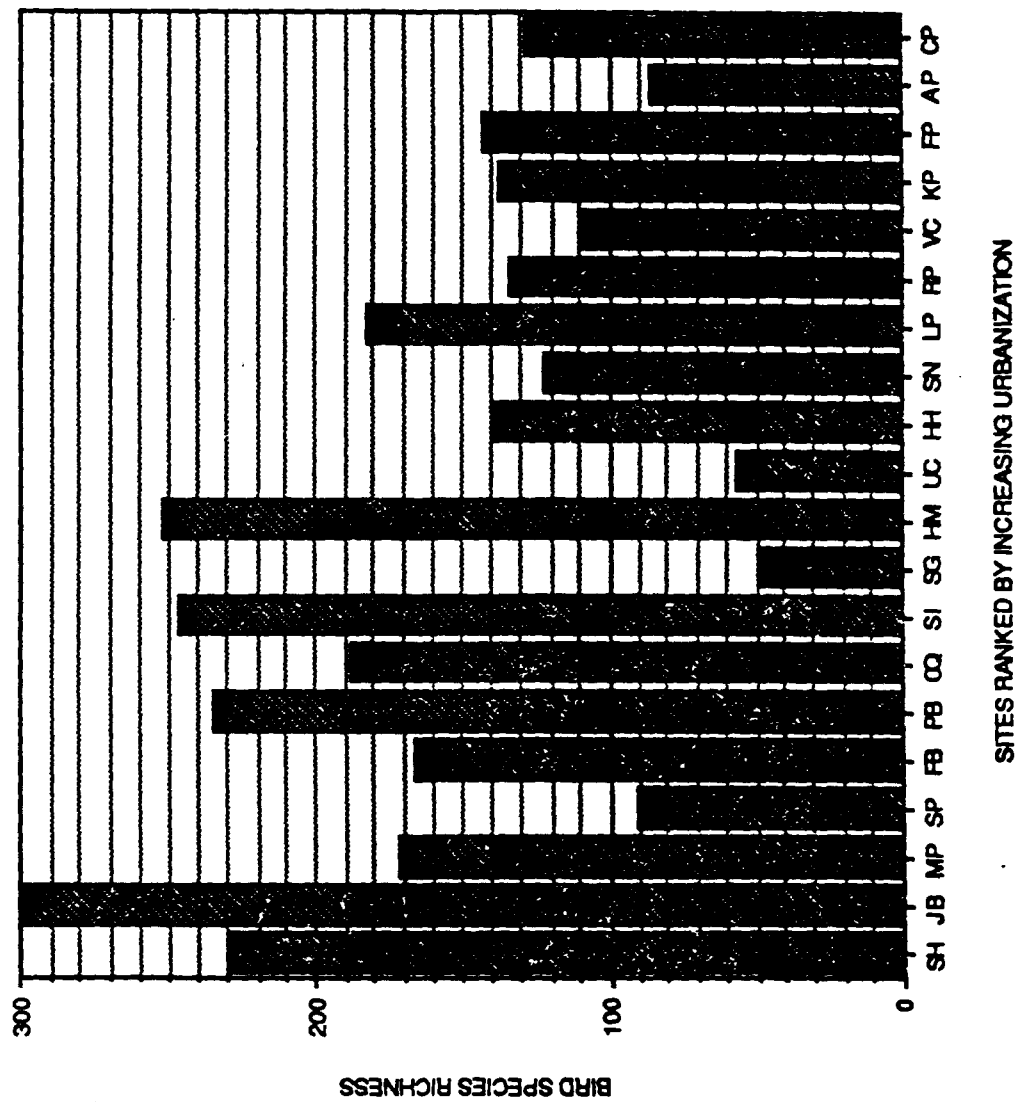


Figure 3. Bird species richness of individual sites ranked by increasing urbanization.

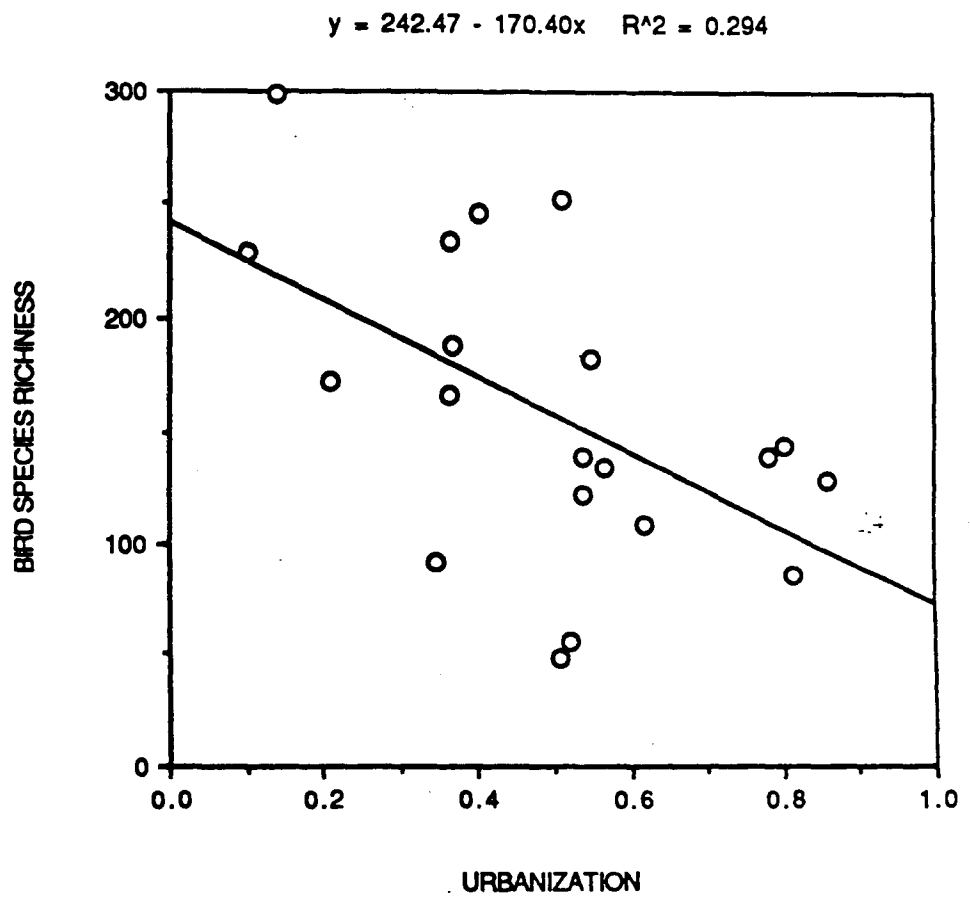


Figure 4. Inverse relationship of bird species richness and urbanization.

276 284

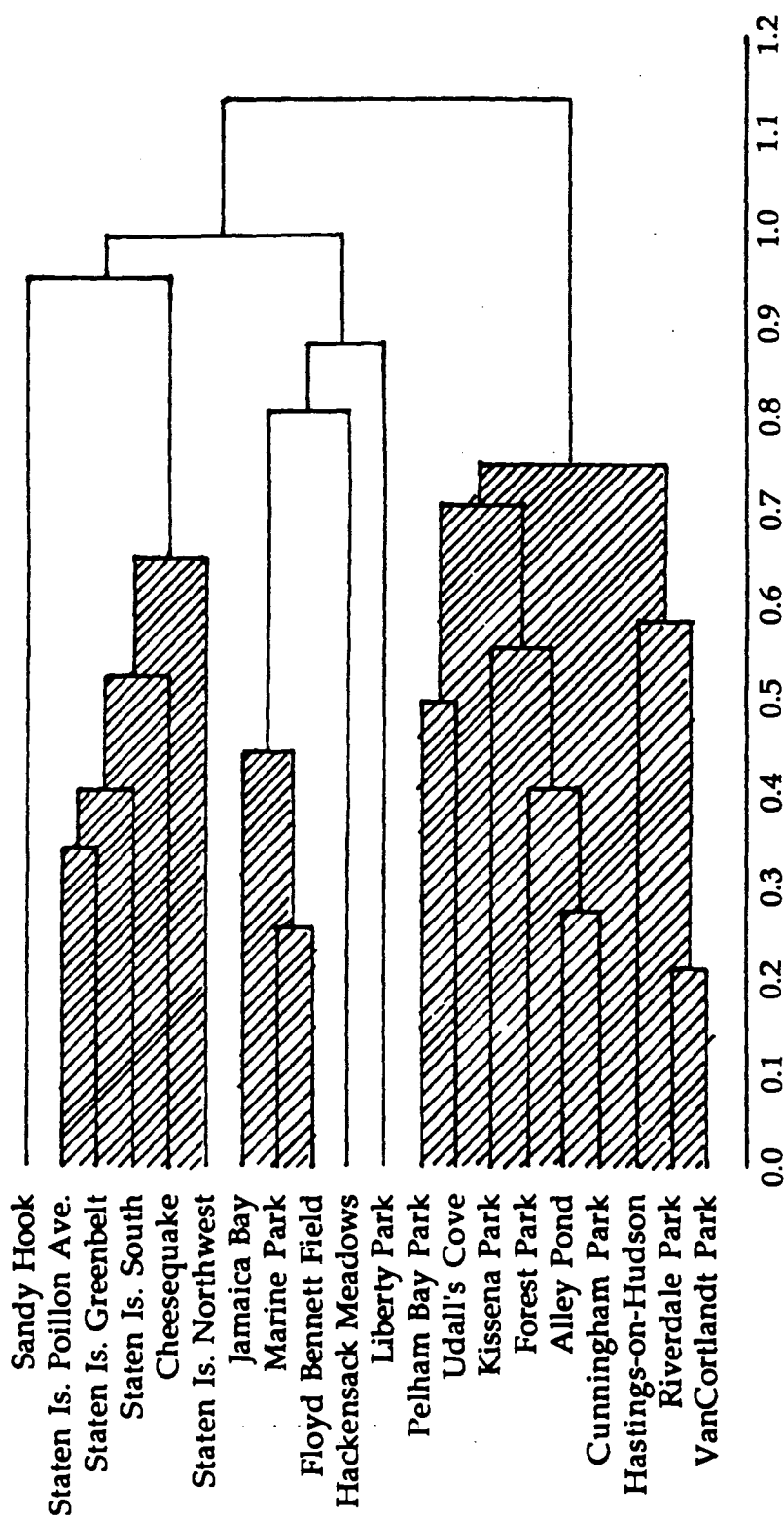


Figure 5. Dendrogram based on habitat criteria (clustering based on pseudo F and pseudo t2 scores with average linkage distance of 0.75 (SAS 1985).

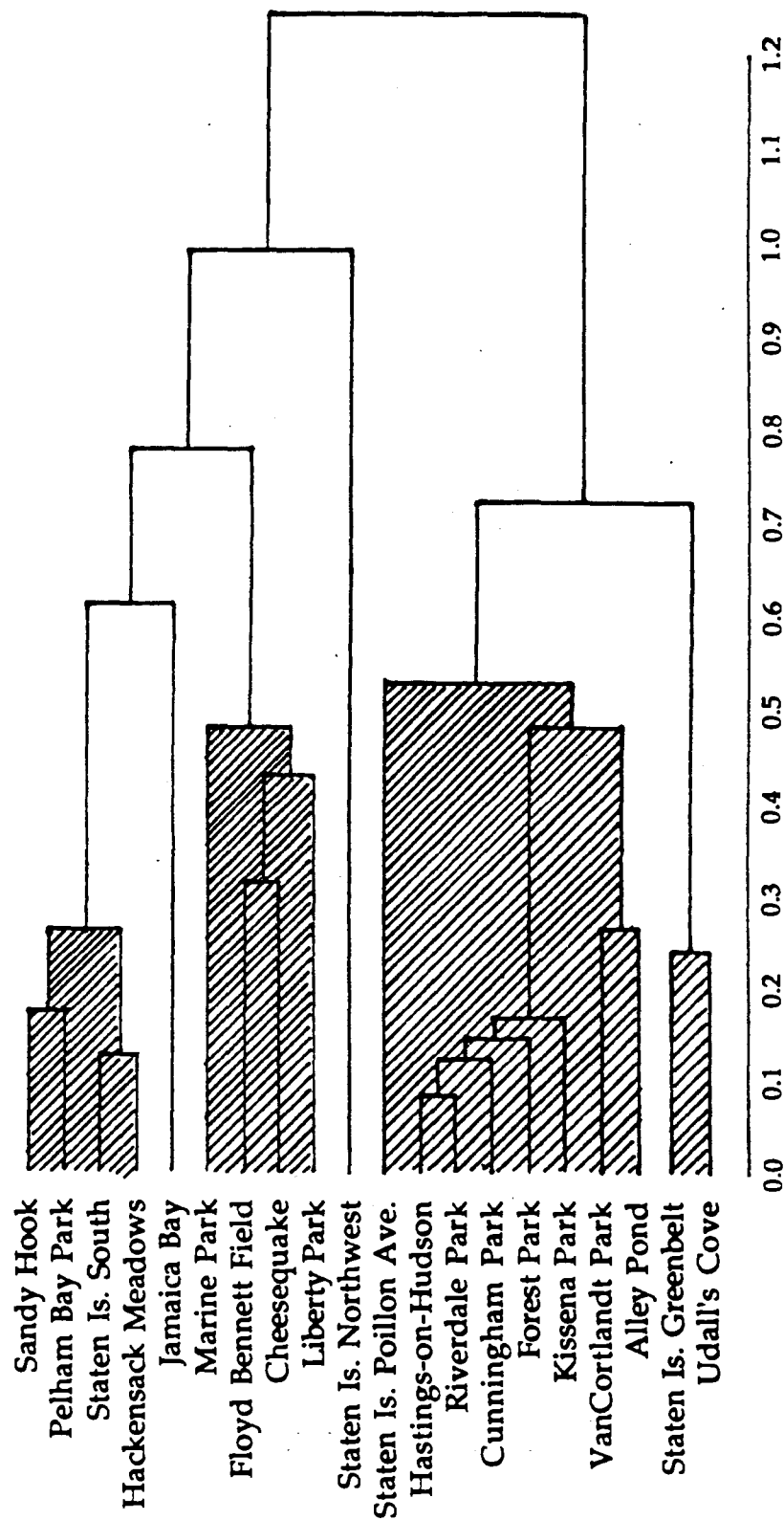


Figure 6. Dendrogram based on bird guild criteria (clustering based on pseudo F and pseudo t2 scores with average linkage distance of 0.53 (SAS 1985).

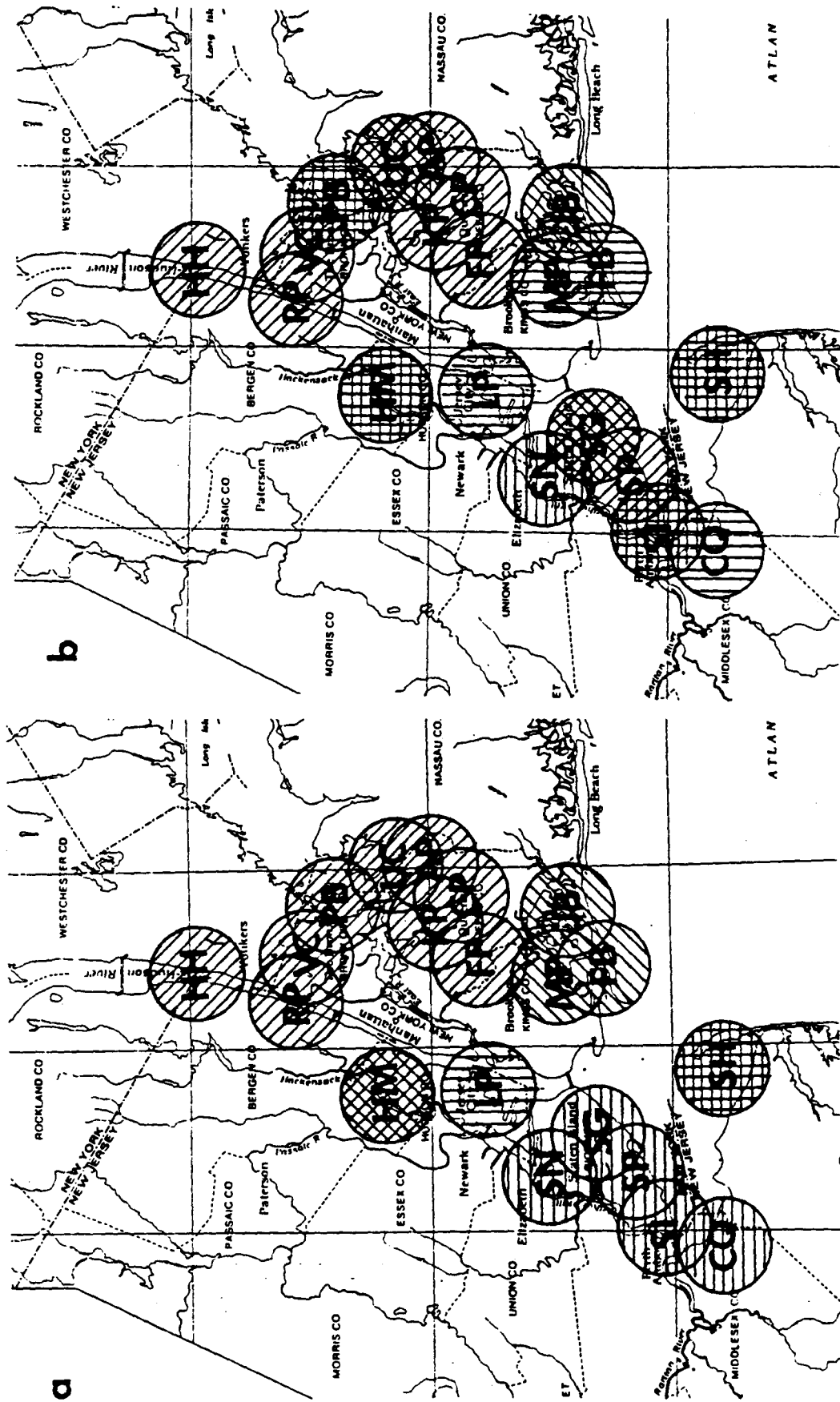


Figure 7. Geographical representation of site groupings: (a) groupings based on habitat criteria, and (b) groupings based on bird guild criteria.

## DISCUSSION

Interpreting the ecological significance of bird species distributions by geographical comparison at a broad, regional scale is difficult. Using an extensive, comparative approach has both pitfalls and advantages (Peters *et al.* 1991). Guild analysis, although subject to some debate (Bayer and Porter 1988) is a more interpretable and functional approach (DeGraaf *et al.* 1985). Guild analysis has revealed how birds use a mosaic of different habitats that describe each geographic site across the NY/NJ HEP region. Habitat/guild relations shown by regression were generally reasonable, yet some results were unexpected or unintuitive (e.g. lack of predictable breeding activity). Exceptionally broad habitat categories (DeGraff and Chadwick 1984) and habitats with much internal heterogeneity (Freemark and Merriam 1986) may not be well suited to distinguish among certain bird guilds. Consequently, the lack of discriminatory power of such habitats causes more overlap than expected among the separate guilds within each ecological class of birds. Such deficits may be compensated by the regional scale of the study. Considering large numbers of species will compensate for some lack in the discriminating power of the habitats (DeGraff and Chadwick 1984). Also, more general interpretations are acceptable in studies conducted at broader scales (Peters *et al.* 1991).

One major contribution of guild analysis has been to show the degree of uniqueness among different sites (DeGraff and Wentworth 1986). In this study, the degree of geographical uniqueness is characterized by the habitat mosaic and the corresponding bird guild structure. Upon casual inspection, the lack of correspondence between the groupings based on the habitat mosaic and the groupings based on bird guild structure suggests that multiple habitat preferences of some guilds (as selected by regression) may render direct comparison between habitat mosaic and guild structure more difficult. An alternate explanation is that habitat mosaic alone may not adequately explain the regional distribution of birds.

Increasing urbanization coincides with a progressive decline in the species richness of birds. This relationship is well documented (Noyes and Progulski 1973; Hounscome 1979; Gill and Bonnett 1973). Most accounts attribute this decline to habitat fragmentation, modification, and loss (Wilcove 1988; Freemark 1988; Hounscome 1979). However, exceptions to this inverse trend between urbanization and species richness do occur when (1) sites with viable habitats exhibit unexpectedly low counts of species richness, and (2) sites largely composed of urban areas exhibit more species than expected. In the first case, species richness counts occurred lower than expected at Udall's Cove (UC), Staten Island Poillion Avenue wetlands (SP) and Staten Island Greenbelt (SG). A depauperate avifauna may occur in small park areas such as UC as a consequence of high recreational demands,

regardless of habitat. The recreational density and the recreational pattern of human use can depress bird species richness if the frequency wildlife/human conflicts are common. This is especially true of parks in highly urbanized centers (Gill and Bonnett 1973) and small parks with exceptional recreational demands (Gilbert 1989).

Habitat modification may also depress bird species richness if basic needs become limiting (e.g. food, water, cover, roost, and nest sites). Highly managed landscapes (e.g. cemeteries and certain gardens) can exhibit a very specific flora and fauna (Gilbert 1989). Lack of habitat heterogeneity can limit the number of species found there (Gilbert 1989, Freemark 1988)

It is conceivable that low bird count can be attributable to an artifact of the study. This may be due to either inadequate data or short length of birding records (e.g. SG is represented by a single survey of High Rock Park)

The second noted exception to the inverse trend between urbanization and bird species richness occurred when largely urbanized areas exhibit counts higher than expected (e.g. Staten Island (SI), Hackensack Meadowlands (HM), and Forest Park (FP)). In such cases, greater bird species richness may reflect the absence of human disturbance. Birds are not displaced because conflicts with humans are infrequent or absent. As a technological landscape, urban areas show a wide range in land use and human occupation. Unsettled urban areas, such as petroleum storage areas, derelict railways and lots, and abandoned landfills many be poor habitats for wildlife, but these areas are not frequented by people. Unsettled urban areas provide refugia for species tolerant of urban habitat conditions but less tolerant of human presence or settlement. Areas where people are actively excluded, like tank farms along the Arthur Kill (SI), are a good example.

The historic pattern of bird use along the Hudson River flyway offers another plausible explanation for high species richness within a particular site. The birds are following ancient pattern of the flyway and have not altered those patterns in the face of urbanization. The Hackensack Meadowlands (HM), besides having large unsettled tracts of land, has historically supported a rich avifauna. In addition, Forest Park (FP) situated at a higher elevation than surrounding areas, may have historically intercepted woodland migrants upon arrival. Also, species richness may be due to habitat island effects. Birds use habitat islands as refugia, and in seeking food cover, etc., they may become concentrated

In summary, two general factors emerge that may explain the distribution of birds throughout the NY/NJ HEP region at the scale of this study. The first factor is structural urbanization, as a gradient of landscape changes from a largely biological landscape to a technological, urbanized landscape. The second factor is the human population gradient from unsettled landscapes to highly populated landscapes. If we visualize changes



in structural urbanization and human population as two opposing axes, the resulting ordination shows the variability of landscapes found in the NY/NJ HEP region. The four extreme endpoints of the ordination can be used to categorize four major landscape types (adapted from Gilbert 1989) and their effect upon bird species richness (Figure 8).

(1) 'Dynamic natural' landscape, where patterns and processes are historically natural elements of the landscape which have not been severely affected by human technology or by human presence. Examples of this landscape type include more remote natural areas where human/wildlife conflicts are minimal.

(2) 'Gardenesque' landscape, where natural patterns and processes are modified by human design and are managed to include human recreation or settlement. Examples of this type include gardens, parkland, and semi-natural areas such as campuses.

(3) 'Unsettled urban' landscape, where technological patterns and processes have displaced natural landscapes but lack the human presence of settled landscapes. Examples of this landscape type include petroleum tank farms, where people are actively excluded, and may include other derelict urban sites or remote urban areas where human/wildlife conflicts are minimal.

(4) 'Settled urban' landscape, where technology has dramatically modified natural patterns and processes or provided artificial substitutes which are managed solely for human activities and/or occupation. Examples of this landscape type include highly populated urban centers and residential complexes.

		structural urbanization gradient	
		<i>biological</i>	<i>technological</i>
human population gradient	<i>unsettled</i>	dynamic natural landscape	unsettled urban landscape
	<i>settled</i>	gardenesque landscape	settled urban landscape

Figure 8. Categories of urban landscapes based on the structural urbanization gradient and the human population gradient.

These categories approximate the system used by Gilbert (1989) with additional emphasis on human presence. The general inverse trend between bird species richness and urbanization remains preserved in the relation between the dynamic natural landscape and the settled urban landscape. However, variations in this trend can be realized as more than simply exceptions and are depicted by the gardenesque and the unsettled urban landscapes (notwithstanding other compounding factors such as historic bird use patterns and habitat island effects).

#### Implications of the findings on wildlife management in urban landscapes

The ecological consequences of urbanization have created a challenge for many professional managers of diverse backgrounds, from urban ecologists to landscape designers (see Bornkam *et al.* 1990, Laurie 1979, Gill and Bonnett 1980, Gilbert 1989). Currently, managers are advocating an ecosystem viewpoint, acknowledging urbanization as an "ecological forcing function" responsible for dramatic changes in environment that distinguish cities from rural areas (McDonnell and Pickett, 1990). By applying ecological principles to address wildlife problems in urban landscapes, managers hope to realize the maximum potential of the habitat for wildlife. "Naturalistic landscaping" (Kenfield 1966), "restoration ecology" (Jordan *et al.* 1987), and the "ecological approach" (Gilbert 1989) represent cogent approaches to embellish wildlife habitat by emulating a dynamic natural landscape by soundly applying ecological principles.

However, planning for habitat must also include a willingness to perceive humans as a biological component of the ecosystem (McDonnell and Pickett 1990). These findings imply that if the limited occurrence of many bird species is attributable not only to habitat limitations but also to being less tolerance of human presence, then we should infer that habitat management must also include people management. Minimizing human/wildlife conflict by controlling human access and educating people about wildlife needs are essential steps toward providing and sustaining adequate habitat refuges for wildlife in a variety of urban landscapes.

Table 1. Areal coverage (km<sup>2</sup>) of 9 different habitats within a 5.6 km radius (100 km<sup>2</sup>) surrounding each geographic site. Proportional values for each habitat were used to assess habitat representativeness.

Geographic Site	Urban areas	Water bodies	Flats	Beaches	Estuarine	Palustrine	Non-forest	Forest	Semi-natural	Total
Sandy Hook (SH)	10.30	78.00	3.70	1.00	1.80	0.00	3.40	1.70	0.10	100.00
Jamaica Bay (JB)	13.90	48.00	19.10	1.00	10.40	0.00	7.10	0.20	0.30	100.00
Marine Park (MP)	21.00	51.40	11.60	2.00	4.10	0.00	8.40	0.00	1.50	100.00
Staten Is., Poillon Ave. (SP)	34.70	37.70	5.70	1.00	1.50	1.00	9.10	8.50	0.80	100.00
Floyd Bennett Field (FB)	36.40	28.70	16.00	1.00	6.40	0.00	9.60	0.00	1.90	100.00
Pelham Bay Park (PB)	36.40	47.00	1.40	0.00	1.40	0.00	5.70	4.30	3.80	100.00
Cheesapeake Nat. Area (CQ)	36.80	24.70	6.50	0.00	7.70	2.00	12.80	9.00	0.50	100.00
Staten Is., South (SI)	40.10	37.40	5.60	0.00	1.30	1.00	6.40	7.60	0.60	100.00
Staten Is., Greenbelt (SG)	50.60	15.50	4.30	1.00	3.10	3.00	12.40	7.70	2.40	100.00
Hackensack Meadowlands (HM)	50.90	12.90	3.50	0.00	22.30	2.00	6.00	0.20	2.20	100.00
Udall's Cove (UC)	52.00	37.60	0.60	0.00	0.30	0.00	2.80	2.00	4.70	100.00
Hastings-on-Hudson (HH)	53.70	20.60	0.00	0.00	1.30	2.00	5.10	15.90	1.40	100.00
Staten Is., Northwest (SN)	53.80	13.40	3.30	0.00	5.80	3.00	13.60	5.10	2.00	100.00
Liberty Park Nat Area (LP)	55.00	36.50	2.50	0.00	0.50	0.00	3.40	0.00	2.10	100.00
Riverdale Park (RP)	56.80	19.00	0.00	0.00	0.00	1.00	4.10	12.30	6.80	100.00
Van Cortlandt Park (VC)	61.80	17.50	0.00	0.00	0.00	0.00	3.90	9.30	7.50	100.00
Kissena Park (KP)	78.40	6.30	1.00	0.00	0.20	0.00	6.50	1.10	6.50	100.00
Forest Park (FP)	80.40	1.40	0.00	0.00	0.20	0.00	6.20	0.90	10.90	100.00
Alley Pond Park (AP)	81.40	4.00	0.20	0.00	0.40	0.00	4.90	2.60	6.50	100.00
Cunningham Park (CP)	85.80	1.60	0.20	0.00	0.30	0.00	2.30	2.60	7.20	100.00

208 293

Table 2. Ecological classifications of bird species recorded in the study areas. (Classes are: migratory status (R, resident; SD, short distance; LD, long distance), foraging stratum (W, water; G, ground; A, air; LC, lower stratum including shrubs, UC, upper canopy; B, bark; O, other), breeding status (B, breeding; N, not breeding), breeding stratum (G, ground; C, cliff; LC, lower stratum including shrubs; UC, upper canopy; H, cavity; O, other). Nomenclature follows A.O.U. *Checklist of the birds of North America* (6th ed. 1983). Migratory status determined from Bull (1964) and A.O.U. *Checklist* (6th ed. 1983). Breeding status determined from Bull (1964) and Andrie and Carroll (1988). Foraging stratum and breeding stratum adapted from DeGraaf and Rudis (1986).

Species	Migratory status	Foraging stratum	Breeding status	Breeding stratum
Red-throated Loon	SD	W	N	-
Common Loon	SD	W	N	-
Pied-billed Grebe	SD	W	B	O
Horned Grebe	SD	W	N	-
Red-necked Grebe	SD	W	N	-
Eared Grebe	SD	W	N	-
Wilson's Storm-Petrel	LD	W	N	-
Northern Gannet	SD	W	N	-
Great Cormorant	SD	W	N	-
Double-breasted Cormorant	R	W	B	O
American Bittern	SD	W	B	O
Least Bittern	R	W	B	O
Great Blue Heron	R	W	B	LC
Great Egret	SD	W	B	LC
Snowy Egret	SD	W	B	LC
Little Blue Heron	SD	W	B	LC
Tricolored Heron	SD	W	B	LC
Cattle Egret	SD	G	B	LC
Green-backed Heron	SD	W	B	LC
Black-crowned Night-Heron	R	W	B	LC
Yellow-crowned Night-Heron	SD	W	B	LC
Glossy Ibis	SD	O	B	G
Mute Swan	R	W	B	G
Greater White-fronted Goose	SD	G	N	-
Snow Goose	SD	G	N	-
Brant	SD	G	N	-
Canada Goose	R	G	B	G
Wood Duck	SD	W	B	H
Green-winged Teal	SD	W	B	G
American Black Duck	SD	W	B	G
Mallard	R	W	B	G
Northern Pintail	SD	W	N	-
Blue-winged Teal	SD	W	B	G
Northern Shoveler	SD	W	N	-
Gadwall	SD	W	B	G
American Wigeon	SD	W	B	G
Canvasback	SD	W	N	-
Redhead	SD	W	N	-
Ring-necked Duck	SD	W	N	-

286 294

Greater Scaup	SD	W	N	-
Lesser Scaup	SD	W	N	-
Common Eider	SD	W	N	-
King Eider	SD	W	N	-
Harlequin Duck	SD	W	N	-
Oldsquaw	SD	W	N	-
Black Scoter	SD	W	N	-
Surf Scoter	SD	W	N	-
White-winged Scoter	SD	W	N	-
Common Goldeneye	SD	W	N	-
Barrow's Goldeneye	SD	W	N	-
Bufflehead	SD	W	N	-
Hooded Merganser	SD	W	N	-
Common Merganser	SD	W	N	-
Red-breasted Merganser	SD	W	N	-
Ruddy Duck	SD	W	B	G
Turkey Vulture	R	G	B	G
Osprey	SD	W	B	UC
Bald Eagle	SD	W	N	-
Northern Harrier	SD	G	B	G
Sharp-shinned Hawk	SD	A	B	G
Cooper's Hawk	SD	A	N	-
Northern Goshawk	SD	A	N	-
Red-shouldered Hawk	SD	G	B	UC
Broad-winged Hawk	LD	G	B	UC
Swainson's Hawk	LD	G	N	-
Red-tailed Hawk	R	G	B	UC
Rough-legged Hawk	SD	G	N	-
Golden Eagle	SD	G	N	-
American Kestrel	SD	G	B	UC
Merlin	SD	A	B	UC
Peregrine Falcon	SD	A	B	C
Gyr Falcon	SD	A	N	-
Ring-necked Pheasant	R	G	B	G
Ruffed Grouse	R	G	B	G
Wild Turkey	R	G	B	G
Northern Bobwhite	R	G	B	G
Yellow Rail	SD	O	N	-
Black Rail	SD	O	N	-
Clapper Rail	SD	O	B	G
King Rail	SD	O	N	-
Virginia Rail	SD	O	B	G
Sora	SD	O	B	G
Common Moorhen	SD	O	B	G
American Coot	SD	W	B	G
Black-bellied Plover	SD	G	N	-
Lesser-golden Plover	LD	G	N	-
Semipalmated Plover	SD	G	N	-
Piping Plover	SD	G	B	G
Kildeer	SD	G	B	G
American Oystercatcher	SD	W	B	G
Black-necked Stilt	SD	O	N	-
American Avocet	SD	O	N	-
Greater Yellowlegs	SD	W	N	-

Lesser Yellowlegs	SD	W	N	.
Solitary Sandpiper	LD	W	N	.
Willet	SD	G	B	G
Spotted Sandpiper	SD	O	B	G
Upland Sandpiper	LD	G	B	G
Eskimo Curlew	LD	G	N	.
Whimbrel	SD	G	N	.
Hudsonian Godwit	LD	G	N	.
Marbled Godwit	SD	G	N	.
Ruddy Turnstone	SD	G	N	.
Red Knot	SD	G	N	.
Sanderling	SD	G	N	.
Semipalmated Sandpiper	SD	G	N	.
Western Sandpiper	SD	G	N	.
Least Sandpiper	SD	G	N	.
White-rumped Sandpiper	LD	G	N	.
Baird's Sandpiper	LD	G	N	.
Pectoral Sandpiper	LD	G	N	.
Purple Sandpiper	SD	G	N	.
Dunlin	SD	G	N	.
Curlew Sandpiper	SD	G	N	.
Stilt Sandpiper	LD	G	N	.
Buff-breasted	LD	G	N	.
Short-billed Dowitcher	SD	G	N	.
Long-billed Dowitcher	SD	G	N	.
Common Snipe	SD	G	N	.
American Woodcock	SD	G	B	G
Wilson's Phalarope	LD	W	N	.
Red-necked Phalarope	LD	W	N	.
Red Phalarope	LD	W	N	.
Pomarine Jaeger	LD	O	N	.
Parasitic Jaeger	LD	O	N	.
Long-tailed Jaeger	LD	O	N	.
Laughing Gull	LD	O	B	G
Franklin's Gull	LD	O	N	.
Little Gull	LD	O	N	.
Common Black-headed Gull	LD	O	N	.
Bonaparte's Gull	SD	O	N	.
Ring-billed Gull	SD	O	N	.
Herring Gull	R	O	B	G
Iceland Gull	SD	O	N	.
Lesser Black-backed Gull	SD	O	N	.
Glaucous Gull	SD	O	N	.
Great Black-backed Gull	SD	O	B	G
Black-legged Kittiwake	SD	W	N	.
Gull-billed Tern	LD	W	N	.
Caspian Tern	SD	W	N	.
Royal Tern	SD	W	N	.
Roseate Tern	LD	W	N	.
Common Tern	SD	W	B	G
Artic Tern	LD	W	N	.
Least Tern	LD	W	B	G
Black Tern	LD	W	N	.
Black Skimmer	SD	W	B	G

208 296

Rock Dove	R	G	B	C
Mourning Dove	SD	G	B	UC
Monk Parakeet	R	G	B	LC
Black-hooded Parakeet	R	G	B	UC
Budgerigar	R	G	B	LC
Black-billed Cuckoo	LD	LC	B	LC
Yellow-billed Cuckoo	LD	LC	B	LC
Barn owl	R	G	B	C
Eastern Screech-Owl	R	G	B	H
Great Horned Owl	R	G	B	UC
Snowy owl	SD	G	N	-
Barred Owl	R	G	B	H
Long-eared Owl	SD	G	B	UC
Short-eared Owl	SD	G	B	G
Northern Saw-whet Owl	SD	G	B	H
Common Nighthawk	LD	A	B	G
Chuck-will's-widow	LD	A	N	-
Whip-poor-will	SD	A	B	G
Chimney Swift	LD	A	B	C
Ruby-throated Hummingbird	LD	O	B	LC
Belted Kingfisher	SD	W	B	O
Red-headed Woodpecker	SD	B	B	H
Red-bellied Woodpecker	R	B	B	H
Yellow-bellied Sapsucker	SD	B	B	H
Downy Woodpecker	R	B	B	H
Hairy Woodpecker	R	B	B	H
Northern Flicker	SD	G	B	H
Pileated Woodpecker	R	B	B	H
Olive-sided Flycatcher	LD	A	N	-
Eastern Wood-Pee-wee	LD	A	B	UC
Yellow-bellied Flycatcher	LD	A	N	-
Acadian Flycatcher	LD	A	B	UC
Alder Flycatcher	LD	A	B	LC
Willow Flycatcher	LD	A	B	LC
Least Flycatcher	LD	A	B	UC
Eastern Phoebe	SD	A	B	C
Say's Phoebe	SD	A	N	-
Great Crested Flycatcher	LD	A	B	H
Western Kingbird	LD	A	N	-
Horned Lark	SD	G	B	G
Purple Martin	LD	A	B	C
Tree Swallow	SD	A	B	H
Northern Rough-wg. Swallow	LD	A	B	C
Bank Swallow	LD	A	B	C
Cliff Swallow	LD	A	N	-
Barn Swallow	LD	A	B	C
Blue Jay	R	LC	B	UC
American Crow	R	G	B	UC
Fish Crow	SD	G	B	UC
Common Raven	SD	G	N	-
Carolina Chickadee	SD	LC	N	-
Black-capped Chickadee	R	LC	B	H
Boreal Chickadee	SD	LC	N	-
Tufted Titmouse	R	LC	B	H



Red-breasted Nuthatch	SD	B	B	H
White-breasted Nuthatch	R	B	B	H
Brown Creeper	SD	B	B	H
Carolina Wren	R	LC	B	H
House Wren	SD	LC	B	H
Winter Wren	SD	G	N	-
Sedge Wren	SD	G	N	-
Marsh Wren	R	O	B	G
Golden-crowned Kinglet	SD	LC	N	-
Ruby-crowned Kinglet	SD	LC	N	-
Blue-gray Gnatcatcher	SD	UC	B	UC
Eastern Bluebird	SD	G	B	H
Veery	LD	G	B	G
Gray-checked Thrush	LD	G	N	-
Swainson's Thrush	LD	G	N	-
Hermit Thrush	SD	G	B	G
Wood Thrush	LD	G	B	LC
American Robin	SD	G	B	LU
Gray Catbird	SD	G	B	LU
Northern Mockingbird	R	G	B	LU
Brown Thrasher	SD	G	B	LU
American Pipit	SD	G	N	-
Cedar Waxwing	SD	UC	B	UC
Northern Shrike	SD	G	N	-
Loggerhead Shrike	SD	G	N	-
European Starling	R	G	B	C
White-eyed Vireo	SD	LC	B	UC
Solitary Vireo	SD	LC	N	-
Yellow-throated Vireo	LD	UC	B	UC
Warbling Vireo	LD	UC	B	UC
Philadelphia Vireo	LD	UC	B	UC
Red-eyed Vireo	LD	UC	B	UC
Blue-winged Warbler	LD	LC	B	G
Golden-winged Warbler	LD	LC	B	G
Tennessee Warbler	LD	UC	N	-
Orange-crowned Warbler	SD	LC	N	-
Nashville warbler	LD	LC	N	-
Northern Parula	LD	UC	N	-
Yellow Warbler	LD	LC	B	LC
Chesnut-sided Warbler	LD	LC	B	LC
Magnolia Warbler	LD	LC	N	-
Cape May Warbler	LD	UC	N	-
Black-throated Blue Warbler	LD	LC	N	-
Yellow-rumped Warbler	SD	LC	N	-
Black-throated Green Warbler	LD	UC	N	-
Blackburnian Warbler	LD	UC	N	-
Yellow-throated Warbler	LD	UC	N	-
Pine Warbler	SD	B	N	-
Prairie Warbler	SD	LC	B	LC
Palm Warbler	SD	G	B	G
Bay-breasted	LD	UC	N	-
Blackpoll Warbler	LD	UC	N	-
Cerulean Warbler	LD	UC	N	-
Black-and-white Warbler	LD	B	B	G

American Redstart	LD	LC	B	LC
Prothonotary Warbler	LD	G	N	-
Worm-eating Warbler	LD	G	B	G
Ovenbird	LD	G	B	G
Nothorn Waterthrush	LD	O	N	-
Louisiana Waterthrush	LD	O	N	-
Kentucky Warbler	LD	G	B	G
Connecticut Warbler	LD	G	N	-
Mourning Warbler	LD	G	N	-
Common Yellowthroat	SD	LC	B	G
Hooded Warbler	LD	LC	B	LC
Wilson's Warbler	LD	LC	N	-
Canada Warbler	LD	LC	N	-
Yellow-breasted Chat	LD	LC	B	LC
Summer Tanager	LD	UC	N	-
Scarlet Tanager	LD	UC	B	UC
Northern Cardinal	R	G	B	LC
Rose-breasted Grosbeak	LD	UC	B	UC
Blue Grosbeak	LD	G	B	LC
Indigo Bunting	LD	LC	B	LC
Dickcissel	LD	G	N	-
Rufous-sided Towhee	SD	G	B	G
American Tree Sparrow	SD	G	N	-
Chipping Sparrow	SD	G	B	LC
Clay-colored Sparrow	LD	G	N	-
Field Sparrow	SD	G	B	G
Vesper Sparrow	SD	G	N	-
Savannah Sparrow	SD	G	B	G
Grasshopper Sparrow	SD	G	B	G
Henslow's Sparrow	SD	G	N	-
Shap-tailed Sparrow	SD	G	B	G
Seaside Sparrow	SD	G	B	G
Fox Sparrow	SD	G	N	-
Song Sparrow	R	G	B	G
Lincoln's Sparrow	SD	G	N	-
Swamp Sparrow	SD	G	B	G
White-throated Sparrow	SD	G	B	G
White-crowned Sparrow	SD	G	N	-
Dark-eyed Junco	SD	G	N	-
Lapland Longspur	SD	G	N	-
Snow Bunting	SD	G	N	-
Bobolink	LD	G	B	G
Red-winged Blackbird	SD	G	B	LC
Eastern Meadowlark	SD	G	B	G
Yellow-headed Blackbird	SD	G	N	-
Rusty Blackbird	SD	G	N	-
Boat-tailed Grackle	SD	G	B	UC
Common Grackle	SD	G	B	UC
Brown-headed Cowbird	SD	G	B	O
Orchard Oriole	LD	UC	B	UC
Northern Oriole	LD	UC	B	UC
Pine Grosbeak	SD	UC	N	-
Purple Finch	SD	UC	B	UC
House Finch	SD	G	B	UC

Red Crossbill	SD	G	N	-
White-winged Crossbill	SD	G	N	-
Common Redpoll	SD	G	N	-
Hoary Redpoll	SD	G	N	-
Pine Siskin	SD	G	N	-
American Goldfinch	R	G	B	LC
Evening Grosbeak	SD	G	N	-
House Sparrow	R	G	B	H

282 300

Table 3. Bird guild spectrum: frequency of occurrence of ecological classes of birds.

Geogr. site	Migratory status			Foraging substratum						
	Long	Short	Res.	Air	Bark	Ground	Low	High	Water	Other
SH	62	139	28	21	9	80	27	19	54	19
JB	88	183	28	26	10	116	28	24	67	28
MP	35	113	24	15	6	69	16	13	38	15
SP	26	44	21	8	6	36	16	9	14	2
FB	38	110	18	14	5	74	17	10	33	13
PB	53	147	34	17	11	92	24	17	52	21
CQ	57	104	27	17	8	73	28	18	32	12
SI	65	153	28	20	10	95	27	21	50	23
SG	11	18	19	3	3	26	9	3	3	1
HM	70	155	27	21	8	101	25	16	56	25
UC	5	36	15	0	2	30	2	1	13	8
HH	50	64	25	13	8	59	25	16	13	5
SN	21	81	20	8	2	49	9	2	38	14
LP	28	134	20	13	5	72	16	9	53	14
RP	46	61	27	12	9	52	25	16	13	7
VC	24	61	24	10	5	44	12	7	25	6
KP	44	73	21	13	9	55	21	15	15	10
FP	59	61	23	15	10	58	26	20	7	7
AP	6	58	22	2	7	41	7	2	20	7
CP	48	59	21	12	9	55	26	14	5	7

Geographic site	Breeding substratum						Breeding status		Total
	Cliff	Ground	Hole	Canopy		Other	Breed	Not breed	
SH	8	46	18	30	32	6	141	88	229
JB	8	56	19	32	35	6	156	143	299
MP	6	45	15	25	23	5	118	54	172
SP	3	13	16	20	22	4	78	13	91
FB	6	40	11	23	24	5	109	57	166
PB	7	53	20	28	32	6	145	89	234
CQ	6	46	18	31	27	5	132	56	188
SI	6	52	20	29	33	6	145	101	246
SG	2	8	11	11	13	1	46	2	48
HM	10	48	16	29	32	6	140	112	252
UC	2	17	4	10	9	2	44	12	56
HH	6	25	15	23	28	3	101	38	139
SN	7	35	8	19	15	5	88	34	122
LP	9	38	9	23	22	6	107	75	182
RP	5	24	17	23	28	3	100	34	134
VC	4	24	14	20	22	5	88	21	109
KP	4	28	14	23	27	5	101	37	138
FP	4	25	18	22	30	2	101	42	143
AP	7	20	12	15	12	4	64	22	86
CP	3	27	15	22	24	2	93	35	128

243 301

Table 4. Results of multiple regression.  $P < 0.1$  for independent variables, habitat, that contributed significantly to the expression of each guild and total bird species.

Ecological classification/ guild	Habitat categories								
	Water	Flats	Beaches	Estuar- ine	Palus- trine	Non- forest	Forest	Semi natural	Urban
Migratory Status									
short distance	0.0823	-	-	-	-	-	-	-	0.0122
long distance	-	-	-	0.0392	-	-	0.0290	-	-
resident	-	-	-	-	-	-	-	-	0.0755
Foraging Substrate									
air	0.0552	-	0.0567	0.0095	0.0212	0.0390	-	-	0.0590
water	0.0008	-	-	-	-	-	-	-	0.0035
bark	0.0770	-	-	-	-	-	-	-	0.0755
ground	-	-	-	0.0419	-	-	0.0312	-	-
lower stratum	-	-	-	-	-	-	-	-	-
upper canopy	-	-	-	-	-	-	-	-	0.0786
other	0.0146	-	-	-	-	-	0.0020	-	-
Breeding Status									
breed	-	-	0.0673	0.0011	0.0129	0.0374	-	-	-
not breed	-	-	-	0.0196	-	-	0.0868	-	-
Breeding Substrate									
hole	-	-	-	-	-	-	-	-	-
ground	-	-	-	0.0041	0.0818	-	-	-	-
cliff	-	-	-	0.0747	-	-	-	-	-
lower stratum	-	-	-	0.0141	0.0234	-	-	-	-
upper canopy	-	-	-	-	-	-	-	-	-
other	-	-	-	0.0045	0.0228	-	-	-	-
Total bird species	-	-	-	0.0022	0.0775	0.0692	-	-	-

244 302

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299305



Appendix F

A Bibliography of the Habitats and Wildlife  
within the Vicinity of the  
New York/New Jersey Harbor Estuary

Compiled by

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**A BIBLIOGRAPHY OF THE HABITATS AND WILDLIFE  
WITHIN THE VICINITY OF  
THE NEW YORK/NEW JERSEY HARBOR ESTUARY**

**Compiled by Nels Barrett**

**Ecology and Evolutionary Biology  
The University of Connecticut**

299 307

This bibliography was prepared as one of the products of the New York/New Jersey Harbor Estuary Program, funded by the U. S. Environmental Protection Agency. One project of the Harbor Estuary Program was to study the nearshore habitats of the estuary and surrounding urban areas. The tasks included characterizing the habitats within the vicinity of the New York/New Jersey Harbor and assessing the constituent wildlife, noting the implications of urbanization upon conditions of the habitat and trends in wildlife populations. This bibliography was prepared as a part of those tasks.

The purpose of this bibliography is to produce a list of references specific to the habitats and wildlife within the vicinity of the New York/New Jersey Harbor Estuary. It is *not* meant to be a comprehensive source for *all* published material relating to the natural resources and environment of the region. This bibliography is a selection of 592 references relating specifically to the habitats and wildlife within the vicinity of the New York/New Jersey Harbor Estuary. The material selected here comes from many sources and journals. Primary sources are:

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313 327



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