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FINAL REPORT
TO
STONE AND WEBSTER ENGINEERING CORPORATION
BOSTON, MASSACHUSETTS

TERRESTRIAL ECOLOGY STUDY OF THE MILLSTONE POINT SITE, WATERFORD, CONNECTICUT

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TABLE OF CONTENTS

PREFACE

The staff of the Environmental Sciences Division of Industrial BIO-TEST Laboratories, Inc. comprised the study groups for data acquisition and preparation of this report. The project was under the direction of H.S. Lewis, M.S., Head, Terrestrial Ecology Section. Dr. B.G. Johnson, Manager, Environmental Sciences Division was the senior advisor of the project. Other personnel involved in writing this report were:

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LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES Continued

LIST OF TABLES Continued

LIST OF TABLES Continued

I. Introduction

The study of the terrestrial environment in the vicinity of the Millstone Point site included programs to evaluate the biotic components of the existing plant and animal communities in the site area and to identify existing effects of both natural and man-induced environmental factors in these communities.

The plant and animal programs included a comprehensive literature survey of the flora and fauna in the site area and extensive seasonal field surveys during 1973-1974.

The specific objectives of the terrestrial environmental programs were:

1. To identify existing plant communities in the vicinity of the site and to make qualitative and quantitative descriptions of selected plant communities;

2. To identify migrant and/or resident populations of mammals, birds, reptiles and amphibians, and terrestrial invertebrates in the vicinity of the site;

3. To determine the general distribution and interrelationships of existing wildlife populations;

4. To assess the utilization of existing wildlife habitats by bird and mammal populations; and

5. To determine existing effects of natural and man-induced factors on animal and plant communities in the area.

Field data utilized in preparing this report were collected during the spring (May 1973), summer (July 1973), fall (October 1973), and winter (January 1974) seasons.

II. Summary and Conclusions

On the basis of studies conducted during May, July, October 1973 and January 1974, the following results were obtained:

A. Vegetation

1. Plant communities in the site area were diverse and the species within each community differed in their tolerance to the various environmental factors characteristic of the region. Forested lands, in various stages of successional development, had biotic compositions comparable to those of the central hardwoods-hemlock zone. Near the shore, plant communities were similar to other coastal areas in Connecticut and Rhode Island.

2. A great reduction in the acreage of original communities on Millstone Point has occurred. Primary agents of environmental stress to vegetational communities include lumbering, infestations, flooding, fires, hurricanes, and conversion of native communities to farm land, residences, commercial and industrial developments, and transportation networks. Various topographic, edaphic, and physical factors associated with proximity to the coast have caused natural environmental stresses.

3. No rare or endangered plant species or unique habitats were observed during the field surveys, nor did the literature review indicate any were present.

4. Nine communities were studied at the Millstone Point site during the periods May 14-17, July 16-19, October 22-25, 1973. The following vegetational analyses were made:

a. The old field (Site 1) was dominated by perennial forbs and grasses such as orchard grass and buckhorn plantain. Woody pioneering species were invading relatively undisturbed areas along the perimeter. Portions of this community were mowed annually.

b. The composition and structure of the mixed hardwood forest (Site 2) were influenced by an intermittant stream and natural depressions. Oaks dominated the drier upper areas, while red maple was more abundant in wet microhabitats. The stand had developed to a subclimax successional stage.

c. Species characteristic of both bottomland and upland habitats occurred in the riparian community (Site 3). Red maple and American beech were codominants. Size class distributions and core samples indicated that the community was relatively mature and stable.

d. The brackish marsh (Site 4) was connected to Long Island Sound by a channelized stream. Salt meadow grass and other salt-tolerant species dominated the marsh. Drier, raised sites, formed by spoil deposits supported a greater diversity of herbs and shrubs.

e. The transmission line corridor (Site 5) was initially cleared during the summer and fall of 1968. Woody and herbaceous species were diverse in the shrub and groundlayer strata. Pioneer species adapted to disturbed environments, as well as residual species of the cleared hardwood forests, were common.

f. The mixed hardwood forest (Site 6) had better drainage and

thereby supported more xeric species than Site 2. The stand was dominated by oaks.

g. A variety of cultivated and native plants was found in the abandoned nursery (Site 7). Vegetation typical of several stages of secondary succession was present. Perennial forbs and grasses were found in relatively open areas, and trees, shrubs, and vines typical of more advanced successional stages occurred in fence rows.

h. The beach and managed recreation area (Site 8) was developed for public recreational use. American beachgrass, beach pea, and tall wormwood were common in the primary vegetation zone. Upland sites were largely maintained by mowing, but marginal areas were dominated by Japanese honeysuckle, poison ivy, and sumac.

i. Plants along the beach community (Site 9) were subjected to harsh environmental stresses. The vegetational diversity was low. American beachgrass was the initial invader and prime stabilizer of soil. Successional advancement to woody vegetation increased with distance from the beach.

B. Mammals

1. No endangered mammalian species permanently inhabit the area that was studied.

2. Eight small mammal species totaling 454 specimens were captured in 6577 trap-nights. White-footed mice were the most abundant and widespread small mammals during the spring and fall sampling periods; this species was collected in each community sampled and accounted for 61.0%

of the total mammal catch. Meadow voles were most abundant in October and constituted 29.7% of the total mammal catch. Less abundant species included the shorttail shrew, meadow jumping mouse, Norway rat, masked shrew, eastern chipmunk, and pine vole.

3. Small mammal habitat utilization was highest in the beach community and lowest in the mixed hardwood forest (Site 6).

4. The relative abundance of small mammals expressed as the number captured per 100 trap-nights, increased significantly ($P < 0.05$) from 3.48 in May to 9.25 in July. With the exception of the riparian community, the relative abundance increased in each community. Increases were greatest in the beach and managed recreation area, beach community, and transmission line corridor.

5. The relative abundance of small mammals, expressed as the number captured per 100 trap-nights, remained stable from July (9.25) to October (8.14).

6. Observations and/or sign of seven larger mammals were recorded during the four census periods. Cottontail rabbits, eastern gray squirrels, and woodchucks were common. Other species recorded for the Millstone Point site included the raccoon, whitetail deer, starnose mole, and muskrat.

C. Birds

1. No endangered avian species permanently inhabit the area that was studied.

2. Observations of 3692 birds comprising 106 species were recorded

along transect routes at the Millstone Point site during the four census periods. Residence status of these species included 39 permanent residents, 42 summer residents, 10 winter residents, and 11 migrants.

3. Predominant birds sighted during the May migration period included red-winged blackbirds, common grackles, barn swallows, and starlings. Common nesting species observed during July included the black duck, blue jay, American robin, and song sparrow. In October double-crested cormorants, Canada geese, herring gulls, starlings, and American goldfinches were most frequently sighted. Red-breasted mergansers, herring gulls, ring-billed gulls, and song sparrows were most prevalent during January.

4. During the spring (mid-May) and fall (late October) migration periods, 63 and 55 species, respectively, were sighted. Sixty-two species were observed during the summer survey and 35 were recorded during the winter census.

D. Reptiles and Amphibians

Five species of amphibians and one reptile were observed. Green frogs, leopard frogs, and wood frogs were most frequently sighted. A northern two-lined salamander, an American toad, and two eastern garter snakes were also recorded in the site area.

E. Terrestrial Invertebrates

Two hundred and thirty-seven specimens representing 2 classes, 11 orders, and 40 families of terrestrial invertebrates were collected from the old field (Site 1) and the riparian community (Site 3) during the two sampling periods. Plant bugs, dance flies, midges, and spiders were most commonly collected.

III. Methodology

A. Vegetation

Field examinations of the flora at Millstone Point were made, and representative plant communities were selected for baseline analysis of vegetational structure and composition (Figure 1). Three extensive vegetational surveys were conducted during the study period. Quantitative surveys of herbaceous and woody species were conducted during the spring (May 1973) and fall (October 1973), and herbaceous species were also sampled during the summer (July 1973) in each of the following communities:

Old field (Site 1);

Mixed hardwood forest (Site 2);

Riparian community (Site 3);

Brackish marsh (Site 4);

Transmission line corridor (Site 5);

Mixed hardwood forest (Site 6); and

Beach community (Site 9).

Qualitative surveys were conducted in an abandoned nursery (Site 7) and a beach and managed recreation area during all sampling periods.

In each wooded community, trees over 4 inches d.b.h. (diameter at breast height, i.e., 4.5 feet above ground level) and saplings over 1 inch d.b.h. were sampled by the quarter method (Curtis and Cottam 1962). Shrubs and saplings over 6 inches high and less than 1 inch d.b.h. (Phillips 1959) were sampled by the line intercept method (Canfield 1941).

From an arbitrarily selected starting point, sampling points were distributed randomly (Snedecor and Cochran 1967) along a predetermined compass line (transect) across the greatest extent of each stand. A minimum distance, normally 50 feet, was maintained between points to insure that each succeeding point was beyond the influence of the preceding one. The length of the transect and the number of sampling points used in each community depended upon the community size. The relative frequency, relative density, and relative dominance for each tree species were determined from standard formulas (Curtis and Cottam 1962). Importance values were calculated as the sum of these relative indices (Curtis and McIntosh 1951).

At alternate sampling points, 50-foot intercepts were made perpendicular to the line of travel to sample small saplings and shrubs. The relative frequency, relative dominance, and ground cover were calculated from standard formulas (Cox 1972).

In non-forested communities where shrubs and tree species were present in conjunction with herbaceous species, 50-foot intercepts were made at alternate ground-layer quadrat points to sample woody vegetation over 6 inches tall.

Woody plants less than 6 inches high, grasses, and forbs were quantitatively sampled by the quadrat method (Wiegert 1962, Phillips 1959) using a circular 1 m^2 quadrat in all communities except in the old field (Site 1) and brackish marsh (Site 4) where a circular 0.1 m^2 quadrat was used. These quadrats were centered on each quarter point in forested communities and were

systematically distributed at 10-meter intervals along transects in all other sites.

In plant communities selected for qualitative analysis, all species that were observed were recorded and rated either abundant, common, or infrequent.

Botanical nomenclature follows Gleason (1968).

B. Mammals

During May, July, and October 1973, Museum Special snap-traps baited with peanut butter were used to sample small mammal populations in each of the plant communities selected for qualitative or quantitative analysis (Figure 1).

In each plant community selected for quantitative analysis, 90 to 100 snap-traps were set in triplicate within a radius of approximately 3 feet from a central point. Fifty traps placed in a similar manner were set in plant communities selected for qualitative analysis. An interval of 25-30 feet between stations was used. Traps were set along the same line transects that were used for vegetation analysis. Traps were normally left in the field for three nights at each station and were checked once daily. Sex, weight, and selected body measurements were recorded for each species that was captured.

All observations or sign of mammals along the transect routes were recorded. During each phase of field work, observations of mammals were made throughout the area. Mammalian nomenclature and/or identifications

follow Murie (1954), Blair et al. (1957), and Burt and Grossenheider (1964).

C. Birds

The relative abundance of birds was determined in each plant community selected for qualitative or quantitative analysis. The same transect route that was used for vegetation sampling and mammal trapping was followed when tallying bird species. Censuses were taken along the transect routes on two or three succesive mornings during May, July, and October 1973 and January 1974. Transect routes averaged approximately one-quarter mile in length. Species were identified by sight or sound. Birds flying overhead were counted. Progress along each transect route was on foot, alternating between slow walking and brief pauses to look and listen.

Records were kept of bird activity and habitat use throughout the site area. Scientific and common names of each species are those of the American Ornithologists' Union (1957) and the Thirty-Second Supplement to the A. O. U. Checklist (American Ornithologists' Union 1973).

D. Reptiles and Amphibians

Reptiles and amphibians that were observed along each transect route were collected and identified. Specific searches for these animals were made in productive-looking habitats, i. e. under logs, rocks, etc. Records were kept of the habitat type from which each individual was taken. Identification and nomenclature follow Conant (1958).

E. Terrestrial Invertebrates

Terrestrial invertebrates were collected from two sampling locations at the Millstone Point site. One community dominated by herbaceous plants

and another dominated by forest vegetation were selected for sampling. These were the old field (Site 1) and riparian community (Site 3).

An aerial insect net, 16 inches in diameter and 2.5 feet deep, was used to make 50 standard sweeps of low herbaceous and shrub-type woody vegetation. One sampling consisted of two separate walks for a distance of 25 paces each. The contents of the net were emptied into a wide-mouthed jar containing 70% ethanol.

Identification and zoological nomenclature for terrestrial invertebrates follow Arnett (1968), Baker (1972), Borror and DeLong (1970), Borror and White (1970), Dillon and Dillon (1966), Holland (1968), Klots (1951), Peterson (1960) and Peterson (1967).

IV. Results and Discussion

A. Vegetation

1. Literature Review

The vegetation of Connecticut and Massachusetts has undergone phenomenal changes from the forests seen by early colonists. Original forests largely disappeared over two centuries ago. During the precolonial period most of New England was forested except for small acreages of salt marsh, rocky ridges and land cultivated by Indians (Moss 1973). The forests were composed of oak (Quercus spp.), beech (Fagus grandifolia), maple (Acer spp.), birch (Betula spp.) and hemlock (Tsuga canadensis). Eastern white pine (Pinus strobus), black cherry (Prunus serotina), chestnut (Castanea dentata), basswood (Tilia spp.), and ash (Fraxinus spp.) were the most common associates. Many of the dominant trees were over 300 years old and over 36 inches in diameter (Kienholz 1963).

Although Indians set fires to facilitate hunting (Egler and Niering 1965), and lightning and other natural phenomena took a toll of the trees (Niering and Egler 1966), forests were more rapidly decimated with the advent of white man. The land was cleared by the colonists for crops, and stone fences were constructed from loose stones in the fields. Trees were also heavily cut for lumber and fuel. Many of the large white pines were claimed by the English navy (Kienholz 1963). Land clearing continued for over 200 years, until the mid-1800's (Olson 1965). Before the Civil War about two-thirds of Connecticut's total land area of three million acres was functionally crop and pasture land,

with the remainder in forest (Niering and Egler 1966). With eastern industrialization and western lands opened for settlement, especially after the Civil War, a reverse trend began. Western grasslands proved far more fertile for agriculture than the eastern deciduous forest soil. Thus, eastern farmland was abandoned, and a succession of native plant species reinvaded the land.

Approximately two-thirds of Connecticut is now forested, and only one-third of the land is used for crops and pastures (Kienholz 1963); about 65 percent of Massachusetts is forested (Lull 1965). About half of the present forested area was reforested within the past 100 years (Stephens and Waggoner 1970). Proof of cultivated land abandonment is evident throughout Connecticut and Massachusetts by the stone walls that now traverse the forests. Olson (1965) estimated that half of the existing Connecticut woodlands are old fields in various stages of succession. The other half has always been woods but may have been cut repeatedly for lumber, firewood, and charcoal. Kienholz (1963) reported that between 71 and 80 percent of the land in Middlesex and New London Counties, Connecticut is forested. The forests of Connecticut are composed primarily of hardwoods (95%) with some softwoods (5%) (Kienholz 1963). Most of the forests are quite young and the trees are small.

Beneficial aspects of New England forests: The native vegetation of New England has developed and adapted concomitantly with other biotic and abiotic components for many thousands of years. It is therefore assumed that the forests in Connecticut and Massachusetts are the best adapted cover type for the topographic and edaphic features. The topography is quite steep

throughout much of the Connecticut River Valley area, and thus trees are the most ideal vegetation to prevent soil erosion.

Four basic hydric processes are at least partially governed by forests; these are: interception, infiltration, storage, and evapotranspiration. The forest canopy may protect the soil from the beating action of rainfall by intercepting a large portion of the precipitation. Thick humus and litter on the forest floor also intercept rainfall and keep the soil loose and friable, thereby increasing the permeability of the soil to absorb water and prevent runoff (Kienholz 1963). Infiltration of water into the soil is slow and occurs primarily along the trees' root systems. Absorbed water drains subterraneously into springs, streams and lakes. Also, since forest soils normally do not freeze to great depths in the winter in southern New England, snow melt in the spring is easily absorbed, therefore the chance of spring floods is greatly reduced by thick humus and litter. Highly permeable forest soils further benefit the entire ecosystem by equalizing stream flow so that spring time flow is reduced and low flow in summer is prevented. Evapotranspiration varies from 25 to 75 percent of the total annual precipitation, depending upon the land surface and vegetation (Smith 1966). The highest percentages are always associated with forest cover (Smith 1966). Forests are very important in maintaining a vital water supply in the New England area, both in quantity and quality.

Forests also provide unique food, cover, and living space for wildlife. For example, deer browse on the small woody growth of twigs and shrubs. Grouse find food from the great diversity of hardwood trees, and they

use the softwoods for cover. Rabbits frequently feed in meadows or at the forest's edge, but they occasionally seek cover in the forests. Environmental conditions for fish and waterfowl are also improved by the forest's effect on watersheds.

Various types of recreational activities are made possible by forests and watersheds in Connecticut and Massachusetts. For example, fishing, hunting, camping, picnicking, swimming, boating, riding, hiking, bird watching, and sightseeing are the major forms of recreation in the Connecticut River Valley area (Kienholz 1963).

Commercially, the New England forests have a history of value to man. Softwoods (e.g., white pine and hemlock) have been used for construction of ships and houses. Knotty pine trim, furniture, doors, shingles and siding have all been made from softwoods. Cedar has been used for poles and posts because of its resistance to decay. The hardwoods also have proven beneficial. Oaks, due to their great strength and beautiful grain, have been used for furniture, trim, posts, and ship building. Maple has been used for furniture, but notably in New England, it was a source of syrup and sugar. Plywood, veneer and furniture have been made from the birches. Baseball bats and other athletic equipment have been made from the ashes. Hickory, white oak, sugar maple, and birch are among the best fuel woods, although the use of wood for fuel has greatly declined in importance during the last fifty years. Several estimates have been made that predict an increase in fuel wood importance in the 1970's and 1980's Although charcoal production from oak slabs and sawmill

waste formerly required considerable wood, its use is now greatly reduced.

Successional development of forests: New England forests have proven to be excellent sites for studying forest regeneration dynamics. A number of studies have been conducted in the area of the Connecticut River. Significant contributions to the understanding of southern New England vegetation include those of Bromley (1935) and Ogden (1961). Nichols (1913a, 1913b, 1914, 1915, 1916, 1920a, 1920b) made early descriptions of Connecticut vegetation, and Lutz (1928) and Egler (1940) wrote about Massachusetts flora. On a larger geographical scale, Braun's (1950) monumental work is quite comprehensive for decicuous forests in the eastern United States. Several of the older New England studies have drawn information from old travel diaries to make comparisons between pre-colonial, colonial, and post-colonial vegetation. Secondary succession in the deciduous forests of New England has been discussed by Braun-Blanquet (1932), Clements (1928), Oosting (1942, 1956), Raunkiaer (1934), and Weaver and Clements (1938). Almost fifty years of mixed-hardwood forest study have been documented in four south-central Connecticut tracts (Hicock et al. 1931, Collins 1962, Olson 1965, Stephens and Waggoner 1970). The forests have undergone a number of structural changes caused by various environmental stresses. Successional development of these forests varies from site to site depending upon the nature of the disturbance or stress and a combination of topographic, edaphic, and climatic factors.

After pastured or plowed fields are abandoned in southern New England a typical successional pattern is established. During the first year

after abandonment, fields are dominated by ragweed (Ambrosia spp.), horseweed (Conyza spp.) and crabgrass (Digitaria spp.) (Daubenmire 1968, Livingston 1972). Usually the ground surface is covered with lichens and mosses. These plants alter the soil by increasing the amount of humus and water retention, and in general, moderate the microclimate for the more vigorous and persistent successional perennials. From three to five years after abandonment, species such as lespedeza (Lespedeza spp.), goldenrod (Solidago spp.), aster (Aster spp.), and Queen Anne's Lace (Daucus carota) increase in importance (Beals and Westover 1971, Livingston 1972). The perennial weed stage is characterized by species with light-weight seeds that are wind dispersed over great distances. This stage usually persists between three and seven years after abandonment (Livingston 1972). After seven to ten years of abandonment, little bluestem (Andropogon scoparius) codominated by goldenrods and asters eventually succeeds many of the perennial weeds. Though less abundant, annual weeds such as ragweed, horseweed, crabgrass, and lespedeza may still be present (Hanson and Churchill 1961). Also, during this period, several small-statured shrubs and vines may invade the old field; their frequency will vary locally. These include sweetfern (Comptonia peregrina), sumac (Rhus spp.), dogwood (Cornus spp.), bittersweet (Celastrus scandens), blackberry (Rubus spp.), and Virginia-creeper (Parthenocissus quinquefolia). Usually after 15 to 20 years the stone walls are covered by tangled thickets and shrubs (Stephens and Waggoner 1970). Where land is abandoned near a tract of relatively undisturbed vegetation which can act as a seed source, succession

may be much more rapid. Bard (1952) found flowering dogwood (Cornus florida, typically represented in a climax forest, invading an old field within five years after abandonment. Several tree species known to invade fallow fields include: juniper (Juniperus spp.), birch, aspen (Populus spp.), cherry (Prunus spp.), and sassafras (Sassafras albidum). Gray birch (B. populifolia) may begin to invade old fields five to ten years after abandonment and eventually become dominant (Harlow and Harrar 1958, Livingston 1972). This tree species moderates the environment by reducing light and wind near the ground. Shade intolerant species such as little bluestem are reduced in frequency. Invading trees further modify the soil temperature, increase humidity near the ground surface, and add humus to greatly enrich the soil. Light-seeded tree species, such as gray birch and aspen, are early secondary invaders because they have windborne seeds that can travel long distances, and they are tolerant to exposed sites. However, as more trees become established the early invaders decrease, because they are intolerant of dense shade. The short-lived gray birch is eventually replaced by the relatively long-lived pitch pine (Pinus rigida) and white pine. Pines usually appear in abundance between 10 and 15 years after field abandonment (Livingston 1972). Their seeds are heavy and can be wind transported only short distances. Seeds are produced only once every three to seven years. Therefore, the time of this stage of succession depends upon the maturity of pine trees and the proximity of the trees to the disturbed area. In many New England areas, pines are commercially preferred over later successional species. By burning the area at intervals the pine stage may

be maintained (Little and Moore 1949). Pitch pine is especially fire resistant. Even when fires are hot enough to kill most of the foliage, recovery may be rapid. Older pine stands may have three strata: an upper canopy, a shrub layer and a thin herbaceous layer. Vegetation common to a pine stand includes pitch pine, quaking aspen (Populus tremuloides), large-toothed aspen (P. grandidentata), pin-cherry (Prunus pennsylvanica), eastern white pine, sheep laurel (Kalmia angustifolia), mountain laurel (K. latifolia), blueberry (Vaccinum angustifolium), huckleberry (Gaylussacia baccata), and sometimes scrub oak (Quercus ilicifolia). Little bluestem frequently occurs in open areas. Pines greatly modify the local environment by reducing light to lower strata, moderating temperatures, reducing wind, and increasing humidity. They also increase the soil acidity which reduces its fertility. However, pines are not tolerant of their own shade, and therefore, they are unable to reproduce in a mature stand (Clarke 1954). After several decades of field abandonment, in the absence of fires, pines are gradually replaced by the more shade-tolerant oaks, hickories, maples, hemlock and beech. Only those species capable of surviving strict competition for available sunlight, nutrients, and soil moisture endure. Most members of terminal, stable communities are tolerant of shade; thus, their seedlings survive and their replacement is high. The climax species are usually those with heavier seeds which must depend upon animals (squirrels and birds), rather than wind for dispersal from the immediate locale.

The compositional changes in New England forests are gradual, continual, and mosaic. As older trees die and create new openings, other trees

replace them. Most of the successional replacement species are present in mature stands in a slow-growing state for several years before they reach significant importance in the community. The climax stage of succession may occur 25 to 50 years after abandonment (Livingston 1972). Local environments dictate the dominant species in the climax or terminal stages of succession. For example, hemlocks are a climax shade tolerant species, but due to their susceptibility to fires, desiccating winds, and rather high moisture requirements, they are poorly adapted to xeric habitats such as south-facing slopes or sandy soils. Red maple (Acer rubrum) seedlings flourish on damp or swampy soils, and they are shade tolerant. Therefore, red maple perpetuates its species as a dominant in swampy habitats.

Successional trends on fallow land in southern New England (Lutz 1928) appear to be somewhat similar to those observed on the piedmont in New Jersey (Bard 1952), and on the Raritan River flood plain in New Jersey (Wistendahl 1958). A high degree of species similarity exists in these three areas, as well as in other mid-Atlantic states (Gleason and Cronquist 1963, Stalter 1973).

Successional progression of vegetation in the forest is concomitant with succession in other biotic and abiotic components. As the forest becomes mature, the leaf canopy becomes thicker and farther above the forest floor. Stratification occurs. Progressively less sunlight penetrates to the lower strata. Understory vegetation changes, and soils are modified. Both forest soil and water increase in fertility, more elements are utilized, more organic matter

is accumulated, and more biomass is produced. Alterations in forest habitats are accompanied by changes in microbial and faunal species composition. Increased stratification, spatial heterogeneity, and zonation bring about an increase in niches which reflects greater species diversity and general stability of the system.

The mature forests in southern New England are highly stratified and contain a rich diversity of life forms. Generally four distinct strata can be observed in highly developed, uneven, aged, deciduous forests. The upper canopy consists primarily of the dominant or codominant trees, such as red oak (Quercus rubra), white oak (Q. alba), scarlet oak (Q. coccinea), black oak (Q. velutina), pin oak (Q. palustris), red maple, sugar maple (A. saccharum), eastern white pine, hemlock, green ash (Fraxinus pennsylvanica), paper birch (Betula papyrifera), black birch (B. lenta), bitternut hickory (Carya cordiformis), pignut hickory (C. glabra), and mockernut hickory (C. tomentosa). Beneath this is a lower tree canopy consisting of flowering dogwood, witch hazel (Hamamelis virginiana), downy juneberry (Amelanchier arborea), sassafras, black cherry, and eastern hophornbeam (Ostrya virginiana). A typical shrub stratum consists of such species as blueberry, huckleberry, mountain laurel, pinxter flower (Rhododendron nudiflorum), and mapleleaf viburnum (Viburnum acerifolium). The ground or field layer consists of herbs and ferns; its composition varies seasonally, from trilliums (Trillium spp.) and hepaticas (Hepatica spp.) in the spring to goldenrods and asters in the fall.

Succession may be set back, modified, or arrested by various disturbances. After a community disturbance occurs, the degree of set-back

and time of recovery depends upon the seral stage of succession before the disturbance, the intensity of the disturbance, and the proximity of successional species tolerant to the particular modified habitat.

The Chestnut Blight created a unique disturbance in the eastern deciduous forests by eliminating the dominant or codominant American chestnut. These trees once comprised from 10 to 60 percent of the composition in many southern New England forests (Egler and Niering 1965, Egler and Niering 1967). The climax stage of succession in southwestern New England was previously classified as an Oak-Chestnut Association. The American chestnut was less important in Massachusetts than further south in Connecticut, but its range originally extended north as far as southern Maine (Gleason and Cronquist 1963). When open environments were created by death of these trees, invasion by other species was made possible. Since the demise of American chestnut trees, New England and other eastern forests have proved to be excellent sites to study forest regeneration dynamics. Many people have predicted an oak-hickory climax replacing the oak-chestnut forest association (e.g., Spurr 1964) with sugar maple, yellow poplar (Liriodendron tulipifera) or beech dominating the more mesic sites (Braun 1950). Predictions have been made from sites studied in New England to North Carolina that the forests would quickly regenerate (Gordon 1940, Keever 1953, Nelson 1955, Woods and Shanks 1957, 1959). Others have predicted complex changes (e.g., Good 1968, Mackey and Sivec 1973) and probably much slower natural replacement. Korstian and Stickel (1927) studied American chestnut replacement in New England, New Jersey and

and Pennsylvania. They found red oak was the dominant replacement species in Connecticut, and white oak and chestnut oak (Quercus prinus) dominated in New Jersey with red maple, dogwood, and gray birch being common associates. In Pennsylvania, Augenbaugh (1935) also reported chestnut oak and red maple were the most important replacement species. In the Southern Highlands of the Great Smoky Mountains, Nelson (1955) found replacement by codominant oaks and sourwood (Oxydendrum arboreum), cucumber tree (Magnolia acuminata), yellow birch, black birch, and hemlock. Other studies in the Great Smoky Mountains found chestnut oak and red maple as the most important replacement species (Woods and Shanks 1959, Whittaker 1956). Some evidence indicates that red oak (Keever 1953) and yellow poplar (Nelson 1955) are among the dominants and red maple will be a secondary tree. In recent studies in the New Jersey Highlands, Good (1968) indicated that mesic species such as American beech, black birch, and red maple are increasing in importance with declining success of the oak species. In the Allegheny Mountains of western Pennsylvania, a blighted and lumbered oak-chestnut forest was studied by Mackey and Sivec (1973). They found the canopy of this forest, formerly dominated by as high as 70 percent American chestnut, presently was dominated by black cherry, red maple, sugar maple, black oak, black birch and sour gum (Nyssa sylvatica). Less common species included chestnut oak, white oak, sassafras, American beech, white ash (Fraxinus americana), hickories, yellow poplar, and hemlock. Black cherry and some red maple will probably undergo a gradual and continual decline as the community undergoes further successional

change within the next decade (Mackey and Sivec 1973). After approximately 70 years since the demise of the American chestnut, equilibrium has not been reached. Judging by the northern forests where the blight began, no major changes are expected soon (Oosting 1956). Since the abundance of American chestnut varied considerably in the original eastern deciduous forests from southern Maine to northern Alabama in the late 1800's, and based on present evidence of eastern forest succession, the terminal replacement species will probably be determined by local site characteristics.

Another type of succession in southern New England is the development of a pond into a deciduous forest. The first or pioneer stage is characterized by free swimming life. As the dead matter settles to form a muck layer, plants such as the green alga, Chara, anchor in the oozy pond bottom (Smith 1966). Organic matter continues to thicken on the bottom, reducing the water depth, and more nutrients are provided for successionally more demanding plants. Submerged aquatics such as pondweed (Potamogeton spp.) often become so prominent that they eliminate light required by the vegetation of lower strata. Floating aquatics next invade the pond and further reduce the lower vegetation. With an increase in decaying vegetation, emergents such as cattail (Typha spp.) become dominant. At this seral stage they may cover most of the former open-water area to form a marsh. When the pond has filled with emergent species, sedges and meadow grass become dominant and form a marsh meadow. In the forested areas, the meadow vegetation is later replaced by shrubs, such as alders (Alnus spp.), willows (Salix spp.), and buttonbush

(Cephalanthus occidentalis). Shrubs give way to trees such as red maple, aspen, and elm (Ulmus spp.). As the forest builds up and the forest floor becomes drier, the intolerants fail to develop. Mesophytic species that are tolerant of shade, such as sugar maple, beech, hemlock, yellow birch (Betula lutea) and paper birch, begin to dominate the understory and subsequently replace the intolerant species. Less important trees in the mesic habitat include white pine, northern red oak, and white ash. Shrubs include mountain laurel, maple-leaf viburnum, hazelnut (Corylus americana), witch hazel and alternate-leaved dogwood (Cornus alternifolia). Several genera of ferns are also common and include: Adiantum, Athyrium, Botrychium, Osmunda, Polypodium and Polystichum. The habitat also supports a rich array of herbaceous plants, including several species of Lycopodium, spring trilliums, violets (Viola spp.), wild ginger (Asarum canadensis), bloodroot (Sanguinaria canadensis), Dutchman's breeches (Dicentra canadensis), wood aster (Aster spp.), and wood sorrel (Oxalis spp.)

Succession does not always develop to the climax vegetation typical of a region. Stable treeless areas can exist under varied climatic conditions and geographical areas. Oosting (1956) found a band of prairie surrounded by deciduous and coastal plain forests in Alabama and Mississippi. The Hempstead Plains on Long Island was once a vast treeless area comprising 60,000 acres, although it is now reduced to about 600 acres and represents the last remnant of natural prairie east of the Appalachian (MacManus 1972). Prairie glades completely encompassed by oak-hickory forests, are found in Missouri, Iowa,

and Nebraska. Clark (1954) reported that the prevailing vegetation near Plymouth, Massachusetts and on Cape Cod consisted of pine and scrub oak. This vegetation appeared to be a climax condition partly determined by fire. A mature stand of beech, maple, oak, hemlock, and yellow birch was also reported in the region on an undisturbed island. No record of fire on the island was found. Pine and scrub oak may develop successionally beyond this stage if forest fires are prevented (Clark 1954, Little 1973), but this development will probably be extremely slow.

2. Environmental Stresses-Natural and Man Induced

Although the growth and development of plants are internal forces, they are under environmental control (Levitt 1969). Any external force-temperature, moisture, radiation, nutrient supply, or gas composition-that enhance or retards growth and development may act as a stress that can injure or kill a certain species of plant, thus altering the vegetational composition of a community. There are natural and continuous forces that result from competion among species in a given community for water, light, nutrients and space. But, some of the major environmental stresses that create pronounced effects are: forest diseases, forest insects, pesticides, forest fires, winds, rain, drought, cutting, agricultural activities, quarrying, ice, snow, and recreational activities.

Forest Diseases: Pathogens have always been a part of every natural community, however, they seldom create significant destruction to warrant alarm. But, when alien organisms are introduced into a community, or if some other environmental stress creates an unbalance, massive infestations may occur.

In New England as in other areas of the U.S. many diseases are known to attack trees. They often kill large numbers of individuals. Some result in defoliation of the forests which drain the energy reserves and change the community growth rate. Repeated defoliations may significantly alter the vegetational composition of the community.

One of the most prominent diseases to occur in the northeast

during this century is the chestnut blight, or "chestnut bark disease", (Endothia parasitica) that killed the American chestnut (Castanea dentata). This fungal disease destroys the cambium layer and causes death by girdling the trees. The composition of the entire former oak-chestnut association was changed by the introduction of this organism in the eastern United States. Trees were reported killed from Maine to Georgia and westward to Indiana (Beattie and Diller 1954). American chestnut was an especially important component of New Jersey forests where it was a dominant or codominant species (Korstian and Stickel 1927).

The fungus was probably introduced before 1900, but its earliest record was in 1904 (Moss 1973). By 1915, most of the chestnut trees in New England had been killed. Although some chestnut sprouts may be found in the forest, they rarely survive to the sapling stage. The only control of this disease has been through the selection of disease resistant strains or by hybridization of the American species with the Japanese or Chinese species.

Another disease common to New England is white pine blister rust (Cronartium ribicola Fischer), an import from Europe, which attacks five-needle pines. After invading a community, the rust may kill seedlings in only one year, but within several years it may girdle and kill mature trees. Control is obtained by removing the alternate hosts (gooseberry and currant) within 900 feet of five-needle pine trees. Red ring rot (Fomes pini) also damages white pine. Pitch pine (Pinus rigida) can be attacked by several fungi but these rarely cause serious damage.

Several heart rot fungi cause damage to shagbark hickory (Carya ovata), mockernut hickory (C. tomentosa), sugar maple (Acer saccarum), and the oaks (Quercus spp.). Chestnut oak (Q. prinus) is more resistant to heartwood and sapwood decay fungi than other oaks. Usually trees are made vulnerable to decay fungi through fires or other physical damage. Most rot in red maple (A. rubum) is caused by the fungus, Polyporus glomeratus. Oaks are particularly sensitive to o ak wilt disease and cankers. Some are killed within several weeks after attack. Ceratocystis fagacearum is a common oak wilt pathogen of chestnut oak, and serious canker damage is caused by Strumella and Nectria fungi, especially to the Northern red oak. Several pathogens attack the seeds of eastern hemlock (Olson et al. 1959).

Forest Insects: Many species of insects are known to attack forest trees. Although some effects are of little consequence to the forest community, others are quite serious. Insect pests cause greater losses to our timber resources annually than fire (Schaffner 1959).

Chronic defoliations appear in the forest at all times (Stephens 1971). Although there are numerous types of defoliators, their damage is usually localized. Particular concern develops when massive defoliation occurs. This happens when there are sudden increases in certain insect populations. Some of the most important defoliators in the New England area are the gypsy moth (Porthetria dispar L.), spring cankerworm (Paleacrita vernata Peck), fall cankerworm (Alsophila pometaria Harris), and elm spanworm (Ennomos subsignarius Hbn.).

The gypsy moth was introduced in Massachusetts from Europe in about 1866; since then it has become widely distributed throughout New England. An estimated 1,773,846 acres of woodland in nine northeastern states were reported defoliated during the summer of 1973; 33,215 acres were defoliated in Connecticut and 43,970 acres were defoliated in Massachusetts (Agri-News, Nov. 1973).

Several oaks, such as the white and chestnut oaks, are apparently favored trees of the gypsy moth, but quaking aspen (Populus tremuloides), red maple, and several other species are frequently affected. Turner (1963) reported one-fifth of the white pines and two-thirds of the hemlock died in one Connecticut area after a single defoliation.

Other forest insects periodically create local concern. White pine cone beetle (Conophthorus coniperda) and white pine weevil (Pissodes strobi) are frequently important to the white pine (Pinus strobus). Pitch pine loopers (Lambdina athasaris pellucidaria) cause extensive damage to pitch pine. Two species of hemlock loopers (L. fiscellaria fiscellaria and L. athasaria athasaria) and the hemlock borer (Melanophila fulvo guttata) are enemies of the eastern hemlock (Tsuga canadensis). Quaking aspen and large tooth aspen (Populus grandidentata) may be heavily damaged by poplar borers (Saperda calcarata) and forest tent caterpillars (Malacosoma disstria). Hickory bark beetles (Scolytus quadrispinosus), hickory shuckworm (Laspeyresia caryana), hickory spiral borer (Agrilus arcuatus), pecan carpenterworm (Cossula magnifica), and several species of twig girdlers (Oncideres spp.)

are the most common insect enemies of the hickories. Forest tent caterpillars and bronze birch borer (Agrilis anxius) are highly injurious to the paper birch (Betula papyrifera). Orange-striped oakworm (Anisota senatoria), forest tent caterpillar, trunk-boring insects (e.g., Goes spp.) are important stresses on the oaks. Acorns (oak fruit) are damaged by various weevils (Curculio spp.), insect larvae, and cynipids. These may damage over two-thirds of the normal acorn crop. Red maple is very susceptible to insect infestations. The gall-making borer (Xylotrechus aceris) and cottony maple scale (Pulvineria vitis) are noted insects of the red maple. Plumb and Friend (1939) reported red maples nearly completely stripped by elm spanworm. Two or three seasons of stripping resulted in death of the trees. Also elm spanworm was reported to have defoliated 60 to 65 percent of the yellow birch. Mortality of defoliated trees has been associated with attack by the two-lined chestnut borer (Agrilus bilineatus Web.) (Baker 1941). In oak mortality data reported in Pennsylvania during 1953-1966 by Nichols (1968), twenty defoliators were listed as active, but oak leaf tier (Croesia semipurpurana Kearf.) was considered most important. However, nearly all dead or dying trees were infested with two-lined chestnut borer. Nichols (1970) later reported mortality of 30 to 90 percent of the oaks in isolated locales of northern Pennsylvania caused by oak leaf roller (Archips semiferanus Wlk.) infestations.

Effects on trees are dependent upon the amount of defoliation and on the time of occurrence. If defoliation occurs early in the growing season, the trees are deprived of their ability to assimilate. A second set of leaves

may be produced during the growing season at the expense of stored reserves. But, depleted reserves may result in smaller leaf size, fewer leaves, and reduced radial growth of the tree. Thus, with reduced resistance, trees are rendered susceptible to attack by other insects and diseases (Duncan and Dodson 1958, Houston and Kuntz 1964, Nichols 1968).

Defoliation increases mortality of oaks more than maples and birches (Stephens 1971). Among the oaks, white and chestnut oaks are more vulnerable than red oak. In eastern New England about 13 percent of the unfavored species and 30 percent of the favored species died after one or more defoliations occurring between 1912 and 1921 (Baker 1941). In the Connecticut River Valley of Massachusetts, defoliation by gypsy moth occurred from one to eight times in 13 years on 34 areas comprising 2641 acres (Turner 1963). Mortality ranged from 10 to 75 percent. Apparently the mortality was greatest in oaks. There has been a continual decline of oak in the Connecticut forests since 1927 (Stephens and Waggoner 1970). This may be due to the selective pressures of defoliators, as well as reductions in forest fire pressures and clearcutting. Mortality after defoliation has not always been as great in the Connecticut forests as that reported elsewhere. In the opinion of House (1952), trees in the Connecticut and Rhode Island forests may have a greater degree of resistance than in other parts of New England.

In the past, control of forest insects and diseases has been by various pesticides, mechanical and physical controls, natural controls, biological controls and cultural controls (Fichter 1966). After recent concerns

of pesticides in the ecosystems, several non-pesticide methods of control have received greater attention (Turner 1969, Reese and Becker 1972). Among these is the silvicultural control which advocates removal of tree species susceptible to insect infestations and encourages growth of unfavored species.

Pesticides: Many people consider one of the greatest stresses that man has placed on the earth's ecosystems is through the widespread use of pesticides. For example, by the end of World War II, approximately 400,000 pounds of lead arsenate was applied to areas infested or threatened by the gypsy moth, and by 1971 over 3.46 million pounds of DDT was applied in New York state (Reese and Becker 1972). Similar treatments have been applied in many New England areas of potential or actual infestations.

Insect pests can be controlled initially by pesticide applications, such as DDT, at a level that will not be immediately harmful to birds and mammals. But, massive and periodic applications have been reported to create far-reaching environmental effects. For example, in East Lansing, Michigan annual spraying of elm trees to control Dutch elm disease resulted in heavy robin mortality. Another report indicated that treetop and trunk feeding birds have virtually disappeared from several sprayed areas (Wallace 1959). In Wisconsin, the density of songbirds was reported as reduced from 38 to 90 percent in pesticide sprayed areas. Hunt (1960) reported that robins in sprayed areas declined 69 to 98 percent below those of unsprayed communities. Bobwhite quail mortality has been reported at nearly 100 percent in some sprayed areas (Clawson 1958). Nesting success of red-winged blackbirds

was reduced 50 percent on areas treated in March and 100 percent on areas treated in May (Lay 1958). Numerous other studies indicate the detrimental effects of DDT and related pesticides on wildlife populations (Pesticides, Wildlife Studies, Fish and Wildlife Circular 199, Rudd 1964, Rudd and Genelly 1956). Effects on animals may be instant or delayed mortality or lowered fecundity.

Pesticides have been used to control many disease and pest organisms, but when used carelessly they create undesirable environmental stresses. Wide-spectrum pesticides have a shotgun affect on the entire community and not just on the target pest species. They not only kill the pest, but they may eradicate the parasites and predators that normally feed on the pests. They generally simplify the biotic community and create instability. Pest species usually recover more rapidly from pesticide applications than predators. Therefore, chemical measures to control pests tend to create a continuing demand for more chemical controls (Dasmann 1972). Baker (1972) stated that chemicals should be employed only as a last resort when other methods of control have failed.

Pesticides affect animal populations by interference with food chain components. If food organisms are killed within an area, dependent animals may result in mass starvation. Also, pesticides accumulate in tissues of organisms at lower levels of the food chain, and they concentrate as the material passes up through the food chain. The top or upper level organisms may receive lethal doses. The concentration of toxic substances in food chains

is referred to as biological magnification or biological amplification. The most serious and best documented examples of biological magnification are seen in certain birds of prey (Wagner 1971).

The bald eagle, the osprey, duck hawk, and peregrine falcon have all declined alarmingly in the past 15 years. The first two are fish-eaters, and the latter two feed on fish-eating birds. All of these exhibit impaired fertility and mortality. DDT and other chlorinated hydrocarbon pesticides have been found in their eggs, in the remains of fish scattered about their nests, and in their carcasses (Smith 1966).

Relationships have been made between reduction of eggshell thickness and population decline of the bald eagle (eggshell decline of 18%), osprey (eggshell decline of 25.1%), and peregrine falcon (eggshell decline of 18.8%) (Hickey and Anderson 1968). In nesting studies in Connecticut between 1960 and 1963, osprey annual rates of decline were reported as 13 to 14 percent (Ames and Mersereau 1964); a similar study in Connecticut during 1964-65 also reported an annual rate decline of 13-14 percent (Peterson 1969).

Small mammals also accumulate pesticides such as DDT. Mice and shrews were tested after a spraying of one pound of DDT per acre to control an outbreak of spruce budworm in Maine. Shrews had approximately 10-40 times the amount of DDT residue concentrated in mice. Mice are herbivors, while shrews, being carnivors, were further up the food chain. The shrew's carnivorous diet led to a concentration of 41 parts per million DDT during the year the forest was sprayed. After nine years the DDT residues were nearly

normal in mice, but they remained unusually high in shrews at 2 to 6 parts per million (Wagner 1971). Although this level of pesticide residue may have affected the shrews but little, their predators would certainly have greater concentrations.

The total degree of environmental stress that various introduced chemicals have placed on ecosystems is yet unclear, however pesticides appear to be omnipresent. They have been detected in the air (Turner 1965), rain water (Wheatley and Hardman 1965), freshwater (Cope 1966), salt water (Butler 1966), soils (Wheatley et al. 1962), muds (Keith 1966), humans (Woodwell 1967), invertebrates, fish, birds, and mammals. Pesticide residues have been found even in the remote corners of the earth. For example, they were found in plants in the Northwest Territories of Canada (Sheldon et al. 1964) and in fish, Adélie penquins, skua gulls and seals in the Antarctic (George and Frear 1966). Tests in Maine and New Brunswick, where DDT was sprayed from airplanes to control spruce budworms in forests, found that about 50 percent of the DDT did not fall to the ground (Woodwell 1967). Instead, the DDT became airborne.

By 1970, most biologists clearly realized the potential danger of losing birds that are high on food chains, such as hawks, falcons, eagles, owls, herons, egrets, and seabirds. Studies in the Long Island estuary, New York estimated that over one billion pounds of DDT alone might be circulating in the biosphere (Woodwell 1967). Much of the pesticides applied on terrestrial ecosystems eventually make their way into the oceans. Wurster (1968) found that

a DDT level of only a few parts per billion in seawater could drastically reduce photosynthesis in the phytoplankton which is the base of oceanic food chains. By passing up the food chains to the carnivorous seabirds, pesticides may eventually cycle back to the terrestrial ecosystems.

It is difficult to evaluate the effects of pesticides on soil. Soil organisms are extremely numerous and varied. A square meter of fertile soil yields 1×10^{15} bacteria, 1×10^{7} roundworms, 1000 earthworms, 50 snails, 5×10^{8} protozoa, 600 spiders, 40 harvestmen, 2×10^{5} mites, 500 pillbugs, 500 centipedes and millipedes, 100 beetles, 200 flies, and 5×10^{4} springtails (Kucera 1973). An integrated array of plants, animals and microorganisms is essential to soil fertility. Considerable evidence exists that insecticides may reduce soil fertility, especially in forest soils (Ehrlich and Ehrlich 1970). Based on Jones' data (1952), Kucera (1973) concluded that bacteria were curtailed when DDT was present at levels above 0.01 percent by weight of dry soil.

DDT breaks down slowly, and it persists for years in the soil, especially in forests (Woodwell and Martin 1964). After 15 years, 50 percent of the original application may still remain (Nash and Woolson 1967). Up to 32 pounds per acre of DDT were found in the upper layer of mud in the Long Island estuary where the marsh had been sprayed for 20 years to control mosquitoes (Woodwell 1967). According to Ehrlich and Ehrlich (1970), these concentrations are not unusual in other ecosystems. Even after spraying had been discontinued in a forest in New Brunswick, the DDT content of the soil increased from half a pound per acre to 1.8 pounds per acre in three years

between 1958 and 1961 (Woodwell 1967). Apparently the pesticide residues were released from the litter in normal turnover.

Forest Fires: In the past, fires periodically burned over large areas in New England. They were started by lightning, by Indians--both accidentally and intentionally, and by early settlers for land clearing. New England colonists reported that fires frequently burned continuously until the rains extinguished them (Bromley 1935, Day 1953). They were also started by railroad locomotives--because spark screens were not required (Moss 1973), and more recently by man to control certain species present in cultured timbers. Most unintentional forest fires have been brought under control in Massachusetts and Connecticut. The acreage burned in Connecticut was reduced from about 60,000 acres per year in 1910 to approximately 2,000 acres per year in 1945 (Kienholz 1963). Also, the number of fires have been reduced. Most Connecticut forest fires occur during the months of March (23%), April (33%), and May (14%). Smaller percentages of fires occur in other months, but increase again in the fall season to 14 percent in October (Kienholz 1963).

Past fires have created damage that has affected the present composition of New England forests. The abundance of more susceptible species has been reduced. Often several decades were required before these species were reestablished. Fires favor oaks, red maple, aspen, pin cherry, and the birches, because these species are rapid sprouters after disturbance. Desirable species such as beech, sugar maple, pines and hemlock may be

restricted to moist sites or eradicated locally as a result of fire.

The secondary effects of forest fires in New England are great. Recreational activities suffer because hiking and picnicking are restricted. The natural beauty of the forest is lost. The cost of clean-up after fires is generally much greater than the cost of harvesting live trees. Wildlife habitat is lost. And, soil protection is lost. The extent of damage largely depends upon the frequency of fires, their intensity, and the time of season of occurrence.

The extent of fire damage to a forest community is not immediately assessible, because some effects are delayed, ramifying, and synergistic. Humus and litter on the forest floor decompose gradually. They enrich the soil and improve the soil structure, especially its permeability. They also enhance the ability of the soil to hold water. Fires on the forest floor frequently destroy humus and immediately release nutrients to the upper layers of the mineral soil. With the loss of humus the forest soil is subject to severe erosion. This results in silt deposition in nearby streams. Loss of humus may also result in soil compaction, with resulting lower infiltration rates, and thus, greater soil run-off. Also, without the buffering effect of humus, soil temperatures increase in the daytime and decrease at nighttime, giving a greater soil temperature range. Numbers of soil microorganisms may be reduced by the intolerable environmental conditions and by the reduction of the humus-food substrate. The potential for epidemics of insects and diseases increases after fires.

Fires affect trees in various ways. Individual trees may be killed outright. Often fire only scars the tree trunk base, but scars allow insects and diseases to attack the tree. Death of the tree may be within weeks or decay may continue for years after a fire. Sprouts arise from the bases of many tree species after the tree has been killed, however these sprouts generally produce inferior trees to those originating from seeds.

Forest fires may occur as surface fires or as crown fires. Surface fires are the most frequent. The intensity of the fire determines the degree of damage. Minor burns damage the forest floor and injure tree bases. Under extremely dry conditions in late summer, deep organic matter in the forest soil may be burned with severe damage to standing trees. Crown fires are more restricted in occurrence. They generally occur in areas dominated by conifers and are usually more important in the western United States than in the east. Crown fires occur in the upper stratum of the forest under very dry conditions and travel rapidly.

The destructive effects of forest fires are well known, but the useful role of fires is generally less understood. Certain forest types originated and are perpetuated by periodic fires. Eastern white pine in Pennsylvania and New England is apparently maintained by fire (Lutz 1930, Cline and Spurr 1942, Hough and Forbes 1943). Also, fires are recommended to maintain the subclimax pitch-shortleaf pines in New Jersey (Lutz 1934, Moore 1939, Moore and Waldron 1940, Little 1946, Little and Moore 1949). Pitch-shortleaf pines are desired over the hardwood forest species that would successionally follow

without human intervention, because the species composition of hardwood forests is frequently dominated by low quality oaks.

Other stresses: The vegetation of New England has been modified by man's activities since Indian occupation some 9,000 years ago. Concomitant with colonization in the 1600's massive deforestation plagued much of the Connecticut River Valley in Massachusetts and Connecticut. During the post-colonial period, lumbering, agricultural activities, and fires probably took place continuously, or at least repeatedly, throughout the nineteenth century.

Heavy winds and storms have been a recurring stress factor throughout the area. At least 18 relatively severe storms have hit southern Connecticut since 1786 (Niering and Goodwin 1962). Two violent storms, one in 1815 and one in 1938, essentially destroyed the oak forests near Stonington, Connecticut (Raup 1941). The most recent hurricane, occurring in September 1938, created heavy damage along the Connecticut River Valley area and in the middle sections of Connecticut to beyond the Massachusetts border. Kirk (1939) reported seven days of heavy rainfall associated with this storm. One station reported 17.7 inches of rain. Over 13 inches of rain fell throughout a belt 10 to 15 miles wide, from Branford, Connecticut, northeast into Massachusetts. The storm consisted of a whirling-circular movement of winds, over 300 miles in diameter, moving at a rate of 50 to 60 miles per hour. Winds were registered at 100 miles per hour in some locations. Due to previous heavy rainfall, the storm's destruction to forests was unprecedented (Meyer and Plusnin 1945). For example, over 100 hemlock, near New London,

Connecticut, measuring 24 to 36 inches dbh (diameter at breast height) blew down (Avery et al. 1940).

Drought has been another stress factor of some importance in the Connecticut River Valley area. Records from Hartford's Brainard Field indicated a normal average annual precipitation of about 44 inches. Between 1927 and 1937, average annual precipitation was 3.6 inches below normal; between 1937 and 1957, it was 1.0 inch above normal; between 1957 and 1967, it measured 6.9 inches below normal. During the period 1959 to 1969, Stephens and Hill (1971) reported that several Connecticut tracts received 8 to 15 percent less average precipitation than in the preceding 6 to 10 years. They found drought had little effect on mortality in undefoliated tracts. In woods where a single prior defoliation had occurred, the drought did not result in increased death. In an area twice defoliated, mortality was greater during the drought. Losses of oaks exceeded the averages of all major species in all tracts examined. Mortality increased with severity of drought and repeated defoliations.

Cutting has been another major influence on Connecticut and Massachusetts forests. For over 250 years these forests were exploited for cordwood, lumber, and charcoal production. By 1800, little mature or virgin timber remained. After the chestnut blight threatened the forest structure (approximately 1909), cutting for lumber began to taper off. Also, there has been a decreased demand for charcoal in the brass and iron industry, and oil has largely replaced wood for fuel. Repeated cuttings tended to eliminate the

non-sprouting species such as hemlock, and thereby, favor the sprouting hardwoods (Niering and Goodwin 1962). The wooded areas that are now dominated by hemlock are local.

Agricultural activities in southern New England reached a peak in about 1840; it is estimated that about 70 percent of Connecticut was cleared. Since that time the state has largely become reforested. Old stone walls traverse most of the present forests and outline the perimeter of formerly cleared agricultural land.

More recent disturbances include local quarrying. Granite was removed from many areas for building construction. Where top soil was removed, exposed barren areas have not become revegetated.

Other periodic natural phenomena causing damage to the structure and function of New England forests are ice and snow. Normally, catastrophic events occur infrequently, and the degree of damage is not easily nor adequately recorded.

Increased leisure time and interest in nature have brought greater recreational use, and thus more stresses, to the forests. Examples are: scarring or debarking of trees, scattering of refuse, destructive cutting, carelessness with fires, and destruction of vegetation and compaction of forest soil by motorized vehicles.

Environmental Stresses of Millstone Point: Ground surveys were made to determine the major environmental stresses on native plant communities in the vicinity of the Millstone Point site. The most common stresses

were caused by lumbering, insect infestations, flooding, fires, hurricanes, gales, and by the conversion of native communities to farm land, residences, commercial and industrial developments, and transportation networks. Several topographic, edaphic, and physical factors associated with the coastal environment have caused natural stresses.

The effects of recent disturbances on Millstone Point appear to be more localized than the initial large scale clearing of forested areas in southern Connecticut. Topographic relief is moderate, and erosion is minimal in most communities. Recreational activities, such as picnicking, swimming, and fishing, are mainly restricted to several beach areas. The transmission line corridor is affected by refuse dumping, periodic clearing, and changes in radiation absorption and albedo. Defoliation damage was observed in the hardwood forests in October 1973. Although defoliation had mainly occurred on the oaks, several other hardwood species were affected. Windthrows in the mixed hardwood forest communities were evidence of past severe storms. Near the coast, terrestrial vegetation communities were affected by salt spray, salt permeation to plant root systems, tidal inundations, a substrate with little or no true soil, and a paucity of available moisture in the well-drained soil. Winds near the beach also interact with the other stresses which make root anchorage uncertain.

Grazing and hay production are examples of agricultural activities that occur near the site. Other stresses on vegetation have resulted from quarrying and construction of roads and the Penn Central Railroad spur.

Approximately one-fourth of the 500-acre site is currently occupied by the station buildings, quarry pond, parking lots, and construction areas (USAEC 1974).

3. The Central Hardwoods-Hemlock Zone

Millstone Point is located in the central hardwoods-hemlock forest zone (Westveld et al. 1956). Hardwoods in this zone are diverse, and are dominated by oaks (Quercus spp.) and hickories (Carya spp.) (Griswold and Ferguson 1957). Hemlock (Tsuga canadensis), a key conifer species, occurs over extensive areas as scattered individuals or as small reproductive groups that have expanded in the absence of fire (Lutz 1928). American beech (Fagus grandifolia), tulip tree (Liriodendron tulipifera), red maple (Acer rubrum), and sugar maple (A. saccharum) are locally important on lower slopes and in valley bottoms, coves and swales, while black oak (Q. velutina), scarlet oak (Q. coccinea), white oak (Q. alba), and chestnut oak (Q. prinus) are principal dominants of xeric ridges and slopes where the soil is thin. Eastern redcedar (Juniperus virginiana), black cherry (Prunus serotina), and gray birch (Betula populifolia) are characteristic of abandoned fields and pastures (Niering and Goodwin 1962, Niering and Egler 1966).

Much of Millstone Point was formerly cultivated. Recently, most of the agricultural land has lain idle and has successionally reverted to its natural state.

Coastal marshes in the area are inhabited by halophytic grasses and herbs. The composition and structure of plant communities adjacent to coastal marshes are largely controlled by the salinity of water in the marsh. Most marshes in the region east of the Connecticut River to Rhode Island are less than 6 feet deep (Hill and Shearin 1970).

Mull and duff mull are the most common soils in this zone and true podzol mors are localized and rare (Westveld et al. 1956).

Long Island Sound tends to moderate the climate of southern New England. Therefore afternoon summer temperatures at Millstone Point are generally lower and winter temperatures are higher than locations further inland.

A mosaic of vegetational communities in a variety of successional stages exist in the study area. Variations in community development have resulted from multiple influences, both natural and man-induced. These include clearing, lumbering, cultivation, reforestation, grazing, fires, hurricanes, gales, and infestations.

4. Millstone Point Study Sites

A map showing the locations of each plant community sampled is presented in Figure 1. The distribution of the major plant communities in the site area is shown in Figure 2. Major vegetation types were selected and classified according to habitat features and dominant species in the habitat. Dominant species exert the greatest control over the community through use of a major portion of the available moisture, light, and nutrients, and modify the environment for lesser species. Habitat topography, moisture, ambient atmospheric and edaphic variations, microclimate effects, and human activities determine species composition.

Site 1 - Old Field

The old field community was located on a gradual south-facing slope at an elevation of approximately 80 feet. Portions of the study area

were mowed annually.

Species composition was similar to old fields in the Connecticut Arboretum at New London (Niering and Goodwin 1962). In May, orchard grass (Dactylis glomerata) and sweet vernal grass (Anthoxanthum odoratum) were dominants with relative frequencies of 21.8% and 20.5%, respectively (Table 1). Other significant vernal grasses and forbs included Kentucky bluegrass (Poa pratensis), bulbous buttercup (Ranunculus bulbosus), and common dandelion (Taraxacum officinale). Buckhorn plantain (Plantago lanceolata) occurred in various morphological stages in all sampling periods and had an average occurrence of 42.3%. The frequency of occurrence of redtop (Agrostis alba), velvet grass (Holcus lanatus), and timothy (Phleum pratense) increased considerably by July. During October the community consisted largely of the vegetative remains of Kentucky bluegrass and panic grass (Panicum sp.). Seasonal decline of some species, such as dwarf cinquefoil (Potentilla canadensis), which normally flourishes all season, was due to early maturation and development of the mid-grasses. These dense grasses effectively blocked light penetration and thereby reduced underlying species.

The old field was surrounded by a fencerow overgrown with vines and shrubs. A mixed hardwood stand bordered the community on the east. Many woody species had invaded the perimeter and were scattered in the old field; these included pioneer woody species such as blackberry (Rubus sp.), Japanese honeysuckle (Lonicera japonica), rose (Rosa sp.), arrowwood (Viburnum dentatum), poison ivy (Rhus radicans), and old field juniper (Juniperus communis).

Periodic artificial disturbances by man will curtail natural community development. However, woody successional species and native perennials such as broom sedge (Andropogon virginicus) and little bluestem (A. scoparius) will become increasingly important in unmowed areas. Orchard grass, sweet vernal grass, redtop, panic grass, velvet grass, and timothy will continue to dominate in mowed areas.

Site 2 - Mixed Hardwood Forest

Prior to disturbances in this community, the stand was probably contiguous to Site 6, another mixed hardwood stand. The two communities are separated by a transmission line corridor (Site 5) and construction storage areas. The woods is bisected by the Penn Central Railroad and a gravel access road to the transmission line corridor. Several stone fences traverse the site; these indicate that the community was previously cleared for agricultural use. Elevation ranges from 20 to 60 feet. Portions of the community occur on very moist soil near an intermittent stream and in natural depressions.

Red maple, a mesophyte, dominated the community near the stream and in depressions (importance value of 103.2), while black oak, a xeric species, dominated the upper slopes (importance value of 80.8) (Table 2). Black birch (Betula lenta), white oak, and sour gum (Nyssa sylvatica) were common associates. The presence of mockernut hickory (Carya tomentosa) and pignut hickory (C. glabra) indicated that the community was successionally progressing toward an oak-hickory climax, common to the region. However, compositional modifications will occur in localized areas, particularly in wet environments or along the edge of openings.

Most trees occurred in the lower size classes (4.0-9.9 in. d.b.h.) (Table 3), but several large and relatively old trees were found. Increment borings of a 20.3 inch d.b.h. black gum tree revealed its age at 110 years old, and a 16.4 inch d.b.h. mockernut hickory was 123 years old. Due to more optimal growing conditions than were present at Site 6, this stand supported a greater basal area per acre (22967 sq. in.), percent crown cover (93.0%), and shrub cover (37.3%) (Table 4). However, the riparian community (Site 3) had a substantially larger basal area per acre (31232 sq. in.), and percent crown cover (98.0%).

Red maple, black birch, mockernut hickory, and sour gum dominated the sapling class (Table 5); they had relative densities of 18.3%, 12.8%, 12.8%, and 12.2%, respectively. Witch hazel (Hamamelis virginiana) and downy juneberry (Amelanchier arborea) were abundant understory components.

Shade-intolerant tree species such as black cherry were present near openings and along the border of the community. The open perimeter also favored development of a dense shrub stratum. Arrowwood, sweet pepperbush (Clethra alnifolia), and spicebush (Lindera benzoin) were dominant shrubs (ground coverage of 11.0%, 9.7%, and 9.8%, respectively) (Table 6). Tree seedlings were scarce in the community.

Canada mayflower (Maianthemum canadense) and New York fern (Thelypteris noveboracensis) were common throughout the growing season (Table 7). Species composition in the groundlayer stratum was nearly 50% greater during July than in May or October. A delayed coastal spring season

and subfreezing temperatures prior to the fall sampling period reduced the number of herbs in May and October. The intermittant stream provided suitable microhabitats for mesophytes such as skunk cabbage (Symplocarpus foetidus), great Solomon's seal (Polygonatum canaliculatum) and ferns.

Site 3 - Riparian Community

The riparian community was less than 300 feet wide from Gardner's Wood Road on the east to an open recreational area on the west. A small stream longitudinally traversed the woods and periodically flooded low-lying areas.

The community was more mature than other forested areas at the site. Increment borings from several species revealed the community age at approximately 125 years old. However, past selective cutting was indicated. Species diversity of trees (16 species) was higher than other forested communities, but density was low (204.4 trees/acre) (Table 4). The basal area per acre of the riparian community was 87% greater than the mixed hardwood forest (Site 6) southeast of the transmission corridor and 36% greater than the mixed hardwood community (Site 2) northeast of the transmission corridor.

Red maple and American beech were community codominants with importance values of 86.1 and 55.4, respectively (Table 8). Although American beech was most dense (48.4 trees/acre), red maple had a greater relative dominance (40.7%). Black oak, black birch, and red oak were common associates, while mockernut hickory, sour gum, green ash (Fraxinus

pennsylvanica), black cherry, and white oak were of lesser importance. Associated tree species occurred in various size classes (Table 9).

Ordination and composition of the saplings were similar to that of the trees (Table 10); this reflected the stability and maturity of the community. American beech saplings were more prevalent than red maple saplings, and the former appeared to be increasing in abundance. Microhabitats were variable and both upland and lowland species flourished. Light penetration along the forest borders allowed successful reproduction of shade-intolerant species such as black cherry.

The shrub stratum was quite dense; small saplings, seedlings, and shrubs had a cover value of 44.4% (Table 11). American beech was the most prominent tree seedling while sweet pepperbush dominated the shrub species. Other important shrubs included common greenbrier (Smilax rotundifolia), arrowwood, pinxter flower (Rhododendron nudiflorum), maple-leaf viburnum (Viburnum acerifolium), spicebush, and mountain laurel (Kalmia latifolia).

In common with other forested communities in the site area, Canada mayflower was the most abundant spring herb that had persisted in vegetative form through July (Table 12). Skunk cabbage, marsh marigold (Caltha palustris), cinnamon fern (Osmunda cinnamomea), and jewelweed (Impatiens capensis) commonly occurred on low damp sites. Solomon's seal, aster (Aster sp.), and New York fern occupied the better drained habitats. The vegetational composition of low, wet microhabitats was similar to that

documented by Egler and Niering (1965) at the Yale Natural Preserve at New Haven, Connecticut.

Well-developed, untilled soil, and other suitable edaphic factors have facilitated development of the riparian forest over other hardwood communities at Millstone Point.

Site 4 - Brackish Marsh

This sea-level community lies along the eastern edge of the Millstone Point site and is connected to Long Island Sound by a channelized stream. Most of the salt marshes along the coast have been trenched to control mosquito breeding (Hill and Shearin 1970). This community was classified as a shallow coastal marsh, 2 to 5 feet deep (Hill and Shearin 1970). Portions are shallow open pools which will eventually fill with invading salt-tolerant emergents. Marsh vegetation is controlled primarily by salinity and water depth.

In May, vegetation was largely dormant, but grass sprouts had an 85% frequency of occurrence (Table 13). Bulrush (Scirpus sp.) was locally abundant throughout the sampling periods in drier areas along the west border of the community. Salt meadow grass (Spartina patens), salt grass (Distichlis spicata), Bigelow's glasswort (Salicornia bigelovii), seaside goldenrod (Solidago sempervirens), and smooth cordgrass (Spartina alterniflora) were the predominant species over the greatest extent of the marsh. In October these species had a total relative frequency of 79.6%. Common reed grass (Phragmites communis) grew on spoil banks adjacent to the channelized stream.

According to Hill and Shearin (1970), reedgrass, as well as shrubs and grasses not typical of the brackish marsh, commonly inhabit these built-up areas. Other less abundant species characteristic of the brackish marsh included black grass (Juncus gerardi) and marsh fleabane (Pluchea purpurascens). These occurred throughout the marsh whereas switch grass (Panicum virgatum) was found in higher areas only a few inches above high tide.

Site 5 - Transmission Line Corridor

The transmission line separates the two mixed hardwood communities (Sites 2 and 6). The corridor was cleared during the summer and fall of 1968. The topography is undulating and rocky. A shallow drainage ditch extends the length of the site. Refuge dumping occurs on the slopes of the ridge adjacent to the drainage ditch. The community is currently in early secondary succession.

A variety of herbaceous and woody pioneering species adapted to disturbed conditions was most commonly present but residual species from the former hardwood forest were also found. The corridor community had a high diversity of woody and herbaceous species (92). Gray birch, a species common to exposed sites, was the dominant tree species. It occurred primarily as seedlings and small saplings and had a relative frequency of 36.4% (Table 14). Most other seedlings originated from rootstocks or as disseminules from adjacent hardwood forests. The combined relative frequency of oaks and yellow birch (Betula lutea) was 50.0%. Blackberry, an early successional shrub, dominated the shrub stratum with a relative dominance value of 55.6%; however,

residual forest species such as mountain laurel and highbush blueberry (Vaccinium corymbosum) were also abundant. The total shrub cover was 29.0%.

Herbaceous species that were mature during the May survey included spikerush (Eleocharis sp.), common cinquefoil (Potentilla simplex), Canada mayflower, and cinnamon fern (Table 15). During the summer, whorled loosestrife (Lysimachia quadrifolia), woolly panicgrass (Panicum auburne), and redtop flourished, whereas rough goldenrod (Solidago rugosa) and broomsedge matured by autumn. Due to early frosts, herbs were scarce during the October sampling period. The presence of dry vegetative remains of asters, whorled loosestrife, sedges (Carex spp.), and rushes (Juncus spp.) indicated that these species had persisted in various stages of morphological development prior to the first frost.

Since woody species will be periodically controlled by herbicides, successional development of the transmission line corridor will be cyclic, and herbaceous vegetation will persist.

Site 6 - Mixed Hardwood Forest

This stand is similar to the mixed hardwood stand (Site 2) northwest of the transmission line corridor. Species composition and structure are comparable, but this community lacks the wet depressions conducive to localized red maple stands. Both communities occur at similar elevations, but Site 6 has better drainage.

Black oak dominated the community. It had an importance value of 98.0 (Table 16), which is over three times greater than its nearest competitor.

White oak, black birch, scarlet oak, pin oak (Quercus palustris), and red maple were the most common associates. Black cherry, American beech, mockernut hickory, and red oak were of less significance. Compared with other wooded sites, this community had the most open canopy (81.1%), the lowest basal area per acre (16668 sq. in.), and the least shrub cover (22.9%) (Table 4). Sixty-four percent of the trees occurred in the smallest size class (Table 17).

Residual earth mounds created by windthrows of past severe storms were prominent throughout the community. Increment cores taken from representative trees, such as a 113 year old American beech (18 in. d.b.h.), indicated that a few trees had survived over a century of disturbances. However, natural and man-induced stresses have left a relatively open canopy in the forest. Light penetration through the upper canopy was sufficient to support dense lower strata. The density of saplings (283.3 stems/acre) was higher in this community than in other wooded communities sampled. Various factors such as past disturbances, edaphic features, and proximity to the Long Island Sound which increased susceptibility to salt spray, may have contributed to the lower basal area value in the stand. White abaxial leaf surfaces from trees proximal to the Sound indicated transpirational salt residues.

Black oak and red maple codominated the sapling class (Table 18). Red maple, black cherry, beech, and mockernut hickory had greater importance as saplings than as trees, indicating a more mesic successional trend. However, major species of the upper canopy were also present as saplings, which indicated general reproductive success of many important species. Sassafras

(Sassafras albidum), and downy juneberry were prominent understory components. Black cherry and oaks dominated the shrub stratum, and sour gum and red maple were common associates. Huckleberry (Gaylussacia baccata) was the primary shrub species (63.0% relative dominance) with a cover value of 14.4% (Table 19). Arrowwood, blueberries, and sweet pepperbush also contributed to a total shrub and tree seedling coverage of 29.5%.

Thick litter and competition among woody seedlings precluded the development of a diverse herbaceous groundlayer (Table 20). Canada mayflower was an exceptionally dense herb, with occurrence values of 88% and 97% in May and July, respectively. Lady fern (Athyrium felix-femina) was locally prominent during summer and fall.

Site 7 - Abandoned Nursery

The abandoned nursery occupied considerable acreage at Millstone Point. The area was occasionally marshy and less than ideal for horticultural species. Many cultivated shrubs and trees were present and some were being salvaged. Many of the ornamental shrubs were rhododendrons and azaleas (Rhododendron spp.), while the trees included crimson king maple (Acer palmatum var. atropurpureum), flowering cherry (Prunus yedoensis var.), and mountain ash (Sorbus americanus). Trees and shrubs usually cultivated for arbors, hedges, and borders that were present in the community included juniper (Juniperus spp.), yew (Taxus spp.), barberry (Berberis spp.), and arbor-vitae (Thuja occidentalis) (Table 21).

Due to partial abandonment, the area is in various successional

stages. Cultivated species were qualitatively surveyed in May, and invading species from the fencerows and neighboring plant communities were analyzed in July and October. Because part of the area was only recently abandoned, annual plants such as common ragweed (Ambrosia artemisiifolia) were present (Table 21). Plantains (Plantago spp.), thistle (Cirsium sp.), lady's thumb (Polygonum persicaria), curly dock (Rumex crispus), and nightshade (Solanum dulcamara) were examples of pioneer species that invaded areas adjacent to cultivated plots and along the dirt access roads. In other open areas, redtop, sweet vernal grass, velvet grass, quackgrass (Agropyron repens), asters, goldenrod (Solidago spp.), and rough fleabane (Erigeron strigosus) were common. Woody species such as arrowwood and rose (Rosa sp.) also occurred in open areas; these species indicated advanced stages of succession. Rushes, sedges, jewelweed, and water hemlock (Cicuta maculata) were present in mesic microhabitats. Boxelder (Acer negundo), red maple, black cherry, and a variety of shrubs and vines inhabited fence rows and borders. Poison ivy, Virginia creeper (Parthenocissus quinquefolia), rose, allegheny blackberry (Rubus allegheniensis), and common greenbrier occurred frequently.

Cultivated species are normally not strong competitors; thus, a climax hardwood forest community will probably successionally develop. Some nursery plants may persist for several decades, depending upon their natural affinity to the community type.

Site 8 - Beach and Managed Recreation Area

This area was developed by NUSCO for public use as a recreation area. The beach is a relatively narrow strip of sand with rock outcroppings.

Although the picnic area is mostly managed lawn with cultivated trees and shrubs, natural vegetation in various stages of succession occurs on marginal land. Beachgrass (Ammophila breviligulata), beach pea (Lathyrus japonicus), and tall wormwood (Artemisia caudata) occurred at the edge of the beach (Table 22). These were pioneer species that represent the first stage of vegetational zonation on a beach. Where these hardy plants were established in the sand, they provided a firmer base for species such as poison ivy, seaside goldenrod (Solidago sempervirens), common evening primrose (Oenothera biennis), rose, and northern bayberry (Myrica pensylvanica). Advanced stages of succession were evident inland. Herbs in these areas included common St. Johnswort (Hypericum perforatum), butterfly weed (Asclepius tuberosa), Bosc's panic grass (Panicum boscii), redtop, sweet vernal grass, common yarrow (Achillea millefolium), and morning glory (Ipomoea sp.). Common shrubs and vines were wine raspberry (Rubus phoenicolasius), dwarf and staghorn sumac (Rhus copalina and R. typhina), Virginia creeper, blackcap raspberry (Rubus occidentalis), huckleberry, and Japanese honeysuckle.

Apple (Malus sp.), cherry, downy juneberry, and juniper were common trees in the managed picnic ground and around the visitors' center. Marginal areas were comprised of Japanese honeysuckle and poison ivy which covered the ground under thickets of staghorn and dwarf sumac. Goldenrod, Kentucky bluegrass, orchard grass, sheep sorrel (Rumex acetosella), redtop, common ragweed, and common St. Johnswort occurred in varying abundance. This mixture of weeds reflected disturbances inherent to borders between recreational and natural areas.

Sedum (Sedum sp.) grew in scarce clumps in the cracks of the extensive granitic outcroppings on Bay Point. Vegetation in this area was largely limited by the solid rock stratum and salt spray.

Site 9 - Beach Community

The beach community provided a harsh environment in which few plant species could survive. Nine species were recorded in May, eighteen in July, and twenty-four in October (Table 23).

American beachgrass with an average relative frequency of 92% strongly dominated the beach and formed the first vegetative successional zone (Table 23). Yellow toadflax (Linaria vulgaris) flourished in the spring (11.5% relative frequency), while common evening primrose (Oenothera biennis) increased substantially by July (15.9% relative frequency) and October (10.2% relative frequency). Seaside goldenrod and jimsonweed (Datura stramonium) also occurred among the beachgrass clumps. Rose shrubs, poison ivy, Virginia creeper, and field bindweed (Convolvulus arvensis) occurred throughout the community inland from the American beachgrass zone.

The environment was harsher for spermatophytes, and succession occurs slowly in areas closer to the sea. The first vegetational zones were subject to greater wave and tide influences, salt sprays, more critical soil moisture, wider ranges in soil and ambient air temperatures, stronger winds, and illusive plant anchorage. Where the sandy beach soil was enriched by an accumulation of organic litter, it provided a more favorable environment for secondary invaders. Diversity of species increased with increasing distance from the water's edge.

B. Mammals

1. Small Mammal Populations

During the May, July, and October 1973 sampling periods, eight species of mammals were recorded from nine study sites within the Millstone Point area. The most common species collected was the white-footed mouse (Peromyscus leucopus), which accounted for 61.0% of all mammals captured (Table 24). The meadow vole (Microtus pennsylvanicus) was next in abundance accounting for 29.7% of the total catch (Table 24). Other species collected included the shorttail shrew (Blarina brevicauda), meadow jumping mouse (Zapus hudsonius), Norway rat (Rattus norvegicus), masked shrew (Sorex cinereus), eastern chipmunk (Tamias striatus), and pine vole (Pitymys pinetorum). Data on sex, weight, and selected body measurements of individual species collected are presented in Appendix B, Tables 1-3.

2. Habitat Utilization

Habitat utilization, defined by Gentry et al. (1971) as the proportion of animals captured within each habitat type, was calculated for each community on a seasonal and cumulative basis (Tables 24-27). To equalize trapping effort among communities, the number of mammals captured per 100 trap-nights was used to calculate habitat utilization rather than the actual number captured.

Although habitat utilization fluctuated seasonally within communities, cumulative data for the three trapping periods indicate that the beach community (Site 9) received the greatest habitat utilization with 22.2% (Table 24). Utilization of this habitat increased from 5.3% in May to 20.1% in July. From July

to October habitat utilization of the beach community increased from 20.1% to 23.4%, although the number of captures per 100 trap-nights declined slightly. A vegetative analysis of the herbaceous stratum in the beach community indicated that little change had occurred in either the amount of cover or food through mid-October.

Based on cumulative data, habitat utilization of the mixed hardwood forest (Site 2) and beach and managed recreation area (Site 8) was 14.1% and 12.9% respectively (Table 24). The importance of the mixed hardwood forest was high in May (19.7%), but declined to 13.4% in July and 10.9% in October. However, the utilization of the beach and managed recreation area doubled from 11.3% in May to 26.1% in July and declined to 9.4% in October. Habitat utilization of the remaining study sites fluctuated seasonally but cumulatively did not exceed 10.5% during the three trapping periods (Table 24).

The white-footed mouse was the most abundant and widespread small mammal captured. Although P. leucopus was taken in all habitat types, wooded or brushy habitats adjacent to forest borders were preferred with 77.2% of this species total taken in these areas. Similar distributions of P. leucopus in continuous and dense shrub cover, or in tree dominated successional stages have been reported by Shure (1970, 1971). In southern New England, P. leucopus prefers wooded habitats dominated by white pine, hemlock, and oaks (Choate 1973).

The meadow vole preferred open grass or shrub dominated community types with 96.5% of this species total captured in these habitats. Hodgson (1972), Zimmerman (1965), and Wirtz and Pearson (1960) also reported that M. pennsylvanicus selects

areas where grassy vegetation is dominant. Sixty-three percent of the M. pennsylvanicus captures occurred in the brackish marsh (Site 4), beach and managed recreation area, and beach community. Shure (1971) documented a similar association of M. pennsylvanicus with a variety of barrier beach habitats in New Jersey.

Twenty-seven shorttail shrews were captured in seven of the habitat types (Table 24). Although B. brevicauda was not restricted to a specific habitat type, Jameson (1949) and Wetzel (1968) reported that wooded areas or rank, weedy fields are preferred by this species. Although the masked shrew was found exclusively within the transmission line corridor (Site 5), the occurrence of this species is not restricted to a specific habitat type (Tester and Marshall 1961).

Zapus hudsonius was collected in the old field (Site 1), transmission line corridor, and abandoned nursery (Site 7) (Table 24). Close association of Z. hudsonius with shrub and grass dominated habitat types has also been reported by Quimby (1951) and Shure (1971).

Three Norway rats were captured in the brackish marsh. Because of their social tolerance Norway rats will inhabit buildings wherever food and shelter are available; however, Schwartz and Schwartz (1959) reported this species may forage or live in nearby fields.

One pine vole was captured in the transmission line corridor. Studies by Hamilton (1938) and Benton (1955) revealed that P. pinetorum prefers mixed deciduous woods, woodland edges, and mixed overgrown fields containing thick

ground litter. It is unusual that only one P. pinetorum was captured, since the occurrence of this species is common in well drained upland coastal areas of Connecticut and Massachusetts (Miller and Getz 1969).

Although the eastern chipmunk was collected with snap-traps on two occasions, general observations of mammals in Tables 28-29 provide a better indication of habitat preference and relative abundance of this species.

3. Abundance and Reproduction

A significant increase ($P<0.05$) in the relative abundance of small mammals occurred from May to July (Table 30). The relative abundance, expressed as the number captured per 100 trap-nights, increased from 3.48 in May to 9.25 in July (Table 30). With the exception of the riparian community, the relative abundance increased within each community during this time interval. Population increases were greatest in the beach and managed recreation area, beach community, and transmission line corridor (Table 30).

From July to October small mammal populations remained stable with the relative abundance declining from 9.25 to 8.14 captures per 100 trap-nights (Table 30). Although the relative abundance remained relatively stable within most of the habitat types, small mammal populations fluctuated dramatically in the abandoned nursery and the beach and managed recreation area (Table 30). The high relative abundance in the abandoned nursery during October reflected the greater amount of cover and food available to small mammals. During this same time period, however, the relative abundance of small mammals in the beach and managed recreation area decreased from

26.00 to 7.75 (Table 30). Since the rate of removal of small mammals normally is highest during the initial day of trapping and progressively declines during the remainder of the trapping period, the high relative abundance in July probably resulted because trapping was conducted on only one day.

With the exception of P. pinetorum, the relative abundance of each small mammal increased from May to July (Table 31). Three species including P. leucopus, B. brevicauda, and R. norvegicus continued to increase in relative abundance from July to October, while M. pennsylvanicus, Z. hudsonius, S. cinereus, and T. striatus declined during this period.

Species composition during each census period remained similar, with P. leucopus constituting a large portion of each catch. The proportion of P. leucopus varied from a high of 96.3% in May to a low of 44.9% in July and averaged 61.0% for the three trapping periods. Microtus pennsylvanicus accounted for 29.7% of the total catch and was most abundant in July when it represented 45.8% of the small mammals captured. Blarina brevicauda represented 5.9% of the total catch while the remaining four species Z. hudsonius, R. norvegicus, S. cinereus, T. striatus, and P. pinetorum accounted for less than 5% of the total catch.

Peromyscus leucopus accounted for 61.0% of the small mammals captured during the three census periods (Table 24). Relative abundance, expressed as the number captured per 100 trap-nights, increased from 3.35 in May to 4.15 in July to 5.14 through mid-October (Tables 25-27). Increased reproductive rates, greater seasonal activity, and an increased carrying capacity were largely responsible

for this species initial increase. Although the number of pregnant females declined to zero in October, the percentage of lactating females remained high. With a loss of an adequate food supply in the autumn, Jameson (1955) observed a cessation of breeding activity for Peromyscus spp. Apparently, a combination of environmental factors including weather and the amount of food and cover remained favorable throughout mid-October to sustain the relatively high population of P. leucopus.

Populations of M. pennsylvanicus fluctuated during the three census periods. The relative abundance, expressed as the number captured per 100 trap-nights, increased from 0.04 in May to 4.24 in July and declined to 2.01 by October (Tables 25-27).

Zapus hudsonius exhibited similar seasonal fluctuations with the relative abundance increasing from 0.04 captures per 100 trap-nights in May to 0.29 in July. None was captured in October. Seasonal trends of Z. hudsonius may be attributed in part to hibernation (Krutzsh 1954).

Blarina brevicauda was captured initially in July, with populations increasing from 0.38 captures per 100 trap-nights in July to 0.85 in October.

The four remaining species R. norvegicus, S. cinereus, T. striatus, and P. pinetorum exhibited slight population fluctuations. The number of these species captured is so low that inferences to the amount of seasonal change in populations cannot be drawn.

4. Measurements

The mean, range, and standard deviation were calculated for total

body length, tail length, hindfoot length, ear length, and body weight for the small mammal species captured on all study sites in the Millstone Point area during the three sampling periods (Appendix B, Tables 4-13). Differences between adult and juvenile P. leucopus and M. pennsylvanicus were most noticeable for the total length and body weight measurements (Appendix B, Tables 4-7).

A high proportion of juvenile B. brevicauda in October accounted for the large standard deviation in total length, tail length, and hindfoot length measurements (Appendix B, Table 8).

5. General Observations of Other Mammals

In addition to the small mammals that were trapped, seven additional species were either observed or their sign recorded during the four census periods (Table 28). Four species were recorded in the riparian community, while only one was observed in the beach and managed recreation area. The mixed hardwood forests (Sites 2 and 6) and the beach community accounted for 51.4% of the observations.

Visual observations or sign of cottontail rabbits (Sylvilagus spp.) were recorded in eight of the habitat types (Table 29). Cottontail rabbits were the most frequently observed larger mammal accounting for 47.2% of the sightings. Two sympatric species of cottontail rabbits, the New England cottontail (S. transitionalis) and the eastern cottontail (S. floridanus), are found in Connecticut (Linkkila 1971, Dalke 1942). Fay and Chandler (1955) noted that S. transitionalis prefers bushy woodlands, whereas S. floridanus prefers open agricultural land interspersed with bushy cover.

The eastern gray squirrel (Sciurus carolinensis) was recorded in three communities, but observations were largely restricted to the two mixed hardwood forest sites (Table 29). The eastern gray squirrel is common throughout southern New England and prefers dense deciduous forests (Hamilton 1939).

Woodchucks (Marmota monax) were abundant with 11 observations in four habitat types (Tables 28-29). Woodlands bordered by open land were preferred habitat for woodchucks.

The eastern chipmunk (T. striatus) was recorded in only three of the study sites and accounted for 12.5% of the observations. Although relatively few eastern chipmunks were observed, Wetzel (1968) reported this species is common throughout Connecticut in timber borderland habitats.

Although sign of only two raccons (Procyon lotor) was observed, this species is common throughout Connecticut (Wetzel 1968). One set of raccoon tracks was observed on mud flats in the riparian community, while the other set was recorded in the beach community (Table 29).

Although only one whitetail deer (Odocoileus virginianus) was recorded in the site area (Table 29) portions of the Millstone Point site provided favorable deer habitat. McCaffery and Creed (1969) reported that forest habitats with an abundance of forage (principally low-growing herbs and shrubs) associated with openings provide prime deer habitat. Wooded areas transversed by transmission line corridors represent somewhat similar deer habitats on the Millstone Point site. However, it is likely that intense vehicular traffic and construction activities have restricted normal patterns of deer movement in the area.

Landowners in Connecticut regard deer as a recreational asset and not an agricultural liability (McDowell and Bensen 1960).

Sign of a muskrat (Ondatra zibethicus) was observed during July in the brackish marsh (Table 29). Cuttings of emergent vegetation were sighted along the north end of the community.

The remains of a starnose mole (Condylura cristata) were found in the old field during October.

C. Birds

1. General Descriptions

Observations of 3692 birds comprising 106 species were recorded along nine transect routes during May, July, October 1973, and January 1974 within the Millstone Point site. The area was diverse with two types of beach habitats (Sites 8 and 9), a brackish marsh (Site 4) dominated by salt meadow grass, and an old field (Site 1) dominated by orchard grass (Figure 1). Other study areas included an abandoned nursery (Site 7) and a transmission line corridor (Site 5), both characterized by a variety of edge habitats - those areas where two or more distinctive cover types meet. The remaining study areas included a riparian community (Site 3) and two mixed hardwood forest communities (Sites 2 and 6).

Of the 106 bird species recorded in the study area, 39 were classified as permanent residents, 42 as summer residents, 10 as winter residents, and 11 as migrants (Table 32). Seasonal occurrence of individual species was based on field observations and published ornithological records (Peterson 1947, Robbins et al. 1966, Vermeer 1970, Kortright 1942, Finch 1972, a, b, c, d, Goodwin and Grandjovan 1958, Mackenzie 1961, Boyd 1962, Manter 1965, and Connecticut Audubon Society 1973). The moderating influence of the Atlantic Ocean on weather conditions during the winter partly accounted for the large number of species in the permanent resident category. Records of individual species sighted along each transect route during May, July, October 1973 and January 1974 are presented in Appendix B, Tables 14-22.

The seasonal classification for each species may vary within a given region depending upon nesting cover, food availability, weather and other environmental factors.

2. Seasonal Variations

Variation in the number of bird species observed during each sampling period reflected typical seasonal population trends. However, seasonal variations were not as extreme as in areas inland from the Atlantic Ocean where maritime climatic conditions do not prevail. The climate is somewhat more moderate and food is more readily available along the coast during winter thereby providing a more favorable environment for birds.

Surveys during the spring (mid-May) and fall (late-October) migration periods accounted for 63 and 55 species, respectively (Table 33); however, these surveys probably did not include the peak migratory movements. In southern New England peak migratory periods during spring and fall normally occur in mid to late April and late September or early October (Finch 1972, a, c). Barn swallows, (Hirundo rustica), starlings (Sturnus vulgaris), red-winged blackbirds (Agelaius phoeniceus), and common grackles (Quiscalus quiscula) were the most abundant species observed in May (Table 33). In October double-crested cormorants (Phalacrocorax auritus), Canada geese Branta canadensis), herring gulls (Larus argentatus), starlings, and American goldfinches (Spinus tristis) were most frequently sighted.

Sixty-two bird species were observed during the summer survey (Table 33). Predominant nesting species included black ducks (Anas rubripes),

blue jays (Cyanocitta cristata), red-winged blackbirds, common grackles, and song sparrows (Melospiza melodia). The Millstone Point area offered a variety of forested, open, and freshwater and marine habitats for these species.

During the winter survey 35 bird species were recorded (Table 33). Waterfowl, gulls, and fringillids were most abundant (Table 33). Species composition and abundance were greatest in the two beach communities (Appendix B, Tables 21-22).

3. Phylogenetic Groupings

The following discussion of major phylogenetic groups pertains to various ecological characteristics of the more common and important avian species observed on the Millstone Point site.

Anseriformes: Mute swans (Cygnus olor), whistling swans (Olor columbianus), Canada geese, mallards (Anas platyrhynchos), black ducks, common goldeneyes (Bucephala clangula), buffleheads (Bucephala albeola), a common merganser (Mergus merganser), and red-breasted mergansers (Mergus serrator) were observed along transect routes in the Millstone Point area (Table 34). Flocks of Canada geese were observed migrating along the coast in October.

Mute swans were recorded during each sampling trip (Table 33). In May four cygnets were observed in the small pond adjacent to the mixed hardwood forest (Site 6). However, only two were present in July. Remains of an adult mute swan were observed in October along the abandoned road in the mixed hardwood forest (Site 6).

Black ducks were the most abundant and widespread dabbling duck, occurring in the riparian community, brackish marsh, transmission line corridor, beach and managed recreation area, and beach community (Table 34). Two broods were observed near the beach community. Although mallard broods were not observed, this species does nest in the Millstone Point area (Kortright 1942). The brackish marsh provided breeding habitat for black ducks and mallards.

Common goldeneyes, buffleheads, common mergansers, and red-breasted mergansers were common migratory species that may overwinter in the site area if open water is available (Manter 1965). Buffleheads and red-breasted mergansers were frequently sighted along the two beach communities during January (Appendix B, Tables 21-22). One pair of wood ducks (Aix sponsa) was observed during May in a shallow pond in the transmission line corridor north of Site 5.

The Long Island Sound corridor is heavily used by diving ducks (Bellrose 1968). Approximately 76,000 to 250,000 diving and 31,000 to 100,000 dabbling ducks utilize the corridor during fall migration. Estimates from winter inventories during 1960-1966, indicate that approximately 225,000 scaup overwinter between Boston and Delaware Bay annually.

Falconiformes: Raptorial birds observed in the Millstone Point area included the Cooper's hawk (Accipiter cooperii), red-tailed hawk (Buteo jamaicensis), broad-winged hawk (B. platypterus), osprey (Pandion haliaetus), and American kestrel (Falco sparverius).

The osprey was the most conspicuous raptor in the site area. Northeast Utilities Service Company in cooperation with the Connecticut Department of Environmental Protection maintains a tall utility pole as a nesting platform. Ospreys were observed most frequently near the nesting platform along the beach community (Table 34). One pair successfully fledged two young at this site in 1973, and from 1970-1972 one-third of the ospreys in Connecticut were produced at this nesting site (USAEC 1974).

A close relationship between the reduction of eggshell thickness and population decline of the osprey has been documented by Hickey and Anderson (1968). In nesting studies in Connecticut between 1960 and 1963, Ames and Mersereau (1964) reported an annual rate of decline in osprey populations of 13 to 14 percent. A similar study in Connecticut during 1964-1965 also revealed an annual rate of decline from 13 to 14 percent (Peterson 1969).

A Cooper's hawk and a broad-winged hawk were observed over the transmission line corridor (Table 34). Because of a declining reproductive rate, the Cooper's hawk is in serious danger in the northeast (Henny and Wight 1972). Production declined from 3.53 fledglings banded per successful nest during the period 1929-45 to 2.67 banded in 1949-67. This represents a 24.4% reduction in productivity.

Single sightings of the American kestrel, the only falcon observed in the Millstone Point area, were recorded in the old field and beach communities (Table 34).

Galliformes: Bobwhite quail (Colinus virginianus) were quite abundant and widespread. This species was observed or heard in all of the plant communities except the beach community (Table 34). Forested and brushy borders along the transmission line corridor and abandoned nursery provided the most favorable habitat for bobwhites. This reflects observations by Edminster (1954) that bobwhites are closely associated with edges. Ring-necked pheasants (Phasianus colchicus) were heard or observed along the border of the old field, and in the abandoned nursery and beach and managed recreation area (Table 34). Two ruffed grouse (Bonasa umbellus) were sighted in the riparian community during October.

Ciconiiformes: The great egret (Casmerodius albus), great blue heron (Ardea herodias), green heron (Butorides virescens), black-crowned night heron (Nycticorax nycticorax), and American bittern (Botaurus lentiginosus) were observed along the two beach communities and the brackish marsh (Table 34). The occurrence of these species was primarily restricted to wet-land habitats since they are adapted for feeding on aquatic animal life. During periods of low tide, the shallow water habitats and the exposed mud and sand flats in the bay adjacent to the beach community (Site 9) provided an excellent foraging area for these species.

Charadriiformes: Three species of gulls were observed in the Millstone Point area. The herring gull and ring-billed gull (Larus delawarensis) preferred the beach communities and brackish marsh while observations of the great black-backed gull (L. marinus) were restricted to marine habitats adjacent

to the beach communities (Table 34). Exposed rocks in the bay area provided resting sites that were commonly used by the gulls during high tide. During low tide gulls fed on mollusks and crabs on the exposed tidal flats in the bay adjacent to the beach community.

Sightings of common terns (Sterna hirundo), a species also dependent upon an aquatic environment, were most frequent in communities utilized by gulls and herons (Table 34). The brackish marsh and bay areas adjacent to the Millstone Point site were commonly used by terns foraging for food.

Additional species in this order that were observed in the Millstone Point area included the black-bellied plover (Squatarola squatarola), killdeer (Charadrius vociferus), spotted sandpiper (Actitis macularia), and greater yellowlegs (Totanus melanoleucus). These species were sighted most frequently along the shore of the beach communities and brackish marsh. Baker (1974) reported that the principal prey of black-bellied plovers is polychaete worms and clams.

Columbiformes: With the exception of the two mixed hardwood forests, mourning doves (Zenaida macroura) were observed in all habitat types (Table 34). This species has a broad distribution and can be found foraging or nesting in virtually all terrestrial shrub and arboreal habitats (Hanson and Kossack 1964). Rock doves (Columba livia) were observed flying over the abandoned nursery and the old field.

Piciformes: The woodpecker most frequently observed was the common flicker (Colaptes auratus), which was most prevalent along the edge

of the transmission line corridor and in the mixed hardwood forest (Site 6) (Table 34). Common flickers were recorded in all nine communities reflecting observations by Graber and Graber (1963) that this species favors a variety of habitats including hedgerows, savanna-type areas, edge shrubbery, residential areas, and forests. Primarily forest inhabiting species, the downy woodpecker (Dendrocopos pubescens) and hairy woodpecker (D. villosus) were found most frequently in the upland hardwood forest (Site 2) and the riparian community. They were not observed in the mixed hardwood forest (Site 6) even though this area provided favorable foraging and nesting habitat.

Passeriformes:

Tyrannidae: Eastern kingbirds (Tyrannus tyrannus) were the most abundant and widespread of the flycatchers. They were found in the transmission line corridor, beach community, mixed hardwood forest (Site 6), brackish marsh and old field (Table 34). This species favored edge habitats between shrubby wooded areas and cleared or partially cleared plant communities. Observations of the great crested flycatcher (Myiarchus crinitus), eastern phoebe (Sayornis phoebe), and eastern wood pewee (Contopus virens) were restricted mainly to the mixed hardwood forest (Sites 2 and 6) and the riparian community. This distribution agrees with Karr (1968) who reported these species were found most often in bottomland forests.

Hirundinidae: Swallows were recorded in all nine communities (Table 34), but were observed most often foraging over open field or standing water habitats. The old field, brackish marsh and the pond adjacent to the

beach community provided favorable foraging habitats for swallows. The barn swallow was the most abundant and widespread, while the cliff swallow (Petrochelidon pyrrhonota) tree swallow (Iridoprocne bicolor), bank swallow (Riparia riparia), and rough-winged swallow (Stelgidopteryx ruficollis) were less numerous and were restricted to the beach communities, the brackish marsh, and the old field.

Corvidae: The blue jay and crow (Corvus brachyrhynchos) were two of the more abundant bird species sighted in the area. They were not confined to any specific habitat (Table 34). Blue jays were sighted most frequently in or along the edge of wooded habitats. Crows preferred forested areas but were observed utilizing or flying over all plant types in the site area. Both species appear to be quite versatile and capable of occupying a variety of wooded habitats.

Paridae: Black-capped chickadees (Parus atricapillus) were the most abundant and widespread member of this group occupying all the study sites except the beach community (Table 34). This species is a permanent resident in the Millstone Point area. The black-capped chickadee was most abundant in the mixed hardwood forest (Site 2) and riparian community. In Illinois Graber and Graber (1963) report that chickadees are restricted to habitats with some woody cover.

The tufted titmouse (Parus bicolor) was first recorded nesting in Connecticut in 1946 (Beddall 1963). Increased farm abandonment allowing the development of oak-hickory forests is cited as the reason for the increasing

abundance of tufted titmouse populations in southern New England (Beddall 1963). Observations of the tufted titmouse were restricted to the abandoned nursery and the wooded edge of the brackish marsh (Table 34).

Mimidae: The three members of the Family Mimidae were common and widespread in the Millstone Point area. The gray catbird (Dumetella carolinensis) was most numerous and had the broadest distribution, occurring in all nine communities (Table 34). Brown thrashers (Toxostoma rufum) were more restricted in distribution, occurring in six of the communities, while the mockingbird (Mimus polyglottos) was observed only in the transmission line corridor, brackish marsh, and old field (Table 34). Similar habitat utilization by these species has been reported by Graber et al. (1970) in Illinois where catbirds were found throughout a variety of habitats (urban areas, forest, orchard, shrubs, pastures, and marsh), while brown thrashers and mockingbirds favored hedgerows and edge communities dominated by shrubs.

Turdidae: The American robin (Turdus migratorius) was the most abundant and widespread species observed in this family. It was found in all nine communities (Table 34). Graber and Graber (1963) and Kendeigh (1945) reported that robins may be found in all types of habitats, but that they prefer residential areas, orchards, edge communities, and hedgerows. Preferred habitats of this species in the Millstone Point area included the abandoned nursery, the transmission line corridor, and the edge of the brackish marsh and the two beach communities (Table 34). The wood thrush (Hylocichla mustelina), hermit thrush (Catharus guttata), and bluebird (Sialia sialis) were

less abundant and more restricted to mixed hardwood forests (Sites 2 and 6) or their borders.

Sturnidae: Starlings were the most abundant and widespread avian species in the Millstone Point area (Table 34). Juvenile recruitment accounted for the abundance of starlings in July and October (Table 33). The relatively low number of sightings of this species during January was partially attributed to its practice of congregating in cities and other urban areas during winter. The starling is an agricultural pest as well as a serious competitor with native birds such as woodpeckers, tree swallows, purple martins (Progne subis) and eastern bluebirds (Graber et al. 1971, 1972, Martin et al. 1961, Thompson 1964).

Parulidae: Eight species of warblers were recorded during the survey. The black-and white-warbler (Mniotilta varia), blue-winged warbler (Vermivora pinus), yellow warbler (Dendroica petechia), prairie warbler (Dendroica discolor), and common yellowthroat (Geothlypis trichas) were established summer residents, while the yellow-rumped warbler (Dendroica coronata), blackburnian warbler (Dendroica fusca), and palm warbler (Dendroica palmarum) were common migrants (Table 33).

The blue-winged warbler became established in New England as a breeding species in 1932 (Boyd 1962). This uncommon warbler prefers abandoned shrubby fields interspersed with mature deciduous trees (Manter 1965, Ficken and Ficken 1968). Similar habitat preferences were observed on Millstone Point where blue-winged warblers were sighted in the beach community

transmission line corridor, riparian community and the mixed hardwood forest (Site 2) (Table 34).

In North Carolina, Parnell (1969) reported yellow warblers prefer wet thickets. Portions of the abandoned nursery and the beach and managed recreation area provided similar habitats on Millstone Point. During May and July, sightings of the yellow warbler were most common in those two habitats.

Dry thickets, stands of deciduous saplings, and wood margins provide favorable habitat for prairie warblers (Parnell 1969). Prairie warblers were sighted most frequently along the wooded borders of the transmission line corridor.

Common yellowthroats utilized moist habitats consisting of rank growths of grass, forbs, briers, shrubs, and saplings. The abandoned nursery and the edge of the transmission line corridor and mixed hardwood forest (Site 2) were preferred habitats for yellowthroats in the study area (Table 34).

Icteridae: The red-winged blackbird and common grackle were the most abundant and widespread species in this family (Table 34). The bobolink (Dolichonyx oryzivorus), eastern meadowlark (Sturnella magna), brown-headed cowbird (Molothrus ater), and northern oriole (Icterus galbula) were less abundant but still common. Red-winged blackbirds and common grackles were sighted in each of the nine habitats sampled (Table 34). Both species are capable of occupying a variety of habitats including marshes, grasslands, shrubbery, orchards, and forests (Graber and Graber 1963, Case and Hewitt 1963, Robertson 1972).

Sightings of the bobolink, eastern meadowlark, and brown-headed cowbird were generally restricted to the old field (Table 34). The northern oriole preferred woody habitats with an abundance of mature trees. Although this species was recorded at each site except the mixed hardwood forest (Site 6), it preferred mature woodlands adjacent to open areas such as the wooded borders of the brackish marsh, transmission line corridor, riparian community, and mixed hardwood forest (Site 2) (Table 34).

Fringillidae: The Family Fringillidae accounted for 16 species and approximately 15% of all bird observations along transect routes in the Millstone Point area. Common permanent residents included the cardinal (Cardinalis cardinalis), American goldfinch, field sparrow (Spizella pusilla), and song sparrow.

Beddall (1963) reported that the cardinal became established in southwestern Connecticut in 1943. Adaptibility to the presence of man, climatic moderation, abandonment of farm land, and residential encroachment, were the primary reasons for the cardinal's recent range expansion. Bond (1957) reported that cardinals prefer pioneer woods over climax stands. Similar habitat preferences were observed in the Millstone Point area (Table 34).

The American goldfinch was observed in a variety of habitats, however, the beach and managed recreation area, old field, and abandoned nursery were preferred. Many observations of this species were made while it was flying over plant communities in the study area.

Field and song sparrows inhabited similar vegetation types such

as shrubby edges, old fields, marshes, and hedgerows; however, song sparrows preferred mesic habitats while the field sparrow preferred more arid areas.

The rufous-sided towhee was the most common summer fringillid in the study area. This species was most abundant in the transmission line corridor and the three wooded communities (Table 34).

Dark-eyed juncos (Junco hyemalis), tree sparrows (Spizella arborea) and white-throated sparrows (Zonotrichia albicollis) were common winter residents (Table 33). Sightings of tree sparrows and white-throated sparrows were restricted to the wooded communities while dark-eyed juncos were observed in both open and wooded areas. Winter habitat requirements of these species include dense brush cover and some patches of open ground (Davis 1973).

Less common fringillid species observed in the Millstone Point area included the rose-breasted grosbeak (Pheucticus ludovicianus), indigo bunting (Passerina cyanea), purple finch (Carpodascus purpureus), savannah sparrow (Passerculus sandwichensis), sharp-tail sparrow (Ammospiza caudacuta), vesper sparrow (Pooecetes gramineus), Lincoln's sparrow (Melospiza lincolnii), and swamp sparrow (M. georgiana).

Less Common Species: Common loons (Gavia immer) were observed in January in the bay adjacent to the two beach communities (Table 34).

A single red-necked grebe (Podiceps grisegena), a rare migrant along the Atlantic coast (Mackenzie 1961), was observed near the water intake structure in October.

Two double-crested cormorants were observed flying over the beach community in July, while 90 were recorded in October (Table 34). Similar seasonal trends were noted by Mackenzie (1961) in the Guilford area. Although the double-crested cormorant is a permanent resident, there is no evidence that this species breeds in the area (Mackenzie 1961). Exposed rocks adjacent to the two beach communities provided resting sites for double-crested cormorants.

Observations of red-eyed vireos (Vireo olivaceus) were restricted to the riparian community.

D. Reptiles and Amphibians

Of the 26 species of amphibians and 28 species of reptiles that occur in Connecticut (Connecticut State Board of Fisheries and Game, unpublished list), only five species of amphibians and one reptile were observed in the Millstone Point area (Table 35). In addition to field observations during this study, further information on distribution, habitat utilization and food habits of individual species are primarily based on studies by Conant (1958), Smith (1961) and Goin and Goin (1962).

One northern two-lined salamander (Eurycea bislineata) was captured at the edge of the stream in the riparian community (Site 3). Northern two-lined salamanders are common in wet leaves along small rocky streams in mesic forests. They feed primarily on arthropods and small worms.

One American toad (Bufo americanus) was recorded in the mixed hardwood forest (Site 6). Although this species was infrequently sighted in the study area, it has a broad ecological distribution and is capable of occupying a variety of rural and urban environments.

Green frogs (Rana clamitans melanota) were commonly sighted in the study area. This species was the most abundant amphibian recorded (16 observations) and was most frequently observed in the riparian community (Site 3), brackish marsh (Site 4), and the abandoned nursery (Site 7). Green frogs are closely associated with aquatic environments. Their diet consists primarily of mollusks, annelids and arthropods.

Six leopard frogs (Rana pipens) were observed in the transmission line

corridor (Site 5) and the abandoned nursery (Site 7). The leopard frog is frequently encountered in terrestrial habitats as well as in areas adjacent to permanent water.

Wood frogs (Rana sylvatica) were observed in the old field (Site 1) and the two mixed hardwood forests (Sites 2 and 6). Wood frogs are primarily restricted to mesic forests which contain permanent or semi-permanent ponds. Their food consists chiefly of arthropods and mollusks.

One eastern garter snake (Thamnophis sirtalis sirtalis) was captured in a Museum Special snap-trap in the riparian community (Site 3) and one in the transmission line corridor (Site 5). This species occurs in a wide variety of habitats including meadows, marshes, forests, and woodland borders. Annelids and small vertebrates comprise the bulk of this snake's diet.

E. Terrestrial Invertebrates

Two hundred and thirty-seven specimens representing 2 classes, 11 orders, and 40 families of terrestrial invertebrates were collected and identified from sweepnet samples taken in May and July 1973 from the old field (Site 1) and the riparian community (Site 3). Results of invertebrate sampling are shown in Table 36.

During both sampling periods, the relative abundance and diversity of invertebrates were greater in the old field in contrast to the riparian community. July samples provided greater numbers and diversity of organisms in both sites than May collections.

During May the most abundant invertebrates in the old field were plant

bugs (25.6%), dance flies (23.0%), and common thrips (15.4%). In samples taken during July, the plant bug population increased and remained numerically dominant (44.4%); however, the dance flies and thrips were replaced in abundance by froghoppers (12.0%) and planthoppers (7.9%).

Midges (41.2%) were the most numerous organisms collected during May in the riparian woodland community. In July spiders (16.4%), froghoppers (12.7%), and long-legged flies (9.1%) were the most abundant groups collected.

V. References Cited

American Ornithologists' Union. 1957. Check-list of North American birds. 5th ed. A. O. U., Baltimore, Md. 691 pp.

_____. 1973. Thirty-second supplement to the American Ornithologists' Union checklist of North American birds. Auk 90:411-419.

Ames, P. L., and G. S. Mersereau. 1964. Some factors in the decline of the osprey in Connecticut. Auk 81:173-185.

Arnett, R. H., Jr. 1968. The beetles of the United States (a manual for identification). American Entomological Institute, Ann Arbor, Mich. 1112 pp.

Augenbaugh, J. E. 1935. Replacement of the Chestnut in Pennsylvania. Bull. Pa. Dept. for Waters 54.

Avery, G. S., Jr., H. B. Creighton, and C. W. Hock. 1940. Annual rings in hemlocks and their relation to environmental factors. Amer. J. Bot. 27:825-831.

Avery, T. E. 1968. Interpretation of aerial photographs. Burgess Publishing Co., Minneapolis. 324 pp.

Baker, M. S. 1974. Foraging behavior of black-bellied plovers (Pluvialis squatarola). Ecology 55:162-167.

Baker, W. L. 1941. Effect of gypsy moth defoliation on certain forest trees. J. Forestry 39:1017-1022.

_____. 1972. Eastern forest insects. U. S. Dept. Agr., Forest Service, Misc. Publ. No. 1175. 642 pp.

Bard, G. E. 1952. Secondary succession on the Piedmont of New Jersey. Ecol. Monogr. 22:295-215.

Beals, W., and P. Westover. 1971. The Pine Creek and Mill River Watersheds-Fairfield, Connecticut. School of Forestry, Yale University, New Haven, Conn. 55 pp.

Beattie, R. K., and J. D. Diller. 1954. Fifty years of chestnut blight in America. J. Forestry 52:323-329.

Beddall, B. G. 1963. Range extension of the cardinal and other birds in the northeastern states. Wilson Bull. 75:140-158.

Bellrose, F. C. 1968. Waterfowl migration corridors east of the Rocky Mountains in the United States. Ill. Nat. Hist. Surv. Biol. Notes No. 61. 24 pp.

Benton, A. H. 1955. Observations on the life history of the northern pine mouse. J. Mammal. 36:52-62.

Blair, W. F., A. P. Blair, P. Brodkorb, F. R. Cagle, and G. A. Moore. 1957. Vertebrates of the United States. McGraw-Hill Book Company, Inc., New York. 819 pp.

Bond, R. B. 1957. Ecological distribution of breeding birds in the upland forests of southern Wisconsin. Ecol. Monogr. 27:351-384.

Borror, D. J., and D. M. Delong. 1970. An introduction to the study of insects. (3rd ed.) Holt, Rinehart and Winston, Inc., N.Y. 812 pp.

_____, and R. E. White. 1970. A field guide to the insects of America north of Mexico. Houghton Mifflin Co., Boston. 404 pp.

Boyd, E. M. 1962. A half-century's changes in the bird-life around Springfield, Massachusetts. Bird Banding 33:137-147.

Braun, E. L. 1950. Deciduous forests of eastern North America. Blakiston Company, Philadelphia. 596 pp.

Braun-Blanquet, J. 1932. Plant Sociology (Trans., rev., and ed. by G. D. Fuller and H. S. Conard). McGraw-Hill Book Co., N.Y.

Bromley, S. W. 1935. The original forest types of southern New England. Ecol. Monogr. 5:61-89.

Burt, W. H. 1957. Mammals of the Great Lakes region. Univ. Mich. Press, Ann Arbor. 246 pp.

Butler, P. A. 1966. In Pesticides in the environment and their effects on wildlife. J. Appl. Ecol. 3:253-259.

Canfield, R. H. 1941. Application of the line interception method in sampling range vegetation. J. Forestry 39:388-394.

Case, N. A., and O. H. Hewitt. 1963. Nesting and productivity of the red-winged blackbird in relation to habitat. Living Bird 2:7-20.

Choate, J. R. 1973. Identification and recent distribution of white-footed mice (Peromyscus) in New England. J. Mammal. 54(1):41-49.

Clarke, G. L. 1954. Elements of Ecology. John Wiley and Sons, Inc., N.Y. 534 pp.

Clements, F. E. 1928. Plant succession and indicators. Wilson Co., N.Y.

Cline, A. C., and S. H. Spurr. 1942. The virgin forest of central New England. Harvard Forest Bull. No. 21.

Collins, S. 1962. Three decades of change in an unmanaged Connecticut woodland. The Conn. Agri. Expt. Sta., New Haven, Bull. 653.

Conant, R. 1958. A field guide to reptiles and amphibians. Houghton Mifflin Co., Boston. 366 pp.

Connecticut Audubon Society. 1973. Birds of Connecticut checklist. Mimeo. n.p.

Cope, O. B. 1966. In Pesticides in the environment and their effects on wildlife. J. Appl. Ecol. 3:33-44.

Cox, G. W. 1972. Laboratory manual of general ecology. Wm. C. Brown Company Publishers, Dubuque, Ia. 195 pp.

Curtis, J. T. and G. Cottam. 1962. Plant ecology workbook. Burgess Publishing Company, Minneapolis. 193 pp.

_____, and R. P. McIntosh. 1951. An upland forest continuum in the prairie forest border region of Wisconsin. Ecology 32:476-493.

Dalke, P. D. 1942. The cottontail rabbits in Connecticut. State Geological and Nat. Hist. Survey of Connecticut. Bull. No. 65. 97 pp.

Dasmann, R. F. 1972. Environmental Conservation. John Wiley and Sons, Inc., N.Y. 473 pp.

Daubenmire, R. 1968. Plant communities. Harper and Row Publishers, N.Y. 300 pp.

Davis, J. 1973. Habitat preferences and competition of wintering juncos and golden-crowned sparrows. Ecology 54:174-180.

Day, G. M. 1953. The Indian as an ecological factor in the northeastern forest. Ecology 34:329-346.

Dillon, E. S., and L. S. Dillon. 1966. A manual of common beetles of eastern North America. Row, Peterson and Co., Evanston, Ill. 884 pp.

Duncan, D. P., and P. C. Dodson. 1960. Influence of the forest tent caterpillar upon the aspen forests of Minnesota. Forest Sci. 4:71-93.

Egler, F. E. 1940. Berkshire Plateau vegetation, Massachusetts. Ecol. Monogr. 10:145-192.

_____, and W. A. Niering. 1965. The vegetation of Connecticut natural areas. No. 1. Yale National Preserve, New Haven. Connecticut Geol. Nat. History Survey 22 pp.

_____, and _____. 1967. The vegetation of Connecticut natural areas. No. 3. The natural areas of the McLean Game Refuge. Connecticut Geol. Nat. History Survey 36 pp.

Ehrlich, P. R., and A. H. Ehrlich. 1970. Population, resources, environment: Issues in Human Ecology. W. H. Freeman Co., San Francisco. 383 pp.

Fay, F. H. and E. H. Chandler. 1955. The geographical and ecological distribution of cottontail rabbits in Massachusetts. J. Mammal. 36(3):415-424.

Fichter, G. S. 1966. Insect Pests. Golden Press, N.Y. 160 pp.

Ficken, M. S. and R. W. Ficken. 1968. Ecology of blue-winged warblers, golden-winged warblers and some other Vermivora. Amer. Midl. Natur. 79:311-319.

Finch, D. W. 1972a. Fall migration August 16, 1971 to November 30, 1971: Northeastern maritime region. Audubon Field Notes 26(1):31-41.

_____. 1972b. The winter season December 1, 1971 to March 31, 1972: Northeastern maritime region. Audubon Field Notes 26(3):575-585.

_____. 1972c. The spring migration April 1 to May 31, 1972: Northeastern maritime region. Audubon Field Notes 26(4):737-744.

_____. 1972d. The nesting season June 1, 1972 to August 15, 1972: Northeastern maritime region. Audubon Field Notes 26(5):832-841.

Gentry, J. B., F. B. Golley, and M. H. Smith. 1971. Yearly fluctuations in small mammal populations in a southeastern United States hardwood forest. Acta Theriol. 12:179-190.

George, J. L., and D. E. H. Frear. 1966. In Pesticides in the environment and their effects on wildlife. J. Appl. Ecol. 3:155-167.

Gleason, H. A. 1968. The new Britton and Brown illustrated flora of the northeastern United States and adjacent Canada. Hafner Publishing Company, Inc., N.Y. 3 Vol.

_____, and A. Cronquist. 1963. Manual of vascular plants of northeastern United States and adjacent Canada. Van Nostrand Reinhold Co., N.Y. 810 pp.

Goin, C. J., and O. B. Goin. 1962. Introduction to herpetology. W. H. Freeman and Co., San Francisco.

Good, N. F. 1968. A study of natural replacement of chestnut in six stands in the Highlands of New Jersey. Bull. Torrey Bot. Club 95(3):240-253.

Goodwin, R. H., and F. A. Grandjouan. 1958. A field list of birds for Connecticut College. The Connecticut Arboretum, Bull. No. 10:3-13.

Gordon, R. B. 1940. The primeval forest types of southwestern New York. New York State Mus. Bull. 321:1-102.

Graber, R. R., and J. W. Graber. 1963. A comparative study of bird populations in Illinois, 1906-1909 and 1956-1958. Ill. Nat. Hist. Surv. Bull. 28:383-528.

_____, _____, and E. L. Kirk. 1970. Illinois birds: Mimidae. Ill. Nat. Hist. Surv. Biol. Notes 68. 38 pp.

_____, _____, and _____. 1971. Illinois birds: Turdidae. Ill. Nat. Hist. Surv. Biol. Notes 75. 44 pp.

_____, _____, and _____. 1972. Illinois birds: Hirundinidae. Ill. Nat. Hist. Surv. Biol. Notes 80. 36 pp.

Griswold, N. B., and R. H. Ferguson. 1957. The timber resources of Connecticut. Northeast Forest Expt. Sta. Forest Service, U.S.D.A. 36 pp.

Hamilton, W. J., Jr. 1938. Life history notes on the northern pine mouse. J. Mammal. 19:163-170.

_____. 1939. Observations on the life history of the red squirrel in New York. Amer. Midl. Natur. 22(3): 13 pp.

Hanson, H. C., and E. D. Churchill. 1961. The plant community. Reinhold Publishing Corp., N.Y. 218 pp.

Harlow, W. M., and E. S. Harrar. 1958. Textbook of dendrology. McGraw-Hill Book Co., Inc., N.Y. 561 pp.

Henny, C. J., and H. M. Wight. 1972. Population ecology and environmental pollution: Red-tailed and Cooper's hawks. Pages 229-250 In Population ecology of migratory birds Bur. Sport Fish. and Wildl., Wildl. Res. Rept. 2.

Hickey, J. J., and D. W. Anderson. 1968. Chlorinated hydrocarbons and eggshell changes in raptorial and fish-eating birds. Science 162:271-273.

Hicock, H. W., M. F. Morgan, H. J. Lutz, H. Bull, and H. A. Lunt. 1931. The relation of forest composition and rate of growth to certain soil characters. Connecticut Agr. Expt. Sta. Bull. 330. 73 pp.

Hill, D. E., and A. E. Shearin. 1970. Tidal marshes of Connecticut and Rhode Island. Connecticut Agri. Expt. Sta., New Haven. Bull. 709. 34 pp.

Hodgson, J. R. 1972. Local distribution of Microtus montanus and M. pennsylvanicus in southwestern Montana. J. Mammal. 53:487-499.

Holland, W. J. 1968. The moth book, a guide to the moths of North America. Dover, N.Y. 479 pp.

Hough, A. F., and R. D. Forbes. 1943. The ecology and silvics of forests in the high plateaus of Pennsylvania. Ecol. Monogr. 13:299-320.

House, W. P. 1952. Appraisal of damage by gypsy moth in New England 1933-1952. U.S.D.A., Agr. Res. Admin., Bur. Ent. Plant Quarantine, Gypsy Moth Control Proj. 22 pp.

Houston, D. R., and J. E. Kuntz. 1964. Pathogens associated with maple blight. Pages 59-79 In Studies of maple blight. Univ. of Wisconsin, Madison. Res. Bull. 250.

Hunt, L. B. 1960. Songbird breeding populations in DDT-sprayed Dutch elm disease communities. J. Wildl. Mgmt. 24(2):139-146.

Jameson, E. W., Jr. 1949. Some factors influencing the local distribution and abundance of woodland small mammals in central New York. J. Mammal. 30:221-235.

Jones, L. W. 1952. Stability of DDT and its effects on microbial activities of soil. Soil Sci. 73:237-241.

Karr, J. R. 1968. Habitat and avian diversity on strip-mined land in east-central Illinois. Condor 70:348-357.

Keever, C. 1953. Present composition of some stands of the former oak chestnut forests in the southern Blue Ridge Mountains. Ecology 34:44-54.

Keith, J. A. 1966. In Pesticides in the environment and their effects on wildlife. J. Appl. Ecol. 3:57-85.

Kendeigh, C. S. 1945. Community selection by birds on the Helderberg Plateau of New York. Auk 62:418-436.

Kienholz, R. 1963. Forests and forestry in Connecticut. The University of Connecticut College of Agriculture Ext. Serv. No. 62-18.

Kirk, J. M. 1939. The weather and climate of Connecticut. State of Conn. Geol. and Nat. Hist. Survey Bull. 61.

Klots, A. B. 1951. A field guide to the butterflies of North America, east of the Great Plains. Houghton Mifflin Co., Boston. 349 pp.

Korstian, C. F., and P. W. Stickel. 1927. The natural replacement of blight-killed chestnut in hardwood forests of the northeast. J. Agr. Res. 34:631-648.

Kortright, F. H. 1942. The ducks, geese, and swans of North America. The Stackpole Co., Harrisburg, Pa. 476 pp.

Krutzsch, P. H. 1954. North American jumping mice (Genus Zapus). Univ. Kansas Publ., Museum Nat. Hist. 7:349-472.

Kucera, C. L. 1973. The Challenge of Ecology. Mosby Co., St. Louis. 226 pp.

Lay, D. W. 1958. Fire ant eradication and wildlife. Proc. 12th Annual Conf. Southeast Assoc. Game Fish Comm. 22-24 pp.

Levitt, J. 1969. Introduction to Plant Physiology. Mosby Co., St. Louis. 280 pp.

Linkkila, T. E. 1971. Influence of habitat upon changes within interspecific Connecticut cottontail populations. M.S. Thesis. Univ. of Connecticut. 21 pp.

Little, S. 1946. The effects of forest fires on the stand history of New Jersey's pine region. Northeastern Forest Expt. Sta. Forest Management Paper 2. 43 pp.

_____. 1973. Eighteen-year changes in the composition of a stand of Pinus echinata and P. rigida in southern New Jersey. Bull Torrey Bot. Club 100:94-102.

_____, and E. B. Moore. 1949. The ecological role of prescribed burns in the pine-oak forests of southern New Jersey. Ecology 30:223-233.

Livingston, B. 1972. Personal comments. Successional trends, western Massachusetts. Unpublished Notes, Dept. of Botany, University of Massachusetts.

Lloyd, M., J. H. Zar, and J. R. Karr. 1968. On the calculation of information - theoretical measures of diversity. Amer. Midl. Natur. 79:257-272.

Lull, H. W., J. H. Noyes, and D. L. Mader. 1965. Factors influencing water production from forested watersheds. Pages 2-7 In Municipal watershed management symposium. Coop. Ext. Serv. Pub. 446 Univ. of Mass., Amherst.

Lutz, H. J. 1928. Trends and silvicultural significance of upland forest succession in southern New England. Yale University School of Forestry Bull. 22:1-68.

_____. 1930. The vegetation of Heart's Content, a virgin forest in northwestern Pennsylvania. Ecology 11:1-29.

_____. 1934. Ecological relations in the pitch pine plains of southern New Jersey. Yale Univ. School of Forestry Bull. 38.

MacArthur, R. H. 1965. Patterns of species diversity. Biol. Rev. 40:510-533.

Mackey, H. E., Jr., and N. Sivec. 1973. The present composition of a former oak-chestnut forest in the Allegheny Mountains of western Pennsylvania. Ecology 54(4):915-918.

MacManus. 1972. In Power lines and the environment. Robert Goodland (ed.): personal communication with Richard Stalter, St. John's University, N.Y.

Manter, J. A. 1965. Birds of Storrs, Connecticut and vicinity. Natchaug Ornith. Soc., Storrs, Conn.

Martin, C. M., H. S. Zim, and A. L. Nelson. 1951. American wildlife and plants: A guide to wildlife food habits. Dover Publications, N.Y. 500 pp.

McCafferty, K. R., and W. A. Creed. 1969. Significance of forest openings to deer in Northern Wisconsin. Wisconsin Dept. of Nat. Res. Tech. Bull. 44. 104 pp.

McDowell, R. D., and F. C. Benson. 1960. The deer herds and the landowner in Connecticut. Bull. No. 348. Agr. Exp. Sta., Storrs, Connecticut.

Meyer, W. H. and B. A. Plusmin. 1945. The Yale forest in Tolland and Windham Counties, Connecticut. Yale University School of Forestry Bull. 55.

Miller, D. H., and L. L. Getz. 1969. Life-history notes on Microtus pinetorum in central Connecticut. J. Mammal. 50:777-784.

Moore, E. B. 1939. Forest management in New Jersey. New Jersey Dept. Conserv. and Devel. 55 pp.

_____, and A. F. Waldron. 1940. A comparison of the growth of oak and pine in southern New Jersey. New Jersey Dept. Conserv. and Devel. Dist. Forests and Parks. Tech. Note 10.

Moss, A. E. 1973. Chestnut and its demise in Connecticut. Connecticut Woodlands. 38:7-13.

Murie, O. J. 1954. A field guide to animal tracks. Houghton Mifflin Co., Boston. 374 pp.

Nash, R. G., and E. A. Woolson. 1967. Persistence of chlorinated hydrocarbon insecticides in soils. Science 157:924-926.

Nelson, T. C. 1955. Chestnut replacement in the southern highlands. Ecology 36:352-353.

Nichols, G. E. 1913a. The vegetation of Connecticut, I: Phytogeographical aspects. Torreya 13:89-112.

_____. 1913b. The vegetation of Connecticut, II: Virgin forests. Torreya 13:199-215.

_____. 1914. The vegetation of Connecticut, III: Plant societies on the uplands. Torreya 14:167-194.

_____. 1915. The vegetation of Connecticut, IV: Plant societies in lowlands. Bull. Torrey Bot. Club 42:169-217.

_____. 1916. The vegetation of Connecticut, V. Plant societies along rivers and streams. Bull. Torrey Bot. Club 43:235-264.

_____. 1920a. The plant associations of eroding areas along the seacoast. Bull. Torrey Bot. Club 27:89-117.

_____. 1920b. The associations of depositing areas along the seacoast. Bull. Torrey Bot. Club 47:511-548.

Nichols, J. O. 1968. Oak mortality in Pennsylvania - a ten year study. J. Forestry 66:681-694.

_____. 1970. Oak mortality. Penn. Dept. Forests and Waters, Harrisburg. Forest Pest Rep. No. 43. 2 pp.

Niering, W. A., and F. E. Egler. 1966. The Natural Area of the Audubon Center of Greenwich. The vegetation of Connecticut Natural Areas No. 2. State Geological Natural History Survey of Connecticut. 20 pp.

_____, and R. H. Goodwin. 1962. Ecological studies in the Connecticut arboretum natural area. I. Introduction and a survey of vegetation types. Ecology 43:41-54.

Ogden, J. G. 1961. Forest history of Martha's Vineyard. Amer. Midl. Natur. 99:417-430.

Olson, A. R. 1965. Natural changes in some Connecticut woodlands during 30 years. Connecticut Agr. Expt. Sta. Bull. 669.

Olson, J. S., F. W. Stearns, and H. Nienstaedt. 1959. Eastern hemlock seeds and seedlings. Conn. Agr. Expt. Sta. Bull. 620.

Oosting, H. J. 1942. An ecological analysis of the plant communities of Piedmont, North Carolina. Amer. Midl. Natur. 28:1-126.

_____. 1956. The study of plant communities. W. H. Freeman and Co., San Francisco. 440 pp.

Parnell, J. F. 1969. Habitat relations of the Parulidae during spring migration. Auk 86:505-521.

Peterson, A. 1960. Larvae of insects, an introduction to Neartic species. Part II. Coleoptera, Diptera, Neuroptera, Siphonaptera, Mecoptera, Trichoptera. (4th ed.) Edwards Bros., Ann Arbor, Mich. 416 pp.

_____. 1967. Larvae of insects, an introduction to Neartic species. Part I. Lepidoptera and plant infesting Hymenoptera. (6th ed.) Edwards Bros., Ann Arbor, Mich. 315 pp.

Peterson, R. T. 1947. A field guide to the birds. Houghton Mifflin Co., Boston. 290 pp.

_____. 1969. Population trends of ospreys in the northeastern United States. Pages 333-337 In J. J. Hickey (ed.) Peregrine falcon populations: their biology and decline. Univ. of Wisconsin Press, Madison. 596 pp.

Phillips, E. A. 1959. Methods of vegetation study. Holt and Co., Inc.. N.Y. 107 pp.

Plumb, G. H., and R. B. Friend. 1939. An outbreak of the elm spanworm in Connecticut. 1938. Pages 98-103 In W. E. Britton (ed.) Connecticut Entomologist 38th report. Connecticut Agr. Expt. Sta. Bull. No. 428.

Quimby, D. C. 1951. The life history and ecology of the jumping mouse, Zapus hudsonius. Ecol. Monogr. 21:61-95.

Raunkiaer, C. 1934. The life forms of plants and statistical plant geography; the collected papers of C. Raunkiaer. Clarendon Press, Oxford.

Raup, H. M. 1941. An old forest in Stonington, Connecticut. Rhodora. 43:67-71.

Reese, C. D., and D. L. Becker. 1972. The movement and impact of pesticides used in forest management on the aquatic environment and ecosystem. Environmental Protection Agency TS-00-72-07.

Robbins, C. S., B. Bruun, and H. S. Zim. 1966. Birds of North America. Golden Press, N.Y. 340 pp.

Robertson, R. J. 1972. Optimal niche space of the red-winged blackbird (Agelaius phoeniceus): I. Nesting success in marsh and upland habitat. Can. J. Zool. 50:247-263.

Rudd, R. L. 1964. Pesticides and the living landscape. Univ. of Wisconsin Press, Madison. 320 pp.

_____, and R. E. Genelly. 1956. Pesticides: their use and toxicity in relation to wildlife. Calif. Fish and Game Bull. No. 7.

Schaffner, J. V. 1959. Microlepidoptera and their parasites reared from field collections in the northeastern United States. Forest Service, U. S. Dept. of Agr. Misc. Publ. 767.

Schwartz, C. W., and E. R. Schwartz. 1959. The wild mammals of Missouri. Univ. Missouri Press and Missouri Conserv. Comm., Columbia, Mo. 341 pp.

Shannon, C. E., and W. Weaver. 1949. The mathematical theory of communication. Univ. Illinois Press, Urbana. 117 pp.

Sheldon, M. G., M. H. Mohn, G. A. Isa, and R. A. Wilson. 1964. In Pesticides - wildlife studies 1964. Circ. Fish Wild. Serv., Wash. 199.

Shure, D. J. 1970. Ecological relationships of small mammals in a New Jersey barrier beach habitat. J. Mammal. 51:267-278.

_____. 1971. Tidal flooding dynamics: its influence on small mammals in barrier beach marshes. Amer. Midl. Natur. 85(1):36-44.

Smith, P. W. 1961. The amphibians and reptiles of Illinois. Ill. Nat. Hist. Survey Bull. 28(1):1-298.

Smith, R. L. 1966. Ecology and field biology. Harper and Row, Publishers. N.Y. 686 pp.

Snedecor, G. W., and W. G. Cochran. 1967. Statistical methods. (6th ed.) Iowa State Univ. Press, Ames. 593 pp.

Spurr, S. H. 1960. Photogrammetry and photo-interpretation. The Ronald Press Company, N.Y. 472 pp.

_____. 1964. Forest ecology. The Ronald Press Company, N.Y. 352 pp.

Stalter, R. 1973. Preparing environmental impact statements: Comments based on personal experience. Pages 131-149 In Goodland (ed.) Power lines and the environment. The Cary Arboretum of the New York Botanical Gardens, Millbrook, N.Y.

Stephens, G. R. 1971. The relation of insect defoliation to mortality in Connecticut forests. Connecticut Agr. Expt. Sta. Bull. 723.

_____, and D. E. Hill. 1971. Drainage, drought, defoliation, and death in unmanaged Connecticut forests. Connecticut Agr. Expt. Sta. Bull. 718.

_____, and P. E. Waggoner. 1970. The forests anticipated from 40 years of natural transitions in mixed hardwoods. Connecticut Agr. Expt. Sta., New Haven. Bull. 707.

Tester, J. R., and W. H. Marshall. 1961. A study of certain plant and animal interrelations on a native prairie in northwestern Minnesota. Minn. Mus. of Nat. Hist. No. 8. 51 pp.

Thomson, A. L. (ed.). 1964. A new dictionary of birds. McGraw-Hill Book Co., New York. 928 pp.

Turner, N. 1963. Effect of defoliation by the gypsy moth. Connecticut Agr. Expt. Sta., New Haven. Bull. 658

_____. 1965. Connecticut Agr. Expt. Sta., New Haven. Bull. 672.

_____. 1969. The gypsy moth in Connecticut. Connecticut Agr. Expt. Sta., New Haven. Circ. 231.

United States Atomic Energy Commission. 1974. Final environmental statement related to the proposed construction of Millstone Nuclear Power Station Unit 3. U.S.A.E.C. Docket No. 50-423.

Vermeer, K. 1970. Breeding biology of California and ring-billed gulls. Canadian Wildl. Serv. Rept. Series No. 12. 52 pp.

Wagner, R. H. 1971. Environment and man. Norton and Co., Inc., N.Y. 491 pp.

Wallace, G. J. 1959. Insecticides and birds. Audubon 61:10-12.

Weaver, J. and F. E. Clements. 1938. Plant Ecology. McGraw-Hill Book Company, N.Y. 601 pp.

Westveld, M. and Committee on Silviculture, New England Section, Society of American Foresters. 1956. Natural forest vegetation zones of New England. J. Forestry 54:332-339.

Wetzel, R. M. 1968. Mammals of Connecticut. Connecticut State Board of Fisheries and Game. Loose-leaf pub. 14 pp.

Wheatley, G. A. and J. A. Hardman. 1965. Indications of the presence of organochlorine insecticides in rainwater in central England. Nature 207:486-487.

_____, _____, and A. B. Strickland. 1962. Residues of chlorinated hydrocarbon insecticides in some farm soils in England. Plant Pathol. 11:81-90.

Whittaker, R. H. 1956. Vegetation of the Great Smoky Mountains. Ecol. Monogr. 26:1-80.

Wiegert, R. G. 1962. The selection of an optimum quadrat size for sampling the standing crop of grasses and forbs. Ecology 43:125-129.

Wirtz, W. O. II, and P. G. Pearson. 1960. A preliminary analysis of habitat orientation in Microtus and Peromyscus. Amer. Midl. Natur. 63:131-142.

Wistendahl, W. A. 1958. The flood plain of the Raritan River, New Jersey. Ecol. Monogr. 28:129-153.

Woods, F. W., and R. E. Shanks. 1957. Replacement of chestnut in the Great Smoky Mountains of Tennessee and North Carolina. J. Forestry 55:847.

_____. 1959. Natural replacement of chestnut by other species in the Great Smoky Mountains. Ecology 40:349-361.

Woodwell, G. M. 1967. Toxic substances and ecological cycles. Scientific Amer. 216:24-31.

_____, and F. T. Martin. 1964. Persistence of DDT in soils of heavily sprayed forest stands. Science 145:481-483.

Wurster, C. F. Jr. 1968. DDT reduces photosynthesis in marine phytoplankton. Science 159:1474-1475.

Yerger, R. W. 1953. Home range, territoriality, and populations of the chipmunk in central New York. J. Mammal. 34(4):448-458.

Zimmerman, E. G. 1965. A comparison of habitat and food of two species of Microtus. J. Mammal. 46:605-612.

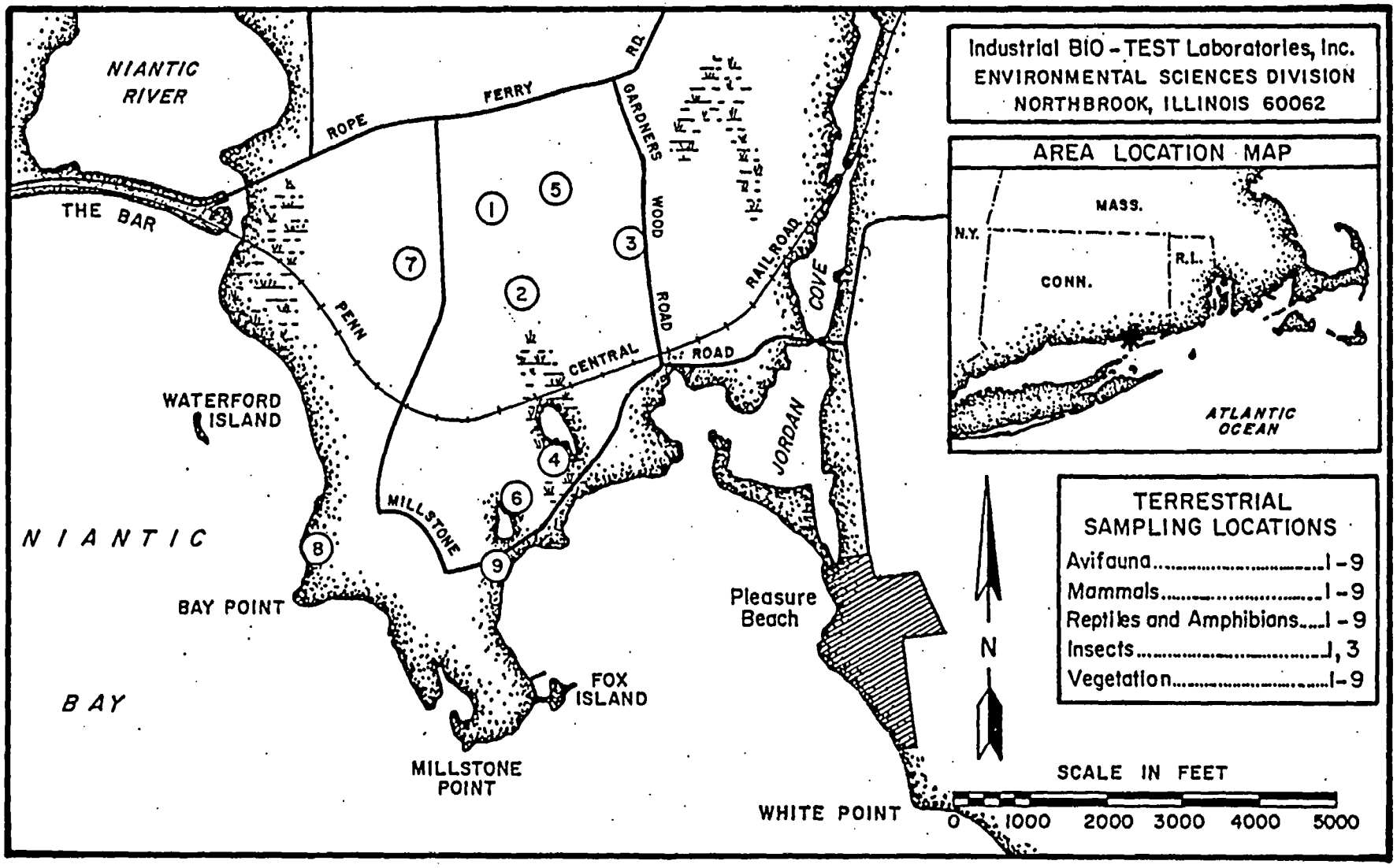

Figure 1. Terrestrial sampling locations in the vicinity of the Millstone Point site, Waterford, Connecticut.

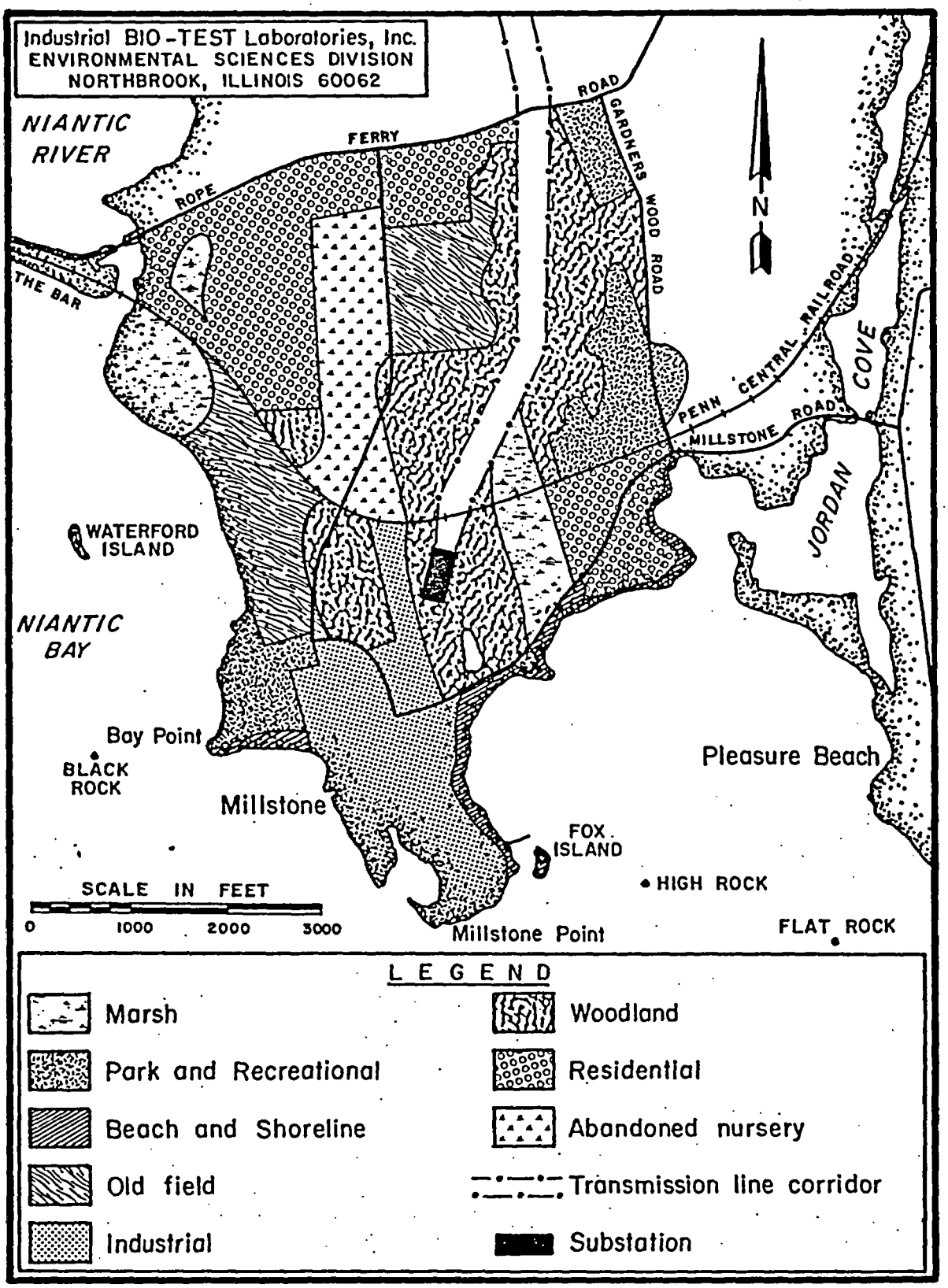

Figure 2. Distribution of vegetation communities in the vicinity of the Millstone Point site, Waterford, Connecticut.

Table 1. Analysis of herbaceous species in an old field community (Site 1) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973).

Scientific Name	Common Name	May		July		October	
		No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency
Dactylis glomerata	Orchard grass	67	21.8	45	13.3	3	0.8
Anthoxanthum odoratum	Sweet vernal grass	63	20.5	36	10.7	-	-
Poa pratensis	Kentucky bluegrass	39	12.7	6	1.8	87	23.8
Plantago lanceolata	Buckhorn plantain	34	11.1	48	14.2	45	12.3
Ranunculus bulbosus	Bulbous buttercup	22	7.2	-	-	-	-
Taraxacum officinale	Common dandelion	20	6.5	-	-	-	-
Panicum sp.	Panic grass	14	4.6	6	1.8	81	22.1
Rubus sp. (imm.)	Blackberry	6	1.9	4	1.2	17	4.6
Compositae (imm.)	Composite	5	1.6	-	-	-	-
Potentilla canadensis	Dwarf cinquefoil	5	1.6	-	-	2	0.5
Hieracium aurantiacum	Orange hawkweed	4	1.3	-	-	-	-
Trifolium sp. (imm.)	Clover	4	1.3	3	0.9	-	-
Carex sp.	Sedge	3	1.0	1	0.3	6	1.6
Gramineae (imm.)	Grass	3	1.0	-	-	-	-
Rosa sp.	Rose	3	1.0	-	-	14	3.8
Viburnum dentatum	Arrowwood	3	1.0	2	0.6	1	0.3
Achillea millefolium	Common yarrow	2	0.7	3	0.9	2	0.5
Fragaria virginiana	Virginia strawberry	2	0.7	3	0.9	16	4.4
Lonicera japonica	Japanese honeysuckle	2	0.7	4	1.2	33	9.0
Oxalis stricta	Yellow wood sorrel	2	0.7	-	-	3	0.8
Convolvulus arvensis	Field bindweed	1	0.3	-	-	-	-
Prunus serotina	Black cherry	1	0.3	-	-	-	-
Rhus radicans	Poison ivy	1	0.3	6	1.8	-	-
Vaccinium corymbosum	Highbush blueberry	1	0.3	-	-	-	-
Agrostis alba	Redtop	-	-	75	22.2	-	-
Holcus lanatus	Velvet grass	-	-	34	10.1	5	1.4
Phleum pratense	Timothy	-	-	29	8.6	-	-
Crepis capillaris	Smooth hawksbeard	-	-	9	2.7	-	-
Agropyron repens	Quackgrass	-	-	5	1.5	-	-
Andropogon virginicus	Broomsedge	-	-	5	1.5	15	4.1
Poa compressa	Canada bluegrass	-	-	4	1.2	-	-
Aster sp. (imm.)	Aster	-	-	2	0.6	2	0.5
Asclepius syriaca	Common milkweed	-	-	1	0.3	-	-
Daucus carota	Wild carrot	-	-	1	0.3	-	-
Erigeron strigosus	Rough fleabane	-	-	1	0.3	-	-
Juncus sp.	Rush	-	-	1	0.3	2	0.5
Linaria vulgaris	Yellow toadflax	-	-	1	0.3	1	0.3
Ranunculus sp.	Buttercup	-	-	1	0.3	-	-
Rudbeckia hirta	Black-eyed susan	-	-	1	0.3	-	-

Table 1. Continued.

Scientific Name	Common Name	May		July		October	
		No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency
Rumex acetosella	Sheep sorrel	-	-	1	0.3	1	0.3
Paspalum sp.	Paspalum	-	-	-	-	14	3.8
Solidago rugosa	Rough goldenrod	-	-	-	-	5	1.4
Andropogan scoparius	Little bluestem	-	-	-	-	2	0.5
Juniperus communis	Old field juniper	-	-	-	-	2	0.5
Veronica sp.	Speedwell	-	-	-	-	2	0.5
Acer rubrum	Red maple	-	-	-	-	1	0.3
Chenopodium sp.	Goosefoot	-	-	-	-	1	0.3
Lysimachia quadrifolia	Whorled loosestrife	-	-	-	-	1	0.3
Myrica pensylvanica	Northern bayberry	-	-	-	-	1	0.3
Prunus virginiana	Choke cherry	-	-	-	-	1	0.3
Totals		307	100.1	338	100.4	366	99.8

Table 2. Analysis of trees in a mixed hardwood forest (Site 2) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973)[a]

Scientific Name	Common Name	No. Points	No. Trees	Total Basal Area (sq. in.)	% Relative Frequency	% Relative Density	% Relative Dominance	Imp. Value	Trees/ Acre	BA/ Acre
Acer rubrum	Red maple	30	58	6399	25.4	32.2	46.0	103.6	95.8	10565
Quercus velutina	Black oak	30	54	3529	25.4	30.0	25.4	80.8	89.3	5834
Betula lenta	Black birch	12	13	816	10.2	7.2	5.9	23.3	21.4	1355
Quercus rubra	Red oak	8	14	1071	6.8	7.8	7.7	22.3	23.2	1768
Quercus alba	White oak	11	11	350	9.3	6.1	2.5	17.9	18.1	574
Nyssa sylvatica	Sour gum	9	11	558	7.6	6.1	4.0	17.7	18.1	919
Quercus coccinea	Scarlet oak	5	5	346	4.2	2.8	2.5	9.5	8.3	574
Carya tomentosa	Mockernut hickory	5	5	234	4.2	2.8	1.7	8.7	8.3	390
Quercus palustris	Pin oak	3	4	327	2.5	2.2	2.4	7.1	6.5	551
Fagus grandifolia	American beech	2	2	45	1.7	1.1	0.3	3.1	3.3	69
Carya glabra	Pignut hickory	1	1	137	0.8	0.6	1.0	2.4	1.8	230
Betula lutea	Yellow birch	1	1	71	0.8	0.6	0.5	1.9	1.8	115
Sassafras albidum	Sassafras	1	1	20	0.8	0.6	0.1	1.5	1.8	23
Totals		118	180	13903	99.7	100.1	100.0	299.8	297.7	22967

[a] Total point to plant distance = 2177.9 ft.
Mean point to plant distance = 2177.9/180 = 12.1 ft.
Trees/acre = $43560/(12.1)^2 = 297.5$
Average basal area = 13903/180 = 77.2 $in.^2$
Basal area/acre = (77.2)(297.5) = 22967 $in.^2$
Percentage crown cover = 93.0

Table 3. Density of trees by size classes (trees/acre) in a mixed hardwood forest (Site 2) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973).

Species	Size Class D.B.H. (inches) 4.0-6.9	7.0-9.9	10.0-12.9	13.0-15.9	16.0-18.9	19.0-21.9	22.0-24.9	25.0-27.9	28.0-30.9	31.0>	Totals
Acer rubrum	44.6	24.8	8.3	5.0	1.7	3.3		5.0	1.7	1.7	96.1
Betula lutea		1.7									1.7
Betula lenta	11.6	3.3	3.3	3.3							21.5
Carya glabra				1.7							1.7
Carya tomentosa	5.0		3.3								8.3
Fagus grandifolia	3.3										3.3
Nyssa sylvatica	9.9	6.6		1.7							18.2
Quercus alba	13.2	5.0									18.2
Quercus coccinea	1.7	1.7	5.0								8.4
Quercus palustris		3.3	3.3								6.6
Quercus rubra	6.6	3.3	11.6	1.7							23.2
Quercus velutina	19.8	47.9	19.8		1.7						89.2
Sassafras albidum	1.7										1.7
Totals	117.4	97.6	54.6	13.4	3.4	3.3		5.0	1.7	1.7	298.1

Table 4. Comparison of wooded communities in the vicinity of the Millstone Point site, Waterford, Connecticut (1973).

Habitat	Trees/ Acre	Average Basal Area ($in.^2$)	B.A./Acre ($in.^2$)	% Crown Cover	Saplings/ Acre	% Shrub Cover[a]
Mixed Hardwood Forest (Site 2)	297.5	77.2	22967	93.0	239.0	37.3
Riparian Community (Site 3)	204.0	152.8	31232	98.0	166.0	33.7
Mixed Hardwood Forest (Site 6)	329.4	50.6	16668	81.1	283.3	22.9

[a] Does not include tree seedlings found in shrub stratum.

Table 5. Analysis of saplings in a mixed hardwood forest (Site 2) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973)[a]

Scientific Name	Common Name	No. Points	No. Saplings	% Relative Frequency	% Relative Density	Saplings/ Acre
Acer rubrum	Red maple	21	33	17.6	18.3	43.7
Betula lenta	Black birch	17	23	14.3	12.8	30.6
Carya tomentosa	Mockernut hickory	14	23	11.8	12.8	30.6
Nyssa sylvatica	Sour gum	13	22	10.9	12.2	29.2
Hamamelis virginiana	Witch hazel	7	17	5.9	9.4	22.5
Prunus serotina	Black cherry	10	11	8.4	6.1	14.6
Betula lutea	Yellow birch	7	8	5.9	4.4	10.5
Quercus velutina	Black oak	5	8	4.2	4.4	10.5
Amelanchier arborea	Downy juneberry	6	6	5.0	3.3	7.9
Lindera benzoin	Spicebush	3	8	2.5	4.4	10.5
Carya glabra	Pignut hickory	4	5	3.4	2.8	6.7
Fagus grandifolia	American beech	3	4	2.5	2.2	5.3
Quercus alba	White oak	3	4	2.5	2.2	5.3
Quercus rubra	Red oak	2	3	1.7	1.7	4.1
Viburnum dentatum	Arrowwood	1	2	0.8	1.1	2.6
Carpinus caroliniana	American hornbeam	1	1	0.8	0.6	1.4
Cretaegus sp.	Hawthorn	1	1	0.8	0.6	1.4
Vaccinium corymbosum	Highbush blueberry	1	1	0.8	0.6	1.4
Totals		119	180	99.8	99.9	238.8

[a] Total point to plant distance = 2426 ft.
Mean point to plant distance = 2426/180 = 13.5 ft.
Sapling/acre = $43560/(13.5)^2$ = 239.0

Table 6. Analysis of tree seedlings and shrubs in a mixed hardwood forest (Site 2) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973)[a]

Scientific Name	Common Name	No. Transects Occurred	Total Length Intercepted (ft.)	% Relative Frequency	% Relative Dominance	% Ground Cover
Tree seedlings						
Prunus serotina	Black cherry	1	4	50.0	66.7	0.4
Nyssa sylvatica	Sour gum	1	2	50.0	33.3	0.2
Totals		2	6	100.0	100.0	0.6
Shrubs						
Viburnum dentatum	Arrowwood	17	110	37.8	29.5	11.0
Clethra alnifolia	Sweet pepperbush	8	97	17.8	26.0	9.7
Lindera benzoin	Spicebush	5	98	11.1	26.3	9.8
Smilax rotundifolia	Common greenbrier	7	17	15.6	4.6	1.7
Vaccinium corymbosum	Highbush blueberry	5	24	11.1	6.4	2.4
Rubus sp.	Blackberry	1	20	2.2	5.4	2.0
Hamamelis virginiana	Witch hazel	1	4	2.2	1.1	0.4
Ilex verticillata	Black alder	1	3	2.2	0.8	0.3
Totals		45	373	100.0	100.1	37.3

[a] Total transect length = 1000 ft.

Table 7. Analysis of herbaceous species in a mixed hardwood forest (Site 2) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973).

Scientific Name	Common Name	May		July		October	
		No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency
Maianthemum canadense	Canada mayflower	16	19.5	25	19.4	-	-
Viburnum dentatum	Arrowwood	13	15.9	16	12.4	7	13.2
Thelypteris noveboracensis	New York fern	11	13.4	6	4.7	8	15.1
Uvularia sessilifolia	Wild oats	6	7.3	2	1.6	-	-
Prunus serotina	Black cherry	4	4.9	4	3.1	2	3.8
Dennstaedtia punctilobula	Hayscented fern	3	3.7	5	3.9	-	-
Symplocarpus foetidus	Skunk cabbage	3	3.7	3	2.3	1	1.9
Polygonatum canaliculatum	Great Solomon's seal	2	2.4	-	-	-	-
Arisaema triphyllum	Jack-in-the-pulpit	2	2.4	3	2.3	-	-
Aster sp. (imm.)	Aster	2	2.4	5	3.9	-	-
Clethra alnifolia	Sweet pepperbush	2	2.4	7	5.4	6	11.3
Gramineae	Grass	2	2.4	-	-	1	1.9
Impatiens capensis	Jewelweed	2	2.4	3	2.3	2	3.8
Lycopodium obscurum	Ground pine	2	2.4	2	1.6	1	1.9
Ranunculus sp.	Buttercup	2	2.4	-	-	-	-
Vaccinium corymbosum	Highbush blueberry	2	2.4	-	-	-	-
Acer rubrum	Red maple	1	1.2	3	2.3	1	1.9
Aralia nudicaulis	Wild sarsaparilla	1	1.2	-	-	-	-
Arenaria lateriflora	Blunt-leaved sandwort	1	1.2	-	-	-	-
Dryopteris spinulosa	Spinulose woodfern	1	1.2	-	-	-	-
Geranium maculatum	Wild geranium	1	1.2	2	1.6	-	-
Lonicera japonica	Japanese honeysuckle	1	1.2	2	1.6	2	3.8
Lysimachia quadrifolia	Whorled loosestrife	1	1.2	1	0.8	-	-
Thalictrum sp.	Meadow rue	1	1.2	-	-	-	-
Smilax rotundifolia	Common greenbrier	-	-	7	5.4	1	1.9
Rhus radicans	Poison ivy	-	-	6	4.7	-	-
Osmunda cinnamomea	Cinnamon fern	-	-	4	3.1	5	9.4
Rubus flagellaris	Northern dewberry	-	-	4	3.1	3	5.7
Medeola virginiana	Indian cucumber-root	-	-	2	1.6	-	-
Myrica pensylvanica	Northern bayberry	-	-	2	1.6	-	-
Osmunda regalis	Royal fern	-	-	2	1.6	-	-
Pteridium aquilinum	Bracken fern	-	-	2	1.6	1	1.9
Viburnum acerifolium	Mapleleaf viburnum	-	-	2	1.6	1	1.9
Athyrium felix-femina	Lady fern	-	-	1	0.8	3	5.7
Chimaphila maculata	Spotted wintergreen	-	-	1	0.8	-	-
Gaylussacia baccata	Black huckleberry	-	-	1	0.8	-	-
Hypericum punctatum	Spotted St. Johnswort	-	-	1	0.8	-	-
Lindera benzoin	Spicebush	-	-	1	0.8	2	3.8

Table 7. Continued.

Scientific Name	Common Name	May		July		October	
		No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency
Lycopodium complanatum	Running pine	-	-	1	0.8	-	-
Monotropa hypopithys	Pinesap	-	-	1	0.8	-	-
Onoclea sensibilis	Sensitive fern	-	-	1	0.8	1	1.9
Rhododendron nudiflorum	Pinxster flower	-	-	1	0.8	-	-
Carya sp.	Hickory	-	-	-	-	1	1.9
Mitchella repens	Partridgeberry	-	-	-	-	1	1.9
Quercus sp.	Oak	-	-	-	-	1	1.9
Sassafras albidum	Sassafras	-	-	-	-	1	1.9
Viola sp.	Violet	-	-	-	-	1	1.9
Totals		82	99.6	129	100.7	53	100.3

Table 8. Analysis of trees in a riparian community (Site 3) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973)[a].

Scientific Name	Common Name	No. Points	No. Trees	Total Basal Area (sq. in.)	% Relative Frequency	% Relative Density	% Relative Dominance	Imp. Value	Trees/ Acre	BA/ Acre
Acer rubrum	Red maple	23	34	9456	23.0	22.4	40.7	86.1	45.8	12711
Fagus grandifolia	American beech	16	36	3656	16.0	23.7	15.7	55.4	48.4	4903
Quercus velutina	Black oak	9	13	2721	9.0	8.6	11.7	29.3	17.6	3654
Betula lenta	Black birch	11	12	1439	11.0	7.9	6.2	25.1	16.1	1936
Quercus rubra	Red oak	5	12	2251	5.0	7.9	9.7	22.6	16.1	3030
Carya tomentosa	Mockernut hickory	6	9	700	6.0	5.9	3.0	14.9	12.1	937
Nyssa sylvatica	Sour gum	5	8	423	5.0	5.3	1.8	12.1	10.8	562
Fraxinus pennsylvanica	Green ash	5	5	512	5.0	3.3	2.2	10.5	6.7	687
Prunus serotina	Black cherry	5	6	160	5.0	3.9	0.7	9.6	8.0	219
Quercus alba	White oak	3	4	894	3.0	2.6	3.8	9.4	5.3	1187
Quercus coccinea	Scarlet oak	3	4	489	3.0	2.6	2.1	7.7	5.3	656
Amelanchier arborea	Downy juneberry	3	3	191	3.0	2.0	0.8	5.8	4.1	250
Carya glabra	Pignut hickory	2	2	132	2.0	1.3	0.6	3.9	2.7	187
Quercus palustris	Pin oak	2	2	121	2.0	1.3	0.5	3.8	2.7	156
Sassafras albidum	Sassafras	1	1	59	1.0	0.7	0.3	2.0	1.4	94
Malus sp.	Apple	1	1	24	1.0	0.7	0.1	1.8	1.4	31
Totals		100	152	23228	100.0	100.1	99.9	300.0	204.5	31200

[a] Total point to plant distance = 2222.1 ft.
Mean point to plant distance = 2222.1/152 = 14.6 ft.
Trees/acre = $43560/(14.6)^2$ = 204.4
Average basal area = 23228/152 = 152.8 $in.^2$
Basal area/acre = (152.8)(204.4) = 31232 $in.^2$
Percentage crown cover = 98.0

Table 9. Density of trees by size classes (trees/acre) in a riparian community (Site 3) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973).

Species	Size Class D.B.H. (inches) 4.0-6.9	7.0-9.9	10.0-12.9	13.0-15.9	16.0-18.9	19.0-21.9	22.0-24.9	25.0-27.9	28.0-30.9	31.0>	Totals
Acer rubrum	10.8	16.1	2.7	2.7	2.7	1.3		4.0	2.7	2.7	45.7
Amelanchier arborea	2.7			1.3							4.0
Betula lenta	1.3	4.0	4.0	4.0	2.7						16.0
Carya glabra	1.3		1.3								2.6
Carya tomentosa	4.0	2.7	2.7	2.7							12.1
Fagus grandifolia	16.1	12.1	8.1	8.1		1.3	2.7				48.4
Fraxinus pennsylvanica	2.7	1.3	1.3			1.3					6.6
Malus sp.	1.3										1.3
Nyssa sylvatica	8.1	1.3		1.3							10.7
Prunus serotina	8.1										8.1
Quercus alba	2.7			1.3					1.3		5.3
Quercus coccinea		1.3	1.3	2.7							5.3
Quercus palustris		2.7									2.7
Quercus rubra		5.4	1.3	2.7	2.7	2.7	1.3				16.1
Quercus velutina	4.0	4.0	1.3	1.3	2.7			2.7	1.3		17.3
Sassafras albidum		1.3									1.3
Totals	63.1	52.2	24.0	28.1	10.8	6.6	4.0	6.7	5.3	2.7	203.5

Table 10. Analysis of saplings in a riparian community (Site 3) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973)[a].

Scientific Name	Common Name	No. Points	No. Saplings	% Relative Frequency	% Relative Density	Saplings/ Acre
Fagus grandifolia	American beech	14	33	12.7	21.7	36.0
Acer rubrum	Red maple	17	26	15.5	17.1	28.4
Quercus velutina	Black oak	10	11	9.1	7.2	12.0
Prunus serotina	Black cherry	7	8	6.4	5.3	8.8
Lindera benzoin	Spicebush	6	9	5.5	5.9	9.8
Quercus alba	White oak	6	8	5.5	5.3	8.8
Carya tomentosa	Mockernut hickory	5	8	4.5	5.3	8.8
Nyssa sylvatica	Sour gum	6	6	5.5	3.9	6.5
Quercus rubra	Red oak	5	5	4.5	3.3	5.5
Sassafras albidum	Sassafras	5	5	4.5	3.3	5.5
Hamamelis virginiana	Witch hazel	4	6	3.6	3.9	6.5
Alnus serrulata	Smooth alder	4	5	3.6	3.3	5.5
Amelanchier arborea	Downy juneberry	4	4	3.6	2.6	4.3
Betula lenta	Black birch	4	4	3.6	2.6	4.3
Fraxinus pennsylvanica	Green ash	4	4	3.6	2.6	4.3
Carya glabra	Pignut hickory	3	4	2.7	2.6	4.3
Clethra alnifolia	Sweet pepperbush	3	3	2.7	2.0	3.3
Carpinus caroliniana	American hornbeam	1	1	0.9	0.7	1.2
Kalmia latifolia	Mountain laurel	1	1	0.9	0.7	1.2
Vaccinium corymbosum	Highbush blueberry	1	1	0.9	0.7	1.2
Totals		110	152	99.8	100.0	166.2

[a] Total point to plant distance = 2460.8 ft.
Mean point to plant distance = 2460/152 = 16.2 ft.
Saplings/acre = $43560/(16.2)^2$ = 166.0

Table 11. Analysis of tree seedlings and shrubs in a riparian community (Site 3) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973)[a]

Scientific Name	Common Name	No. Transects Occurred	Total Length Intercepted (ft.)	% Relative Frequency	% Relative Dominance	% Ground Cover
Tree seedlings						
Fagus grandifolia	American beech	6	76	42.9	73.8	8.0
Betula lenta	Black birch	2	7	14.3	6.8	0.7
Prunus serotina	Black cherry	1	5	7.1	4.9	0.5
Quercus sp.	Oak	1	5	7.1	4.9	0.5
Nyssa sylvatica	Sour gum	1	4	7.1	3.9	0.4
Carya glabra	Pignut hickory	1	3	7.1	2.9	0.3
Sassafras albidum	Sassafras	1	2	7.1	1.9	0.2
Amelanchier arborea	Downy juneberry	1	1	7.1	1.0	0.1
Totals		14	103	99.8	100.1	10.7
Shrubs						
Clethra alnifolia	Sweet pepperbush	8	110	24.2	34.4	11.6
Smilax rotundifolia	Common greenbrier	6	68	18.2	21.3	7.2
Viburnum dentatum	Arrowwood	8	30	24.2	9.4	3.2
Rhododendron nudiflorum	Pinxter flower	3	63	9.1	19.7	6.6
Viburnum acerifolium	Mapleleaf viburnum	4	16	12.1	5.0	1.7
Lindera benzoin	Spicebush	3	25	9.1	7.8	2.6
Kalmia latifolia	Mountain laurel	1	8	3.0	2.5	0.8
Totals		33	320	99.9	100.1	33.7

[a] Total transect length = 950 ft.

Table 12. Analysis of herbaceous species in a riparian community (Site 3) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973).

Scientific Name	Common Name	May		July		October	
		No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency
Maianthemum canadense	Canada mayflower	11	16.2	12	10.3	-	-
Polygonatum biflorum	Solomon's seal	8	11.8	-	-	-	-
Aster sp. (imm.)	Aster	6	8.8	3	2.6	-	-
Thelypteris noveboracensis	New York fern	6	8.8	9	7.8	5	14.3
Ranunculus sp.	Buttercup	5	7.4	-	-	-	-
Gramineae	Grass	4	5.9	2	1.7	2	5.7
Amelanchier arborea	Downy juneberry	3	4.4	-	-	-	-
Clethra alnifolia	Sweet pepperbush	3	4.4	18	15.5	7	20.0
Fagus grandifolia	American beech	2	2.9	2	1.7	-	-
Polygonatum canaliculatum	Great Solomon's seal	2	2.9	-	-	-	-
Rhododendron nudiflorum	Pinxter flower	2	2.9	-	-	-	-
Smilacina racemosa	False Solomon's seal	2	2.9	6	5.2	-	-
Symplocarpus foetidus	Skunk cabbage	2	2.9	6	5.2	-	-
Viburnum dentatum	Arrowwood	2	2.9	9	7.8	2	5.7
Caltha palustris	Marsh marigold	1	1.5	-	-	-	-
Dryopteris spinulosa	Spinulose wood fern	1	1.5	-	-	-	-
Onoclea sensibilis	Sensitive fern	1	1.5	2	1.7	-	-
Parthenocissus quinquefolia	Virginia creeper	1	1.5	1	0.9	-	-
Polystichum acrostichoides	Christmas fern	1	1.5	1	0.9	-	-
Rhus radicans	Poison ivy	1	1.5	2	1.7	-	-
Rubus sp. (imm.)	Blackberry	1	1.5	1	0.9	1	2.9
Smilax rotundifolia	Common greenbrier	1	1.5	7	6.0	6	17.1
Viburnum acerifolium	Mapleleaf viburnum	1	1.5	2	1.7	3	8.6
Viola sp. (imm.)	Violet	1	1.5	1	0.9	1	2.9
Osmunda cinnamomea	Cinnamon fern	-	-	7	6.0	-	-
Carex sp.	Sedge	-	-	4	3.4	2	5.7
Impatiens capensis	Jewelweed	-	-	4	3.4	-	-
Lindera benzoin	Spicebush	-	-	3	2.6	1	2.9
Medeola virginiana	Indian cucumber-root	-	-	3	2.6	-	-
Arisaema triphyllum	Jack-in-the-pulpit	-	-	2	1.7	-	-
Lonicera japonica	Japanese honeysuckle	-	-	2	1.7	-	-
Acer rubrum	Red maple	-	-	1	0.9	-	-
Boehmeria cylindrica	False nettle	-	-	1	0.9	-	-
Dennstaedtia punctilobula	Hayscented fern	-	-	1	0.9	-	-
Lysimachia quadrifolia	Whorled loosestrife	-	-	1	0.9	-	-
Monotropa uniflora	Indian-pipe	-	-	1	0.9	-	-
Quercus alba	White oak	-	-	1	0.9	-	-
Thalictrum sp.	Meadow rue	-	-	1	0.9	-	-
Compositae	Composite	-	-	-	-	1	2.9

Table 12. Continued.

Scientific Name	Common Name	May		July		October	
		No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency
Nyssa sylvatica	Sour gum	-	-	-	-	1	2.9
Prunus serotina	Black cherry	-	-	-	-	1	2.9
Quercus sp.	Oak	-	-	-	-	1	2.9
Smilax glauca	Glaucous greenbrier	-	-	-	-	1	2.9
Totals		68	100.1	116	100.2	35	100.3

Table 13. Analysis of herbaceous species in a brackish marsh (Site 4) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973).

Scientific Name	Common Name	May		July		October	
		No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency
Gramineae (imm.)	Grass	85	52.1	-	-	10	6.4
Scirpus sp. (imm.)	Bulrush	19	11.7	9	7.1	7	4.5
Distichlis spicata	Salt grass	17	10.4	14	11.0	22	14.0
Solidago sempervirens	Seaside goldenrod	17	10.4	16	12.6	9	5.7
Carex sp. (imm.)	Sedge	6	3.7	1	0.8	-	-
Labiatae (imm.)	Mint	5	3.1	3	2.4	-	-
Phragmites communis	Common reed grass	5	3.1	18	14.2	6	3.8
Poa pratensis	Kentucky bluegrass	2	1.2	4	3.1	-	-
Rhus radicans	Poison ivy	2	1.2	1	0.8	1	0.6
Rosa sp.	Rose	2	1.2	-	-	1	0.6
Ammophila breviligulata	American beachgrass	1	0.6	-	-	-	-
Convolvulus arvensis	Field bindweed	1	0.6	-	-	-	-
Vaccinium corymbosum	Highbush blueberry	1	0.6	-	-	-	-
Spartina patens	Salt meadow grass	-	-	29	22.8	56	35.7
Salicornia bigelovii	Bigelow's glasswort	-	-	10	7.9	23	14.6
Festuca sp.	Fescue grass	-	-	7	5.5	-	-
Juncus gerardi	Black grass	-	-	5	3.9	1	0.6
Juncus sp.	Rush	-	-	3	2.4	-	-
Panicum virgatum	Switch grass	-	-	2	1.6	-	-
Rumex acetosella	Sheep sorrel	-	-	2	1.6	-	-
Equisetum arvense	Common horsetail	-	-	1	0.8	-	-
Geum sp. (imm.)	Avens	-	-	1	0.8	-	-
Sparganium sp.	Burreed	-	-	1	0.8	-	-
Spartina alterniflora	Smooth cordgrass	-	-	-	-	15	9.6
Pluchea purpurascens	Marsh fleabane	-	-	-	-	5	3.2
Atriplex sp.	Orache	-	-	-	-	1	0.6
Totals		163	99.9	127	100.1	157	99.9

Table 14. Analysis of tree seedlings and shrubs in a transmission line corridor (Site 5) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973)[a].

Scientific Name	Common Name	No. Transects Occurred	Total Length Intercepted (ft.)	% Relative Frequency	% Relative Dominance	% Ground Cover
Tree seedlings						
Betula populifolia	Gray birch	8	11	36.4	25.6	0.6
Quercus sp.	Oak	5	6	22.7	14.0	0.3
Betula lutea	Yellow birch	4	7	18.2	16.3	0.4
Quercus rubra	Red oak	2	9	9.1	20.9	0.5
Ostrya virginiana	Eastern hophornbeam	1	8	4.5	18.6	0.5
Acer rubrum	Red maple	2	2	9.1	4.7	0.1
Totals		22	43	100.0	100.1	2.4
Shrubs						
Rubus allegheniensis	Allegheny blackberry	24	147	26.1	29.0	8.4
Rubus sp.	Blackberry	8	135	8.7	26.6	7.7
Kalmia latifolia	Mountain laurel	10	55	10.9	10.8	3.1
Vaccinium corymbosum	Highbush blueberry	12	43	13.0	8.5	2.5
Smilax rotundifolia	Common greenbrier	6	19	6.5	3.7	1.1
Rosa sp.	Rose	4	25	4.3	4.9	1.4
Smilax glauca	Glaucous greenbrier	3	25	3.3	4.9	1.4
Clethra alnifolia	Sweet pepperbush	3	15	3.3	3.0	0.9
Rhododendron nudiflorum	Pinxter flower	4	8	4.3	1.6	0.5
Rhus typhina	Staghorn sumac	4	7	4.3	1.4	0.4
Viburnum dentatum	Arrowwood	4	7	4.3	1.4	0.4
Spiraea tomentosa	Steeplebush	4	5	4.3	1.0	0.3
Hamamelis virginiana	Witch hazel	2	4	2.2	0.8	0.2
Myrica pensylvanica	Northern bayberry	1	6	1.1	1.2	0.3
Rhus copalina	Dwarf sumac	1	3	1.1	0.6	0.2
Comptonia peregrina	Sweetfern	1	2	1.1	0.4	0.1
Viburnum acerifolium	Mapleleaf viburnum	1	1	1.1	0.2	0.1
Totals		92	507	99.9	100.0	29.0

[a] Total transect length = 1750 ft.

Table 15. Analysis of herbaceous species in a transmission line corridor (Site 5) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973).

Scientific Name	Common Name	May		July		October	
		No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency
Aster spp. (imm.)	Aster	35	12.5	29	10.7	-	-
Eleocharis sp.	Spikerush	25	8.9	-	-	-	-
Rubus allegheniensis	Allegheny blackberry	24	8.6	17	6.3	9	5.4
Lysimachia quadrifolia	Whorled loosestrife	22	7.9	26	9.6	-	-
Potentilla simplex	Common cinquefoil	20	7.1	10	3.7	2	1.2
Maianthemum canadense	Canada mayflower	16	5.7	1	0.4	-	-
Carex spp.	Sedge	14	5.0	16	5.9	15	9.0
Osmunda cinnamomea	Cinnamon fern	13	4.6	6	2.2	-	-
Gramineae (imm.)	Grass	10	3.6	-	-	13	7.8
Juncus sp.	Rush	10	3.6	13	4.8	10	6.0
Potentilla canadensis	Dwarf cinquefoil	8	2.9	7	2.6	3	1.8
Lonicera japonica	Japanese honeysuckle	7	2.5	1	0.4	1	0.6
Digitaria sp.	Crabgrass	6	2.1	-	-	-	-
Anthoxanthum odoratum	Sweet vernal grass	5	1.8	3	1.1	-	-
Aralia nudicaulis	Wild sarsaparilla	4	1.4	-	-	-	-
Impatiens capensis	Jewelweed	4	1.4	5	1.9	-	-
Phragmites communis	Common reed grass	4	1.4	-	-	1	0.6
Symplocarpus foetidus	Skunk cabbage	4	1.4	1	0.4	-	-
Arenaria lateriflora	Blunt-leaved sandwort	3	1.1	-	-	-	-
Arisaema triphyllum	Jack-in-the-pulpit	3	1.1	-	-	-	-
Cerastium vulgatum	Mouse-ear chickweed	3	1.1	-	-	-	-
Rumex acetosella	Sheep sorrel	3	1.1	2	0.7	3	1.8
Smilax rotundifolia	Common greenbrier	3	1.1	4	1.5	4	2.4
Betula lutea	Yellow birch	2	0.7	2	0.7	1	0.6
Equisetum arvense	Field horsetail	2	0.7	1	0.4	-	-
Fragaria virginiana	Virginia strawberry	2	0.7	2	0.7	4	2.4
Geranium maculatum	Wild geranium	2	0.7	-	-	-	-
Labiatae (imm.)	Mint	2	0.7	-	-	-	-
Polygonatum canaliculatum	Great Solomon's seal	2	0.7	-	-	-	-
Thalictrum sp.	Meadow rue	2	0.7	-	-	-	-
Viola lanceolata	Lance-leaved violet	2	0.7	-	-	-	-
Acer rubrum	Red maple	1	0.4	2	0.7	-	-
Betula populifolia	Gray birch	1	0.4	3	1.1	2	1.2
Convolvulus arvensis	Field bindweed	1	0.4	-	-	1	0.6
Geum sp. (imm.)	Avens	1	0.4	-	-	-	-
Hamamelis virginiana	Witch hazel	1	0.4	1	0.4	-	-
Onoclea sensibilis	Sensitive fern	1	0.4	-	-	-	-
Oxalis stricta	Yellow wood sorrel	1	0.4	5	1.9	-	-
Poa pratensis	Kentucky bluegrass	1	0.4	1	0.4	-	-
Prunus serotina	Black cherry	1	0.4	2	0.7	-	-

Table 15. Continued.

Scientific Name	Common Name	May		July		October	
		No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency
Quercus sp. (imm.)	Oak	1	0.4	-	-	-	-
Ranunculus sp. (imm.)	Buttercup	1	0.4	-	-	-	-
Rosa sp.	Rose	1	0.4	1	0.4	1	0.6
Scrophularia lanceolata	Lance-leaved figwort	1	0.4	-	-	-	-
Uvularia grandiflora	Large-flowered bellwort	1	0.4	-	-	-	-
Vaccinium corymbosum	Highbush blueberry	1	0.4	2	0.7	4	2.4
Viburnum acerifolium	Mapleleaf viburnum	1	0.4	-	-	1	0.6
Viburnum dentatum	Arrowwood	1	0.4	1	0.4	3	1.8
Rubus flagellaris	Northern dewberry	-	-	17	6.3	11	6.6
Panicum auburne	Wooly panicgrass	-	-	16	5.9	-	-
Solidago sp. (imm.)	Goldenrod	-	-	12	4.4	-	-
Kalmia latifolia	Mountain laurel	-	-	6	2.2	4	2.4
Agrostis alba	Red top	-	-	5	1.9	8	4.8
Clethra alnifolia	Sweet pepperbush	-	-	5	1.9	4	2.4
Ipomoea sp. (imm.)	Morning glory	-	-	4	1.5	-	-
Linaria vulgaris	Yellow toadflax	-	-	4	1.5	3	1.8
Baptisia tinctoria	Wild indigo	-	-	3	1.1	-	-
Galium triflorum	Fragrant bedstraw	-	-	3	1.1	-	-
Panicum boscii	Bosc's panicgrass	-	-	3	1.1	-	-
Achillea millefolium	Common yarrow	-	-	2	0.7	-	-
Lyonia ligustrina	Maleberry	-	-	2	0.7	-	-
Mimulus ringens	Square-stemmed monkeyflower	-	-	2	0.7	-	-
Pteridium aquilinum	Bracken fern	-	-	2	0.7	-	-
Sassafras albidum	Sassafras	-	-	2	0.7	-	-
Viola fimbriatula	Northern downy violet	-	-	2	0.7	-	-
Amelanchier laevis	Smooth juneberry	-	-	1	0.4	-	-
Apios americana	Groundnut	-	-	1	0.4	-	-
Berberis vulgaris	Common barberry	-	-	1	0.4	-	-
Compositae (imm.)	Composite	-	-	1	0.4	-	-
Holcus lanatus	Velvet grass	-	-	1	0.4	-	-
Lindera benzoin	Spicebush	-	-	1	0.4	-	-
Lycopus americanus	American bugleweed	-	-	1	0.4	-	-
Phytolacca americana	Pokeweed	-	-	1	0.4	-	-
Polygonum sp.	Smartweed	-	-	1	0.4	-	-
Quercus rubra	Red oak	-	-	1	0.4	-	-
Rhododendron nudiflorum	Pinxter flower	-	-	1	0.4	1	0.6
Smilax glauca	Glaucous greenbrier	-	-	1	0.4	1	0.6
Spiraea tomentosa	Steeplebush	-	-	1	0.4	2	1.2
Thelypteris noveboracensis	New York fern	-	-	1	0.4	-	-

Table 15. Continued.

Scientific Name	Common Name	May		July		October	
		No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency
Verbena sp. (imm.)	Vervain	-	-	1	0.4	2	1.2
Vitis sp. (imm.)	Grape	-	-	1	0.4	-	-
Solidago rugosa	Rough goldenrod	-	-	-	-	22	13.3
Panicum spp.	Panic grass	-	-	-	-	13	7.8
Andropogon virginicus	Broomsedge	-	-	-	-	5	3.0
Lycopodium obscurum	Ground pine	-	-	-	-	2	1.2
Cyperus sp.	Sedge	-	-	-	-	1	0.6
Dennstaedtia punctilobula	Hayscented fern	-	-	-	-	1	0.6
Epilobium sp.	Willowherb	-	-	-	-	1	0.6
Eupatorium perfoliatum	Boneset	-	-	-	-	1	0.6
Hypericum sp.	St. Johnswort	-	-	-	-	1	0.6
Juniperus virginiana	Eastern redcedar	-	-	-	-	1	0.6
Myrica pensylvanica	Northern bayberry	-	-	-	-	1	0.6
Polygonum arifolium	Halberd-leaved tearthumb	-	-	-	-	1	0.6
Typha latifolia	Common cattail	-	-	-	-	1	0.6
Totals		280	100.3	270	100.2	166	99.7

Table 16. Analysis of trees in a mixed hardwood forest (Site 6) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973)[a]

Scientific Name	Common Name	No. Points	No. Trees	Total Basal Area (sq. in.)	% Relative Frequency	% Relative Density	% Relative Dominance	Imp. Value	Trees/ Acre	BA/ Acre
Quercus velutina	Black oak	33	76	3243	28.0	38.0	32.0	98.0	125.2	5334
Quercus alba	White oak	13	22	1015	11.0	11.0	10.0	32.0	36.2	1667
Betula lenta	Black birch	15	19	837	12.7	9.5	8.3	30.5	31.3	1383
Quercus coccinea	Scarlet oak	14	22	660	11.9	11.0	6.5	29.4	36.2	1083
Quercus palustris	Pin oak	14	22	591	11.9	11.0	5.8	28.7	36.2	967
Acer rubrum	Red maple	11	13	1242	9.3	6.5	12.3	28.1	21.4	2050
Prunus serotina	Black cherry	4	6	1646	3.4	3.0	16.3	22.7	9.9	2717
Fagus grandifolia	American beech	4	7	373	3.4	3.5	3.7	10.6	11.5	617
Carya tomentosa	Mockernut hickory	5	7	252	4.2	3.5	2.5	10.2	11.5	417
Quercus rubra	Red oak	2	3	105	1.7	1.5	1.0	4.2	4.9	167
Hamamelis virginiana	Witch hazel	1	1	111	0.8	0.5	1.1	2.4	1.6	183
Populus grandidentata	Bigtooth aspen	1	1	29	0.8	0.5	0.3	1.6	1.6	50
Sassafras albidum	Sassafras	1	1	18	0.8	0.5	0.2	1.5	1.6	33
Totals		118	200	10122	99.9	100.0	100.0	299.9	329.1	16668

[a] Total point to plant distance = 2305.0 ft.
Mean point to plant distance = 2305.0/200 = 11.5 ft.
Trees/acre = $43560/(11.5)^2$ = 329.4
Average basal area = 10122/200 = 50.6 $in.^2$
Basal area/acre = (50.6)(329.4) = 16668 $in.^2$
Percent crown cover = 81.1

Table 17. Density of trees by size classes (trees/acre) in a mixed hardwood forest (Site 6) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973).

Species	Size Class D.B.H. (inches) 4.0-6.9	7.0-9.9	10.0-12.9	13.0-15.9	16.0-18.9	19.0-21.9	22.0-24.9	25.0-27.9	28.0-30.9	31.0>	Totals
Acer rubrum	13.2	1.6	1.6	1.6		1.6	1.6				21.2
Betula lenta	16.5	8.2	3.3	1.6							29.6
Carya glabra	1.6										1.6
Carya tomentosa	6.6	4.9									11.5
Fagus grandifolia	3.3	6.6	1.6								11.5
Hamamelis virginiana			1.6								1.6
Populus grandidentata	1.6										1.6
Prunus serotina	4.9	1.6	1.6							1.6	9.7
Quercus alba	23.1	8.2	1.6	1.6	1.6						36.1
Quercus coccinea	24.7	11.5									36.2
Quercus palustris	29.6	6.6									36.2
Quercus rubra	1.6	3.3									4.9
Quercus velutina	82.4	28.0	9.9	1.6	3.3						125.2
Sassafras albidum	1.6										1.6
Totals	210.7	80.5	21.2	6.4	4.9	1.6	1.6			1.6	328.5

Table 18. Analysis of saplings in a mixed hardwood forest (Site 6) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973)[a]

Scientific Name	Common Name	No. Points	No. Saplings	% Relative Frequency	% Relative Density	Saplings/ Acre
Quercus velutina	Black oak	25	42	17.1	21.0	59.5
Acer rubrum	Red maple	25	39	17.1	19.5	55.2
Prunus serotina	Black cherry	17	23	11.6	11.5	32.6
Quercus alba	White oak	16	20	11.0	10.0	28.3
Carya tomentosa	Mockernut hickory	13	15	8.9	7.5	21.2
Fagus grandifolia	American beech	10	14	6.8	7.0	19.8
Betula lenta	Black birch	10	10	6.8	5.0	14.2
Amelanchier arborea	Downy juneberry	8	10	5.5	5.0	14.2
Quercus coccinea	Scarlet oak	8	10	5.5	5.0	14.2
Sassafras albidum	Sassafras	3	5	2.1	2.5	7.1
Quercus palustris	Pin oak	3	4	2.1	2.0	5.7
Quercus rubra	Red oak	3	3	2.1	1.5	4.2
Rhododendron nudiflorum	Pinxter flower	2	2	1.4	1.0	2.8
Carya glabra	Pignut hickory	1	1	0.7	0.5	1.4
Malus sp.	Apple	1	1	0.7	0.5	1.4
Nyssa sylvatica	Sour gum	1	1	0.7	0.5	1.4
Totals		146	200	100.1	100.0	283.2

[a] Total point to plant distance = 2474.8 ft.
Mean point to plant distance = 2474.8/200 = 12.4 ft.
Saplings/acre = $43560/(12.4)^2$ = 283.3

Table 19. Analysis of tree seedlings and shrubs in a mixed hardwood forest (Site 6) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973)[a]

Scientific Name	Common Name	No. Transects Occurred	Total Length Intercepted (ft.)	% Relative Frequency	% Relative Dominance	% Ground Cover
Tree seedlings						
Prunus serotina	Black cherry	6	41	22.2	43.6	2.8
Quercus sp.	Oak	5	13	18.5	13.8	0.9
Nyssa sylvatica	Sour gum	4	7	14.8	7.4	0.5
Acer rubrum	Red maple	3	7	11.1	7.4	0.5
Quercus alba	White oak	2	8	7.4	8.5	0.6
Quercus velutina	Black oak	1	8	3.7	8.5	0.6
Sassafras albidum	Sassafras	2	2	7.4	2.1	0.1
Fagus grandifolia	American beech	1	4	3.7	4.3	0.3
Quercus coccinea	Scarlet oak	1	2	3.7	2.1	0.1
Amelanchier arborea	Downy juneberry	1	1	3.7	1.1	0.1
Carya glabra	Pignut hickory	1	1	3.7	1.1	0.1
Totals		27	94	99.9	99.9	6.6
Shrubs						
Gaylussacia baccata	Black huckleberry	21	209	48.8	63.0	14.4
Viburnum dentatum	Arrowwood	8	43	18.6	13.0	3.0
Vaccinium sp.	Blueberry	5	29	11.6	8.7	2.0
Clethra alnifolia	Sweet pepperbush	2	36	4.7	10.8	2.5
Rhododendron nudiflorum	Pinxter flower	2	8	4.7	2.4	0.6
Smilax rotundifolia	Common greenbrier	2	3	4.7	0.9	0.2
Rosa sp.	Rose	2	2	4.7	0.6	0.1
Vaccinium corymbosum	Highbush blueberry	1	2	2.3	0.6	0.1
Totals		43	332	100.1	100.0	22.9

[a] Total transect length = 1450 ft.

Table 20. Analysis of herbaceous species in a mixed hardwood forest (Site 6) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973).

Scientific Name	Common Name	May		July		October	
		No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency
Malanthemum canadense	Canada mayflower	22	26.5	34	22.1	-	-
Gaylussacia baccata	Black huckleberry	10	12.0	19	12.3	13	24.1
Prunus serotina	Black cherry	9	10.8	11	7.1	1	1.9
Viburnum dentatum	Arrowwood	7	8.4	10	6.5	2	3.7
Quercus sp. (imm.)	Oak	7	8.4	-	-	5	9.3
Rhus radicans	Poison ivy	5	6.0	4	2.6	-	-
Gramineae	Grass	5	6.0	1	0.6	3	5.6
Lysimachia quadrifolia	Whorled loosestrife	3	3.6	3	1.9	-	-
Rosa sp.	Rose	3	3.6	-	-	-	-
Osmunda cinnamomea	Cinnamon fern	3	3.6	2	1.3	-	-
Acer rubrum	Red maple	2	2.4	7	4.5	1	1.9
Aster sp. (imm.)	Aster	2	2.4	5	3.2	1	1.9
Vaccinium corymbosum	Highbush blueberry	2	2.4	6	3.9	8	14.8
Parthenocissus quinquefolia	Virginia creeper	1	1.2	-	-	-	-
Pteridium aquilinum	Bracken fern	1	1.2	3	1.9	-	-
Rubus sp.	Blackberry	1	1.2	1	0.6	4	7.4
Athyrium felix-femina	Lady fern	-	-	7	4.5	6	11.1
Quercus rubra	Red oak	-	-	7	4.5	-	-
Carex sp. (imm.)	Sedge	-	-	6	3.9	-	-
Monotropa uniflora	Indian-pipe	-	-	4	2.6	-	-
Smilax rotundifolia	Common greenbrier	-	-	4	2.6	1	1.9
Trientalis borealis	Starflower	-	-	4	2.6	-	-
Clethra alnifolia	Sweet pepperbush	-	-	3	1.9	2	3.7
Rhododendron nudiflorum	Pinxter flower	-	-	2	1.3	-	-
Smilax glauca	Glaucous greenbrier	-	-	2	1.3	2	3.7
Chimaphila maculata	Spotted wintergreen	-	-	1	0.6	1	1.9
Danthonia sp.	Oat grass	-	-	1	0.6	-	-
Lonicera japonica	Japanese honeysuckle	-	-	1	0.6	-	-
Luzula campestris	Hairy woodrush	-	-	1	0.6	-	-
Lycopodium complanatum	Running pine	-	-	1	0.6	-	-
Lycopodium obscurum	Ground pine	-	-	1	0.6	-	-
Medeola virginiana	Indian cucumber-root	-	-	1	0.6	-	-
Quercus alba	White oak	-	-	1	0.6	2	3.7
Smilacina racemosa	False Solomon's seal	-	-	1	0.6	-	-
Solidago flexicaulis	Zigzag goldenrod	-	-	-	-	1	1.9
Thelypteris noveboracensis	Hayscented fern	-	-	-	-	1	1.9
Totals		83	99.7	154	99.1	54	100.4

Table 21. Qualitative survey of cultivated trees and shrubs, and native species in an abandoned nursery (Site 7) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973).

Scientific Name	Common Name	Occurrence[a]
Cultivated trees		
Acer palmatum var. *atropurpureum*	Crimson king	C
Cornus florida	Flowering dogwood	C
Cornus florida var. *rubra*	Pink flowering dogwood	C
Malus floribunda	Flowering crab apple	C
Prunus cerasitera var. *pissardi*	Japanese flowering cherry	C
Prunus yedoensis	Flowering cherry	C
Prunus yedoensis var. *flore-plena*	Double flowering cherry	C
Sorbus americana	American mountain ash	C
Cultivated shrubs		
Andromeda glaucophylla	Bog rosemary	C
Berberis thunbergi	Japanese barberry	C
Berberis vulgaris	European barberry	C
Ilex opaca	American holly	C
Juniperis chinensis var. *pfitzeriana*	Pfitzer's juniper	C
Juniperis communis	Common juniper	C
Juniperis virginiana	Eastern redcedar	C
Philadelphus coronarias	Mock-orange	C
Pieris japonica	Pieris	C
Rhododendron spp. (deciduous)	Azaleas	C
Rhododendron spp. (evergreen)	Rhododendron	C
Taxus cuspidata	Japanese yew	C
Thuja occidentalis	American arbor-vitae	C
Native trees		
Acer negundo	Boxelder	I
Acer rubrum	Red maple	C
Prunus serotina	Black cherry	C
Native shrubs		
Aronia arbutifolia	Red chokeberry	I
Parthenocissus quinquefolia	Virginia creeper	C
Rhus radicans	Poison ivy	A
Rosa sp.	Rose	C
Rubus allegheniensis	Allegheny blackberry	C
Rubus flagelleris	Northern dewberry	I
Smilax rotundifolia	Common greenbrier	C
Spiraea tomentosa	Steeplebush	I
Vaccinium corymbosum	Highbush blueberry	I
Viburnum dentatum	Arrowwood	A
Vitis sp.	Grape	I
Native herbs		
Agropyron repens	Quackgrass	I
Agrostis alba	Redtop	C
Ambrosia artemisiifolia	Common ragweed	I
Anthoxanthum odoratum	Sweet vernal grass	C
Asclepius incarnata	Swamp milkweed	I
Aster sp. (imm.)	Aster	C
Carex sp.	Sedge	C
Cicuta maculata	Water hemlock	C
Cirsium vulgare	Bull thistle	I
Dennstaedtia punctilobula	Hayscented fern	I

Table 21. Continued.

Scientific Name	Common Name	Occurrence[a]
Erigeron strigosus	Rough fleabane	I
Galium aparine	Catchweed bedstraw	I
Holcus lanatus	Velvet grass	A
Impatiens capensis	Jewelweed	C
Ipomoea sp.	Morning glory	I
Juncus sp.	Rush	C
Phleum pratense	Timothy	C
Plantago lanceolata	Buckhorn plantain	C
Plantago rugelii	Blackseed plantain	C
Polygonum persicaria	Lady's thumb	I
Rumex crispus	Curly dock	C
Sisyrinchium sp.	Blue-eyed grass	I
Solanum dulcamera	Nightshade	C
Solidago graminifolia	Narrow-leaved goldenrod	C
Solidago rugosa	Rough goldenrod	C

[a] A= Abundant; frequently found, wide distribution.
C= Common; often found, scattered distribution.
I= Infrequent; seldom found, scattered distribution.

Table 22. Qualitative survey of trees, shrubs, and herbs in a beach and managed recreation area (Site 8) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973).

Scientific Name	Common Name	Occurrence[a]
Trees		
Amelanchier arborea	Downy juneberry	I
Betula populifolia	Gray birch	I
Juniperus virginiana	Eastern red cedar	C
Malus sp.	Apple	A
Prunus avium	Sweet cherry	I
Prunus serotina	Black cherry	A
Salix sp.	Willow	I
Shrubs		
Celastrus scandens	Climbing bittersweet	I
Gaylussacia baccata	Black huckleberry	C
Lonicera japonica	Japanese honeysuckle	A
Myrica pensylvanica	Northern bayberry	C
Parthenocissus quinquefolia	Virginia creeper	I
Rhus copalina	Dwarf sumac	C
Rhus radicans	Poison ivy	A
Rhus typhina	Staghorn sumac	A
Rosa sp.	Rose	C
Rubus sp.	Blackberry	I
Rubus phoenicolasius	Wineberry	I
Sambucus canadensis	American elder	I
Viburnum dentatum	Arrowwood	C
Herbs		
Achillea millefolium	Common yarrow	I
Agropyron repens	Quackgrass	I
Agrostis alba	Red top	C
Ambrosia artemisiifolia	Common ragweed	I
Ammophila breviligulata	American beachgrass	C
Andropogon scoparius	Little bluestem	C
Anthoxanthum odoratum	Sweet vernal grass	C
Artemisia caudata	Tall wormwood	C
Asclepius syriaca	Common milkweed	I
Asclepius tuberosa	Butterflyweed	I
Aster sp. (imm.)	Aster	I
Chrysanthemum leucanthemum	Ox-eye daisy	I
Dactylus glomerata	Orchard grass	I
Holcus lanatus	Velvetgrass	I
Hypericum perforatum	Common St. Johnswort	C
Ipomoea sp.	Morning glory	I
Juncus sp.	Rush	C
Lactuca sp.	Lettuce	C
Lathyrus japonicus	Beach pea	C
Oenothera biennis	Common evening primrose	I
Panicum boscii	Bosc's panic grass	C
Phleum pratense	Timothy	I
Phytolacca americana	Pokeweed	I
Plantago lanceolata	Buckhorn plantain	I
Poa pratensis	Kentucky bluegrass	I
Polygonum scandens	Climbing false buckwheat	I

Table 22. Continued.

Scientific Name	Common Name	Occurrence[a]
Rumex acetosella	Sheep sorrel	I
Sedum sp.	Sedum	I
Smilacina racemosa	False Solomon's seal	I
Solanum dulcamera	Nightshade	I
Solidago sempervirens	Seaside goldenrod	C
Solidago sp. (imm.)	Goldenrod	C
Spartina alterniflora	Smooth cordgrass	C

[a] A = Abundant, frequently found, wide distribution.
C = Common, often found, scattered distribution.
I = Infrequent, seldom found, scattered distribution.

Table 23. Analysis of herbaceous species in a beach community (Site 9) in the vicinity of the Millstone Point site, Waterford, Connecticut (1973).

Scientific Name	Common Name	May		July		October	
		No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency	No. of Quadrats	% Relative Frequency
Ammophila brevilligulata	American beachgrass	72	69.2	25	30.5	41	41.8
Linaria vulgaris	Yellow toadflax	12	11.5	4	4.9	1	1.0
Rhus radicans	Poison ivy	5	4.8	4	4.9	7	7.1
Poa pratensis	Kentucky bluegrass	4	3.9	-	-	-	-
Rumex acetosella	Sheep sorrel	4	3.9	-	-	-	-
Parthenocissus quinquefolia	Virginia creeper	3	2.9	5	6.1	1	1.0
Convolvulus arvensis	Field bindweed	2	1.9	5	6.1	1	1.0
Achillea millefolium	Common yarrow	1	1.0	1	1.2	1	1.0
Oxalis stricta	Yellow wood sorrel	1	1.0	-	-	-	-
Oenothera biennis	Common evening primrose	-	-	13	15.9	10	10.2
Lactuca sp. (imm.)	Lettuce	-	-	5	6.1	2	2.0
Agropyron repens	Quackgrass	-	-	4	4.9	-	-
Rosa sp.	Rose	-	-	3	3.7	1	1.0
Solidago sempervirens	Seaside goldenrod	-	-	3	3.7	5	5.1
Datura stramonium	Jimsonweed	-	-	2	2.4	5	5.1
Daucus carota	Wild carrot	-	-	2	2.4	-	-
Ipomoea sp.	Morning glory	-	-	2	2.4	-	-
Cirsium arvense	Canada thistle	-	-	1	1.2	5	5.1
Cyperus strigosus	Umbrella sedge	-	-	1	1.2	-	-
Labiatae (imm.)	Mint	-	-	1	1.2	-	-
Solanum dulcamera	Nightshade	-	-	1	1.2	1	1.0
Elymus virginicus	Virginia wildrye	-	-	-	-	3	3.1
Spartina alterniflora	Smooth cordgrass	-	-	-	-	3	3.1
Euphorbia sp.	Spurge	-	-	-	-	2	2.0
Rubus sp.	Blackberry	-	-	-	-	2	2.0
Ambrosia artemisiifolia	Common ragweed	-	-	-	-	1	1.0
Atriplex glabriuscula	Orache	-	-	-	-	1	1.0
Digitaria sp.	Crabgrass	-	-	-	-	1	1.0
Panicum sp.	Panic grass	-	-	-	-	1	1.0
Quercus rubra	Red oak	-	-	-	-	1	1.0
Umbelliferae	Parsley	-	-	-	-	1	1.0
Viburnum dentatum	Arrowwood	-	-	-	-	1	1.0
Totals		104	100.1	82	100.0	98	99.6

Table 24. Total number of mammals captured, number of mammals captured per 100 trap-nights, percent composition of each species, and the percent utilization of each community in the vicinity of the Millstone Point site, Waterford, Connecticut (May, July, and October 1973).

Species	Old Field (Site 1)		Mixed Hardwood Forest (Site 2)		Riparian (Site 3)		Brackish Marsh (Site 4)		Transmission Line Corridor (Site 5)		Mixed Hardwood Forest (Site 6)	
	No.	No. Per 100 TN	No.	No. Per 100 TN	No.	No. Per 100 TN	No.	No. Per 100 TN	No.	No. Per 100 TN	No.	No. Per 100 TN
Peromyscus leucopus	1	0.12	76	8.45	50	5.63	20	2.22	32	3.56	37	4.12
Microtus pennsylvanicus	26	3.04	7	0.78	-	-	23	2.56	23	2.56	-	-
Blarina brevicauda	12	1.40	2	0.22	3	0.34	-	-	-	-	2	0.22
Zapus hudsonius	1	0.12	-	-	-	-	-	-	5	0.56	-	-
Rattus norvegicus	-	-	-	-	-	-	3	0.33	-	-	-	-
Sorex cinereus	-	-	-	-	-	-	-	-	2	0.22	-	-
Tamias striatus	-	-	-	-	1	0.11	-	-	-	-	1	0.11
Pitymys pinetorum	-	-	-	-	-	-	-	-	1	0.11	-	-
Community totals	40	4.67	85	9.45	54	6.08	46	5.11	63	7.00	40	4.45
% a	7.0		14.1		9.1		7.6		10.5		6.6	

Table 24. Continued.

Species	Abandoned Nursery (Site 7) No.	Abandoned Nursery (Site 7) No. Per 100 TN	Beach and Managed Recreation Area (Site 8) No.	Beach and Managed Recreation Area (Site 8) No. Per 100 TN	Beach Community (Site 9) No.	Beach Community (Site 9) No. Per 100 TN	Totals No.	Totals No. Per 100 TN	Percent Composition of Each Species
Peromyscus leucopus	20	4.44	12	3.57	29	6.44	277	4.21	61.0
Microtus pennsylvanicus	8	1.78	13	3.87	35	7.78	135	2.05	29.7
Blarina brevicauda	1	0.22	4	1.19	3	0.67	27	0.41	5.9
Zapus hudsonius	1	0.22	-	-	-	-	7	0.11	1.6
Rattus norvegicus	-	-	-	-	-	-	3	0.04	0.6
Sorex cinereus	-	-	-	-	-	-	2	0.03	0.4
Tamias striatus	-	-	-	-	-	-	2	0.03	0.4
Pitymys pinetorum	-	-	-	-	-	-	1	0.02	0.3
Community totals	30	6.67	29	8.63	67	14.88	454	6.90	
%a	10.0		12.9		22.2		100.0		

[a] Percent utilization of each plant community.

Table 25. Total number of mammals captured, number of mammals captured per 100 trap-nights, percent composition of each species, and the percent utilization of each community in the vicinity of the Millstone Point site, Waterford, Connecticut (May 1973).

	Old Field (Site 1)		Mixed Hardwood Forest (Site 2)		Riparian (Site 3)		Brackish Marsh (Site 4)		Transmission Line Corridor (Site 5)		Mixed Hardwood Forest (Site 6)	
	No.	No. Per 100 TN	No.	No. Per 100 TN	No.	No. Per 100 TN	No.	No. Per 100 TN	No.	No. Per 100 TN	No.	No. Per 100 TN
Peromyscus leucopus	1	0.33	18	6.00	21	7.05	9	3.00	4	1.33	10	3.33
Microtus pennsylvanicus	-	-	-	-	-	-	-	-	-	-	-	-
Pitymys pinetorum	-	-	-	-	-	-	-	-	1	0.33	-	-
Zapus hudsonius	-	-	-	-	-	-	-	-	1	0.33	-	-
Community totals	1	0.33	18	6.00	21	7.05	9	3.00	6	2.00	10	3.33
%[a]	1.1		19.7		23.1		9.8		6.6		10.9	

Table 25. Continued.

Species	Abandoned Nursery (Site 7) No.	Abandoned Nursery (Site 7) No. Per 100 TN	Beach and Managed Recreation Area (Site 8) No.	Beach and Managed Recreation Area (Site 8) No. Per 100 TN	Beach Community (Site 9) No.	Beach Community (Site 9) No. Per 100 TN	Totals No.	Totals No. Per 100 TN	Percent Composition of Each Species
Peromyscus leucopus	-	-	5	3.45	7	4.67	75	3.35	96.3
Microtus pennsylvanicus	-	-	-	-	1	0.67	1	0.04	1.1
Pitymys pinetorum	-	-	-	-	-	-	1	0.04	1.1
Zapus hudsonius	-	-	-	-	-	-	1	0.04	1.1
Community totals	-	-	5	3.45	8	5.33	78	3.48	
%[a]			11.3		17.5		100.0		

[a] Percent utilization of each plant community.

Table 26. Total number of mammals captured, number of mammals captured per 100 trap-nights, percent composition of each species, and the percent utilization of each community in the vicinity of the Millstone Point site, Waterford, Connecticut (July 1973).

Species	Old Field (Site 1)		Mixed Hardwood Forest (Site 2)		Riparian (Site 3)		Brackish Marsh (Site 4)		Transmission Line Corridor (Site 5)		Mixed Hardwood Forest (Site 6)	
	No.	No. Per 100 TN	No.	No. Per 100 TN	No.	No. Per 100 TN	No.	No. Per 100 TN	No.	No. Per 100 TN	No.	No. Per 100 TN
Microtus pennsylvanicus	15	5.86	7	2.33	-	-	21	7.00	11	3.67	-	-
Peromyscus leucopus	-	-	32	10.67	14	4.76	3	1.00	17	5.67	11	3.69
Blarina brevicauda	2	0.78	1	0.33	1	0.34	-	-	-	-	1	0.34
Zapus hudsonius	1	0.39	-	-	-	-	-	-	4	1.33	-	-
Sorex cinereus	-	-	-	-	-	-	-	-	2	0.67	-	-
Tamias striatus	-	-	-	-	1	0.34	-	-	-	-	1	0.34
Community totals	18	7.03	40	13.33	16	5.44	24	8.00	34	11.33	13	4.36
%[a]	7.1		13.4		5.5		8.0		11.4		4.4	

Table 26. Continued.

Species	Abandoned Nursery (Site 7) No.	Abandoned Nursery (Site 7) No. Per 100 TN	Beach and Managed Recreation Area (Site 8) No.	Beach and Managed Recreation Area (Site 8) No. Per 100 TN	Beach Community (Site 9) No.	Beach Community (Site 9) No. Per 100 TN	Totals No.	Totals No. Per 100 TN	Percent Composition of Each Species
Microtus pennsylvanicus	4	2.67	9	18.00	22	14.67	89	4.24	45.8
Peromyscus leucopus	-	-	3	6.00	7	4.67	87	4.15	44.9
Blarina brevicauda	1	0.67	1	2.00	1	0.67	8	0.38	4.1
Zapus hudsonius	1	0.67	-	-	-	-	6	0.29	3.1
Sorex cinereus	-	-	-	-	-	-	2	0.10	1.1
Tamias striatus	-	-	-	-	-	-	2	0.10	1.1
Community totals	6	4.00	13	26.00	30	20.00	194	9.25	
%[a]	4.0		26.1		20.1		100.0		

[a] Percent utilization of each plant community.

Table 27. Total number of mammals captured, number of mammals captured per 100 trap-nights, percent composition of each species, and the percent utilization of each community in the vicinity of the Millstone Point site, Waterford, Connecticut (October 1973).

Species	Old Field (Site 1) No.	Old Field (Site 1) No. Per 100 TN	Mixed Hardwood Forest (Site 2) No.	Mixed Hardwood Forest (Site 2) No. Per 100 TN	Riparian (Site 3) No.	Riparian (Site 3) No. Per 100 TN	Brackish Marsh (Site 4) No.	Brackish Marsh (Site 4) No. Per 100 TN	Transmission Line Corridor (Site 5) No.	Transmission Line Corridor (Site 5) No. Per 100 TN	Mixed Hardwood Forest (Site 6) No.	Mixed Hardwood Forest (Site 6) No. Per 100 TN
Peromyscus leucopus	-	-	26	8.7	15	5.07	8	2.67	11	3.67	16	5.33
Microtus pennsylvanicus	11	3.67	-	-	-	-	2	0.67	12	4.0	-	-
Blarina brevicauda	10	3.33	1	0.33	2	0.68	-	-	-	-	1	0.33
Rattus norvegicus	-	-	-	-	-	-	3	1.0	-	-	-	-
Community Totals	21	7.0	27	9.03	17	5.74	13	4.33	23	7.67	17	5.67
%[a]	8.5		10.9		7.0		5.2		9.4		6.9	

Table 27. Continued.

Species	Abandoned Nursery (Site 7) No.	Abandoned Nursery (Site 7) No. Per 100 TN	Beach and Managed Recreation Area (Site 8) No.	Beach and Managed Recreation Area (Site 8) No. Per 100 TN	Beach Community (Site 9) No.	Beach Community (Site 9) No. Per 100 TN	Totals No.	Totals No. Per 100 TN	Percent Composition of Each Species
Peromyscus leucopus	20	13.33	4	2.82	15	10.0	115	5.14	63.1
Microtus pennsylvanicus	4	2.67	4	2.82	12	8.0	45	2.01	24.7
Blarina brevicauda	-	-	3	2.11	2	1.33	19	0.85	10.4
Rattus norvegicus	-	-	-	-	-	-	3	0.13	1.6
Community Totals	24	16.0	11	7.75	29	19.33	182	8.14	
%[a]	19.4		9.4		23.4		100.1		

[a] Percent utilization of each plant community.

Table 28. Summary of the number of individual mammal species observations and/or signs recorded along transect routes in the environs of the Millstone Point site, Waterford, Connecticut (May 1973-January 1974).

Species	May	July	Oct.	Jan.	Species Total
Cottontail rabbit (species?)	7	20	6	1	34
Eastern gray squirrel	1	2	7	3	13
Woodchuck	3	5	3	-	11
Eastern chipmunk	4	3	2	-	9
Raccoon	-	2	-	-	2
Whitetail deer	-	-	1	-	1
Starnose mole	-	-	1	-	1
Muskrat	-	1	-	-	1
Monthly totals	15	33	20	4	72

Table 29. Number of mammal signs and/or observations recorded along transect routes in the vicinity of the Millstone Point site, Waterford, Connecticut (May 1973 - January 1974).

Species	Number and/or Sign Observed				Species Total
	May	July	October	January	
Old field (Site 1)					
Cottontail rabbit (species?)	1	2	-	-	3
Starnose mole	-	-	1	-	1
Mixed hardwood forest (Site 2)					
Eastern gray squirrel	1	-	4	3	8
Eastern chipmunk	-	1	2	-	3
Cottontail rabbit (species?)	-	1	a	1	2
Riparian community (Site 3)					
Eastern chipmunk	3	2	-	-	5
Cottontail rabbit (species?)	-	1	-	-	1
Woodchuck	-	1	-	-	1
Raccoon	-	1	-	-	1
Brackish marsh (Site 4)					
Eastern chipmunk	1	-	-	-	1
Muskrat	-	1	-	-	1
Eastern gray squirrel	-	1	-	-	1
Transmission line corridor (Site 5)					
Woodchuck	1	1	1	-	3
Cottontail rabbit (species?)	a	2	-	-	2
Whitetail deer	-	-	1	-	1
Mixed hardwood forest (Site 6)					
Cottontail rabbit (species?)	1	3	2	-	6
Eastern gray squirrel	-	1	3	-	4
Abandoned nursery (Site 7)					
Cottontail rabbit (species?)	3	2	-	a	5
Woodchuck	-	1	1	-	2
Beach and managed recreation area (Site 8)					
Cottontail rabbit (species?)	2	2	3	a	7
Beach community (Site 9)					
Cottontail rabbit (species?)	a	7	1	-	8
Woodchuck	2	2	1	-	5
Raccoon	-	1	-	-	1
Monthly totals	15	33	20	4	72

[a]Numerous sign, however the actual number was not estimated.

Table 30. Number of snaptrap-nights, mammals captured, and number of mammals captured per 100 snaptrap-nights in nine habitat types in the environs of the Millstone Point site, Waterford, Connecticut (15-17 May, 17-19 July and 23-25 October 1973).

Habitat Type	Number of Snaptrap-Nights			Number of Mammals Captured			Number of Mammals Captured/100 Snaptrap-Night		
	May	July	Oct.	May	July	Oct.	May	July	Oct.
Old field (Site 1)	300	256	300	1	18	21	0.33	7.03	7.00
Mixed hardwood forest (Site 2)	300	300	299	18	40	27	6.00	13.33	9.03
Riparian (Site 3)	298	294	296	21	16	17	7.05	5.44	5.74
Brackish marsh (Site 4)	300	300	300	9	24	13	3.00	8.00	4.33
Transmission line corridor (Site 5)	300	300	300	6	34	23	2.00	11.33	7.67
Mixed hardwood forest (Site 6)	300	298	300	10	13	17	3.33	4.36	5.67
Abandoned nursery (Site 7)	150	150	150	0	6	24	0.00	4.00	16.00
Beach and managed recreation area (Site 8)	144	50	142	5	13	11	3.47	26.00	7.75
Beach community (Site 9)	150	150	150	8	30	29	5.33	20.00	19.33
Totals and average	2242	2098	2237	78	194	182	3.48	9.25	8.14

Table 31. Number of mammals captured per 100 trap-nights, and the net change per 100 trap-nights from May to July and from July to October at the Millstone Point site, Waterford, Connecticut.

Species	Number Captured per 100 Trapnights			Net Change per 100 Trapnights	
	May	July	October	May to July	July to October
Peromyscus leucopus	3.35	4.15	5.14	+0.80	+0.99
Microtus pennsylvanicus	0.04	4.24	2.01	+4.20	-2.23
Blarina brevicauda	-	0.38	0.85	+0.38	+0.47
Zapus hudsonius	0.04	0.29	-	+0.25	-0.29
Rattus norvegicus	-	-	0.13	-	+0.13
Sorex cinereus	-	0.10	-	+0.10	-0.10
Tamias striatus	-	0.10	-	+0.10	-0.10
Pitymys pinetorum	0.04	-	-	-0.04	-
Total	3.48	9.25	8.14	+5.77	-1.11

Table 32. Residency status of the bird species observed in the Millstone Point site area, Waterford, Connecticut.

Scientific Name	Common Name	Permanent Resident	Summer Resident	Winter Resident	Migrant
Gavia immer	Common loon			X	
Podiceps grisegena	Red-necked grebe				X
Phalacrocorax auritus	Double-crested cormorant	X			
Olor columbianus	Whistling swan				X
Cygnus olor	Mute swan	X			
Branta canadensis	Canada goose				X
Anas platyrhynchos	Mallard	X			
Anas rubripes	Black duck	X			
Aix sponsa	Wood duck		X		
Bucephala clangula	Common goldeneye			X	
Bucephala albeola	Bufflehead			X	
Mergus merganser	Common merganser			X	
Mergus serrator	Red-breasted merganser			X	
Accipiter cooperii	Cooper's hawk	X			
Buteo jamaicensis	Red-tailed hawk	X			
Buteo platypterus	Broad-winged hawk		X		
Pandion haliaetus	Osprey		X		
Falco sparverius	American kestrel	X			
Bonasa umbellus	Ruffed grouse	X			
Colinus virginianus	Bobwhite	X			
Phasianus colchicus	Ring-necked pheasant	X			
Casmerodius albus	Great egret		X		
Ardea herodias	Great blue heron	X			
Butorides virescens	Green heron		X		
Nycticorax nycticorax	Black-crowned night heron		X		
Botaurus lentiginosus	American bittern		X		
Rallidae	Rail (species ?)		X		
Rallus elegans	King rail		X		
Squatarola squatarola	Black-bellied plover			X	
Charadrius vociferus	Killdeer	X			
Actitis macularia	Spotted sandpiper		X		
Totanus melanoleucus	Greater yellowlegs				X
Larus marinus	Great black-backed gull	X			
Larus argentatus	Herring gull	X			
Larus delawarensis	Ring-billed gull	X			
Sterna hirundo	Common tern		X		
Columba livia	Rock dove	X			
Zenaida macroura	Mourning dove	X			
Chaetura pelagica	Chimney swift		X		
Megaceryle alcyon	Belted kingfisher	X			
Colaptes auratus	Common flicker	X			
Dendrocopos villosus	Hairy woodpecker	X			
Dendrocopus pubescens	Downy woodpecker	X			
Tyrannus tyrannus	Eastern kingbird		X		
Myiarchus crinitus	Great crested flycatcher		X		
Sayornis phoebe	Eastern phoebe		X		
Contopus virens	Eastern wood pewee		X		
Hirundo rustica	Barn swallow		X		
Petrochelidon pyrrhonota	Cliff swallow		X		
Iridoprocne bicolor	Tree swallow		X		
Riparia riparia	Bank swallow		X		
Stelgidopteryx ruficollis	Rough-winged swallow		X		
Cyanocitta cristata	Bluejay	X			
Corvus brachyrhynchos	Common crow	X			
Parus atricapillus	Black-capped chickadee	X			

Table 32. Continued.

Scientific Name	Common Name	Permanent Resident	Summer Resident	Winter Resident	Migrant
Parus bicolor	Tufted titmouse	X			
Sitta carolinensis	White-breasted nuthatch	X			
Troglodytes aedon	House wren		X		
Troglodytes troglodytes	Winter wren			X	
Mimus polyglottos	Mockingbird		X		
Dumetella carolinensis	Gray catbird		X		
Toxostoma rufum	Brown thrasher		X		
Turdus migratorius	American robin	X			
Hylocichla mustelina	Wood thrush		X		
Catharus guttata	Hermit thrush		X		
Sialia sialis	Eastern bluebird	X			
Bombycilla cedrorum	Cedar waxwing				X
Sturnus vulgaris	Starling	X			
Vireo philadelphicus	Philadelphia vireo				X
Vireo olivaceus	Red-eyed vireo		X		
Mniotilta varia	Black-and-white warbler		X		
Vermivora pinus	Blue-winged warbler		X		
Dendroica petechia	Yellow warbler		X		
Dendroica coronata	Yellow-rumped warbler				X
Dendroica fusca	Blackburnian warbler				X
Dendroica discolor	Prairie warbler		X		
Dendroica palmarum	Palm warbler				X
Geothlypis trichas	Common yellowthroat		X		
Passer domesticus	House sparrow	X			
Dolichonyx oryzivorus	Bobolink		X		
Sturnella magna	Eastern meadowlark	X			
Agelaius phoeniceus	Red-winged blackbird	X			
Quiscalus quiscula	Common grackle		X		
Molothrus ater	Brown-headed cowbird		X		
Icterus galbula	Northern oriole		X		
Piranga olivacea	Scarlet tanger		X		
Cardinalis cardinalis	Cardinal	X			
Pheucticus ludovicianus	Rose-breasted grosbeak		X		
Passerina cyanea	Indigo bunting		X		
Carpodacus purpureus	Purple finch	X			
Spinus tristis	American goldfinch	X			
Pipilo erythrophthalmus	Rufous-sided towhee		X		
Passerculus sandwichensis	Savannah sparrow	X			
Ammospiza caudacuta	Sharp-tailed sparrow	X			
Poocetes gramineus	Vesper sparrow		X		
Junco hyemalis	Dark-eyed junco			X	
Spizella arborea	Tree sparrow			X	
Spizella pusilla	Field sparrow	X			
Zonotrichia albicollis	White-throated sparrow			X	
Melospiza lincolnii	Lincoln's sparrow				X
Melospiza georgiana	Swamp sparrow				X
Melospiza melodia	Song sparrow	X			

Table 33. The number of individual bird species observed during May, July, October 1973, and January 1974 sampling periods in the Millstone Point site area, Waterford, Connecticut.

Scientific Name	Common Name	May	July	October	January
Gavia immer	Common loon	-	-	-	6
Podiceps grisegena	Red-necked grebe	-	-	1	-
Phalacrocorax auritus	Double-crested cormorant	-	2	90	-
Olor columbianus	Whistling swan	2	-	-	-
Cygnus olor	Mute swan	11	12	6	3
Branta canadensis	Canada goose	-	-	115	-
Anas platyrhynchos	Mallard	7	1	29	13
Anas rubripes	Black duck	10	70	19	21
Aix sponsa	Wood duck	2	-	-	-
Bucephala clangula	Common goldeneye	-	-	-	1
Bucephala albeola	Bufflehead	3	-	3	20
Mergus merganser	Common merganser	1	-	-	-
Mergus serrator	Red-breasted merganser	-	-	-	30
Accipiter cooperii	Cooper's hawk	-	-	-	1
Buteo jamaicensis	Red-tailed hawk	-	-	-	1
Buteo platypterus	Broad-winged hawk	1	1	-	-
Pandion haliaetus	Osprey	6	9	-	-
Falco sparverius	American kestrel	-	-	2	-
Bonasa umbellus	Ruffed grouse	-	-	2	-
Colinus virginianus	Bobwhite	8	29	28	2
Phasianus colchicus	Ring-necked pheasant	-	1	4	-
Casmerodius albus	Great egret	3	4	1	-
Ardea herodias	Great blue heron	3	1	24	1
Butorides virescens	Green heron	8	6	-	-
Nycticorax nycticorax	Black-crowned night heron	6	17	36	-
Botaurus lentiginosus	American bittern	-	2	-	-
Rallidae	Rail (species ?)	1	-	-	-
Rallus elegans	King rail	1	-	-	-
Squatarola squatarola	Black-bellied plover	-	-	1	1
Charadrius vociferus	Killdeer	1	9	1	6
Actitis macularia	Spotted sandpiper	-	2	-	-
Totanus melanoleucus	Greater yellowlegs	2	-	40	-
Larus marinus	Great black-backed gull	-	-	10	5
Larus argentatus	Herring gull	36	62	125	40
Larus delawarensis	Ring-billed gull	21	1	6	24
Sterna hirundo	Common tern	19	35	-	-
Columba livia	Rock dove	23	33	4	2
Zenaida macroura	Mourning dove	14	18	76	1
Chaetura pelagica	Chimney swift	1	6	-	-
Megaceryle alcyon	Belted kingfisher	-	10	8	1
Colaptes auratus	Common flicker	5	25	10	-
Dendrocopos villosus	Hairy woodpecker	-	2	3	2
Dendrocopos pubescens	Downy woodpecker	4	5	1	-
Tyrannus tyrannus	Eastern kingbird	2	17	-	-
Myiarchus crinitus	Great crested flycatcher	2	1	-	-
Sayornis phoebe	Eastern phoebe	1	1	-	-
Contopus virens	Eastern wood pewee	-	1	1	-
Hirundo rustica	Barn swallow	45	59	-	-
Petrochelidon pyrrhonota	Cliff swallow	-	11	-	-
Iridoprocne bicolor	Tree swallow	1	5	-	-
Riparia riparia	Bank swallow	4	3	-	-
Stelgidopteryx ruficollis	Rough-winged swallow	-	18	-	-
Cyanocitta cristata	Bluejay	36	52	65	16
Corvus brachyrhynchos	Common crow	14	25	40	6

Table 33. Continued.

Scientific Name	Common Name	May	July	October	January
Parus atricapillus	Black-capped chickadee	6	44	51	18
Parus bicolor	Tufted titmouse	-	5	1	-
Sitta carolinensis	White-breasted nuthatch	-	-	-	1
Troglodytes aedon	House wren	4	7	1	-
Troglodytes troglodytes	Winter wren	-	-	-	1
Mimus polyglottos	Mockingbird	5	5	2	-
Dumetella carolinensis	Gray catbird	23	16	5	-
Toxostoma rufum	Brown thrasher	3	3	2	-
Turdus migratorius	American robin	25	47	66	2
Hylocichla mustelina	Wood thrush	-	3	-	-
Catharus guttata	Hermit thrush	-	-	3	-
Sialia sialis	Eastern bluebird	3	-	-	-
Bombycilla cedrorum	Cedar waxwing	-	-	8	-
Sturnus vulgaris	Starling	41	132	139	12
Vireo philadelphicus	Philadelphia vireo	-	-	2	-
Vireo olivaceus	Red-eyed vireo	2	-	-	-
Mniotilta varia	Black-and-white warbler	1	-	-	-
Vermivora pinus	Blue-winged warbler	10	1	-	-
Dendroica petechia	Yellow warbler	9	6	-	-
Dendroica coronata	Yellow-rumped warbler	-	-	36	-
Dendroica fusca	Blackburnian warbler	-	-	2	-
Dendroica discolor	Prairie warbler	10	3	-	-
Dendroica palmarum	Palm warbler	-	-	1	-
Geothlypis trichas	Common yellowthroat	33	23	-	-
Passer domesticus	House sparrow	11	24	-	2
Dolichonyx oryzivorus	Bobolink	7	-	-	-
Sturnella magna	Eastern meadowlark	2	6	5	5
Agelaius phoeniceus	Red-winged blackbird	100	80	-	20
Quiscalus quiscula	Common grackle	100	69	-	-
Molothrus ater	Brown-headed cowbird	4	-	-	-
Icterus galbula	Northern oriole	23	18	-	-
Piranga olivacea	Scarlet tanger	1	-	-	-
Cardinalis cardinalis	Cardinal	2	3	4	-
Pheucticus ludovicianus	Rose-breasted grosbeak	1	-	-	-
Passerina cyanea	Indigo bunting	-	1	-	-
Carpodacus purpureus	Purple finch	1	3	1	-
Spinus tristis	American goldfinch	8	42	92	-
Pipilo erythrophthalmus	Rufous-sided towhee	14	39	-	-
Passerculus sandwichensis	Savannah sparrow	-	8	2	-
Ammospiza caudacuta	Sharp-tailed sparrow	-	-	-	1
Pooecetes gramineus	Vesper sparrow	-	-	3	-
Junco hyemalis	Dark-eyed junco	-	-	8	2
Spizella arborea	Tree sparrow	-	-	-	3
Spizella pusilla	Field sparrow	7	21	25	20
Zonotrichia albicollis	White-throated sparrow	-	-	18	-
Melospiza lincolnii	Lincoln's sparrow	-	-	3	-
Melospiza georgiana	Swamp sparrow	-	-	13	-
Melospiza melodia	Song sparrow	36	61	48	32
Total number		796	1226	1292	322
Total species		63	62	55	35

Table 34. Number of sightings of avian species along transect routes through nine habitat types in the vicinity of the Millstone Point site, Waterford, Connecticut (May, July, October 1973, and January 1974).

Species	Habitat Type[a] Beach (Site 9)	Brackish Marsh[b] (Site 4)	Beach & Managed Recreation Area (Site 8)	Old Field (Site 1)	Abandoned Nursery (Site 7)	Transmission Line Corridor (Site 5)	Riparian (Site 3)	Mixed Hardwood Forest (Site 6)	Mixed Hardwood Forest (Site 2)	Total
Common loon	2	-	4	-	-	-	-	-	-	6
Double-crested cormorant	19	-	73	-	-	-	-	-	-	92
Mute swan	15	-	2	-	-	-	-	15	-	32
Mallard	23	15	2	-	-	2	8	-	-	50
Black duck	52	55	6	-	-	1	6	-	-	120
Common goldeneye	1	-	-	-	-	-	-	-	-	1
Bufflehead	23	-	3	-	-	-	-	-	-	26
Red-breasted merganser	12	-	18	-	-	-	-	-	-	30
Osprey	12	-	-	1	-	-	-	2	-	15
American kestrel	1	-	-	-	1	-	-	-	-	2
Great egret	2	3	3	-	-	-	-	-	-	8
Green heron	1	9	-	2	-	1	1	-	-	14
Black-crowned night heron	44	6	-	-	-	-	1	8	-	59
Black-bellied plover	2	-	-	-	-	-	-	-	-	2
Spotted sandpiper	1	-	1	-	-	-	-	-	-	2
Great black-backed gull	10	-	5	-	-	-	-	-	-	15
Herring gull	78	15	109	15	17	24	3	1	1	263
Ring-billed gull	21	1	17	-	7	4	-	2	-	52
Common tern	21	11	22	-	-	-	-	-	-	54
Rock dove	1	-	-	30	31	-	-	-	-	62
Mourning dove	5	2	4	5	8	73	12	-	-	109
Belted kingfisher	4	7	2	-	-	-	4	2	-	19
Common flicker	2	7	4	2	4	7	3	7	4	40
Downy woodpecker	1	-	-	1	1	2	3	-	2	10
Eastern kingbird	5	1	-	2	-	9	-	2	-	19
Eastern phoebe	1	-	-	-	-	-	1	-	-	2
Barn swallow	23	13	8	18	3	24	3	11	1	104
Tree swallow	1	-	-	2	2	-	-	1	-	6
Bank swallow	1	3	-	3	-	-	-	-	-	7
Rough-winged swallow	2	5	2	8	1	-	-	-	-	18
Bluejay	12	28	10	19	19	21	22	23	15	169
Common crow	6	9	3	4	5	15	9	21	13	85
Gray catbird	5	4	5	2	5	2	8	6	7	44
American robin	19	7	27	17	19	38	6	3	4	140
Starling	50	20	48	40	43	94	25	-	4	324
Blue-winged warbler	1	-	-	-	-	3	1	-	6	11
Yellow warbler	2	-	4	1	6	1	-	-	1	15
Common yellowthroat	3	-	6	5	8	17	5	1	11	56
House sparrow	18	-	6	11	-	2	-	-	-	37
Red-winged blackbird	21	28	11	60	19	27	13	8	13	200
Common grackle	45	18	39	30	10	5	14	6	2	169
Northern oriole	4	7	2	1	3	6	7	11	-	41
Purple finch	3	-	2	-	-	-	-	-	-	5
American goldfinch	8	9	32	35	42	10	1	-	5	142
Savannah sparrow	9	-	-	-	-	1	-	-	-	10
Lincoln's sparrow	1	-	-	-	-	-	-	-	2	3
Song sparrow	67	9	28	-	28	33	5	1	6	177
Common merganser	-	1	-	-	-	-	-	-	-	1
Bobwhite	-	1	1	8	18	15	13	5	6	67
Great blue heron	20	5	-	-	-	-	-	3	1	29
American bittern	-	1	-	-	-	1	-	-	-	2

Table 34. Continued.

Species	Habitat Type: Beach (Site 9)	Brackish Marsh (Site 4)	Beach & Managed Recreation Area (Site 8)	Old Field (Site 1)	Abandoned Nursery (Site 7)	Transmission Line Corridor (Site 5)	Riparian (Site 3)	Mixed Hardwood Forest (Site 6)	Mixed Hardwood Forest (Site 2)	Total
King rail	-	1	-	-	-	-	-	-	-	1
Rail (species ?)	-	1	-	-	-	-	-	-	-	1
Greater yellowlegs	-	42	-	-	-	-	-	-	-	42
Great crested flycatcher	-	1	-	-	-	-	-	2	-	3
Black-capped chickadee	3	5	24	7	14	10	26	7	23	119
Tufted titmouse	-	2	-	-	4	-	-	-	-	6
White-breasted nuthatch	-	1	-	-	-	-	-	-	-	1
House wren	1	2	-	-	1	-	1	-	7	12
Mockingbird	-	2	-	6	-	4	-	-	-	12
Brown thrasher	-	1	-	1	1	3	1	-	1	8
Warbler (species ?)	-	2	1	-	3	2	-	4	25	37
Prairie warbler	-	1	-	-	-	11	-	-	1	13
Rufous-sided towhee	-	4	-	1	-	16	14	8	10	53
Red-necked grebe	-	-	1	-	-	-	-	-	-	1
Canada goose	20	15	-	65	-	-	15	-	-	115
Hermit thrush	-	-	1	-	1	-	-	1	-	3
Sharp-tailed sparrow	-	-	1	-	-	-	-	-	-	1
Whistling swan	-	-	2	-	-	-	-	-	-	2
Sandpiper (species ?)	-	-	3	-	-	-	-	-	-	3
Dark-eyed junco	-	-	4	2	-	-	4	-	-	10
Chimney swift	-	-	1	3	-	3	-	-	-	7
Cliff swallow	-	-	7	4	-	-	-	-	-	11
Cedar waxwing	-	-	8	-	-	-	-	-	-	8
Ring-necked pheasant	-	-	1	1	3	-	-	-	-	5
Yellow-rumped warbler	-	-	8	-	23	3	-	2	-	36
Killdeer	6	-	1	2	-	7	-	-	1	17
Bobolink	-	-	-	6	1	-	-	-	-	7
Eastern meadowlark	-	-	-	13	2	3	-	-	-	18
Brown-headed cowbird	-	-	-	4	-	-	-	-	-	4
Sparrow (species ?)	-	-	2	-	6	1	-	-	-	9
Cardinal	-	-	-	3	1	2	3	-	-	9
Field sparrow	-	-	19	10	16	23	3	-	2	73
Broad-winged hawk	-	-	-	-	1	1	-	-	-	2
Rose-breasted grosbeak	-	-	-	-	1	-	-	-	-	1
Cooper's hawk	-	-	-	-	-	1	-	-	-	1
Winter wren	-	-	-	-	1	-	-	-	-	1
Palm warbler	-	-	-	-	1	-	-	-	-	1
Vesper sparrow	-	-	-	-	3	-	-	-	-	3
Tree sparrow	-	-	-	-	3	-	-	-	-	3
White-throated sparrow	-	-	-	-	3	-	5	5	5	18
Swamp sparrow	-	-	4	-	3	6	-	-	-	9
Indigo bunting	-	-	-	-	-	-	1	-	-	1
Wood thrush	-	-	-	-	-	1	-	1	1	3
Eastern bluebird	-	-	-	-	-	1	-	-	2	3
Red-eyed vireo	-	-	-	-	-	-	2	-	-	2
Black-and-white warbler	-	-	-	-	-	-	1	-	-	1
Eastern wood pewee	-	-	-	-	-	1	1	-	-	2
Ruffed grouse	-	-	-	-	-	-	2	-	-	2
Hairy woodpecker	-	-	-	1	2	-	2	-	2	7
Woodpecker (species ?)[c]	-	-	-	-	-	-	1	-	2	3
Nuthatch (species ?)	-	-	-	-	-	-	-	1	1	2

Table 34. Continued.

Species	Habitat Type[a] Beach (Site 9)	Brackish Marsh (Site 4)	Beach & Managed Recreation Area (Site 8)	Old Field (Site 1)	Abandoned Nursery (Site 7)	Transmission Line Corridor (Site 5)	Riparian (Site 3)	Mixed Hardwood Forest (Site 6)	Mixed Hardwood Forest (Site 2)	Total
Vireo (species ?)	-	-	-	-	-	-	-	-	4	4
Philadelphia vireo	-	-	-	-	-	-	-	2	-	2
Blackburnian warbler	-	-	-	-	-	-	-	-	2	2
Scarlet tanager	-	-	-	-	-	-	-	-	1	1
Red-tailed hawk	-	-	-	-	-	-	-	-	1	1
Total number	710	380	597	451	394	537	256	172	195	3692
Total species	52	43	50	41	45	46	39	30	35	106

[a] Habitat types are arranged left to right in order of increasing successional development.

[b] Not sampled in January 1974.

[c] Not included in the species total.

Table 35. Summary of reptiles and amphibians observed in May, July, and October 1973 in the environs of the Millstone Point site, Waterford, Connecticut.

Scientific Name	Common Name	May	July	October
Old Field (Site 1)				
Rana sylvatica	Wood frog	-	2	-
Mixed hardwood forest (Site 2)				
Rana sp.	Frog	1	-	-
Rana sylvatica	Wood frog	-	2	-
Riparian community (Site 3)				
Thamnophis sirtalis sirtalis	Eastern garter snake	-	-	1
Eurycea bislineata bislineata	Northern two-lined salamander	-	1	-
Rana clamitans melanota	Green frog	-	1	-
Brackish marsh (Site 4)				
Rana clamitans melanota	Green frog	-	13	-
Transmission line corridor (Site 5)				
Thamnophis sirtalis sirtalis	Eastern garter snake	-	-	1
Rana pipiens	Leopard frog	-	2	-
Mixed hardwood forest (Site 6)				
Bufo americanus	American toad	-	1	-
Rana sylvatica	Wood frog	-	4	-
Abandoned nursery (Site 7)				
Rana pipiens	Leopard frog	-	4	-
Rana clamitans melanota	Green frog	-	2	-

Tabl 3. Enumeration of terrestrial invertebrates c[illegible]cted from the old field (Site 1) and the riparian community (Site 3) in the vicinity of the Millstone Point site, Waterford, Connecticut (May and July 1973).

Scientific Name	Common Name	Site 1				Site 3			
		May		July		May		July	
		N[a]	%[b]	N	%	N	%	N	%
Arthropoda	Arthropods								
Arachnida	Arachnids								
Araneae	Spiders								
Tetragnathidae	four-jawed spiders	-[c]	-	1	0.8	-	-	-	-
Thomisidae	crab spiders	-	-	-	-	-	-	1	16.4
Unidentifiable Araneae		-	-	2	1.6	1	5.9	9	-
Acarina	Mites and ticks								
Unidentifiable immatures		-	-	-	-	2	11.7	-	-
Insecta	Insects								
Collembola	Springtails								
Sminthuridae		1	2.6	-	-	-	-	-	-
Orthoptera	Grasshoppers, crickets, etc.								
Acrididae	short-horned grasshoppers	-	-	1	0.8	-	-	-	-
Tettigoniidae	long-horned grasshoppers	-	-	1	0.8	-	-	-	-
Thysanoptera	Thrips								
Phlaethripidae		1	2.6	-	-	-	-	-	-
Thripidae	common thrips	6	15.4	4	3.2	-	-	-	-
Hemiptera	Bugs								
Lygaeidae	seed bugs	-	-	1	0.8	-	-	-	-
Miridae	plant or leaf bugs	10	25.6	56	44.4	-	-	-	-
Nabidae	damsel bugs	-	-	1	0.8	-	-	-	-
Pentatomidae	stink bugs, etc.	-	-	6	4.7	-	-	1	1.8
Unidentifiable immatures		-	-	-	-	-	-	3	5.4
Homoptera	Hoppers, aphids, etc.								
Aphididae	plantlice	-	-	3	2.4	-	-	-	-
Cercopidae	froghoppers	-	-	15	12.0	-	-	7	12.7
Cicadellidae	leafhoppers	2	5.1	6	4.7	-	-	1	1.8
Delphacidae	planthoppers	-	-	10	7.9	-	-	2	3.7
Unidentifiable immatures		-	-	-	-	-	-	2	3.7
Coleoptera	Beetles								
Alleculidae	comb-clawed beetles	-	-	-	-	-	-	1	1.8
Cantharidae	soldier beetles	5	12.8	-	-	-	-	-	-
Cerambycidae	long-horned beetles	-	-	-	-	-	-	1	1.8
Chrysomelidae	leaf beetles	-	-	-	-	-	-	1	1.8
Coccinellidae	ladybird beetles	-	-	1	0.8	-	-	-	-
Curculionidae	snout beetles	-	-	1	0.8	-	-	-	-
Scarabaeidae	scarab beetles	-	-	1	0.8	-	-	-	-
Lepidoptera	Butterflies and moths								
Liparidae	tussock moths, etc.	1	2.6	-	-	1	5.9	-	-
Unidentifiable Lepidoptera		-	-	4	3.2	-	-	2	3.7

Table 33. (continued)

Scientific Name	Common Name	Site 1				Site 3			
		May		July		May		July	
		N	%	N	%	N	%	N	%
Diptera	Flies								
Asilidae	robber flies	-	-	-	-	-	-	1	1.8
Calliphoridae	blow flies	-	-	1	0.8	-	-	1	1.8
Cecidomyiidae	gall midges	-	-	-	-	-	-	1	1.8
Chamaemyiidae	aphid flies	-	-	1	0.8	-	-	-	-
Chironomidae	midges	-	-	-	-	7	41.2	1	1.8
Culicidae	mosquitoes	-	-	-	-	-	-	1	1.8
Dolichopodidae	long-legged flies	-	-	2	1.6	-	-	5	9.1
Empididae	dance flies	9	23.0	-	-	2	11.7	-	-
Muscidae	muscids	-	-	-	-	-	-	1	1.8
Mycetophilidae	fungus gnats	-	-	-	-	-	-	2	3.7
Sciaridae	dark-winged fungus gnats	-	-	-	-	1	5.9	2	3.7
Syrphidae	flower flies	-	-	5	3.9	-	-	-	-
Tipulidae	crane flies	-	-	-	-	1	5.9	1	1.8
Unidentifiable Diptera		-	-	1	0.8	-	-	5	9.1
Hymenoptera	Wasps, ants, bees, etc.								
Formicidae	ants	-	-	1	0.8	1	5.9	-	-
Halictidae	halictid bees	1	2.6	1	0.8	-	-	-	-
Ichneumonidae	ichneumon wasps	-	-	-	-	-	-	3	5.4
Tenthredinidae	common sawflies	3	7.7	-	-	-	-	-	-
Unidentifiable Hymenoptera		-	-	-	-	1	5.9	-	-
Total Number of Organisms		39		126		17		55	
Total Number of Families		10		21		6		19	

[a] Number of organisms
[b] Percent composition
[c] Dash indicates not present

APPENDIX A

PHYLOGENETIC SPECIES LIST

PLANTS OF THE MILLSTONE POINT SITE

WATERFORD, CONNECTICUT

Flora of Millstone Point

LYCOPODIALES

Lycopodiaceae (Clubmoss Family)

Lycopodium obscurum L.
L. complanatum L.

EQUISETALES

Equisetaceae (Horsetail Family)

Equisetum arvense L.

FILICALES

Osmundaceae (Royal Fern Family)

Osmunda cinnamomea L.
O. regalis L.

Polypodiaceae (Polypody Family)

Dennstaedtia punctilobula (Michx.) Moore.
Pteridium aquilinum (L.) Kuhn.
Onoclea sensibilis L.
Athyrium felix-femina (L.) Roth.
Thelypteris noveboracensis (L.) Nieuwl.
Dryopteris austriaca var. spinulosa (Müll.) Fior. = D. spinulosa
Polystichum acrostichoides (Michx.) Schott.

CONIFERAE

Taxaceae (Yew Family)

Taxus cuspidata Sieb. & Zucc.

Cupressaceae (Cypress Family)

Thuja occidentalis L.
Juniperus communis L.
J. virginiana L.
J. chinensis var. pfitzeriana Mast.

PANDANALES

Typhaceae (Cattail Family)

Typha latifolia L.

Sparganiaceae (Burreed Family)

Sparganium L. sp.

GRAMINALES

Gramineae (Grass Family)

Festuca L. sp.
Poa compressa L.
P. pratensis L.
Distichlis spicata (L.) Greene.
Phragmites communis Trin.
Dactylis glomerata L.
Agropyron repens (L.) Beauv.
Elymus virginicus L.
Holcus lanatus L.
Danthonia Lam. &DC. sp.
Ammophila breviligulata Fern.
Agrostis stolonifera L. = A. alba
Phleum pratense L.
Spartina patens (Ait.) Muhl.
S. alterniflora Loisel.
Anthoxanthum odoratum L.
Digitaria Heist. sp.
Paspalum L. sp.
Panicum L. spp.
P. virgatum L
P. auburne Ashe.
P. boscii Poir.
Andropogon scoparius Michx.
A. virginicus L.

Cyperaceae (Sedge Family)

Cyperus L. sp.
C. strigosus L.
Eleocharis R. Br. sp.
Scirpus L. sp.

Carex L. spp.

ARALES

Araceae (Arum Family)

Arisaema triphyllum (L.) Schott.
Symplocarpus foetidus (L.) Nutt.

LILIALES

Juncaceae (Rush Family)

Juncus L. sp.
J. gerardi Loisel.
Luzula campestris (L.) DC.

Liliaceae (Lily Family)

Smilacina racemosa (L.) Desf.
Maianthemum canadense Desf.
Uvularia grandiflora Sm.
U. sessilifolia L.
Polygonatum canaliculatum (Muhl.) Pursh.
Medeola virginiana L.
Smilax glauca Walt.
S. rotundifolia L.

Iridaceae (Iris Family)

Sisyrinchium L. sp.

SALICALES

Salicaceae (Willow Family)

Populus grandidentata Michx.
Salix L. sp.

MYRICALES

Myricaceae (Bayberry Family)

Myrica asplenifolia L. = Comptonia peregrina
M. pensylvanica Loisel.

JUGLANDALES

Juglandaceae (Walnut Family)

Carya glabra (Mill.) Sweet.
C. tomentosa (Poir.) Nutt.

FAGALES

Betulaceae (Birch Family)

Ostrya virginiana (Mill.) K. Koch.
Carpinus caroliniana Walt.
Betula lutea Michx.
B. lenta L.
B. populifolia Marsh.
Alnus serrulata (Ait.) Willd.

Fagaceae (Beech Family)

Fagus grandifolia Ehrh.
Quercus alba L.
Q. palustris Muench.
Q. velutina Lam.
Q. borealis Michx. = *Q. rubra*
Q. coccinea Muench.

URTICALES

Urticaceae (Nettle Family)

Boehmeria cylindrica (L.) Sw.

POLYGONALES

Polygonaceae (Smartweed Family)

Rumex acetosella L.
R. crispus L.
Polygonum L. sp.
P. arifolium L.
P. persicaria L.
P. scandens L.

CARYOPHYLLALES

Chenopodiaceae (Goosefoot Family)

Chenopodium L. sp.
Atriplex L. sp.
A. glabriuscula Edmonston.
Salicornia bigelovii Torr.

Phytolaccaceae (Pokeweed Family)

Phytolacca americana L.

Caryophyllaceae (Pink Family)

Cerastium vulgatum L.
Arenaria lateriflora L.

RANALES

Ranunculaceae (Crowfoot Family)

Caltha palustris L.
Ranunculus L. spp.
R. bulbosus L.
Thalictrum L. sp.

Berberidaceae (Barberry Family)

Berberis vulgaris L.
B. thunbergi DC.

Lauraceae (Laurel Family)

Sassafras albidum (Nutt.) Nees.
Lindera benzoin (L.) Blume.

ROSALES

Crassulaceae (Orpine Family)

Sedum L. sp.

Saxifragaceae (Saxifrage Family)

Philadelphus coronarius L.

Hamamelidaceae (Witch Hazel Family)

Hamamelis virginiana L.

Rosaceae (Rose Family)

Spiraea tomentosa L.
Frageria virginiana Duchesne.
Potentilla canadensis L.
P. simplex Michx.
Geum L. sp.
Rubus L. sp.
R. allegheniensis Porter.
R. flagellaris L.
R. phoenicolasius Maxim.
Rosa L. spp.
Prunus virginiana L.
P. serotina Ehrh.
P. avium L.
P. cerasifera var. pissardii Koehne.
P. yedoensis Matsum.
P. yedoensis var. flore-plena Matsum.
Pyrus malus L. = Malus sp.
Malus floribunda Sieb.
Aronia arbutifolia (L.) Ell.
Sorbus americana Marsh.
Crataegus L. sp.
Amelanchier arborea (Michx. f.) Fern.
A. laevis Wieg.

Fabaceae (Bean Family)

Baptisia tinctoria (L.) R. Br.
Trifolium L. sp.
Lathyrus maritimus (L.) Bigel. = L. japonica
Apios americana Medic.

GERANIALES

Oxalidaceae (Wood Sorrel Family)

Oxalis stricta L.

Geraniaceae (Geranium Family)

Geranium maculatum L.

Euphorbiaceae (Spurge Family)

Euphorbia L. sp.

SAPINDALES

Anacardiaceae (Cashew Family)

Rhus radicans L.
R. copallinum L. = *R. copalina*
R. typhina L.

Aquifoliaceae (Holly Family)

Ilex opaca Ait.
I. verticillata (L.) Gray.

Celastraceae (Staff-tree Family)

Celastrus scandens L.

Aceraceae (Maple Family)

Acer rubrum L.
A. negundo L.
A. palmatum var. *atropurpureum* Van Houtte.

Balsaminaceae (Touch-me-not Family)

Impatiens biflora Walt. = *I. capensis* Meerb.

RHAMNALES

Vitaceae (Grape Family)

Vitis L. spp.
Parthenocissus quinquefolia (L.) Planch.

PHRIETALES

Hypericaceae (St. Johnswort Family)

Hypericum L. sp.
H. perforatum L.
H. punctatum Lam.

Violaceae (Violet Family)

Viola L. sp.
V. fimbriatula Sm.
V. lanceolata L.

MYRTALES

Onagraceae (Evening Primrose Family)

Epilobium L. sp.
Oenothera biennis L.

UMBELLALES

Araliaceae (Ginseng Family)

Aralia nudicaulis L.

Umbelliferae (Parsley Family)

Daucus carota L.
Cicuta maculata L.

Cornaceae (Dogwood Family)

Cornus florida L.
C. florida var. rubra West.
Nyssa sylvatica Marsh.

ERICALES

Clethraceae (White Alder Family)

Clethra alnifolia L.

Ericaceae (Heath Family)

Monotropa hypopithys L.
M. uniflora L.
Chimaphila maculata (L.) Pursh.
Rhododendron L. spp.
R. nudiflorum (L.) Torr.
Kalmia latifolia L.
Pieris japonica D. Don.

Lyonia ligustrina (L.) DC.
Gaylussacia baccata (Wang.) K. Koch.
Vaccinium L. spp.
V. corymbosum L.

PRIMULALES

Primulaceae (Primrose Family)

Lysimachia quadrifolia Sims.
Trientalis borealis Raf.

GENTIANALES

Oleaceae (Olive Family)

Fraxinus pennsylvanica Marsh.

Asclepiadaceae (Milkweed Family)

Asclepius tuberosa L.
A. incarnata L.
A. syriaca L.

POLEMONIALES

Convolvulaceae (Morning-glory Family)

Ipomoea L. sp.
Convolvulus arvensis L.

Verbenaceae (Vervain Family)

Verbena L. sp.

Labiatae (Mint Family)

Lycopus americanus Muhl.

Solanaceae (Nightshade Family)

Solanum dulcamara L.
Datura stramonium L.

Scrophulariaceae (Figwort Family)

Mimulus ringens L.
Scrophularia lanceolata Pursh.
Linaria vulgaris Hill.
Veronica L. sp.

PLANTAGINALES

Plantaginaceae (Plantain Family)

Plantago lanceolata L.
P. rugelii Decne.

RUBIALES

Rubiaceae (Madder Family)

Mitchella repens L.
Galium aparine L.
G. triflorum Michx.

Caprifoliaceae (Honeysuckle Family)

Viburnum dentatum L.
V. acerifolium L.
Sambucus canadensis L.
Lonicera japonica Thunb.

ASTERALES

Compositae (Composite Family)

Rudbeckia hirta L.
Ambrosia artemisiifolia L.
Achillea millefolium L.
Chrysanthemum leucanthemum L.
Artemisia campestris L. = *A. caudata*
Solidago L. spp.
S. sempervirens L.
S. flexicaulis L.
S. rugosa Mill.
S. graminifolia (L.) Salisb.
Aster L. spp.
Erigeron strigosus Muhl.

Pluchea purpurascens (Sw.) DC.
Eupatorium perfoliatum L.
Cirsium vulgare (Savi) Tenore.
C. arvense (L.) Scop.
Hieracium aurantiacum L.
Crepis capillaris (L.) Wallr.
Taraxacum officinale Weber.
Lactuca L. sp.

APPENDIX B

WILDLIFE DATA

MILLSTONE POINT SITE

WATERFORD, CONNECTICUT

Table 1. Summary of mammal trapping in the environs of the Millstone Point site, Waterford, Connecticut (May 1973).

Species	Common Name	Sex	Body Length (mm)	Tail Length (mm)	Weight (g)
Old field (Site 1)					
Peromyscus leucopus	White-footed mouse	F	82	74	21
Mixed hardwood forest (Site 2)					
Peromyscus leucopus	White-footed mouse	F	85	85	32
P. leucopus	White-footed mouse	F	89	77	25
P. leucopus	White-footed mouse	F	89	84	29
P. leucopus	White-footed mouse	F	79	73	22
P. leucopus	White-footed mouse	F	92	88	29
P. leucopus	White-footed mouse	F	93	87	30
P. leucopus	White-footed mouse	F	91	75	29
P. leucopus	White-footed mouse	F	89	77	31
P. leucopus	White-footed mouse	F	90	78	29
P. leucopus	White-footed mouse	F	--	67	--
P. leucopus	White-footed mouse	M	86	79	26
P. leucopus	White-footed mouse	M	94	82	29
P. leucopus	White-footed mouse	M	81	81	21
P. leucopus	White-footed mouse	M	91	77	29
P. leucopus	White-footed mouse	M	87	78	28
P. leucopus	White-footed mouse	M	86	--	27
P. leucopus	White-footed mouse	M	91	73	27
P. leucopus	White-footed mouse	M	92	82	28
Riparian (Site 3)					
Peromyscus leucopus	White-footed mouse	F	89	85	39

Table 1. Continued.

Species	Common Name	Sex	Body Length (mm)	Tail Length (mm)	Weight (g)
Peromyscus leucopus	White-footed mouse	F	79	76	23
P. leucopus	White-footed mouse	F	86	76	34
P. leucopus	White-footed mouse	F	83	74	24
P. leucopus	White-footed mouse	F	86	79	28
P. leucopus	White-footed mouse	F	91	74	28
P. leucopus	White-footed mouse	F	93	72	26
P. leucopus	White-footed mouse	F	98	74	26
P. leucopus	White-footed mouse	F	89	66	19
P. leucopus	White-footed mouse	M	77	76	25
P. leucopus	White-footed mouse	M	90	72	23
P. leucopus	White-footed mouse	M	94	80	29
P. leucopus	White-footed mouse	M	78	77	26
P. leucopus	White-footed mouse	M	88	78	25
P. leucopus	White-footed mouse	M	87	--	21
P. leucopus	White-footed mouse	M	86	70	28
P. leucopus	White-footed mouse	M	87	80	27
P. leucopus	White-footed mouse	M	90	69	20
P. leucopus	White-footed mouse	F	61	67	8
P. leucopus	White-footed mouse	M	62	63	9
P. leucopus	White-footed mouse	M	65	73	12
Brackish marsh (Site 4)					
Peromyscus leucopus	White-footed mouse	F	85	88	22
P. leucopus	White-footed mouse	F	91	77	24
P. leucopus	White-footed mouse	F	96	74	20

Table 1. Continued..

Species	Common Name	Sex	Body Length (mm)	Tail Length (mm)	Weight (g)
Peromyscus leucopus	White-footed mouse	M	81	69	21
P. leucopus	White-footed mouse	M	81	87	27
P. leucopus	White-footed mouse	M	93	79	24
P. leucopus	White-footed mouse	M	93	73	26
P. leucopus	White-footed mouse	F	56	56	9
P. leucopus	White-footed mouse	F	63	58	8
Transmission line corridor (Site 5)					
Peromyscus leucopus	White-footed mouse	F	88	79	25
P. leucopus	White-footed mouse	F	91	84	29
P. leucopus	White-footed mouse	M	92	74	28
P. leucopus	White-footed mouse	M	91	79	24
Pitymys pinetorum	Pine vole	M	76	22	17
Zapus hudsonius	Eastern jumping mouse	M	65	115	16
Mixed hardwood forest (Site 6)					
Peromyscus leucopus	White-footed mouse	F	82	73	20
P. leucopus	White-footed mouse	F	92	83	26
P. leucopus	White-footed mouse	F	85	67	18
P. leucopus	White-footed mouse	M	87	80	22
P. leucopus	White-footed mouse	M	91	83	24
P. leucopus	White-footed mouse	M	94	74	24
P. leucopus	White-footed mouse	M	86	80	20
P. leucopus	White-footed mouse	M	86	--	26
P. leucopus	White-footed mouse	M	89	71	25
P. leucopus	White-footed mouse	M	86	78	21

Table 1. Continued.

Species	Common Name	Sex	Body Length (mm)	Tail Length (mm)	Weight (g)
Beach and managed recreation area (Site 8)					
Peromyscus leucopus	White-footed mouse	F	90	87	30
P. leucopus	White-footed mouse	F	94	78	31
P. leucopus	White-footed mouse	M	88	76	25
P. leucopus	White-footed mouse	M	77	--	20
P. leucopus	White-footed mouse	M	91	74	27
Beach Community (Site 9)					
Peromyscus leucopus	White-footed mouse	F	94	98	25
P. leucopus	White-footed mouse	F	87	85	23
P. leucopus	White-footed mouse	F	88	--	24
P. leucopus	White-footed mouse	F	88	77	20
P. leucopus	White-footed mouse	M	86	84	27
P. leucopus	White-footed mouse	F	69	--	10
P. leucopus	White-footed mouse	M	64	57	7
Microtus pennsylvanicus	Meadow vole	F	91	44	62

Table 2. Summary of mammal trapping in the environs of the Millstone Point site, Waterford, Connecticut (July 1973).

Species	Common Name	Sex	Total Length (mm)	Tail Length (mm)	Hind Foot Length (mm)	Ear Length (mm)	Weight (gm)
Old field (Site 1)							
Blarina brevicauda	Shorttail shrew	M	129	27	15	5	24.4
Blarina brevicauda	Shorttail shrew	F	127	28	15	4	20.8
Microtus pennsylvanicus	Meadow vole	F	155	40	21	40	47.2
M. pennsylvanicus	Meadow vole	F	163	44	21	15	37.0
M. pennsylvanicus	Meadow vole	M	178	42	22	18	55.4
M. pennsylvanicus	Meadow vole	F	180	44	23	16	59.6
M. pennsylvanicus	Meadow vole	M	128	38	19	14	17.9
M. pennsylvanicus	Meadow vole	M	162	43	21	16	49.3
M. pennsylvanicus	Meadow vole	F	162	41	20	17	42.2
M. pennsylvanicus	Meadow vole	M	140	42	21	15	30.1
M. pennsylvanicus	Meadow vole	F	111	29	19	11	15.3
M. pennsylvanicus	Meadow vole	F	122	36	20	12	15.9
M. pennsylvanicus	Meadow vole	F	159	39	21	18	46.4
M. pennsylvanicus	Meadow vole	F	144	36	20	14	34.0
M. pennsylvanicus	Meadow vole	F	148	39	20	15	27.3
M. pennsylvanicus	Meadow vole	M	118	33	18	11	17.0
M. pennsylvanicus	Meadow vole	M	111	34	20	13	16.3
Zapus hudsonius	Meadow jumping mouse	F	206	134	31	12	9.8
Mixed hardwood forest (Site 2)							
Blarina brevicauda	Shorttail shrew	M	132	27	14	5	23.3
Peromyscus leucopus	White-footed mouse	F	189	88	21	18	30.7
P. leucopus	White-footed mouse	M	182	83	21	18	24.6
P. leucopus	White-footed mouse	F	172	79	21	19	24.9
P. leucopus	White-footed mouse	F	172	78	19	17	26.1
P. leucopus	White-footed mouse	F	181	92	21	20	27.8
P. leucopus	White-footed mouse	M	184	87	22	18	26.6
P. leucopus	White-footed mouse	M	190	90	20	18	27.8
P. leucopus	White-footed mouse	M	174	79	21	18	21.4
P. leucopus	White-footed mouse	M	178	84	20	19	25.2
P. leucopus	White-footed mouse	M	181	84	21	19	28.2
P. leucopus	White-footed mouse	M	159	72	19	17	16.7
P. leucopus	White-footed mouse	M	161	74	21	18	16.9
P. leucopus	White-footed mouse	M	140	66	19	17	11.3
P. leucopus	White-footed mouse	M	108	50	17	13	6.7
P. leucopus	White-footed mouse	F	121	57	20	15	8.2
P. leucopus	White-footed mouse	-	-	-	-	-	-
P. leucopus	White-footed mouse	M	180	84	21	18	27.6
P. leucopus	White-footed mouse	M	157	78	21	17	19.3
P. leucopus	White-footed mouse	F	188	91	19	19	28.6
P. leucopus	White-footed mouse	M	168	82	21	18	24.8
P. leucopus	White-footed mouse	F	-	-	19	18	22.7
P. leucopus	White-footed mouse	F	174	80	21	18	25.6
P. leucopus	White-footed mouse	F	130	63	19	18	10.4
P. leucopus	White-footed mouse	F	134	64	20	16	11.0
P. leucopus	White-footed mouse	M	174	86	21	18	21.9
P. leucopus	White-footed mouse	M	161	74	20	17	18.8
P. leucopus	White-footed mouse	M	179	83	21	19	25.0
P. leucopus	White-footed mouse	M	180	87	19	19	25.8
P. leucopus	White-footed mouse	M	161	75	21	17	20.1
P. leucopus	White-footed mouse	F	173	82	21	16	29.7
P. leucopus	White-footed mouse	M	154	73	20	16	13.6
P. leucopus	White-footed mouse	F	-	-	19	18	10.2

Table 2. Continued.

Species	Common Name	Sex	Total Length (mm)	Tail Length (mm)	Hind Foot Length (mm)	Ear Length (mm)	Weight (gm)
Microtus pennsylvanicus	Meadow vole	F	162	40	21	15	43.2
M. pennsylvanicus	Meadow vole	M	170	45	20	15	47.3
M. pennsylvanicus	Meadoe vole	F	175	49	20	16	49.0
M. pennsylvanicus	Meadow vole	F	114	35	18	13	15.6
M. pennsylvanicus	Meadow vole	M	112	34	20	11	16.2
M. pennsylvanicus	Meadow vole	M	134	37	19	14	20.0
M. pennsylvanicus	Meadow vole	F	120	31	18	13	17.0
Riparian (Site 3)							
Blarina brevicauda	Shorttail shrew	F	127	26	15	3	19.0
Tamias striatus	Eastern chipmunk	M	227	82	33	17	75.9
Peromyscus leucopus	White-footed mouse	M	182	92	20	19	22.2
P. leucopus	White-footed mouse	M	163	77	20	18	17.8
P. leucopus	White-footed mouse	F	157	74	20	18	15.7
P. leucopus	White-footed mouse	F	176	85	21	19	18.2
P. leucopus	White-footed mouse	M	178	80	20	19	25.7
P. leucopus	White-footed mouse	F	174	81	20	17	24.2
P. leucopus	White-footed mouse	F	149	69	19	17	15.3
P. leucopus	White-footed mouse	M	168	78	21	17	18.8
P. leucopus	White-footed mouse	F	169	80	20	16	19.1
P. leucopus	White-footed mouse	M	180	85	20	19	21.4
P. leucopus	White-footed mouse	M	150	67	20	18	18.5
P. leucopus	White-footed mouse	M	154	79	20	18	19.1
P. leucopus	White-footed mouse	F	137	67	20	18	16.6
P. leucopus	White-footed mouse	M	-	-	21	17	15.6
Brackish marsh (Site 4)							
Peromyscus leucopus	White-footed mouse	M	189	90	21	19	28.0
P. leucopus	White-footed mouse	F	168	79	20	19	19.4
P. leucopus	White-footed mouse	M	187	93	20	17	24.0
Microtus pennsylvanicus	Meadow vole	M	185	45	21	16	59.3
M. pennsylvanicus	Meadow vole	M	150	39	21	14	42.2
M. pennsylvanicus	Meadow vole	M	131	39	20	15	24.9
M. pennsylvanicus	Meadow vole	F	148	41	20	14	30.7
M. pennsylvanicus	Meadow vole	-	-	-	-	-	-
M. pennsylvanicus	Meadow vole	-	-	-	-	-	-
M. pennsylvanicus	Meadow vole	-	-	-	-	-	-
M. pennsylvanicus	Meadow vole	F	132	32	19	14	17.0
M. pennsylvanicus	Meadow vole	M	161	41	22	16	36.9
M. pennsylvanicus	Meadow vole	F	181	50	21	14	50.4
M. pennsylvanicus	Meadow vole	M	176	45	22	16	51.2
M. pennsylvanicus	Meadow vole	F	183	51	20	16	53.3
M. pennsylvanicus	Meadow vole	M	135	40	20	13	22.8
M. pennsylvanicus	Meadow vole	F	98	29	17	8	8.1
M. pennsylvanicus	Meadow vole	M	125	37	20	13	16.6
M. pennsylvanicus	Meadow vole	M	135	39	20	14	23.9
M. pennsylvanicus	Meadow vole	M	137	40	21	14	29.3
M. pennsylvanicus	Meadow vole	M	133	31	20	14	24.0
M. pennsylvanicus	Meadow vole	M	-	37	21	13	21.9
M. pennsylvanicus	Meadow vole	F	104	29	18	11	10.6
M. pennsylvanicus	Meadow vole	M	101	27	19	10	10.2
Transmission Corridor (Site 5)							
Sorex cinereus	Masked shrew	M	98	39	11	5	4.3
Soricidae	Shrew	F	94	37	11	6	3.4
Peromyscus leucopus	White-footed mouse	M	171	78	21	18	28.0
P. leucopus	White-footed mouse	M	179	80	21	18	24.8

Table 2. Continued.

Species	Common Name	Sex	Total Length (mm)	Tail Length (mm)	Hind Foot Length (mm)	Ear Length (mm)	Weight (gm)
P. leucopus	White-footed mouse	M	172	81	21	19	19.9
P. leucopus	White-footed mouse	M	172	86	21	19	20.0
P. leucopus	White-footed mouse	F	182	85	21	20	25.8
P. leucopus	White-footed mouse	M	178	79	22	19	28.4
P. leucopus	White-footed mouse	M	174	83	20	17	21.9
P. leucopus	White-footed mouse	M	175	80	21	19	27.7
P. leucopus	White-footed mouse	F	174	79	21	17	24.0
P. leucopus	White-footed mouse	F	161	74	20	17	21.7
P. leucopus	White-footed mouse	M	162	76	20	18	21.4
P. leucopus	White-footed mouse	M	163	75	21	16	22.7
P. leucopus	White-footed mouse	F	154	74	19	17	15.7
P. leucopus	White-footed mouse	M	162	82	20	17	16.4
P. leucopus	White-footed mouse	M	156	76	21	19	16.3
P. leucopus	White-footed mouse	M	132	60	19	16	11.0
P. leucopus	White-footed mouse	M	165	74	21	18	24.7
Microtus pennsylvanicus	Meadow vole	M	149	37	15	14	27.0
M. pennsylvanicus	Meadow vole	F	159	35	20	16	54.5
M. pennsylvanicus	Meadow vole	F	149	44	20	14	30.0
M. pennsylvanicus	Meadow vole	M	140	38	21	14	39.3
M. pennsylvanicus	Meadow vole	F	122	36	20	13	17.1
M. pennsylvanicus	Meadow vole	M	168	41	20	15	59.4
M. pennsylvanicus	Meadow vole	M	167	42	22	17	42.9
M. pennsylvanicus	Meadow vole	M	151	38	21	15	37.6
M. pennsylvanicus	Meadow vole	F	135	36	19	14	21.3
M. pennsylvanicus	Meadow vole	M	117	26	19	11	14.7
M. pennsylvanicus	Meadow vole	M	127	32	19	14	17.7
Zapus hudsonius	Meadow jumping mouse	F	189	110	26	11	12.0
Z. hudsonius	Meadow jumping mouse	M	204	115	30	14	17.1
Z. hudsonius	Meadow jumping mouse	F	225	136	31	13	18.3
Z. hudsonius	Meadow jumping mouse	M	213	132	30	12	12.4
Mixed hardwood forest (Site 6)							
Blarina brevicauda	Shorttail shrew	F	118	26	14	5	15.4
Tamias striatus	Eastern chipmunk	M	236	84	35	14	91.8
Peromyscus leucopus	White-footed mouse	M	179	85	21	17	23.4
P. leucopus	White-footed mouse	M	149	74	21	14	17.2
P. leucopus	White-footed mouse	F	-	-	20	18	25.5
P. leucopus	White-footed mouse	M	164	78	20	16	19.7
P. leucopus	White-footed mouse	M	164	78	21	18	18.3
P. leucopus	White-footed mouse	M	147	69	20	17	19.7
P. leucopus	White-footed mouse	M	157	72	21	17	17.6
P. leucopus	White-footed mouse	M	159	66	21	16	23.6
P. leucopus	White-footed mouse	M	170	85	21	17	17.0
P. leucopus	White-footed mouse	F	-	-	20	16	12.0
P. leucopus	White-footed mouse	M	142	72	21	18	11.2
Abandoned nursery (Site 7)							
Blarina brevicauda	Shorttail shrew	F	116	25	14	5	18.0
Microtus pennsylvanicus	Meadow vole	M	158	44	21	14	54.6
M. pennsylvanicus	Meadow vole	F	107	29	18	11	10.9
M. pennsylvanicus	Meadow vole	M	102	26	17	10	9.6
M. pennsylvanicus	Meadow vole	-	-	-	-	-	-
Zapus hudsonius	Meadow jumping mouse	F	195	124	30	13	10.1
Beach and managed recreation area (Site 8)							
Blarina brevicauda	Shorttail shrew	F	126	27	14	5	23.3
Peromyscus leucopus	White-footed mouse	M	178	85	21	18	24.4

Table 2. Continued.

Species	Common Name	Sex	Total Length (mm)	Tail Length (mm)	Hind Foot Length (mm)	Ear Length (mm)	Weight (gm)
P. leucopus	White-footed mouse	M	167	71	20	19	21.1
P. leucopus	White-footed mouse	M	175	77	21	17	24.6
Microtus pennsylvanicus	Meadow vole	M	181	52	22	17	55.8
M. pennsylvanicus	Meadow vole	F	160	45	20	15	51.0
M. pennsylvanicus	Meadow vole	F	145	37	20	13	35.9
M. pennsylvanicus	Meadow vole	F	165	43	21	12	54.3
M. pennsylvanicus	Meadow vole	M	126	36	19	10	22.2
M. pennsylvanicus	Meadow vole	F	167	48	20	14	48.4
M. pennsylvanicus	Meadow vole	M	154	39	21	13	49.7
M. pennsylvanicus	Meadow vole	M	178	50	21	10	46.9
M. pennsylvanicus	Meadow vole	F	170	45	21	14	42.7
Beach community (Site 9)							
Blarina brevicauda	Shorttail shrew	F	121	25	14	5	18.4
Peromyscus leucopus	White-footed mouse	M	180	81	20	18	24.3
P. leucopus	White-footed mouse	M	186	91	20	20	28.0
P. leucopus	White-footed mouse	M	162	76	19	17	20.5
P. leucopus	White-footed mouse	M	165	75	21	19	22.0
P. leucopus	White-footed mouse	F	178	80	20	19	21.1
P. leucopus	White-footed mouse	M	155	73	21	18	19.9
P. leucopus	White-footed mouse	F	146	70	20	17	13.4
Microtus pennsylvanicus	Meadow vole	M	155	36	21	15	46.7
M. pennsylvanicus	Meadow vole	M	152	45	21	14	29.7
M. pennsylvanicus	Meadow vole	F	159	40	20	16	47.4
M. pennsylvanicus	Meadow vole	M	174	40	22	16	55.8
M. pennsylvanicus	Meadow vole	M	174	50	22	15	58.7
M. pennsylvanicus	Meadow vole	M	162	44	22	15	56.1
M. pennsylvanicus	Meadow vole	M	165	46	21	15	37.9
M. pennsylvanicus	Meadow vole	F	178	43	22	16	62.4
M. pennsylvanicus	Meadow vole	M	163	42	21	16	48.2
M. pennsylvanicus	Meadow vole	F	165	44	21	16	48.9
M. pennsylvanicus	Meadow vole	M	170	46	21	16	46.9
M. pennsylvanicus	Meadow vole	M	156	42	21	15	37.4
M. pennsylvanicus	Meadow vole	M	161	43	20	16	33.4
M. pennsylvanicus	Meadow vole	M	149	40	20	15	33.4
M. pennsylvanicus	Meadow vole	M	179	41	20	16	56.5
M. pennsylvanicus	Meadow vole	F	185	46	21	16	60.6
M. pennsylvanicus	Meadow vole	M	184	48	21	16	55.5
M. pennsylvanicus	Meadow vole	M	156	43	21	15	28.3
M. pennsylvanicus	Meadow vole	F	157	43	21	14	30.4
M. pennsylvanicus	Meadow vole	-	-	-	-	-	-
M. pennsylvanicus	Meadow vole	-	-	-	-	-	-
M. pennsylvanicus	Meadow vole	-	-	-	-	-	-

Table 3. Summary of mammal trapping in the environs of the Millstone Point site, Waterford, Connecticut (October 1973).

Species	Common Name	Sex	Total Length (mm)	Tail Length (mm)	Hind Foot Length (mm)	Ear Length (mm)	Weight (gm)
Old field (Site 1)							
Blarina brevicauda	Shorttail shrew	M	129	24	14	5	20.3
B. brevicauda	Shorttail shrew	F	123	14	15	4	18.5
B. brevicauda	Shorttail shrew	F	131	27	15	5	21.3
B. brevicauda	Shorttail shrew	F	125	25	15	5	16.1
B. brevicauda	Shorttail shrew	F	114	25	15	4	19.9
B. brevicauda	Shorttail shrew	F	124	24	14	5	18.1
B. brevicauda	Shorttail shrew	F	128	26	15	5	21.5
B. brevicauda	Shorttail shrew	M	124	23	15	5	24.8
B. brevicauda	Shorttail shrew	F	120	20	15	5	18.0
B. brevicauda	Shorttail shrew	M	127	25	14	6	18.1
Microtus pennsylvanicus	Meadow vole	M	139	35	21	-	27.6
M. pennsylvanicus	Meadow vole	M	149	39	22	15	33.0
M. pennsylvanicus	Meadow vole	M	147	36	21	13	33.2
M. pennsylvanicus	Meadow vole	F	179	39	31	14	60.0
M. pennsylvanicus	Meadow vole	M	141	35	21	11	31.4
M. pennsylvanicus	Meadow vole	M	121	31	19	13	18.3
M. pennsylvanicus	Meadow vole	M	109	24	16	9	11.1
M. pennsylvanicus	Meadow vole	M	124	30	20	13	18.3
M. pennsylvanicus	Meadow vole	M	132	30	18	13	19.2
M. pennsylvanicus	Meadow vole	F	160	40	21	14	52.7
M. pennsylvanicus	Meadow vole	M	135	34	20	13	27.6
Mixed hardwood forest (Site 2)							
Blarina brevicauda	Shorttail shrew	M	120	22	15	5	17.8
Peromyscus leucopus	White-footed mouse	M	167	78	21	17	19.9
P. leucopus	White-footed mouse	M	174	78	21	17	25.0
P. leucopus	White-footed mouse	F	161	74	20	16	18.5
P. leucopus	White-footed mouse	F	174	83	20	19	21.7
P. leucopus	White-footed mouse	F	185	83	21	17	24.3
P. leucopus	White-footed mouse	-	140	39	21	18	26.9
P. leucopus	White-footed mouse	M	157	74	21	18	20.5
P. leucopus	White-footed mouse	F	139	63	19	16	10.9
P. leucopus	White-footed mouse	M	168	75	20	-	16.4
P. leucopus	White-footed mouse	M	172	76	21	17	21.7
P. leucopus	White-footed mouse	F	158	68	20	16	19.7
P. leucopus	White-footed mouse	F	188	88	20	17	23.9
P. leucopus	White-footed mouse	M	167	75	20	16	22.8
P. leucopus	White-footed mouse	M	145	58	19	14	16.5
P. leucopus	White-footed mouse	F	142	60	18	15	14.3
P. leucopus	White-footed mouse	M	140	57	19	16	12.8
P. leucopus	White-footed mouse	M	166	82	21	16	19.1
P. leucopus	White-footed mouse	F	173	81	21	16	19.8
P. leucopus	White-footed mouse	M	172	78	19	17	21.6
P. leucopus	White-footed mouse	F	152	66	19	15	18.2
P. leucopus	White-footed mouse	M	150	65	21	15	18.2
P. leucopus	White-footed mouse	M	150	61	19	15	17.8
P. leucopus	White-footed mouse	F	165	70	21	17	18.8
P. leucopus	White-footed mouse	M	143	64	19	15	16.3
P. leucopus	White-footed mouse	M	96	5	21	16	20.2
P. leucopus	White-footed mouse	-	-	-	-	-	-
Riparian (Site 3)							
Blarina brevicauda	Shorttail shrew	F	123	23	14	15	18.0
B. brevicauda	Shorttail shrew	F	116	22	14	5	19.0
Peromyscus leucopus	White-footed mouse	F	183	82	20	18	26.9
P. leucopus	White-footed mouse	M	182	79	21	16	22.7
P. leucopus	White-footed mouse	M	164	73	21	17	17.6

Table 3. Continued.

Species	Common Name	Sex	Total Length (mm)	Tail Length (mm)	Hind Foot Length (mm)	Ear Length (mm)	Weight (gm)
Riparian (Site 3) Continued							
Peromyscus leucopus	White-footed mouse	F	167	78	20	17	17.4
P. leucopus	White-footed mouse	F	176	84	20	16	19.9
P. leucopus	White-footed mouse	F	178	75	21	19	22.5
P. leucopus	White-footed mouse	F	171	76	20	18	20.8
P. leucopus	White-footed mouse	F	155	67	20	17	17.2
P. leucopus	White-footed mouse	F	163	72	20	16	17.4
P. leucopus	White-footed mouse	F	156	70	21	16	14.2
P. leucopus	White-footed mouse	M	168	76	20	17	20.7
P. leucopus	White-footed mouse	M	183	89	20	17	20.8
P. leucopus	White-footed mouse	F	159	74	20	17	18.0
P. leucopus	White-footed mouse	F	157	72	22	15	19.4
P. leucopus	White-footed mouse	F	124	28	21	16	24.4
Brackish marsh (Site 4)							
Peromyscus leucopus	White-footed mouse	M	159	74	20	19	14.2
P. leucopus	White-footed mouse	M	-	74	20	-	-
P. leucopus	White-footed mouse	F	183	88	20	18	22.1
P. leucopus	White-footed mouse	M	147	66	20	17	12.9
P. leucopus	White-footed mouse	M	149	65	20	17	15.4
P. leucopus	White-footed mouse	M	146	66	21	16	17.0
P. leucopus	White-footed mouse	M	160	77	20	16	17.3
P. leucopus	White-footed mouse	M	164	77	20	16	15.4
Microtus pennsylvanicus	Meadow vole	M	172	44	22	14	48.0
M. pennsylvanicus	Meadow vole	M	147	38	21	15	34.0
Rattus norvegicus	Norway rat	M	282	122	36	21	95.2
R. norvegicus	Norway rat	M	285	125	37	21	101.6
R. norvegicus	Norway rat	M	271	120	34	19	95.9
Transmission corridor (Site 5)							
Peromyscus leucopus	White-footed mouse	F	169	77	21	17	18.7
P. leucopus	White-footed mouse	M	169	76	20	16	22.5
P. leucopus	White-footed mouse	F	184	87	21	18	20.3
P. leucopus	White-footed mouse	M	168	69	21	17	18.0
P. leucopus	White-footed mouse	F	167	79	19	17	76.1
P. leucopus	White-footed mouse	F	129	57	19	15	10.4
P. leucopus	White-footed mouse	M	158	73	20	17	14.3
P. leucopus	White-footed mouse	M	155	70	19	18	16.1
P. leucopus	White-footed mouse	M	174	75	21	17	21.7
P. leucopus	White-footed mouse	M	174	82	21	18	16.9
P. leucopus	White-footed mouse	F	150	64	21	14	16.7
Microtus pennsylvanicus	Meadow vole	M	154	39	22	14	40.2
M. pennsylvanicus	Meadow vole	M	157	37	22	14	37.2
M. pennsylvanicus	Meadow vole	M	145	36	21	13	31.1
M. pennsylvanicus	Meadow vole	F	147	37	20	13	29.0
M. pennsylvanicus	Meadow vole	M	163	47	21	14	42.0
M. pennsylvanicus	Meadow vole	M	136	34	19	13	26.4
M. pennsylvanicus	Meadow vole	M	146	38	20	14	31.4
M. pennsylvanicus	Meadow vole	M	150	35	22	-	-
M. pennsylvanicus	Meadow vole	M	146	36	20	14	35.6
M. pennsylvanicus	Meadow vole	M	149	47	22	14	46.7
M. pennsylvanicus	Meadow vole	M	160	44	21	13	44.0
M. pennsylvanicus	Meadow vole	M	155	41	22	3	34.4
Mixed hardwood forest (Site 6)							
Blarina brevicauda	Shorttail shrew	F	115	21	16	4	15.1
Peromyscus leucopus	White-footed mouse	F	180	81	20	17	21.7
P. leucopus	White-footed mouse	M	98	4	20	17	21.5

Table 3. Continued.

Species	Common Name	Sex	Total Length (mm)	Tail Length (mm)	Hind Foot Length (mm)	Ear Length (mm)	Weight (gm)
Mixed hardwood forest (Site 6) Continued							
Peromyscus leucopus	White-footed mouse	F	161	67	19	14	19.6
P. leucopus	White-footed mouse	F	182	79	19	18	28.5
P. leucopus	White-footed mouse	F	159	65	20	15	18.6
P. leucopus	White-footed mouse	M	173	74	20	16	19.8
P. leucopus	White-footed mouse	M	165	79	21	17	18.0
P. leucopus	White-footed mouse	F	140	61	20	15	14.6
P. leucopus	White-footed mouse	F	175	81	19	17	18.5
P. leucopus	White-footed mouse	M	165	72	21	17	17.1
P. leucopus	White-footed mouse	M	181	84	20	17	20.0
P. leucopus	White-footed mouse	M	160	72	21	16	21.7
P. leucopus	White-footed mouse	F	93	2	21	16	18.6
P. leucopus	White-footed mouse	M	168	76	20	15	24.3
P. leucopus	White-footed mouse	M	157	72	21	15	19.6
P. leucopus	White-footed mouse	M	160	70	20	15	17.6
Abandoned nursery (Site 7)							
Peromyscus leucopus	White-footed mouse	M	161	71	20	17	14.0
P. leucopus	White-footed mouse	M	157	74	20	19	16.6
P. leucopus	White-footed mouse	M	177	84	22	17	19.1
P. leucopus	White-footed mouse	M	157	72	20	17	17.1
P. leucopus	White-footed mouse	F	159	73	21	17	18.9
P. leucopus	White-footed mouse	F	162	72	20	17	16.4
P. leucopus	White-footed mouse	F	154	63	21	17	18.0
P. leucopus	White-footed mouse	F	155	73	20	17	17.0
P. leucopus	White-footed mouse	M	155	70	20	16	16.2
P. leucopus	White-footed mouse	F	169	72	21	18	20.6
P. leucopus	White-footed mouse	M	155	73	20	17	14.0
P. leucopus	White-footed mouse	F	176	81	20	17	22.7
P. leucopus	White-footed mouse	F	165	74	21	18	16.0
P. leucopus	White-footed mouse	F	146	65	20	17	12.0
P. leucopus	White-footed mouse	M	156	69	20	17	17.8
P. leucopus	White-footed mouse	M	177	84	20	18	19.4
P. leucopus	White-footed mouse	M	157	72	21	16	19.5
P. leucopus	White-footed mouse	F	145	65	20	13	16.2
P. leucopus	White-footed mouse	F	147	67	20	13	14.8
P. leucopus	White-footed mouse	M	130	55	18	14	10.8
Microtus pennsylvanicus	Meadow vole	M	164	45	22	15	42.2
M. pennsylvanicus	Meadow vole	M	140	38	21	13	32.2
M. pennsylvanicus	Meadow vole	M	152	43	22	13	35.6
M. pennsylvanicus	Meadow vole	M	167	40	22	14	44.2
Beach and managed recreation area (Site 8)							
Blarina brevicauda	Shorttail shrew	M	134	22	15	5	20.2
B. brevicauda	Shorttail shrew	M	112	16	8	4	19.5
B. brevicauda	Shorttail shrew	F	107	18	8	5	18.3
Peromyscus leucopus	White-footed mouse	M	159	74	21	17	14.8
P. leucopus	White-footed mouse	M	162	73	20	18	19.8
P. leucopus	White-footed mouse	M	167	78	20	17	18.6
P. leucopus	White-footed mouse	F	-	89	22	19	-
Microtus pennsylvanicus	Meadow vole	M	169	40	21	14	49.3
M. pennsylvanicus	Meadow vole	F	175	45	22	16	61.5
M. pennsylvanicus	Meadow vole	M	165	40	19	15	41.8
M. pennsylvanicus	Meadow vole	M	134	33	21	13	31.6
Beach community (Site 9)							
Blarina brevicauda	Shorttail shrew	F	125	24	14	4	18.1
B. brevicauda	Shorttail shrew	F	120	23	15	4	18.4
Peromyscus leucopus	White-footed mouse	M	117	25	20	16	24.1
P. leucopus	White-footed mouse	F	171	74	19	18	21.1

Table 3. Continued.

Species	Common Name	Sex	Total Length (mm)	Tail Length (mm)	Hind Foot Length (mm)	Ear Length (mm)	Weight (gm)
Beach community (Site 9) Continued							
Peromyscus leucopus	White-footed mouse	M	170	78	19	15	20.9
P. leucopus	White-footed mouse	M	157	74	19	15	17.9
P. leucopus	White-footed mouse	M	159	70	19	15	16.1
P. leucopus	White-footed mouse	F	177	80	20	17	25.6
P. leucopus	White-footed mouse	M	158	77	20	15	17.4
P. leucopus	White-footed mouse						
P. leucopus	White-footed mouse	-	-	-	-	-	-
P. leucopus	White-footed mouse	F	150	64	19	17	15.7
P. leucopus	White-footed mouse	F	152	66	21	18	15.6
P. leucopus	White-footed mouse	M	165	73	20	17	17.9
P. leucopus	White-footed mouse	F	150	68	19	15	16.4
P. leucopus	White-footed mouse	M	156	68	21	15	17.1
P. leucopus	White-footed mouse	F	140	58	19	13	15.0
P. leucopus	White-footed mouse	M	156	76	20	15	13.1
Microtus pennsylvanicus	Meadow vole	M	172	43	19	13	58.1
M. pennsylvanicus	Meadow vole	M	153	42	21	14	36.9
M. pennsylvanicus	Meadow vole	M	167	44	20	14	47.1
M. pennsylvanicus	Meadow vole	M	147	38	18	12	52.7
M. pennsylvanicus	Meadow vole	M	151	36	20	13	38.7
M. pennsylvanicus	Meadow vole	M	174	45	21	13	45.8
M. pennsylvanicus	Meadow vole	M	146	39	20	13	31.9
M. pennsylvanicus	Meadow vole	M	154	40	21	14	37.4
M. pennsylvanicus	Meadow vole	M	143	37	20	14	29.0
M. pennsylvanicus	Meadow vole	M	155	37	21	13	39.2
M. pennsylvanicus	Meadow vole	M	142	38	20	13	38.6
M. pennsylvanicus	Meadow vole	M	164	41	22	15	53.3

Table 4. Seasonal comparisons of morphological parameters of adult Peromyscus leucopus in the vicinity of the Millstone Point site, 1973.

Parameter	Mean			Range			Standard Deviation			Sample Size		
	May	July	October	May	July	October	May	July	October	May	July	October
Total length (mm)	166.7	172.4	169.8	150-92	147-190	150-188	8.0	10.0	9.0	62	59	56
Tail length (mm)	77.9	80.5	76.8	66-98	66-93	64-89	6.0	5.9	6.1	63	59	57
Hindfoot length (mm)	-[a]	20.5	20.3	-	19-22	19-22	-	0.7	0.7	-	61	63
Ear length (mm)	-	18.0	16.7	-	16-20	14-19	-	1.0	1.2	-	61	63
Weight (gm)	25.7	23.5	20.6	19-39	17.0-30.7	16.0-28.5	3.8	3.4	2.8	67	61	63

[a] Parameter not measured.

Table 5. Seasonal comparisons of morphological parameters of immature Peromyscus leucopus in the vicinity of the Millstone Point site, 1973.

Parameter	Mean			Range			Standard Deviation			Sample Size		
	May	July	October	May	July	October	May	July	October	May	July	October
Total length (mm)	122.5	147.0	152.8	102-138	108-176	129-174	11.8	16.0	9.3	6	21	48
Tail length (mm)	62.3	70.1	68.7	56-73	50-85	55-82	6.7	8.1	6.4	6	21	49
Hindfoot length (mm)	-[a]	19.9	19.9	-	17-21	18-21	-	1.0	0.8	-	24	49
Ear Length (mm)	-	16.9	16.1	-	13-19	13-19	-	1.4	1.4	-	24	49
Weight (gm)	9.0	14.0	16.0	7-12	6.7-18.2	10.4-20.7	1.6	3.3	2.4	7	24	48

[a] Parameter not measured.

Table 6. Seasonal comparisons of morphological parameters of adult Microtus pennsylvanicus in the vicinity of the Millstone Point site, 1973.

Parameter	Mean			Range			Standard Deviation			Sample Size		
	May	July	October	May	July	October	May	July	October	May	July	October
Total length (mm)	135.0	161.7	155.1	135-135	131-185	132-179	0.0	13.8	11.6	1	57	38
Tail length (mm)	44.0	42.4	39.7	44-44	31-52	30-47	0.0	4.3	3.8	1	58	38
Hindfoot length (mm)	-[a]	20.7	20.8	-	15-23	18-22	-	1.1	1.1	-	58	39
Ear length (mm)	-	15.1	13.7	-	10-18	12-16	-	1.4	0.8	-	58	38
Weight (gm)	62.0	44.2	40.2	62.0-62.0	21.9-62.4	19.2-61.5	0.0	11.1	9.6	1	58	38

[a] Parameter not measured.

Table 7. Seasonal comparisons of morphological parameters of immature Microtus pennsylvanicus in the vicinity of the Millstone Point site, 1973.

Parameter	Mean		Range		Standard Deviation		Sample Size	
	July	October	July	October	July	October	July	October
Total length (mm)	120.7	128.3	98-156	109-141	14.0	12.5	24	6
Tail length (mm)	33.6	31.5	26-43	24-35	4.8	4.2	24	6
Hindfoot length (mm)	19.0	19.3	17-21	16-21	1.1	1.9	24	6
Ear length (mm)	12.9	11.8	8-19	9-13	2.4	1.8	24	6
Weight (gm)	17.0	22.2	8.1-30.1	11.1-31.4	5.4	7.6	24	6

Table 8. Seasonal comparisons of morphological parameters of Blarina brevicauda in the vicinity of the Millstone Point site, 1973.

Parameter	Mean		Range		Standard Deviation		Sample Size	
	July	October	July	October	July	October	July	October
Total length (mm)	124.5	121.9	116-132	107-134	5.6	6.9	8	19
Tail length (mm)	26.4	22.3	25-28	14-27	1.1	3.4	8	19
Hindfoot length (mm)	14.4	13.9	14-15	8-15	0.5	2.1	8	19
Ear length (mm)	4.6	4.7	3-5	4-6	0.7	0.6	8	19
Weight (gm)	20.3	19.0	15.4-24.4	15.1-24.8	3.2	2.1	8	19

Table 9. Seasonal comparisons of the morphological parameters of Zapus hudsonius in the vicinity of the Millstone Point Site, 1973.

Parameter	Mean		Range		Standard Deviation		Sample Size	
	May	July	May	July	May	July	May	July
Total length (mm)	180.0	205.3	180-180	189-225	0.0	12.8	1	6
Tail length (mm)	115.0	125.2	115-115	110-136	0.0	10.7	1	6
Hindfoot length (mm)	-[a]	29.7	-	26-31	-	1.9	1	6
Ear length (mm)	-	12.5	-	11-14	-	1.0	1	6
Weight (gm)	16.0	13.3	16.0-16.0	9.8-18.3	0.0	3.6	1	6

[a] Parameter not measured.

Table 10. Comparisons of morphological parameters of Rattus norvegicus in the vicinity of the Millstone Point site, October 1973.

Parameter	Mean	Range	Standard Deviation	Sample Size
Total length (mm)	279.3	271-285	7.4	3
Tail length (mm)	122.3	120-125	2.5	3
Hindfoot length (mm)	35.7	34-37	1.5	3
Ear length (mm)	20.3	19-21	1.2	3
Weight (gm)	97.6	95.2-101.6	3.5	3

Table 11. Comparisons of morphological parameters of Sorex cinereus in the vicinity of the Millstone Point-site, July 1973.

Parameter	Mean	Range	Standard Deviation	Sample Size
Total length (mm)	96.0	94-98	2.8	2
Tail length (mm)	38.0	37-39	1.4	2
Hindfoot length (mm)	11.0	11-11	0.0	2
Ear length (mm)	5.5	5-6	0.7	2
Weight (gm)	3.9	3.4-4.3	0.6	2

Table 12. Comparisons of morphological parameters of Tamias striatus in the vicinity of the Millstone site, July 1973.

Parameter	Mean	Range	Standard Deviation	Sample Size
Total length (mm)	231.5	227-236	6.4	2
Tail length (mm)	83.0	82-84	1.4	2
Hindfoot length (mm)	34.0	33-35	1.4	2
Ear length (mm)	15.5	14-17	2.1	2
Weight (gm)	83.9	75.9-91.8	11.2	2

Table 13. Comparisons of morphological parameters of Pitymys pinetorum in the vicinity of the Millstone Point site, May 1973.

Parameter	Mean	Range	Standard Deviation	Sample Size
Total length (mm)	98	98-98	0.0	1
Tail length (mm)	22	22-22	0.0	1
Hindfoot length (mm)	-[a]	-	-	-
Ear length (mm)	-	-	-	-
Weight (gm)	17.0	17.0-17.0	0.0	1

[a] Parameter not measured.

Table 14. Summary of May, July, October 1973, and January 1974 transect counts of birds in an old field (Site 1) in the vicinity of the Millstone Point site, Waterford, Connecticut.

Scientific Name	Common Name	Number of Birds Observed														
		May				July				October				January		
		15th	16th	17th	%[a]	16th	18th	19th	%	23rd	24th	25th	%	10th	11th	%
Branta canadensis	Canada goose	-	-	-	-	-	-	-	-	-	65	-	48.5	-	-	-
Pandion haliaetus	Osprey	-	1	-	.7	-	-	-	-	-	-	-	-	-	-	-
Phasianus colchicus	Ring-necked pheasant	-	-	-	-	-	-	1	0.9	-	-	-	-	-	-	-
Colinus virginianus	Bobwhite	2	-	-	1.4	1	-	3	3.6	-	-	-	-	-	2	3.1
Butorides virescens	Green heron	1	-	1	1.4	-	-	-	-	-	-	-	-	-	-	-
Charadrius vociferus	Killdeer	-	-	1	0.7	-	-	1	0.9	-	-	-	-	-	-	-
Larus argentatus	Herring gull	1	-	3	2.8	-	-	3	2.7	-	2	-	1.5	-	6	9.4
Columba livia	Rock dove	-	10	13	16.3	-	-	3	2.7	-	4	-	3.0	-	-	-
Zenaida macroura	Mourning dove	2	-	-	1.4	-	-	1	0.9	-	1	1	1.5	-	-	-
Chaetura pelagica	Chimney swift	-	-	-	-	1	2	-	2.7	-	-	-	-	-	-	-
Colaptes aurates	Common flicker	-	-	-	-	-	-	1	0.9	-	1	-	0.7	-	-	-
Dendrocopos villosus	Hairy woodpecker	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1.6
Dendrocopos pubescens	Downy woodpecker	-	-	-	-	-	-	-	-	-	1	-	0.7	-	-	-
Tyrannus tyrannus	Eastern kingbird	-	-	-	-	-	-	2	1.8	-	-	-	-	-	-	-
Hirundo rustica	Barn swallow	5	2	-	4.9	3	6	2	10.0	-	-	-	-	-	-	-
Petrochelidon pyrrhonota	Cliff swallow	-	-	-	-	4	-	-	3.6	-	-	-	-	-	-	-
Iridoprocne bicolor	Tree swallow	-	-	-	-	-	2	-	1.8	-	-	-	-	-	-	-
Riparia riparia	Bank swallow	-	-	-	-	-	3	-	2.7	-	-	-	-	-	-	-
Stelgidopteryx ruficollis	Rough-winged swallow	-	-	-	-	4	2	2	7.2	-	-	-	-	-	-	-
Cyanocitta cristata	Bluejay	3	1	1	3.5	-	-	2	1.8	3	3	3	6.7	1	2	4.7
Corvus brachyrhynchos	Common crow	-	-	-	-	-	-	2	1.8	-	1	-	0.7	-	1	1.6
Parus atricapillus	Black-capped chickadee	-	-	2	1.4	-	-	-	-	-	1	-	0.7	-	4	6.3
Mimus polyglottos	Mockingbird	2	2	1	3.5	-	-	1	0.9	-	-	-	-	-	-	-
Dumetella carolinensis	Gray catbird	1	-	-	0.7	1	-	-	0.9	-	-	-	-	-	-	-
Toxostoma rufum	Brown thrasher	-	-	1	0.7	-	-	-	-	-	-	-	-	-	-	-
Turdus migratorius	American robin	1	-	-	0.7	-	-	4	3.6	1	7	3	7.5	-	1	1.6
Sturnus vulgaris	Starling	-	-	1	0.7	1	3	5	8.1	3	5	11	14.2	-	11	17.2
Dendroica petechia	Yellow warbler	-	1	-	0.7	-	-	-	-	-	-	-	-	-	-	-
Geothlypis trichas	Common yellowthroat	1	1	1	2.1	-	1	1	1.8	-	-	-	-	-	-	-
Passer domesticus	House sparrow	1	5	2	5.6	-	-	1	0.9	-	-	-	-	-	2	3.1
Dolichonyx oryzivorus	Bobolink	3	2	1	4.2	-	-	-	-	-	-	-	-	-	-	-
Sturnella magna	Eastern meadowlark	1	1	-	1.4	-	2	4	5.4	-	-	1	0.7	2	2	6.3
Agelaius phoeniceus	Red-winged blackbird	12	8	8	19.8	-	4	8	10.9	-	-	-	-	-	20	31.3
Quiscalus quiscula	Common grackle	10	11	3	17.0	3	-	3	5.4	-	-	-	-	-	-	-
Molothrus ater	Brown-headed cowbird	-	4	-	2.8	-	-	-	-	-	-	-	-	-	-	-
Icterus galbula	Northern oriole	-	1	-	0.7	-	-	-	-	-	-	-	-	-	-	-
Cardinalis cardinalis	Cardinal	-	-	2	1.4	-	-	1	0.9	-	-	-	-	-	-	-
Spinus tristis	American goldfinch	3	-	-	2.1	4	4	6	12.7	-	15	3	13.4	-	-	-
Pipilo erythrophthalmus	Rufous-sided towhee	-	-	-	-	-	-	1	0.9	-	-	-	-	-	-	-
Junco hyemalis	Dark-eyed junco	-	-	-	-	-	-	-	-	-	-	-	-	2	-	3.1
Spizella pusilla	Field sparrow	2	-	-	1.4	-	-	1	0.9	-	-	-	-	1	6	10.9

[a] Percentage occurrence of individuals of each species during a three or two day sampling period.

Table 15. Summary of May, July, October 1973, and January 1974 transect counts of birds in an upland hardwood forest (Site 2) in the vicinity of the Millstone Point site, Waterford, Connecticut.

Scientific Name	Common Name	Number of Birds Observed														
		May				July				October				January		
		15th	16th	17th	%	17th	18th	19th	%	23rd	24th	25th	%	10th	11th	%
Buteo jamaicensis	Red-tailed hawk	-	-	-	-	-	-	-	-	-	-	-	-	1	-	9.1
Colinus virginianus	Bobwhite	-	1	1	2.3	1	1	1	5.8	1	-	-	2.1	-	-	-
Ardea herodias	Great blue heron	-	-	-	-	-	-	-	-	-	-	-	-	1	-	9.1
Charadrius vociferus	Killdeer	-	-	-	-	-	-	1	1.9	-	-	-	-	-	-	-
Larus argentatus	Herring gull	-	-	-	-	-	-	-	-	-	-	1	2.1	-	-	-
Colaptes auratus	Common flicker	-	1	-	1.1	-	-	-	1.9	-	2	1	6.3	-	-	-
Dendrocopos sp.	Woodpecker (species?)	-	-	-	-	-	1	-	1.9	-	-	1	2.1	-	-	-
Dendrocopos villosus	Hairy woodpecker	-	-	-	-	2	-	-	3.9	-	-	-	-	-	-	-
Dendrocopos pubescens	Downy woodpecker	1	-	1	2.3	-	-	-	-	-	-	-	-	-	-	-
Hirundo rustica	Barn swallow	-	-	-	-	1	-	-	1.9	-	-	-	-	-	-	-
Cyanocitta cristata	Bluejay	-	3	-	3.4	-	2	-	3.9	4	3	1	16.7	1	1	18.2
Corvus brachyrhynchos	Common crow	-	3	-	3.4	-	-	1	1.9	2	4	1	14.6	1	1	18.2
Parus atricapillus	Black-capped chickadee	-	2	-	2.3	2	6	4	23.5	2	2	-	8.3	-	5	45.3
Sitta sp.	Nuthatch (species?)	-	-	-	-	-	-	1	1.9	-	-	-	-	-	-	-
Troglodytes aedon	House wren	1	1	1	3.4	2	1	1	7.8	-	-	-	-	-	-	-
Dumetella carolinensis	Gray catbird	3	2	2	8.1	-	-	-	-	-	-	-	-	-	-	-
Toxostoma rufum	Brown thrasher	-	-	-	-	-	1	-	1.9	-	-	-	-	-	-	-
Turdus migratorius	American robin	-	-	1	1.1	-	-	2	3.9	1	-	-	2.1	-	-	-
Hylocichla mustelina	Wood thrush	-	-	-	-	-	-	1	1.9	-	-	-	-	-	-	-
Sialia sialis	Eastern bluebird	-	1	1	2.3	-	-	-	-	-	-	-	-	-	-	-
Sturnus vulgaris	Starling	-	-	1	1.1	1	-	2	5.8	-	-	-	-	-	-	-
Vireo sp.	Vireo (species?)	-	4	-	4.6	-	-	-	-	-	-	-	-	-	-	-
Parulidae	Wood warbler (species?)	-	7	5	13.9	-	-	-	-	13	-	-	27.1	-	-	-
Vermivora pinus	Blue-winged warbler	1	3	2	6.9	-	-	-	-	-	-	-	-	-	-	-
Dendroica petechia	Yellow warbler	1	-	-	1.1	-	-	-	-	-	-	-	-	-	-	-
Dendroica fusca	Blackburnian warbler	-	-	-	-	-	-	-	-	2	-	-	4.2	-	-	-
Dendroica discolor	Prairie warbler	-	-	1	1.1	-	-	-	-	-	-	-	-	-	-	-
Geothlypis trichas	Common yellowthroat	-	3	7	11.6	-	1	-	1.9	-	-	-	-	-	-	-
Agelaius phoeniceus	Red-winged blackbird	6	3	2	12.8	-	2	-	3.9	-	-	-	-	-	-	-
Quiscalus quiscula	Common grackle	-	-	2	2.3	-	-	-	-	-	-	-	-	-	-	-
Piranga olivacea	Scarlet tanager	-	1	-	1.1	-	-	-	-	-	-	-	-	-	-	-
Spinus tristis	American goldfinch	-	-	-	-	2	2	1	9.8	-	-	-	-	-	-	-
Pipilo erythrophthalmus	Rufous-sided towhee	1	1	2	4.6	1	3	2	11.7	-	-	-	-	-	-	-
Spizella pusilla	Field sparrow	-	1	-	1.1	-	-	1	1.9	-	-	-	-	-	-	-
Zonotrichia albicollis	White-throated sparrow	-	-	-	-	-	-	-	-	5	-	-	10.4	-	-	-
Melospiza lincolnii	Lincoln's sparrow	-	-	-	-	-	-	-	-	2	-	-	4.2	-	-	-
Melospiza melodia	Song sparrow	-	6	-	6.9	-	-	-	-	-	-	-	-	-	-	-

Table 16. Summary of May, July, and October 1973 transect counts of birds in a brackish marsh (Site 4) in the vicinity of the Millstone Point site, Waterford, Connecticut.

Scientific Name	Common Name	Number of Birds Observed											
		May				July				October			
		15th	16th	17th	%	17th	18th	19th	%	23rd	24th	25th	%
Branta canadensis	Canada goose	-	-	-	-	-	-	-	-	-	15	-	12.6
Anas platyrhynchos	Mallard	2	-	-	1.9	-	-	1	0.6	2	4	6	10.1
Anas rubripes	Black duck	-	-	3	2.9	12	28	4	28.0	1	7	-	6.7
Mergus merganser	Common merganser	1	-	-	0.9	-	-	-	-	-	-	-	-
Colinus virginianus	Bobwhite	-	-	-	-	-	-	1	0.6	-	-	-	-
Casmerodius albus	Great egret	-	-	-	-	-	2	-	1.2	1	-	-	0.8
Ardea herodias	Great blue heron	-	1	-	0.9	1	-	-	0.6	1	1	1	2.5
Butorides virescens	Green heron	1	1	2	3.8	1	2	2	3.1	-	-	-	-
Nycticorax nycticorax	Black-crowned night heron	2	-	-	1.9	1	-	3	2.5	-	-	-	-
Botaurus lentiginosus	American bittern	-	-	-	-	-	1	-	0.6	-	-	-	-
Rallus sp.	Rail (species?)	1		-	0.9	-	-	-	-	-	-	-	-
Rallus elegans	King rail		1	-	0.9	-	-	-	-	-	-	-	-
Totanus melanoleucus	Greater yellowlegs	-	1	1	1.9	-	-	-	-	12	11	17	33.6
Larus argentatus	Herring gull	4	-	-	3.8	1	-	2	1.9	5	-	3	6.7
Larus delawarensis	Ring-billed gull	-	1	-	0.9	-	-	-	-	-	-	-	-
Sterna hirundo	Common tern	-	-	5	4.8	2	2	2	3.8	-	-	-	-
Zenaida macroura	Mourning dove	1	-	-	0.9	1	-	-	0.6	-	-	-	-
Megaceryle alcyon	Belted kingfisher	-	-	-	-	2	-	1	1.9	2	1	1	3.7
Colaptes auratus	Common flicker	-	1	-	0.9	1	-	4	3.1	-	1	-	0.8
Tyrannus tyrannus	Eastern kingbird	-	-	-	-	1	-	-	0.6	-	-	-	-
Myiarchus crinitus	Great-crested flycatcher	-	-	-	-	1	-	-	0.6	-	-	-	-
Hirundo rustica	Barn swallow	3	3	1	6.8	2	-	4	3.8	-	-	-	-
Riparia riparia	Bank swallow	1	2	-	2.9	-	-	-	-	-	-	-	-
Stelgidopteryx ruficollis	Rough-winged swallow	-	-	-	-	3	-	2	3.1	-	-	-	-
Cyanocitta cristata	Bluejay	2	6	3	10.6	5	3	3	7.0	1	2	3	5.0
Corvus brachyrhynchos	Common crow	2	-	-	1.9	1	-	-	0.6	5	-	1	5.0
Parus atricapillus	Black-capped chickadee	-	-	-	-	2	2	1	3.1	-	-	-	-
Parus bicolor	Tufted titmouse	-	-	-	-	-	1	-	0.6	1	-	-	0 8
Sitta carolinensis	White-breasted nuthatch	-	-	-	-	-	-	-	-	-	1	-	0.8
Troglodytes aedon	House wren	-	-	-	-	1	-	1	1.2	-	-	-	-
Mimus polyglottos	Mockingbird	-	-	-	-	-	-	1	0.6	-	1	-	0.8
Dumetella carolinensis	Gray catbird	3	-	-	2.9	-	1	-	0.6	-	-	-	-
Toxostoma rufum	Brown thrasher	-	1	-	0.9	-	-	-	-	-	-	-	-
Turdus migratorius	American robin	-	-	1	0.9	2	1	2	3.1	-	1	-	0.8
Sturnus vulgaris	Starling	4	1	5	9.7	3	-	3	3.8	4	-	-	3.4
Parulidae	Wood warbler (species?)	-	-	-	-	-	-	-	-	2	-	-	1.7
Dendroica discolor	Prairie warbler	-	1	-	0.9	-	-	-	-	-	-	-	-
Agelaius phoeniceus	Red-winged blackbird	6	2	4	11.6	6	-	9	9.5	-	-	-	-
Quiscalus quiscula	Common grackle	1	8	2	10.6	4	2	1	4.4	-	-	-	-
Icterus galbula	Northern oriole	1	1	1	2.9	4	-	-	2.5	-	-	-	-
Spinus tristis	American goldfinch	1	2	-	2.9	-	1	1	1.2	2	2	-	3.4
Pipilo erythrophthalmus	Rufous-sided towhee	-	2	1	2.9	1	-	-	0.6	-	-	-	-
Melospiza melodia	Song sparrow	1	1	1	2.9	1	2	2	3.1	-	1	-	0.8

Table 17. Summary of May, July, October 1973, and January 1974 transect counts of birds in a riparian community (Site 3) in the vicinity of the Millstone Point site, Waterford, Connecticut.

Scientific Name	Common Name	Number of Birds Observed														
		May				July				October				January		
		15th	16th	17th	%	17th	18th	19th	%	23rd	24th	25th	%	10th	11th	%
Branta canadensis	Canada goose	-	-	-	-	-	-	-	-	-	15	-	14.2	-	-	-
Anas platyrhynchos	Mallard	-	2	-	2.7	-	-	-	-	-	-	4	3.8	-	2	14.3
Anas rubripes	Black duck	-	1	-	1.3	-	-	-	-	2	3	-	4.7	-	-	-
Bonasa umbellus	Ruffed grouse	-	-	-	-	-	-	-	-	-	2	-	1.9	-	-	-
Colinus virginianus	Bobwhite	-	2	-	2.7	1	2	-	4.8	-	-	8	7.5	-	-	-
Butorides virescens	Green heron	-	1	-	1.3	-	-	-	-	-	-	-	-	-	-	-
Nycticorax nycticorax	Black-crowned night heron	-	-	-	-	1	-	-	1.6	-	-	-	-	-	-	-
Larus sp.	Gull (species?)	-	-	-	-	-	-	-	-	-	-	-	-	1	1	14.3
Larus argentatus	Herring gull	1	-	-	1.3	-	-	-	-	-	-	-	-	-	-	-
Zenaida macroura	Mourning dove	1	-	-	1.3	-	-	-	-	-	11	-	10.4	-	-	-
Megaceryle alcyon	Belted kingfisher	-	-	-	-	-	1	2	4.8	1	-	-	0.9	-	-	-
Colaptes auratus	Common flicker	-	-	-	-	1	-	1	3.2	-	-	1	0.9	-	-	-
Dendrocopos sp.	Woodpecker (species?)	-	-	-	-	-	-	-	-	-	-	-	-	-	1	7.1
Dendrocopos villosus	Hairy woodpecker	-	-	-	-	-	-	-	-	1	-	1	1.9	-	-	-
Dendrocopos pubescens	Downy woodpecker	-	2	-	2.7	-	1	-	1.6	-	-	-	-	-	-	-
Sayornis phoebe	Eastern phoebe	-	1	-	1.3	-	-	-	-	-	-	-	-	-	-	-
Contopus virens	Eastern wood pewee	-	-	-	-	-	1	-	1.6	-	-	-	-	-	-	-
Hirundo rustica	Barn swallow	-	1	2	4.0	-	-	-	-	-	-	-	-	-	-	-
Cyanocitta cristata	Bluejay	1	1	4	8.1	4	5	-	14.5	2	1	2	4.7	-	2	14.3
Corvus brachyrhynchos	Common crow	-	-	2	2.7	-	3	-	4.8	1	1	2	3.8	-	-	-
Parus atricapillus	Black-capped chickadee	-	-	2	2.7	3	4	2	14.5	5	2	6	12.3	2	-	14.3
Troglodytes aedon	House wren	1	-	-	1.3	-	-	-	-	-	-	-	-	-	-	-
Dumetella carolinensis	Gray catbird	1	-	4	6.7	-	2	1	4.8	-	-	-	-	-	-	-
Toxostoma rufum	Brown thrasher	-	1	-	1.3	-	-	-	-	-	-	-	-	-	-	-
Turdus migratorius	American robin	-	1	-	1.3	-	-	-	-	1	3	1	4.7	-	-	-
Sturnus vulgaris	Starling	-	1	4	6.7	-	-	-	-	-	20	-	18.9	-	-	-
Vireo olivaceus	Red-eyed vireo	-	-	2	2.7	-	-	-	-	-	-	-	-	-	-	-
Mniotilta varia	Black-and-white warbler	-	1	-	1.3	-	-	-	-	-	-	-	-	-	-	-
Vermivora pinus	Blue-winged warbler	-	1	-	1.3	-	-	-	-	-	-	-	-	-	-	-
Geothlypis trichas	Common yellowthroat	-	-	1	1.3	1	2	1	6.4	-	-	-	-	-	-	-
Agelaius phoeniceus	Red-winged blackbird	5	4	3	16.2	-	1	-	1.6	-	-	-	-	-	-	-
Quiscalus quiscula	Common grackle	5	5	4	18.9	-	-	-	-	-	-	-	-	-	-	-
Icterus galbula	Northern oriole	1	1	2	5.4	1	2	-	4.8	-	-	-	-	-	-	-
Cardinalis cardinalis	Cardinal	-	-	-	-	-	2	-	3.2	1	-	-	0.9	-	-	-
Passerina cyanea	Indigo bunting	-	-	-	-	-	-	1	1.6	-	-	-	-	-	-	-
Spinus tristis	American goldfinch	-	-	-	-	-	-	1	1.6	-	-	-	-	-	-	-
Pipilo erythrophthalmus	Rufous-sided towhee	-	1	-	1.3	2	10	1	20.9	-	-	-	-	-	-	-
Junco hyemalis	Dark-eyed junco	-	-	-	-	-	-	-	-	-	2	2	3.8	-	-	-
Spizella pusilla	Field sparrow	-	-	1	1.3	-	1	-	1.6	-	-	-	-	-	1	7.1
Zonotrichia albicollis	White-throated sparrow	-	-	-	-	-	-	-	-	-	5	-	4.7	-	-	-
Melospiza melodia	Song sparrow	-	-	-	-	-	-	1	1.6	-	-	-	-	-	4	28.6

Table 18. Summary of May, July, October 1973, and January 1974 transect counts of birds along a transmission line corridor (Site 5) in the vicinity of the Millstone Point site, Waterford, Connecticut.

Scientific Name	Common Name	Number of Birds Observed														
		May				July				October				January		
		15th	16th	17th	%	17th	18th	19th	%	23rd	24th	25th	%	10th	11th	%
Anas platyrhynchos	Mallard	-	2	-	3.3	-	-	-	-	-	-	-	-	-	-	-
Anas rubripes	Black duck	-	-	-	-	1	-	-	0.3	-	-	-	-	-	-	-
Accipiter cooperii	Cooper's hawk	-	-	-	-	-	-	-	-	-	-	-	-	1	-	6.7
Buteo platypterus	Broad-winged hawk	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Colinus virginianus	Bobwhite	-	-	-	-	2	3	2	2.6	1	7	-	4.1	-	-	-
Butorides virescens	Green heron	-	-	1	1.7	-	-	-	-	-	-	-	-	-	-	-
Botaurus lentiginosus	American bittern	-	-	-	-	-	1	-	0.3	-	-	-	-	-	-	-
Charadrius vociferus	Killdeer	-	-	-	-	3	2	2	2.6	-	-	-	-	-	-	-
Larus argentatus	Herring gull	1	1	2	6.7	1	4	1	2.2	-	6	4	5.2	-	4	26.7
Larus delawarensis	Ring-billed gull	-	-	1	1.7	1	-	-	0.3	-	-	-	-	-	2	13.3
Zenaida macroura	Mourning dove	-	1	2	5.0	1	-	8	3.3	55	5	-	31.1	-	1	6.7
Chaetura pelagica	Chimney swift	-	-	-	-	-	-	3	1.1	-	-	-	-	-	-	-
Colaptes auratus	Common flicker	-	1	-	1.7	-	4	2	2.2	-	-	-	-	-	-	-
Dendrocopos pubescens	Downy woodpecker	-	-	-	-	-	2	-	0.7	-	-	-	-	-	-	-
Tyrannus tyrannus	Eastern kingbird	-	-	-	-	3	3	3	3.3	-	-	-	-	-	-	-
Contopus virens	Eastern wood pewee	-	-	-	-	-	-	-	-	1	-	-	0.5	-	-	-
Hirundo rustica	Barn swallow	-	-	-	-	16	3	5	8.8	-	-	-	-	-	-	-
Cyanocitta cristata	Bluejay	-	1	-	1.7	-	6	1	2.6	2	5	2	4.7	-	4	26.7
Corvus brachyrhynchos	Common crow	-	1	3	6.7	-	-	2	0.7	-	9	-	4.7	-	-	-
Parus atricapillus	Black-capped chickadee	-	-	-	-	-	4	-	1.4	-	3	1	2.1	-	2	13.3
Mimus polyglottos	Mockingbird	-	-	-	-	-	3	-	1.1	1	-	-	0.5	-	-	-
Dumetella carolinensis	Gray catbird	-	-	-	-	-	1	1	0.7	-	-	-	-	-	-	-
Toxostoma rufum	Brown thrasher	-	-	-	-	-	1	1	0.7	-	1	-	0.5	-	-	-
Turdus migratorius	American robin	-	-	-	-	1	7	4	4.4	2	18	6	13.5	-	-	-
Hylocichla mustelina	Wood thrush	-	-	-	-	-	1	-	0.3	-	-	-	-	-	-	-
Sialia sialis	Eastern bluebird	-	1	-	1.7	-	-	-	-	-	-	-	-	-	-	-
Sturnus vulgaris	Starling	1	1	-	3.3	3	34	33	25.9	2	5	15	11.4	-	-	-
Parulidae	Wood warbler (species?)	-	-	-	-	-	-	-	-	-	-	2	1.0	-	-	-
Vermivora pinus	Blue-winged warbler	-	2	1	5.0	-	-	-	-	-	-	-	-	-	-	-
Dendroica petechia	Yellow warbler	-	-	-	-	-	1	-	0.3	-	-	-	-	-	-	-
Dendroica coronata	Yellow-rumped warbler	-	-	-	-	-	-	-	-	-	3	-	1.6	-	-	-
Dendroica discolor	Prairie warbler	3	2	3	13.5	-	2	1	1.1	-	-	-	-	-	-	-
Geothlypis trichas	Common yellowthroat	1	3	3	11.8	1	6	3	3.7	-	-	-	-	-	-	-
Passer domesticus	House sparrow	-	2	-	3.3	-	-	-	-	-	-	-	-	-	-	-
Sturnella magna	Eastern meadowlark	-	-	-	-	-	-	-	-	-	3	-	1.6	-	-	-
Agelaius phoeniceus	Red-winged blackbird	1	4	2	11.8	3	12	5	7.4	-	-	-	-	-	-	-
Quiscalus quiscula	Common grackle	1	3	-	6.7	-	-	1	-	-	-	-	-	-	-	-
Icterus galbula	Northern oriole	-	-	-	-	-	6	-	2.2	-	-	-	-	-	-	-
Fringillidae	Sparrow (species?)	-	-	-	-	-	-	-	-	-	1	-	0.5	-	-	-
Cardinalis cardinalis	Cardinal	-	-	-	-	-	-	-	-	1	-	1	1.0	-	-	-
Spinus tristis	American goldfinch	-	-	1	1.7	1	3	2	2.2	3	-	-	1.6	-	-	-
Pipilo erythrophthalmus	Rufous-sided towhee	2	-	2	6.7	4	3	5	4.4	-	-	-	-	-	-	-
Passerculus sandwichensis	Savannah sparrow	-	-	-	-	-	-	-	-	1	-	-	0.5	-	-	-
Spizella pusilla	Field sparrow	-	-	-	-	3	8	5	5.9	2	3	1	3.1	-	1	6.7
Melospiza georgiana	Swamp sparrow	-	-	-	-	-	-	-	-	1	4	1	3.1	-	-	-
Melospiza melodia	Song sparrow	-	2	1	5.0	5	6	4	5.5	10	4	1	7.8	-	-	-

Table 19. Summary of May, July, October 1973, and January 1974 transect counts of birds in a mixed hardwood forest (Site 6) in the vicinity of the Millstone Point site, Waterford, Connecticut.

Scientific Name	Common Name	Number of Birds Observed														
		May				July				October				January		
		15th	16th	17th	%	17th	18th	19th	%	23rd	24th	25th	%	10th	11th	%
Cygnus olor	Mute swan	1	5	5	18.9	-	-	4	5.4	-	-	-	-	-	-	-
Pandion haliaetus	Osprey	-	2	-	3.4	-	-	-	-	-	-	-	-	-	-	-
Colinus virginianus	Bobwhite	-	-	-	-	3	-	2	6.8	-	-	-	-	-	-	-
Ardea herodias	Great blue heron	-	2	-	3.4	-	-	-	-	1	-	-	2.9	-	-	-
Nycticorax nycticorax	Black-crowned night heron	3	1	-	6.8	-	3	1	5.4	-	-	-	-	-	-	-
Larus argentatus	Herring gull	-	-	-	-	-	-	-	-	-	-	-	-	-	1	16.7
Larus delawarensis	Ring-billed gull	-	2	-	3.4	-	-	-	-	-	-	-	-	-	-	-
Megaceryle alcyon	Belted kingfisher	-	-	-	-	-	2	-	2.7	-	-	-	-	-	-	-
Colaptes auratus	Common flicker	-	-	-	-	1	2	4	9.5	-	-	-	-	-	-	-
Tyrannus tyrannus	Eastern kingbird	-	1	1	3.4	-	-	-	-	-	-	-	-	-	-	-
Myiarchus crinitus	Great-crested flycatcher	-	-	2	3.4	-	-	-	-	-	-	-	-	-	-	-
Hirundo rustica	Barn swallow	3	3	5	18.9	-	-	-	-	-	-	-	-	-	-	-
Iridoprocne bicolor	Tree swallow	-	-	1	1.7	-	-	-	-	-	-	-	-	-	-	-
Cyanocitta cristata	Bluejay	-	-	1	1.7	5	3	6	19.1	2	3	2	20.6	-	1	16.7
Corvus brachyrhynchos	Common crow	1	-	1	1.7	4	3	1	10.9	3	3	5	32.4	-	-	-
Parus atricapillus	Black-capped chickadee	-	-	-	-	2	1	1	5.4	-	-	-	-	-	3	50.0
Sitta sp.	Nuthatch (species?)	-	-	-	-	-	-	-	-	-	-	-	-	-	1	16.7
Dumetella carolinensis	Gray catbird	1	2	-	5.1	-	1	1	2.7	-	-	1	2.9	-	-	-
Turdus migratorius	American robin	-	1	-	1.7	1	-	1	2.7	-	-	-	-	-	-	-
Hylocichla mustelina	Wood thrush	-	-	-	-	1	-	-	1.3	-	-	-	-	-	-	-
Catharus guttata	Hermit thrush	-	-	-	-	-	-	-	-	-	-	1	2.9	-	-	-
Vireo philadelphicus	Philadelphia vireo	-	-	-	-	-	-	-	-	-	2	-	5.9	-	-	-
Parulidae	Wood warbler (species?)	-	-	-	-	-	-	-	-	-	4	-	11.8	-	-	-
Dendroica coronata	Yellow-rumped warbler	-	-	-	-	-	-	-	-	2	-	-	5.9	-	-	-
Geothlypis trichas	Common yellowthroat	-	-	-	-	1	-	-	1.3	-	-	-	-	-	-	-
Agelaius phoeniceus	Red-winged blackbird	1	-	2	5.1	2	3	-	6.8	-	-	-	-	-	-	-
Quiscalus quiscula	Common grackle	-	-	-	-	-	6	-	8.2	-	-	-	-	-	-	-
Icterus galbula	Northern oriole	4	3	3	17.2	1	-	-	1.3	-	-	-	-	-	-	-
Pipilo erythrophthalmus	Rufous-sided towhee	1	1	-	3.4	3	2	1	8.2	-	-	-	-	-	-	-
Zonotrichia albicollis	White-throated sparrow	-	-	-	-	-	-	-	-	-	4	1	14.7	-	-	-
Melospiza melodia	Song sparrow	-	-	-	-	-	-	1	1.3	-	-	-	-	-	-	-

Table 20. Summary of May, July, October 1973, and January 1974 transect counts of birds in an abandoned nursery (Site 7) in the vicinity of the Millstone Point site, Waterford, Connecticut.

Scientific Name	Common Name	Number of Birds Observed														
		May				July				October				January		
		15th	16th	17th	%	17th	18th	19th	%	23rd	24th	25th	%	10th	11th	%
Falco sparverius	American kestrel	-	-	-	-	-	-	-	-	1	-	-	0.6	-	-	-
Buteo platypterus	Broad-winged hawk	-	1	-	1.3	-	-	-	-	-	-	-	-	-	-	-
Colinus virginianus	Bobwhite	1	-	-	1.3	2	3	1	4.8	-	11	-	6.6	-	-	-
Phasianus colchicus	Ring-necked pheasant	-	-	-	-	-	-	-	-	1	2	-	1.8	-	-	-
Larus argentatus	Herring gull	2	-	-	2.6	1	3	2	4.8	3	-	2	3.0	2	2	15.4
Larus delawarensis	Ring-billed gull	-	1	2	3.9	-	-	-	-	-	-	-	-	-	4	15.4
Columba livia	Rock dove	-	-	-	-	-	9	20	23.3	-	-	-	-	-	2	7.7
Zenaida macroura	Mourning dove	-	-	2	2.6	2	1	2	4.0	1	-	-	0.6	-	-	-
Colaptes auratus	Common flicker	-	1	-	1.3	-	2	-	1.6	-	-	1	0.6	-	-	-
Dendrocopos villosus	Hairy woodpecker	-	-	-	-	-	-	-	-	-	1	-	0.6	1	-	3.8
Dendrocopos pubescens	Downy woodpecker	-	-	-	-	-	1	-	0.8	-	-	-	-	-	-	-
Hirundo rustica	Barn swallow	2	1	-	3.9	-	-	-	-	-	-	-	-	-	-	-
Iridoprocne bicolor	Tree swallow	-	-	-	-	-	2	-	1.6	-	-	-	-	-	-	-
Stelgidopteryx ruficollis	Rough-winged swallow	-	-	-	-	-	1	-	0.8	-	-	-	-	-	-	-
Cyanocitta cristata	Bluejay	-	2	-	2.6	1	-	2	1.6	1	8	3	7.2	1	1	7.7
Corvus brachyrhynchos	Common crow	1	-	-	1.3	1	-	-	-	-	2	-	1.2	-	1	3.8
Parus atricapillus	Black-capped chickadee	-	-	-	-	-	3	3	4.8	3	5	-	4.8	-	-	-
Parus bicolor	Tufted titmouse	-	-	-	-	-	-	4	3.2	-	-	-	-	-	-	-
Troglodytes aedon	House wren	-	-	-	-	-	-	1	0.8	-	-	-	-	-	-	-
Troglodytes troglodytes	Winter wren	-	-	-	-	-	-	-	-	-	-	-	-	1	-	3.8
Dumetella carolinensis	Gray catbird	-	1	-	1 3	-	-	1	0.8	1	1	1	1.8	-	-	-
Toxostoma rufum	Brown thrasher	-	-	-	-	-	-	-	-	1	-	-	0.6	-	-	-
Turdus migratorius	American robin	1	3	-	5.2	2	2	1	4.0	-	4	5	5.4	-	1	3.8
Catharus guttata	Hermit thrush	-	-	-	-	-	-	-	-	1	-	-	0.6	-	-	-
Sturnus vulgaris	Starling	2	5	3	13.1	-	1	5	4.8	1	26	-	16.2	-	-	-
Parulidae	Wood warbler (species?)	-	-	-	-	-	-	-	-	3	-	-	1.8	-	-	-
Dendroica petechia	Yellow warbler	1	-	-	1.3	-	4	1	4.8	-	-	-	-	-	-	-
Dendroica coronata	Yellow-rumped warbler	-	-	-	-	-	-	-	-	20	-	3	13.8	-	-	-
Dendroica palmarum	Palm warbler	-	-	-	-	-	-	-	-	1	-	-	0.6	-	-	-
Geothlypis trichas	Common yellowthroat	1	2	3	7.8	-	-	2	1.6	-	-	-	-	-	-	-
Dolichonyx oryzivorus	Bobolink	1	-	-	1.3	-	-	-	-	-	-	-	-	-	-	-
Sturnella magna	Eastern meadowlark	-	-	-	-	-	-	-	-	-	1	-	0.6	1	-	3.8
Agelaius phoeniceus	Red-winged blackbird	5	4	5	18.4	-	2	3	4.0	-	-	-	-	-	-	-
Quiscalus quiscula	Common grackle	6	3	1	11.8	-	-	-	-	-	-	-	-	-	-	-
Icterus galbula	Northern oriole	-	-	-	-	-	-	3	2.4	-	-	-	-	-	-	-
Fringillidae	Sparrow (species?)	-	-	-	-	-	-	-	-	5	-	1	3.6	-	-	-
Cardinalis cardinalis	Cardinal	-	-	-	-	-	-	-	-	-	1	-	0.6	-	-	-
Pheucticus ludovicianus	Rose-breasted grosbeak	1	-	-	1.3	-	-	-	-	-	-	-	-	-	-	-
Spinus tristis	American goldfinch	-	-	-	-	3	3	4	8.0	32	-	-	19.2	-	-	-
Pooecetes gramineus	Vesper sparrow	-	-	-	-	-	-	-	-	1	2	-	1.8	-	-	-
Spizella arborea	Tree sparrow	-	-	-	-	-	-	-	-	-	-	-	-	3	-	11.5
Spizella pusilla	Field sparrow	-	1	2	3.9	1	1	-	1.6	3	2	-	3.0	6	-	23.1
Zonotrichia albicollis	White-throated sparrow	-	-	-	-	-	-	-	-	-	3	-	1.8	-	-	-
Melospiza georgiana	Swamp sparrow	-	-	-	-	-	-	-	-	-	3	-	1.8	-	-	-
Melospiza melodia	Song sparrow	2	3	5	13.1	5	9	4	14.5	-	-	-	-	-	-	-

Table 21. Summary of May, July, October 1973, and January 1974 transect counts of birds along a beach community and managed recreation area (Site 8) in the vicinity of the Millstone Point site, Waterford, Connecticut.

Scientific Name	Common Name	Number of Birds Observed														
		May				July				October				January		
		15th	16th	17th	%	17th	18th	19th	%	23rd	24th	25th	%	10th	11th	%
Gavia immer	Common loon	-	-	-	-	-	-	-	-	-	-	-	-	1	3	6.3
Podiceps grisegena	Red-necked grebe	-	-	-	-	-	-	-	-	-	-	1	0.3	-	-	-
Phalacrocorax auritis	Double-crested cormorant	-	-	-	-	-	-	-	-	36	26	11	20.8	-	-	-
Cygnus olor	Mute swan	-	-	-	-	-	-	-	-	-	-	2	0.6	-	-	-
Olor columbianus	Whistling swan	-	-	2	2.1	-	-	-	-	-	-	-	-	-	-	-
Anas platyrhynchos	Mallard	-	-	-	-	-	-	-	-	-	-	-	-	2	-	3.1
Anas rubripes	Black duck	-	-	6	6.4	-	-	-	-	-	-	-	-	-	-	-
Bucephala albeola	Bufflehead	-	-	-	-	-	-	-	-	-	-	1	0.3	1	1	3.1
Mergus serrator	Red-breasted merganser	-	-	-	-	-	-	-	-	-	-	-	-	6	12	28.1
Colinus virginianus	Bobwhite	-	-	1	1.0	-	-	-	-	-	-	-	-	-	-	-
Phasianus colchicus	Ring-necked pheasant	-	-	-	-	-	-	-	-	-	-	1	0.3	-	-	-
Casmerodius albus	Great egret	-	-	3	3.1	-	-	-	-	-	-	-	-	-	-	-
Scolopacidae	Sandpiper (species?)	-	-	-	-	1	-	2	2.4	-	-	-	-	-	-	-
Charadrius vociferus	Killdeer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Actitis macularia	Spotted sandpiper	-	-	-	-	-	1	-	0.8	-	-	-	-	-	-	-
Larus marinus	Great black-backed gull	-	-	-	-	-	-	-	-	1	1	2	1.3	-	1	1.6
Larus argentatus	Herring gull	5	-	2	7.4	2	2	3	5.7	21	50	9	25.0	13	2	23.4
Larus delawarensis	Ring-billed gull	-	3	1	4.2	-	-	-	-	1	-	5	1.9	7	-	10.9
Sterna hirundo	Common tern	1	1	10	12.7	2	6	2	8.2	-	-	-	-	-	-	-
Zenaida macroura	Mourning dove	-	-	3	3.2	1	-	-	-	-	-	-	-	-	-	-
Chaetura pelagica	Chimney swift	-	1	-	1.0	-	-	-	-	-	-	-	-	-	-	-
Megaceryle alcyon	Belted kingfisher	-	-	-	-	-	-	-	-	1	-	1	0.6	-	-	-
Colaptes auratus	Common flicker	1	-	-	1.0	-	-	-	-	3	-	-	0.9	-	-	-
Hirundo rustica	Barn swallow	4	-	-	4.2	-	2	2	3.2	-	-	-	-	-	-	-
Petrochelidon pyrrhonota	Cliff swallow	-	-	-	-	7	-	-	5.7	-	-	-	-	-	-	-
Stelgidopteryx ruficollis	Rough-winged swallow	-	-	-	-	2	-	-	1.6	-	-	-	-	-	-	-
Cyanocitta cristata	Bluejay	-	-	5	5.3	-	-	1	0.8	1	2	1	1.3	-	-	-
Corvus brachyrhynchos	Common crow	-	-	-	-	-	-	3	2.4	-	-	-	-	-	-	-
Parus atricapillus	Black-capped chickadee	-	-	-	-	-	4	-	3.2	6	9	3	5.6	-	2	3.1
Dumetella carolinensis	Gray catbird	1	1	1	3.2	-	1	-	0.8	-	1	-	0.3	-	-	-
Turdus migratorius	American robin	5	5	2	12.7	1	2	1	3.2	11	-	-	3.4	-	-	-
Catharus guttata	Hermit thrush	-	-	-	-	-	-	-	-	-	1	-	0.3	-	-	-
Bombycilla cedrorum	Cedar waxwing	-	-	-	-	-	-	-	-	-	-	8	2.5	-	-	-
Sturnus vulgaris	Starling	4	1	1	6.4	1	3	12	13.1	5	20	-	7.8	-	1	1.6
Parulidae	Wood warbler (species?)	-	-	-	-	-	-	-	-	-	1	-	0.3	-	-	-
Dendroica petechia	Yellow warbler	2	1	1	4.2	-	-	-	-	-	-	-	-	-	-	-
Dendroica coronata	Yellow-rumped warbler	-	-	-	-	-	-	-	-	2	4	2	2.5	-	-	-
Geothlypis trichas	Common yellowthroat	-	-	-	-	3	1	2	4.9	-	-	-	-	-	-	-
Passer domesticus	House sparrow	-	-	-	-	-	2	4	4.9	-	-	-	-	-	-	-
Agelaius phoeniceus	Red-winged blackbird	2	3	1	6.4	2	1	2	4.1	-	-	-	-	-	-	-
Quiscalus quiscula	Common grackle	1	1	3	5.3	2	22	10	27.8	-	-	-	-	-	-	-
Icterus galbula	Northern oriole	1	-	1	2.1	-	-	-	-	-	-	-	-	-	-	-
Fringillidae	Sparrow (species?)	-	-	-	-	-	-	-	-	-	-	2	0.6	-	-	-
Carpodacus purpureus	Purple finch	-	-	1	1.0	-	-	-	-	-	1	-	0.3	-	-	-
Spinus tristis	American goldfinch	-	-	1	1.0	-	-	1	0.8	1	26	3	9.4	-	-	-
Ammospiza caudacuta	Sharp-tailed sparrow	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1.6
Junco hyemalis	Dark-eyed junco	-	-	-	-	-	-	-	-	-	4	-	1.3	-	-	-
Spizella pusilla	Field sparrow	-	-	-	-	-	-	-	-	2	12	-	4.4	-	5	9.4
Melospiza georgiana	Swamp sparrow	-	-	-	-	-	-	-	-	-	4	-	1.3	-	-	-
Melospiza melodia	Song sparrow	-	2	3	5.3	2	1	3	4.9	1	7	4	3.8	3	2	7.8

Table 22. Summary of May, July, October 1973 and January 1974 transect counts of birds along a beach community (Site 9) in the vicinity of the Millstone Point site, Waterford, Connecticut.

Scientific Name	Common Name	Number of Birds Observed														
		May				July				October				January		
		15th	16th	17th	%	17th	18th	19th	%	23rd	24th	25th	%	10th	11th	%
Gavia immer	Common loon	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1.6
Phalacrocorax auritis	Double-crested	-	-	-	-	-	-	2	0.7	6	6	5	8.2	-	-	-
Cygnus olor	Mute swan	-	-	-	-	4	4	-	2.9	4	-	-	1.9	3	-	2.4
Branta canadensis	Canada goose	-	-	-	-	-	-	-	-	-	20	-	9.6	-	-	-
Anas platyrhynchos	Mallard	1	-	-	0.9	-	-	-	-	4	8	1	6.3	7	2	7.3
Anas rubripes	Black duck	-	-	-	-	7	-	18	9.3	3	-	3	2.9	11	10	16.9
Bucephala clangula	Common goldeneye	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.8
Bucephala albeola	Bufflehead	1	1	1	2.7	-	-	-	-	1	1	-	1.0	14	4	14.5
Mergus serrator	Red-breasted merganser	-	-	-	-	-	-	-	-	-	-	-	-	7	5	9.7
Pandion haliaetus	Osprey	1	1	1	2.7	3	3	3	3.3	-	-	-	-	-	-	-
Falco sparverius	American kestrel	-	-	-	-	-	-	-	-	-	-	1	0.5	-	-	-
Casmerodius albus	Great egret	-	-	-	-	2	-	-	0.7	-	-	-	-	-	-	-
Ardea herodias	Great blue heron	-	-	-	-	-	-	-	-	7	12	1	9.6	-	-	-
Butorides virescens	Green heron	-	-	-	-	1	-	-	0.3	-	-	-	-	-	-	-
Nycticorax nycticorax	Black-crowned night heron	-	-	-	-	-	4	4	2.9	12	16	8	17.3	-	-	-
Squatarola squatarola	Black-bellied plover	-	-	-	-	-	-	-	-	1	-	-	0.5	1	-	0.8
Charadrius vociferus	Killdeer	-	-	-	-	-	-	-	-	-	-	-	-	2	4	4.8
Actitis macularia	Spotted sandpiper	-	-	-	-	-	-	1	0.3	-	-	-	-	-	-	-
Larus marinus	Great black-backed gull	-	-	-	-	-	-	-	-	3	2	1	2.9	2	2	43.2
Larus argentatus	Herring gull	11	2	1	12.7	5	15	17	13.8	4	11	4	9.1	5	3	6.5
Larus delawarensis	Ring-billed gull	1	8	1	9.0	-	-	-	-	-	-	-	-	9	2	8.9
Sterna hirundo	Common tern	1	-	1	1.8	-	3	16	7.0	-	-	-	-	-	-	-
Columba livia	Rock dove	-	-	-	-	-	-	1	0.3	-	-	-	-	-	-	-
Zenaida macroura	Mourning dove	2	-	-	1.8	1	-	-	0.3	-	2	-	1.0	-	-	-
Megaceryle alcyon	Belted kingfisher	-	-	-	-	-	-	2	0.7	1	-	-	0.5	1	-	0.8
Colaptes auratus	Common flicker	-	-	-	-	1	1	-	0.7	-	-	-	-	-	-	-
Dendrocopos pubescens	Downy woodpecker	-	-	-	-	-	-	1	0.3	-	-	-	-	-	-	-
Tyrannus tyrannus	Eastern kingbird	-	-	-	-	1	2	2	1.8	-	-	-	-	-	-	-
Sayornis phoebe	Eastern phoebe	-	-	-	-	-	-	1	0 3	-	-	-	-	-	-	-
Hirundo rustica	Barn swallow	9	1	-	9.0	-	2	11	4.8	-	-	-	-	-	-	-
Riparia riparia	Bank swallow	1	-	-	0.9	-	-	-	-	-	-	-	-	-	-	-
Iridoprocne bicolor	Tree swallow	-	-	-	-	-	-	1	0.3	-	-	-	-	-	-	-
Stelgidopteryx ruficollis	Rough-winged swallow	-	-	-	-	-	2	-	0.7	-	-	-	-	-	-	-
Cyanocitta cristata	Bluejay	2	-	-	1.8	-	2	1	1.1	1	2	2	2.4	-	2	1.6
Corvus brachyrhynchos	Common crow	-	-	-	-	-	1	3	1.4	-	-	-	-	-	2	1.6
Parus atricapillus	Black-capped chickadee	-	-	-	-	-	-	-	-	2	1	-	1.4	-	-	-
Troglodytes aedon	House wren	-	-	-	-	-	-	-	-	-	-	1	0.5	-	-	-
Dumetella carolinensis	Gray catbird	-	-	-	-	1	3	1	1.8	-	-	-	-	-	-	-
Turdus migratorius	American robin	3	-	1	3.6	-	7	6	4.8	-	-	2	1.0	-	-	-
Sturnus vulgaris	Starling	3	3	-	5.4	6	3	13	8.2	3	19	-	10.6	-	-	-
Vermivora pinus	Blue-winged warbler	-	-	-	-	1	-	-	0.3	-	-	-	-	-	-	-
Dendroica petechia	Yellow warbler	1	1	-	1.8	-	-	-	-	-	-	-	-	-	-	-
Geothlypis trichas	Common yellowthroat	-	-	-	-	-	2	1	1.1	-	-	-	-	-	-	-
Passer domesticus	House sparrow	1	-	-	0.9	7	2	8	6.3	-	-	-	-	-	-	-
Agelaius phoeniceus	Red-winged blackbird	4	-	3	6.3	3	5	6	5.2	-	-	-	-	-	-	-
Quiscalus quiscula	Common grackle	14	6	10	27.2	2	10	3	5.5	-	-	-	-	-	-	-
Icterus galbula	Northern oriole	2	1	-	2.7	-	1	-	0.3	-	-	-	-	-	-	-
Carpodacus purpureus	Purple finch	-	-	-	-	-	3	-	1.1	-	-	-	-	-	-	-
Spinus tristis	American goldfinch	-	-	-	-	-	3	-	1.1	2	1	2	2.4	-	-	-
Passerculus sandwichensis	Savannah sparrow	-	-	-	-	-	2	6	2.9	-	1	-	0.5	-	-	-
Melospiza lincolnii	Lincoln's sparrow	-	-	-	-	-	-	-	-	-	1	-	0.5	-	-	-
Melospiza melodia	Song sparrow	4	2	3	8.1	2	2	11	5.5	5	12	3	9.6	13	10	18.5