A Plan
From: Vince Ollivier
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IEP inc.

ORLCT-1

Environmental Assessment
Kent Property
Orleans, Massachusetts

September, 1988

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Location

Kent's Point is a narrow, finger-like peninsula of land extending into the headwaters of Little Pleasant Bay, Orleans, Massachusetts. The property has frontage on Frost Fish Cove to the north, Meeting House River ("The River") to the east and south, and Kescayogansett (or Lonnie's) Pond and River to the west - southwest.

Site Description

Kent's Point is one of the few remaining large tracts of undeveloped land in the Town of Orleans with frontage on the Pleasant Bay estuary system. The property is characterized by gentle to steep slopes and supports a variety of habitat types, including pine-oak woodlands, abandoned cranberry bogs, scrub thickets, overgrown fields, and coastal salt marshes.

The property supports a rich and diverse mixture of native and naturalized plant species. One small population of little ladies tresses (*Spiranthes tuberosa*) is located on the site. This small orchid appears on the most recently published (April, 1988) "Watch List" for uncommon or rare Massachusetts plants which is published by the Massachusetts Natural Heritage Program, Boston, Massachusetts.

During the field inspections over 160 plant species were identified on the property. This figure represents just over ten percent of the plants which are reproducing naturally on Cape Cod as reported by Svenson and Pyle in, "The Flora of Cape Cod", 1979. A plant species list for the property is included in Appendix A.

The important role this parcel plays as a botanical preserve and as habitat for rare, threatened, or endangered wildlife cannot be overstated. Yet, the changing land use patterns have influenced and altered the naturally

occurring plant and animal populations on the property. Where natural plant succession has progressed unchecked, the changes are most dramatic. Once open fields and meadows now support pine-oak woodlands and scrub thickets, while the abandoned cranberry bogs are now brackish marshes, swamp thickets, or wet sedge meadows.

Based on the field visits six (6) major habitat types were identified on the point, they are:

1. pine-oak woodlands,
2. salt marshes,
3. overgrown fields and meadows,
4. abandoned cranberry bog,
5. swamp thickets, and
6. lawn community.

Habitat Types and Maps

General habitat descriptions follow.

1. Pine-Oak Woodlands

Dominant tree species within the forest canopy are pitch pine (*Pinus rigida*), black oak (*Quercus velutina*), white oak (*Q. alba*), and scarlet oak (*Q. coccinea*) mixed with red maple (*Acer rubrum*), red cedar (*Juniperus virginiana*), black cherry (*Prunus serotina*), and sweet cherry (*Prunus avium*). Common plants in the understory and ground cover were poison ivy (*Toxicodendron radicans*), lowbush blueberry (*Vaccinium corymbosum*), hair grass (*Deschampsia flexuosa*), arrowwood (*Viburnum recognitum*), and catbrier (*Smilax rotundifolia*).

2. Salt Marshes

The narrow band of salt marsh, which encircles the point, contains salt marsh cordgrass (*Spartina alterniflora*), salt meadow hay (*Spartina patens*), spike grass (*Distichlis spicata*), sea lavender (*Limonium nashii*), glasswort (*Salicornia europaea*), with seablite (*Suaeda linearis*), orach (*Atriplex patula*), black grass (*Juncus gerardi*), and groundsel tree (*Baccharis halimifolia*) along the higher edges or at the base of the coastal banks.

3. Overgrown Fields and Meadows

The abandoned fields and pastures have gentle slopes and are located principally along the south-southwestern sections of the property. A few characteristic herbaceous plants are: blue stemgrass (*Andropogon scoparius*), daisy fleabane (*Erigeron annuus*), golden aster (*Chrysopsis falcata*), blackberry (*Rubus spp.*), bushy aster (*Aster dumosus*), and goldenrods (*Solidago odora, S. nemoralis,* and *S. graminifolia*). Woody species present are: bayberry (*Myrica pensylvanica*), black oak (*Q. velutina*), pitch pine (*Pinus ridiga*), black cherry (*Prunus serotina*), and scrub oak (*Q. ilicifolia*).

4. Abandoned Cranberry Bog

The small abandoned bog (Norgeot/Reed) has succeeded to a wet meadow association, in which the conspicuous plant species are: wool grass (*Scirpus cyperinus*), cotton grass (*Eriophorum virginicum*), water willow (*Decodon verticillatus*), and soft rush (*Juncus effusus*). The wooded border, which completely encircles the bog, was comprised of black alder (*Ilex vertcillata*), highbush blueberry (*Vaccinium corymbosum*), swamp azalea (*Rhododendron viscosum*), and poison sumac (*Rhus vernix*).

5. Swamp Thicket

The larger southwestern bog (Udall) grades from a high salt marsh association of plants into a swamp thicket in which black alder, poison sumac, and highbush blueberry were conspicuous. Understory plants included cinnamon fern (*Osmunda cinnamomea*), blue flag (*Iris versicolor*), and water horehound (*Lycopus spp.*).

6. Lawn Community

The area in the immediate vicinity of the house and out buildings is maintained as a mowed lawn community. Many of the ornamental species were recorded in this area of the property.

Historically, the fields were mowed and open in all directions but, once abandoned, the wooded uplands increased. Many pitch pines and oaks are found on the property with diameters greater than 12 inches DBH. A few specimens greater than 16 inches DBH were recorded for both the pitch pines

and black oaks present. Based on a growth ring count, the larger trees were approximately 45 years old.

Soils

The Interim Soil Survey Report for Barnstable County, Massachusetts, published by the Cape Cod Conservation District (June, 1987) identifies two major soil types on the property (see Appendix B).

The dry, upland soils which comprise nearly all of Kent's Point are Carver coarse sands with 3 to 15 percent slopes. These soils formed in sandy, glacial outwash materials deposited by the glacial meltwater streams. Pine needles, leaves, and twigs cover the surface. The surface soil layer is composed of loose, brown, coarse sand over a much thicker subsoil (@ 2.5 feet) which grades from a "strong, brown, very friable, coarse sand "to a" brownish yellow, loose, coarse sand" with depth. The substratum is "light yellowish brown, loose, coarse sand," and may extend to a depth of 60 inches or more.

The Freetown muck soils developed in organic deposits associated with low wetland areas where the water table is at or near the surface for most of the year. This soil type was identified in association with the wet sedge meadow which has formed on the smaller abandoned bog (Norgeot/Reed).

Wildlife

The field survey work identified the following species based on animal signs (tracks, droppings, pellets) or sightings.

Birds

Black Crowned Night Heron	Morning Dove	Common Tern
Great Blue Heron	Goldfinch	Hairy Woodpecker
Greenbacked Heron	Blue Jay	Downy Woodpecker
Osprey	Kingfisher	Yellowlegs, Greater
Crow	House Finch	Mockingbird
Herring Gull	Catbird	Quail
Common Flicker	Great Horned Owl	Grouse
Merlin	Cormorant	Robin

Mammals

Red Squirrel	Red Fox	Cottontail Rabbit
Gray Squirrel	Raccoon	Skunk
Deer	Short-tailed Shrew	

Further field investigations would most certainly add to the mammal species list based on the habitat types present and current range distributions, particularly for the smaller mammals which would be expected in the area such as shrews, bats, weasels, mice, voles, and opossum.

The annotated list of the birds of Pleasant Bay, which was complied by Blair Nikula for the ACEC application, lists 248 species which occur more or less annually in the area. This list contains three federally listed "endangered" species (Peregrine Falcon, Roseate Tern, and Bald Eagle), and has five species listed as "endangered," four "threatened" species, and 14 "special concern" species for the Commonwealth of Massachusetts.

A revised list of the birds of the Pleasant Bay area is included in Appendix C.

Furthermore, Kent's Point is included in the 1988 Atlas of Estimated Habitat of State-Listed Rare Wetlands Wildlife, published by the Massachusetts Natural Heritage Program. The fringe of salt marsh, exposed sandy banks, and inshore shallow waters, provide important nesting, feeding, and shelter areas for the Diamondback Terrapin (*Malaclemys terrapin*), a state-threatened species.

The Eastern box turtle (*Terrapene carolina*), another state-listed "special concern" species, is a past sited resident species on the property; but, the present field surveys did not document its occurrence on the property. Further field work is recommended to determine its status and to check the abandoned bogs and open grassy areas for additional state-listed species.

The wetland bogs and swamps on Kent's Point are important not only as breeding sites for spring peepers and wood frogs, which have been reported from the site, but also play an important role in providing cover, nest sites, and building materials for the bird species which nest on the property.

Following an overnight rain, a green frog was observed in one of the shallow pools of rain water which collected in the shrub swamp (Udall). Spotted salamanders, red-backed salamanders, and tree frogs are three highly probable resident amphibian species on the property which could be field checked in the spring. Small isolated wetlands, such as these, are very significant to the local amphibian populations.

The coastal marshes and tidal flats of Pleasant Bay are recognized by the U.S. Environmental Protection Agency as a priority wetland for wintering black duck and for common and least terns in the summer months. The freshwater seeps along the southern edge of the point are important geologic features because they provide feeding areas for great blue herons, black ducks, and other winter residents of the bay.

In addition, the coastal salt marshes contribute to the species richness and productivity of Pleasant Bay. Field work conducted by George Buckley, Director of the Pleasant Bay Marine Ecology Project, and his associates, has documented the biological richness of Pleasant Bay.

Many of the smaller marine invertebrates collected during this work are not well known to the casual observer; but, nonetheless, they play an important role in the bay's natural cycles and food chains. Commercially important marine shellfish, such as quahogs, soft shell clams, bay scallops, mussels, and whelks, are harvested from the waters of Pleasant Bay each year. The salt marshes and shallow waters provide the bay with a unique estuarine environment in which these species can prosper. The information collected by the Marine Ecology Project's researchers will be used to develop a flora and fauna inventory of Pleasant Bay, which may be used to develop management strategies for protection of the bay's resources. A preliminary faunal survey of the marine organisms is included in Appendix C.

With the recent break in North Beach, a protective barrier beach, the dynamics of Pleasant Bay have been altered and dramatic changes are underway. Coastal banks and sand dunes have been lost to erosion, currents are altered, and tidal fluctuations have increased significantly.

Less apparent, but equally important, is the influence of the break on the marine organisms of Pleasant Bay. Kent's Point can serve as a focal point from which these changes, and other physical characteristics, can be observed and documented through research and study. The influence of the higher

tides is already apparent on the low plant communities, just above the high salt marsh zone.

Development Pressures

Since habitat diversity is directly correlated to species richness, the development of this property would diminish the property's natural resources and threaten valuable habitat for state-listed species.

The loss of this undeveloped parcel of land to residential development would most certainly have a negative impact on the breeding habitat of both the diamondback terrapin and the Eastern box turtle. Furthermore, the potential damage to the quality of the water in Frost Fish Cove, Kescayogansett Pond, and Meeting House River would be increased due to development.

The development of the Kent Property will result in the input of additional nutrients to the receiving water of "The River," Pleasant Bay, and Frost Fish Cove. Typical sources of nutrients from a residential subdivision include individual sewage disposal systems (ISDS), road runoff, and lawn fertilizer. All these sources input nitrogen through direct surface runoff or ground water infiltration.

Nitrogen is considered to be the limiting nutrient in coastal ecosystems and excessive levels can result in substantial degradation of water quality as documented by recent fish kills in coastal ponds of Falmouth. It is difficult to determine the effect of the additional input without detailed knowledge of many of the parameters relating to the Pleasant Bay estuary. However, nitrogen input from a 23-lot subdivision would represent a significant addition of nutrients to the water body.

Management Recommendations

The loss of valuable habitat diversity which the land now has can be averted through the development and implementation of a sound land-use management plan for the property. The plan should include management guidelines for the proposed educational and recreational uses of the land to ensure that these activities do not negatively impact the important natural resources present.

The abandoned fields are rapidly becoming woody thickets; and IEP recommends that select areas be cut over, on a regular three to five year cycle,

to maintain the open fields with their associated plants and animals. Smooth sumac (*Rhus glabra*), which is an aggressive invading species on abandoned land or disturbed areas, appears in scattered locations on the southwestern end of the point. This species could completely monopolize the partially grassy fields, resulting in a monotypic habitat type with lessened wildlife value. A maintenance program will be needed to keep the fields open. From a wildlife standpoint, allowing the oaks (black, white, and scarlet) to attain a dominant status in the woodlands will increase the land's wildlife value. The progression toward a "hardwood" forest type should favor the smaller birds of prey, such as the sharp-shinned hawk or Cooper's hawk, two "special concern" species. Maintenance of the open fields and "edges" will also provide important habitat for smaller rodents (mice, voles, chipmunks, etc.) which are important food species for the larger predators in the area (fox, great-horned owl, etc.).

In planning for habitat enhancement practices, care must be given to the placing of "wildlife corridors" to ensure that the corridors have sufficient depth and cover to allow for the undisturbed movement of the resident animals through the area. Wherever possible, existing corridors and "animal trails" should be left alone. Viewed on a larger scale, the entire property now serves this function due to its natural conditions and may be justifiably classified as a "Wildlife Conservancy Area."

The land's potential for supervised educational or recreational activities is excellent, but any future trail system should be designed to protect sensitive environmental areas, such as the coastal banks, salt marshes, and known sites for state or federally listed plants and animals. The trail system can be designed to provide outstanding views, without impacting the coastal banks or forested woodlands. Access points to direct the public to the salt marsh edge must be clearly marked; and the construction of wooden stairs, at points where the slopes are gentle, is strongly recommended to minimize negative environmental impacts (bank erosion, trampling of the cover vegetation, soil compaction, etc.). Spreading wood chips or bark mulch on the upland trails is also recommended to lessen damage to the woodlands from public use. Construction of a small, gravel parking area off the access road to the electric poles will provide adequate parking in a less sensitive area. The trail system can be designed to start from and return to this area. Development of an interpretive trail guide, educational leaflets, and a bird blind would increase the educational value for visitors who use the interpretive trails.

Proposed plans for the trail layout should show the location of alternate routes to reduce the risk of negative environmental impacts which may develop from the long term use of a single pathway. A proposed trail layout is shown on Map 1.

Relocating the Town of Orlean's shellfishing biology laboratory to the property is also highly desirable, for the site is close to important seed areas and a strong alewife (*Alosa pseudoharangus*) fish run (Pilgrim Lake/Kescayogansett Pond). The bay is also a significant nursery and spawning area for winter flounder (*Pseudopleuronectes americanus*) and American eel (*Anquilla rostrata*) which spawns well off shore beyond the continental shelf. As noted in the work produced by George Buckley, the bay supports a rich and complex marine community (Appendix C) with many commercially important shellfish and finfish species including: scallops, soft shell clams, mussells, quahogs, striped bass, and bluefish. The bay's eelgrass beds, which are recognized feeding ground, shelter, and nursery area for many species of fish and marine invertebrates, can also be more closely monitored through the relocation of the shellfish laboratory and office. It would also provide a measure of security for the property.

In addition, IEP recommends the following management actions be taken to protect the property's resources:

1) Review all proposed activities on the point to protect the salt marsh's capacity to function as an estuarine nursery; and as a natural buffer which reduces storm erosion of the coastal banks.

2) Implement strategies to protect cultural features on the site.

3) Encourage a mixture of habitat types for educational, aesthetic, and research purposes through the development of a written management policy with clearly defined goals and objectives. This management policy should be reviewed and updated on a regular yearly basis.

4) Maintain a well-balanced "edge" and natural linkage between the habitat types to provide wildlife corridors.

5) Develop cooperative programs with local environmental groups to develop the land's "interpretive" functions.

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APPENDIX A

Plant Species
Kent Property
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Plant Species
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Dryopteris spinulosa	spinulose wood fern
Osmunda cinnamomea	cinnamon fern
Onoclea sensibilis	sensitive fern
Dennstaedtia punctilobula	hay scented fern
Thelypteris thelypteroides	marsh fern
Pteridium aquilinum	bracken fern
Juniperus virginiana	red cedar
Juniperus communis	ground juniper
Pinus rigida	pitch pine
Sparganium americanum	bur-reed
Calamagrostis canadensis	blue joint grass
Distichlis spicata	spike grass
Elymus virginicus	wild rye
Deschampsia flexuosa	hairgrass
Ammophila breviligulata	beachgrass
Spartina alterniflora	salt water cordgrass
Spartina patens	salt meadow hay
Spartina patens var. monogyna	salt meadow hay (var.)
Andropogon scoparius	blue stem
Panicum virgatum	panic grass
Andropogon virginicus	broom sedge
Cyperus spp.	sedge
Scirpus americanus	chairmaker's rush
Carex scoparia	sedge
Juncus tenuis	slender rush
Juncus effusus	soft rush
Juncus gerardi	black rush
Asparagus officinalis	asparagus
Smilax rotundifolia	catbrier

Iris versicolor	blue flag
Cypripedium acaule	pink lady's slipper
Spiranthes tuberosa	little ladies tresses (State: Watch List)
Populus tremuloides	trembling aspen
Populus grandidentata	large toothed aspen
Myrica pensylvanica	bayberry
Quercus alba	white oak
Quercus velutina	black oak
Quercus coccinea	scarlet oak
Quercus ilicifolia	scrub oak
Morus alba	white mulberry
Rumex crispus	dock, common
Rumex acetosella	sheep sorrel
Polygonum scandens	climbing false buckwheat
Atriplex patula	orach
Salicornia europaea	glasswort
Suaeda linearis	seablite
Salicornia virginica	woody glasswort
Dianthus armeria	deptford pink
Berberis vulgaris	common barberry
Chelidonium majus	celandine poppy
Lunaria annua	honesty
Rosa multiflora	multiflora rose
Amelanchier canadensis	shadbush
Fragaria virginiana	wild strawberry
Rubus hispidus	dewberry
Rosa eglanteria	sweet brier
Rubus spp.	blackberry

Rosa virginiana	field rose
Rosa rugosa	salt-spray rose
Prunus maritima	beach plum
Prunus serotina	black cherry
Prunus avium	sweet cherry
Pyrus malus	apple
Rosa spinosissima	scotch rose
Ribes spp.	current
Baptisia tinctoria	wild indigo
Cytisus scoparius	scotch broom
Robinia pseudo-acacia	black locust
Lathyrus latifolius	everlasting pea
Trifolium pratense	red clover
Gleditsia triacanthos	honey locust
Rhus vernix	poison sumac
Toxicodendron radicans	poison ivy
Rhus glabra	smooth sumac
Ilex verticillata	black alder
Euonymus europaeus	euonymus
Celastrus orbiculatus	oriental bittersweet
Acer platanoides	Norway maple
Acer rubrum	red maple
Parthenocissus quinquefolia	virgina creeper
Vitis labrusca	fox grape
Vitis aestivalis	summer grape
Triadenum virginicum	marsh St. John's wort
Hypericum perforatum	common St. John's wort
Hudsonia tomentosa	poverty grass
Lechea intermedia (spp.?)	pinweed
Daucus carota	wild carrot

Chimaphila maculata	spotted wintergreen
Arctostaphylos uva-ursi	bearberry
Vaccinium macrocarpon	large cranberry
Limonium nashii	sea lavender
Syringa vulgaris	lilac
Asclepias syriaca	common milkweed
Prunella vulgaris	heal-all
Solanum dulcamara	bittersweet nightshade
Verbascum thapsus	common mullein
Linaria vulgaris	butter and eggs
Lonicera morrowi	bush honeysuckle
Lonicera japonica	Japanese honeysuckle
Viburnum recognitum	arrow-wood
Iva frutescens	marsh elder
Chrysopsis falcata	golden aster
Solidago sempervirens	seaside goldenrod
Solidago odora	sweet goldenrod
Aster dumosus	bush aster
Aster tenuifolius	large salt marsh aster
Aster linariifolius	stiff aster
Erigeron annuus	fleabane
Baccharis halimifolia	groundsel tree
Hieracium flagellare	large mouse ear
Ambrosia artemisiifolia	ragweed
Hypochoeris radicata	cat's ear
Achillea millefolium	yarrow
Chrysanthemum leucanthemum	ox-eye daisy
Lactuca biennis	blue-flowered lettuce
Solidago tenuifolia	narrow-leaved goldenrod
Solidago graminifolia	grass-leaved goldenrod
Solidago nemoralis	gray goldenrod

Solidago rugosa	rough goldenrod
Erigeron canadensis	horseweed
Cirsium vulgare	bull thistle
Gnaphalium obtusifolium	sweet everlasting

Additional Species

Pyrus floribunda	purple chokeberry
Suaeda maritima	low sea blite
Oenothera biennis	common primrose
Eleagnus umbellata	olive
Scirpus cyperinus	woolgrass
Trientalis borealis	starflower
Lyonia ligustrina	maleberry
Kalmia angustifolia	sheep laurel
Vaccinium corymbosum	highbush blueberry
Lycopus spp.	water horehound
Vaccinium angustifolium	lowbush blueberry
Monotropa hypopithys	pinesap
Monotropa uniflora	indian pipe
Pyrola rotundifolia	shinleaf
Clethra alnifolia	sweet pepper bush
Plantago spp.	plantain
Danthonia spicata	poverty grass
Festuca rubra	red fescue
Anthoxanthum odoratum	sweet vernal grass
Campsis radicans	trumpet creeper vine
Polygonella articulata	sand jointweed
Pinus strobus	white pine
Potentilla simplex	common cinquefoil
Bidens frondosa	beggar's tick
Trifolium arvense	rabbit-foot clover

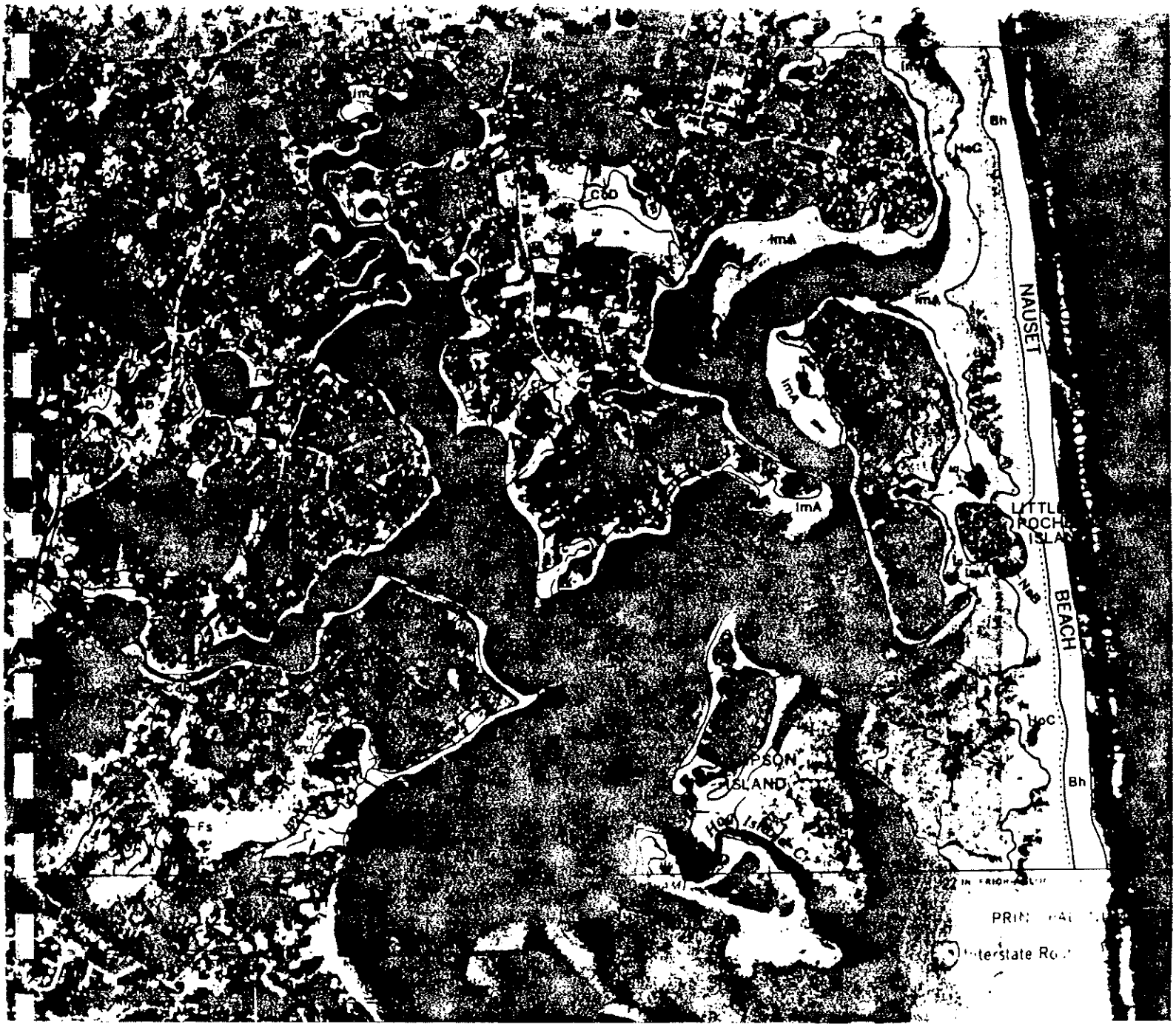
Saponaria officinalis	bouncing bet
Lilium tigrinum	tiger lily
Hemerocallis fulva	day lily
Rhododendron viscosum	swamp azalea
Thuja occidentalis	arborvitae
Picea abies	Norway spruce
Aster novi-belgii	New York aster
Epigaea repens	mayflower
Barbarea vulgaris	common wintercress
Convallaria majalis	lily-of-the-valley
Lepidium spp.	peppergrass
Prunus spp.	peach
Aesculus hippocastanum	horse chestnut
Gaylussacia baccata	huckleberry
Chenopodium rubrum	coast blite
Phytolacca americana	pokeweed
Hedera helix	english ivy
Wisteria floribunda	wisteria

Reported Species:

Quercus rubra	red oak
Acer pseudo-platanus	sycamore maple
Prunus pennsylvanica	pin cherry
Prunus virginianum	choke cherry
Rhamnus cathartica	common buckthorn
Salsola kali	common saltwort
Chimaphila maculata	pipsissewa
Ranuculus repens	creeping buttercup
Hypericum canadense	Canada St. John's wort
Ulmus spp.	weeping elm
Myrica gale	sweet gale

APPENDIX B

Soil Characteristics
Kent Property
Orleans, Massachusetts



Location: Kent Property
Orleans, Massachusetts

Map reproduced from: Interim Soil Survey Report, Barnstable County, Massachusetts. Published by the Cape Cod Conservation District, June 1987.

CARVER soils formed in sandy material (glacial outwash). They developed in dry, upland areas that have a water table greater than 6 feet below the surface. Carver soils are nearly level to steep (0 to 35 percent slopes), and occur on a wide range of landscapes ranging from broad plains to steep hills and ridges.

There are two different Carver soil types mapped within Barnstable County: Carver loamy coarse sand and Carver coarse sand. Brief descriptions for both are given.

Typically the surface of Carver loamy coarse sand soils is covered with a layer comprised of nondecomposed and partially decomposed pine needles, leaves and twigs. The surface layer is light brownish gray, very friable, loamy coarse sand about 3 inches thick. The subsoil is about 16 inches thick. The upper portion is dark brown, very friable, loamy coarse sand which grades with depth to a brownish yellow, very friable, coarse sand. The substratum is light yellowish brown, loose, coarse sand and extends to a depth of 60 or more inches.

Typically the surface of Carver coarse sand soils is covered with a layer comprised of nondecomposed and partially decomposed pine needles, leaves and twigs. The surface layer is brown, loose, coarse sand about 7 inches thick. The subsoil is about 2.5 feet thick. The upper portion is a strong, brown, very friable, coarse sand which grades with depth to a brownish yellow, loose, coarse sand. The substratum extends to a depth of 60 inches or more. It is light yellowish brown, loose, coarse sand.

FREETOWN AND SWANSEA mucks are areas of one or both of these soils. Freetown and Swansea soils were not separated in mapping because there are no major differences in their use and management. These soils developed in level (0 to 1 percent slopes) wetland areas that have a water table at or near the surface for most of the year.

Freetown soils developed in deep deposits (>51 inches) of organic matter. Typically they have a surface layer about 2 inches thick of dark reddish brown muck. Below the surface layer and to a depth of 60 inches or more, are alternating layers of dark reddish brown and very dusky red muck.

Swansea soils developed in organic material (15 to 51 inches thick) and are underlain by sandy and gravelly material. Typically these soils have a surface layer of black muck about 2 inches thick. Below the surface layer and to a depth of about 2.5 feet is very dark gray and black muck. The substratum extends to a depth of 60 inches or more. It is a yellowish brown, very friable, loamy sand that grades with depth to a dark yellowish brown, very friable, loamy sand.

Freetown and Swansea soils are very poorly drained soils that have a seasonal high water table at or near the surface for most of the year. Permeability of the Freetown soils is moderate (0.6-2.0 in/hr) or moderately rapid (2.0-6.0 in/hr) in the subsoil and substratum. Permeability of the Swansea soils is moderate (0.6-2.0 in/hr) or moderately rapid (2.0-6.0 in/hr) in the subsoil, and very rapid (>20 in/hr) in the substratum.

APPENDIX C

Wildlife
Kent Property
Orleans, Massachusetts

This list was compiled by: Blair Nikula* (23 Atwood Lane, Chatham)

*Blair Nikula, a Chatham resident, has been birding on Cape Cod for over 20 years. He has taught courses on birds at the Cape Cod Museum of Natural History, at the University of Maine and at the Wellfleet Bay Wildlife Sanctuary where he has also served as a Season Naturalist. He has been vice-president and president of the Cape Cod Bird Club and organized and led birding trips to various far flung parts of North America. At present, he is Regional Editor of American Birds, a special publication of the National Audobon Society, and as such he compiles and reports on ornithological sightings in the five New England states and the four Canadian maritime provinces.

Red-throated Loon: rare fall migrant and winter visitor.
Common Loon: rare to uncommon migrant and winter visitor. Mass. Special Concern
Pied-billed Grebe: rare winter visitor, usually only after being frozen out of freshwater ponds. Mass. Threatened
Horned Grebe: uncommon fall migrant.
Great Cormorant: common winter resident; increasing in the last decade.
Double-crested Cormorant: common migrant and summer resident (not known to breed); increasing dramatically.
American Bittern: rare but regular fall migrant and winter visitor. Mass Special Concern
Great Blue Heron: common migrant and winter resident.
Great Egret: rare but regular visitor, April - October.
Snowy Egret: uncommon to fairly common visitor, April - October; nests on south Monomoy Island.
Little Blue Heron: rare but regular visitor, April - November.
Cattle Egret: rare visitor, April - October.
Tricolored Heron: rare visitor, April - September.
Green-backed Heron: uncommon nester and migrant.
Black-crowned Night-Heron: uncommon spring and summer visitor, fairly common fall migrant. Nests on south Monomoy Island.
Yellow-crowned Night-Heron: rare visitor, April - October.
Glossy Ibis: rare but regular visitors, April - September; usually in small flocks of 3-10 birds.
Mute Swan: rare but increasingly regular visitor; at least one pair nests nearby.
Snow Goose: rare migrant.
Brant: common to abundant migrant and winter resident; occasionally up to a few hundred present.
Canada Goose: abundant migrant and winter resident; occasionally over 1,000 present.
Green-winged Teal: uncommon migrant and winter visitor.
American Black Duck: abundant migrant and winter resident; numbers often over 1,000.

Source: Pleasant Bay Area of Critical Environmental Concern: Draft Policy. (Appendix VIII). Four Towns ACEC Nominating Committee. 1986. Reviewed September, 1988.

Mallard: common year-round resident, a few pairs nest (almost all are descendants of feral birds).
Northern Pintail: uncommon migrant, rare winter visitor.
Blue-winged Teal: rare to uncommon migrant.
Gadwall: rare migrant.
Eurasian Wigeon: uncommon migrant and winter visitor.
American Wigeon: uncommon migrant and winter visitor.
Canvasback: uncommon winter visitor, primarily after freshwater ponds freeze.
Greater Scaup: fairly common migrant and winter resident.
Lesser Scaup: rare winter visitor, primarily after freshwater ponds freeze.
Common Eider: common to abundant winter resident; flocks of 5,000 - 10,000 occasionally present in the mouth of the Bay.
Oldsquaw: fairly common migrant and winter visitor, primarily in the mouth of the Bay.
Black Scoter: uncommon migrant and winter visitor; primarily in the mouth of the Bay.
White-winged Scoter: fairly common migrant and winter visitor; primarily in the mouth of the Bay.
Common Goldeneye: common to abundant winter resident.
Barrow's Goldeneye: rare but regular winter resident.
Bufflehead: Abundant winter resident.
Hooded Merganser: uncommon winter visitor after freshwater freezes.
Common Merganser: uncommon winter visitor, after ponds freeze.
Red-breasted Merganser:common to abundant winter resident.
Osprey: uncommon migrant, rare nester (one pair currently nesting) Mass. Special Concern.
Bald Eagle: rare but regular visitor at all seasons; up to 3-4 have wintered in some years. U.S. & Mass. Endangered.
N. Harrier: uncommon migrant & winter resident; nesting suspected. Mass Threatened.
Sharp-shinned Hawk: fairly common migrant, uncommon winter resident. Mass. Special Concern.
Cooper's Hawk: **rare but regular migrant and winter visitor.** Mass. Special Concern.
Northern Goshawk: rare and irregular winter visitor.
Broad-winged Hawk: rare migrant, primarily in spring.
Red-tailed Hawk: uncommon year-round resident; nests on adjacent uplands and possible on the islands in the Bay.
Rough-legged Hawk: rare winter resident and migrant.
American Kestrel: uncommon year-round resident; fairly common spring migrant.
Merlin: uncommon migrant, rare winter resident.
Peregrine Falcon: uncommon migrant; rare winter visitor. U.S. & Mass. Endangered.
Ring-necked Pleasant: uncommon year-round resident.
Northern Bobwhite: fairly common year-round resident.
Clapper Rail: rare to uncommon fall visitor; rare winter visitor; may occasionally nest.
Virginia Rail: uncommon migrant; rare winter visitor.

Sora: uncommon migrant.
Black-bellied Plover: common to abundant migrant; uncommon winter visitor.
Lesser Golden-Plover: rare to uncommon fall migrant.
Semipalmated Plover: uncommon spring and common to abundant fall migrant.
Piping Plover: uncommon migrant and nester (estimated 4-5 pairs on North Beach). U.S. & Mass. Threatened.
Killdeer: rare to uncommon migrant.
American Oystercatcher: uncommon summer visitor; rare nester (1-2 pairs on North Beach).
Greater Yellowlegs: common migrant; rare winter visitor.
Lesser Yellowlegs: rare spring and common fall migrant.
Willet: uncommon migrant and nester (3-4 pairs on North Beach).
Spotted Sandpiper: uncommon migrant; rare winter visitor.
Upland Sandpiper: rare migrant. Mass. Endangered.
Whimbrel: rare spring and fairly common fall migrant.
Hudsonian Godwit: rare fall migrant.
Marbled Godwit: rare fall migrant.
Ruddy Turnstone: common migrant.
Red Knot: uncommon spring and common to abundant fall migrant; rare winter visitor.
Sanderling: common to abundant migrant; uncommon to fairly common winter resident.
Semipalmated Sandpiper: common to abundant migrant.
Western Sandpiper: rare to uncommon fall migrant.
Least Sandpiper: common spring and common to abundant fall migrant.
White-rumped Sandpiper: uncommon migrant.
Baird's Sandpiper: rare fall migrant.
Pectoral Sandpiper: rare spring and uncommon fall migrant.
Dunlin: common to abundant migrant; fairly common winter resident.
Stilt Sandpiper: rare fall migrant.
Buff-breasted Sandpiper: rare fall migrant.
Short-billed Dowitcher: uncommon spring and common to abundant fall migration.
Long-billed Dowitcher: rare fall migrant.
Common Snipe: uncommon migrant; rare winter visitor.
American Woodcodk: uncommon nester and migrant; rare winter visitor.
Wilson's Phalarope: rare fall migrant.
Red-necked Phalarope: rare migrant.
Laughing Gull: common migrant and summer visitor; nests on north Monomoy.
Little Gull: rare migrant and winter visitor.
Common Black-headed Gull: rare migrant and winter visitor.
Bonaparte's Gull: uncommon spring and common fall migrant; uncommon winter visitor.
Ring-billed Gull: common to abundant migrant and winter resident.
Herring Gull: abundant year-round resident; nests on Monomoy Island.
Iceland Gull: rare to uncommon winter visitor.
Glaucous Gull: rare winter visitor.
Great Black-backed Gull: abundant year-round visitor; nests on Monomoy Island.

Black-legged Kittiwake: uncommon to common winter visitor, primarily in the mouth of the Bay.
Royal Tern: rare summer visitor.
Roseate Tern: uncommon to common migrant and summer visitor; formerly nested on Monomoy. U.S. & Mass. Endangered
Common Tern: common to abundant migrant and summer visitor; nests on Monomoy. Mass Special Concern.
Arctic Tern: rare to uncommon summer visitor; formerly nested on Monomoy. Mass. Special Concern.
Forster's Tern: uncommon fall migrant.
Least Tern: common to abundant summer resident; usually nests on North Beach, but numbers highly variable from year to year. Mass. Special Concern.
Black Tern: rare spring migrant, uncommon fall migrant.
Black Skimmer: rare to uncommon summer visitor.
Rock Dove: fairly common resident.
Mourning Dove: common to abundant year-round resident.
Black-billed Cuckoo: rare nester; rare to uncommon migrant.
Yellow-billed Cuckoo: rare nester; rare to uncommon migrant.
Common Barn-owl: rare visitor. Mass. Special Concern.
Eastern Screech-Owl: rare visitor; may nest nearby.
Great Horned Owl: fairly common year-round resident.
Snowy Owl: rare and irregular winter visitor.
Long-eared Owl: rare visitor. Mass. Special Concern.
Short-eared Owl: rare to uncommon migrant and winter visitor; may nest on North Beach. Mass. Endangered.
Northern Saw-whet Owl: rare winter visitor and fall migrant.
Common Nighthawk: rare migrant.
Whip-poor-will: uncommon and declining nester.
Chimney Swift: uncommon summer resident and migrant.
Ruby-throated Hummingbird: uncommon migrant; may nest.
Belted Kingfisher: uncommon year-round resident.
Red-headed Woodpecker: rare migrant.
Yellow-bellied Sapsucker: uncommon migrant.
Downy Woodpecker: common resident.
Hairy Woodpecker: rare to uncommon resident.
Northern Flicker: common resident and migrant.
Olive-sided Flycatcher: rare migrant.
Eastern Wood-Pewee: uncommon to fairly common nester and migrant.
Yellow-bellied Flycatcher: rare to uncommon migrant.
Alder Flycatcher: rare migrant (presumed - status uncertain; cannot be safely identified in the field).
Willow Flycatcher: uncommon migrant, rare nester.
Least Flycatcher: uncommon migrant.
Eastern Phoebe: uncommon migrant, rare nester.
Great Crested Flycatcher: uncommon nester and migrant.
Western Kingbird: rare fall migrant.
Eastern Kingbird: common migrant, uncommon nester.
Horned Lark: common resident.
Purple Martin: uncommon migrant and summer visitor.
Tree Swallow: common nester and migrant.
Northern Rough-winged Swallow: rare nester, uncommon migrant.

Bank Swallow: uncommon migrant.
Cliff Swallow: rare migrant.
Barn Swallow: common nester and migrant.
Blue Jay: common resident.
Black-capped Chickadee: common resident
Tufted Titmouse: uncommon resident.
Red-breasted Nuthatch: common migrant, uncommon winter resident; may nest rarely.
White-breasted Nuthatch: uncommon year-round resident.
Brown Creeper: rare nester, uncommon migrant.
Carolina Wren: rare year-round resident.
House Wren: rare nester and migrant.
Winter Wren: uncommon migrant, rare winter visitor.
Marsh Wren: rare to uncommon migrant, rare winter visitor.
Golden-crowned Kinglet: uncommon to fairly common migrant and winter resident.
Ruby-crowned Kinglet: common migrant, rare winter visitor.
Blue-gray Gnatcatcher: uncommon migrant.
Eastern Bluebird: rare visitor.
Veery: uncommon migrant.
Gray-cheeked Thrush: rare migrant.
Swainson's Thrush: uncommon to fairly common migrant.
Hermit Thrush: uncommon migrant, rare winter visitor.
Wood Thrush: rare migrant, rare nester (?).
American Robin: common nester and migrant, uncommon to fairly common winter resident.
Gray Catbird: common nester and migrant, rare winter visitor.
Northern Mockingbird: common year-round resident.
Brown Thrasher: rare to uncommon nester and migrant.
Water Pipit: rare to uncommon spring and common fall migrant.
Cedar Waxwing: rare to uncommon nester, common migrant, uncommon winter visitor.
Northern Shrike: rare winter visitor.
European Starling: common nester, abundant migrant and winter resident.
White-eyed Vireo: rare migrant, may nest rarely.
Solitary Vireo: uncommon migrant.
Yellow-throated Vireo: rare migrant.
Warbling Vireo: rare migrant.
Philadelphia Vireo: rare spring and uncommon fall migrant.
Red-eyed Vireo: uncommon nester, common migrant.
Blue-winged Warbler: rare spring and uncommon fall migrant.
Golden-winged Warbler: rare migrant. Mass. Threatened.
Tennessee Warbler: uncommon migrant.
Orange-crowned Warbler: rare to uncommon fall migrant, rare winter visitor.
Nashville Warbler: uncommon migrant.
Northern Parula: uncommon to fairly common migrant. Mass. Special Concern.
Yellow Warbler: common nester and migrant.
Chestnut-sided Warbler: uncommon migrant.
Magnolia Warbler: fairly common migrant.
Cape May Warbler: uncommon spring and common fall migrant.

Black-throated Blue Warbler: uncommon migrant.
Yellow-rumped Warbler: common to abundant migrant, common winter resident.
Black-throated Green Warbler: uncommon migrant.
Blackburnian Warbler: uncommon migrant.
Pine Warbler: fairly common nester, uncommon migrant.
Prairie Warbler: fairly common nester, uncommon migrant.
Palm Warbler: common migrant, rare winter visitor.
Bay-breasted Warbler: uncommon migrant.
Blackpoll Warbler: common migrant. Mass. Special Concern.
Black-and-white Warbler: rare nester, fairly common migrant.
American Redstart: rare nester, fairly common migrant.
Ovenbird: rare nester, uncommon migrant.
Northern Waterthrush: uncommon migrant.
Connecticut Warbler: rare fall migrant.
Mourning Warbler: rare to uncommon migrant. Mass Special Concern.
Common Yellowthroat: common nester and migrant, rare winter visitor.
Wilson's Warbler: uncommon migrant.
Canada Warbler: uncommon migrant.
Yellow-breasted Chat: rare migrant; may nest rarely.
Scarlet Tanager: uncommon migrant.
Northern Cardinal: common resident.
Rose-breasted Grosbeak: uncommon migrant.
Indigo Bunting: uncommon migrant.
Dickcissel: rare fall migrant.
Rufous-sided Towhee: fairly common nester, uncommon migrant, rare winter visitor.
American Tree Sparrow: uncommon winter visitor.
hipping Sparrow: common nester, uncommon migrant.
Field Sparrow: rare nester, uncommon migrant.
Vesper Sparrow: rare fall migrant
Savannah Sparrow: common nester and migrant, uncommon winter resident.
Grasshopper Sparrow: rare fall migrant. Mass. Special Concern.
Sharp-tailed Sparrow: common nester, rare winter visitor.
Seaside Sparrow: may nest rarely, rare migrant and winter visitor.
Fox Sparrow: rare migrant and winter visitor.
Song Sparrow: common year-round resident.
Lincoln's Sparrow: uncommon fall migrant.
Swamp Sparrow: uncommon migrant and winter resident.
White-throated Sparrow: commom migrant and winter resident.
White-crowned Sparrow: uncommon migrant.
Dark-eyed Junco: common migrant and uncommon winter resident.
Lapland Longspur: uncommon migrant and winter resident.
Snow Bunting: common fall migrant and uncommon winter resident.
Bobolink: uncommon spring, common fall migrant.
Red-winged Blackbird: common nester and migrant; rare winter visitor.
Eastern Meadowlark: uncommon migrant and winter resident.
Rusty Blackbird: uncommon migrant.
Common Grackle: common nester; common to abundant migrant; rare winter visitor.

Brown-headed Cowbird: common nester and migrant; rare winter visitor.
Orchard Oriole: rare spring migrant.
Northern Oriole: common nester and migrant; rare winter visitor.
Purple Finch: uncommon nester and winter resident; fairly common migrant.
House Finch: common year-round resident.
Pine Siskin: rare to common winter visitor.
American Goldfinch: common year-round resident.
Evening Grosbeak: rare to common winter visitor.
House Sparrow: common year-round resident.

FAUNAL SURVEY OF SELECTED AREAS OF PLEASANT BAY, CAPE COD, MASSACHUSETTS

by P. Morse and G. Buckley

* Note: most common organisms

PHYLUM PORIFERA: Sponges, softbodied, very simple invertebrate

* Leucoselenia sp. - Whitish sponge found associated with the eel grass, the uncommon one, usually right at the base.

* Cliona sp. - Brilliant yellow sponge usually in oval masses commonly washed on shore and found subtidally, especially in the Narrows.

Halacondria sp. - Very common at the bases of the eel grass. Usually a yellow to dirty tan color.

* Microciona prolifera - A brilliant red sponge which has two common growth forms. One is an upright tubular type growth and another is flat encrusting. Commonly found growing on dead clam and quahog shells. This is just subtidal in occurrence and it stands out by the color.

PHYLUM COELENTERATA: soft bodied, "Jellyfish-like", medusa or polypbody-form

Hydrozoa - These were not too plentiful which would be expected in an estuarine situation. Some hermit crabs were taken from Sipson Island which had an hydrozoan on the surface which was probably either Hydractinia or Podocoryne but I did not see it back at the lab.

Scyphozoa - None were seen during the expedition but two weeks earlier, Aurelia aurita were seen in great quantities throughout the bay.

Anthozoa - Sea Anenome-like

Nematostella ectensis - On Strong Island, there is a salt pond just behind the boathouse on the East Side. Adhering to the algae were found several of the usually burrowing Nematostella.

Haliplanella luciae - This species seems to be found on the upper limit of the subtidal line on the large glacial boulders in the bay.

PHYLUM PLATYHELMINTHES: Flatworms

Class Turbellaria

Childia spinosa - This is one of the most exciting finds. This was taken in a plankton haul near eel grass and it is not presently known whether it came from the eel grass or was actually a part of the plankton. At any rate, it is a species which

Childia spinosa (cont.'d)

was originally described by Von Graff and was later (1959) synonymized by Hyman. This is the first known taking of this species since the original description by Von Graff.

Kalyptorhynchia: Several unidentified species were taken in the interstitial samples and are as yet unidentified.

Acoels: Several of this group were also taken in the interstitial fauna and are also not identified.

* Bdelloura candida - This is an ectoparasite on the underside of Limulus polyphemus. It occurs in great numbers being noticeably more abundant on the large female horseshoe crabs. These forms are described as commensals and they deposit their eggs in the book-gills of Limulus. These can be seen as dark black spots in the gills and are noticeable in the large Limulus. One observation I made was that they are often very dense in the depression at the most anterior part of the ventral carapace in front of the appendages. Also, although they are usually described as being at the bases of the appendages, they appear to be more common at the junctions of the segmented appendages clinging to the arthropodial membranes.

Stylochus ellipticus - This species with two obvious tentacles and marginal eyes was taken in several interstitial samples.

PHYLUM NEMERTEA

Tetrastema sp. - These were common in some of the samples of the interstitial animals. They appear as rather short (as nemerteans go) cream-colored forms with four dark eyes.

Amphiporus sp. - These also were found in the interstitial samples. These can be distinguished from Tetrastema by having either less or more pairs of ocelli.

PHYLUM SIPUNCULIDA

Golfingia gouldi - This is a rather common animal which lives in the mudflats. They are rather deep and thus one does not usually find them on a regular shovel full of gravel. They were common off Old Field Point (below the Sargent's house) and they were also taken from the sand spit on low tide (-0.2) in the middle of the mud flat behind Sipson Island. Small ones were taken on several occasions from the Narrows in interstitial samples.

PHYLUM ANNELIDA: Segmented worms

Class Archiannelida - What appears as a new species of this group was found by Dr. N.W. Riser in an interstitial sample.

Class Polychaeta

* Arenicola cristata - Several interesting populations of this species were found in Pleasant Bay and this by no means indicated its distribution. On Old Field Point (below the Sargent's house) there are some relatively small ones which do not have any egg masses associated with them. They also seem to be rather shallow in the substrate. Out at Sipson Island, on the west side where on the chart it is marked "foul", there is a very substantial population which also shows the classical mounds, depressions, and globular egg mass. They are subtidal and were observed by walking in about 2 feet of water at 0.1 low tide.

* Glycera dibranchiata - This was taken at Old Field Point and was quite common. This is probably common throughout the Bay but is only taken by spading and a minimum of this sort of collecting was done.

Family Maldanidae - Several times maldanidids were taken but they were not keyed out before they died. They are easily recognized by their segments being longer than wide.

Nereis sp. - Specimens of this genus were taken, especially on the mainland side of the Narrows at the outer edge at the low tide (-0.4) in coarse sand. These were probably Nereis pelagica but closer identifications will have to be made.

Family Opheliidae - Numerous interstitial samples from the east and west side of Sipson Island yielded numerous ophelids, and it is probably that in this case they were young of a larger form. The adult population was not located but the Narrows offers numerous sandy areas just subtidally which these forms may prefer.

Scoloplos sp. - These were found in parts from the mud flat at Old Field Point. Yellow-orange worms with dorsally placed parapod in parts of their body.

Pectinaria gouldii - A typical sand tube of the "mason worm" was dug at Old Field Point. All indications would point to a living population in the area although I did not find a living specimen.

* Spirobis granulatus - Often found on eel grass. Has longitudinal ridges in the calcareous tube.

* Hydroides dianthus - The tubes of this species were found at the Narrows. They are intertwined and are common on the shells of Mya and Aequipecten.

Syllis sp. - Several species of syllids were seen in the interstitial samples and they were in various phases of sexual reproduction. They can be separated from the rest of the family syllidae by the beaded and head tentacles.

Family Terebellidae - Common in the interstitial were parts of the bright red terebellid which was probably in the genus Pista.

PHYLUM ARTHROPODA: Joint footed

Class Xiphosurida

Limulus polyphemus - The horseshoe crab is one of the commonest inhabitants of Pleasant Bay. They occur in large numbers, and all sizes and states of sexual maturity can be found in the Bay in the month of July. We found eggs hatching both from Strong Island samples and Hog Island samples. Second molt youngsters still without their telson were often found in interstitial samples. In the mudflat behind Sipson Island, many first year forms were found. Not too many were doubles (or in the mating posture) but several very large mates were found around Old Field Point. On one occasion a sea gull (Larus argenataus) was observed feeding on an horseshoe crab, and Dr. Henry Russell (M.C.Z. Harvard Univ.) reported he had observed predation by sea gulls in Duxbury.

Subclass Ostracoda - These so called seed shrimp which have a small bivalved carapace were found in several interstitial samples and were of two types. One type had a smooth oval white shell and the other had a more rounded and ridged (and was bigger) white shell.

Subclass Copepoda - On numerous occasions barpacticoid copepods were found in bottom samples. They usually have a single egg case, have short antennae, and run quickly around the sediments.

Subclass Cirripedia:

* Balanus - Barnacles are common in two places in the bay. First is on the sides of the few large boulders that have been deposited by the glacier, the second is on the small bouldered beaches which are characteristic of the two Islands (Sipson and Strong) in the exposed areas.

Superorder Peracarida

Order Cumacea - Common among the interstitial samples where other crustaceans were abundant. Of the genus Diastylis these are easily recognized by the inflated cephalothorax and the slender abdomen ending in a forked tail. (or extended uropods)

Order Isopoda

* Probopyrus Pandalicola - Parasitic in gill chamber of marsh shrimp Palaemonetes.

Sphaeroma sp. - Small pill bug found in the interstitial samples.

Chiridotea sp. - Flattened forms, rather large in the interstitial samples with notches on the side of the head, flat broad body and pointed telson.

* Idotea - These are the fast swimming, dark bodied elongated and flattened isopods which are found around rocks, in the eel grass and just about everywhere.

Order Amphipoda

* Family Gammaridae - This includes the common side swimmers which are common around rocks and seaweed. Several species of Gammarus are probably here but need to be further keyed out using Bousfield's new key (Cornell Univ. Press).

Family Corophiidae - These are small tube dwellers which were seen both with eel grass and from muddy areas.

Family Talitridae - These are the sand or beach hoppers and are common at the high tide area among the dead eel grass mats. They are probably of the genus Talorchestia. Two sizes, large ones were found just above high tide mark in sand on Strong Island.

HIGHER CRUSTACEA

Order Decapoda

Section Caridea (shrimp)

Crangon Septempsinosus - This shrimp was taken in the seine when in the eel grass area. It is about 2-3" and is clear to translucent in appearance.

Hippolyte zostericola - This shrimp is found in the eel grass and was seined as the previous from Old Field Point. It is distinctive as it takes on the green coloration which makes it invisible in the eel grass beds where it is common.

* Palaemonetes vulgaris - Marsh shrimp in creeks 1-2", eats and decomposes eel grass - Zostera.

Brachyura (true crabs)

* Callinectes sapidus - - These were relatively common among the eel grass and seemed to have rather well established little burrows in the mud sand clearings in the eel grass areas. One large berried female was taken and later released, and the majority of forms seemed to be sexually mature males. No doubles were seen nor were any young crabs seen. Although probably common throughout the Bay,

Callinectes sapidus (cont.'d)

they were most readily observed at Old Field Point.

* Carcinus maenas - Although not common, these were often found, on several occasions they were buried in the sand. One very large specimen was captured, one of the largest I have seen.

* Libinia sp. - The toad crab or often called the spider crab, was quite common throughout the bay. They seem quite happy in several habitats and probably are scavengers.

Uca sp. - One specimen of Uca was taken at Old Field's Point and several burrows were seen indicating there is a viable population. These animals are extremely susceptible to the effects of DDT and their presence may be a good sign.

PHYLUM MOLLUSCA

Class Gastropoda

* Busycon canaliculatum - The channeled welk is rather common in deeper water but is not found too often in the intertidal area. However, the broken shells are very common, especially near very large rocks. This is due to the habits of feeding by the sea gulls whereby they drop the welks on the rocks to break them open. This was observed on several occasions and appears to be the origin of the majority of the shells on the beach.

* Busycon carica - The knobbed welk, is also found in the Bay but again is not seen in the intertidal areas. They seem to have the same fate as the channeled welk, being found commonly in the "broken condition."

Crepidula convexa - This is the small dark slipper shell which is very common on the eel grass. Although the books seem to indicate it is not so common, it certainly is plentiful on the eel grass occurring in a two-stack as well as single.

* Crepidula fornicata - The "common slipper-shell" was not seen in any great abundance except several large specimens were found attached to the underside on the margins and on the posterior section of the cephalothorax on the dorsal surface of Limulus polyphemus.

Eupleura caudata - Only one small living specimen of this species was found in an interstitial sample.

* Littorina littorea - These were found on the occasional large boulders but were by no means common. Fuscus vesiculosus was the only algae present in any amount and is probably the food source.

Mitrella lunata - Only one specimen of this species was seen although it is probably present in greater numbers in the eel grass.

* Nassarius obsoletus - The common mud snail was just that, common. Just off Old Field Point, it was in a migratory pattern as described by Russell-Hunter and Grant for Barnstable Harbor. It was interesting to note that up in the creek, it tended to be actually buried in the sand and mud. It was certainly, by far, the commonest snail around.

* Polinices duplicatus - The moon snail was found living in the mud flat behind Sipson Island. They are undoubtedly common all over the Bay, and the sand dollars were abundant.

* Urosalpinx cinerea - The oyster drill was found as the dominant snail on the large boulders throughout the Bay and was associated with barnacle zone on these rocks.

Class Bivalvia

Solemya velum - This bright yellow-brown bivalve was found rather commonly on Old Field Point. It was in the upper foot of the mud and sand.

* Aequipecten irradians - The bay scallop was common if one looked at the beaches! This was especially true on the west side of Strong Island where the shells were packed in next to the rocks. Living first year class were found on the mud flat on the East Side of Sipson Island.

Anomia simplex - The jingle shell or mermaids toenail was only seen on the mainland side of the Narrows and this was only the shells.

Crassostrea virginica - Several oysters were transplanted to the area off Old Field Point and are said to be from parts unknown.

Ensis directus - Very small, about 1 inch specimens, were found in an interstitial sample and one living adult about 10 inches was found at Old Field Point.

* Gemma gemma - The gem clam was commonly found at the low tide mark in various areas and is probably very abundant in the Bay.

* Mercenaria mercenaria - The quahog is very common in certain places. Usually they are subtidal and must be dug. A large number were taken just off the river, on the point of land north-west of Barley neck. The young, called 'seed' are easily confused with Gemma gemma.

* Modiolus demissus - The ribbed-mussel is common in the Spartina banks along the creeks. There is a creek which empties out at Old Field Point and they line both sides.

* Mya arenaria - The soft shell clam is found quite commonly and one very large specimen (about 8 inches) was found on the north shore of Strong Island.

* Mytilus edulis - The edible blue mussel was found on the large glacial boulders and only small ones were seen.

Nucula sp. - Probably N. proxima but not checked. It shows up in the interstitial samples.

Petricola pholadiformis - Two locations for the false angel wings were located. This species is an inhabitant of peat moss and one bed was found below the house on the south side of the land portion of the Narrows, and another patch was found below the cliffs on the west side of Sipson Island.

PHYLUM ECHINODERMATA

Class Asteroidea

Asterias forbesi - Only one was taken probably due to the low salinity in the Bay.

Class Echinoidea

Echinarachnius parma - Found on Hog Island.

Class Holothuroidea

* Leptosynapta tenius - Abundant in the mudflats, forms most of the surface holes on Old Field Point.

Synapta rosea - Large red burrowing sea cucumber found on Old Field Point and Strong Island. Not as abundant as L. tenius.

PHYLUM CHORDATA

Subphylum Tunicata

* Botryllus schlosseri - This colonial tunicate which either appears black or brown is most commonly found covering eel grass, especially out toward the channels. It is very plentiful.

* Mogula manhattensis - The sea grape is also found in great numbers increasing as you go out from shore through the eel grass and may occur as a single animal or may be clumped 2 or 3 together.

PHYLUM CHORDATA

The following fish were taken in Pleasant Bay:

* Gasterosteus aculeatus - three spined stickleback
* Sygnathus fuscus - pipe fish
* Opsanus tau - toadfish
* Anguilla rostrata - American eel
* Menidia menidia - Atlantic silversides
* Fundulus majalis - striped killifish
* Fundulus heteroclitus - common mummichog

Pomatomus saltatrix - bluefish young snapper blues common

Roccus saxatilis - striped bass

also: sandsharks