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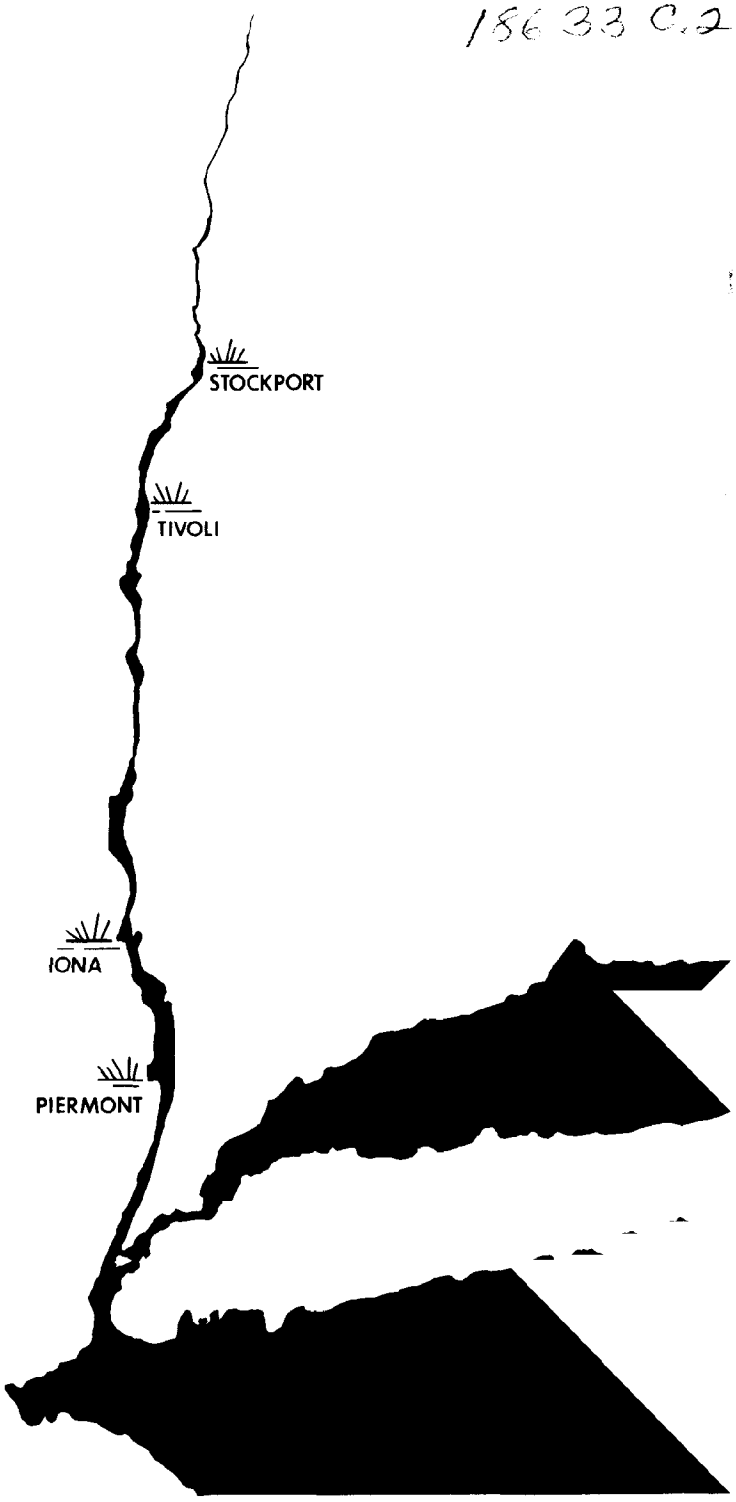
Draft Environmental Impact Statement

Hudson River Estuarine Sanctuary

Proposed Estuarine Sanctuary
Grant Award for Hudson River
Estuarine Sanctuary in the
State of New York



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United States

Department of Commerce

Draft Environmental Impact Statement

PROPOSED

ESTUARINE SANCTUARY GRANT AWARD

TO THE STATE OF NEW YORK

FOR

A HUDSON RIVER ESTUARINE SANCTUARY

June 1982

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Prepared by:

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National Oceanic and Atmospheric Administration
Office of Coastal Zone Management
3300 Whitehaven Street, N.W.
Washington, D.C. 20235

and

State of New York
Department of Environmental Conservation
50 Wolf Road
Albany, New York 12205

FEB 24 1987

PUBLIC HEARINGS WILL BE HELD

On this Draft Environmental Impact Statement for the proposed Hudson River Estuarine Sanctuary on:

July 19, 1982 at 7:00 p.m. - Piermont Village Hall (comments on Piermont and Iona Island)

July 20, 1982 at 7:00 p.m. - Red Hook Town Hall (comments on Tivoli)

July 21, 1982 at 7:00 p.m. - Stockport Town Hall at Stottville (comments on Stockport)

Comments or presentations will be scheduled on a first-come, first-heard basis, and may be limited to a maximum of 5 minutes. No verbatim transcript of the hearing will be prepared, but the hearing staff will record and summarize the comments. All comments received at the hearing, or in writing, will be considered in the preparation of the Final Environmental Impact Statement.

DESIGNATION: Draft Environmental Impact Statement

TITLE: Proposed Estuarine Sanctuary Grant Award to the State of New York for a Hudson River Estuarine Sanctuary

ABSTRACT: The State of New York has submitted an application for a grant from the Office of Coastal Zone Management to establish an estuarine sanctuary on the Hudson River, New York.

For the purposes of research and education, sites representative of the Hudson's estuarine gradient are appropriate. Four natural areas, the Hudson's highest quality tidal wetland complexes, are proposed for inclusion in the Sanctuary: Stockport Flats (1,149 acres), Tivoli Bays (1,481), Iona Island (556 acres), and Piermont Marsh (943 acres), for a total of 4,130 acres of land and water. The acquisition grant request to NOAA for $375,000, matched by an equivalent amount of State funds and services would be used for fee simple acquisition of wetlands, waters and shoreline at Stockport Flats (maximum 264 acres), Tivoli Bays (45 acres), and Piermont Marsh (73 acres), and to develop or renovate facilities at two or more of the four Hudson River sites. These facilities (buildings, roads, parking lots, trails, and boardwalk) will be used to accommodate research activities, educational programs, and visitors. All other land at the four sites is in public ownership.

Approval of this grant application would permit the establishment of an estuarine sanctuary representing a subcategory of the Virginian biogeographic region. The proposed sanctuary would be used primarily for research and education purposes, especially to provide information useful for coastal zone management decisionmaking. Multiple use would be encouraged to the extent that it is compatible with the proposed sanctuary's research and educational programs.

Research and monitoring in and near the proposed sanctuary would provide baseline information against which the impacts of human activities elsewhere in the Hudson River and the Virginian biogeographic region could be assessed.

APPLICANT: New York Department of Environmental Conservation

LEAD AGENCY: U.S. Department of Commerce
National Oceanic and Atmospheric Administration
Office of Coastal Zone Management

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Individuals receiving copies of the Draft Environmental Impact Statement will NOT automatically receive copies of the Final Environmental Impact Statement unless specifically requested, or unless they submit oral or written comments on the Draft Environmental Impact Statement.

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SUMMARY

BACKGROUND

Section 315 of the Coastal Zone Management Act of 1972 (P.L. 92-583), as amended, established the National Estuarine Sanctuary Program, which provides grants on a matching basis to States to acquire, develop, and operate estuarine areas to be set aside as natural field laboratories. These areas are to be used primarily for long-term scientific and educational programs that will provide information essential to coastal management decisionmaking.

Uses of estuarine sanctuaries are intended to serve objectives such as the following:

-- To gain a more thorough understanding of ecological relationships within the estuarine environment;

-- To make baseline ecological measurements;

-- To serve as a natural control in order to monitor changes and assess the impacts of human stresses on the ecosystem;

-- To provide a vehicle for increasing public knowledge and awareness of the complex nature of estuarine ecosystems, their values and benefits to man and nature, and the problems confronting them; and

-- To encourage multiple use of the estuarine sanctuaries to the extent that such usage is compatible with the primary sanctuary purposes of research and education.

To ensure that the Estuarine Sanctuary Program includes sites that adequately represent regional and ecological differences, the program regulations established a biogeographical classification scheme that reflects geographic, hydrographic, and biological characteristics. Eleven (11) biogeographic categories are defined in the program regulations. Subcategories of this basic system are developed and utilized as appropriate to distinguish different subclasses of each category. The total number of sanctuaries that will be needed to provide adequate representation of the various estuarine ecosystems occurring within the United States is currently under study. The proposed sanctuary is representative of the Virginian biogeographic region.

The State of New York is committed to maintaining the resource productivity of its coastal zone. The Hudson River Estuary, a part of New York's coastal zone, supports an extremely valuable fishery resource and is a biological and esthetic treasure used and enjoyed by millions of people. In order to effectively protect and manage the Hudson River Estuary ecosystem, an understanding of estuarine ecology is essential. For this reason, establishment of an estuarine sanctuary in New York on the Hudson River would provide a valuable tool for enhancing the management of the Hudson River and associated coastal zone areas.

The Estuarine Sanctuary Program regulations, first published in 1974, and amended in 1977, authorize three kinds of 50 percent matching grants: (1) an optional, initial planning grant for such preliminary purposes as assessing the lands to be acquired, preparing an environmental impact statement, and developing management, research and education plans; (2) grants for acquisition of the real property within the sanctuary boundaries and development of interpretive/research facilities; and (3) operations grants for managing the established sanctuary's research and education programs.

New York's involvement in the Estuarine Sanctuary Program is not new, but has spanned a period of approximately three years (see summary of site selection process in the Alternatives section). An initial proposal for a sanctuary on Long Island was impracticable, and New York was encouraged by the U.S. Office of Coastal Zone Management to propose a sanctuary on the Hudson River Estuary, the State's alternate choice. Representatives of involved State agencies met to select sites on the Hudson; the New York Department of Environmental Conservation (DEC) took the role of Lead Agency, with cooperation from the Palisades Interstate Park Commission, the Office of Parks, Recreation and Historic Preservation, the Department of State, and the Office of General Services.

For the purposes of research and education, sites representative of the Hudson's estuarine gradient are appropriate. Four natural areas, the Hudson's highest quality tidal wetland complexes, are proposed for inclusion in the Sanctuary: Stockport Flats in the Town of Stockport, Columbia County; Tivoli Bays in the Town of Red Hook, Dutchess County; Iona Island Marsh in the Town of Stony Point, Rockland County; and Piermont Marsh in the Town of Orangetown, Rockland County. All four of these sites contain extensive high quality tidal marshes with comparable vegetation types, as well as adjoining tidal shallows and forested upland margins. The sites also contain typical plants and animals of tidal river wetlands of the Estuarine Sanctuary System's Virginian Biogeographic Region (Cape Cod to Cape Hatteras), and productive ecological communities that are representative of the region. These areas also have a history of observation and research that provides basic information valuable to the initiation of a research and education program.

On behalf of the State, DEC submitted a grant application to the National Oceanic and Atmospheric Administration's (NOAA) Office of Coastal Zone Management (OCZM) in May 1981 to gather information and plan the proposed Hudson River Estuarine Sanctuary at the above-named sites. In September 1981, a pre-acquisition grant of $50,000 was awarded by NOAA to DEC, to be matched by DEC funds and services. Work on the planning of the sanctuary began in earnest in January 1982 when the Federal money was received.

PROPOSED ACTION

The acquisition grant request to NOAA for $375,000, matched by an equivalent amount of State funds and services, would be used for establishment of a 4,130 acre sanctuary of which potentially 382 acres of wetlands, waters and shoreline would be purchased and to develop or renovate facilities at two or more of the four Hudson River sites. These facilities (i.e., buildings,

roads, parking lots, trails, and boardwalk) will be used to accommodate research activities, educational programs, and visitors. The great majority of land within the proposed sanctuary boundaries (see page 11) is already publicly owned or under negotiation for public acquisition under pre-existing programs. The chief importance of establishing the proposed sanctuary would be the development of a coordinated program of research and education that would not be otherwise realized.

The composition of real property within the proposed sanctuary is as follows (acreages are approximate):

Stockport	Total area - 1,149 acres
Currently publicly owned	692-804 acres (see Table 2, parcel 6)
Proposed for acquisition	152-264 acres (see Table 2, Parcel 6)
Tivoli	Total area - 1,481 acres
Currently publicly owned	1,436 acres
Under negotiation	45 acres
Iona Island	Total area - 556 acres
Currently publicly owned	556 acres
Proposed for acquisition	0 acres
Piermont Marsh	Total area - 934 acres
Currently publicly owned	871 acres
Under negotiation	73 acres

The total area of all four sites is 4,130 acres. Of this, 2,860 acres are wetlands and shallows, comprising 13% of the Hudson River Estuary's total area of wetlands and shallows (less than 6 feet deep at low tide).

MANAGEMENT

The DEC will administer the proposed sanctuary and will be directly responsible for the content and structure of the sanctuary's management plan, the expenditure of program funds, and the formulation and implementation of general program elements (such as research programs and educational programs). A sanctuary Steering Committee comprised of the five State agencies involved in the sanctuary (Department of Environmental Conservation (DEC), Palisades Interstate Park Commission (PIPC), the Office of Parks, Recreation and Historic Preservation (OPRHP), the Department of State (DOS), and the Office of General Services (OGS)) has been formed. DEC will chair this Steering Committee. The Committee is advisory to DEC on issues related to the formulation and implementation of the sanctuary's management plan, the expenditure of program funds, and formulation and implementation of general program elements. Consistent with the management plan, the State agencies will exercise prerogatives and make decisions regarding use of lands to which they hold title.

A Memorandum of Agreement, signed by the agencies represented on the Steering Committee, will be appended to the Final Environmental Impact Statement. The Memorandum of Agreement will outline interagency arrangements for the administration and management of the sanctuary, and express the agencies agreement to carry out the management plan.

Three citizens' advisory groups (Columbia, Dutchess, and Rockland Counties), representing local government and sanctuary user groups, will act as a Sanctuary Advisory Committee and make recommendations to the Steering Committee. The Advisory Committee will channel public support and criticism to the Steering Committee.

Estuarine sanctuary programs would be closely coordinated with related programs on the Hudson River, particularly the DEC's Hudson River Fisheries Unit and Fisheries Advisory Committee, and the Hudson River Foundation for Science and Environmental Research. Sanctuary programs would also be coordinated with and would serve to enhance existing programs of research and education including those of Hudson River Sloop Clearwater and the Hudson Valley's colleges and universities.

RESEARCH

Estuarine sanctuary research programs would emphasize ecosystem-level understanding of the Hudson Estuary and especially its wetlands and shallows, as well as applied concerns of coastal management including the management of fish, game and fur resources, vegetation, endangered and rare species, and the reduction and mitigation of human impacts on the coastal zone. Much research has been done on the Hudson River Estuary, but efforts have generally been fragmented and there are many serious gaps in the knowledge needed to effectively manage the Estuary. The proposed Hudson River Estuarine Sanctuary would help to coordinate and unify Hudson River research and to provide information to coastal managers at all levels of government and the private sector with the goal of wise resource management.

EDUCATION

The proposed estuarine sanctuary sites contain a variety of fauna and flora and estuarine habitats representative of the Hudson River Estuary, and are located within easy reach of millions of New York State and greater New York City area residents. The proposed sanctuary would provide an opportunity for many to learn more of the estuary's geology, ecology and resources. Estuarine sanctuary funds would be used to develop exhibit space at the Bear Mountain Trailside Museums complex near Iona Island Marsh for Hudson Estuary related exhibits; this complex is visited by over 600,000 people each year. Funds would also be used to set up facilities at or near the Tivoli Bays site for educational exhibits and for research work. Additionally, selected programs such as guided field trips, self-guided trail brochures, and educational media available to public groups and schools on loan could be developed.

IMPACTS

The overall and major impacts of designation of the proposed Hudson River Estuarine Sanctuary are expected to be positive through better scientific and public understanding of the estuary and its resources. The proposed estuarine sanctuary does not conflict with existing commercial or recreational uses of the Hudson River. Any conflicts that may arise with future uses of the river can be reduced through negotiation. Without an estuarine sanctuary, the Hudson River would not have areas dedicated specifically and permanently for research and education. However, with a sanctuary, present uses of the sites including hunting and other recreational uses where currently allowed, would continue. Furthermore, designation of the sanctuary and acquisition of lands, would provide additional public access to the riverfront for recreation and enjoyment.

PART I: PURPOSE OF AND NEED FOR ACTION

In response to intense pressures on the coastal resources of the United States, Congress enacted the Coastal Zone Management Act (CZMA), which was signed into law on October 27, 1972, and amended in 1976 and 1980. The CZMA authorized a Federal grant-in-aid and assistance program to be administered by the Secretary of Commerce, who in turn delegated this responsibility to the Office of Coastal Zone Management (OCZM) in the National Oceanic and Atmospheric Administration (NOAA).

The CZMA affirms a national interest in the effective protection and development of the Nation's coastal zone, and provides financial and technical assistance to coastal States (including those bordering on the Atlantic and Pacific Oceans, the Gulf of Mexico, and the Great Lakes) and U.S. territories to develop and implement State coastal zone management programs. The Act established a variety of grant-in-aid programs to such States for purposes of:

-- developing coastal zone management programs (Sec. 305);

-- implementing and administering coastal management programs that receive Federal approval (Sec. 306);

-- avoiding or minimizing adverse environmental, social, and economic impacts resulting from coastal energy activities (Sec. 308);

-- coordinating, studying, planning, and implementing interstate coastal management activities and programs (Sec. 309);

-- conducting research, study, and training programs to provide scientific and technical support to State coastal zone management programs (Sec. 310); and

-- acquiring land for estuarine sanctuaries and island preservation (Sec. 315).

Section 315 of the Act established the Estuarine Sanctuary Program to provide matching grants to States to acquire, develop, and operate natural estuarine areas as sanctuaries, so that scientists and students may be provided the opportunity to examine the ecological relationships within the areas over time. Section 315 provides a maximum of $3 million in Federal funds, to be matched by an equivalent amount from the State, to acquire and manage lands for each sanctuary. The regulations for implementation of the Estuarine Sanctuary Program are found at 15 CFR Part 921. Amendments were proposed on September 9, 1977, 42 Federal Register: 45522-45523 (see Appendix 7). Regulations are presently being prepared for the Island Preservation Program that is also included within Section 315 of the CZMA.

Estuarine sanctuaries have the dual purposes of (1) preserving relatively undisturbed areas so that a representative series of natural estuarine systems will always remain available for ecological research and education, and (2) ensuring the availability of natural areas for use as a control against

which impacts of human activities in other areas can be assessed. These sanctuaries are to be used primarily for long-term scientific and educational purposes, especially to provide information useful to coastal zone management decisionmaking.

Research purposes may include:

-- Gaining a more complete understanding of the natural ecological relationships within the various estuarine environments of the United States;

-- Making baseline ecological measurements;

-- Serving as a natural control against which changes in other estuaries can be measured, and aiding in evaluation of the impacts of human activities on estuarine ecosystems; and

-- Providing a vehicle for increasing public knowledge and awareness of the complex nature of estuarine systems, their benefits to people and nature, and the problems confronting these ecosystems.

While the primary purposes of estuarine sanctuaries are scientific and educational, multiple use of estuarine sanctuaries by the general public is encouraged to the extent that such usage is compatible with the primary sanctuary purposes. Such uses may generally include low-intensity recreation, such as boating, fishing, shellfishing, hunting, and wildlife photography or observation. Commercial fishing and shellfishing may also be compatible uses.

The estuarine sanctuary regulations envision that the Estuarine Sanctuary Program will ultimately represent the full variety of regional and ecological differences among the estuaries of the United States. The regulations state that "the purpose of the estuarine sanctuary program...shall be accomplished by the establishment of a series of estuarine sanctuaries which will be designated so that at least one representative of each estuarine ecosystem will endure into the future for scientific and educational purposes" [15 CFR 921.3 (a)]. As administered by OCZM, the Estuarine Sanctuary Program defined 11 different biogeographic regions based on geographic, hydrographic, and biological characteristics. Subcategories of this basic system are established as appropriate to distinguish different subclasses of each biogeographic region. The total number of sanctuaries that will be needed to provide minimal representation for the Nation's estuarine ecosystems is currently under study.

Since 1974, OCZM has awarded grants to establish twelve national estuarine sanctuaries. These include:

Sanctuary	Biogeographic Classification
South Slough Coos Bay, Oregon	Columbian
Sapelo Island McIntosh County, Georgia	Carolinian
Waimanu Valley Island of Hawaii, Hawaii	Insular
Rookery Bay Collier County, Florida	West Indian
Old Woman Creek Erie County, Ohio	Great Lakes
Apalachicola River/Bay Franklin County, Florida	Louisianian
Elkhorn Slough Monterey County, California	Californian
Padilla Bay Skagit County, Washington	Columbian
Narragansett Bay Newport County, Rhode Island	Virginian
Chesapeake Bay (2 sites) Anne Arundel and Somerset Counties, Maryland	Virginian
Jobos Bay Puerto Rico	West Indian
Tijuana River San Diego County, California	Californian

The proposed action under consideration by OCZM is providing a land acquisition grant to the State of New York to establish a National Estuarine Sanctuary in the Hudson River. This proposed sanctuary would consist of four individual sites representing different estuarine gradient zones in the Hudson River, and would contain approximately 4,130 acres of the Hudson's highest quality tidal wetland complexes. The acquisition grant request to NOAA for $375,000, matched by an equivalent amount of State funds and services, would be used for fee simple acquisition of wetlands, waters and shoreline at Stockport Flats (152-264 acres), Tivoli Bays (45 acres), Piermont Marsh (73 acres), and to develop or renovate facilities at two or more of the four Hudson River sites. These facilities (buildings, roads, parking lots,

trails and boardwalk) would be used to accommodate research activities, educational programs, and visitors. All other land at the four sites is in public ownership.

Approval of this grant application would permit the establishment of an estuarine sanctuary representing a subcategory of the Virginian biogeographic region. The proposed sanctuary would be used primarily for research and education purposes, especially to provide information useful for coastal zone management decisionmaking. Multiple use would be encouraged to the extent that it is compatible with the proposed sanctuary's research and educational programs.

The Hudson River Estuarine Sanctuary, if established, would represent a major subcategory within the northern half of the Virginian biogeographic region. This region extends over 1,000 miles of Atlantic coastline from Cape Cod to Cape Hatteras, featuring lowland streams, marshes, and muddy bottoms and representative plants and animals.

New York's proposal follows several years of interest in and concern for the Hudson Estuary by State and local officials, and university and conservation groups. The four sites to be included in the estuarine sanctuary--Stockport Flats, Tivoli Bays, Iona Island Marsh, and Piermont Marshes--were selected by a New York Estuarine Sanctuary Steering Committee because they are essentially undisturbed, representative sites, and because publicly owned land and water comprising an estuarine system were available for research, education, and recreation purposes. In September 1981, NOAA awarded New York a $50,000 pre-acquisition grant for the proposed sanctuary, which enabled the State to initiate a real estate appraisal and environmental assessment of the sites, and to prepare management, research, education, and recreation plans.

PART II: ALTERNATIVES CONSIDERED FOR THE ESTUARINE SANCTUARY (INCLUDING PROPOSED ACTION)

The action under consideration by NOAA is a proposal from the State of New York to establish a Hudson River Estuarine Sanctuary consisting of four sites representing estuarine areas on the Hudson River.

The State of New York has applied to NOAA for an acquisition grant of $375,000 to be matched with an equivalent amount of State, local, or private funds, donations of land, and in-kind services (for example, surveys and appraisals) to establish a Hudson River Estuarine Sanctuary composed of approximately 4,130 acres of water, wetlands, islands and uplands in Columbia, Dutchess and Rockland Counties. Acquisition funds would be spent for acquiring property through easements or fee simple purchases in these counties, as well as for developing facilities for research and education programs at the sanctuary. NOAA would serve as a temporary partner in the funding process for five years, after which the sanctuary would be wholly-State operated.

The proposed sanctuary would be named the Hudson River Estuarine Sanctuary with each site being designated as the "Hudson River Estuarine Sanctuary at Stockport Flats," "Hudson River Estuarine Sanctuary at Tivoli Bays," "Hudson River Estuarine Sanctuary at Iona Island Marsh," and "Hudson River Estuarine Sanctuary at Piermont Marsh."

Although this project is called the Hudson River Estuarine "Sanctuary," this does not mean that traditional uses will be changed. In fact, a multiple-use policy is clearly practicable. To insure this policy, the agencies presently administering these sites (Department of Environmental Conservation, Office of Parks, Recreation and Historic Preservation, Palisades Interstate Park Commission, and Office of General Services) will continue to make the major management policy decisions for their respective sites, in coordination with the other agencies. This coordination will be achieved through a Memorandum of Agreement. Representatives of these agencies and of the New York State Department of State are expected to confer every 3 years to review the status of the program.

A. Preferred Alternative for the Hudson River Estuarine Sanctuary

The $375,000 acquisition grant would be used for acquisition of lands and development of facilities at the Stockport Flats, Tivoli Bays, Iona Island Marsh and Piermont Marsh sites to provide the control necessary for the establishment of a Hudson River Estuarine Sanctuary. Most of the lands included within the proposed Sanctuary boundaries are already owned by New York State.

The Hudson River Estuary in eastern New York is a long narrow tidal river containing a diversity of near-pristine and high quality natural areas and nationally significant biological features. The area includes bald eagle and osprey feeding areas, a large shortnose sturgeon population, rare estuarine plant species, a flyway for waterfowl and other birds,

brackish and freshwater tidal river marshes and swamps, undeveloped forested clay and rock bluffs, and rocky and sandy islands. The proposed sanctuary sites are the major remaining near-pristine areas on the Hudson Estuary and are characterized by relatively unpolluted air and water, moderate to low tidal ranges, large tidal wetlands, heavily forested shores, great diversity of fish, wildlife and plants, and low human populations.

The purpose of this proposed sanctuary would be to manage and to maintain the Stockport Flats, Tivoli Bays, Iona Island Marsh and Piermont Marsh as they are now--healthy, productive, unspoiled estuarine natural systems, to encourage research and public education on these little-studied tidal river wetlands and associated environments, and to continue existing uses of the sites, including hunting, fishing, and trapping where presently permitted.

1. Boundaries and Acquisition of Sanctuary Lands

The proposed sanctuary would include approximately 4,130 acres of waters, wetlands, islands and uplands. The boundaries of the proposed sanctuary are shown in Figures 1-4. Most of the lands within the sanctuary boundaries are already owned by New York State. The presently State-owned areas and the areas proposed for acquisition are shown in Figures 1-4 and listed in Table 1.

The grant request to NOAA would be matched by New York State, using such sources as Environmental Quality Bond Act and other State agency funds, value of donated land, bargain sales of the parcels to be acquired, donated money from fund raising, the value of easements granted, and the value of land acquisitions within the proposed sanctuary boundaries currently being negotiated.

Eleven specific parcels of private land are to be acquired as funds permit (not in priority order; see Figures 1, 2, 4, and Table 2). In addition, the involved State agencies may acquire other parcels adjacent to the sanctuary boundaries in fee simple, or through conservation easements, as available funds permit. Furthermore, cooperative management agreements may be sought with adjoining private owners on a voluntary basis to further protect the areas surrounding the proposed sanctuary.

2. Public and Private Access

Acquisition of public access points or protection of existing access points will be sought at Stockport and Tivoli. Access is adequate at Iona and Piermont. All four sites are accessible by small boat from the river using put-in points at both public and private landings within a few miles of the sites. Land access is limited at Stockport and Tivoli and traditionally has been largely along the railroad service roads at these sites, but Consolidated Rail Corporation has indicated that it plans to close off some access points on its land in the near future. Thus, access points within the proposed sanctuary would be even more important to the public.

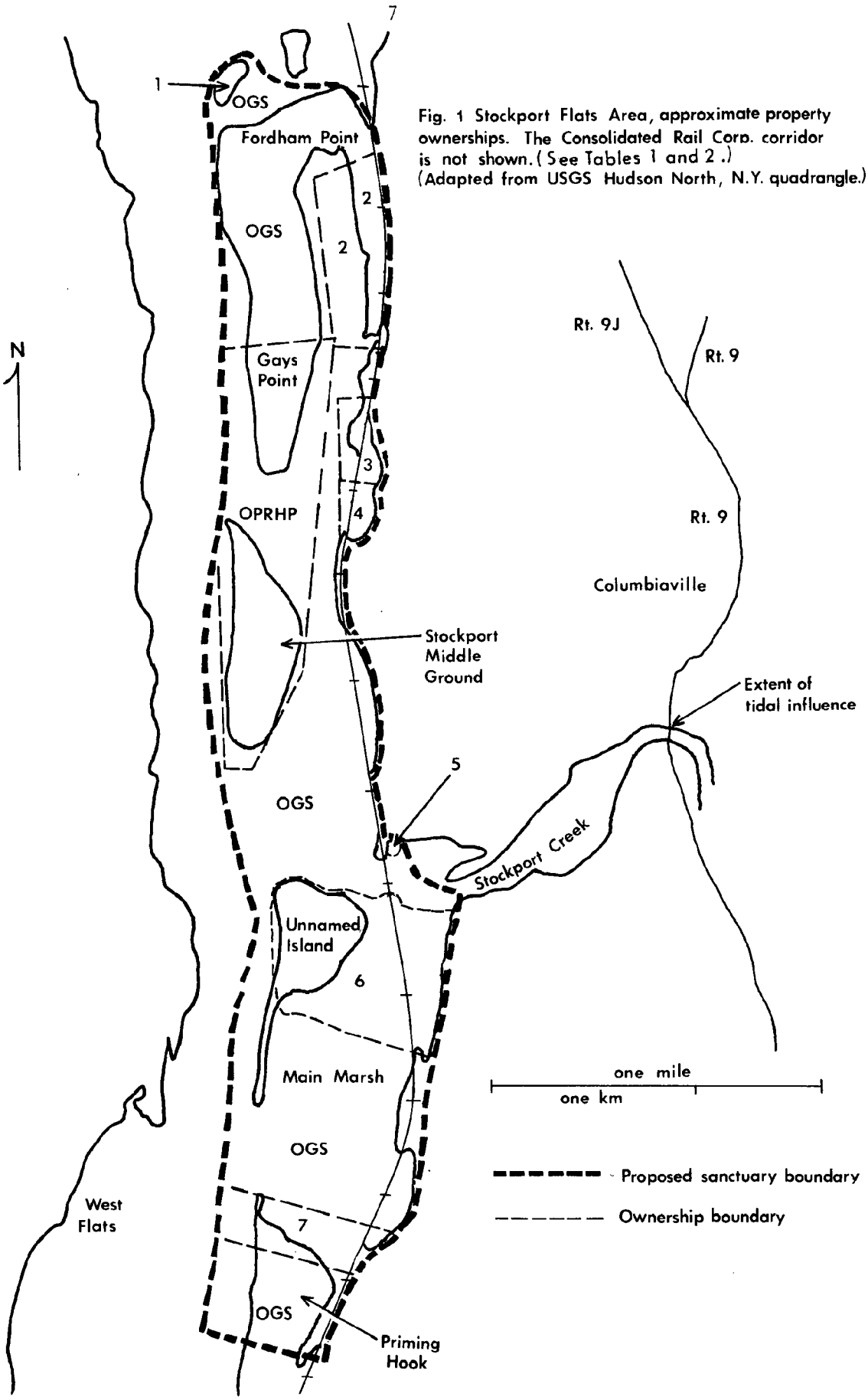


Fig. 1 Stockport Flats Area, approximate property ownerships. The Consolidated Rail Corp. corridor is not shown. (See Tables 1 and 2.)
(Adapted from USGS Hudson North, N.Y. quadrangle.)

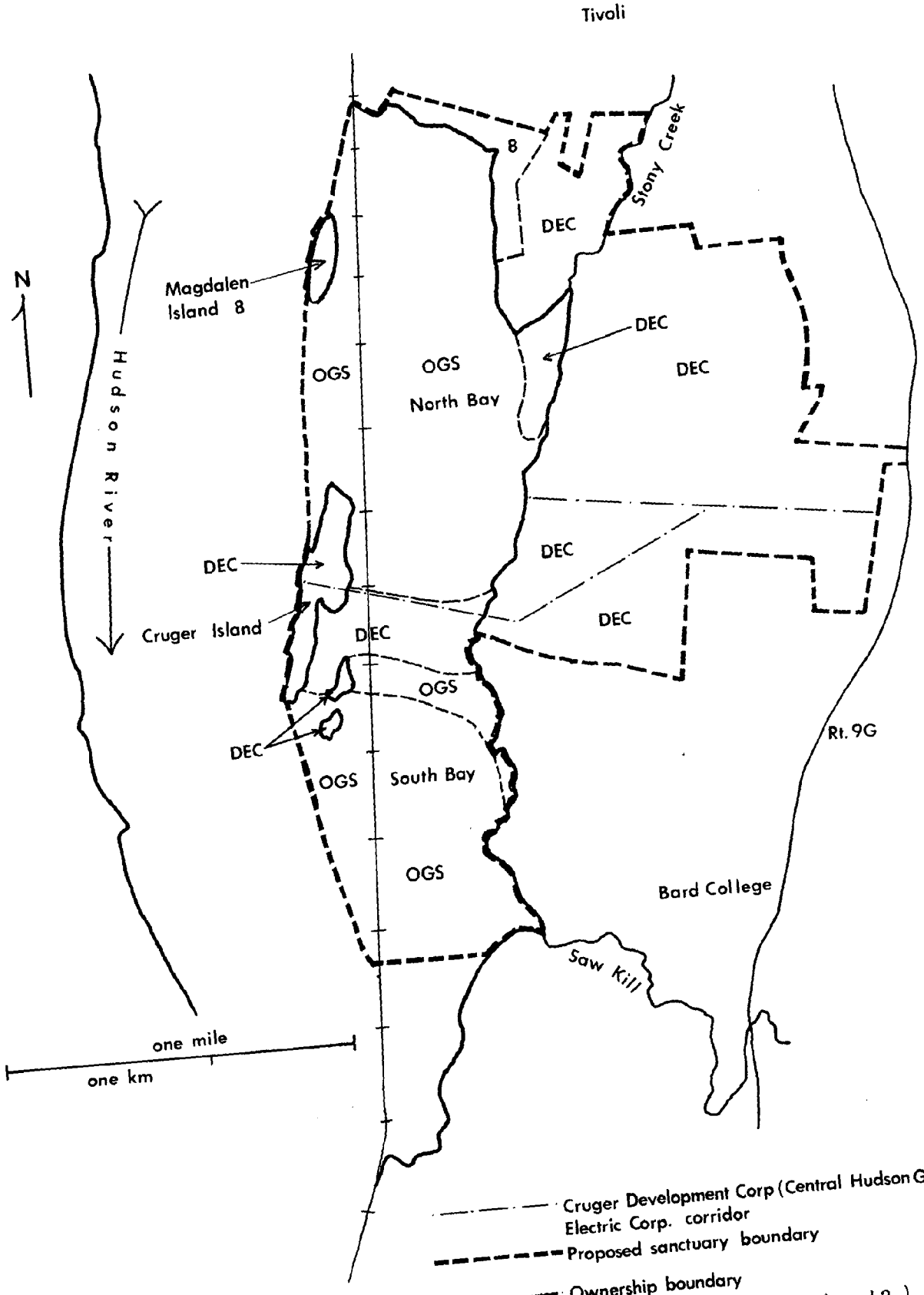


Fig. 2 Tivoli Bays Area. (See Tables 1 and 2.)
(Adapted from USGS Saugerties, N.Y. quadrangle.)

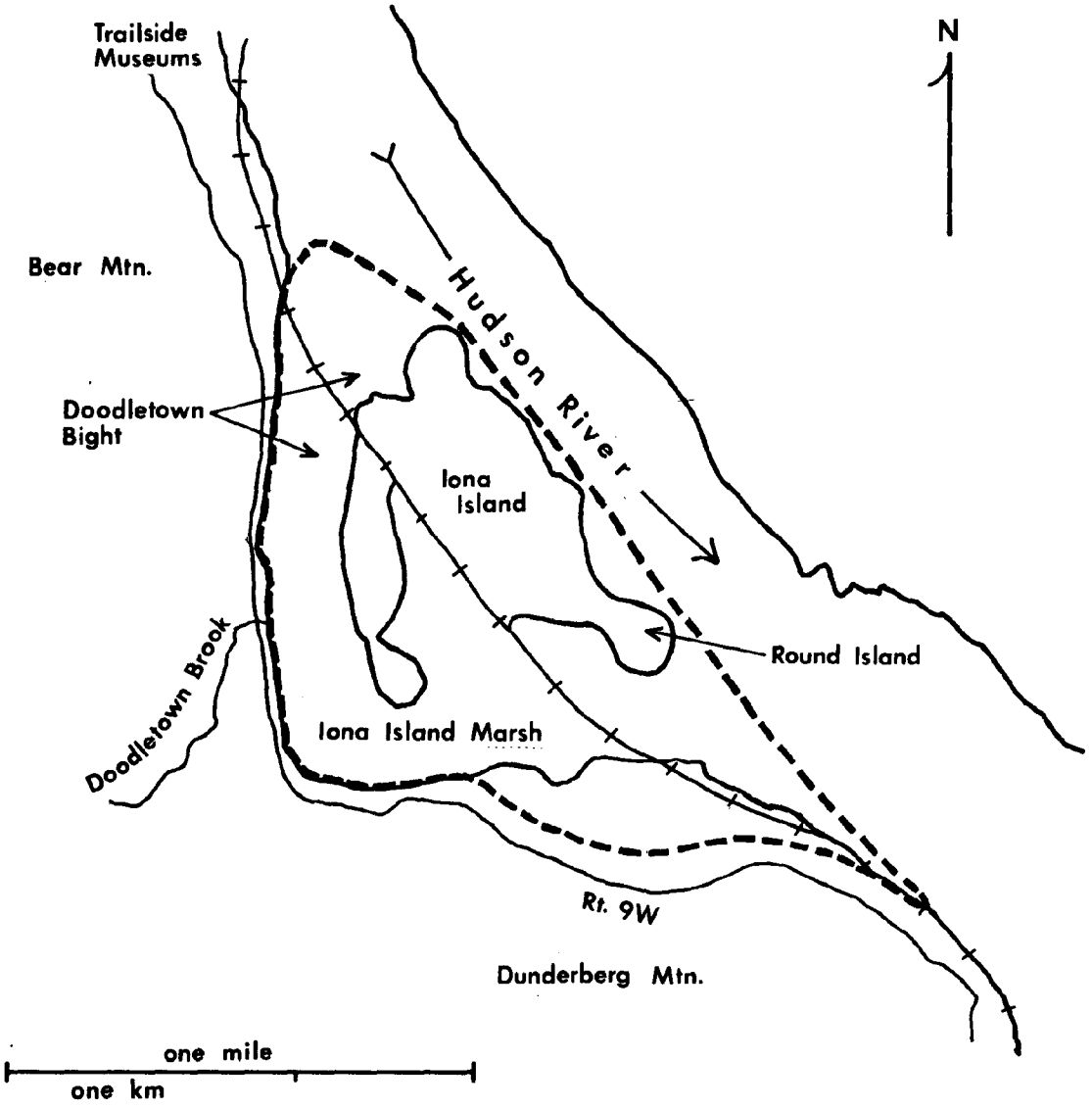


Fig. 3 Iona Island Marsh Area (See Tables 1 and 2.)
(Adapted from USGS Peekskill, N.Y. quadrangle.)
Ownership all PIPC

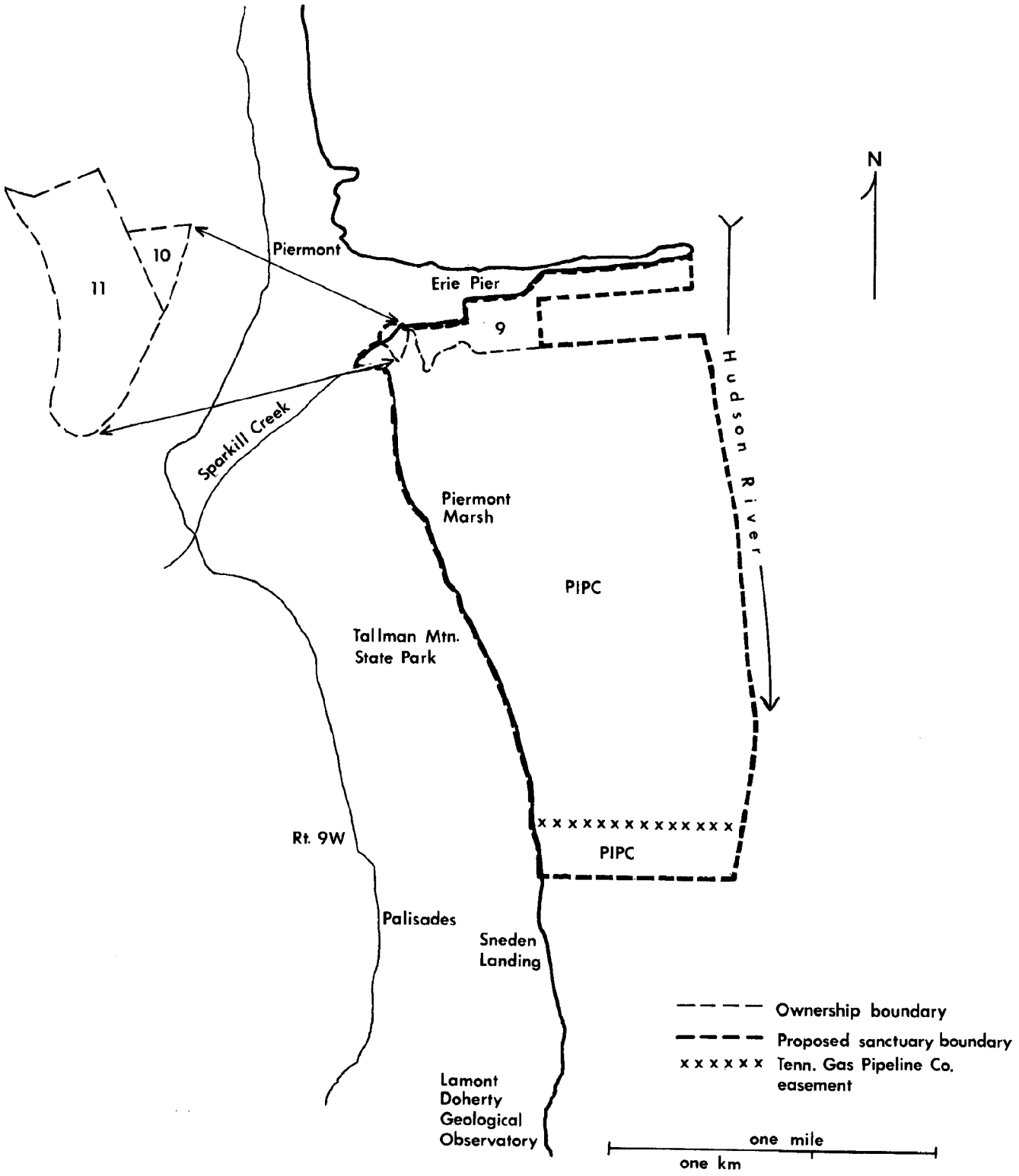


Fig. 4 Piermont Marsh Area. (See Tables 1 and 2.)
(Adapted from USGS Nyack, N.Y. – N.J. quadrangle.)

Table 1. Ownership of Parcels Within the Proposed Estuarine Sanctuary Boundaries (see Figures 1-4)[a] (approximate acreages).

	Acres
Stockport Flats:	
New York State Office of General Services (OGS)	692-804[b]
New York State Office of Parks, Recreation and Historic Preservation (OPRHP)	193
Private (see Table 2)	152-264[b]
Tivoli Bays:	
New York State Department of Environmental Conservation (DEC)	707
New York State Office of General Services (OGS)	729
Private (see Table 2)	45
Iona Island Marsh:	
Palisades Interstate Park Commission (PIPC)	556
Piermont Marsh:	
Palisades Interstate Park Commission (PIPC)	871
Private (including The Nature Conservancy, see Table 2)	73

Stockport Flats	approximately 1,149 acres
Tivoli Bays	approximately 1,481 acres
Iona Island Marsh	approximately 556 acres
Piermont Marsh	approximately 944 acres
Total	approximately 4,130 acres

[a] The following ownerships are adjacent to, but will not be part of, the proposed sanctuary: corridors approximately 75 feet wide passing through or adjacent to Stockport Flats, Tivoli Bays and Iona Island Marsh and owned by Consolidated Rail Corporation; a Y-shaped corridor (undeveloped) 200 feet wide crossing part of the Tivoli Bays State lands and owned by Cruger Development Corporation of Central Hudson Gas & Electric Corporation; the Erie Pier properties at the north end of Piermont Marsh owned by the Village of Piermont, Clevepak Corporation, and Federal Paper Board Company.

[b] The ranges of acreage given are due to the incompletely determined size of the private holding on the unnamed island, the rest of which is owned by OGS.

Table 2. Parcels Proposed for Acquisition (not in priority order)

At Stockport Flats:

Parcel 1: An approximately 5-acre sandy islet owned by Joseph Nostrand between Fordham Point and Little Nutten Hook.

Parcel 2: An approximately 57-acre area of shallows and shoreline, a water grant known as the "Gay Grant," owned by Irving Domnitch.

Parcel 3: An approximately 18-acre area of water, marsh and shoreline, a water grant known as the "Judson Grant," owned by Irving Domnitch.

Parcel 4: An approximately 10-acre area of water and marsh, a water grant known as the "Alvord Grant," owned by Robert L. Pierson.

Parcel 5: An approximately 1-acre area of madeland adjacent to the railroad and the mouth of Stockport Creek with an unimproved parking area and landing, owned by Consolidated Rail Corporation.

Parcel 6. Portions of the "unnamed island" lying off the mouth of Stockport Creek owned by Porter Fearey, Jr. The extent of Mr. Fearey's ownership is believed to be between 7 and 119 acres, and to this extent the State is negotiating with him.

Parcel 7: An approximately 54-acre area of water, marsh and shoreline, a water grant known as the "French Grant," owned by Algis C. Saurusaitis.

At Tivoli Bays:

Parcel 8: Approximately 45-acres of land including the approximately 9-acre Magdalen Island and additional area of upland at the north end of North Bay, owned by Tivoli Properties, Inc. This acquisition is under negotiation by the State and the exact size of the parcel has not been agreed upon.

At Piermont Marsh:

Parcel 9: An approximately 65-acre area of water and marsh donated to the Village of Piermont by Continental Group, Inc., together with about 6 acres previously owned by the Village, was transferred to The Nature Conservancy and the entire 71 (plus or minus) acres is being transferred to the New York State DEC.

Parcel 10: An approximately 0.04 acre area in the northwest corner of Piermont Marsh, owned by Louis Hurban, Jr.

Parcel 11: An approximately 2-acre area in the northwest corner of Piermont Marsh owned by James J. MacMurray.

Stockport. Existing access is mostly via the large unimproved parking area and unimproved boat landing on the ConRail property at the railroad crossing of Stockport Creek. Purchase of this access point would ensure its continued availability to the public.

The need for an additional access point on tidal Stockport Creek upstream from the proposed sanctuary site would be studied. This point would provide access for researchers, fishermen, and canoeists. Gay's Point and Stockport Middle Ground are accessible by boat. There are three improved public boat launch sites (at Coxsackie, Hudson, and Athens) within approximately two miles of the proposed sanctuary site.

Tivoli. Most access now is via the railroad service road from the Cruger Island Road (both northward and southward), from Barrytown (northward), and from Tivoli (southward). The management plan being developed by the DEC for the Tivoli Bays area will include development of two unimproved boat landings using old roads, one at the south end of North Bay (from Cruger Island Road), and the other on the east side of North Bay at a point just north of Stony Creek. Additionally, an existing trail system around the east side of North Bay connecting Cruger Island Road and Kidd Lane will be renovated for foot access to the site. Three small primitive parking areas will be developed in conjunction with the access points, away from the margin of the wetlands. The proposed access system will provide access for researchers and educational groups as well as fishermen, hunters and outdoor recreationists. There is an unimproved river landing at the Village of Tivoli north of North Bay.

Iona. There is access to the marsh from Rt. 9W and also from the dirt causeway connecting 9W to Iona Island. The Palisades Interstate Park Commission will repair the causeway in 1982 or 1983 as soon as PIPC funds are available. The causeway provides access for researchers and certain other users, but generally permits are required from the Park Commission. The Trailside Museums complex north of the site is accessible from the highway and will house the proposed sanctuary educational facility. The Appalachian Trail passes through this complex.

Piermont. The Erie Pier, owned by the Village of Piermont, is used for launching boats and has parking space for about 40 vehicles. The Village is planning construction of a launching ramp.

The pier is also used by fishermen and birdwatchers. There is foot-path access to the marsh edge as well as to views over the marsh in Tallman Mountain State Park.

3. Management of the Proposed Sanctuary

The Estuarine Sanctuary Program is not a new State or Federal regulatory program. The proposed sanctuary would be managed using existing State laws and programs. The Estuarine Sanctuary Program is a State program; the Federal government is a partner in providing funds and guidance during the establishment phase. The principal goals of the proposed Hudson River Estuarine Sanctuary are to:

(1) Manage the area's natural resources in a manner compatible with the National Estuarine Sanctuary Program goals and objectives in order to maintain, protect, and enhance the quality of the area's biological, physical, and cultural resources.

(2) Encourage scientific research that focuses on both improving decisionmaking in coastal management and increasing understanding of estuarine ecosystems.

(3) Increase national and local awareness of the significance of the estuarine resources within the proposed sanctuary and the Hudson River Estuary in general, and encourage wise use of these resources.

(4) Allow traditional resource uses (including hunting, fishing and and trapping) in coordination with National Estuarine Sanctuary Program objectives.

a. Management Plan

A Management Plan for the proposed Hudson River Estuarine Sanctuary would be formulated within one year after the acquisition grant is received (i.e., approximately Fall 1983). This plan would be prepared under the direction of the Sanctuary Steering Committee in full consultation with the land-owning agencies, the Sanctuary Advisory Committee, and the public. The plan would provide a framework for conducting research and educational programs and for integrating public uses into broader National Estuarine Sanctuary purposes, while ensuring compatibility of the various Federal, State, and local programs already in effect on the Hudson River Estuary. The management plan would incorporate the management prerogatives of the various Sanctuary land-owning agencies.

b. Management Structure

The DEC will administer the proposed sanctuary and will be directly responsible for the content and structure of the sanctuary's management plan, the expenditure of program funds, and the formulation and implementation of general program elements (such as research programs and educational programs). A Sanctuary Steering Committee comprised of the five State agencies involved in the proposed sanctuary has been formed.

The Steering Committee consists of representatives from the following State agencies:

1. Department of Environmental Conservation (DEC) including Regions 3 and 4 (lead agency, owner of certain sanctuary lands).

2. Office of Parks, Recreation and Historic Preservation (OPRHP) (Saratoga-Capital District State Park and Recreation Commission) (owner of certain sanctuary lands);

3. Palisades Interstate Park Commission (PIPC) (owner of certain sanctuary lands);

4. Office of General Services (OGS) (owner of certain sanctuary lands);

5. Department of State (DOS) (responsible for N.Y. State's Coastal Management Program).

DEC will chair this Steering Committee. The Committee is advisory to DEC on issues related to the formulation and implementation of the proposed sanctuary's management plan, the expenditure of program funds, and formulation and implementation of general program elements. Consistent with the management plan, the State agencies will exercise prerogatives and make decisions regarding use of lands to which they hold title.

The National Oceanic and Atmospheric Administration (NOAA) would serve as an ex-officio representative to the Steering Committee. A Memorandum of Agreement, signed by the agencies represented on the Steering Committee, would be appended to the Final Environmental Impact Statement. The Memorandum of Agreement would outline interagency arrangements for the administration and management of the proposed sanctuary, and express the agencies' agreement to carry out the management plan.

The Sanctuary Advisory Committee (SAC) will represent local government, user groups, conservation organizations, researchers, educators, funding organizations, and adjoining land owners. The purpose of the SAC is to achieve coordination among the public and private groups participating in the sanctuary program, and to assist and advise the Sanctuary Steering Committee. The SAC will help in securing funding from the private sector, organizing volunteer efforts in education and management work, soliciting and channeling public input to the sanctuary planning process, reviewing the proposed sanctuary management plan and any changes in the plan, reviewing proposals for educational and research use and other activities within the proposed sanctuary, enhancing communication and cooperation among all interests involved in the proposed sanctuary.

The SAC will function as three local subcommittees for the three local counties containing proposed sanctuary sites (Columbia, Dutchess, and Rockland), with an executive committee that meets to coordinate the work of the three subcommittees. The subcommittees will consist of local representatives as outlined in Table 3. The chairpersons of the three local committees will meet with the Steering Committee.

Coordination of the Steering Committee will be assured by the Memorandum of Agreement among the agencies involved that they agree to the objectives and specifications of the Final Environmental Impact Statement and the Federal Guidelines for the National Estuarine Sanctuary Program. The purpose of the coordinated management approach is to improve consistency, reduce conflicts, and provide better service to the public. The site-by-site organization of ownership and management responsibility follows.

Table 3. Sanctuary Advisory Committee (Tentative Composition)

Stockport (Columbia Co.)

Town Government
County Environmental Advisory Group
Sportsmen's Group
Commercial Fisherman
Conservation Group or Nature Club
Adjoining Land Owner
Scientific Researcher
Educator
Business Representative

Tivoli (Dutchess Co.) (This subcommittee will be the same as the Tivoli Bays State Lands Advisory Committee.)

Town Government
Village of Tivoli Representative
Town Conservation Council
Dutchess County Trappers' Association
Ralph T. Waterman Bird Club
Adjoining Land Owner
Scientific Researcher
Bard College Educator
Business Representative
Local Waterfowl Hunter

Piermont and Iona (Rockland Co.)

Local Government
Municipal Environmental Advisory Group
Sportsmen's Representative
Commercial Fisherman
Conservation Group or Nature Club
Adjoining Land Owner
Scientific Researcher
Educator
Business Representative

Stockport

Office of Parks, Recreation and Historic Preservation, Saratoga-Capital District Park and Recreation Commission:

owns land at Gay's Point and Stockport Middle Ground and is responsible for any facilities at those areas. There is a management plan for the Gay's Point and Stockport Middle Ground elements of the Hudson River Islands State Park, and picnicing, camping, fishing and hunting are permitted at those areas in accordance with provisions in the management plan.

Office of General Services:

owns the remainder of the currently State-owned lands at the Stockport site. Fishing, hunting and trapping are permitted on OGS lands, and these uses will continue. OGS has no facilities on its lands at Stockport.

Department of Environmental Conservation; Office of Parks, Recreation and Historic Preservation, and Office of General Services:

together will plan and conduct whatever further acquisition of lands at the Stockport site is desired.

Tivoli

Department of Environmental Conservation:

owns lands at Cruger Island, North Bay, and east of North Bay, and is negotiating further acquisition there. A management plan for the Tivoli Bays State lands is being prepared by DEC under a directive that predated the Estuarine Sanctuary Program. (This acquisition project was initiated in 1980 using on a 50-50 matching basis a Heritage Conservation and Recreation Service grant and New York State's Environmental Quality Bond Act funds, and has also been called "Tivoli Bays Nature and Historical Preserve." The area will also serve as a wildlife management area.) Facilities constructed at the Tivoli site for the proposed estuarine sanctuary would be funded (construction and maintenance) with estuarine sanctuary funds and other funds as needed. However, DEC will be responsible for physical management of the site.

Office of General Services:

owns lands in North Bay, the northern end of South Bay, and around Cruger Island and Magdalen Island which are to be transferred to DEC under an agreement which pre-dated the Estuarine Sanctuary Program. OGS also owns lands in the middle of South Bay and outside South Bay (west) which will remain in OGS ownership, but will be managed by DEC under the National Estuarine Sanctuary Program. OGS has no facilities at the Tivoli site.

Iona

Palisades Interstate Park Commission:

owns the Iona Island Marsh and all surrounding areas west of the railroad, as well as the portions of Iona Island and Round Island east of the railroad, the shallows adjacent to the island, and the Bear Mountain State Park Trailside Museums complex. PIPC maintains a portion of the Appalachian Trail which passes within three-tenths of a mile of the marsh (this is the only point where the Appalachian Trail passes through the coastal zone). The United States Department of the Interior holds a reversionary interest in the portions of Iona Island and Round Island east of the railroad. PIPC patrols the entire site, and regulates use of the site in accordance with established PIPC management policies. PIPC will be responsible for the maintenance of all improvements, additions, and exhibits at the Trailside Museums built with estuarine sanctuary funds. PIPC is also responsible for the maintenance of the access road to Iona Island. Hunting, trapping and fishing have not been permitted for more than 65 years at Iona Islands on PIPC lands and permits are generally required for other uses.

Piermont

Palisades Interstate Park Commission:

owns the major (central) portion of Piermont Marsh, and water rights grants adjacent to the eastern edge of the marsh. Hunting and trapping have not been permitted for more than 50 years on the PIPC lands, which are managed according to established PIPC policy. There are no structures on the PIPC lands included in the proposed sanctuary boundaries.

Department of Environmental Conservation:

is acquiring lands in the north end of Piermont Marsh between Sparkill Creek and the Erie Pier, and will manage the parcels to be acquired and any other parcels acquired in that portion of the marsh under the National Estuarine Sanctuary Program.

Office of General Services:

owns all lands under water east of Piermont Marsh with the exception of water rights granted to PIPC in certain areas. OGS will retain its lands and enter into a management agreement with the proposed estuarine sanctuary. There are no structures on the OGS lands.

c. Sanctuary Staff

The DEC in consultation with the Sanctuary Steering Committee would direct a staff consisting of at least one person, the Sanctuary Manager. The Manager will be an individual experienced in the environmental sciences and in grant proposal preparation. An alternative arrangement would be two individuals, a scientist and a grants writer. The Manager will occupy an office at a State-owned facility to be selected near the Tivoli or Iona site or between these two sites. If only one person is appointed, arrangements would be made to secure the part-time services of at least one other person, so that one staff member resides near the up-river sites and one resides near the downriver sites. The part-time staff member could be a shared position with another Hudson River Estuary related job in the public or private sector. Additionally, the services of volunteers would be sought wherever possible.

The sanctuary staff would be accountable to the DEC and the duties of the staff would be:

(1) Coordinating research within or related to the proposed sanctuary, and sharing the research results with the State Coastal Management Program and other State Programs related to the Hudson River Estuary;

(2) Coordinating the educational program for the proposed sanctuary and establishing a forum for open discussion between environmental and economic interests along the estuary;

(3) Preparing grant proposals and managing the finances of the proposed sanctuary;

(4) Performing other administrative duties for the proposed sanctuary, including maintenance of complete and detailed scientific and management records of the proposed sanctuary;

(5) Working with the Steering Committee and the Sanctuary Advisory Committee;

(6) Advising government agencies on issues, questions and projects that have an impact on the proposed sanctuary.

d. General and Specific Management Requirements

Management policies would be based on the primary objective of maintaining the proposed sanctuary in a natural condition to assure long-term protection of these four areas for research, education, and recreation. Development uses that would significantly alter the ecosystem or that are inconsistent with the purposes and goals of the proposed sanctuary would not be allowed on the proposed sanctuary lands.

Existing Federal, State, and local laws would, as in the past, control uses of the land and water areas within the proposed sanctuary boundaries. Changes in management policies and regulations that affect the proposed sanctuary would be reviewed by the Sanctuary Advisory Committee. This Committee may provide advisory comments on policies and programs, but would have no regulatory authority.

Major traditional uses of the lands and water within the proposed sanctuary boundaries are compatible with the research and education objectives of the proposed sanctuary. These traditional uses include fishing, hunting, and trapping (at Tivoli and Stockport), commercial shipping and recreational boating, rail and transportation, and recreational use of the Erie Pier at Piermont. The Experimental Ecological Reserve Program at Tivoli, the DEC Management Plan for the Tivoli Bays State Lands (in preparation), the National Natural Landmark status (U.S. National Park Service) of Iona Island Marsh, other State Park uses of the proposed sanctuary sites, and other established policies of the involved State agencies will remain in effect.

Although some Experimental Ecological Reserves have programs of large-scale physical manipulation of habitats for experimental purposes, such manipulation would not be consistent with the goals of the proposed Hudson River Estuarine Sanctuary. Experiments would be designed to assess, evaluate and expand knowledge of natural systems within the proposed sanctuary, or larger scale manipulations outside of the proposed sanctuary boundaries which would not alter the natural systems within the proposed sanctuary. Significant long-term or permanent habitat manipulation is generally considered incompatible with estuarine sanctuaries.

e. Enforcement of Existing Laws

Enforcement of existing Federal, State and local laws within the proposed sanctuary would continue as it has in the past. Establishment of an estuarine sanctuary does not bring any new Federal or State regulation to the area, but it emphasizes the importance of the area for research and education. The following laws, among others, would guarantee the integrity of the proposed sanctuary: Federal Clean Waters Act, Section 404; and Rivers and Harbors Act Section 10; State Tidal Wetlands Act, Freshwater Wetlands Act; and Stream Protection Act; other parts of the State Environmental Conservation Law; New York State Parks and Recreation Law; and New York State Waterfront Revitalization and Coastal Resources Act. A more detailed list of existing laws and jurisdictions is in Appendix 2.

f. Research Program: Hudson River Estuarine Sanctuary

Estuarine sanctuary research would focus on estuarine studies and studies of the interaction of terrestrial and marine ecosystems with the estuarine ecosystem. Studies would be carried out in wetlands, shoreline, shallows and deepwater habitats with a special emphasis on shoreline and wetlands habitats because these habitats of tidal rivers have been least-studied, particularly in the Hudson River Estuary. Most research would be done by private laboratories, colleges, universities and State agencies. The Steering Committee would coordinate research objectives and priorities for the proposed sanctuary, and coordinate research activities.

The State agencies represented on the Steering Committee would stimulate new research in the proposed sanctuary. Public interests, especially sanctuary user groups, would draw attention to practical problems of ecology and management in the Hudson River Estuary. Interaction between New York's Coastal Management Program, (NYS Department of State), New York Sea Grant Institute, and the Steering Committee members would enable the Sanctuary Research program to function partly in an "experiment station" mode to identify and address the information needs of coastal management. A significant factor in future scientific research on the Hudson is the newly-established not-for-profit Hudson River Foundation for Science and Environmental Research, Inc., with an endownment of $12 million provided by Consolidated Edison Company of New York, Inc., Niagara Mohawk Power Corporation, Central Hudson Gas & Electric Corporation, and Orange and Rockland Utilities as a result of the landmark negotiated settlement involving the utilities, U.S. Environmental Protection Agency, N.Y. State DEC, Scenic Hudson, Inc., Hudson River Fishermen's Association, and the Natural Resources Defense Council.

A considerable amount of research has already been done on the Hudson River Estuary. The National Estuarine Sanctuary Program can provide the coordination needed to make the most efficient use of funds, existing data, and research opportunities, while facilitiating the availability of information resulting from research and avoiding duplication within the proposed sanctuary. The goals of the proposed estuarine sanctuary are compatible with those of the Hudson River Environmental Society and the Hudson River Research Council (groups of scientists and educators formed to coordinate research and disseminate research results to the public). There is opportunity for improved sharing of equipment, facilities and personnel of the tyupe shown by the two Hudson River Field Weeks in April 1977 and August 1978. Special opportunities also exist for the public (students, sportsmen, naturalists, etc.) to assist as volunteers in research projects; this approach was used successfully by Boyce Thompson Institute in collecting data on Hudson River Estuary fish, invertebrates, and marsh vegetation. This "volunteerism" will link research and education efforts in two ways: (1) educational field trips can collect samples and make observations useful to scientists, and (2) amateur naturalists can do field work under scientific supervision. Fishermen are already assisting in tagging projects, and a postcard reporting system is under study by the Hudson River Fisheries Advisory Committee to enable sportsmen and naturalists to contribute to a scientific data base information on observations

of unusual events and species that would otherwise be lost. The Fisheries Advisory Committee and the DEC Hudson River Fisheries Coordinator will work closely with the Steering Committee to stimulate and plan research, and exchange assistance and information.

Tivoli Bays was designated an Experimental Ecological Reserve (EER) in 1981 under the Institute of Ecology (Butler University) national system of Experimental Ecological Reserves. This is a non-funded system of reserves that are selected to serve as sites for long-term ecosystem-level studies. Some of the monitoring and research planned for the EER would be extended to cover all four estuarine sanctuary sites. The proposed sanctuary sites were selected to allow research on a cross-section of areas representing similar habitats (shoreline, marshes, shallows) along the ecological gradient of the estuary, and these sites are well-suited for long-term studies comparing stability and change in vegetation, animals and ecosystem function. New York's commitment to maintaining these natural areas will permit long-term ecological research not possible elsewhere.

In connection with the proposed estuarine sanctuary, appropriate facilities (existing or new) would be designated to serve as respositories for published and unpublished reports, data, and voucher specimens of plants and animals in different reaches of the Estuary. It is expected that the planning of repositories would be coodinated with the Hudson River Foundation for Science and Environmental Research, Inc. and other active groups.

Estuarine Sanctuary grant funds will not be adequate to support all research. Some operations funds may be used for environmental monitoring. Therefore, estuarine sanctuary staff would conduct an active fund-raising effort to support research, in conjunction with the preparation of grant proposals by independent researchers and other institutions.

The specific research projects to be conducted would be determined later and would be carried out within the scope of available funding. In general, research would be encouraged that is relevant to effective coastal management and the wise use of Hudson Estuary resources. The following topics are examples.

(1) Ecosystem-level studies of the flows of energy and nutrients within the wetlands, between the wetlands and the open estuary, and between the wetlands and the shores;

(2) Studies of the role of terrestrial and acquatic plant detritus in the nutrition of estuarine organisms in the Hudson's fresh-tidal and brackish-tidal areas, and the effects of detritus from different sources of these processes;

(3) Patterns and changes in vegetation of wetlands, shallows and shores, and effects on fish and wildlife populations, soils, and nutrient cycles;

(4) Ecology of wildlife food plants such as water-celery, wild-rice and cattail;

(5) Role of the Hudson River Estuary wetlands and the shallows in the spawning, juvenile development (nursery) and feeding of commercial and sport fishes;

(6) Role of the Hudson River in the Atlantic waterfowl and shorebird flyway, and the value of the wetlands and shallows as resting, breeding, and wintering places for water fowl;

(7) Marsh bird (rail, gallinule, bittern, wren, blackbird and sparrow) populations and their relationship to marsh vegetation, food organisms, and other animals;

(8) Muskrat ecology, populations, relationship to soil, vegetation and other wildlife, diseases, environmental contaminants, limiting factors, and economic value;

(9) Invertebrates (benthic and planktonic) and their role as fish and wildlife food and in sediment processes and nutrient cycling in the wetlands and shallows;

(10) The species composition and production of Hudson River marsh vegetation compared to fish-tidal and brackish-tidal marshes in other East Coast estuaries, and to saline-tidal marshes;

(11) The ecology, vegetation, wildlife, and resources values of freshwater-tidal swamps;

(12) Ecology of endangered species including shortnose sturteon, bald eagle, osprey, heartleaf plantain and Nuttall's micranthemum, and ecology of "estuarine endemics" such as cylindrical bulrush;

(13) Effects of rising sea level on tidal wetlands;

(14) Geologic character and history of wetland sediments and vegetational history of the wetlands; and

(15) Microbial communities and role in ecosystem processes.

In addition, the "experiment station" approach could address management problems elsewhere on the estuary such as:

(1) Fish stocking potentials and policies;

(2) The sources and cycling of toxic substances and the uses of plants and animals to monitor toxic substances;

(3) Effects of introduced plant and animal species on the estuary and on native species;

(4) Mitigation of effects of channel maintenance and dredged material disposal;

(5) Shoreline erosion and its management;

(6) The assimilation capacity of natural environments for nutrients and other waste materials;

(7) Manipulative experiments on wetlands outside the proposed sanctuary sites, to study effects of management practices such as impoundment, water level control, pest control, and wildlife species management, and restoration of damaged wetlands; and

(8) Experiments in mitigation and minimization of development and management impacts to include industry, marinas, railroad right-of-way management, and shoreline stabilization.

g. Existing Monitoring

Several State and Federal Agencies and private institutions conduct monitoring of physical, chemical and biological characteristics of the Hudson River Estuary.

(1) Tides and freshwater flow;

(2) Water quality;

(3) Air quality and weather;

(4) Fisheries surveys and stock assessments;

(5) Commercial fishing activity;

(6) Levels of PCB and metals in fish;

(7) Distribution and abundance of endangered animals and plants;

(8) Mid-winter aerial water fowl surveys (see Appendix 5);

(9) Christmas Bird Counts (several locations):

(10) New York State Breeding Bird Atlas;

(11) Breeding birds and vegetation of the railroad right-of-way; and

(12) Seismic activity.

The monitoring and research program at the proposed sanctuary would be designed for compatibility with similar work at the other existing National Estuarine Sanctuaries and coastal Experimental Ecological Reserves. It is anticipated that the proposed Hudson River Estuarine Sanctuary would be the site of regular workshops and conferences on ecology and management of estuaries and wetlands. A research prospectus would be circulated regularly to inform and attract potential researchers.

h. Education and Public Awareness Program

While few people live next to the proposed sanctuary sites themselves, approximately 15 million people are located within a 45- minute drive of the sites. Each year millions of people visit the shores of the Hudson River for recreation and other purposes. The Trailside Museums complex adjoining the Iona Island Marsh site has an estimated 600,000 visitors annually. At the Trailside Museums and at selected locations on or adjacent to the other three proposed sanctuary sites, it would be possible to accommodate many people for educational purposes without damage to the natural areas or conflicts with other uses.

The proposed sanctuary staff and Sanctuary Advisory Committee would be active in public education. There is a growing body of scientific information on the Hudson River Estuary, but relatively little of it has been interpreted for the lay public. During the last 5-10 years, Hudson Valley residents have evidenced considerable interest in seeing and learning about the estuary and its life, and the wetland and shoreline environments represented in the proposed sanctuary lend themselves well to this purpose.

These are examples of possible education programs:

(1) Improvements to the Bear Mountain Trailside Museums to accommodate indoor and outdoor exhibits on the Hudson River Estuary and the Iona Island Marsh complex, oriented toward the general public with no prior knowledge of the estuary;

(2) Facilities in a renovated barn at the Tivoli Bays site for undergraduate and graduate student and public class use;

(3) A boardwalk accessible to the handicapped, through tidal marsh, swamp and pool habitats at the margin of the Tivoli Bays wetland, for the use by public and by researchers;

(4) Traveling exhibits about the estuarine sanctuary for sportsmen's shows, elementary and secondary schools, nature and civic club meetings, county fairs, conferences, and other events;

(5) Interpretive brochures describing the four proposed sanctuary sites and the Hudson River Estuary in general, with trail maps and guides to access points and special interest features (e.g., birding "hotspots");

(6) A kit for teachers outlining estuary-related classroom activities for various age groups, coastal studies curricula, and do-it-yourself field trips to the proposed sanctuary sites or other Hudson River Estuary wetlands and shoreline locations;

(7) Slide shows with pre-recorded taped narrations for loan to schools and public groups;

(8) Posters interpreting the estuary and its life and management;

(9) Videotaped programs for cable television stations, other public television, and school use;

(10) Organized field trips, guided by volunteer experts, at the proposed sanctuary sites and other locations, dealing with specific as well as general subjects;

(11) A "speakers' bureau" for all public groups, consisting of persons with special knowledge of various Hudson River and general estuarine subjects (e.g., wetland ecology, fisheries, birds); and

(12) A canoeist's guide to the proposed estuarine sanctuary.

Estuarine sanctuary educational activities would be closely coordinated with ongoing programs at the Dutchess Community College Norrie Point Environmental Center, Hudson River Sloop Clearwater, Wave Hill Environmental Studies Center, and other institutions. The New York State Sea Grant Institute in cooperation with the County Extension service has just inaugurated the position of Hudson River Sea Grant Cooperative Extension Specialist to promote public understanding of and appreciation for the estuarine system.

B. Other Alternatives Considered

1. No Action

Without a Hudson River Estuarine Sanctuary there would be no estuarine area specifically identified and protected within New York, and New York would lose the opportunity to participate in the National Estuarine Sanctuary Program. New York and the Nation would be unable to derive the benefits from the research information and public awareness that would result from establishing and this area as an Estuarine Sanctuary.

Although much of the land within the proposed sanctuary boundaries is already State-owned, under the "No Action" alternative New York would not be as readily able to acquire the remaining lands to fill in the public ownership gaps in the Piermont, Tivoli and Stockport marshes and these areas might not be manageable as State reserves. Furthermore, there would be less incentive for the several State agencies to work together to develop consistent management policies and practices with short-term and long-term benefits for natural area conservation, rare and endangered species, research, education, and recreation. Without designation of the estuarine sanctuary there would be less incentive for donation or bargin sales of lands adjacent to present State ownerships. Also, there would be no prestigious national program to attract research funds and highly qualified scientists from various fields to do long-term research with the confidence that their study area would remain protected.

Without the designation of the Hudson River Estuarine Sanctuary, the National Estuarine Sanctuary System would lose the opportunity to study the extensive low salinity brackish and fresh-tidal estuarine marshes and swamps so little studied to date. Also the opportunity would be lost to inform the large urban populations of the New York Metropolitan Area and the State Capital District that have had little exposure to information about estuarine systems.

The "No Action" alternative would not specifically prevent any single research project or land acquisition project, but the impetus for unification of management and coordination of research and education would be lost. The sanctuary designation plus the provision of management funds and the planning acompanying it, would establish a more comprehensive program as well as encourage additional research in the area, while such focus would likely not occur without designation.

2. Alternative Sites and the Site Selection Process for New York State

The State of New York commenced its site selection process soon after receiving a memorandum from the Office of Coastal Zone Management (OCZM) sent in September 1979, inviting Mid-Atlantic States to nominate a candidate site. The Coastal Management Unit staff of the New York Department of State forwarded this invitation, along with the Federal Estuarine Sanctuary guidelines and case studies of Sanctuaries created in other parts of the country, to other State, regional and county agencies which had already been assisting in development of the New York Coastal Management Program. Representatives from these agencies, as well as from the New York Sea Grant Institute and the Marine Sciences Research Center of the State University were asked to review the Federal site selection criteria and consider possible candidate sites. Virtually all eligible sites had already been identified through the State's Coastal Management Program, and many were documented as Geographical Areas of Particular Concern or as Significant Habitats. New York' landmark Tidal Wetlands and Freshwater Wetlands regulatory laws also helped to identify candidates through the mapping required by those statutes. Information was also provided by the programs of the Department of Environmental Conservation to identify and acquire key tidal and freshwater wetlands with funds provided under the State Environmental Quality Bond Act of 1972. All of these identification and registration programs and involved broadbased public input from sportsmen, scientists, naturalists, educators, politicians and other interested individuals and groups.

In October 1979, representatives from these agencies met to discuss New York's possible involvement in the Program and to identify potential candidate sites. At this meeting the Estuarine Sanctuary Steering Committee was created (in a slightly different form than at present) to guide the Department of State in its selection of the best candidate site. The Steering Committee then consisted of the following persons:

Ms. Frances Dunwell, Center for the Hudson River Valley

Mr. Francis A. Hyland, Long Island State Park and Recreation Commission

Mr. Joe Ketas, City of New York Department of City Planning

Mr. Ronald Killian, The Nature Conservancy

Mr. Erik Kiviat, Bard College

Dr. Lee E. Koppelman, Long Island Regional Planning Board

Mr. James W. Morton, NYS Department of State

Mr. John Muenziger, Westchester County Environmental Management Council

Mr. Steven Resler, Town of Smithtown Planning Department

Dr. Jerry R. Schubel, State University at Stony Brook

Dr. Donald F. Squires, New York Sea Grant Institute

Mr. Anthony Taormina, NYS Department of Environmental Conservation

Mr. Ivan Vamos, New York State Office of Parks and Recreation

The Steering Committee evaluated a number of candidate sites using the selection criteria listed in the Federal Estuarine Sanctuary Program Guidelines. The three sites which best met the Federal criteria were:

(1) The Peconic-Flanders Bays area;

(2) The Hudson River marshes; and

(3) The Nissequogue River.

Short position papers describing each estuarine area were prepared and sent to OCZM for preliminary review. The object of this review was to determine in any of these sites would be clearly ineligible for the Program. OCZM staff deferred expression of preference for any one site in order to allow New York to make an independent decision on the State's best candidate. OCZM staff prepared a memorandum clarifying the current interpretation of the Federal selection criteria. Copies of this memorandum and all three position papers were sent to every Steering Committee member for review.

Early in December 1979 the Steering Committee held public information meetings in Hauppauge and New Paltz to publicize its interest in selecting a candidate site and to seek public comment on the selected sites. Shortly afterwards, members of the Steering Committee and a representative from Washington visited each of the three areas, making overflights and holding meetings with local public officials and interested groups.

Later in December, the Steering Committee met to re-evaluate the sites in light of the OCZM memorandum on selection criteria, their observations during the site visits, and additional information provided at the public meetings. Each Steering Committee member had been asked to complete site evaluation forms prior to the meeting. Evaluation scores were compiled at the beginning of the meeting and discussion of the strengths and weaknesses of each candidate followed. After considerable discussion, the Peconic-Flanders Bays area was selected as the State's best candidate for nomination in the Program, with the Hudson River Marshes as a strong second.

When the primary nomination had to be withdrawn in early 1980 due to programmatic and local political difficulties, the Hudson River proposal became the primary candidate, and the pre-application process resumed, with a new lead agency (DEC) and a new Steering Committee (see list of preparers). The initial Hudson River proposal included five wetland complexes, from north to south: Tivoli Bays, Constitution Island Marsh, Iona Island Marsh, Croton Marshes, and Piermont Marsh. OCZM and Hudson River ecologists suggested that Constitution be dropped from the proposal because of a localized pollution problem, and that Croton be dropped because of conflicting land uses. Afterwards, Stockport Flats was added to the Hudson River proposal to represent the narrow and sandy upper reach of the estuary.

The Federal guidelines require that the sites be representative of the estuary, and that the sites do not duplicate each other in character. The four Hudson River Estuary sites represent the salinity-vegetation-fauna gradient of the Hudson, and one site is located in each of the four differing geologic-ecologic segments of the estuary (see Affected Environment). The total (high tide) surface area of the Hudson River Estuary from Battery Park to Troy is approximately 82,800 acres, and the portion of this total which is composed of intertidal wetlands plus subtidal shallows (less than 6 feet deep at low tide) is 21,200 acres (26%). Thus, the total acreage of the wetlands and shallow of the four sites (Stockport, Tivoli, Iona, Piermont) is approximately 2,860 acres or about 13% of the Hudson River Estuary's wetlands-shallows component, a fraction considered representative and adequate for the estuarine sanctuary purposes.

All four Hudson River Estuary sites are large wetland complexes, among the Hudson's largest, and all four have subsystems that lend themselves to comparative research along the estuarine salinity gradient: extensive cattail stands cut by tidal creeks, associated tidal shallows and mudflats, and forested terrestrial zones. All sites include the wetlands-shallows and wetlands-uplands habitat combinations that promote wildlife use and allow study of ecosystem linkages.

The four Hudson River Estuary sites are among the Hudson's highest quality estuarine natural areas, and contain biological features of national significance including rare and endangered species. The sites are well-buffered by compatible adjoining land uses, ensuring manageability and future quality. All areas are conveniently near (for research and education) academic facilities, laboratories, and large urban populations, but retain their wildland character and offer secluded and pleasing environments for research and educational activities. All sites have have suitable existing or potential access for the purposes of the Estuarine Sanctuary Program.

The Hudson River Estuary is demographically central in New York State. A great amount of biological research has been done on the Hudson Estuary, in part because of its proximity to New York City and to numerous academic and scientific institutions, in part due to environmental analysis carried out in connection with land use planning and environmental management, and also due to the Hudson's inherent and unique interest to biologists as a diverse and productive natural estuarine system.

For at least 12 years private and public groups have called attention to the need for overall coordination of research, education, and management efforts on the Hudson. The Hudson River Research Council convened two conferences to address this problem in 1976 and 1977, and the Hudson River Environmental Society held a Hudson River Marsh Workshop in 1976, five Hudson River Ecology Symposia from 1966 to 1980, and a Hudson River Fisheries Conference in 1981.

Because of an excellent State land acquisition program during the last several decades, many of the ecologically significant Hudson River Estuary wetlands, islands, and shore natural areas are already in State ownership as parks, wildlife management areas, and preserves. Therefore, it was appropriate to propose the establishment of an estuarine sanctuary involving areas already predominantly State-owned and to use the program to fill out existing core public lands.

Several alternatives were considered during the process of selecting sites on the Hudson River Estuary. One alternative was a sanctuary consisting of the entire Hudson River Estuary from Battery Park to Troy. This alternative has many advantages for management, research and education, but was rejected as being unworkable in the short-term due to constraints of funding and land use conflicts. Individual alternative sites were considered, and a number of sites were suggested by individuals and private groups. Several recommendations were received in favor of the addition of the Grassy Point wetland complex at Haverstraw to the proposal, but this seemed inappropriate because of the same standards of environmental quality to Constitution Island Marsh and Croton Marshes. Among many other areas considered were Con Hook Island and Marsh, Manitou Marsh, Moodna Marsh, Vanderburgh Cove, Suckley Cove, Kingston Point Marsh, Rogers Island Marshes, the Hudson North and South Bays, Inbocht Bay-Duck Cove, West Flats-Vosburgh Swamp, Ramshorn Creek-Livingston Marsh and Papscanee Creek Marshes. These areas were all rejected for one or more of the following reasons: small size, lack of representative sub-systems, localized environmental quality problems, incompatible land and water uses. Special consideration

was given to selecting a site in the northernmost section of the estuary between Troy and Saugerties, before settling on Stockport Flats as the best choice. Papscanee Creek Marshes have modified tidal circulation and the quality of the cattail stands is not as high; the West Flats-Vosburgh Swamp complex is partly diked off from tidal flow and the diversity in the remaining tidal portion is low; Hudson North and South Bays have been adversely affected by neighboring land uses; and the Rogers Island complex does not contain vegetation types comparable to the three southern sites although it is a high-quality natural area. Stockport Flats stood out as the site with the highest environmental quality and having subsystems appropriate to the overall representativeness of the Hudson River Estuary selection.

3. Alternative Boundaries

Boundaries set for the individual sites represent a mix of these considerations: inclusion of the primary resources for research and education, adequate protection and manageability, sufficient terrestrial buffer zones, access, present ownership, availability of funding for acquisition.

a. Inclusion of Primary Resources. The extensive main wetland areas at all four sites are the focal points of the proposed sanctuary. The placement of the lower (river) boundaries of the sites between the minus-6 foot contour and the navigation channel includes enough of the shallows for management purposes while acknowledging that research work can be carried out in the deeper waters where no specific protection is required.

b. Adequate Protection and Manageability. The range of size of the four sites is within a range considered manageable yet still provides for the future integrity and protection of the sites. Inclusion of areas on both sides of the river at any one site (e.g., Stockport Flats and West Flats) was avoided because of logistical problems. Extension of site boundaries across zones with little or no shallow water was also avoided because it would have created unnecessary disjunction (e.g., Iona Island Marsh and the mouth of Popolopen Creek).

c. Terrestrial Buffer Zones and Access. Extent of buffer zones was set depending upon status of adjoining lands and topography. At Iona and Piermont, the amount of terrestrial mainland included in the site boundaries was moot because of the stringent protection afforded the State Park lands. At Tivoli, a decision was made to include the entire State-owned uplands to achieve consistency in the boundaries of the State lands, Experimental Ecological Reserve, and proposed estuarine sanctuary, while creating a management unit. At Stockport, the primary considerations were access and reasonable size of management unit and proposed acquisitions, while affording protection for the main marsh and for endangered species. All of the terrestrial portions of Iona Island are included in the site boundary because of management consistency and protection of endangered species. At Piermont, it was decided to include the north end of the marsh to avoid management conflicts, to protect both sides of the mouth of Sparkill Creek, and to use the Erie Pier as an access point.

The proposed boundaries are the products of extensive Steering Committee discussions and meet the needs of all State agencies involved as well as the requirements of the Federal Program. The boundaries will permit workable administration and ease of management of the proposed sanctuary.

4. Alternative Management Scheme

The proposed management scheme (separate State agency ownerships with integrated management agreement and management plan) is considered the best choice because it respects traditional agency prerogatives and enables the pooling of resources and expertise of all agencies and interests involved. Consideration was given to alternative schemes, for example, transfer of all lands to a single agency or administration of the proposed sanctuary by a private group. The other alternatives were rejected because of the lack of adequate mechanisms and the desire to retain traditional uses and policies as much as possible. The State's Coastal Management Program has involved strong cooperation among State agencies and has shown that collaborative management of the proposed sanctuary is the best alternative.

5. Funding

Several sources of funds have been used in the past for the acquisition of natural areas in the Hudson River Estuary; these include Federal Land and Water Conservation Fund, State Environmental Quality Bond Act of 1972 funds, and private initiatives including the donation of lands to conservation groups. At the present time, no adequate source of funds is available for an estuarine sanctuary project (acquisition and operation) other than the NOAA National Estuarine Sanctuary Program funds here considered.

Special advantages of NOAA National Estuarine Sanctuary Program funding include:

(1) The emphasis on research and education programs while retaining other traditional uses of the sites;

(2) The prestige of the National Estuarine Sanctuary System which would attract national attention to New York, increase the chances of receiving substantial research grants from other public and private sources, improve research and education opportunities at the selected sites, and strengthen public support for continued pollution abatement and public enjoyment of the resource; and

(3) The National Estuarine Sanctuary Program provides five years of matching operations funds which are needed to establish the proper management of the proposed sanctuary during its first years after establishment.

Federal estuarine sanctuary grants are not available for other purposes. During the first years of sanctuary operation, plans would be made for funding of the proposed sanctuary after Federal funding expires. Sources of post-Federal funding may include one or more of the following: State agency funds; private donations or grants for sanctuary operations; interest from an endownment raised by a not-for-profit corporation; a possible State Legislative appropriation; equipment, services, and time donated to the proposed sanctuary by the private sector; and voluntary donations by users of the proposed sanctuary.

PART III: AFFECTED ENVIRONMENT

A. Hudson River - General Description

The Hudson River flows 315 miles through eastern New York State from the Adirondack Mountains southward to New York City. The Hudson is a tidal river for 152 miles from Troy to Battery Park at the tip of Manhattan Island where it empties into New York Harbor, Lower New York Bay, and the New York Bight. Tidal freshwater extends from Troy south to Hyde Park (Figure 5). The 0.1 parts-per-thousand salinity "salt front" shifts through the Hyde Park to Yonkers reach.

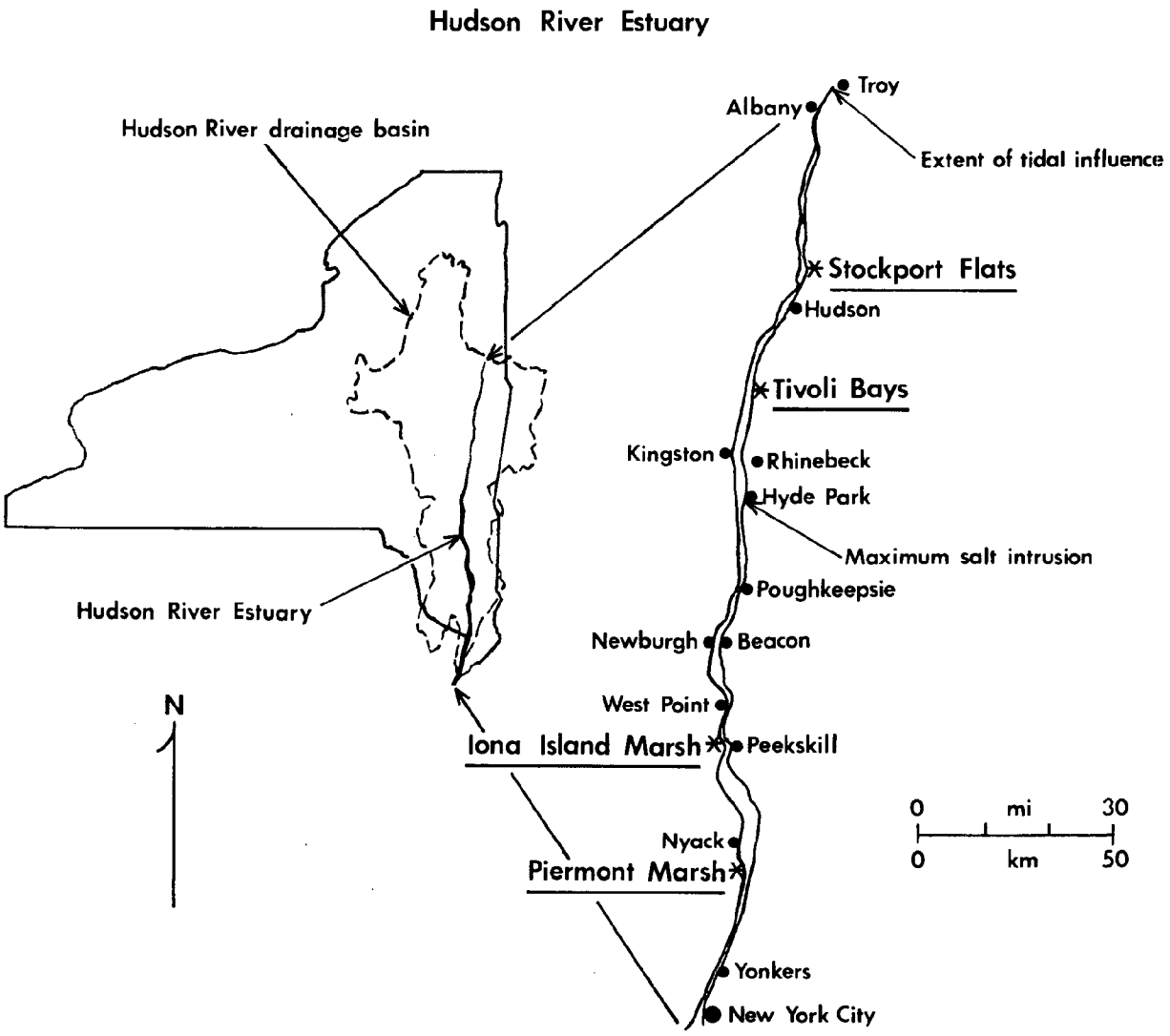
The Hudson River is entirely in New York State except for 20 miles at its mouth where it flows between New York and New Jersey. The Hudson River watershed lies in New York State except for small areas in New Jersey, Massachusetts, Connecticut and Vermont. In New York, the Hudson Estuary flows through or past 14 counties and 41 townships.

Geologic diversity is great in the Hudson River watershed and along the tidal Hudson itself. Sandstone, shale, limestone, gneiss, diabase, sand, clay and till are prominent along the tidal shores. Topography is also varied, with narrow shallow reaches, narrow deep reaches, and broad shallow reaches. River widths are about one-sixth to two-and-one-half miles; maximum depths 13-200 feet. The tidal Hudson is a long narrow estuary with an extended tidal-freshwater reach. Partial stratification occurs at times in the lower estuary where a layer of fresher water may flow outward over a layer of more saline water. The mean vertical tide range averages 3-4 feet.

Ecologically, the Hudson River Estuary resembles other East Coast estuaries in the Virginian Biogeographic Region (Cape Cod to Cape Hatteras). For example, wetlands and shallows vegetation, and communities of fish and wildlife resemble those found in the Connecticut River Estuary, the Delaware River Estuary, and Chesapeake Bay.

Numerous habitat types are present in the Hudson Estuary. These include open deep water, shallows, marshes, swamps, rocky and sandy islands, silt bottom, peat bottom, clay banks, and rock cliffs. Extensive areas of the Hudson Estuary shores are forested with oaks, maples, beech, birches, hemlock, white pine and other trees. About 150 species of fishes occur in the Hudson.

The four sites proposed for inclusion in the Hudson River Estuarine Sanctuary are distributed as shown in Figure 5, and mapped in Figures 6-9. These sites are, from north to south, Stockport Flats, Tivoli Bays, Iona Island Marsh and Piermont Marsh. The great majority of lands (both estuarine and terrestrial areas) at these sites are already State-owned.



Stockport			
19 mi 45 min	Tivoli		
67 mi 120 min	49 mi 75 min	Iona	
84 mi 160 min	66 mi 120 min	18 mi 45 min	Piermont

Distances (airline miles) and approximate driving times (minutes) between sites.

Fig. 5

Stockport Flats. The northernmost site is in the Town of Stockport in Columbia County, near Columbiaville, 4 miles north of the city of Hudson and 22 miles south of Albany (Figures 5-6). The Stockport site comprises the mouth of a tributary stream (Stockport Creek) and a four-mile long series of peninsulas, islands, marshes and shallows along the east shore of the Hudson. Parts of the site are (or have been) known as Columbiaville Creek, Stockport Marsh, East Flats, Priming Hook, Unnamed Island, Stockport Middle Ground, Gay's Point, and Fordham Point. Stockport Middle Ground and Gay's Point are part of Hudson River Islands State Park. Stockport Flats was listed in the following surveys: The Hudson: Biological Resources (Smith et al. nd) for rare plants, bird migration stopover, landscape and educational values; Geographic Areas of Particular Concern (CZM Study Program, 1977a); Significant Coastal Related Fish & Wildlife Habitats of New York (CZM Study Program, 1977b).

Tivoli Bays. The next site to the south is in the Town of Red Hook, Dutchess County, and stretches for two miles between Tivoli and Barrytown; it is 7 miles north of Rhinebeck and 19 miles north of Poughkeepsie (Figures 5, and 7). A small portion at the north end of the proposed site is within the jurisdiction of the Village of Tivoli. Tivoli Bays comprises two large coves on the east shore of the Hudson River, North Bay and South Bay, and includes Cruger Island and Magdalen Island and associated tidal shallows, as well as the mouths of two tributary streams, Stony Creek and Saw Kill. Parts of the site are (or have been) known as Tivoli Bay, North Tivoli Bay or Tivoli North Bay, South Tivoli Bay or Tivoli South Bay, North Cove, South Cove, DeKoven's Cove or Bay, the Vly or Fly, Goat Island, Slipsteen Island, South Curger Island, White Clay Kill and Stony Kill. North Bay and most of South Bay, Cruger Island, and a mainland area east of North Bay make up the Tivoli Bays State lands. (This acquisition project was initiated in 1980 using, on a 50/50 basis, matching funds from the U.S. Heritage Conservation and Recreation Service and New York State's Environmental Quality Bond Act.) The area has also been called "Tivoli Bays Nature and Historical Preserve". The Preserve has been designated an Experimental Ecological Reserve by the Institute of Ecology at Butler University. The entire Tivoli Bays site is listed on the National Register of Historic Places and is included in the Mid-Hudson Historic Shorelands State Scenic Area which extends from Clermont to Hyde Park. Tivoli Bays was listed in the following surveys: The Hudson: Biological Resources (Smith et al. nd) for rare plants, bird migration stopover, landscape and educational values; Geographic Areas of Particular Concern (CZM Study Program, 1977a); Significant Coastal Related Fish & Wildlife Habitats of New York (CZM Study Program, 1977b); Hudson River Valley Study Site Inventory (Raymond, Parish, Pine and Weiner, 1979); Hudson River East Bank Natural Areas, Clermont to Norrie (Kiviat, 1978).

Iona Island Marsh. The next site is in the Town of Stony Point, Rockland County, 6 miles south of West Point and 4 miles northwest of Peekskill (Figures 5 and 8). The Iona Island marshes occupy a mile-long area between Iona Island and the west shore of the Hudson. Parts of the Iona Island site are (or have been) known as Salisbury Meadow, Ring Meadow, Doodletown Bight, Doodletown Brook, Round Island, Manahawagh, Salisbury Island, Weint's Island, and Beveridge's Island. The Iona Island site is part of Bear Mountain State Park, an element in the Palisades Interstate Park system. The Iona Marsh has been designated a National Natural Landmark

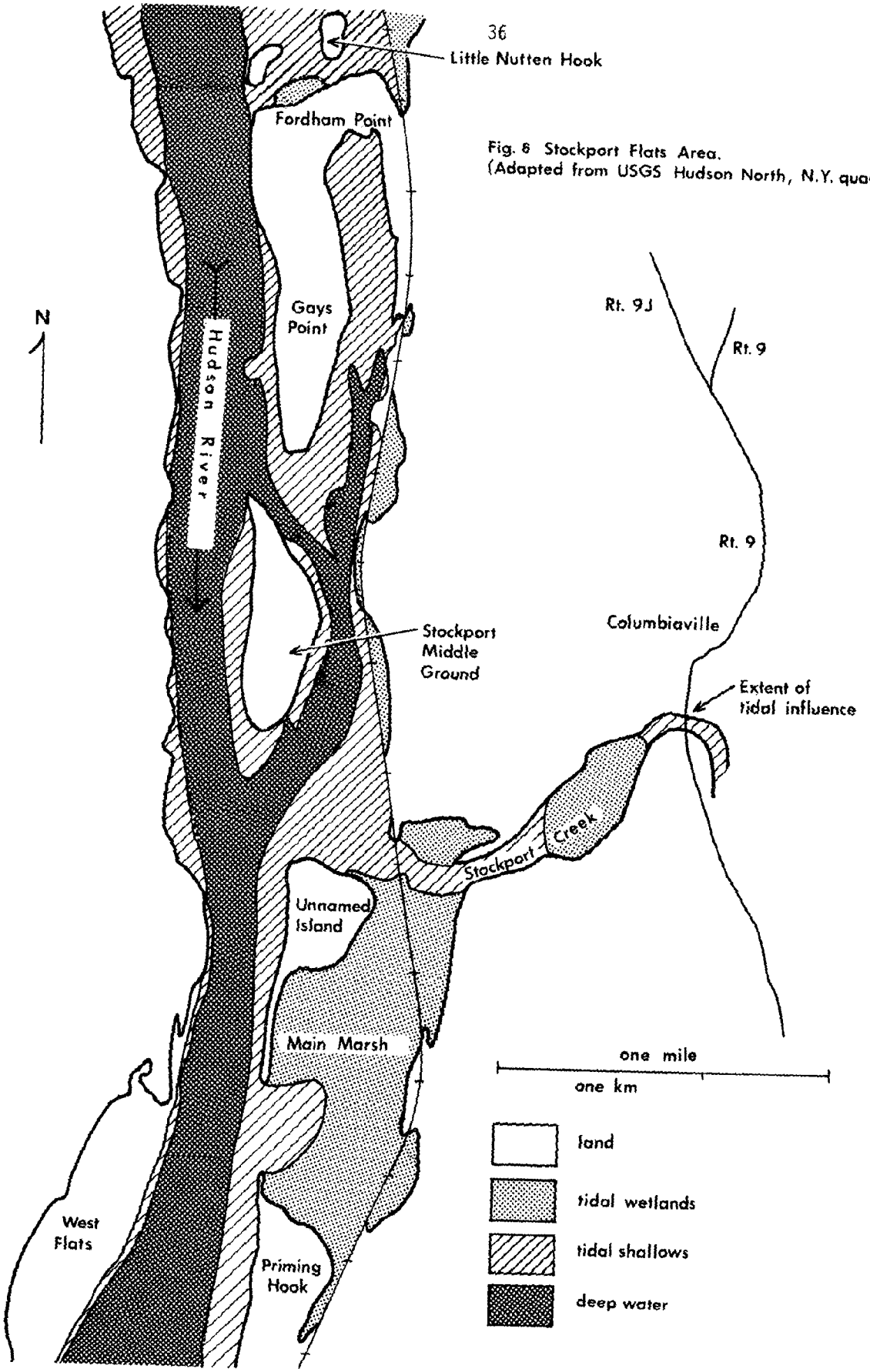


Fig. 6 Stockport Flats Area.
(Adapted from USGS Hudson North, N.Y. quadrangle.)

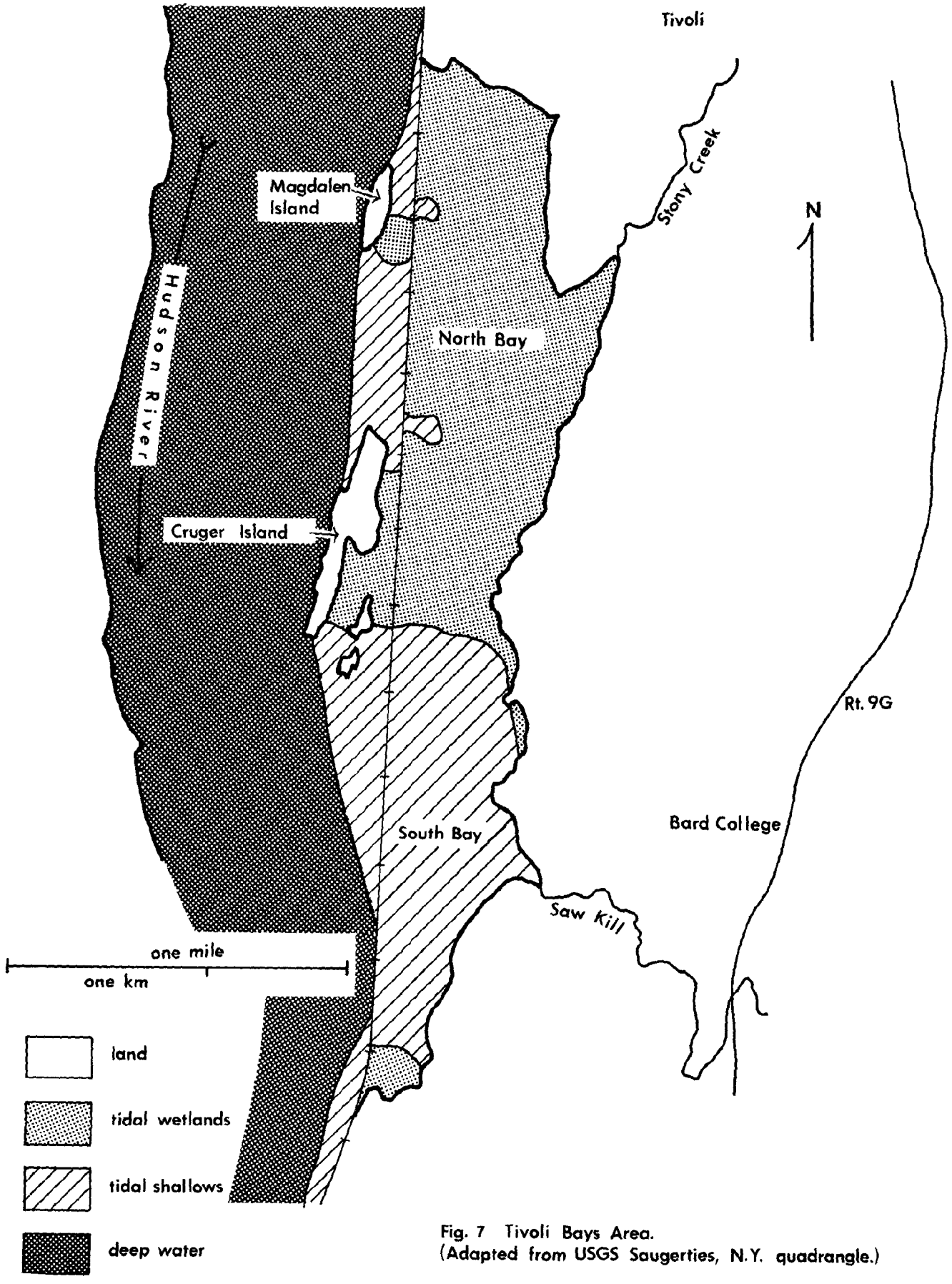


Fig. 7 Tivoli Bays Area.
(Adapted from USGS Saugerties, N.Y. quadrangle.)

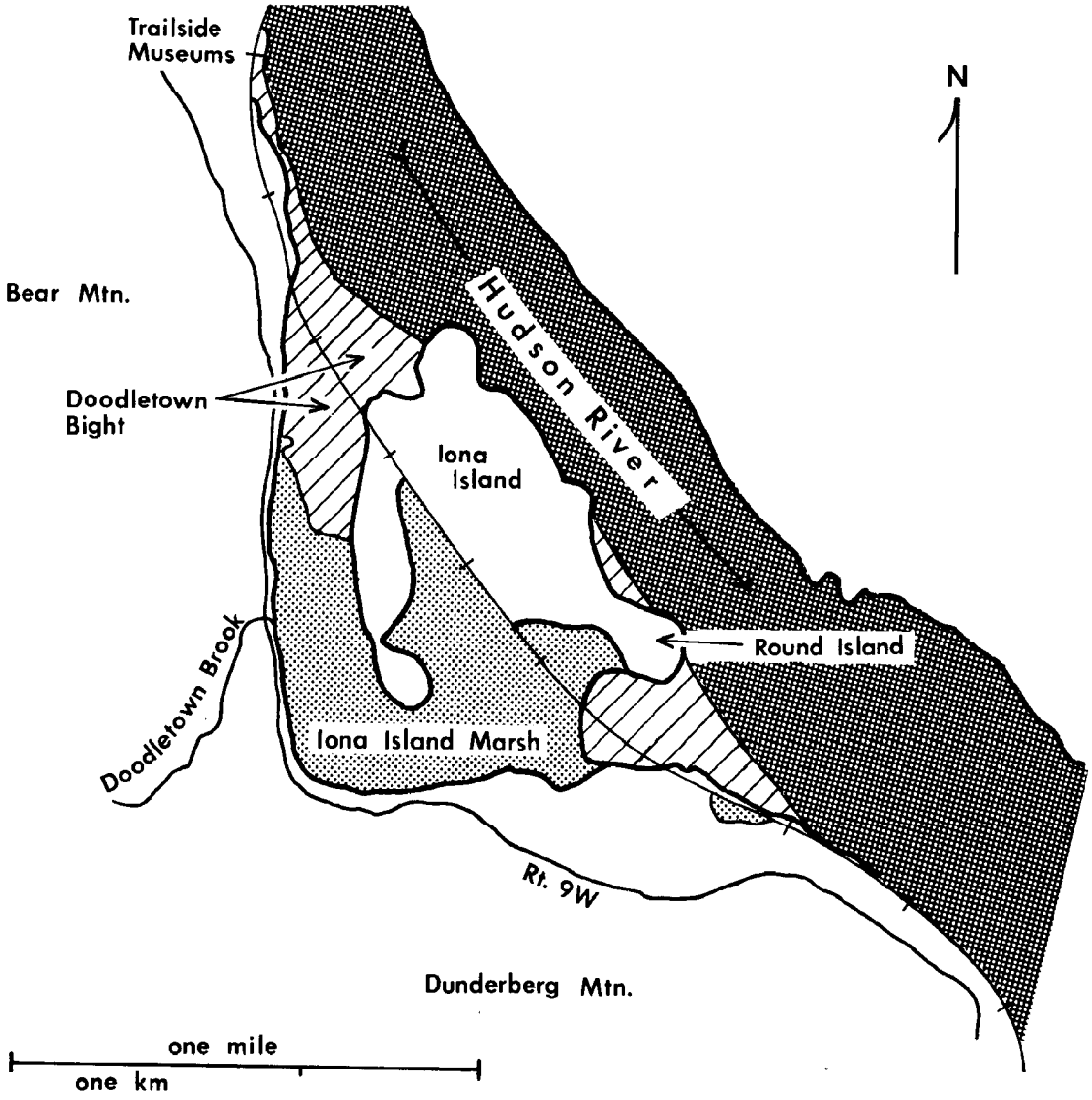


Fig. 8 Iona Island Marsh Area
(Adapted from USGS Peekskill, N.Y. quadrangle.)

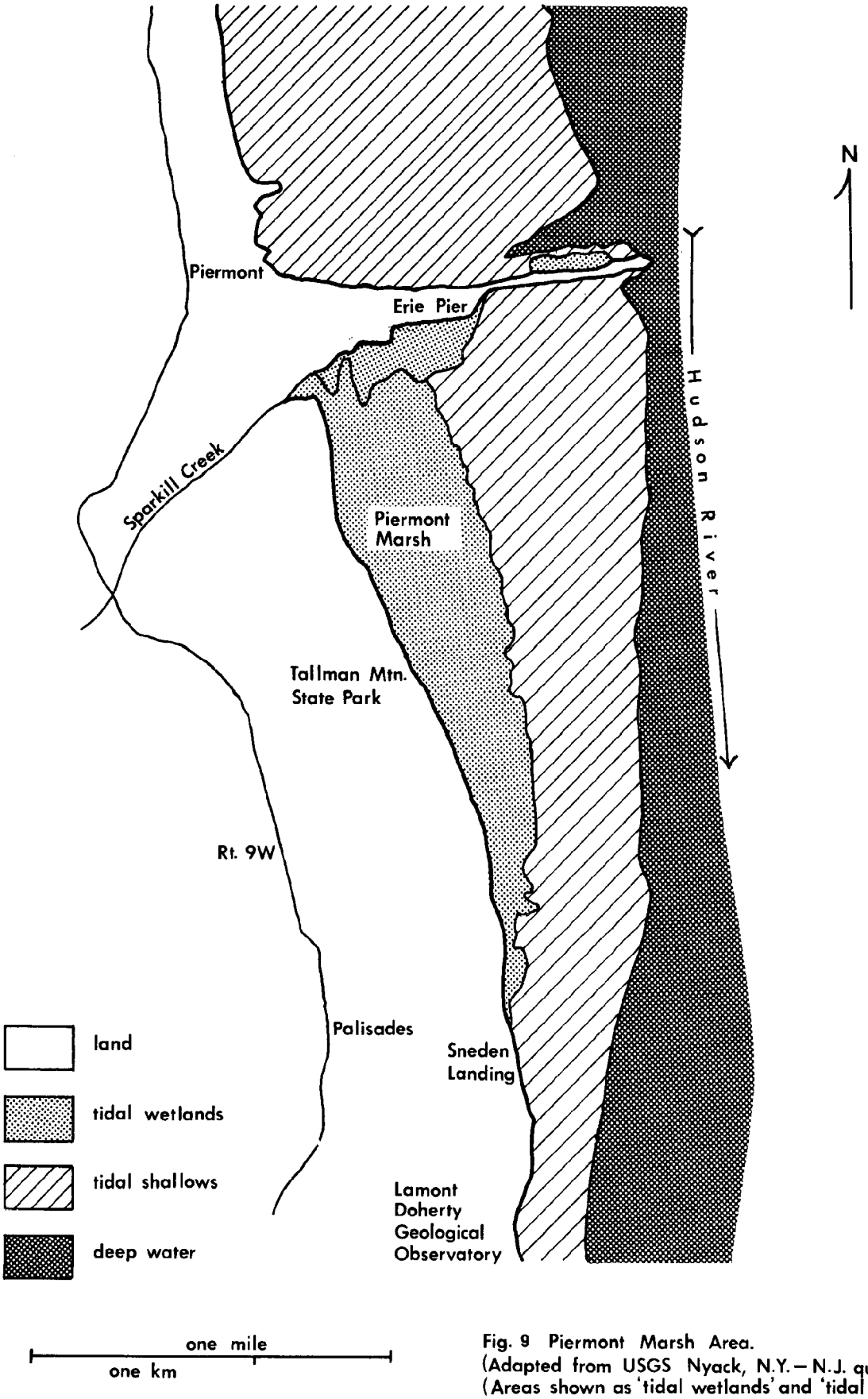


Fig. 9 Piermont Marsh Area.
(Adapted from USGS Nyack, N.Y.—N.J. quadrangle.)
(Areas shown as 'tidal wetlands' and 'tidal shallows' are both considered tidal wetlands under the State Tidal Wetlands Act.)

by the United States National Park Service. Iona Island Marsh was listed in the following surveys: The Hudson: Biological Research (Smith et al. nd) for rare ecological niches, rare plants, bird migration stopover, and educational value; Geographic Areas of Particular Concern (CZM Study Program, 1977a); Significant Coastal Related Fish & Wildlife Habitats of New York (CZM Study Program, 1977b); Hudson River Valley Study Site Inventory (Raymond, Parish, Pine and Weiner, 1979).

Piermont Marsh. The southermost site is in the Town of Orangetown, Rockland County, 4 miles south of Nyack (Figures 5, and 9). A portion at the north end of the proposed site is within the jurisdiction of the Village of Piermont. Piermont Marsh is one-and-one-half miles long, between Piermont and Sneden's Landing; it includes the mouth of a tributary stream (Sparkill Creek) and is surrounded by very extensive tidal shallows. Parts of the site are (or have been) known as Sparkill Marsh, and Taulman Landing or Point. The Piermont Marsh site is largely a part of Tallman Mountain State Park, an element of the Palisades Interstate Park system. Piermont Marsh was listed in the following surveys: The Hudson: Biological Resources (Smith et al. nd) for rare ecological niches, rare plants, bird migration stopover, landscape and educational values; Geographic Areas of Particular Concern (CZM Study Program, 1977a); Significant Coastal Related Fish and Wildlife Habitats of New York (CZM Study Program, 1977b); Hudson River Valley Study Site Inventory (Raymond, Parish, Pine and Weiner, 1979).

1. Natural Environment

a. Geology

The Hudson River watershed is one of the most geologically complex regions in the United States, and the shores of the Estuary show great variety of bedrock, landforms and soils. After several geologic episodes of uplift, folding and faulting, alternating with periods of erosion, the Hudson Valley was overridden by the continental ice sheets. Glaciers gouged out the broad U-shaped valley of the Estuary, and left bare rock exposed in some locations and other areas covered with glacial and post-glacial deposits of till, sand and clay. The bed of the Estuary itself is filled with glacial deposits beneath recent estuarine sediments. Because of predominantly steep shores, the Hudson's floodplain is very limited in extent.

The Hudson River Estuary may be divided in four geologic-ecologic reaches (Kiviat, 1979):

1. Troy south to Saugerties, narrow and shallow with many islands and wetlands, bordered by low bluffs of sand, clay and shale;

2. Saugerties to Beacon, deep, of medium width, with scattered islands and wetlands, bordered by bluffs of clay or sedimentary rock (sandstone, shale, some limestone);

3. Beacon to Peekskill, the Hudson Highlands, narrow, twisting and deep, bordered by steep high hills of gneiss and granite;

4. Peekskill to New York City, at first broad and shallow, then narrow and deep, bordered on the west by a diabase ridge (the Palisades Ridge) and on the east by low hills and bluffs of various metamorphic rocks.

The four proposed sanctuary sites, Stockport, Tivoli, Iona and Piermont, respectively, lie one in each of the geologic-ecologic reaches listed above.

Generalized soil types along the Hudson River Estuary are: limy soils on clay and silt deposits from postglacial lakes; usually acid soils on sands from terraces and deltas; acid (occasionally limy) soils on glacial tills (unsorted deposits containing clay, silt, sand, gravel and larger stones); soils on alluvium (stream-deposited material); and tidal wetland sediments.

Stockport Flats. The bluff north of the mouth of Stockport Creek is Cambrian shale with thin layers of interbedded quartzite, and there are clay deposits farther inland. The bluff south of the creek is clay. Slate, conglomerate, and limestone are also present near the site. These steep bluffs rise to an elevation of 100 feet above the river, and then the land levels off. Small tidal coves are scalloped into the bluffs at several locations along the shore. There is evidence of a clay slide in at least one location on the south bank of Stockport Creek.

Tidal influence in Stockport Creek extends inland to the Route 9 highway bridge, almost one mile. The mouth of the creek is dotted with islands of floodplain and tidal swamp at elevations of about 0-3 feet above high tide level, and these islands are interspersed with areas of tidal marsh, subsidiary stream channels, and the main channel of the creek. The wetlands and islands both inside and outside of the creek mouth comprise the tidal delta deposits of the creek.

The main marsh (East Flats) lies just south of the mouth of Stockport Creek in the river proper, between the unnamed island (north) and the point of Priming Hook (south). A sandy bar extends southward along much of the western margin of the main marsh, broken by one large and one small passage between the marsh and the main river. A few tidal creeks cut through the marsh. The marsh bottoms vary from fine sand to shallow or deep soft muck.

A large island, Stockport Middle Ground, and a large peninsula, Gay's Point - Fordham Point, lie northwest and north of the creek mouth. Stockport Middle Ground, Gay's Point, Fordham Point, Priming Hook and the Unnamed Island are sandy and composed partly of old dredged material, and they have maximum elevations of about 5-20 feet above high tide level. Extensive shallows lie between Gay's Point - Fordham Point and the mainland, and there are small channels around Stockport Middle Ground. The dredged shipping channel west of the Stockport Flats site is 32 feet deep. Terrestrial soils of the site are derived from clay, sand and till.

Tivoli Bays. Bedrock at this site is Ordovician gray sandstone and shale. The more resistant sandstone outcrops are on the islands, the points projecting into the bays, and in the waterfalls of the creeks. Bluffs east of the bays are composed largely of clay with small areas of sand; the bluffs rise steeply to an elevation of 100 feet above the river and then level off inland. The clays were deposited as thin alternating winter and summer layers of clay and silt in a postglacial lake. Gradual slumping is common on the clay bluffs. "Clay dogs," small ring-shaped concretions of limestone and clay that formed around the stems of marsh plants, occur in the clays.

Cruger Island is one-half mile long, with a maximum elevation of forty feet above high tide level. Magdalen Island is smaller and lower. North Bay is predominantly intertidal marsh, with a well-developed network of tidal creeks and pools. The deepest creeks and pools are about five feet deep at low tide. A similar network of creeks and pools is beginning to form in South Bay, which is predominantly shallows and mudflats near low tide level. A few deep spots in South Bay are also about five feet at low tide. The bottom in the bays is largely soft muck, as much as 25 feet deep. The tidal swamp between North Bay and South Bay has 8 feet of peat overlying silt.

Extensive tidal shallows lie north and south of Cruger Island, and much of this area is only 1-2 feet deep at low tide. Just west of Cruger Island, the main river is 50 feet deep.

Terrestrial soils of the site are derived largely from clay, with sandy soil in local areas, and till soils farther east.

Iona Island Marsh. Bedrock at this site is mostly Precambrian gneiss. This rock is very resistant to erosion and forms the bold hills that rise more than 1,000 feet within a half mile of the marshes (Dunderberg and Bear Mountains) and the rocky knobs of Iona Island that project 100 feet above the river. The same steep slopes dive down under the marsh where the sediments are more than 100 feet deep. Iona Island is in the Hudson Highlands, a part of the Old Appalachians, and this is the only location where the Old Appalachians are breached by an estuary. Pegmatite dikes occur locally in the Iona Island area, and there is a great variety of minerals associated with these igneous intrusions.

The Iona Island Marsh formed in the shelter of the island, in a side channel of the Hudson River that was made larger by glacial erosion and glacial meltwaters. The marsh began to form at least 6,000 years ago according to radiocarbon dating of the peat, and some of the sediments uderlying the marsh are 12,500 years old. The marsh surface is peaty, but the sediments become increasingly silty beneath. Winding tidal creeks lace the marsh, with greatest depths at low tide about three feet. In Doodletown Bight, large areas of mud flats are exposed at low tide. The main river close to Iona Island has a maximum depth of 143 feet, and this is one of the narrowest reaches of the Hudson Estuary.

Soils on Iona Island and the mainland are derived from glacial till and tend to be very shallow, acid, and nutrient-poor.

Piermont Marsh. The west shore of Piermont Marsh is formed by part of the Palisades Ridge, where an abrupt flat-topped 150-foot high cliff-and-sliderock formation close to the marsh. The cliff is Triassic diabase, a hard igneous rock. The ridge is underlain by Triassic sandstone and shale which outcrop in small areas close to the marsh. Sparkill Gap, the valley of Sparkill Creek just west of the north end of Piermont Marsh, is the only sea level break in the Palisades Ridge and was thought to be a former route of the Hudson River. However, the gap was more likely created by torrential glacial meltwaters. Sparkill Gap has been proposed as a geological National Natural Landmark (Butler et al., 1975).

The marsh sediments are peat and organic silt and are at least 40 feet deep in the western part where the marsh has been developing for 4-5 thousand years. A few well-defined tidal creeks cut the marsh, but their deepest portions are only a few feet deep at low tide. Piermont Marsh is located at the south end of the very broad and shallow segment of the Estuary known as the Haverstraw Bay and Tappan Zee, and very extensive shallows border the east side of the marsh. While these shallows are only 1-2 feet deep at low tide, the river channel farther east has 50-foot depths.

Soils on shore near Piermont Marsh are derived from glacial till and are shallow and acid, with deeper, richer pockets close to the marsh. The Erie Pier borders the marsh on the north.

b. Hydrology

The Hudson River Estuary drains about 13,400 square miles of land, mostly in New York State but includes small areas of New Jersey, Massachusetts, Connecticut and Vermont. The tidal river is 152 miles long from Troy south to the southern tip of Manhattan Island (Battery Park). Throughout this distance, the river bed is below sea level, allowing tidal penetration to Troy. Salt water, however, intrudes only half the length of the tidal river due to the Hudson's substantial and relatively dependable freshwater flow.

Average freshwater flow (net discharge) in the tidal Hudson is 13 billion gallons per day, of which 60% enters from the mainstream of the Hudson-Mohawk above Troy and 40% comes in from 25 major and numerous minor tributaries below Troy. Peak freshwater flows occur in March or April with snow melt, and secondary peak flows often occur in November. Minimum flow is in summer and early fall. The reversing tidal flow moves about 30 times as much water as the average freshwater discharge. The average flushing rate for the tidal Hudson River (turnover time) is about 5 months.

Salt water from the Atlantic Ocean moves upriver, mixing with the fresh water, and penetrating farther upriver at times of lower freshwater flow. Depending on freshwater flow, the 0.1 parts-per-thousand (ppt) salinity level ("salt front") may occur anywhere between about Yonkers and Hyde Park, but usually is somewhere in the region between Nyack and Beacon (Figure 5). Late summer and early fall are generally the periods of farthest intrusion of saline water. In the mid-1960s drought, the

salt front was recorded at the farthest known inland location in this century, definitely at Hyde Park and possibly at Kingston, but no farther. Freshwater flow from the Hudson River slightly dilutes sea water well out into the New York Bight.

The Hudson is a partially stratified estuary. More saline water tends to move upriver under lighter outflowing fresh water in the New York City to Peekskill region. However, vertical salinity gradients are small with bottom waters only 0-20% more saline than surface waters.

Vertical tidal fluctuation (tide range) is least in the middle of the estuary, about 3.1 feet at West Point, and greater at the two ends of the estuary, reaching a maximum of about 5.1 feet at Troy (National Ocean Survey 1982 Tide Tables for East Coast of North and South America). Individual tides can be considerably higher or lower than average levels, and maximum tide ranges for any one month may exceed 9 feet. Although extremely high tides flood the higher wetlands to greater depth and for longer times, these tides do not cover large areas of land because the steep banks of the estuary generally restrict the extent of the floodplain to small areas. There are two high tides alternating with two low tides in an approximately 25-hour period, but the time, duration, and height of both high and low tides are affected by wind and runoff (freshwater flow as well as by gravitational forces). Tides are less regular farther upriver.

The estuary has reversing tidal currents. Downriver ebb currents are slightly faster than upriver flood currents. Peak current speeds during a normal tidal cycle are about 2 miles-per-hour.

All major estuaries in the Virginian biogeographic region have water quality problems. Quality in the Hudson River Estuary is remarkably good in view of the proximity of the Nation's largest metropolitan area. Dissolved oxygen may be in short supply at New York City during hot dry weather, but elsewhere in the estuary oxygen levels are almost always adequate for aquatic animals. Water quality has improved considerably in the last 15 years. Many health and esthetic problems associated with raw sewage discharges have been solved by construction of secondary treatment facilities. The generalized contamination of the Hudson by PCB discovered in the early 1970s has declined during the last 5 years as evidenced by reduced PCB levels in large samples of fish of several species monitored annually by the New York State Department of Environmental Conservation. There are persistent reports by longtime residents that the Hudson Estuary has become less turbid during the last few decades.

Wetland hydrology in the Hudson is influenced most by the estuary's vertical tidal fluctuation, but also by runoff from tributary streams, wind, and the degree of shelter afforded by adjacent shallows, islands and bars. Incoming tides churn up sediments in the confines of marsh creeks creating high turbidity. Outgoing tides and dilution by clear water from tributaries, reduce turbidity greatly in the landward portions of the marshes. The downriver marshes are subject to higher salinity than the main river due to evaporation of water from the marsh surface: at Piermont Marsh, river salinity reaches a maximum around 12 ppt (Table 4) but on the intercreek marsh areas salinity may reach 15 ppt (nearly half the strength of sea water).

Table 4. Environmental Characteristics of the Four Proposed Estuarine Sanctuary Sites

Site	Salinity in main river	Tide range (feet)	Bedrock	Sediments	Marsh
Stockport Flats	fresh	4.0	shale, etc.	muck, sand	cattail, wild-rice
Tivoli Bays	fresh	3.9	sandstone, shale	muck	cattail, purple loose-strife, spatterdock
Iona Island	fresh to 6 ppt	2.8	gneiss	peat, silt	cattail, reed
Piermont Marsh	fresh to 12 ppt	3.2	diabase, shale, sandstone	peat, silt	cattail, reed, etc.

Ice forms first and remains longest on the wetlands, and the constant grinding of ice lifted and lowered by the river's tides is highly erosive. Ice covers the wetlands from one to four months per year, depending on the severity of the winter. The downriver wetlands have less ice cover than upriver areas. Ice a foot or more thick may form on tidal creeks and pools in the wetlands. However, in dense upper intertidal zone vegetation (such as cattail, purple loose-strife, or woody plants) thick dense ice does not normally form, but rather many layers of thin ice are produced. The surface of the main river in the vicinity of Tivoli Bays and Stockport Flats usually freezes solid; but the Coast Guard keeps open the shipping channel.

c. Climate

Average annual precipitation along the Hudson River Estuary is about 37-46 inches, tending to be higher southward. Monthly averages for Poughkeepsie (39 inches annually) range from 2.7 inches in February to 4.1 inches in July. Average annual snowfall is about 39-50 inches mid-estuary.

January average air temperature is 23-29° F, and July average 71-73° F. Average temperatures are slightly lower northward, higher southward. Growing season is in the range of 150-200 days. The large water mass of the estuary warms more slowly in spring and cools more slowly in the fall than the air. This temperature lag moderates the climate in wetlands and shoreline areas relative to sites off the river. The Hudson River Estuary is to some extent a climatic arm of the coast where coastal weather mixes with inland weather.

Prevailing winds are north or northwest in winter, and south or southwest in summer. Average wind speeds are highest in March and lowest in August. Winds are highly variable, and sudden squalls, summer thunderstorms, and occasional hurricanes affect the river. Day-to-day weather is variable and shoreline areas and wetlands are exposed to extremes of sunshine, temperature, freezing and thawing, wind, waves and spray, and other factors. Temperature inversions with night and morning fogs are frequent in summer and fall.

d. Biology

Vegetation. Lists of plants found in the four proposed sanctuary sites are in Appendix 6.

The tidal shallows, from low tide level down to about 6 feet below low tide level (Figures 6-9), and the subtidal creeks and pools in the wetlands, support communities of submerged plants. There are some patches of bare mud.

Wetlands of the upper intertidal zone (between average tide level and high tide level) are mostly covered by grass-like plants 1-10 feet tall, often growing in extensive and dense patches of one or a few species. Locally, a few kinds of broadleaved plants are also common, and there are many less common or smaller secondary species of plants that occur scattered or in small patches especially on creek and pool banks and near the high tide shoreline.

Lower intertidal wetlands (average tide level to low tide level) are mostly bare mud in downriver more saline marshes, but in fresher upriver marshes are covered with broad-leaved plants with large heartshaped or arrowhead-shaped leaves 2-3 feet tall and some grass-like plants. Predominant species vary, but the communities in the proposed sites are typical of the Hudson River Estuary in general in the four geologic-ecologic reaches of the river.

Near the high tide level, flooded by the higher high tides, are localized areas of tidal swamp, especially upriver in tidal freshwater. These areas are covered by trees and/or shrubs.

Tidal freshwater and low-salinity marshes are similar in the Hudson and other Virginian Region estuaries, with the most abundant species generally including the following: narrowleaf cattail (Typha angustifolia), wild-rice (Zizania aquatica), river bulrush (Scirpus fluviatilis), spatterdock (Nuphar advena), pickerelweed (Pontederia cordata), arrow arum (Peltandra virginica), broadleaf arrowhead (Sagittaria latifolia), tall cordgrass (Spartina cynosuroides), swamp rose mallow (Hibiscus palustris), tidewater-hemp (Amaranthus cannabinus), bur-marigolds (Bidens spp.), water-millet (Echinochloa walteri), jewelweed (Impatiens biflora), rice cutgrass (Leersia oryzoides), purple loosestrife (Lythrum salicaria), smartweeds (Polygonum spp.), and common reed (Phragmites communis). Aboveground standing crops reported for Hudson River marshes are similar to those reported for Delaware and Chesapeake Bay estuary marshes. Plant communities of fresh-tidal and low-salinity shallows are also similar in the Hudson River Estuary and other Virginian Region estuaries, with the most abundant species generally water-celery (Vallisneria americana), pondweeds (Potamogeton spp.) and watermilfoil (Myriophyllum spicatum). Freshwater tidal swamps also occur in other Virginian Region estuaries but have been the subject of virtually no research.

Terrestrial vegetation along the Hudson River Estuary in undeveloped areas is generally deciduous forest. On the dry rocky slopes of the Palisades Ridge and Hudson Highlands the most abundant trees are red oak (Quercus borealis), chestnut oak (Q. prinus), and a few other deciduous species. Mid-Hudson and upper estuary deeper-soil areas, as well as moist ravines down-river, support oaks, sugar maple (Acer saccharum), tulip tree (Liriodendron tulipifera), black birch (Betula lenta), beech (Fagus grandifolia), white pine (Pinus strobus), hemlock (Tsuga canadensis) and flowering dogwood (Cornus florida). All four proposed sanctuary sites have very well developed forested buffer zones on most of the upland frontage and particularly on steeper slopes. These buffer forests range in width (map distance) from 100 yards to well over one-half mile.

The railroad rights-of-way, away from the tracks, tend to be thickly grown with herbs, shrubs and sometimes trees. Among the most common larger species are false-indigo (Amorpha fruticosa), sumacs (Rhus glabra, R. typhina), silky dogwood (Cornus amomum), honeysuckle (Lonicera spp.), and brambles (Rubus spp.). Vegetation of the Erie Pier at Piermont is similar with the addition of white mulberry (Morus alba).

Stockport Flats. Water-celery is very abundant in the shallows. The intertidal marshes are dominated by narrowleaf cattail, wild-rice, spatterdock and pickerelweed. The wild-rice stands are very lush and appear to be the most extensive stands of wild-rice anywhere on the Hudson; wild-rice has increased greatly in the last 5 years both in Stockport and elsewhere on the Hudson Estuary and now approximates former (1930s-40s) levels.

Tidal swamps and floodplain swamps are dominated by red ash (Fraxinus pennsylvanica), silver maple (Acer saccharinum), cottonwood (Populus deltoides), sycamore (Platanus occidentalis), willows (Salix ssp.) and silky dogwood. Some of the tidal swamps have many large trees (stems 1-3 feet or more in diameter-at-breast-height).

The bluffs along the south side of Stockport Creek and east of the main marsh are covered by deciduous forest with oaks and other trees, and localized areas of white pine. The sandy islands and points have abundant cottonwood, black-locust (Robinia pseudoacacia), red cedar (Juniperus virginiana), oaks, staghorn sumac (Rhus typhina), etc.

Tivoli Bays. Water-celery, watermilfoil, and waterchestnut (Trapna natans) are the most abundant plants in the shallows. The intertidal marshes are dominated by narrowleaf cattail, spatterdock, and purple loosestrife. The tidal swamps are predominantly red maple (Acer rubrum), red ash, black ash (Fraxinus nigra), silky dogwood, willows, buttonbush (Cephalanthus occidentalis) and smooth alder (Alnus serrulata). The Tivoli tidal swamps cover 45 acres and are very rich in shrub and moss species.

The clay bluffs and rocky islands support well-developed forest with sugar maple, hemlock, red oak, white oak, chestnut oak, white ash (Fraxinus americana), pignut hickory (Carya glabra), shagbark hickory (C. ovata), white pine and flowering dogwood. A grove of particularly large oaks and hemlocks borders the tidal mouth of Stony Creek.

Iona Island Marsh. Water-celery is very abundant in the shallows. The intertidal marshes are dominated by narrowleaf cattail, with small amounts of swamp rose mallow and common reed. A small area of tidal swamp is dominated by crack willow (Salix fragilis).

The island and mainland slopes are covered with deciduous forest with abundant red oak, chestnut oak, and pignut hickory.

Piermont Marsh. Pondweeds are present in the shallows. The intertidal marshes are dominated by narrowleaf cattail and common reed, with lesser amounts of tall cordgrass, saltwater cordgrass (Spartina alterniflora), salt-meadow cordgrass (S. patens), saltgrass (Distichlis spicata), swamp rose mallow, and purple loosestrife. There is no appreciable area of tidal swamp.

The mainland forest at the base of the Palisades Ridge has abundant and large beech, tulip tree, red oak, black birch and flowering dogwood. The cliff-and-sliderock has red oak, black birch and other trees.

Endangered, Threatened and Rare Plants. Several species listed in the New York State Museum's Rare and Endangered Vascular Plant Species in New York State (Mitchell et al., 1980) have been found in the proposed sanctuary sites and are listed in Table 5. Heartleaf plantain (Plantago cordata), proposed in the Federal Register for Federal Endangered status, is present at the Stockport and Tivoli sites. Potential for continued survival of the plantain, and for research on it, is excellent at these locations.

Nuttall's micranthemum (Micranthemum micranthemoides) is known from Tivoli Bays. This is the only recorded station for this species in New York and one of about 20 localities known in the world (all in East Coast tidal freshwater habitats). Although the micranthemum was last seen in 1936, some botanists think the species may still survive at Tivoli; it is a small plant and difficult to identify. Nuttall's micranthemum was proposed in the Federal Register for Federal Threatened status. It has not been found recently at other East Coast locations.

Most of the other species listed in Table 5 are restricted to brackish-tidal or fresh-tidal wetlands, and are the subject of concern by botanists because of the general vulnerability of these types of ecosystems on the East Coast.

Numerous other species of wetland and terrestrial plants that are not considered threatened or endangered, but are rare in New York and have special interest to scientists are (or may be) found at the proposed sanctuary sites. One example is goldenclub (Orontium aquaticum), a species common in the southeastern United States in inland wetlands, but declining in northeastern estuaries. Goldenclub occurs at Stockport Flats and Tivoli Bays, and is sought out as an esthetic attraction during its May flowering period. A list of "Plants Concentrated in the Tidal Marshes of the Hudson River" prepared by the late Stanley J. Smith in 1974 includes 21 species of mostly rare (and a few common) plants; many of these 21 have been recorded from the proposed sanctuary sites.

Because of the large size and environmental complexity of the proposed sites, thorough botanical studies in the future may discover many more rare plants and unusual plant communities than are now known.

Fish and Wildlife. The deep waters, shallows, wetlands, and shores of the Hudson River Estuary act as a migration and dispersal pathway for many kinds of fish and wildlife. These environments provide suitable corridors for movements of animals northward and southward, and suitable stopover habitats with shelter and food. Many kinds of animals also find habitats on the estuary where they reside seasonally or permanently.

Of Hudson River Estuary animals, many do not remain in a single type of habitat, but more back and forth between two or more habitat types in tidal, daily or seasonal cycles. These species require combinations of

Table 5. Plants of the Proposed Sanctuary Sites Listed in "Rare and Endangered Vascular Plant Species in New York State" (Mitchell et al., 1980).

Species	Site	Significance (NY)[a]
Spatulate arrowhead, *Sagittaria spatulata*	Stockport	HAB
Ovate spikerush *Eleocharis ovata*	Stockport Tivoli, Iona	R, SERL
Cylindrical bulrush, *Scirpus cylindricus*	Iona, Piermont	SPOR
Parker's pipewort, *Eriocaulon parkeri*	Stockport, Tivoli	R, VULN
Sea pink, *Sabatia dodecandra*	Iona	EXT?, NRL, SNYS?
Nuttall's micranthemun *Micranthemum micranthemoides*	Tivoli	*EXT?, R, SNYS, SPOR, VULN
Heartleaf plantain, *Plantago cordata*	Stockport, Tivoli	*R, DECL, SPOR
Eaton's bur-marigold, *Bidens eatonii*	Tivoli	R, HAB, END
Estuary beggar-ticks, *Bidens hyperborea*	Tivoli	SRL

[a]DECL = Observed to be declining in New York State; END = Highly restricted range, endemic; EXT? = Possibly extirpated in New York State; HAB = Restricted to habitats rare in the State; R = Rare throughout its range; SNYS = Single New York station; SPOR = Sporadic: scattered populations; VULN = Vulnerable to commercial or private exploitation or imminent land development; SRL, SERL, NRL = Southern, southeastern, or northern range limits or nearing the periphery of their distributions.

* Listed in the Federal Register (proposed for Federal Endangered or Threatened listing).

habitat types to fulfill their life requirements: for example, the wood duck that nests in a hollow tree in the forest, but raises its brood in the marsh, and the striped bass (Morone saxatilis) that moves from the river channel into the marsh, pools, and creeks to feed. The most important habitat combinations are the marsh-shallows combination, and the marsh-forest combination. These patterns of animal use emphasize the special nature of the shallows-wetlands-forest complexes at the four proposed sanctuary sites.

Some Hudson Estuary habitats support unusual abundance or diversity of animals. Some examples are: abundance and diversity of chironomid midge larvae in submerged vegetation in the Haverstraw Bay - Tappan Zee; abundance and diversity of burrowing animals in sandy soils; abundance of post breeding humming birds in jewelweed in the marshes; abundance of certain breeding birds (least bittern, long-billed marsh wren) in extensive cattail stands (Kiviat, 1979).

Endangered, Threatened, and Special Concern Animals. Species currently on Federal or New York State Endangered Species lists, or on the Tentative New York State Species List (a proposed revision of the existing State list), and which occur at the proposed sanctuary sites, are shown in Table 6. The Tentative State List has three categories (in decreasing order of endangerment): Endangered, Threatened, and Special Concern.

Endangered. The shortnose sturgeon (Acipenser brevirostrum) is listed on both Federal and New York State Endangered Lists, and has a sizeable resident population in the Hudson River Estuary. The primary wintering area is in deep water in the vicinity of the Esopus Meadow - Kingston Flats approximately 2-9 miles south of the Tivoli Bays. Spawning occurs in spring as the shortnose migrate northward to Troy. Adult shortnose sturgeon in the St. John River Estuary in New Brunswick (Canada) feed on mollusks in beds of submerged vegetation. If Hudson River shortnose sturgeon have similar feeding habits, they may be attracted to shallows near Tivoil and Stockport as well as in other areas of the upper Estuary.

The bog turtle (Clemmys muhlenbergi) has been reported from locations within a few miles of two of the proposed sites (early-mid 1900s) and could occur at the sites, but the nature of the available habitats makes this unlikely. This species is listed as Endangered by New York State.

Golden eagle (Aquila chrysaetos) records are few, and it is not clear if they occur regularly at any of the proposed sites.

The bald eagle (Haliaeetus leucocephalus) was common on the Hudson River Estuary, especially in winter, in the late 1800s according to naturalists of the period (e.g., Mearns, Burroughs). Bald eagles became rare along the Hudson in the last few decades when there was a nationwide decline in populations. However, birdwatchers who spend a lot of time on the Estuary may see one or more bald eagles yearly, and there are slight indications that numbers have increased in the last two years. There are regular sightings at the proposed sanctuary sites mostly when the waters are partly frozen. Some eagles have been seen during other seasons as well, but there have been no nesting attempts. Bald eagles require open water and

Table 6. Animals Recorded at the Proposed Sanctuary Sites either Currently Listed as Endangered by the State or Federal Government, or Included in the December 1981 "Tentative New York State Species List" (Endangered, Threatened Special Concern). Additional species have been recorded near the sites and are discussed in the text.

Species	Site	Status
Shortnose sturgeon, *Acipenser brevirosturm*	(see text)	Endangered (US,NY)
Spotted turtle, *Clemmys guttata*	Tivoli	Special Concern
Common loon, *Gavia immer*	all	Special Concern
Double-crested cormorant, *Phalacrocorax auritus*	all	Special Concern
Least bittern, *Ixobrychus exilis*	all	Special Concern
Cooper's hawk, *Accipiter cooperii*	all	Special Concern
Red-shouldered hawk, *Buteo lineatus*	all	Threatened
Golden eagle, *Aquila chrysaetos*	Tivoli, Iona, Piermont	Endangered (NY)
Bald Eagle, *Haliaeetus leucocephalus*	all	Endangered (US, NY)
Marsh hawk, *Circus cyaneus*	all	Threatened
Osprey, *Pandion haliaetus*	all	Endangered[a] (NY)
Peregrine falcon, *Falco peregrinus*	Iona, Piermont	Endangered (US,NY)
Common tern, *Sterna hirundo*	Tivoli, Iona, Piermont	Threatened
Black tern, *Chlidonias niger*	Tivoli, Piermont	Special Concern

Table 6 (Continued)

Species	Site	Status
Common raven, *Corvus corax*	Tivoli	Special Concern
Grasshopper sparrow, *Ammodramus savannarum*	Tivoli Piermont	Special Concern
Henslow's sparrow, *A. henslowii*	Tivoli	Special Concern
Vesper sparrow, *Pooecetes gramineus*	Tivoli, Iona	Special Concern

[a]The osprey is currently on the New York Endangered List, but the "Tentative List" proposes a change to Threatened status.

dead fish or other carrion for food. Iona Island has the potential to become a regular winter roosting area.

Ospreys (Pandion haliaetus) are commonly seen in small numbers (1-4 at once) along the Hudson in April and May, and occasionally in summer and fall. There are isolated historical records of osprey breeding along the Hudson River Estuary, but it is not clear to what extent ospreys nested successfully here. Possibly the high natural turbidity of Hudson River waters makes it difficult for nesting osprey to catch enough fish to feed their young. The sizeable Long Island Sound osprey population declined severly after World War II due to DDT contamination of their food, but in the last few years Long Island Sound ospreys have begun a remarkable comeback. Unverified reports of nesting attempts along the Hudson could indicate a spillover from the sound. Osprey occur at all four proposed sanctuary sites where they catch fish in the shallows and marsh pools and and retire to eat in large (often dead) tree. A late -1950s nest was reported at Tivoli Bays, and a possible 1970s nest near Iona Island, but no details are available for verification.

Several pairs of peregrine falcons (Falco peregrinus) nested along the Hudson River Estuary on the Palisades and Hudson Highlands cliffs for many years until the nationwide population decline in the 1950s. None of these nesting sites is active at present. Peregrine falcons are being reintroduced experimentally to former nest sites at other northeastern locations and there is potential for re-establishment at one or more of the Hudson River eyries. The peregrine falcon occurs now as a rare transient along the Hudson.

Threatened. The mud turtle (Kinosternon subrubrum) has been reported from Bear Mountain State Park, but no verification is available. There is a single specimen of this species from Ossining, but mud turtle distribution in the lower Hudson region is a mystery (Craig et al., 1980). Mud turtles could occur at Iona or Piermont; they have been found in tidal marshes outside of the Hudson Estuary.

Red-shouldered hawks (Buteo lineatus) are seen along the Hudson during migration, and nests have been found at a small number of off-river localities in the 1970s. Nesting is possible at the proposed sanctuary sites.

The marsh hawk (Circus cyaneus) is seen regularly at Hudson River marshes including the proposed sanctuary sites in late summer and fall, rarely in winter, and occasionally in spring. There is no evidence of nesting although the species formerly nested at inland localities in the Hudson Valley.

The common tern (Sterna hirundo) is seen occasionally as a windblown wanderer at the proposed sanctuary sites, more often downriver. There does not seem to be any breeding potential.

Special concern. The Jefferson salamander (Ambystoma jeffersonianum) is found at a few locations inland and could occur near nontidal woodland pools at the proposed sanctuary sites. Spotted turtles (Clemmys guttata) are quite rare in tidal wetlands, but nesting has been verified at least

at Tivoli Bays; the species is more common at certain inland locations. Hognose snakes (Heterodon platyrhinos) have not been reported from the sites although found here and there offriver; the hognose could be found wherever toads (their food) are abundant and especially in sandy soils.

Common loons (Gavia immer) are seen occasionally as migrants on the estuary, including the proposed sites; there is no breeding potential. Double crested cormorants (Phalacrocorax auritus) occur regularly downriver, sporadically upriver; they are quite rare near the two upriver sites. There does not appear to be any breeding potential. The least bittern (Ixobrychus exilis) is known from the extensive cattail marshes of the proposed sanctuary sites as a breeding species. It is a rare bird in the Hudson Valley because of the scarcity of large cattail stands. Semiquantitative data suggest a stable breeding population of perhaps a dozen pairs at Tivoli Bays during the period 1973-81. The Cooper's hawk (Accipiter cooperii) is seen occasionally at the proposed sites, and recent inland breeding records suggest potential breeding in the forests of the proposed sanctuary. The black tern (Chlidonias niger) is a rare spring migrant on the Hudson River Estuary; there are no breeding records, although black terns breed in large inland marshes in central New York. The barn owl (Tyto alba) is rare along the Hudson where availability of nest sites may be a limiting factor. Barn owls could occur, and there is some breeding potential at the proposed sanctuary sites. Short-eared owls (Asio flammeus) could occur in winter at the proposed sites as there are a few regular wintering areas offriver in the Hudson Valley. The common raven (Corvus corax) seems to be increasing in the northeast, but there is only one record from the proposed sanctuary. Grasshopper sparrow (Ammodramus savannarum), Helslow's sparrow (A. henslowii) and vesper sparrow (Pooecetes gramineus) formerly bred in fields near Tivoli, and there may be breeding potential at Tivoli and Iona.

Blue List Birds. Some other species that are not included in the Tentative New York List, but were in the American Birds "Blue List for 1981" (Tate, 1981) and occur at one or more of the proposed sanctuary sites are: great blue heron (Ardea herodias), black-crowned night heron (Nycticorax nycticorax), American bittern (Botaurus lentiginosus), sharp-shinned hawk (Accipiter striatus), king rail (Rallus elegans), screech owl (Otus asio), ruby-throated hummingbird (Archilochus colubris), cliff swallow (Petrochelidon pyrrhonota), purple martin (Progne subis), shortbilled marsh wren (Cistothorus platensis), golden-winged warbler (Vermivora chrysoptera), eastern meadowlark (Sturnella magna), black duck (Anas rubripses), and canvasback (Aythaya valisineria). These are species that seem to be undergoing (or have recently undergone) noncyclical decline in the Northeast.

Marine Mammals. Few species penetrate the Hudson River Estuary above the New York Bay complex. Harbor seals (Phoca vitulina) occasionally appear almost anywhere in the Hudson River Estuary, in recent years as in the 1800s. There were reports of the harbor porpoise (Phocoena phocoena) in the lower estuary in the 1800s. A single well-documented incursion of common dolphins (Delphinus delphis) up the Hudson Estuary nearly to Albany took place in 1936. There is no evidence that any specific locations or habitats in the Hudson are significant to marine mammal populations.

Wetland and Terrestrial Mammals. At least 31 species of wild mammals have been recorded on or close to the proposed sanctuary sites (other than marine mammals). The muskrat (Ondatra zibethicus) is the most characteristic mammal of the Hudson River Estuary marshes and is present at all the proposed sanctuary sites in numbers that vary considerably from year to year. The mink (Mustela vison) also occurs at the sites. The river otter (Lutra canadensis) is rare in the Hudson, but transient individuals have been seen at Iona and Tivoli in the marshes.

The whitetail deer (Odocoileus virginianus) is very common along the Hudson including at the four proposed sites. Deer frequently enter Iona Island Marsh, probably to feed. Deer have been seen in Piermont Marsh in winter, and occasionally in the marsh at Tivoli North Bay, but they are common upland at these sites and at Stockport.

Some other mammals that enter the tidal wetlands are: white-footed mouse (Peromyscus leucopus) mostly in winter; eastern cottontail (Sylvilagus floridanus), in tidal swamps in winter; gray squirrel (Sciurus carolinensis) and red squirrel (Tamiasciurus hudsonicus), tidal swamps and shoreline; meadow vole (Microtus pennsylvanicus); shorttail shrew (Blarina brevicauda); raccoon (Procyon lotor); gray fox (Urocyon cinereoargenteus); red fox (Vulpes fulva); and opossum (Didelphis virginiana).

Birds. Many species of land, wetland and water birds are found along the Hudson River Estuary. Marine and coastal species penetrate upriver varying distances, becoming less diverse and less abundant upriver. All four proposed sanctuary sites attract rare birds wandering through or settling in the Hudson Valley. Common species also tend to concentrate in the proposed sites. The four sites are well known as excellent birding areas--among the best in the Hudson Valley (Drennan, 1981.) A list of birds recorded at the proposed sanctuary is in Appendix 4.

Herons. A dozen great blue herons is not an unusual sight at Tivoli South Bay or Stockport Flats during late summer on a low tide. Great egrets (Casmerodius alba) are also common in some years. Apart from the bitterns, the only nesting heron at the proposed sanctuary sites is the green heron (Butorides striatus).

Waterfowl. The proposed sanctuary sites are concentration areas for waterfowl during migration. Wintering waterfowl occur wherever there is open water, mostly downriver. Numbers of breeders are small, probably because suitable nests sites are scarce on the intertidal marshes. At least 30 species of ducks, geese, and swans have been recorded at the proposed sites. The most abundant migrants are Canada goose (Branta canadensis), mallard (Anas platyrhynchos), black duck, green-winged teal (A. crecca), blue-winged teal (A. discors), wood duck (Aix sponsa), and canvasback. Hundreds of canvasbacks feed in the Iona Island shallows, and probably thousands winter in some years in the Haverstraw Bay Tappan Zee. (See Appendix 5 for data on wintering waterfowl.) The most abundant nesting species are black duck, mallard, and wood duck; the Tivoli Bay site supports about a dozen pairs of each of three species each year.

Raptors. The shores of the Hudson River, including the proposed sites, are moderately attractive to birds of prey. Migrating hawks cross the Estuary at a number of locations, but there is an area of concentrated crossing especially in fall at Anthony's Nose and Dunderberg Mountain by Iona Island, and concentrated migration along Hook Mountain just north of Piermont Marsh.

Regular residents at or near the proposed sanctuary sites include red-tailed hawk (Buteo jamaicensis), American kestrel (Falco sparverius), great horned owl (Bubo virginianus) and screech owl (Otus asio). Rough-legged hawks (Buteo lagopus) frequent the Iona Island fields in winter. (See discussion of Endangered Animals, above.)

Marsh Birds. Several species of marsh-nesting birds use the extensive cattail stands and associated vegetation at the proposed sites. Regular breeders are the least bittern (discussed under Endangered Animals) and long billed marsh wren (Cistothorus palustris). Irregular breeders are the American bitterns (Botaurus lentiginosus), clapper rail (Rallus longirostris), king rail (R. elegans), Virginia rail (R. limicola), sora (Porzana carolina), and common gallinule (Gallinula chloropus). In the Hudson Valley, the least bittern, long-billed marsh wren, common gallinule and king rail are nearly restricted to large (many acres) cattail marshes as breeding habitat, although a few other wetland plant communities are used for nesting elsewhere in United States.

The sharp-tailed sparrow (Ammospiza caudacuta) and seaside sparrow (A. maritima) have nested at Piermont Marsh. These species are associated with specific saline marsh plant communities and are quite rare away from the immediate coast in New York.

In addition to the obligate marsh species, red-winged blackbirds (Agelaius phoeniceus), American goldfinch (Carduelis tristis), swamp sparrow (Melospiza georgiana), and song sparrow (M. melodia) also nest in the tidal marshes.

Shorebirds. The Hudson River Estuary marshes and mudflats, including the proposed sanctuary sites, are good habitat for migrating shorebirds. The most commonly seen species are killdeer (Charadrius vociferus), common snipe (Capella gallinago), spotted sandpiper (Actitis macularia), greater yellowlegs (Tringa melanoleuca), lesser yellowlegs (T. flavipes), and least sandpiper (Calidris minutilla). At least eleven other species are seen at times. The only breeding shorebirds at the proposed sites are American woodcock (Philohela minor), killdeer, and spotted sandpiper.

Gulls and Terns. The Hudson River Estuary is good habitat for non-breeding gulls, but attracts few terns due to the inland location. No gulls or terns breed on the Hudson. The herring gull (Larus argentatus) is the most common gull and is a conspicuous feature of the proposed sanctuary sites nearly all year round. Ring-billed gull (L. delawarensis) and great black-backed gull (L. marinus) are common. Laughing gull (L. atricilla) and Bonaparte's gull (L. philadelphia) are uncommon and usually seen only downriver. A few other species of gulls and terns are seen occasionally, mostly downriver.

Other Birds. Ruffed grouse (Bonasa umbellus) are resident in the terrestiral forests, and feed in the tidal swamps in winter. Woodpeckers are common in the tidal swamps and forest, including the pileated woodpecker (Dryocopus pileatus). Winter birds of the marshes include downy woodpecker (Picoides pubescens), black-capped chickadee (Parus atricapillus), winter wren (Troglodytes troglodytes), tree sparrow (Spizella arborea), white-throated sparrow (Zonotrichia albicollis) and song sparrow. Very large flocks of tree swallows (Iridoprocne bicolor), bank swallows (Riparia riparia), starlings (Sturnus vulgaris), red-winged blackbirds, and common grackles (Quiscalus quiscula) roost in the marshes, especially in late summer and early fall. Breeding birds of the tidal swamps are many, including willow flycatcher (Empidonax traillii), great crested flycatcher (Myiarchus crinitus), blue jay (Cyanocitta cristata), black-capped chickadee, veery (Catharus fuscescens), yellow warbler (Dendroica petechia) and common yellowthroat (Geothlypis trichas).

There are many species of small birds in the terrestrial forests. Breeding bird communities are typical of northeastern forests, including warblers, vireos, thrushes and others. The cerulean warbler (Dendroica cerulea) nest here and there and is much sought-after by birdwatchers. Spring and fall warbler migrations also attract birdwatchers to the proposed sites.

The railroad right-of-way supports a very interesting breeding bird community (Stapleton and Kiviat, 1979). The most abundant species are gray catbird (Dumetella carolinensis), yellow warbler, and song sparrow. Population density of all breeding species combined is among the highest reported for any breeding bird communities of the United States.

Reptiles and Amphibians. About two dozen species of reptiles and amphibians occur along the Hudson River Estuary and almost all are present at one or more of the proposed sites. Tidal fluctuation and salinity prevent some species from living in the estuary itself. The most important habitats for reptiles and amphibians are the tidal marshes and shallows, woodland pools and ponds, and the terrestrial forests.

The snapping turtle (Chelydra serpentina) is common in the wetlands and shallows at all four sites. The map turtle (Graptemys geographica) maintain small scattered populations in the estuary and has been found at Stockport and Tivoli. The diamondback terrapin (Malaclemys terrapin), the ecological equivalent of the map turtle in brackish areas, is rare in the Hudson River Estuary and has been found at Iona and Piermont.

The five-lined skink (Eumeces fasciatus) occurs on land near the Iona Island Marsh, and there are unverified reports of the fence lizard (Sceloporus undulatus) which is better known from the east bank of the estuary in the Hudson Highlands.

Several snakes occur at the sites. Those that most often enter the tidal wetlands are water snake (Nerodia sipedon) and garter snake (Thamnophis sirtalis).

Amphibians are not abundant in the tidal habitats probably because tidal wetlands are not favorable for amphibian reproduction. The green frog (Rana clamitans) is present at low densities at Tivoli and Iona, and probably Stockport. Bullfrogs (R. catesbeiana), pickerel frogs (R. palustris), American toads (Bufo americanus), spring peepers (Hyla crucifer), and gray treefrogs (H. versicolor) enter the wetlands to some extent, but are more common in nearby nontidal wetlands where the woodfrog (Rana sylvatica) also occurs. Few salamanders have been found in Hudson Estuary tidal habitats, but several species occur in the terrestrial forests and tributary streams at the proposed sites.

Fishes. About 150 species of fish have been found in the Hudson River Estuary in the last 15 years, and the fish community of the Estuary is probably one of the best-studied estuarine fish communities in the world. Like coastal birds and marine mammals, marine and estuarine fishes penetrate up the Hudson in relation to salinity intrusion and distance from its mouth. Also, many freshwater fish species inhabit the upper estuary. The Hudson is a very important nursery area for many fish species including several very valuable food and game fishes: striped bass (Morone saxatilis), white perch (M. americana), American shad (Alosa sapidissima), alewife herring (A.pseudoharengus), blueback herring (A. aestivalis), tomcod (Microgadus tomcod), Atlantic sturgeon (Acipenser oxyrhynchus), American eel (Anguilla rostrata), and rainbow smelt (Osmerus mordax).

Important nursery areas for some migratory fishes in the estuary are in the Haverstraw Bay - Tappan Zee region within a few miles of Nyack (Figure 5), where conditions of salinity, shelter and food availability in the tidal shallows are very favorable for juvenile fish. Additionally, shad, alewife, blueback herring, and other species use the upper estuary for spawning and as a nursery.

Much remains to be learned about the role of the Hudson River wetlands and tributary mouths in the support of the estuary's fishery resources. Many fish species reside in or temporarily enter the wetlands and tidal stream mouths. For example, of 59 species that have been found in the vicinity of the Tivoli Bays complex, 34 have been found in the wetlands and stream mouths. Banded killifish (Fundulus diaphanus) and mummichog (F. heteroclitus) are very abundant in the marshes and apparently reside there. American eels of all sizes live in the marshes. Alewife spawn in the upriver shallows, and alewife, rainbow smelt and white sucker (Catostomus commersoni) spawn in the tributary stream mouths. Striped bass and white perch enter the marshes to feed, and are particularly common at locations around the tidal inlets connecting the marshes and the main river. Juvenile striped bass have been found in tidal creeks in Iona Island Marsh in early fall and are reported to occur in other marshes as well.

Among the more unusual records of fishes from the proposed sanctuary sites are blue-spotted sunfish (Enneacanthus gloriosus) reported from Iona; American brook lamprey (Lampetra appendix) and northern hog sucker (Hypentelium nigricans) from the mouth of the Saw Kill at Tivoli South Bay; and a population of central mudminnow (Umbra limi) in ponds on Cruger Island (Tivoli). A list of fishes known from the proposed sanctuary sites is in Appendix 3.

Invertebrates. Important groups of larger invertebrate animals in benthic communities of the Hudson River Estuary include polychaete worms, oligochaete worms, chironomid midge larvae, snails and clams, crabs and crayfish, Gammarus and other amphipods, and isopods. Zooplankton communities include rotifers, crustaceans, and other groups. The most economically important invertebrate, the blue crab (Callinectes sapidus), moves upriver in summer and fall as salinity increases and may become common as far as the Hudson Highlands (Peekskill to Beacon).

The red-jointed fiddler crab (Uca minax) is common in Piermont Marsh. Several species of land and aquatic snails occur at the proposed sites, but most have not been definitively identified. In fact, the invertebrates of the marsh are very poorly known. Estuarine invertebrates are a very important link in food chains between, on the one hand, algae and detritus, and on the other hand, fish, reptiles, birds, and mammals. Invertebrates are particularly important in the nutrition of young and adult fish, including the endangered shortnosed sturgeon and the economically important American shad, striped bass, and other species. Invertebrates occur on and in the sediments, in the water, on plants, and in the air, as well as on land. Invertebrate ecology of the proposed sanctuary is a very important field for research.

The wetlands support many invertebrates on the aerial parts of plants. Some of the most conspicuous or abundant species are a snail (Succinea ovalis); the waterlily leaf beetle (Pyrrhalta nymphaeae) on spatterdock and other plants; the cattail moth (Lymnaecia phragmitella) on cattails; a caterpillar of genus Mompha in purple loosestrife stalks; the weevil Smicronyx in dodder (Cuscuta gronovii); and scale insect (Chaetococcus phragmitis) on common reed. Monarchs (Danaus plexippus) and other butterfiles, and various bees (including honeybees (Apis mellifera) are attracted to blossoms of pickerelweed and other plants.

A rare bug (Bellonochilus numenius) has been found on sycamore fruits at Stockport. A newly-described crayfish (Orconectes kinderhookensis) has so far been found only in Kinderhook Creek, a tributary of Stockport Creek. It is not known if it occurs downstream as far as the proposed sanctuary sites.

In late spring and early summer, mosquitos can be annoying on the marshes on calm nights, and in moist woods and tidal swamps day or night, but mosquitos do not bite in the marshes by day. Deer flies (Chrysops) may bite for a few weeks in June and July during the day around the edges of the marshes, but rarely fly far out onto the marshes. "Shad flies" (Simuliidae) and punkies (Ceratopogonidae) bite on calm days in April and their numbers vary from year to year; they also do not fly out on the marshes. Scheduling of field activities or use of insect repellents mitigates biting fly nuisances and no problems are anticipated for the proposed sanctuary research and education programs.

e. Estuarine Ecosystem

Generalized patterns of energy flow (production and feeding) for the proposed sanctuary sites are shown in Figure 10. These diagrams represent many interwoven food chains (for example spatterdock to leaf beetle to songbirds to birds of prey, or vascular plants to detritus to crustaceans to small fish to striped bass), and there are many species that feed on more than one type of food. In general, using energy from the sun, green plants produce matter which is consumed while alive by grazing animals or after death by detritus-feeding animals. These primary consumers in turn are eaten by larger and larger animals, culminating in the highest-level consumers such as striped bass, snapping turtle, herons, hawks, mink and man. The great abundance of plants, small invertebrates and small fish in the Hudson River Estuary provides a rich food base for economically important larger animals such as sport and commercial fishes, waterfowl, blue crab, etc.

The major producers in the Hudson are phytoplankton in the waters, and vascular plants in the shallows and wetlands. Turbidity limits phytoplankton populations but these producers are important in the Haverstraw Bay - Tappan Zee region. Zooplankton and benthic invertebrates feed on phytoplankton and on detritus (dead plant particles) from the plants of the marshes and shallows as well as from terrestrial sources. The zooplankton and benthic invertebrates are food for larger invertebrates and small fish, which in turn are eaten by larger fish, birds, and other animals. Estimates of the relative importance of terrestrial and estuarine energy (food) sources vary.

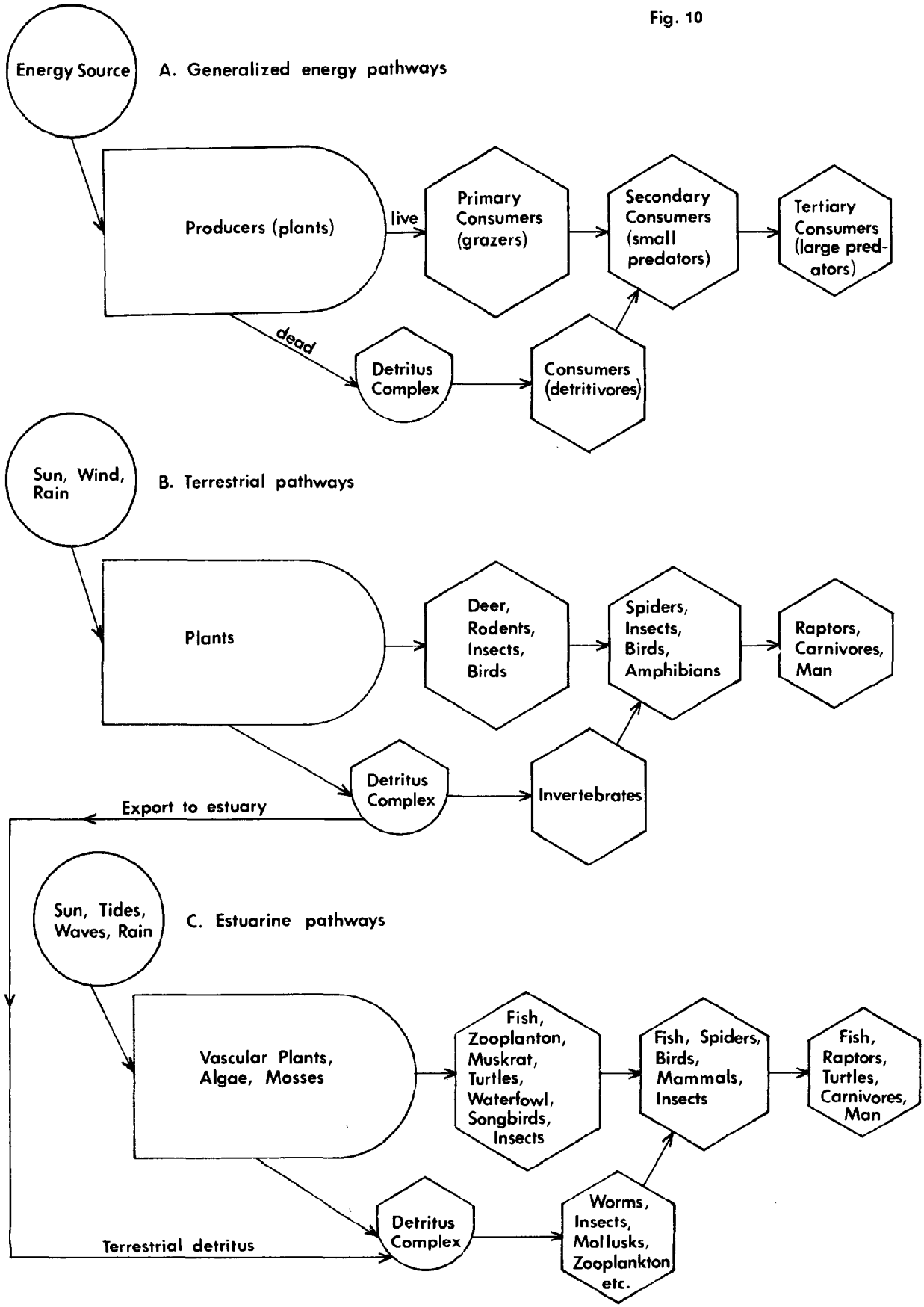
Research done in other estuaries suggests that Hudson River wetlands may absorb nutrients from the main river, but it is not clear to what extent these nutrients may be returned to the river with the decomposition of dead plants. The vegetation of the wetlands and shallows is a nutrient-recycling system that channels nutrients into food chains that yield resources for society in the form of fish, crabs, ducks, and furbearers. At the same time this vegetation is improving water quality in the river.

2. Current Uses of the Sites

a. Commercial and Recreational Fishing

Fishing has been an important activity along the Hudson River Estuary from Indian times to the present day. Catch records were first kept in the late 1880s. From that time, the commercial fin-fishery grew until the late 1930s-early 1940s, then declined. Average annual commercial finfish catch from 1913-1964 was 847,000 lbs., with the largest catch 2.3 million lbs., reported in 1945. Average annual catch from 1965-74 was 170,000 lbs., including 275,000 lbs. in 1974. Shad represented 86% of these catches. Reported catches are minimum and Sheppard (1976) estimated actual 1976 catch at around 600,000 lbs. Sheppard felt that the commercial fisheries of the Hudson River Estuary could be increased to perhaps 1-2 million lbs. per year. In 1978, there were 47 licensed commercial fishermen on the Hudson.

Fig. 10


Energy Source
A. Generalized energy pathways
Producers (plants)
live
Primary Consumers (grazers)
Secondary Consumers (small predators)
Tertiary Consumers (large predators)
dead
Detritus Complex
Consumers (detritivores)
Sun, Wind, Rain
B. Terrestrial pathways
Plants
Deer, Rodents, Insects, Birds
Spiders, Insects, Birds, Amphibians
Raptors, Carnivores, Man
Detritus Complex
Invertebrates
Export to estuary
Sun, Tides, Waves, Rain
C. Estuarine pathways
Vascular Plants, Algae, Mosses
Fish, Zooplanton, Muskrat, Turtles, Waterfowl, Songbirds, Insects
Fish, Spiders, Birds, Mammals, Insects
Fish, Raptors, Turtles, Carnivores, Man
Detritus Complex
Worms, Insects, Mollusks, Zooplankton etc.
Terrestrial detritus

The Hudson River Estuary contributes to marine fisheries of striped bass, shad, bluefish, butterfish, winter flounder, summer flounder, menhaden, weakfish, tidewater silversides and sea robin (Sheppard, 1976). In 1974, New York marine landings were about 7 million lbs. The average Hudson River contribution to the marine striped bass fishery alone has been estimated at about 700,000 lbs. in the period 1965-74.

During the period 1970-74 between Troy and the Tappan Zee Bridge (Nyack), there were an estimated 165,000 person-days spent in recreational fishing on the Hudson (Sheppard 1976). Sheppard felt that the estuary was capable of supporting perhaps 2 million angler-days of recreational fishing per year. The major recreational species include striped bass, white perch, alewife and blueback herring, brown bullhead, largemouth and smallmouth bass, yellow perch, smelt, bluegill, and pumpkinseed sunfish.

In 1978, the Hudson River Estuary generated an estimated $150-200,000 from the commercial sector and $1.65 million from the recreational sector, as well as a contribution to the marine fin fishery worth $20 million (commercial plus recreational). These figures do not include blue crab fisheries, nor the recreational fin fishery in the Hudson south of the Tappan Zee Bridge. A summer 1980 survey of anglers between Troy and the George Washington Bridge (just north of Manhattan) estimated over 16,000 individual recreational fishermen using the estuary. The creel survey showed that in August 33% of anglers had caught white perch, 23% had caught blue crab, and 9% had caught catfish (New York State Department of Environmental Conservation Hudson River Unit, 1980).

In 1976, the Hudson River Estuary was closed to commercial fishing of all species except American shad, Atlantic sturgeon, and blue crab, due to PCB residues in some species exceeding the Federal allowable limit for interstate commerce of 5 parts-per-million. Intensive monitoring of Hudson River fish since then has shown significant declines of PCB levels. The Department of Environmental Conservation (DEC) is lifting the bans on commercial fishing for alewife, blueback herring, smelt and tomcod in 1982. It is hoped that the ban on striped bass can be lifted during the next few years.

Shad enter the Hudson River in early spring and migrate up-river to spawn in tidal shallows from the Kingston area northward. Commercial (staked and drift gillnets) and recreational fishing for shad takes place almost throughout the estuary. In 1981, the DEC published a leaflet "A Guide to Angling for Hudson River Shad" which has been successful in promoting hook-and-line fishing for shad and a concomitant increase in interest in the Hudson River and its management among recreational fishermen.

Fishing for blue crab (blue-claw crab) with pots and lines is popular as far up the Hudson River Estuary as Beacon. There is also a small commercial crab fishery. Both blue crab and shad appear to have increased in numbers in the Hudson in the last 15 years, probably due partly to improved water quality.

The commercial fishery for Atlantic sturgeon is very small. There is a small commercial seine fishery for baitfish, primarily killifish and shiners, in the shallows and marshes.

A few commercial shad fishermen operate in the shallows near Piermont Marsh. There is a recreational fishery for blue crab and fin fish (including tomcod in winter) off the tip of the Erie Pier, and some recreational fishing by boat near the marsh and in the mouth of Sparkill Creek.

There is virtually no commercial fishing near Iona Island. The marsh itself is closed to all fishing. Limited crabbing and recreational fin fishing take place along the railroad.

Considerable commercial shad fishing takes place in the Kingston Flats area a few miles south of Tivoli Bays, but little shad fishing is done close to the bays. One commercial fisherman seines baitfish in the Tivoli Bays. Recreational fishing is concentrated at the stream mouths (Saw Kill and Stony Creek) and the railroad bridges, with some boat fishing. Species fished at Tivoli are primarily alewife (scap-netted), striped bass, white perch, yellow perch, largemouth bass, white sucker, catfish and eel. There are approximately 500 person-days per year of recreational fishing in the Tivoli Bays area.

Some commercial shad fishing occurs in the areas near Stockport Flats. One commercial fisherman seines bait fish in the wetlands and shallows. The tidal mouth of Stockport Creek is an excellent recreational fishing area best known for striped bass. Most of the recreational fishing is concentrated at the railroad bridge area and the Route 9 highway bridge, with some fishing by boat. Fishing from small craft also takes place on the river side of Stockport Middle Ground and Gay's Point.

The carrying capacity of the Hudson River Estuary for fisheries is far greater than the present harvest. The DEC is prepared to carefully regulate fishing for striped bass when commercial fishing for this species is once again permitted. Hudson River commercial fishing operations are currently licensed and monitored, but there is no license required for recreational fishermen on the estuary. Such a license is under consideration by the DEC. There is no foreseeable conflict between fishing and scientific or educational use of the proposed estuarine sanctuary. Hudson River fish stocks and fisheries are under continued study.

b. Fur Trapping

Historically, fur trapping was a mainstay of the Hudson Valley's economy. Today trapping is a source of supplementary income for a number of Valley residents.

The primary furbearer along the Hudson River Estuary is the muskrat, although raccoon, mink, red fox, and gray fox are also trapped in very small numbers.

Muskrat population fluctuate considerably over several-year periods and trapping effort and harvest also vary. In tidal marshes, muskrats make tunnels connecting the tidal creeks and pools to the intercreek areas, and also construct winter lodges (houses) in the intercreek areas. Much trapping is done in the tunnel entrances; a few trappers also use floating trap platforms. Leghold traps and conibear traps are used on the Hudson.

The 1980-81 and 1981-82 muskrat trapping season ran November 15 to March 15. As of February 1982, good muskrat pelts were selling for $4-5 each, down markedly from a year before. During the late 1960s - early 1970s, muskrat populations were high in Hudson River marshes, and estimated annual catch at that time was 500-800 muskrats at Tivoli Bays and perhaps a similar number at Stockport Flats. Several trappers are active in each area, but catch has been lower in the last few years. The Palisades Interstate Park areas at Iona and Piermont are closed to trapping.

Sharp fluctuations in muskrat numbers are normal in most muskrat habitats in North America, with or without trapping. Muskrats are important in the marsh ecosystem as diggers of tunnels that aerate the sediments, and creators of clearings around their winter lodges that increase variety in the vegetation. In general, fur trapping is not in conflict with existing or potential scientific and educational uses of the proposed sanctuary sites.

c. Hunting

Hunting along the Hudson River Estuary is primarily waterfowl hunting and deer hunting. Hunting is not permitted in the Palisades Interstate Park areas at Iona and Piermont, but hunting is permitted on State-owned lands at Tivoli Bays and Stockport Flats.

There is limited hunting for Canada geese on the Hudson but most waterfowl hunting is duck hunting. The primary game species are mallard, black duck, green-winged teal, blue-winged teal, wood duck and canvasback. Canvasbacks are shot on open waters as this species rarely enters the wetlands; there is little hunting of canvasbacks or other diving ducks at Tivoli and Stockport.

Duck hunting season on the Hudson Estuary usually opens in the first half of October and runs (with or without a closed period) until sometime in December or January. Lack of open water and ducks upriver in December and January effectively limits the season to October-November. Duck season usually opens on a Wednesday. The heaviest hunting is on opening day, and hunting may be fairly heavy the Thursday and Friday after opening day and the first 2-3 weekends. Hunting is thus concentrated into the equivalent of about a week's time. Furthermore, there is little shooting between about 10 a.m. and 5 p.m.

There are four types of shooting on the wetlands and shallows at Stockport and Tivoli: shooting from blinds, pass shooting on foot on land, shooting on foot in the wetlands, and shooting from boats in the

wetland creeks and pools and along the shorelines of the shallows. At Tivoli Bays, almost all shooting is from blinds or boats; at Stockport Flats, most shooting is done on foot.

At Tivoli Bays, at opening day dawn of the duck season, Wednesday, 15 October 1981, there were 45 hunters' vehicles parked around the area, indicating a total of about 90 hunters that morning. There were about 40-45 active duck blinds in Tivoli Bays in fall 1981, almost all of them in North Bay where most of the hunting occurs. On opening day, 25 parties of hunters interviewed by DEC bagged 140 ducks, of which 19 were black ducks or mallards and the rest mostly teal.

It is estimated that the number of hunters in the Stockport Flats area on opening day 1981 was approximately the same as at Tivoli. There were only 7 blinds in the main marsh at Stockport in fall 1981. Reports of hunters indicate a considerable decline in hunter numbers at Stockport since the 1940s or 1950s, and a continued decline during the last 10 years. Car counts at Tivoli indicate a reduction in the hunter numbers on opening day since the early 1970s when the season opened on weekends instead of Wednesdays.

The upper Hudson River Estuary, including Tivoli and Stockport, was restricted to the use of steel shot for waterfowl hunting for the first time in the 1981 season. This rule was based on a finding of ingested lead shot in approximately 10% of ducks bagged on the upper estuary. Steel shot use should reduce the incidence of lead poisoning in ducks from ingesting lead shot pellets while feeding on organisms in the mud.

Concentration of duck hunting in early morning and late afternoon during October reduces potential conflicts between hunting and other uses of the marshes. Research field work has been conducted for 11 years at Tivoli North Bay during duck season with relatively few problems. The management plan for Tivoli Bays will include measures to further reduce conflicts or potential conflicts between hunting and other uses of the area. This is important because of the mix of different uses existing and anticipated at Tivoli, and would occur regardless of the sanctuary designation. At Stockport Flats, differences in use patterns and the proposed emphasis in the sanctuary program on spring and summer research (as opposed to year-round research and educational activities) insures that major problems with use conflicts will not arise.

There is a moderate amount of deer hunting at Stockport and Tivoli on terrestrial areas. Deer populations have been high throughout the 1970s-80s and are very high now (1982). Deer hunting season usually opens in mid-November and runs for 3 weeks.

There is a moderate amount of hunting for upland small game (ruffed grouse, pheasant, gray squirrel, eastern cottontail, raccoon, red and gray foxes). The various small game seasons run through much of the fall and winter. There is virtually no hunting of rails, gallinule, snipe or woodcock at Stockport or Tivoli.

d. Forestry

The Hudson River Valley has had an increasing amount of forest cover over the last century, and now is about half covered by forest. Forest cover is much more than 50% on most slopes immediately adjacent to to the estuary. Shore forests at some locations are selectively harvested for timber and fuel. There is no harvest in the Palisades Interstate Park system, including the Iona Island and Piermont areas.

Portions of the State Preserve at Tivoli Bays were selectively logged in 1980 before State acquisition. Very little was cut within 100 yards of the estuarine habitats and most cutting was well over 200 yards east of the North Bay; there was no cutting on Cruger Island or along the tidal mouth of Stony Creek. The last time the forests close to North Bay had been extensively cut was around 1906. There has been virtually no recent cutting on private forests adjoining the Tivoli Bays.

There has been no recent logging at the Stockport Flats area. Some fuelwood has been cut on a few small private areas near the wetlands.

e. Agriculture

Field corn, grain, hay, apples, peaches, grapes and a few other crops are cultivated atop the bluffs along the Hudson River Estuary, in the middle and upper regions from about Beacon to Albany. Recent years have seen a resurgence of grape culture in the Mid-Hudson region, and continued strength in the apple industry. Stock are grazed on the bluff tops in some areas. Non-agricultural (usually wooded) zones generally exist between agriculture and the shoreline, especially where shore slopes are steep (over 10% slope); rarely is agriculture less than 100 yards from the shoreline and usually the distance is much greater.

Crops and stock are raised on farms east of Stockport Flats. Hay, field corn and oats were grown on the fields east of Tivoli North Bay until 1979, and the DEC expects to permit hay cutting again on some of these fields. Thoroughbred horses are raised on the private property north of North Bay, and apples and peaches are grown commercially east of South Bay. In all cases at at Stockport and Tivoli, substantial areas of forested slopes (map distance of 100 yards to one-half mile wide) separate agriculture from the tidal shoreline. There is no agriculture near the Piermont and Iona Island marshes.

f. Industry

In the 1800s, many industries stood right on the Hudson River Estuary shoreline, among them brickworks, ice houses, and grist, saw, and textile mills. Most of these structures are gone with little trace. Contemporary industry along the Hudson includes cement and aggregate plants, petroleum terminals, manufacturing plants, and electric power stations. However, virtually no heavy industry is visible from the proposed sanctuary sites, with the exception of Piermont.

Stockport. The nearest heavy industry to the main marsh is one and one-half miles to the southwest across the river, not visible from the marsh. A locality near the proposed sanctuary site was included on a DEC list of possible sites for a toxic waste treatment facility.

It is anticipated that once the estuarine sanctuary is designated and a management plan has been adopted, that use of areas near the sanctuary and within the State Coastal Area Boundary as a hazardous waste treatment facility would be a noncompatible use. The treatment facility proposal is inactive now.

Tivoli. The nearest heavy industry is more than two miles to the northwest, at Saugerties, and not visible from the proposed sanctuary site.

Iona Island. The portion of the island east of the railroad was a Navy supply depot from about 1900 to 1965, when it was acquired by the Palisades Interstate Park Commission (PIPC). All, but five of the buildings were removed, along with railroad sidings, docks, and roads, and the occupied areas were restored to field. The remaining buildings are used by PIPC for part of its maintenance and storage operations, the rest of which is located on the mainland near Doodletown Bight. This is the only existing industry near the site. The nearest heavy industry is across the river in Peekskill one and one-half miles to the east. The Indian Point nuclear power station is across the river and over two miles southeast (downriver) of Iona Island; the power station is hidden from the proposed sanctuary site by Dunderberg Mountain.

Piermont. A paper recycling plant and a carton factory are located at the base of the Erie Pier just north of the proposed sanctuary site and visible from the marsh. Other industry and a railroad siding formerly occupied the rest of the pier, but have been removed. There is no other industry adjacent to Piermont Marsh; the next nearest industry is over one mile east of the marsh across the river. The factories on the Erie Pier are monitored by the State DEC and Department of Health for potential pollution. A former municipal landfill adjacent to the pier has recently been bored and the levels of metals and pesticides found in the pore water were very low.

g. Transportation

The Hudson River Estuary has been a primary transportation route throughout historic and prehistoric human occupancy of the northeast. In the 1900s, much transportation shifted to highway routes off the river, but the Hudson is still an important transportation corridor.

Shipping. A Federally marked and maintained shipping route extends the length of the Hudson River Estuary. Most of this route has naturally sufficient depths, but the portions of the route between Nyack and Peekskill in Haverstraw Bay, and between Saugerties and Troy, have been deepened and are periodically maintained by dredging. The dredged channel passes close to the Stockport Flats proposed site. None of the proposed sites, however, includes any part of the shipping routes; the proposed site boundaries in all four cases extend downward only to the six foot depth contour below low tide level.

Formerly, some wetlands, islands, and shoreline areas on the upper Hudson Estuary were used for dredged material disposal. The United States Army Corps of Engineers (1981) has published a Draft Environmental Impact Statement for the next decade of channel maintenance and spoil disposal along the Hudson, in which a commitment is made to upland disposal and to avoidance of sensitive natural areas. Dredged material from the shipping channel is expected to be sandy and low in PCB content (less than one part-per-million) so that toxic substance problems are not anticipated. Analyses will be performed just before dredging any reach, and contingency plans will be available for safe landfilling if high-contaminant material is found.

Ship traffic in the narrow and relatively shallow upper estuary produces wakes and swash that have been blamed for shoreline erosion and other problems. The matter is currently under study by the Hudson River Fisheries Advisory Committee to DEC. Most estuaries in the United States that are used for shipping have speed limits; the Hudson is an exception. Commercial ships on the Hudson carry fruit, cement, petroleum, and other products. Small craft are discussed under Recreation, below. The Erie Pier at Piermont is used for infrequent docking of the Lamont Doherty Geological Observatory ocean-going research vessel, but not for other large craft.

Railways. Two ConRail railroads parallel the Hudson River Estuary and border the shoreline in places, the Hudson Division line on the east shore and the West Shore line across the river. These railroads were built circa 1850 and 1880, respectively. The east shore railroad carries both freight and passenger service; along the upper estuary about 8 passenger trains and a similar number of freight trains pass daily each way. The west shore railroad carries only freight.

The railroads pass through the proposed sanctuary sites at Stockport, Tivoli and Iona, but not at Piermont. The railroad at Stockport is between the major wetlands and the uplands; at Tivoli and Iona, the railroads pass mostly between the wetlands and the main river. The railroad at Tivoli was built on a fill causeway with several small openings for tidal flow; at Iona, the railroad was built partly on pilings and has much larger openings. The railroad at Stockport has a single large opening where it crosses the mouth of Stockport Creek. The openings in the railroads are sufficient to allow complete flooding and draining of water onto and off the wetlands with each tidal cycle, much as occurs in wetlands which are not bordered by the railroads.

Ecologically, the railroad causeways, where they lie between the wetlands and the main river, resemble baymouth bars. The tidal openings (bridges) are much used for feeding by predatory fish, especially striped bass, and are well known recreational fishing spots. Large portions of the causeways (rights-of-way) have dense belts of herbaceous or woody vegetation 25 or more feet wide on both sides of the tracks, and these belts support a diversity of plant species, breeding birds, and small mammals. The vegetation also screens the wetlands from the train disturbance. Even where there is no vegetation, migrating ducks on the shallows do not flush when a train passes unless they are within about 50 yards of the tracks.

h. Recreation

Hiking, ski-touring, birdwatching, and related activities are discussed here; hunting, trapping and fishing were discussed in section 3a-c.

Birdwatching. The four proposed sanctuary sites are very well known birding areas and received high ratings in Where to Find Birds in New York State; The Top 500 Sites (Drennan, 1981) and other guides. Many birdwatchers regard the proposed sites among the five most productive sites along the Hudson River Estuary for water and wetland birds as well as land birds (the 5th area is Crofton Point).

Most birdwatching takes place in spring and fall, with less in summer and little in winter. Almost all birding is done by foot from the shoreline and the railroads (and Erie Pier); a few birders use canoes. Birders generally come from the counties containing the proposed sites, either in organized field trips or individually, but birders also come from other Hudson River counties, as far away as New York City and Albany, and farther. A minimal estimate of the number of person-days spent annually birdwatching at the proposed sites is 200 person-days per year per site on the average (10 organized field trips of 10 people each plus an equal amount of individual or small party use). Thus the amount of birdwatching use at Tivoli and Stockport is approximately equal to the amount of hunting use.

Birdwatching has little impact on the sites. There is occasional disturbance of nesting birds through close observation or the playback of recorded bird calls to locate birds.

Other nature recreation occurs at the sites, but is difficult to separate quantitatively from birdwatching, hiking, etc. Some individuals and occasional organized groups come specifically to botanize, and a number of persons visit the areas soley to photograph nature.

Hiking. There are existing foot trails at or near the sites at Piermont, Iona, and Tivoli, and trails are planned for the Gay's Point portion of Hudson River Islands State Park at the Stockport site. A network of hiking trails connects Tallman Mountain State Park and Bear Mountain State Park (Webster, 1971), effectively linking the Piermont and Iona Marshes. The hub of this trail system is the Long Path which begins at the George Washington Bridge in New Jersey, passes near Piermont Marsh and west of Bear Mountain, and will eventually extend to the Adirondacks - nearly the course of the Hudson River itself.

The Appalachian Trail, from Georgia to Maine, passes through the Bear Mountain State Park Trailside Museums complex, and crosses the Hudson River on the Bear Mountain Bridge about two miles north of Iona Island. This is the only place where the Appalachian Trail crosses an estuary in its 2,000 mile length.

Old trails on the State and Bard College lands at the Tivoli Bays are well-used for walking, cross-country skiing, and some snowshoeing and running. Skiing is also popular on the trails near the Piermont and

Iona sites. These activities offer rewarding access to views of the marshes, with little impact. Public transportation allows access to the sites for non-car owners. Buses from New York City stop at Piermont and Bear Mountain; Amtrak trains from New York City and Albany run to Hudson and Rhinecliff, about 8 road-miles from the Stockport and Tivoli sites, respectively.

Miscellaneous Recreation. Occasional groups (e.g., scout encampments) use the Iona Island fields during the warm season, under special permits from PIPC. Otherwise the Island is closed to the public.

A bicycle trail paralleling the west shore of the estuary passes by the Piermont and Iona Island Marshes, partly on highways and partly on old roads reserved for bicycle and pedestrian use and affording good views of the marshes. The Dunderberg section of the bicycle trail is currently (1982) closed for repairs.

Ice boating originated on the Hudson River in the 1860. Ice boats resemble elongated sailboats on sled runners, and are still built and sailed by a few residents in the Mid-Hudson area, particularly near Barrytown and Rhinecliff. Ice boating occurs on the main river during periods of smooth solid ice, often near Tivoli Bays and sometimes on South Bay. Skaters also occasionally use South Bay. Tidal ice can be dangerous, but these activities have no ecological impact.

There are no safe swimming beaches, and swimming in the Estuary is not permitted on public lands at the proposed sites.

Small Craft. Recreational boating by canoe, kayak, sailboat, and powerboat is popular on the Hudson River Estuary. Improved and unimproved boat landings are available to the public at locations near the proposed sanctuary sites. Primitive landings and a semi-improved landing are adjacent to Piermont Marsh (the Erie Pier). There are no improved landings within the proposed sanctuary boundaries. All boating is prohibited in the Iona Island Marsh, except for research purposes.

The ideal way to see the wetlands and shallows is by canoe. Different habitats of the wetlands are accessible, depending on the tide and the season. Canoeists can view wildlife and vegetation with minimal disturbance. The Sparkill Creek, the main river near Iona Island, the Tivoli Bays and the Saw Kill, and Stockport Creek and its tributaries are described in Appalachian Water 2: The Hudson River and its Tributaries (Burmeister, 1974), a canoeing guide. The main river is described in The ITTustrated Hudson River Pilot (Wilkie, nd).

i. Archaeological Resources

The Hudson River Estuary corridor, especially stream mouths, points, and islands, is rich in archaeological sites. Several Native American cultures inhabited the region, and some sites were in use more than 5,000 years ago. Food remains from estuary sites show a considerable

use of estuarine productivity, particularly sturgeon, mollusks, and turtles as well as deer and other terrestrial species. The Indians were attracted to the same sites as modern hunters, fishermen, and birdwatchers--for the same reasons.

Archaeological sites at Iona Island and Tivoli Bays have been scientifically excavated and documented, as have several sites across the river from Stockport. Much remains to be learned about these sites, and the archaeological resources need protection from illegal "scavenging" of artifacts.

j. Plant Resources

There has been no commercial harvest of plant material from the Hudson Estuary. Although wild-rice is abundant at Stockport Flats and a few other upriver marshes, the amount potentially available for harvest is tiny compared to the wild-rice marshes of Great Lakes that sustain commercial harvest. Hudson Estuary wild-rice ripens over several weeks and only a portion of the crop is harvestable at any one time; furthermore, tidal flucuations means that access to these middle-intertidal zone plants is difficult.

k. Esthetic Use

The Hudson River has a three-century tradition of esthetic appreciation of the natural landscape, and the wetlands and shores are an intimate part of this scenic resource. Artistic interest in the estuary reached a high level in the 1800s with the Hudson River School of landscape painting. Many contemporary artists, including painters, photographers and filmmakers, use the estuary as a source of inspiration and a subject for their works.

In an article titled "Some International Values of Wetlands" Jorgensen (1980) said, "Wetlands are important in bringing visitors from many lands together to enjoy a common interest while promoting a better understanding among people." International visitors have shown interest in the Hudson's wetlands and shores throughout the river's history, and there is great potential for increased tourist appreciation of the estuary in keeping with the interest of Hudson Valley communities in tourism as an industry with relatively little environmental impact. Related to this are the burgeoning activities in regional historic preservation and excursion boat operation.

l. Research and Education

Research. Past research on the Hudson River has emphasized sport and commercial fish species; roughly $50-100 million has been spent by the public utilities alone in work on fisheries and related aspects of Hudson River ecology. Other research subjects have been wetlands plants, bottom invertebrates, plankton, marsh and land birds, reptiles, mammals, sediments, economic geology, hydrology, water quality, and endangered species. A program tilted "The Hudson River Field Weeks" was organized by the Hudson River Research Council in 1977 and 1978, and involved coordination of efforts among a dozen different research institutions in a study of water quality under

high-flow and low-flow conditions in the entire estuary. Most of the intensive research to date has focused on the main river and relatively little work has been done in the wetlands. Although there is a hydraulic model of the Hudson Estuary at the U.S. Army Corps of Engineers Waterways Experiment Station in Vicksburg, Mississippi, there are no quantitative models of the Hudson River Estuary ecosystem or of marshes and shallows subsystems. References to published work on the proposed Sanctuary sites appear in a bibliography in the Appendices. Available information on the four sites is being synthesized in more detail and will be published later this year as a basic reference for research workers.

Institutions currently active in Hudson River Estuary research are listed in Table 7, and current research projects involving the four sites are listed in Table 8. A program for future research in the proposed estuarine sanctuary is outlined in the Alternatives section of this DEIS; the program would emphasize long-term environmental monitoring, ecosystem-level studies, and applied problems of management of resources including such topics as shoreline erosion, sedimentation, waterfowl, fisheries, furbearers, wetlands and aquatic vegetation, rare and endangered species, and the impacts of human activities on estuarine resources.

The Estuarine Sanctuary Program would enhance coordination and communication in Hudson River research. A program extending the length of the estuary and setting priorities for certain types of work would encourage fuller and more efficient use of existing facilities, equipment, and collections, perhaps on a time-sharing basis among research institutions. Availability of existing data and its effective use could be enhanced, and a system for indexing and sharing published and unpublished information could be set up. It is expected that planning and conducting research would be closely coordinated with the new Hudson River Foundation for Science and Environmental Research, Inc. resulting from the settlement between the United States Environmental Protection Agency and the public utilities, as well as with older groups set up to coordinate research and communicate research results (Hudson River Environmental Society and Hudson River Research Council). There are ample opportunities for public involvement in certain types of research, e.g., fish tagging by recreational fishermen, and reporting of observations on estuarine animals and plants by sportsmen and naturalists.

Education. Schools, nature clubs, conservation organizations and other groups use the Hudson for educational activities. Most colleges in the New York City to Troy region have courses that take field trips to the estuary. Subjects include geology, botany, fish, wildlife and history, and the numbers of class trips vary from one to 25 per college per year. Class trip time is divided about evenly between the main river and the wetlands. Vassar College, Rockland Community College, and the New School for Social Research have offered courses specifically on the Hudson Estuary. A few schools maintain small laboratories on the shoreline: Dutchess Community College, Bard College, and Marist College. A few elementary schools and a number of secondary schools have also used the estuary for field trips. North Rockland High School has for several years had a program of education and data collection focusing on the Grassy Point marsh complex at Haverstraw.

Boyce Thompson Institute used teacher and student volunteer groups very successfully for data collection in its multi-year intensive studies of the lower estuary wetlands and shallows. Graduate students from New York University and other schools have written master's and doctoral theses on the estuary.

Hudson River Sloop Clearwater has the largest public education program on the estuary. The Sloop, a replica of early commercial vessels, sails up and down the Hudson several months each year, making scheduled stops at many cities and taking groups of children and adults aboard for half-day educational trips. The on-board program involves short lectures, and sampling or water, benthos, or fish.

About 20 nature clubs offer their members and the general public field trips and lectures relating to the Hudson Estuary. Some of the most active groups are bird clubs, but clubs with other specific interests (e.g., botany) and general purpose nature clubs also use the estuary. Each club has from one to 10 field trips per year on the Hudson.

Several museums and galleries have featured exhibits on Hudson River Estuary biology and history, including the New York State Museum, American Museum of Natural History, Museum of the Hudson Highlands, Hudson River Museum, Wave Hill Environmental Studies Center, and the gallery at Hudson River Sloop Clearwater's Fire House.

The last 13 years have seen an extensive popular educational literature on the Hudson River. A major contribution is Robert Boyle's (1969) The Hudson River; a Natural and Unnatural History. This book and the Hudson River Sloop Clearwater have been predominant influences on the burgeoning public interest in the Hudson during the 1970s-80s.

Table 7. Some Institutions and Agencies that Have Used the Hudson River for Research and Education.

Institution or Agency	Type of Use
American Museum of Natural History New York, NY	Research and Education
New York State Museum Albany, NY	Research
Lamont Doherty Geological Observatory of Columbia University, Palisades, NY	Research
Cary Arboretum of the New York Botanical Garden, Millbrook, NY	Research
Stonykill Environmental Education Center, Fishkill, NY (DEC)	Education
Cornell University Ithaca, NY	Research (planned)
Boyce Thompson Institute for Plant Research, Ithaca, NY	Research
Rockefeller University Center for Field Research, Millbrook, NY	Research
Academy of Natural Sciences, Philadelphia, PA	Research
Museum of the Hudson Highlands Cornwell, NY	Research and Education
Wave Hill Environmental Studies Center, Bronx, NY	Education
New York University, Institute of Environmental Medicine, New York, N.Y.	Research
State University of New York Stony Brook, NY	Research
Marist College Poughkeepsie, NY	Education
State University College New Paltz, NY	Education

Table 7. (Continued)

Institution or Agency	Type of Use
Queens College Flushing, NY	Research and Education
Manhattan College and College of Mount St, Vincent, Riverdale, NY	Research and Education
Bard College, Annandale, NY	Research and Education
United States Military Academy West Point, NY	Education
Vassar College Poughkeepsie, NY	Research and Education
Columbia-Greene Community College Hudson, NY	Education
The New School for Social Research New York, NY	Education
Dutchess Community College Staatsburg, NY	Education
Ulster Community College Stone Ridge, NY	Education
New York State Department of Environmental Conservation Albany, NY	Research and Management
New York State Department of State Coastal Management Program Albany, NY	Research and Management
New York State Office of Parks Recreation, and Historic Preservation Albany, NY	Research and Management
United States Army Corps of Engineers New York, NY	Research and Management
Scenic Hudson, Inc. Poughkeepsie, NY	Research and Education
The Oceanic Society Stanford, CT	Research

Table 7. (Continued)

Institution or Agency	Type of Use
Hudson River Sloop Clearwater Poughkeepsie, NY	Education
National Audubon Society New York, NY	Education
Ralph T. Waterman Bird Club Poughkeepsie, NY	Education
Alan Devoe Bird Club Chatham, NY	Education
Rockland Audubon Society New City, NY	Education
John Burroughs Natural History Society, Olive Bridge, NY	Education
New Jersey Audubon Society Ramapo Research Group Mahwah, NJ	Research
Project L.O.S.T. Mountainville, NY	Research and Education

Table 8. Some current research projects involving the proposed Sanctuary Sites. (Proposed research is outlined in the Alternatives section.)

Flora and fauna survey updates

Fish surveys of the marshes

Rare and endangered plant and animal distribution and abundance

Muskrat populations, muskrat ecology

Waterfowl nesting

Duck blind ecology

Vegetation patterns and changes in wetlands

Vegetation structure and bird populations

Toxic substances in sediments, plants and animals

Wetland sediment structure and history of marshes

Insects associated with marsh plants

PART IV: ENVIRONMENTAL CONSEQUENCES

A. General Impacts

An acquisition grant from NOAA would enable the State of New York to acquire lands and develop facilities (i.e., buildings, roads, parking lots, trails, boardwalk). These lands and facilities, combined with other lands already owned by the State and existing facilities, would constitute a National Estuarine Sanctuary representative of the Hudson River as a subcategory of the Virginian Biogeographic Region. The proposed action would have a variety of environmental and economic consequences. It is important to understand the overall effect of the estuarine sanctuary designation. The sanctuary designation would not change existing ownerships, uses, or activities at the proposed sites, but would offer significant future benefits. These benefits would include additional protection of the marshes, and improved and better coordinated research and education opportunities.

The most important overall effect would be to better protect areas included within the sanctuary from development pressures and to improve access to wildland and estuarine natural areas for research and educational purposes. The sanctuary would require very little development because most facilities already exist in some form; little change would be caused in the existing natural environment. The sanctuary would not significantly affect current uses or activities in or near the proposed sanctuary sites.

The greatest environmental benefit of this sanctuary would be the long-term protection of the natural resources of the tidal wetlands, shallows, shoreline, and islands of Stockport Flats, Tivoli Bays, Iona Island Marsh and Piermont Marsh. The sanctuary would serve as an area for people to use for esthetic and recreational enjoyment as well as for scientific and educational purposes. Information collected in the sanctuary would increase knowledge of East Coast estuarine ecosystems and provide an important link with existing National Estuarine Sanctuaries and other coastal research and educational reserves. The estuarine sanctuary designation would complement and enhance existing ecological, scenic, and historical management programs.

Including a representative of this type of estuary within the Virginian Biogeographic Region would also improve understanding of estuarine species and processes peculiar to tidal river systems along the Atlantic Coast.

The establishment of the proposed estuarine sanctuary would have minimal adverse effects on the natural environment. An increased number of visitors to the sites should be anticipated. The sanctuary management

plan would describe sanctuary facilities, including trails and access points. The management plan would also describe educational uses in areas of the sites where such use would not damage the environment, disturb adjoining landowners, or interfere with other uses of the sanctuary.

Traditional uses vary from one proposed sanctuary site to another. These uses include (in certain areas): waterfowl and upland hunting, sport and commercial fishing, fur trapping, recreational boating, bird watching and other forms of nature recreation.

B. Specific Impacts

1. Natural Environment

a. Fish and Wildlife Habitat

Many species of fish and wildlife, both resident and migratory, use the proposed sanctuary sites for feeding, reproduction, and other purposes. Establishment of this proposed sanctuary would ensure long-term protection of important fish and wildlife habitats including tidal wetlands, shallows, shorelines and islands. This protection of habitats could benefit endangered species including bald eagle, osprey, possibly the shortnose sturgeon, and also the other endangered, threatened, and "special concern" species discussed in the Affected Environment (Part III) section of this DEIS. Additional information on endangered species is being collected to assist in developing the sanctuary management plan.

The proposed sanctuary would have a positive impact by protecting high quality ecosystems in the Hudson River Estuary. Increased visitor use of the sanctuary sites for educational, recreational, and research purposes would have a minimal adverse effect on the proposed sanctuary's value as a fish and wildlife habitat. Hiking, cross-country skiing, boating and other recreational activities would not increase greatly over levels anticipated without the establishment of the proposed sanctuary, and fishing, trapping and hunting are expected to remain at present levels in areas where these activities are currently allowed. Existing management policies at Piermont and Iona protect fish and wildlife in those areas. The management plan under development by DEC for Tivoli Bays takes into account the protection of fish and wildlife habitat. At Stockport, there is no evidence of any threat to habitat from existing recreational uses or from research activities proposed under the proposed sanctuary program.

b. Soils and Vegetation

Adverse impact on soils within the proposed sanctuary would be minimized by taking appropriate precautions. Trail construction and improvement will be largely confined to locations of former or existing trails or roads, and steep slopes and poorly drained soils will be avoided. A boardwalk may be constructed at Tivoli North Bay after studies are made to determine the appropriate design and location to avoid degradation of soils, vegetation, or fish and wildlife habitats. A boardwalk would allow visitors and researchers to experience wetland habitats with minimal detrimental effects. The impacts of any construction activities would be assessed and appropriate permits obtained.

Vegetation would not be significantly altered by establishing the proposed sanctuary. Parking would occur in existing parking areas or in the case of Tivoli Bays, in small areas which are not wooded or near the shoreline. Sanctuary programs, such as research and education, would provide increased opportunities to monitor human activities which could damage the environment--for example, potential theft of fuelwood.

c. Water Quality

Establishing the proposed sanctuary would prevent potential impacts from water pollution that might otherwise occur due to further industrial or residential development within the proposed sanctuary sites. Increased recreational boating due to sanctuary establishment would be mostly non-motorized craft, and the use of motorized craft in the proposed sanctuary areas is expected to remain at low impact levels. Vigilance associated with research and educational activities would speed detection and clean-up of any pollution incidents that might occur.

2. Human Environment

a. Residents of the Towns and Counties

There are no residences in the areas proposed for inclusion in the proposed sanctuary, and no displacement of residents would result. The public has limited access to the shoreline and waters of the Hudson River Estuary, and the establishment of the proposed sanctuary would benefit people by protecting existing access points in the proposed sanctuary areas and providing additional access at Tivoli and possibly Stockport. Assessments of properties adjoining the proposed sanctuary would not change as a result of sanctuary establishment.

The proposed estuarine sanctuary would help preserve the Hudson River's scenic and historic uniqueness and already great attraction to tourists. Visitors from all over the United States and indeed the world visit the Hudson River for enjoyment of esthetic, historic, and recreational resources. This tourism is part of the Hudson's rich tradition and is an environmentally sound source of income to communities along the estuary. Research and education activities associated with an estuarine sanctuary would contribute to local economies: users of the sanctuary would require transportation, housing, food, and supplies from area merchants.

An estuarine sanctuary on the Hudson River would encourage a more thorough examination and understanding of the relationships between human activities and the environment. There would be increasing public knowledge and awareness of natural resources, ecosystems, sensitivities, and conservation needs. The proposed sanctuary would increase the support for and public understanding of coastal management programs and activities.

Residents would benefit from long-term protection of sport and commercial fishing, and (at Tivoli and Stockport) fur trapping and hunting, by protection of the estuary. The impacts of these activities would remain unchanged. The integrity of fish and wildlife habitats and populations would be

protected by preserving the natural areas of the proposed sanctuary sites from adverse development. Protection of water quality and habitat quality and improvements in the quality of fishing and hunting experiences would go hand-in-hand. Furthermore, increased research resulting from sanctuary establishment would very probably result in better management of fish and wildlife populations and their habitats along the entire Hudson River Estuary.

b. Scientific and Educational

Existing research and education programs would be enhanced by establishment of an estuarine sanctuary, and new opportunities would be created for research and education both within the proposed sanctuary and elsewhere along the Hudson River. There would be increased coordination and improved effectiveness of the now disparate and often fragmented programs on the estuary, especially research on the wetlands and shallows. Protection of high-quality natural ecosystems and improved access would allow school groups and the general public of all ages easier access to educational and scientific resources. It would be an advantage to scientists and students of science to have areas set aside as an estuarine sanctuary for long-term ecological research and environmental monitoring.

c. State and Federal

Establishment of a Hudson River Estuarine Sanctuary would protect for New Yorkers and other Americans natural areas to enjoy and use for science and education. The sanctuary designation would especially benefit people from urban areas who have difficulty finding coastal areas for these activities.

Establishment and management of the proposed sanctuary would have a relatively slight and short-term financial impact on the Federal Government. Since long-term operation of the proposed sanctuary would be based on retention of its natural features, expenditures would be minimal. All facilities would be designed for minimal maintenance. Volunteer efforts could assist in the upkeep and management of trails and other features of the sanctuary. The proposed sanctuary Advisory Committee's fund-raising activities could provide an appropriate blend of private sector and public sector support for the perpetuation of suitable sanctuary operation. Sanctuary programs would be closely coordinated with other government programs as well as private programs of research, education, and conservation.

Sanctuary goals would be compatible with the protection of wetlands, floodplains, shorelines and other estuarine environments in accordance with Executive Orders 11988 and 11990, the State Coastal Management plan, and other Federal and State laws listed in Appendix 2.

C. Unavoidable Adverse Environmental or Socioeconomic Effects

Except for the minor problems listed earlier, there are no adverse environmental effects associated with this proposed action. With regard to the alternatives (except for the No Action Alternative), none have

significantly different environmental impacts. However, the Preferred Alternative would create an excellent estuarine sanctuary for research and education. If the No Action alternative were chosen, the net benefits presented in the proposal would be foregone.

Unavoidable adverse economic effects would include the loss of tax revenue if additional land acquisition takes place. The following figures are approximate, but they are the best available estimates on potential loss of property tax revenues in connection with proposed sanctuary acquisitions on the Hudson River:

Stockport Marsh area	-	Approximately $1,141/year
Tivoli Bays area	-	Approximately $ 780/year
Iona Island area	-	No Acquisition proposed
Piermont Marsh area	-	Approximately $1,000/year

The total potential loss of property tax revenues is estimated at $2,921 per year. Some or all of this lost property tax revenue would be offset by new spending from sanctuary visitors, scientists, and educators.

Establishment of this proposed sanctuary could result in minor disturbances to the environment through the construction or improvement of trails and parking areas, and renovation of existing buildings. Any proposed construction in wetland areas would require an environmental assessment.

D. Relationship between Short-term Uses of the Environment and the Maintenance and Enhancement of Long-term Productivity

Sanctuary designation would provide long-term assurance that the natural resources and resulting benefits of the area would be available for future use and enjoyment. Without sanctuary designation, intensive uses such as residential subdivisions or commercial-industrial development might take place in some parts of the proposed sanctuary. However, such uses would result in a loss of ecological benefits due to disruption and degradation of natural resources.

Research information collected from the proposed estuarine sanctuary over the long-term would assist Federal, State and local government in making better coastal management decisions. Better management would in turn help resolve use conflicts and mitigate adverse impacts of human activities in the coastal zone, saving both money and resources. Research in the proposed estuarine sanctuary might well allow more efficient and safer use of resources in the coastal zone, and this research might also result in the discovery of previously unknown resources (medical, nutritional, esthetic, recreational) for human use. A public education program would provide a grassroots foundation for wise public use of estuarine resources.

E. Irreversible or Irretrievable Commitment of Resources

Within the proposed sanctuary, there are no resources that will be irreversibly or irretrievably lost. The intent of the proposed action is to protect, enhance, and manage the natural resources for research, education, and recreation. If these resources are protected and managed instead of altered, they would be available for future use. It is also believed that establishment of the proposed sanctuary could insure the future harvest by commercial and sport fishermen and also hunters and trappers through scientific research and proper management of resources, without resulting in loss of other potential benefits such as nonconsumptive enjoyment of the resource.

F. Possible Conflicts between the Proposed Action and the Objectives of Federal, State, Regional and Local Land Use Plans, Policies and Controls for the Areas Concerned

No conflicts are anticipated between this proposed action and the objectives of Federal, State, regional or local land use plans, policies, and controls for the area concerned.

1. Federal and Regional Plans

The entire Tivoli Bays site is listed on the National Register of Historic Places as part of a historic district that stretches along the the east bank of the Hudson River from Germantown south to Hyde Park. A special procedure is required before structures existing on the property may be altered. However, none of the several buildings on the upland area away from the wetlands has any great historic value and it is planned by DEC to raze these buildings which are in too poor condition to use, except for the concrete barn. The barn may be renovated and used as a research and education center for the proposed estuarine sanctuary. A private cemetery of less than one-fourth acre in size, dating from approximately the 1930s-40s, is located on the uplands more than 300 yards east of the wetlands. This cemetery will be protected and marked as part of the DEC management of the property. A small (less than 50 feet square) ruins on South Cruger Island was built for ornamental reasons in the mid-1800s and will be left as is.

The establishment of the proposed Hudson River Estuarine Sanctuary in and of itself would not interfere with the maintenance or enforcement of the U.S. Coast Guard rules and regulations. The proposed sanctuary would also not interfere with commercial shipping use or U.S. Army Corps of Engineers maintenance of the Federal Shipping Channel. The proposed sanctuary sites would not be available for disposal of dredged material from the navigation channel. Alternative disposal sites are available upland outside of the proposed sanctuary boundaries. The Corps of Engineers in their DEIS and 10-year management plan for Federal channel maintenance dredging has indicated that spoil disposal in marshes is no longer acceptable. There is a small, long disused silted-in mapped spur channel within the proposed sanctuary boundary at Stockport. The proposed sanctuary would not interfere with existing railroad operations and maintenance.

Sanctuary management policies would not interfere with existing regulations of the U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, or any other Federal regulatory agency.

2. State Plans

The purposes and objectives of the proposed estuarine sanctuary are consistent with the programs of the Department of Environmental Conservation (DEC), the Department of State (DOS), the Office of Parks, Recreation and Historic Preservation (OPRHP), and the Palisades Interstate Park Commission (PIPC). All of these agencies, as well as the Office of General Services, are involved in planning the proposed estuarine sanctuary and are represented on the Sanctuary Steering Committee. DEC, DOS, OPRHP and PIPC were all involved in the statewide and the Hudson River site selection processes for the proposed sanctuary.

The proposed sanctuary is consistent with the objectives and plans of the developing State Coastal Management Program.

The Tivoli Bays site lies entirely within the DEC-designated Mid-Hudson Historic Shorelands State Scenic Area, which stretches from Germantown to Hyde Park and is approximately conterminous with the National Register of Historic Places historic district. The proposed sanctuary objectives are consistent with the objectives of the Scenic Area, and both programs would be mutually supportive.

At Stockport and Tivoli, portions of State Agricultural Districts approach or adjoin the proposed sanctuary sites. No portion of any Agricultural District is within the proposed sanctuary boundaries. The management of the proposed sanctuary would not interfere with agricultural land uses.

Proposed and potential estuarine sanctuary research and education programs are complementary to, and would not interfere with, any research or education programs conducted by State agencies, or within the State educational system, or by private groups or schools. Indeed, sanctuary programs and other research and education programs would be mutually enchancing.

3. Local Plans

The proposed Hudson River Estuarine Sanctuary would not interfere with any known county, town, or village plans, policies, or regulations (see Appendix 2). The proposed sanctuary management plan would take into account all county, town, and village laws and regulations governing portions of the proposed sanctuary that lie within these political divisions. Protection of scenic, recreational, historic, and archaeological resources within the proposed sanctuary is consistent with local plans and policies as well as with State policies. Existing uses of the proposed sanctuary would continue, including hunting, fishing, trapping, recreational boating, bird watching and other recreational uses where permitted.

It is not anticipated that the establishment of the proposed sanctuary would interfere with existing or potential industrial or commercial land uses near or adjoining the proposed sites. Such uses include: the Tennessee Gas Pipeline Company corridor at Piermont, the Clevepak Corporation and Federal Paper Board Company plants on the Erie Pier at Piermont, the thoroughbred horse breeding farm of Tivoli Properties, Inc., other agricultural activities at Tivoli and Stockport, the Central Hudson Gas & Electric Corporation corridor at Tivoli, and the railroads. If problems should arise, negotiated agreements would be sought.

PART V: LIST OF PREPARERS

Dr. Richard J. Podgorny -- U.S. Department of Commerce

Dr. Podgorny holds both B.A and Ph.D. degrees in Biology and a M.S. degree in the earth sciences. He is the Project Manager for the Hudson River Estuarine Sanctuary proposal. Also, he is the Regional Sanctuary Projects Manager for the Great Lakes, portions of the East Coast, and the Gulf of Mexico for both of NOAA's National Estuarine and Marine Sanctuary Programs. His background includes serving as Director of Marine Education for the District of Columbia Public School System, Science Professor, and Peace Corps Volunteer in Ethiopia.

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PART VI: LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS RECEIVING COPIES

Federal Agencies

Advisory Council on Historic Preservation
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Army Corps of Engineers
National Park Service
Department of Agriculture
Department of Commerce
Department of Energy
Department of Health and Human Services
Department of Housing & Urban Developement
Department of the Interior
Department of Justice
Department of Labor
Department of Transportation
  U.S. Coast Guard
Federal Energy Regulatory Commission
Nuclear Regulatory Commission

National Interest Groups

A.M.E.R.I.C.A.N.
AFL-CIO
American Association of Port Authorities
American Bureau of Shipping
American Farm Bureau Federation
American Fisheries Society
American Gas Association
American Industrial Development Council
American Institute of Architects
American Petroleum Institue
American Shore and Beach Preservation Association
American Society of Civil Engineers
American Society of Landscape Architects, Inc.
American Society of Planning Officials
American Waterways Operators
Amoco Production Company
Atlantic Richfield Company
Atomic Industrial Forum
Boating Industry Association
Bultema Dock and Dredge Company
Center for Law and Social Policy
Center for Natural Areas
Center for Urban Affairs
Center for Urban and Regional Resources
Chamber for Commerce of the United States
Chevron U.S.A., Inc.
Cities Service Company
Coast Alliance
Conservation Foundation

National Interest Groups (Cont'd.)

Continental Oil Company
Council of State Planning Agencies
The Cousteau Society
CZM Newsletter
Edison Electric Institute
El Paso Natural Gas Co.
Environmental Policy Center
Environmental Defense Fund, Inc.
Environmental Law Institute
EXXON Company, U.S.A.
Friends of the Earth
Great Lakes Basin Commission
Gulf Energy and Minerals, U.S.
Gulf Oil Company
Gulf Refining Company
Industrial Union of Marine and Shipbuilding
  Workers of America
Institute for the Human Environment
Interstate Natural Gas Association of America
Lake Michigan Federation
Marathon Oil Company
Marine Technology Society
Mobil Oil Corportation
Mobil Exploration and Producing, Inc.
Murphy Oil Company
National Association of Conservation Districts
National Association of Counties
National Association of Home Builders
National Association of Realtors
National Audubon Society
National Coalition for Marine Conservation, Inc.
National Farmers Union
National Federation of Fisherman
National Fisheries Institute
National Forest Products Association
National Marine Manufacturers Association
National Ocean Industries Association
National Parks and Conservation Association
National Recreation and Park Association
National Research Council
National Society of Professional Engineers
National Waterways Conference
National Wildlife Federation
Natural Resources Defense Council
Natural Resources Law Institute
The Nature Conservancy
Norfolk Dredging Company
Outboard Marine Corporation
Resources for the Future
Rose, Schmidt & Dixon
Shell Oil Company
Sierra Club

National Interest Groups (Cont'd.)

Skelly Oil Company
Soil Conservation Society of America
Sport Fishing Institute
Standard Oil Company of Ohio
State University Law School
State University of New York
Sun Company, Inc.
Tenneco Oil Company
Texaco, Inc.
Texas A & M University
Union Oil Company of California
University of Pittsburgh
Urban Research and Development Association, Inc.
Western Oil and Gas Association
Wildlife Management Institute
The Wildlife Society
Woods Hole Oceanographic Institute

State/County Government

New York City Department of City Planning
New York State Department of Environmental Conservation
New York State Office of General Services
New York State Department of State
New York State Office of Parks, Recreation and Historic Preservation
Bear Mountain State Park
New York State Geological Survey
New York Department of Public Service
New York State Coastal Coalition
Saratoga Spa State Park
Palisades Interstate Park Commission
New York State Department of Transportation
New York State Governor's Offfice
Department of State Education
State Museum and Science Service
New York State Conservation Council
Taconic State Park and Recreation Commission
New York Fish and Wildlife Management Board
Tallman Mountain State Park
Dutchess Co. Department of Planning
Town of Red Hook Conservation Council
Town Planning Board of Red Hook
Rockland Legislature
Rockland County Environmental Management Council
Stony Point Town Planning Board
Orangetown Planning Board
Sparkill Creek Watershed Protection

State and Local Interest Groups

Red Hook Rotary Club
West Branch Conservation Association

State and Local Interest Groups (Cont'd.)

Piermont Conservation Advisory Commission
West Hudson Environmental Association
Rockland County Planning Department
Rockland County Cooperative Extension
Piermont Civic Association
Hudson River Conservation Society
Hudson River Heritage, Inc.
Manitago Hudson River Center
American Littorial Society
Rockland Audubon Society
Central Westchester Audubon Society
New Jersey Audubon Society
Ralph T. Waterman Bird Club
Federation of New York State Bird Clubs
The Nature Conservancy
Hudson River Environmental Society
Hudson River Shorelands Task Force
National Audubon Society
Putnam Highlands Audubon Society
Alan Devoe Bird Club
Linnaean Society of New York
Sierra Club
Torrey Botanical Club
Federated Garden Clubs of New York
Marshland Conservancy
Federated Conservationists of Winchester Co.
Commerical Fisherman's Association of New York
New York Bass Chapter Federation
John Burroughs Natural History Society
Dutchess County Garden Clubs
Palisades Nature Association Greenbrook Sanctuary
The Wildlife Society
Hudson River Fisherman's Association
Trout Unlimited
Columbia County Sportsmen's Federation, Inc.
Federated Sportmen's Club of Ulster County Inc.
Federation of Dutchess County Fish and Game Club
Hudson River Waterfowlers
Upper Catskill Fur Takers
New York-New Jersey Trail Conference
Dutchess County Landmarks Association
Ducks Unlimited
Dutches County Trapper's Association
Dutchess County Archeological Society
Project L.O.S.T.
The Georgia Conservancy
Tappan Zee Sloop Club
Buccaneer Boat Club, Inc.
Julius Petersen, Inc.

State and Local Interest Groups (Cont'd.)

Chelsa Marina
Norrie Point Marine Corporation
Hudson River Pilots Association
Tappan Zee Marina
Lighthouse Yacht Center
Sailhaven
Poughkeepsie Yacht Club
Beacon Sloop Club

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In addition, 350 copies of the DEIS were distributed to identified State and local interest groups and individuals, including property owners, libraries, newspapers, researchers and educators, conservation and sportsmen's groups, industries and user groups.

PART VII: APPENDICES

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APPENDIX I

Bibliography and Literature Cited

Appendix 1. Bibliography and literature cited. The annotations S (Stockport), T (Tivoli), I (Iona), and P (Piermont) indicate references specifically treating the indicated sites.

Aldrich, J. W. 1979. A brief account of Cruger's Island, Magdalen Island, the North Bay, and adjoining uplands. Year Book Dutchess County Historical Society 64:72-86. T

Anonymous. nd. Bear Mountain Trailside Museums, Nature Trails & Zoo. Trailside Museums, Bear Mountain NY. 10 p. brochure. I

_____. 1968. The Bear Mountain Trailside Museums and Nature Trails. Palisades Interstate Park Commission. Trailside Museums, Bear Mountain NY. 10 p. brochure. I

_____. 1975. Hudson River Recreationway: Master Development Plan for Gays Point, Stockport Middle Ground Islands and Middle Ground Flats. New York State Office of Parks and Recreation. 7 p. unpubl. rept. S

_____. 1977? Bear Mountain Trailside Museums, Nature Trails & Zoo. Palisades Interstate Park Commission. Bear Mountain State Park, NY. 12 p. brochure. I

_____. 1979. 2 river island parksites planned. Hudson Register-Star, 19 July: A1, back page. S

_____. 1980a. The Tivoli Bays. Hudson River Heritage News 5(2):4-5. T

_____. 1980b. Bear Mountain State Park. Iona Island - Program of utilization. New York State Office of Parks and Recreation. 26 p. unpubl. rept. I

_____. 1981. Tidal marsh saved. Land Lines (Lower Hudson Chap. Nature Conservancy), spring:1.P

Arbib, R. S., Jr., O.S. Pettingill, Jr. and S. H. Spofford. 1966. Enjoying birds around New York City. Houghton Mifflin Co., Boston. 171 p. T, I, P

Averill, S. P., R. R. Pardi, W. S. Newman and R. J. Dineen. nda. Late Wisconsin - Holocene history of the lower Hudson region: new evidence from the Hackensack and Hudson River valleys. Pp. 160-186 in Warren Manspeizer, ed. Field Studies of New Jersey Geology and Guide to Field Trips: 52nd Annual Meeting of the New York State Geological Association. I, P

Barlow, M. 1981. Company giving pier to Piermont. Bird's-eye view of Piermont Marsh. West Nyack Journal-News, 4 Jan.:A1, back p. P

Beauchamp, W. M. 1900. Aboriginal occupation of New York. New York State Museum Bulletin 32, 187 p. S, T, I

Boyle, R. H. 1969. The Hudson River; a natural and unnatural history. W. W. Norton, NY. 304 p. S, T, P

Brown, D. 1981. Tivoli Bay to be kept for nature. Albany Times-Union, 2 Aug. T

Buckley, E. H. and S. S. Ristich. 1976. Distribution of rooted vegetation in the brackish marshes and shallows of the Hudson River Estuary. Paper 20, 30 p. in Fourth Symposium on Hudson River Ecology. Hudson River Environmental Society, Bronx NY.

Burmeister, W. F. 1974. Appalachian waters 2: the Hudson River and its tributaries. Appalachian Books, Oakton VA. 488 p. S, T, I, P

Butler, J.R., E. S. Custer, Jr., and W. A. White. 1975. Potential geological Natural Landmarks Piedmont Region, eastern United States. Dept. Geology, University of North Carolina, Chapel Hill, NC. 240 p. P

Carr, W. H. 1940. Birds of Bear Mountain Park; A check-list. Bear Mountain Trailside Museum, 31 p.

Cinquemani, L. J., W. S. Newman, J. A. Sperling, L. F. Marcus and R. R. Pardi. In press. Holocene sea level changes and vertical movements along the East Coast of the United States: a preliminary report. (Dept. Earth and Environmental Sciences, Queens College, Flushing, NY.) I

Clarke & Rapuano, Inc. 1976. Iona Island Bear Mountain State Park entrance road environmental assessment design feasibility. Palisades Interstate Park Commission. 90 p. + maps. I

Coastal Zone Management Study Program. 1977a. Final report on Geographic Areas of Particular Concern (GAPC) recommendations. (Task 7.3). New York Department of Environmental Conservation, Division of Land Resources and Forest Management, Coastal Zone Management Study Program, Albany, NY. S, T, I, P

_____. 1977b. Final report on significant coastal related fish and wildlife habitats of New York State (Task 7.3). New York State Department of Environmental Conservation, Division of Land Resources and Forest Management, Coastal Zone Managment Study Program, Albany, NY. S, T, I, P

Connor, J. 1978. Osprey trapped by water chestnut. Auk 95:610-611. T

Craig, R. J., M. W. Klemens, and S. S. Craig. 1980. The northeastern range limit of the eastern mud turtle Kinosternon s. subrubrum (Lacepede). Journal of Herpetology 14(3):295-297.

Dalmas, J. 1980. Eye on Iona. Of an isolated island in the Hudson. West Nyack Journal-News, 12 Oct.:3M-4M. I

Deed, R. F. 1959. Birds of Rockland County and the Hudson Highlands. 44 p. Rockland Audubon Society, West Nyack, NY. I, P

_____. 1968. Supplement to Birds of Rockland County and the Hudson Highlands. 27 p. Rockland Audubon Society, West Nyack, NY. I, P

_____. 1976. Rockland County's on-again, off-again resting places for shorebirds. Linnaean News-Letter 29(7): 1-3. I, P

_____. 1981a. The endless change in a local checklist. Linnaean News-Letter 34(7-8):1-2. I, P

_____. 1981b. The Piermont Pier and marsh. The Observer 34(2):1-2. P

Drennan, S. R. 1981. Where to find birds in New York State; the top 500 sites. Syracuse University Press, 499 p. S, T, I, P

Duch, T. M. 1976. Aspects of the feeding habits of Viviparus georgianus. Nautilus 90(1):7-10. T

Dutchess County Environmental Management Council Significant Areas Committee. In press. Significant areas. In Natural Resources of Dutchess County, New York. Dutchess County Department of Planning, Poughkeepsie, NY. T

Faulds, C. A., ed. 1969. The Piermont study. Rockland Community College (Suffern, NY) and the Hudson River Valley Commission. np. P

Ferren, W. R., Jr., and A. E. Schuyler. 1980. Intertidal vascular plants of river systems near Philadelphia. Proceedings of the Academy of Natural Sciences of Philadelphia 132:86-120.

Fitzpatrick, J. F., Jr. and J. F. Pickett, Sr. 1980. A new crawfish of the genus Orconectes from eastern New York (Decapoda: Cambaridae). Proceedings of the Biological Society of Washington 93:373-382. S

Foley, D. D. and R. W. Taber. 1951. Lower Hudson waterfowl investigation. Pittman-Robertson Project 47-R. New York State Conservation Department, Albany, NY. 796 p. S, T, I, P

Funk, 1967. The Hudson; archeological sites. A report on archeological resources in the Hudson River Valley. State of New York Hudson River Valley Commission, Iona Island, Bear Mountain, NY. 19 p. S, T, I

_____. 1976. Recent contributions to Hudson Valley prehistory. New York State Museum Memoir 2, 325 p. S, T, I

Garlinghouse, H. M. 1976. William Seward Teator (1860-1930). Nautilus 90(4):148-149. T

Gleason, H. A. and A. Cronquist. 1963. Manual of vascular plants of northeastern United States and adjacent Canada. Van Nostrand, Princeton, NJ. 861 p.

Goldhammer, A. 1981. Canoeing the Hudson's marshes. Clearwater Navigator 12(6):4-6.

Goldring, W. 1943. Geology of the Coxsackie quadrangle, New York; with a chapter on glacial geology by J. H. Cook. New York State Museum Bulletin 322, 374 p. + maps. S

Griscom, L. 1933. The birds of Dutchess County, New York. Transactions of the Linnaean Society of New York 3, 184 p. T

Hall, A. J. 1978. The Hudson: "That river's alive". National Geographic 153(1):62-89. T, P

Hickey, J. J. 1969. Peregrine falcon populations; their biology and decline. University of Wisconsin Press, Madison. 596 p. I, P

Hudson River Research Council. 1980. Results of Hudson River Field Weeks April 1977 and August 1978. Water temperature, conductivity, dissolved oxygen, and total suspended solids at spring high flow and summer low flow. HRRC, Bronx, NY. 50 p. S, T, P

Jorgenson, S. E. 1980. Some international values of wetlands. Parks 5(3):5-8

Key, M. C. 1981. Fulvous whistling duck. Wings over Dutchess 22(5):8. T

Kiviat, E. 1973. Down along the cove. Bard Review, spring:21-23. T

____. 1974. A fresh-water tidal marsh on the Hudson, Tivoli North Bay. Paper 14, 33 p. in Third Symposium on Hudson River Ecology. Hudson River Environmental Society, Bronx, NY. T

____. 1976a. Goldenclub, a threatened plant in the tidal Hudson River. Paper 21, 13 p. in Fourth Symposium on Hudson River Ecology. Hudson River Environmental Society, Bronx, NY. S, T

____. 1976b. (Notes on Hudson River Tidal Marsh Workshop, 2 June 1976 at Bard College, sponsored by Hudson River Environmental Society). Currents (HRES) 6(2): 1, (3): 3-4.

____. 1977. Reptiles and amphibians of the Hudson Estuary. North River Navigator (Hudson River Sloop Clearwater) 8(9):4-5.

____. 1978. Hudson River east bank natural areas, Clermont to Norrie. Nature Conservancy, Arlington, VA 115 p. T

____. 1979a. Hudson Estuary shore zone: ecology and management. Master's thesis (unpubl.), State University College at New Paltz, NY. 159 p. T, I, P

____. 1979b. Cattail marshes, birds, good water, and people. Dutchess Life 8:13. T

____. 1980a. A Hudson River tidemarsh snapping turtle population. Transactions of the Northeast section, Wildlife Society 37:158-158. T

____. 1980b. Low tides and turtle trails. Hudson Valley 9(5):27-29.T

____. 1981a. Hudson River Estuary shore zone annotated natural history bibliography with index. Scenic Hudson, Poughkeepsie, NY. 76 p. S, T, I, P

____. 1981b. Profile of the Hudson. Hudson Valley 9(9):24-28. T, I, P

____. 1981c. Profile of the Hudson: the air. Hudson Valley 9(12):39-41. T

____. 1981d. A Hudson River fresh - tidal marsh: management planning. Restoration and Management Notes 1(1): 14-15. T

____. 1982. Eastern bluebird remote natural nest sites. Kingbird 32(1): 6-8.1

____. and F. Dunwell. 1981. The marshes stand watch. Hudson Valley 10(5): 33-37. S, T, I, P

Lehr, J. H. 1967a. The plants of Iona Island; a field report. Sarracenia (New York Botanical Garden) 11:35-38. I

____. 1967b. The marshes at Piermont, New York; a field report. Sarracenia (New York Botanical Garden) 11:31-34. P

Mckeon, W. Ca. 1974. An appraisal of the current status of marshes or wetland areas along the Hudson River. Hudson River Environmental Society, Bronx, NY. 7 p. unpubl. ms. T, I, P

McVaugh, R. 1958. Flora of the Columbia County area, New York. New York State Museum and Science Service Bulletins 360-360A. 433 p. S, T

Merrill, T. B. 1981. Piermont double donation "worth a celebration". Clearwater Navigator (Hudson River Sloop Clearwater), April:3. P

Meyer, G. 1980. The ecological perspective. Piermont Newsletter 14(1):7. P

Mitchell, R. S., C. J. Sheviak and J. K. Dean. 1980. Rare and endangered vascular plant species in New York State. New York State Museum, Albany. 38 p. T, I

Muenscher, W. C. 1935. Aquatic vegetation of the Mohawk watershed. Supplement, 24th Annual Report of the New York State Conservation Department, Biological Survey 9 (Mohawk-Hudson Watershed):228-249. S

____. 1937. Aquatic vegetation of the lower Hudson area. Supplement, 26th Annual Report of the New York State Conservation Department, Biological Survey 11 (Lower Hudson Watershed):231-248. S, T, I, P

Muenscher, W. C. 1944. Aquatic plants of the United States. Cornell University Press, Ithaca, NY. 374 p. T

Mylod, J. 1969. Biography of a river; the people and legends of the Hudson Valley. Bonanza Books, New York. 244 p. I

Newman, W. S. 1973. Iona Island - the last fifteen millenia. Communicator (Journal of the New York State Outdoor Education Association) 5(1):28-30. I

____, D. H. Thurber, H. S. Zeiss, A. Rokach and L. Musich. 1969. Late Quaternary geology of the Hudson River estuary: a preliminary report. Transactions of the New York Academy of Science, Series 2, 31(5):548-570. I

New York State Department of Environmental Conservation and United States Fish and Wildlife Service. 1978. Hudson River fish and wildlife report; Hudson River Level B Study. NYS DEC, Albany NY.

Nicholas, G. L. 1900. The swallow-tailed kite at Piermont, New York. Auk 17:386. P

Nordstrom, C. 1973. Frontier elements in a Hudson River village. Kennikat Press, Port Washington, NY. P

Oceanic Society. 1980. Hudson River Fishery Management Program Study. A Report to the New York State Department of Environmental Conservation.

(Orth, J. C.) (Ca. 1965.) Vertebrates of Iona Island and vicinity. Bear Mountain State Park Trailside Museums. 17 p. I

Pink, E. and O. Waterman. 1967. Birds of Dutchess County 1933-1964. Ralph T. Waterman Bird Club, Dutchess County, NY. 124 p. T

____ and ____. 1980. Birds of Dutchess County 1964-1979. Ralph T. Waterman Bird Club, Dutchess County, NY. 93 p. T

Raymond, Parish, Pine and Weiner, Inc., and A. Gussow. 1979. Hudson River Valley Study. New York State Department of Environmental Conservation, New Paltz, NY. 180 p. T, I, P

Ritchie, W. A. 1958. An introduction to Hudson Valley prehistory. New York State Museum Science Service Bulletin 367, 112 p. T

Rockland County Planning Board. 1974. Piermont community development goals and Erie Pier assessment. Piermont Planning Commission, Village Hall, Piermont NY. 22 p. P

Romero, A. B., et al. 1977. Where to bird in Dutchess County. Ralph T. Waterman Bird Club, Moores Mills, Pleasant Valley, NY. T

Rosenthal, M. 1977. Monitoring prevents creek deterioration. New York State Association of Conservation Councils 3(4):4-5. T

____. 1977-present. The Sawkill Newsletter. Bard College, Annandale-on-Hudson, NY. Monthly.

Rubinstein, L. C. 1969. Historic resources of the Hudson: a preliminary inventory January 1969. Hudson River Valley Commission. 96 p. I

Saratoga Capital District State Park and Recreation Commission. nd. Hudson River Islands State Park. Master Plan. Gays Point. Stockport Middle Ground. Middle Ground Flats. Unpubl. rept.

Schuyler, A. E. 1975. Scirpus cylindricus: an ecologically restricted eastern North American tuberous bulrush. Bartonia (43):29-37. I, P

Sheppard, J. D. 1976. Valuation of the Hudson River Fishery Resources: Past, Present and Future. New York State Department of Environmental Conservation 51 p.

Smith, D. G. 1981. A note on the morphological variability of Orconectes kinderhookensis (Decapoda: Cambaridae) from the Hudson River system in New York. Journal of Crustacean Biology 1(3):389-391.S

Smith, S. J., J. A. Wilcox, and E. M. Reilly, Jr. (1967?). The Hudson; biological resources. A report on areas of biological significance in the Hudson River Valley. State of New York Hudson River Valley Commission, Iona Island, Bear Mountain, NY. 43 p. S, T, I, P

Stapleton, J. and E. Kiviat. 1979. Rights of birds and rights of way; vegetation management on a railroad causeway and its effects on breeding birds. American Birds 33(1):7-10. T

Stone, W. B., E. Kiviat and S. Butkas. 1980. Toxicants in snapping turtles. New York Fish and Game Journal 27(1):39-50. T, I, P

Svenson, H. K. 1935. Plants from the estuary of the Hudson River. Torreya 35(5):117-125. T

Tate, J., Jr. 1981. The Blue List for 1981. American Birds 35(1): 3-10 in the Hudson Basin region. 16-18 June 1976 at Bard College. Report of the Bard conference: Proceedings of a Conference on the enhancement of environmental research in the Hudson Basin region. State of New York Department of Environmental Conservation, Albany NY. 63 p.

Tauber, G., ed. 1976? Conference on the enhancement of environmental research

Teator, W. S. 1890. Collecting land shells in eastern New York. Nautilus 3(10):109-110; (11):129-132. T

Torrey, R. H. 1931. Trip of August 2. Torreya 31:153-154. I (plants)
___. 1932. Lichen observations on winter walks of the Club. Torreya 32:45-47. I

Webster, W., ed. 1971. New York walk book. 4th ed. With an introduction to the geology of the region by C. J. Schuberth. New York - New Jersey Trail Conference and American Geographical Society. Doubleday/Natural History Press, Garden City, NY. 326 p. + 23 maps. I, P

Weinstein, L. H., ed. 1977. An atlas of the biologic resources of the Hudson Estuary. Boyce Thompson Institute for Plant Research, Yonkers (now Ithaca), NY. 105 p. I, P

Wilkie, R. W. The illustrated Hudson River Pilot; being a smallcraft sailor's pictorial guide to the tidewater Hudson Albany to New York. Three City Press, Albany, NY. 183 p. S, T, I, P

Williams, S. C., H. J. Simpson, C. R. Olsen and R. F. Bopp. 1978. Sources of heavy metals in sediments of the Hudson River. Marine Chemistry 6(1978): 195-213. P

Worley, I. A. 1974. Natural landmark belief. Iona Island Marsh, Rockland County, New York. unpubl. rept.

APPENDIX 2

Existing Jurisdiction Involving the Proposed Hudson River Estuarine Sanctuary

Appendix 2. Existing Jurisdiction Involving the Proposed Hudson River Estuarine Sanctuary

AGENCY	JURISDICTION	LEGISLATION (if any)
Federal:		
Army Corps of Engineers	dredging, filling, dumping, hazards to navigation, wetlands in river and larger tributaries	Sec. 404 of Clean Water Act, Rivers & Harbors Act, as amended
Dept. of Commerce: Office of Coastal Zone Management	oversight of National Estuarine Sanctuary Program	Coastal Zone Management Act, as amended
Sea Grant Program	research, education, and conservation in the coastal zone	Public Law 94461
Dept. of the Interior: Fish & Wildlife Service	migratory birds, endangered species, marine mammals, interstate commerce of organisms	Migratory Bird Treaty Act, Endangered Species Conservation Act, Lacey Act, Marine Mammal Protection Act, all as amended
National Park Service	Natl. Register of Historic Places, Natl. Natural Landmarks, Natl. Trust for Historic Preservation	Historic Preservation Act, as amended
Dept. of Transportation: Coast Guard	maintenance of navigable waters, shipping, small craft, aids to navigation, search and rescue	14 USC 89
Environmental Protection Agency	air and water quality guidelines, solid waste and toxic materials guidelines, spills noise pollution, PCB reclamation demonstration, environmental review of projects	Clean Air Act, Clean Water Act, TOSCA, RCRA, FIFRA, Superfund, NEPA, all as amended

AGENCY	JURISDICTION	LEGISLATION
Federal (cont.):		
Nuclear Regulatory Commission	oversight over operation Indian Point power plants	Energy Reorganization Act
ConRail Corporation	right-of-way improvement and maintenance	
State:		
Department of Environmental Conservation	lead agency in Hudson River Estuarine Sanctuary Program, landowner at Tivoli Bays & Piermont, fish & game, protected animals, collecting and marking licenses, freshwater and tidal wetlands, water and air quality solid water & toxic substances pesticides, mining, scenic areas, project review. The Heritage Task Force for the Hudson River Valley, Inc.	Environmental Conservation Law and regulations promulgated thereunder (as amended) including the Fish & Wildlife Law, Water Resources Law, Freshwater Wetlands Act, Tidal Wetlands Act, Resource Conservation and Recovery Act, and Wild, Scenic, and Recreational River System, State Environmental Quality Act
Department of Commerce	tourism developement	Tourist Promotion Act
Department of Health	food quality (e.g., fish)	Public Health Law
Department of State	cooperating agency in Hudson River Estuarine Sanctuary Program, coastal management	Waterfront Revitilization & Coastal Resources Act
Department of Transportation	navigation channel, spoil disposal, roads, bridges	Transportation Law

AGENCY	JURISDICTION	LEGISLATION
County (cont.):		
Planning Departments	review of federal spending (A-95), planning recommendations and coordination of planning activities	(as above)
Town:		
Planning, Zoning, and Conservation Boards & Commissions	planning, zoning, advice to town boards on environmental issues, natural resource inventories, conformance to existing laws	(as above) also town ordinances including zoning ordinances*
Highway Departments	maintenance of town roads and town landfills	
Village:		
Piermont	owner of pier, portion of marsh within its jurisdiction	See under Town
Tivoli	small portion of Tivoli Bay within its jurisdicition	See under Town

*Zoning classifications for the four Proposed Estuarine Sanctuary areas:

Piermont - Village of Piermont - - - Use by special permit from Village
Town of Orangetown - - - Residential, 2 acre minimum

Iona - wholly within the Palisades Interstate Park

Tivoli - Town of Red Hook - - - Agricultural (uplands), Land Conservation (wetlands and Cruger Island)
Village of Tivoli

Stockport - no zoning ordinances

APPENDIX 3

List of Fishes Reported From the Proposed Estuarine Sanctuary on the Hudson River, New York

Appendix 3. List of fishes reported from the proposed Estuarine Sanctuary sites on the Hudson River, New York. Letters in the Ecological Classification column refer to the relationship of the fish to the estuary following McHugh (10): A=Freshwater fishes that enter brackish water, B=Truly estuarine species, C=Anadromous/ catadromous species, D=Seasonal adult marine species, E=Estuarine nursery species, and F=Adventitious marine species. Numbers listed under the proposed sanctuary areas indicate presence of the species in that area and the source of the data; only one source is listed although several sources may have reported that species.

Common name	Scientific name	Ecological Classification (EC)	Sites S	T	I	P
PETROMYZONTIDAE						
American brook Lamprey	Lampetra appendix	A		1		
Sea Lamprey	Petromyzon marinus	C		1		
ANGUILLIDAE						
American eel	Anguilla rostrata	C	8	1	2	5
CLUPEIDAE						
Blueback herring	Alosa aestivalis	C		1	2	4
Alewife	A. pseudoharengus	C	9	1		
American shad	A. sapidissima	C	9	2		7
Menhaden	Brevoortia tyrannus	E				7
ENGRAULIDAE						
Bay anchovy	Anchoa mitchilli	B				7
SALMONIDAE						
Rainbow trout	Salmo gairdneri	A		1		
Brown trout	S. trutta	A	9	1		
Brook trout	Salvelinus fontinalis	A		1		
OSMERIDAE						
Rainbow smelt	Osmerus mordax	C	9	1		
UMBRIDAE						
Central mudminnow	Umbra limi	A		1		
Eastern mudminnow	U. pygmaea	A				5
ESOCIDAE						
Redfin pickerel	Esox americanus	A	3	1	2	6
Northern pike	E. lucius	A	9			
Chain pickerel	E. niger	A		1		

Common name	Scientific name	EC	S	T	I	P
CYPRINIDAE						
Goldfish	Carassius auratus	A	4	1	2	
Carp	Cyprinus carpio	A	8	1	2	
Cutlips minnow	Exoglossum maxillingua	A		1		
Eastern silvery minnow	Hybognathus regius	A	3	1		
Golden shiner	Notemigonus crysoleucas	A	3	1	2	7
Satinfin shiner	Notropis analostanus	A		1		
Bridle shiner	N. bifrenatus	A	3	1		
Common shiner	N. cornutus	A	3	1		
Spottail shiner	N. hudsonius	A		1	8	7
Spotfin shiner	N. spilopterus	A	3			
Blacknose dace	Rhinichthys atratulus	A		1		5
Creek chub	Semotilus atromaculatus	A		1		
Fallfish	S. corporalis	A	3	1		
CATOSTOMIDAE						
White sucker	Catostomus commersoni	A	4	1	2	5
Creek chubsucker	Erimyzon oblongus	A				6
Northern hogsucker	Hypentelium nigricans	A	3	1		
ICTALURIDAE						
White catfish	Ictalurus catus	A	4	1		
Yellow bullhead	I. natalis	A				2
Brown bullhead	I. nebulosus	A	4	1	2	
GADIDAE						
Atlantic tomcod	Microgadus tomcod	B			2	7
FUNDULIDAE						
Banded killifish	Fundulus diaphanus	A	8	8	1	7
Mummichog	F. hetercolitus	B	8	1	8	8
ATHERINIDEA						
Tidewater silversides	Menidia beryllina	E				7
Waxen siversides	M. menidia	E				7
GASTEROSTEIDAE						
Fourspine stickleback	Apeltes quadracus	B		1		7
Threespine stickleback	Gasterosteus aculeatus	B			2	
SYNGNATHIDEA						
Northern pipefish	Syngnathus fuscus	D				7

Common name	Scientific name	EC	S	T	I	P
PERCICHTHYIDAE						
White perch	Morone americana	B	9	1	8	8
Striped bass	M. saxatilis	C	4	1	8	7
CENTRARCHIDAE						
Rock bass	Ambloplites rupestris	A		1		
Bluespotted sunfish	Enneacanthus gloriosus	A			2	
Redbreast sunfish	Lepomis auritus	A	3	1	8	
Pumpkinseed	L. gibbosus	A	3	1	2	6
Warmouth	L. gulosus	A		1		
Bluegill	L. macrochirus	A	9	1		7
Smallmouth bass	Micropterus dolomieui	A	9	1		
Largemouth bass	M. salmoides	A	4	1	2	7
Black crappie	Pomoxis nigromaculatus	A		1		
PERCIDAE						
Tessellated darter	Etheostoma olmstedi	A	3	1	2	5
Yellow perch	Perca flavescens	A	3	1		
POMATOMIDAE						
Bluefish	Pomotomus saltatrix	E				7
SCIAENIDAE						
Weakfish	Cynoscion regalis	E				7

SOURCES

1. Kiviat, E. In press. Natural history of the fish fauna of Tivoli Bays. Hudson River Fisheries Symposium, Hudson River Environmental Society. (Includes a few species found in nontidal waters close to the proposed site).

2. Orth, J. D. ca. 1965. Vertebrates of Iona Island and vicinity. Bear Mountain State Park Trailside Museums. 17 p.

3. Greeley, J. R. 1937. Fishes of the area with annotated list, pp. 45-85. In. Anonymous. A biological survey of the lower Hudson watershed. Supplement to 26th Annual Report, New York Conservation Department, Part II.

4. New York State Department of Environmental Conservation, 1971 Stream Survey.

5. New York State Department of Environmental Conservation, Sparkill Creek Stream Surveys.

6. Bailey, R. M. 1936. Stream survey records. New York State Department of Environmental Conservation.

7. Smith, C. L. Stream survey records, American Museum of Natural History.

8. Hudsonia Limited. Miscellaneous collections, 1981

9. Observations by Everett Nack (Claverack, New York), Salvatore Cozzolino (Department of Environmental Conservation), or Louis Gerrain (DEC).

10. McHugh, J. L. 1967. Estuarine Nekton, pp 581-620. In. G. H. Lauff (Ed.) Estuaries. AAAS Publ. No. 83, Washington, D.C.

APPENDIX 4

Birds Reported In or Close to Proposed Sanctuary Sites

Appendix 4. Birds reported in or close to proposed sanctuary sites. Sources of data are listed at end of this appendix.

Common name	Scientific name	Sites			
		S	T	I	P
Common loon	Gavia immer	S	T	I	P
Red-throated loon	G. stellata	s	T	I	P
Red-necked grebe	Podiceps grisegena	S	T	I	
Horned grebe	P. auritus	S	T	I	P
Pied-billed grebe	Podilymbus podiceps	s	T	I	P
Gannet	Morus bassanus		T		
Great cormorant	Phalacrocorax carbo				P
Double-crested cormorant	P. auritus	s	T	I	P
Great blue heron	Ardea herodias	S	T	I	P
Green heron	Butorides striatus	s	T	I	P
Little blue heron	Florida caerulea		T	I	P
Cattle egret	Bubulcus ibis				
Great egret	Casmerodius albus	s	T	I	P
Snowy egret	Egretta thula		T	I	P
Louisiana heron	Hydranassa tricolor				P
Black-crowned night heron	Nycticorax nycticorax	s	T	I	P
Yellow-crowned night heron	Nyctanassa violacea				P
Least bittern	Ixobrychus exilis		T	I	P
American bittern	Botaurus lentiginosus	S	T	I	P
Glossy ibis	Plegadis falcinellus		T		P
Mute swan	Cygnus olor	S		I	P
Whistling swan	Olor columbianus		T		
Canada goose	Branta canadensis	S	T	I	P
Brant	B. bernicla	s	T	I	P
White-fronted goose	Anser albifrons				P
Snow goose	Chen caerulescens	S	T	I	P
Fulvous whistling duck	Dendrocygna bicolor		T		
Mallard	Anas platyrhynchos	S	T	I	P
Black duck	A. rubripes	S	T	I	P
Gadwall	A. strepera	S	T	I	P
Pintail	A. acuta	S	T	I	P
Green-winged teal	A. crecca crecca	S			
American green-winged teal	A. crecca carolinensis	S	T	I	P
Blue-winged teal	A. discors	S	T	I	P
European wigeon	A. penelope		T		
American wigeon	A. americana	S	T	I	P
Northern shoveler	A. clypeata	S	T		
Wood duck	Aix sponsa	S	T	I	
Redhead	Aythya americana	s	T	I	
Ring-necked duck	A. collaris	s	T	I	P
Canvasback	A. valisineria	S	T	I	P
Greater scaup	A. marila	s	T	I	P
Lesser scaup	A. affinis	S	T	I	P
Common goldeneye	Bucephala clangula	S	T	I	P
Bufflehead	B. albeola	s	T	I	P
Oldsquaw	Clangula hyemalis	s	T	I	P
White-winged scoter	Melanitta deglandi	s	T	I	P

Common name	Scientific name	S	T	I	P
Surf scoter	M. perspicillata	s	T	I	P
Black scoter	M. nigra	s	T	I	
Ruddy duck	Oxyura jamaicensis		T	I	P
Hooded merganser	Lophodytes cucullatus	S	T	I	P
Common merganser	Mergus merganser	S	T	I	P
Red-breasted merganser	M. serrator	s	T	I	P
Turkey vulture	Cathartes aura	S	T	I	P
Goshawk	Accipiter gentilis	S	T	I	P
Sharp-shinned hawk	A. striatus	s	T	I	P
Cooper's hawk	A. cooperii	S	T	I	P
Red-tailed hawk	Buteo jamaicensis	S	T	I	P
Red-shouldered hawk	B. lineatus	S	T	I	P
Broad-winged hawk	B. platypterus	s	T	I	P
Rough-legged hawk	B. lagopus	s	T	I	P
Golden eagle	Aquila chrysaetos		T	I	P
Bald eagle	Haliaeetus leucocephalus	S	T	I	P
Marsh hawk	Circus cyaneus	S	T	I	P
Osprey	Pandion haliaetus	S	T	I	P
Gyrfalcon	Falco rusticolus		T		
Peregrine falcon	F. peregrinus		T	I	P
Merlin	F. columbarius		T	I	P
American kestrel	F. sparverius	S	T	I	P
Ruffed grouse	Bonasa umbellus	S	T	I	
Ring-necked pheasant	Phasianus colchicus	s	T	I	P
Gray partridge	Perdix perdix		T		
King rail	Rallus elegans	s	T	I	P
Clapper rail	R. longirostris				P
Virginia rail	R. limicola	s	T	I	P
Sora	Porzana carolina	s	T	I	P
Common gallinule	Gallinula chloropus	s	T	I	P
American coot	Fulica americana	s	T	I	P
Semipalmated plover	Charadrius semipalmatus		T		P
Killdeer	C. vociferus	S	T	I	P
American golden plover	Pluvialis dominica		T		
Black-bellied plover	P. squatarola		T		P
Ruddy turnstone	Arenaria interpres		T		P
American woodcock	Philohela minor	S	T	I	P
Common snipe	Capella gallinago	s	T	I	P
Upland sandpiper	Bartramia longicauda			I	P
Spotted sandpiper	Actitis macularia	S	T	I	P
Solitary sandpiper	Tringa solitaria	s	T		P
Willet	Catoptrophorus semipalmatus				P
Greater yellowlegs	Tringa melanoleuca	S	T	I	P
Lesser yellowlegs	T. flavipes	S	T	I	P
Red knot	Calidris canutus				P
Pectoral sandpiper	C. melanotos	S	T		P
White-rumped sandpiper	C. fuscicollis				P
Least sandpiper	C. minutilla	s	T		P

Common name	Scientific name	S	T	I	P
Dunlin	C. alpina	S	T		P
Short-billed dowitcher	Limnodromus griseus		T		P
Long-billed dowitcher	L. scolopaceus				P
Semiplamated sandpiper	Calidris pusillus		T		P
Western sandpiper	C. mauri				P
Sanderling	C. alba		T		P
Northern phalarope	Lobipes lobatus			I	P
Glaucous gull	Larus hyperboreus	s		I	P
Iceland gull	L. glaucoides	s		I	
Great black-backed gull	L. marinus	S	T	I	P
Herring gull	L. argentatus	S	T	I	P
Ring-billed gull	L. delawarensis	S	T	I	P
Laughing gull	L. atricilla		T	I	P
Bonaparte's gull	L. philadelphia	s	T	I	P
Black-legged kittiwake	Rissa tridactyla		T		
Forster's tern	Sterna forsteri				P
Common tern	S. hirundo	s	T	I	P
Roseate tern	S. dougallii				P
Sooty tern	S. fuscata			I	P
Least tern	S. albifrons				P
Royal tern	S. maximus	S			P
Sandwich tern	S. sandvicensis				P
Caspian tern	S. caspia		T		P
Black tern	Chlidonias niger	s	T	I	P
Rock dove	Columbia livia	S	T	I	P
Mourning dove	Zenaida macroura	S	T	I	P
Monk parakeet	Myiopsitta monachus				P
Yellow-billed cuckoo	Coccyzus americanus	s	T	I	P
Black-billed cuckoo	C. erythrophthalmus	s	T	I	P
Barn owl	Tyto alba	s	T		
Screech owl	Otus asio	s	T	I	P
Great horned owl	Bubo virginianus	S	T	I	
Snowy owl	Nyctea scandiaca				P
Barred owl	Strix varia		T	I	
Long-eared owl	Asio otus		T		P
Short-eared owl	A. flammeus	s			P
Saw-whet owl	Aegolius acadicus	s	T		
Whip-poor-will	Caprimulgus vociferus	s	T	I	P
Common nighthawk	Chordeiles minor	s	T	I	P
Chimney swift	Chaetura pelagica	S	T	I	P
Ruby-throated hummingbird	Archilochus colubris	s	T	I	P
Belted kingfisher	Megaceryle alcyon	S	T	I	P
Common flicker	Colaptes auratus	S	T	I	P
Pileated woodpecker	Dryocopus pileatus	s	T	I	P
Red-bellied woodpecker	Melanerpes carolinus	s	T		P
Red-headed woodpecker	M. erythrocephalus		T		
Yellow-bellied sapsucker	Sphyrapicus varius		T	I	P
Hairy woodpecker	Picoides villosus	s	T	I	P

Common name	Scientific name	S	T	I	P
Downy woodpecker	P. pubescens	S	T	I	P
Black-backed three-toed woodpecker	P. arcticus		T		
Eastern kingbird	Tyrannus tyrannus	S	T	I	P
Western kingbird	T. verticalis		T		
Great crested flycatcher	Myiarchus crinitus	s	T	I	P
Eastern phoebe	Sayornis phoebe	S	T	I	P
Yellow-bellied flycatcher	Empidonax flaviventris		T	I	
Acadian flycatcher	E. virescens		T		
Willow flycatcher	E. traillii	s	T	I	P
Alder flycatcher	E. alnorum				P
Least flycatcher	E. minimus	s	T	I	P
Eastern wood pewee	Contopus virens	s	T	I	P
Olive-sided flycatcher	Nuttallornis borealis		T	I	
Horned lark	Eremophila alpestris	s	T	I	P
Tree swallow	Iridoprocne bicolor	S	T	I	P
Bank swallow	Riparia riparia	S	T	I	
Rough-winged swallow	Stelgidopteryx ruficollis	s	T	I	P
Barn swallow	Hirundo rustica	S	T	I	P
Cliff swallow	Petrochelidon pyrrhonota	s	T	I	P
Purple martin	Progne subis	s	T	I	P
Blue jay	Cyanocitta cristata	S	T	I	P
Common raven	Corvus corax		T	I	
Common crow	C. brachyrhynchos	;	T	I	P
Fish crow	C. ossifragus	s	T	I	P
Black-capped chickadee	Parus atricapillus	S	T	I	P
Boreal chickadee	P. hudsonicus		T		P
Tufted titmouse	P. bicolor	S	T	I	P
White-breasted nuthatch	Sitta carolinensis	S	T	I	P
Red-breasted nuthatch	S. canadensis	s	T	I	P
Brown creeper	Certhia familiaris	S	T	I	P
House wren	Troglodytes aedon	s	T	I	P
Winter wren	T. troglodytes	S	T	I	P
Carolina wren	Thryothorus ludovicianus	s	T		P
Long-billed marsh wren	Cistothorus palustris	S	T	I	P
Mockingbird	Mimus polyglottos	s	T	I	P
Gray catbird	Dumetella carolinensis	S	T	I	P
Brown thrasher	Toxostoma rufum	s	T	I	P
American robin	Turdus migratorius	S	T	I	P
Wood thrush	Catharus mustelina	s	T	I	P
Hermit thrush	C. guttata	s	T	I	P
Swainson's thrush	C. ustulata	s	T	I	P
Gray-cheeked thrush	C. minima		T	I	
Veery	C. fuscescens	s	T	I	P
Eastern bluebird	Sialia sialis		T	I	P
Blue-gray gnatcatcher	Polioptila caerulea	S	T	I	P
Golden-crowned kinglet	Regulus satrapa	s	T	I	P
Ruby-crowned kinglet	R. calendula	s	T	I	P
Water pipit	Anthus spinoletta	s	T	I	P
Cedar waxwing	Bombycilla cedrorum	s	T	I	P

Common name	Scientific name	S	T	I	P
Northern shrike	Lanius excubitor		T		P
Loggerhead shrike	L. ludovicianus		T		P
Starling	Sturnus vulgari	S	T	I	P
White-eyed vireo	Vireo griseus		T	I	
Yellow-throated vireo	V. flavifrons	s	T	I	P
Solitary vireo	V. solitarius	s	T	I	P
Red-eyed vireo	V. olivaceus	s	T	I	P
Philadelphia vireo	V. philadelphicus		T		P
Warbling vireo	V. gilvus	s	T		P
Black-and-white warbler	Mniotilta varia	s	T	I	P
Prothonotary warbler	Protonotaria citrea		T		P
Worm-eating warbler	Helmitheros vermivorus		T	I	P
Golden-winged warbler	Vermivora chrysoptera		T	I	
Blue-winged warbler	V. pinus		T	I	P
Tennessee warbler	V. peregrina		T	I	P
Orange-crowned warbler	V. celata		T		P
Nashville warbler	V. ruficapilla		T	I	P
Northern parula	Parula americana		T	I	P
Yellow warbler	Dendroica petechia	s	T	I	P
Magnolia warbler	D. magnolia	s	T	I	P
Cape May warbler	D. tigrina	s	T	I	
Black-throated blue warbler	D. caerulesces	s	T	I	P
Yellow-rumped warbler	D. coronata	s	T	I	P
Black-throated green warbler	D. virens	s	T	I	P
Cerulean warbler	D. cerulea	s	T	I	
Blackburnian warbler	D. fusca	s	T	I	P
Yellow-throated warbler	D. dominica		T		
Chestnut-sided warbler	D. pensylvanica	s	T	I	P
Bay-breasted warbler	D. castanea	s	T	I	P
Blackpoll warbler	D. striata	s	T	I	P
Pine warbler	D. pinus	s	T	I	
Prairie warbler	D. discolor	s	T	I	P
Ovenbird	Seiurus aurocapillus	s	T	I	P
Northern waterthrush	S. noveboracensis	s	T	I	P
Louisiana waterthrush	S. motacilla	s	T	I	P
Kentucky warbler	Oporonis formosus		T		P
Connecticut warbler	O. agilis		T		
Mourning warbler	O. philadelphia		T		
Common yellowthroat	Geothlypis trichas	S	T	I	P
Yellow-breasted chat	Icteria virens		T	I	P
Hooded warbler	Wilsonia citrina		T	I	P
Wilson's warbler	W. pusilla	s	T	I	P
Canada warbler	W. canadensis	s	T	I	P
American redstart	Setophaga ruticilla	s	T	I	P
House sparrow	Passer domesticus	s	T	I	P
Bobolink	Dolichonyx oryziviorus	s	T	I	P
Eastern meadowlark	Sturnella magna	s	T	I	P
Yellow-headed blackbird	Xanthocephalus xanthocephalus		T		

Common name	Scientific name	S	T	I	P
Red-winged blackbird	Agelaius phoeniceus	S	T	I	P
Orchard oriole	Icterus spurius	s	T		P
Northern oriole	I. galbula	S	T	I	P
Rusty blackbird	Euphagus carolina	s	T	I	P
Common grackle	Quiscalus quiscula	S	T	I	P
Brown-headed cowbird	Molothrus ater	S	T	I	P
Scarlet tanager	Piranga olivacea	s	T	I	P
Summer tanager	P. rubra		T		
Cardinal	Cardinalis cardinalis	S	T	I	P
Rose-breasted grosbeak	Pheucticus ludovicianus	s	T	I	P
Blue grosbeak	Guiraca caerulea		T		
Indigo bunting	Passerina cyanea	s	T	I	P
Evening grosbeak	Hesperiphona vespertina	s	T	I	P
Purple finch	Carpodacus purpureus	S	T	I	P
House finch	C. mexicanus	S	T		P
Pine grosbeak	Pinicola enucleator		T	I	P
Hoary redpoll	Acanthis hornemanni		T		
Common redpoll	A. flammea	s	T	I	P
Pine siskin	Carduelis pinus	s	T	I	P
American goldfinch	C. tristis	S	T	I	P
Red crossbill	Loxia curvirostra		T		
White-winged crossbill	L. leucoptera		T	I	
Rofous-sided towhee	Pipilo erythrophthalmus	S	T	I	P
Savannah sparrow	Passerculus sandwichensis	s	T	I	P
Grasshopper sparrow	Ammodramus savannarum		T		P
Henslow's sparrow	A. henslowii		T		
Sharp-tailed sparrow	Ammospiza caudacuta		T		P
Seaside sparrow	A. maritima				P
Vesper sparrow	Pooecetes gramineus		T	I	P
Lark sparrow	Chondestes grammacus				P
Dark-eyed junco	Junco hyemalis	S	T	I	P
Tree sparrow	Spizella arborea	S	T	I	P
Chipping sparrow	S. passerina	s	T	I	P
Field sparrow	S. pusilla	s	T	I	P
White-crowned sparrow	Zonotrichia leucophrys	s	T	I	P
White-throated sparrow	Z. albicollis	s	T	I	P
Fox sparrow	Passerella iliaca	s	T	I	P
Lincoln's sparrow	Melospiza lincolnii	s	T	I	P
Swamp sparrow	M. georgiana	S	T	I	P
Song sparrow	M. melodia	S	T	I	P
Lapland longspur	Calcarius lapponicus		T		
Chestnut-collard longspur	C. ornatus		T		
Snow bunting	Plectrophenax nivalis	S	T	I	P

a) Sources of data:

Stockport: Richard Guthrie, William Cook and Erik Kiviat. S (upper case) indicates sight record of the site; s (lower case) indicates species likely to occur based on records from nearby areas.

Tivoli: from Kiviat (1978); (includes a few species recorded from areas near, but not within, the proposed sanctuary boundaries); and Richard Gunthrie.

Iona: from Orth (1965).

Piermont: Robert Deed, includes species of land birds observed within about 50 yards of the landward edge of the marsh (landward boundary of the proposed sanctuary site); all sight records.

APPENDIX 5

Selected Data From New York Mid-Winter
Aerial Waterfowl Survey

Appendix 5. Selected Data from New York Mid-Winter Aerial Waterfowl Survey (Hudson Estuary only).[a]

Common name	Scientific name	1978-1982 Counts Average (Range)
Mute swan	Cygnus olor	42(0-77)
Canada goose	Branta canadensis	251(150-401)
Mallard	Anas platyrhynchos	464(0-896)
Black duck	A. rubripes	829(25-2172)
Canvasback	Aythya valisineria	886(0-3585)
Scaups	Aythya	7(0-15)
Common goldeneye	Bucephala clangula	19(0-85)
Mergansers	Mergus	230(84-550)
Unidentified		12(0-60)
	Total (all species)	2740(259-7841)

a) New York State Department of Environmental Conservation data.

APPENDIX 6

Tidal Wetlands and Shallows Vascular Plants of the Sites

Appendix 6. Tidal wetlands and shallows vascular plants of the sites. Sources of data are listed at end of this appendix.

Family Common name	Scientific name	Sites S	T	I	P
ACERACEAE					
Boxelder	Acer negundo	S	T		
Red maple	A. rubrum		T	I	
Silver maple	A. saccharinum	S	T		
ALISMATACEAE					
Water-plantain	Alisma sp.		T		
Water-plantain	A. subcordatum			I	
Arrowhead	Sagittaria eatoni	S	T	I	
Broadleaf arrowhead	S. latifolia	S	T		
Stiff arrowhead	S. rigida	S	T		
Arrowhead	S. spatulata	S			
Subulate arrowhead	S. subulata	S	T	I	
AMARANTHACEAE					
Tidewater-hemp	Amaranthus cannabinus	S	T	I	P
ANACARDICEAE					
Smoke tree	Continus coggygria		T		
Poison ivy	Rhus radicans		T		
Poison sumac	Rhus vernix			I	
AQUIFOLIACEAE					
Winterberry	Ilex veticillata		T	I	
ARACEAE					
Sweet flag	Acorus calamus	S	T		
Jack-in-the-pulpit	Arisaema triphyllum		T		
Goldenclub	Orontium aquaticum	S	T		
Arrow arum	Peltandra virginica	S	T	I	P
Skunk cabbage	Symplocarpus foetidus	S	T	I	
Swamp milkweed	Asclepias incarnata		T	I	
BALSAMINACEAE					
Jewelweed	Impatiens biflora		T	I	P

Family Common name	Scientific name	Sites S	T	I	P
BETULACEAE					
Speckled alder	Alnus rugosa			I	
Smooth alder	A. serrulata		T	I	
Yellow birch	Betula lutea		T		
Gray birch	B. populifolia		T		
American hornbeam	Carpinus caroliniana		T		
Hazel	Corylus sp.		T		
Hop hornbeam	Ostrya virginiana		T		
BORAGINACEAE					
Forget-me-not	Myosotis sp.			I	
CAESALPINIACEAE					
Wild senna	Cassia hebecarpa	S			
CALLITRICHACEAE					
Water starwort	Callitriche verna		T		
CAPRIFOLIACEAE					
Bell's honeysuckle	Lonicera x. bella	S	T		
Elderberry	Sambucus canadensis	S	T	I	
Arrow-wood	Viburnum dentatum		T	I	
Nannyberry	V. lentago		T		
CARYOPHYLLACEAE					
Water chickweed	Stellaria aquatica		T		
CELASTRACEAE					
Bittersweet	Celastrus scandens		T		
CERATOPHYLLACEAE					
Coontail	Ceratophyllum demersum	S	T	I	
CLETHRACEAE					
Sweet pepperbush	Clethra alnifolia			I	
COMMELINACEAE					
Dayflower	Commelina communis		T		

Family Common name	Scientific name	Sites S	 T	 I	 P
CHENOPODIACEAE					
Spearscale	Atriplex patula				P
COMPOSITAE					
Giant ragweed	Ambrosia trifida		T		
Aster	Aster puniceus		T		
Aster	A. subulatus				P
Beggar-ticks	Bidens bidenoides	S	T	I	
Bur-marigold	B. cernua	S	T		
Eaton's bur-marigold	B. eatoni		T		
Beggar-ticks	B. frondosa		T		
Estuary beggar-ticks	Bidens hyperborea		T		
Beggar-ticks	B. laevis		T		
Fireweed	Erechtites hieracifolia				P
Fleabane	Erigeron philadelphicus		T		
Joe Pye-weed	Eupatorium maculatum		T		
Boneset	E. perfoliatum	S	T		
Sneezeweed	Helenium autumnale	S	T		
Marsh elder	Iva frutescens				P
Climbing hempweed	Mikania scandens		T	I	
Marsh fleabane	Pluchea purpurascens			I	P
Greenheas coneflower	Rudbeckia laciniata		T		
Groundsel	Senecio aureus		T		
Goldenrod	Solidago sp.	S			
Goldenrod	S. sempervirens				P
Cocklebur	Xanthium strumarium	S			
CONVOLVULACEAE					
Bindweed	Convolvulvus sepium		T		
Dodder	Cuscuta cephalanthi			I	
Dodder	C. gronovii		T		
CORNACEAE					
Silky dogwood	Cornus amomum	S	T	I	
Gray dogwood	C. racemosa		T		
Red-osier dogwood	C. stolonifera		T		
CRASSULACEAE					
Ditch stonecrop	Penthorum sedoides		T		

Family Common name	Scientific name	Sites S	T	I	P
CRUCIFERAE					
Garlic-mustard	Alliaria officinalis		T		
Wintercress	Barbarea vulgaris		T		
Bittercress	Cardamine pensylvanica		T		
Cuckoo flower	C. pratense		T		
Dame's rocket	Hesperis matronalis		T		
Marshcress	Rorippa islandica		T		
CUCURBITACEAE					
Balsam-apple	Echinocystis lobata	S			
Bur-cucumber	Sicyos angulatus	S			
CUPRESSACEAE					
Arborvitae	Thuja occidentialis		T		
CYPERACEAE					
Sedge	Carex gravii		T		
Sedge	C. stipata		T		
Tussock sedge	C. stricta		T		
Galingale	Cyperus rivularis		T		
Galingale	C. strigosus		T		
Three-way sedge	Dulichium arundinaceum		T		
Spikerush	Eleocharis acicularis	S			
Spikerush	E. ovata	S	T		
Spikerush	E. diandra	S	T	I	
Spikerush	E. palustris	S	T		
Bulrush	Scirpus acutus	S			
Threesquare	S. americanus	S	T	I	P
Bulrush	S. atrovierens		T		
Cylindrical bulrush	S. cylindricus			I	P
River bulrush	S. fluviatilis	S	T		P
Bulrush	S. maritimus				P
Threesquare	S. olneyi			I	P
Salt marsh bulrush	S. robustus			I	P
Bluntscale bulrush	S. smithii	S	T	I	
Bulrush	S. validus	S	T	I	P
DIOSCOREACEAE					
Wild yam	Dioscorea villosa		T		
ELATINACEAE					
Waterwort	Elatine americana	S	T		

Family Common name	Scientific name	Sites S	T	I	P
EQUISETACEAE					
Field horsetail	Equisetum arvense		T		
Horsetail	Equisetum fluviatile		T		
ERICACEAE					
Highbush blueberry	Vaccinium corymbosum		T		
ERIOCAULACEAE					
Pipewort	Eriocaulon parkeri		T		
FABACEAE					
False-indigo	Amorpha fruticosa		T		
Hog-peanut	Amphicarpa bracteata		T		
Groundnut	Apios americana		T		
Wild pea	Lathyrus palustris		T		
FAGACEAE					
Swamp white oak	Quercus bicolor		T		
GENTIANACEAE					
Closed gentian	Gentiana andrewsii		T		
Floating heart	Nymphoides cordata		T		
GRAMINEAE					
Redtop	Agrostis alba				P
Wood-reed	Cinna arundinacea		T		
Saltgrass	Distichlis spicata				P
Barnyard grass	Echinochloa crusgalli		T		
Water-millet	E. walteri		T	I	P
Wild-rye	Elymus virginicus		T		
Rice cutgrass	Leersia oryzoides		T		
White grass	L. virginica	S	T		
Panic grass	Panicum capillare	S			
Panic grass	P. dichotomiflorum	S	T		
Panic grass	P. virgatum				P
Common reed	Phragmites communis	S	T	I	P
Saltwater cordgrass	Spartina alterniflora				P
Tall cordgrass	S. cynosuroides				
Saltmeadow cordgrass	S. patens				P

Family Common name	Scientific name	Sites S	T	I	P
Freshwater cordgrass	S. pectinata	S	T		P
Wild-rice	Zizania aquatica	S	T	I	P
HALORAGACEAE					
Watermilfoil	Myriophyllum sp.	S		I	
Watermilfoil	M. humile		T		
Eurasian watermilfoil	M. spicatum	S	T	I	
HYDROCARYACEAE					
Water-chestnut	Trapa natans	S	T	I	
Waterweed	Elodea canadensis	S	T	I	
Waterweed	E. nuttallii	S	T	I	
Water-celery	Vallisneria americana	S	T	I	P
IRIDACEAE					
Yellow iris	Iris pseudacorus		T	I	
Blue flag	I. versicolor		T	I	
ISOETACEAE					
Quillwort	Isoetes riparia		T		
JUNCACEAE					
Rush	Juncus brachycephalus		T		
Black-grass	J. gerardi				P
Path rush	J. tenuis		T		
LABIATAE					
Stoneroot	Collinsonia canadensis		T		
Bugleweed	Lycopus americanus		T		
Bugleweed	L. europaeus		T		
Field mint	Mentha arvensis		T		
Skullcap	Scutellaria galericulata			I	
Skullcap	S. lateriflora		T		
Hedge-nettle	Stachys palustris		T		
Wood sage	Teucrium canadense				P

Family Common name	Scientific name	Sites S	T	I	P
LAURACEAE					
Spicebush	Lindera benzoin	S	T		
LEMNACEAE					
Common duckweed	Lemna minor	S	T	I	P
Great duckweed	Spirodela polyrhiza	S	T		
LENTIBULARIACEAE					
Bladderwort	Utricularia vulgaris	S		I	
LILIACEAE					
Day-lily	Hemerocallis fulva		T		
Canada lily	Lilum canadense		T		
Greenbrier	Smilax herbacea		T		
Greenbrier	S. hispida		T		
LOBELIACEAE					
Cardinal flower	Lobelia cardinalis		T	I	
Great blue lobelia	L. siphilitica		T		
LYTHRACEAE					
Purple loosestrife	Lythrum salicaria	S	T	I	P
MALVACEAE					
Swamp rose mallow	Hibiscus palustris	S	T	I	P
MORACEAE					
Hops	Humulus lupulus		T		
NAJADACEAE					
Naiad	Najas flexilis	S	T	I	
Naiad	N. guadalupensis	S			
Naiad	N. minor	S	T		
Muenscher's naiad	N. muenscheri	S	T	I	
Curlyleaf pondweed	Potamogeton crispus		T	I	
Pondweed	P. epihydrus	S	T		
Leafy pondweed	P. foliosus	S	T	I	

Family Common name	Scientific name	Sites S	T	I	P
Long-leaved pondweed	*P. nodosus*	S	T		
Sago pondweed	*P. pectinatus*	S		I	P
Pondweed	*P. perfoliatus*	S	T	I	P
Pondweed	*P. pusillus*	S			
Pondweed	*P. richardsonii*	S	T	I	
Flat-stemmed pondweed	*P. zosteriformis*	S	T		
Horned pondweed	*Zannichellia palustris*	S	T	I	
NYMPHAEACEAE					
Spatterdock	*Nuphar advena*	S	T	I	
White water-lily	*Nymphaea sp.*		T		
OLEACEAE					
Ash	*Fraxinum sp.*			I	
Black ash	*F. nigra*	S?	T		
Red ash	*F. pennsylvanica*	S	T		
ONAGRACEAE					
Willow herb	*Epilobium glandulosum*				P
Water-purslane	*Ludwigia palustris*	S	T		
Evening-primrose	*Oenothera sp.*	S			
ORCHIDACEAE					
Helleborine	*Epipactis helleborine*		T		
OSMUNDACEAE					
Cinnamon fern	*Osmunda cinnamomea*			I	
Interrupted fern	*O. claytoniana*			I	
Royal fern	*O. regalis*		T	I	
PINACEAE					
White pine	*Pinus strobus*		T		
PLANTAGINACEAE					
Heartleaf plantain	*Plantago cordata*	S	T		
PLATANACEAE					
Sycamore	*Platanus occidentalis*	S			

Family Common name	Scientific name	Sites S	T	I	P
POLYGONACEAE					
Tearthumb	Polygonum arifolium		T	I	P
Smartweed	P. caespitosum		T		
Japanese knotweed	P. cuspidatum	S			
Seabeach knotweed	P. glaucum				P
Water-pepper	P. hydropiper		T		
Swamp smartweed	P. hydropiperoides			I	
Dotted smartweed	P. punctatum	S	T	I	P
Tearthumb	P. sagittatum	S	T	I	
Jumpseed	P. virginianum		T		
Dock	Rumex mexicanus			I	
Water dock	R. verticillatus		T		
POLYPODIACEAE					
Ostrich fern	Matteuccia struthiopteris	S			
Sensitive fern	Onoclea sensibilis	S	T	I	
Marsh fern	Thelpteris palustris			I	P
PONTEDERIACEAE					
Mud-plantain	Heteranthera reniformis	S	T		
Pickerel-weed	Pontederia cordata	S	T	I	
Water star-grass	Zosterella dubia	S	T	I	
PORTULACACEAE					
Spring beauty	Claytonia virginica		T		
PRIMULACEAE					
Fringed loosestrife	Lysimachia ciliata		T		
Moneywort	L. nummularia		T		
Water pimpernel	Samolus parviflorus			I	P
RANUNCULACEAE					
Marsh-marigold	Caltha palustris	S	T		
Virgin's bower	Clematis virginiana	S	T		
Crowfoot	Ranunculus abortivus		T		
Cursed crowfoot	R. sceleratus		T		
Buttercup	R. septentrionalis	S	T		
Tall meadow-rue	Thalictrum polygamum	S	T		

Family Common name	Scientific name	Sites S	T	I	P
RHAMNACEAE					
Buckthorn	Rhamnus cathartica		T		
ROSACEAE					
Ninebark	Physocarpus opulifolius		T		
Swamp-rose	Rosa palustris		T	I	
Meadowsweet	Spiraea latifolia			I	
Hardhack	S. tomentosa				
RUBIACEAE					
Buttonbush	Cephalanthus occidentalis		T	I	
Bedstraw	Galium trifidum		T		
Bedstraw	G. palustre		T		
SALICACEAE					
Cottonwood	Populus deltoides	S		I	P
Quaking aspen	P. tremuloides		T		
Willow	Salix sp.	S	T	I	
Crack willow	S. fragilis		T	I	
Black willow	S. nigra			I	
Basket willow	S. purpurea			I	
Heart-leaved willow	S. rigida		T		
SCROPHULARIACEAE					
Turtlehead	Chelone glabra		T		
Mudwort	Limosella subulata	S	T		
False-pimpernel	Lindernia dubia	S	T		
Nuttall's micranthemum	Micranthemum micranthemoides		T		
Monkeyflower	Mimulus ringens		T		
SOLANACEAE					
Climbing nightshade	Solanum dulcamara		T		
SPARGANIACEAE					
Burreed	Sparganium americanum		T		
Big burreed	S. eurycarpum	S	T		

Family Common name	Scientific name	Sites S	T	I	P
TILLIACEAE					
Narrowleaf cattail	Typha angustifolia	S	T	I	P
Broadleaf cattail	T. latifolia	S	T	I	p
Hybrid cattail	T. x. glauca	S	T	I	
TYPHACEAE					
Basswood	Tilia americana	S	T		
ULMACEAE					
Elm	Ulmus sp.			I	
American elm	U. americana	S			
UMBELLIFERAE					
Angelica	Angelica atropurpurea		T		
Bulb-bearing water-hemlock	Cicuta bulbifera		T	I	
Water-hemlock	C. maculata		T		
Lilaeopsis	Lilaeopsis chinensis				P
Mock bishop weed	Ptilimnium capillaceum				P
Water-parsnip	Sium suave	S	T	I	P
URTICACEAE					
False nettle	Boehmeria cylindrica		T	I	
Wood nettle	Laportea canadensis	S	T		
Clearweed	Pilea fontana			I	
Clearweed	P. pumila		T		
VIOLACEAE					
Blue violet	Viola sp.		T		
VITACEAE					
Virginia-creeper	Parthenocissus quinquefolia	S	T		

Sources of information: Buckley & Ristich (1976), Foley & Taber (1951), Kiviat (1978) and unpublished data, Lehr (1967a, b), McVaugh (1958), Muenscher (1935, 1937), John C. Orth (unpubliched data at Bear Mountain State Park Trailside Museums), Schuyler: 1975 and Torrey (1931). These records span approximately the last 50 years. Nomenclature has been adjusted to conform with Gleason & Cronquist (1963) where practicable.

APPENDIX 7

Estuarine Sanctuary Guidelines, 1974 and 1977

necessary to the objectives of the grant project. As used herein the terms "cost" and "grant project" pertain to both the Federal grant and the matching share. The allowability of cost will be determined in accordance with the provisions of FMC 74-4: Cost Principles applicable to Grants and Contracts with State and Local Governments, and with the guidance contained in section 920.42(b)(3).

(f) The Form SF-424, Application for Federal Assistance (Non-Construction Programs), constitutes the formal application and must be submitted 60 days prior to the desired grant beginning date. The application must be accompanied by evidence of compliance with A-95 requirements including the resolution of any problems raised by the proposed project. The Associate Administrator will not accept application substantially deficient in adherence to A-95 requirements.

(g) In Part IV, Program Narrative of the Form SF-424, the applicant should repond to the following requirements:

(1) Set forth a work program describing the activities to be undertaken during the grant period. This work program shall include:

(i) A precise description of each major task to be undertaken to resolve section 305 deficiencies, and a specific timetable for remedying these deficiencies;

(ii) A precise description of implementation activities for approved management components, including a demonstration that these implementation funds will not be applied outside the approved coastal management boundaries;

(iii) A precise description of any other tasks necessary for and allowable under subsection 305(d);

(iv) For each task, identify any "Other Entities," as defined in the "Manual," that will be allocated responsibility for carrying out all or portions of the task, and indicate the estimated cost of the subcontract for each allocation. Identify, if any, that portion of the task that will be carried out under contract with consultants and indicate the estimated cost of such contract(s); and

(v) For each task, indicate the estimated total cost. Also, indicate the estimated total months of effort, if any, allocated to the task from the applicant's staff.

(2) The sum of all task costs in the above paragraph should equal the total estimated grant project cost.

(3) Using two categories, Professional and Clerical, indicate the total number of personnel in each category on the applicant's staff that will be assigned to the grant project. Also indicate the number assigned full time and the number assigned less than full time in the two categories. Additionally, indicate the number of new positions created in the two categories as a result of the grant project.

PART 921—ESTUARINE SANCTUARY GUIDELINES

Subpart A—General

Sec.

921.1 Policy and objectives.
921.2 Definitions.
921.3 Objectives and implementation of the program.
921.4 Biogeographic classification.
921.5 Multiple use.
921.6 Relationship to other provisions of the Act and to marine sanctuaries.

Subpart B—Application for Grants

921.10 General.
921.11 Application for initial acquisition, development and operation grants.
921.12 Application for subsequent development and operation grants.
921.13 Federally owned lands.
921.14 Application time schedule and procedure.

Subpart C—Selection Criteria

921.20 Criteria for selection.
921.21 Public participation.

Subpart D—Operation

921.30 General.
921.31 Changes in the sanctuary boundary, management policy or research program.
921.32 Program review.

AUTHORITY: Sec. 312, Pub. L. 92-583, as amended; 86 Stat. 1280 (16 USC 1461).

SOURCE: 39 FR 19924, June 4, 1974, unless otherwise noted.

Subpart A—General

§ 921.1 Policy and Objectives.

The estuarine sanctuaries program will provide grants to States on a matching basis to acquire, develop and operate natural areas as estuarine sanctuaries in order that scientists and students may be provided the opportunity to examine over a period of time the ecological relationships within the area. The purpose of these guidelines is to establish the rules and regulations for implementation of the program.

§ 921.2 Definitions.

(a) In addition to the definitions found in the Act and in the regulations dealing with Coastal Zone Management Program Development Grants published November 29, 1973 (Part 920 of this chapter) the term "estuarine sanctuary" as defined in the Act, means a research area which may include any part or all of an estuary, adjoining transitional areas, and adjacent uplands, constituting to the extent feasible a natural unit, set aside to provide scientists and students the opportunity to examine over a period of time the ecological relationships within the area.

(b) For the purposes of this section, "estuary" means that part of a river or stream or other body of water having unimpaired connection with the open sea where the seawater is measurably diluted with freshwater derived from land drainage. The term includes estuary-type areas of the Great Lakes as well as lagoons in more arid coastal regions.

(c) The term "multiple use" as used in this section shall mean the simultaneous utilization of an area or resource for a variety of compatible purposes or to provide more than one benefit. The term implies the long-term, continued uses of such resources in such a fashion that other uses will not interfere with, diminish or prevent the primary purpose, which is the long-term protection of the area for scientific and educational use.

§ 921.3 Objectives and implementation of the program.

(a) General. The purpose of the estuarine sanctuaries program is to create natural field laboratories in which to gather data and make studies of the natural and human processes occurring within the estuaries of the coastal zone. This shall be accomplished by the establishment of a series of estuarine sanctuaries which will be designated so that at least one representative of each type of estuarine ecosystem will endure into the future for scientific and educational purposes. The primary use of estuarine sanctuaries shall be for research and educational purposes, especially to provide some of the information essential to coastal zone management decision-making. Specific examples of such purposes and uses include but are not limited to:

(1) To gain a thorough understanding of the ecological relationships within the estuarine environment.

(2) To make baseline ecological measurements.

(3) To monitor significant or vital changes in the estuarine environment.

(4) To assess the effects of man's stresses on the ecosystem and to forecast and mitigate possible deterioration from human activities.

(5) To provide a vehicle for increasing public knowledge and awareness of the complex nature of estuarine systems, their values and benefits to man and nature, and the problems which confront them.

(b) The emphasis within the program will be on the designation as estuarine sanctuaries of areas which will serve as natural field laboratories for studies and investigations over an extended period. The area chosen as an estuarine sanctuary shall, to the extent feasible, include water and land masses constituting a natural ecological unit.

(c) In order that the estuarine sanctuary will be available for future studies, research involving the destruction of any portion of an estuarine sanctuary which would permanently alter the nature of the ecosystem shall not normally be permitted. In the unusual circumstances where permitted, ma-

nipulative field research shall be carefully controlled. No experiment which involves manipulative research shall be initiated until the termination date is specified and evidence given that the environment will be returned to its condition which existed prior to the experiment.

(d) It is anticipated that most of the areas selected as sanctuaries will be relatively undisturbed by human activities at the time of acquisition. Therefore, most of the areas selected will be areas with a minimum of development, industry or habitation.

(e) *If sufficient permanence and control* by the State can be assured, the acquisition of a sanctuary may involve less than the acquisition of a fee simple interest. Such interest may be, for example, the acquisition of a conservation easement, "development rights", or other partial interest sufficient to assure the protection of the natural system. Leasing, which would not assure permanent protection of the system, would not be an acceptable alternative.

§ 921.4 Biogeographic classification.

(a) It is intended that estuarine sanctuaries should not be chosen at random, but should reflect regional differentiation and a variety of ecosystems so as to cover all significant variations. To ensure adequate representation of all estuarine types reflecting regional differentiation and a variety of ecosystems, selections will be made by the Secretary from the following biogeographic classifications:

1. *Arcadian.* Northeast Atlantic coast south to Cape Cod, glaciated shoreline subject to winter icing; well developed algal flora; boreal biota.

2. *Virginian.* Middle Atlantic coast from Cape Cod to Cape Hatteras; lowland streams, coastal marshes and muddy bottoms; characteristics transitional between 1 and 3; biota primarily temperate with some boreal representatives.

3. *Carolinian.* South Atlantic coast, from Cape Hatteras to Cape Kennedy; extensive marshes and swamps; waters turbid and productive; biota temperate with seasonal tropical elements.

4. *West Indian.* South Florida coast from Cape Kennedy to Cedar Key; and Caribbean Islands; shoreland low-lying limestone; calcareous sands, marls and coral reefs; coastal marshes and mangroves; tropical biota.

5. *Louisianian.* Northern Gulf of Mexico, from Cedar Key to Mexico; characteristics of 3, with components of 4; strongly influenced by terrigenous factors; biota primarily temperate.

6. *Californian.* South Pacific coast from Mexico to Cape Mendocino; shoreland influenced by coastal mountains; rocky coasts with reduced fresh-water runoff; general absence of marshes and swamps; biota temperate.

7. *Columbian.* North Pacific coast from Cape Mendocino to Canada; mountainous shoreland; rocky coasts; extensive algal communities; biota primarily temperate with some boreal.

8. *Fiords.* South coast Alaska and Aleutians; precipitous mountains; deep estuaries, some with glaciers; shoreline heavily indented and subject to winter icing; biota boreal to sub-Arctic.

9. *Subarctic.* West and north coasts of Alaska; ice stressed coasts; biota Arctic and sub-Arctic.

10. *Insular.* Larger islands, sometimes with precipitous mountains; considerable wave action; frequently with endemic species; larger island groups primarily with tropical biota.

11. *Great Lakes.* Great Lakes of North America; bluff-dune or rocky, glaciated shoreline; limited wetlands; freshwater only; biota a mixture of boreal and temperate species with anadromous species and some marine invaders.

(b) Various sub-categories will be developed and utilized as appropriate.

§ 921.5 Multiple use.

(a) While the primary purpose of estuarine sanctuaries is to provide long-term protection for natural areas so that they may be used for scientific and educational purposes, multiple use of estuarine sanctuaries will be encouraged to the extent that such use is compatible with this primary sanctuary purpose. The capacity of a given sanctuary to accommodate additional uses, and the kinds and intensity of such use, will be determined on a case by case basis. While it is anticipated that compatible uses may generally include activities such as low intensity recreation, fishing, hunting, and wildlife observation, it is recognized that the exclusive use of an area for scientific or educational purposes may provide the optimum benefit to coastal zone management and resource use and may on occasion be necessary.

(b) There shall be no effort to balance or optimize uses of an estuarine sanctuary on economic or other bases. All additional uses of the sanctuary are clearly secondary to the primary purpose and uses, which are long-term maintenance of the ecosystem for scientific and educational uses. Non-compatible uses, including those uses which would cause significant short or long-term ecological change or would otherwise detract from or restrict the use of the sanctuary as a natural field laboratory, will be prohibited.

§ 921.6 Relationship to other provisions of the act and to marine sanctuaries.

(a) The estuarine sanctuary program must interact with the overall coastal zone management program in two ways: (1) the intended research use of the sanctuary should provide relevant data and conclusions of assistance to coastal zone management decision-making, and (2) when developed, the State's coastal zone management program must recognize and be designed to protect the estuarine sanctuary; appropriate land and water use regulations and planning considerations must apply to adjacent lands. Although estuarine sanctuaries should be incorporated into the State coastal zone management program, their designation need not await the development and approval of the management program where operation of the estuarine sanctuary would aid in the development of a program.

(b) The estuarine sanctuaries program will be conducted in close cooperation with the marine sanctuaries program (Title III of the Marine Protection, Research Act of 1972, Pub. L. 92-532, which is also administered by the Office of Coastal Zone Management, NOAA), which recognizes that certain areas of the ocean waters, as far seaward as the outer edge of the Continental Shelf, or other coastal waters where the tide ebbs and flows, or of the Great Lakes and their connecting waters, need to be preserved or restored for their conservation, recreational, ecologic or esthetic values. It is anticipated that the Secretary on occasion may establish marine sanctuaries to complement the designation by States of estuarine sanctuaries, where this may be mutually beneficial.

Subpart B—Application for Grants

§ 921.10 General.

Section 312 authorizes Federal grants to coastal States so that the States may establish sanctuaries according to regulations promulgated by the Secretary. Coastal States may file applications for grants with the Director, Office of Coastal Zone Management, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Rockville, Maryland 20852. That agency which has been certified to the Office of Coastal Zone Management as the entity responsible for administration of the State coastal zone management program may either submit an application directly, or must endorse and approve applications submitted by other agencies within the State.

§ 921.11 Application for initial acquisition, development and operation grants.

(a) Grants may be awarded on a matching basis to cover the costs of acquisition, development and operation of estuarine sanctuaries. States may use donations of land or money to satisfy all or part of the matching cost requirements.

(b) In general, lands acquired pursuant to this section, including State owned lands but not State owned submerged lands or bay bottoms, that occur within the proposed sanctuary boundary are legitimate costs and their fair market value may be included as match. However, the value of lands donated to or by the State for inclusion in the sanctuary may only be used to match other costs of land acquisition. In the event that lands already exist in a protected status, their value cannot be used as match for sanctuary development and operation grants, which will require their own matching funds.

(c) Development and operation costs may include the administrative expenses necessary to minitor the sanctuary, to ensure its continued viability

and to protect the integrity of the ecosystem. Research will not normally be funded by Section 312 grants. It is anticipated that other sources of Federal, State and private funds will be available for research in estuarine sanctuaries.

(d) Initial applications should contain the following information:

(1) Description of the proposed sanctuary include location, boundaries, size and cost of acquisition, operation and development. A map should be included, as well as an aerial photograph, if available.

(2) Classification of the proposed sanctuary according to the biogeographic scheme set forth in § 921.4.

(3) Description of the major physical, geographic and biological characteristics and resources of the proposed sanctuary.

(4) Identification of ownership patterns; proportion of land already in the public domain.

(5) Description of intended research uses, potential research organizations or agencies and benefits to the overall coastal zone management program.

(6) Demonstration of necessary authority to acquire or control and manage the sanctuary.

(7) Description of proposed management techniques, including the management agency, principles and proposed budget including both State and Federal shares.

(8) Description of existing and potential uses of and conflicts within the area if it were not declared an estuarine sanctuary; potential use, use restrictions and conflicts if the sanctuary is established.

(i) Assessment of the environmental and socio-economic impacts of declaring the area an estuarine sanctuary, including the economic impact of such a designation on the surrounding community and its tax base.

(9) Description of planned or anticipated land and water use and controls for contiguous lands surrounding the proposed sanctuary (including if appropriate an analysis of the desirability of creating a marine sanctuary in adjacent areas).

(10) List of protected sites, either within the estuarine sanctuaries program or within other Federal, State or private programs, which are located in the same regional or biogeographic classification.

(i) It is essential that the opportunity be provided for public involvement and input in the development of the sanctuary proposal and application. Where the application is controversial or where controversial issues are addressed, the State should provide adequate means to ensure that all interested parties have the opportunity to present their views. This may be in the form of an adequately advertised public hearing.

(ii) During the development of an estuarine sanctuary application, all landowners within the proposed boundaries should be informed in writing of the proposed grant application.

(iii) The application should indicate the manner in which the State solicited the views of all interested parties prior to the actual submission of the application.

(e) In order to develop a truly representative scheme of estuarine sanctuaries, the States should attempt to coordinate their activities. This will help to minimize the possibility of similar estuarine types being proposed for designation in the same region. The application should indicate the extent to which neighboring States were consulted.

(f) Discussion, including cost and feasibility, of alternative methods for acquisition, control and protection of the area to provide similar uses. Use of the marine sanctuary authority and funds from the Land and Water Conservation Fund Act should be specifically addressed.

§ 921.12 Application for subsequent development and operation grants.

(a) Although the initial grant application for creation of an estuarine sanctuary should include initial development and operation costs, subsequent applications may be submitted following acquisition and establishment of an estuarine sanctuary for additional development and operation funds. As indicated in § 921.11, these costs may include administrative costs necessary to monitor the sanctuary

and to protect the integrity of the ecosystem. Extensive management programs, capital expenses, or research will not normally be funded by section 312 grants.

(b) After the creation of an estuarine sanctuary established under this program, applications for such development and operation grants should include at least the following information:

(1) Identification of the boundary.

(2) Specifications of the management program, including managing agency and techniques.

(3) Detailed budget.

(4) Discussion of recent and projected use of the sanctuary.

(5) Perceived threats to the integrity of the sanctuary.

§ 921.13 Federally owned lands.

(a) Where federally owned lands are a part of or adjacent to the area proposed for designation as an estuarine sanctuary, or where the control of land and water uses on such lands is necessary to protect the natural system within the sanctuary, the State should contact the Federal agency maintaining control of the land to request cooperation in providing coordinated management policies. Such lands and State request, and the Federal agency response, should be identified and conveyed to the Office of Coastal Zone Management.

(b) Where such proposed use or control of federally owned lands would not conflict with the Federal use of their lands, such cooperation and coordination is encouraged to the maximum extent feasible.

(c) Section 312 grants may not be awarded to federal agencies for creation of estuarine sanctuaries in Federally owned lands; however, a similar status may be provided on a voluntary basis for Federally owned lands under the provisions of the Federal Committee on Ecological Preserves program.

§ 921.14 Application time schedule and procedure.

(a) Effective January 1, 1975, the review and selection of estuarine sanctuary applications will be conducted on a twice yearly basis. All applications received between January 1 and June 30 of any year will be considered together beginning July 1 of that year; applications received between July 1 and December 31 will be considered together beginning January 1 of the following year.

(b) All applications received during any application period will be subject to simultaneous review and consideration. At the end of each application period, a suitable number of applications, based on the level of funding available, will be selected for further review and processing. Unless sufficiently distinguished as major subcategories, no more than one application from each biogeographic category will be selected for final processing during each review period. Normally, the applications selected will be processed and the grants awarded within 6 months from the end of the application period, that is before the next review period begins. Applications which are not selected for processing may be resubmitted for consideration during the next review period.

(c) At least ninety (90) days prior to submission of an application under this section, an applicant state must notify in writing the OCZM, appropriate state and regional A-95 clearinghouses, and other states within the same biogeographic category (see Table 1) of its intention to file an application for an estuarine sanctuary grant. Such notification should include at least the identification of the state agency applying for the grant; the geographic location of the proposed sanctuary and its boundaries; proposed objectives of the sanctuary, including intended research uses; estimated cost of sanctuary; and estimated date for submission of application. Copies of the A-95 notifications to the state and regional clearinghouse would be considered sufficient and desirable notification to OCZM and to the other states.

TABLE 1—LIST OF STATES BY BIOGEOGRAPHIC CLASSIFICATION

1. Acadian—Maine, New Hampshire, Massachusetts.

2. Virginian—Massachusetts, Rhode Island, Connecticut, New York, New Jersey,

Delaware, Maryland, Virginia, North Carolina.

3. Carolinian—North Carolina, South Carolina, Georgia, Florida.

4. West Indian—Florida, Puerto Rico, Virgin Islands.

5. Louisianian—Florida, Mississippi, Alabama.

6. Californian—California.

7. Columbian—California, Oregon, Washington.

8. Fiord—Alaska.

9. Sub-Arctic—Alaska.

10. Insular—Hawaii, Guam, American Samoa.

11. Great Lakes—Minnesota, Wisconsin, Michigan, Illinois, Indiana, Ohio, Pennsylvania, New York.

(d) The Director of OCZM may, upon the finding of extenuating circumstances relating to applications for assistance, waive appropriate administrative requirements contained herein.

[39 FR 45214, Dec. 31, 1974]

Subpart C—Selection Criteria

§ 921.20 Criteria for selection.

Applications for grants to establish estuarine sanctuaries will be reviewed and judged on criteria including:

(a) Benefit to the coastal zone management program. Applications should demonstrate the benefit of the proposal to the development or operations of the overall coastal zone management program, including how well the proposal fits into the national program of representative estuarine types; the national or regional benefits; and the usefulness in research.

(b) The ecological characteristics of the ecosystem, including its biological productivity, diversity and representativeness. Extent of alteration of the natural system, its ability to remain a viable and healthy system in view of the present and possible development of external stresses.

(c) *Size and choice of boundaries.* To the extent feasible, estuarine sanctuaries should approximate a natural ecological unit. The minimal acceptable size will vary greatly and will depend on the nature of the ecosystem.

(d) Cost. Although the Act limits the Federal share of the cost for each sanctuary to $2,000,000, it is anticipated that in practice the average grant will be substantially less than this.

(e) Enhancement of non-competitive uses.

(f) Proximity and access to existing research facilities.

(g) Availability of suitable alternative sites already protected which might be capable of providing the same use or benefit. Unnecessary duplication of existing activities under other programs should be avoided. However, estuarine sanctuaries might be established adjacent to existing preserved lands where mutual enhancement or benefit of each might occur.

(h) Conflict with existing or potential competing uses.

(i) *Compatibility with existing or proposed land and water use in contiguous areas.*

If the initial review demonstrates the feasibility of the application, an environmental impact statement will be prepared by the Office of Coastal Zone Management in accordance with the National Environmental Policy Act of 1969 and implementing CEQ guidelines.

§ 921.21 Public participation.

Public participation will be an essential factor in the selection of estuarine sanctuaries. In addition to the participation during the application development process (§ 921.11(e)), public participation will be ensured at the Federal level by the NEPA process and by public hearings where desirable subsequent to NEPA. Such public hearings shall be held by the Office of Coastal Zone Management in the area to be affected by the proposed sanctuary no sooner than 30 days after it issues a draft environmental impact statement on the sanctuary proposal. It will be the responsibility of the Office of Coastal Zone Management, with the assistance of the applicant State, to issue adequate public notice of its intention to hold a public hearing. Such public notice shall be distributed widely, especially in the area of the proposed sanctuary; affected property owners and those agencies, organizations or individuals with an identified interest in the area or estuarine sanctuary program shall be notified of the public hearing. The public notice shall contain the name, address and phone number of the appropriate Federal and State officials to contact for additional information about the proposal.

Subpart D—Operation

§ 921.30 General.

Management of estuarine sanctuaries shall be the responsibility of the applicant State or its agent. However, the research uses and management program must be in conformance with these guidelines and regulations, and others implemented by the provisions of individual grants. It is suggested that prior to the grant award, representatives of the proposed sanctuary management team and the Office of Coastal Zone Management meet to discuss management policy and standards. It is anticipated that the grant provisions will vary with individual circumstances and will be mutually agreed to by the applicant and the granting agency. As a minimum, the grant document for each sanctuary shall:

(a) Define the intended research purposes of the estuarine sanctuary.

(b) Define permitted, compatible, restricted and prohibited uses of the sanctuary.

(c) Include a provision for monitoring the uses of the sanctuary, to ensure compliance with the intended uses.

(d) Ensure ready access to land use of the sanctuary by scientists, students and the general public as desirable and permissible for coordinated research and education uses, as well as for other compatible purposes.

(e) Ensure public availability and reasonable distribution of research results for timely use in the development of coastal zone management programs.

(f) Provide a basis for annual review of the status of the sanctuary, its value to the coastal zone program.

(g) Specify how the integrity of the system which the sanctuary represents will be maintained.

(h) Provide adequate authority and intent to enforce management policy and use restrictions.

§ 921.31 Changes in the sanctuary boundary, management policy or research program.

(a) The approved sanctuary boundaries; management policy, including permissible and prohibited uses; and research program may only be changed after public notice and the opportunity of public review and participation such as outlined in § 921.21.

(b) Individuals or organizations which are concerned about possible improper use or restriction of use of estuarine sanctuaries may petition the State management agency and the Office of Coastal Zone Management directly for review of the management program.

§ 921.32 Program review.

It is anticipated that reports will be required from the applicant State on a regular basis, no more frequently than annually, on the status of each estuarine sanctuary. The estuarine sanctuary program will be regularly reviewed to ensure that the objectives of the program are being met and that the program itself is scientifically sound. The key to the success of the estuarine sanctuaries program is to assure that the results of the studies and research conducted in these sanctuaries are available in a timely fashion so that the States can develop and administer land and water use programs for the coastal zone. Accordingly, all information and reports, including annual reports, relating to estuarine sanctuaries shall be part of the public record and available at all times for inspection by the public.

PART 922—MARINE SANCTUARIES

Subpart A—General

Sec.

922.1 Policy and objectives.

922.2 Programmatic objectives.

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[15 CFR Part 921]

ESTUARINE SANCTUARY GUIDELINES

Policies and Procedures for Selection Acquisition and Management

AGENCY: National Oceanic and Atmospheric Administration, Department of Commerce.

ACTION: Proposed rule.

SUMMARY: This proposed rule will allow the National Oceanic and Atmospheric Administration to make a preliminary acquisition grant to a State to undertake a fair market value appraisal, and to develop a uniform relocation act plan, a detailed management plan and a research framework for a proposed estuarine sanctuary, developed pursuant to Section 315 of the Coastal Zone Management Act of 1972, as amended.

DATE: Comments must be received on or before October 1, 1977.

FOR FURTHER INFORMATION CONTACT:

Robert R. Kifer, Physical Scientist, Policy and Programs Development Office, Office of Coastal Zone Management, 3300 Whitehaven Parkway, Page One Building, Washington, D.C. 20235 (202-634-4241).

SUPPLEMENTARY INFORMATION: On June 4, 1974, The National Oceanic and Atmospheric Administration (NOAA) published 15 CFR Part 921 entitled, "Estuarine Sanctuary Guidelines" pursuant to then section 312 of the Coastal Zone Management Act of 1972, as amended, for the purpose of establishing policy and procedures for the selection, acquisition, and management of estuarine sanctuaries.

Under new subsection 315(1) of the Act, the Secretary of Commerce is authorized to make available to coastal States grants of up to 50 per centum of the cost of acquisition, development, and operation of estuarine sanctuaries. In general, subsection 315(1) provides that grants may be awarded to States on a matching basis to acquire, develop, and operate natural areas as estuarine sanctuaries in order that scientists and students may be provided the opportunity to examine over a period of time ecological relationships within the area. The purpose of these guidelines is to implement this program.

As a result of two years of program implementation, the regulations are proposed to be modified to specifically authorize the granting of acquisition money to States in two stages:

(i) An initial grant for such preliminary purposes, as surveying and assessing the land to be acquired, and the development of management procedures and research programs; and

(ii) A second grant for the actual acquisition of the land. The Federal share of the sum of the two grants shall not exceed 50 percent of the acquisition costs involved. Any State receiving an initial grant shall be obligated to repay it if, due to any fault of the State, the sanctuary is not established.

As a result of this new grant procedure, much more information relating to costs, values, management procedures, and research programs will be available at the time of the publication of a draft environmental impact statement. Proposals made public to date in the form of an Environmental Impact Statement (EIS) have been criticized for lack of specificity in these areas. By making a small preliminary acquisition grant to a State, the estuarine sanctuary proposal can be more fully developed and the public can become more aware of the costs and the exact nature of the long-term management.

In response to State questions about estuarine sanctuary research, the proposed regulations provide that such research can be funded if it can be shown to be related to program administration.

NOAA has reviewed these proposed regulations pursuant to the National Environmental Policy Act of 1969 and has determined that promulgation of these regulations will have no significant impact on the environment.

Compliance with Executive Order 11821. The economic and inflationary impact of these proposed regulations has been evaluated in accordance with OMB Circular A-107 and it has been determined that no major inflationary impact will result.

Dated: August 26, 1977.

T. P. GLEITER,
Assistant Administrator for Administration.

It is proposed to amend 15 CFR Part 921 as follows:

(1) By revising the table of contents and authority citation to read as follows:

Subpart A—General

Sec.
921.1 Policy and objectives.
921.2 Definitions.
921.3 Objectives and implementation of the program.
921.4 Biogeographic classification.
921.5 Multiple use.
921.6 Relationship to other provisions of the Act and to marine sanctuaries.

Subpart B—Application for Grants

921.10 General.
921.11 Application for preliminary acquisition grants.
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AUTHORITY: Sec. 315(1), Coastal Zone Management Act of 1972, as amended (90 Stat. 1030, (16 U.S.C. 1461) Pub. L. 94-370).

(2) By revising Subpart B—Application for Grants—as follows:

Subpart B—Application for Grants

§ 921.10 General.

Section 315 authorizes Federal grants to coastal States so that the States may establish sanctuaries according to regulations promulgated by the Secretary. Coastal States may file applications for grants with the Associate Administrator for Coastal Zone Management (OCZM), Office of Coastal Zone Management, Page 1, 3300 Whitehaven Parkway NW, Washington, D.C. 20235. That agency which has been certified to the Office of Coastal Zone Management as the entity responsible for administration of the State coastal zone management program may either submit an application directly, or must endorse and approve applications submitted by other agencies within the State.

§ 921.11 Application for preliminary acquisition grants.

(a) A grant may be awarded on a matching basis to cover costs necessary to preliminary actual acquisition of land. As match to the Federal grant, a State may use money, the cost of necessary services, the value of foregone revenue, and/or the value of land either already in its possession or acquired by the State specifically for use in the sanctuary. If the land to be used as match already is in the State's possession and is in a protected status, the State may use such land as match only to the extent of any revenue from the land foregone by the State in order to include it in the sanctuary. Application for a preliminary acquisition grant shall be made on form SF 424 application for Federal assistance (non-construction programs).

(b) A preliminary acquisition grant may be made for the defrayal of the cost of:

(1) An appraisal of the land, or of the value of any foregone use of the land, to be used in the sanctuary;

(2) The development of a Uniform Relocation Assistance and Real Property Acquisition Policies Act plan;

(3) The development of a sanctuary management plan;

(4) The development of a research and educational program; and/or,

(5) Such other activity of a preliminary nature as may be approved in writing by OCZM. Any grant made pursuant to this subsection shall be refunded by the State to whatever extent it has spent in relation to land not acquired for the sanctuary, and if OCZM requests such refund.

(c) The application should contain:

(1) Evidence that the State has conducted a scientific evaluation of its estuaries and selected one of those most representative.

(2) Description of the proposed sanctuary including location, proposed boundaries, and size. A map(s) should be included, as well as an aerial photograph if available.

(3) Classification of the proposed sanctuary according to the biogeographic scheme set forth in § 921.4.

(4) Description of the major physical, geographic, biological characteristics and resources of the proposed sanctuary.

(5) Demonstration of the necessary authority to acquire or control and manage the sanctuary.

(6) Description of existing and potential uses of, and conflicts within, the area if it were not declared an estuarine sanctuary; and potential use restriction and conflicts if the sanctuary is established.

(7) List of protected sites, either within the estuarine sanctuaries program or within other Federal, State, or private programs, which are located in the same region or biogeographic classification.

(8) The manner in which the State solicited the views of interested parties.

(9) In addition to the standard A-95 review procedures, the grant application should be sent to the State Historic Preservation Office for comment to insure compliance with section 106 of the National Preservation Act of 1966.

(d) In order to develop a truly representative scheme of estuarine sanctuaries, the States should coordinate their activities. This will help to minimize the possibility of similar estuarine types being proposed in the same region. The extent to which neighboring States were consulted should be indicated.

§ 921.12 Application for land acquisition grants.

(a) Acquisition grants will be made to acquire land and facilities for estuarine sanctuaries that have been thoroughly described in a preliminary acquisition grant application, or where equivalent information is available. Application for an acquisition grant shall be made on SF 424 application for Federal assistance (construction program).

In general, lands acquired pursuant to this subsection are legitimate costs and their fair market value, developed according to Federal appraisal standards, may be included as match. The value of lands donated to the State and cash donations may also be used as match. If the State already owns land which is to be used in the sanctuary, the value of any use of the land foregone by the State in order to include such land in the sanctuary, capitalized over the next 20 years, may be used by the State as match. The value of lands purchased by a State within the boundaries of proposed sanctuaries while an application for a preliminary acquisition grant or land acquisition grant is being considered may also be used as match.

(b) An acquisition application should contain the following information:

(1) Description of any changes in proposed sanctuary from that presented in the preliminary acquisition grant application. If such an application has not been made, then, information equivalent to that required in such a grant application should be provided.

(2) Identification of ownership patterns, proportions of land already in the public domain; fair market value appraisal and Uniform Relocation Act plan.

(3) Description of research programs, potential and committed research organizations or agencies, and benefits to the overall coastal zone management program.

(4) Description of proposed management techniques, including the management agency and proposed budget—including both State and Federal shares.

(5) Description of planned or anticipated land and water use and controls for contiguous lands surrounding the proposed sanctuary (including, if appropriate, an analysis of the desirability of creating a marine sanctuary in adjacent areas).

(6) Assessment of the environmental, and socio-economic impacts of declaring the area an estuarine sanctuary, including the economic impact on the surrounding community and its tax base.

(7) Discussion, including cost and feasibility of alternative methods for acquisition and protection of the area.

§ 921.13 Application for operation grants.

(a) Although an acquisition grant application for creation of an estuarine sanctuary should include initial operation costs, subsequent applications may be submitted following acquisition and establishment of an estuarine sanctuary for additional operational funds. As indicated in § 921.11, these costs may include administrative costs necessary to monitor the sanctuary and to protect the integrity of the ecosystem. Extensive management programs, capital expenses, or research will not normally be funded by section 315 grants.

(b) After the creation of an estuarine sanctuary established under this program, applications (Form SF 424) for Federal assistance (non-construction program), for such operational grants should include at least the following information:

(1) Identification of the boundary (map).

(2) Specifications of the research and management programs, including managing agency and techniques.

(3) Detailed budget.

(4) Discussion of recent and projected use of the sanctuary.

(5) Perceived threats to the integrity of the sanctuary.

§ 921.14 Federally-owned lands.

(a) Where Federally-owned lands are a part of or adjacent to the area proposed for designation as an estuarine sanctuary, or where the control of land and water uses on such lands is necessary to protect the natural system within the sanctuary, the State should contact the Federal agency maintaining control of the land to request cooperation in providing coordinated management policies. Such lands and State request, and the Federal agency response, should be identified and conveyed to the Office of Coastal Zone Management.

(b) Where such proposed use or control of Federally-owned lands would not conflict with the Federal use of their lands, such cooperation and coordination is encouraged to the maximum extent feasible.

(c) Section 315 grants may not be awarded to Federally-owned lands; however, a similar status may be provided on a voluntary basis for Federally-owned lands under the provisions of the Federal Committee on Ecological Perserves program.

§ 921.20 [Amended]

(4) Subpart C—Selection Criteria—is amended by changing the first sentence in § 921.20 to read: "Applications for preliminary acquisition or land acquisition grants to establish estuarine sanctuaries will be reviewed and judged on criteria including:"

(5) Section 921.21 is revised, as follows:

§ 921.21 Public participation.

(a) Public participation in the selection of an estuarine sanctuary is required. In the selection process, the selecting entity (see § 921.10) shall seek the views of possibly affected landowners, local governments, and Federal agencies, and shall seek the views of possibly interested other parties and organizations. The latter would include, but need not be limited to, private citizens and business, social, and environmental organizations in the area of the site being considered for selection. This solicitation of views may be accomplished by whatever means the selecting entity deems appropriate, but shall include at least one public hearing in the area. Notice of such hearing shall include information as to the time, place, and subject matter, and shall be published in the principal area media. The hearing shall be held no sooner than 15 days following the publication of notice.

(b) The Office of Coastal Zone Management (OCZM) shall prepare draft and final environmental impact statements pertaining to the site finally selected for the estuarine sanctuary following public participation in the selection of that site, and shall distribute these as appropriate. OCZM may hold a public hearing in the area of such site at which both the draft environmental impact statement (DEIS) and the merits of the site selection may be addressed by those in attendance. OCZM shall hold such a hearing if: (1) In its view, the DEIS is controversial, or (2) if there appears to be a need for further informing the public with regard to either the DEIS or one or more aspects of the site selected, or (3) if such a hearing is requested in writing (to either the selecting entity or (CZM) by an affected or interested party, or (4) for other good cause. If held, such hearing shall be held no sooner than 30 days following the issuance of the DEIS and no sooner than 15 days after appropriate notice of such hearing has been given in the area by OCZM with the assistance of the selecting entity.

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