The Mammals of Long Island, New York

by PAUL F. CONNOR
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THE UNIVERSITY OF THE STATE OF NEW YORK

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The Mammals of Long Island, New York

by PAUL F. CONNOR

INTRODUCTION

Long Island at the time of the first white settlers abounded in a wonderful variety of wildlife in pleasant surroundings. The various woodland, grassland, and marsh habitats provided homes for most, although not quite all, of the mammals found on the adjacent mainland, while in the ocean and in the many sounds and bays of the area were numerous whales and smaller marine mammals. As the island was settled and tamed from one end to the other, all of the larger species suffered a drastic reduction in numbers, and the large land carnivores were exterminated. However, many small mammals (insectivores, bats, rodents, etc.) and several species in the muskrat-to-fox size range which survived the bounties and other persecutions of early days, and years of fur trapping, are still surprisingly common in much of central and eastern Long Island. Deer, too, are numerous again.

Nevertheless, Long Island today is in a period of incredibly rapid human exploitation. According to Stout (1958) and others, land use on the island is the most swiftly changing in the State as New York City exerts a constant pressure on farm and forest lands for residential development; with a soaring population and a thick network of roads much of the island is rapidly becoming a suburban area. Thus it seemed important to extend the State Museum’s continuing small mammal survey to this area at an early date, before further loss of natural areas and habitats occurred.

Field Survey

The field survey was started in the fall of 1960 and continued through the summer of 1963. This work was concerned mainly with collecting small mammals from shrew to squirrel size, preparing study skins and skeletal material, and obtaining information on the local distribution and habits of the various species. All study skins and other preserved material, and field-data sheets for most of the individuals examined are at the New York State Museum, Albany. Concurrently with this survey, other field work was done in cooperation with the New York State Department of Health and other agencies which had initiated a survey of arthropod-borne viruses on Long Island. This work mainly involved collecting migratory blackbirds and some other common vertebrates in Suffolk County. Material preserved, such as bird spleens and blood samples, was tested primarily by the State Department of Health and the information published elsewhere.

Small mammal collecting was confined almost entirely to Suffolk County, a large area consisting of approximately the eastern two-thirds of Long Island (map 2). Field headquarters was located at Hampton Bays during most of the period. Collecting was concentrated in certain regions, especially south and southeast of Riverhead, a relatively wild area for Long Island, with a variety of natural habitats, and in the region of Hither Hills and Napeague Meadows, which are well out on the southern

MAP 1. MAP OF NEW YORK STATE SHOWING LOCATION OF LONG ISLAND

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fork of eastern Long Island. Trapping was also undertaken at various points along the south shore from Montauk Point to Babylon; on the north shore from Orient to the Nissequogue River; and at some other places such as Shelter Island, and scattered interior localities west to the region of Mineola in Nassau County. These and most of the other places mentioned in the text are shown on map 3.

Other Information

This bulletin is based primarily on the small mammal collecting program, but I have also attempted to assemble information on the occurrence of the other land mammals and the marine mammals. For this region of the State, there is a rather extensive and scattered natural history literature going back many years; mammal specimens and records are located in various museums and private collections. Long Island has been well endowed with many resident and visiting naturalists, collectors, and students. A more intensive search of these sources would reveal additional information and records of interest. However, it seems worthwhile to summarize the published and unpublished information now available to me on the status of the various mammals, as well as our own findings in the field.

The most important published accounts of Long Island mammals in general are by Helme (1902) and Hamilton (1949). Publications dealing exclusively with the bats of this area are by Murphy and Nichols (1913) and Nichols and Nichols (1934). A recent publication of the Nature Conservancy (Anon., 1968a) has interesting firsthand accounts of the larger land mammals. Other Long Island naturalists who have considerable knowledge of the subject and who have made collections of mammals include William T. Helmuth of East Hampton (deceased), Roy Latham of Orient, and Gilbert S. Raynor of Manorville.

The accounts of species in the present paper deal mainly with the native and naturalized wild mammals which now occur on Long Island and in its adjacent waters, or for which there are at least occasional recent records. Available records of interest concerning mammals on outlying islands such as Gardiners Island, Fishers Island, and Staten Island, have been worked into the species accounts. My information on the status of most species in these peripheral areas is less complete than for Long Island proper. Additional species, such as some which have been extirpated on the island, introduced forms of temporary or local occurrence, and certain small mammals of the nearby mainland which have not been found on Long Island, are discussed briefly under “Other Mammals” following the species accounts. Extinct species, such as the mastodon, are not discussed.

Maps of eastern United States and North America in several books which show ranges of species of mammals by shading are deceptive as far as Long Island is concerned and are puzzling to many people. Such maps may be large enough to show Long Island as a discrete area, yet the island may be incorrectly shaded in or left blank for certain species. This probably happens from lack of local information, through oversight, or because the area seems insignificant in size.

Most of the mammals living on Long Island at the present time probably were on hand to greet the first white settlers from Europe in the 1600’s. De Quon (1670), for example, lists muskrats, foxes, raccoons, skunks, otters, and deer among the “wilde beasts” of Long Island. At several Indian archaeological sites on Long Island, with radiocarbon dates ranging between 1043 B.C. and 763 B.C., bones of woodchuck, gray fox, raccoon, mink, white-tailed deer, and various small rodents have been found, and at later prehistoric sites, muskrat, raccoon, whale, and deer have been reported (Ritchie, 1969).

Roy Latham (personal communication) has records from about 100 excavated Indian camps and village sites from Montauk and Orient to Riverhead. At these sites he found the same species mentioned by Ritchie, and also discovered the remains of cottontail (Sylvilagus sp.), Eastern chipmunk, gray squirrel, flying squirrel (Riverhead only), red fox, weasel (Mustela sp.), striped skunk, and harbor seal. This material was identified by Roy Latham and authorities at the United States National Museum, Washington, D.C., and other museums. Also small bones of mice, moles, and bats were collected but no attempt was made to name them. Evidently only a very few of the established species, as mentioned elsewhere, have arrived since the time of the first Europeans settlers.

Marine Mammals

The accounts of marine mammals are based mainly on a brief survey of the literature and museum collections, and correspondence with a few observers. But it is hoped that all species known from Long Island and its offshore waters have been included. Cetaceans travel widely, and additional species may eventually be recorded from the area. Stranding records include species which regularly frequent coastal waters and those which normally live farther out. Some strand alive for one reason or another, but certain species seem more careful in avoiding this; some float in after death or disablement,
but many species are likely to sink when dead. All strandings are considered local records, but I have indicated, when known, if the animals were actually alive when found on the shore.

There are no separate species accounts for those marine mammals which have been reported only north or south of Long Island, but some which approach the area quite closely are mentioned under accounts of related species. A few species for which I have no firm Long Island records, but which have been recorded nearby to the north and south of the island, or well offshore, have been included as complete accounts; for these, the Long Island coast is considered to be at least on the edge of their range or occasionally visited. Marine mammals in general; i.e., all the large whales, dolphins, porpoises, and the seals, were very numerous originally, but have been greatly decimated in this area and occur at only a very small fraction of the population present before the heavy settlement of the coast and the era of whaling. Several of the small, little-known whales, however, have never been common. As far as I know, there has not been a general report on the cetaceans of Long Island since the brief statements of a few species by Miller (1899) and Helme (1902).

Checklist

The species accounts, as listed in the Contents, may be considered a checklist of known present-day native and naturalized mammals of Long Island, with certain qualifications in the case of the marine species. This list totals 59 species. Of these, 35 are land mammals, collected on this survey or examined as museum specimens except for gray fox and short-tailed weasel (published records exist for these). Marine species total 24, and at least 14 of these are represented in museums by Long Island specimens (strandings or killed near shore). I was unable to locate specimens of the other 10, as follows—killer whale, little piked whale, blue whale, and humpback whale, for which there are published records of occurrence; white whale, with one probable sight record, not previously published; gray grampus, sei whale, hooded seal, harp seal, and gray seal, species which have been found both north and south of this area, and also within a very few miles of our coast or directly offshore (details given in text). The author would be very pleased to receive additional records or information concerning land and marine mammals in the Long Island area.

Little attention was given to the question of subspecies, and most of the subspecies names used are merely those of the forms which would, on geographical grounds, be expected to occur; in some especially doubtful cases no subspecific name is given.

Accounts of various species have been handled somewhat differently; for example, information on the small mammals we collected is arranged under subheadings for convenience, and the marine mammals have very brief, general descriptive information for the benefit of readers unfamiliar with these animals.
DESCRIPTION OF REGION

Location

Long Island, approximately 118 miles long and 12 to 20 miles wide for most of its length, is the largest island adjacent to the eastern coast of the United States. A coastal-plain extension of New York State south of Connecticut, Long Island is surrounded by salt water, primarily the Atlantic Ocean and Long Island Sound. At its western end it is narrowly separated from other portions of New York: from the Bronx mainland and Manhattan by the East River, a tidal channel or tidal strait partly occupying a passage cut in rock, and no more than one-half mile wide in places, and from Staten Island by The Narrows, about 1 mile wide. New Jersey is about 2 miles away across the waters of Upper New York Bay. The principal political units of Long Island are the counties of Nassau and Suffolk, and the New York City boroughs of Brooklyn and Queens. Suffolk County, the largest unit, also includes various islands off the east end of Long Island; the most remote is Fishers Island, which is closer to Rhode Island and Connecticut than to Long Island. Staten Island (Borough of Richmond), the least developed part of New York City, together with Long Island and its small outlying islands, make up the coastal-plain portion of New York State.

Topography and Geology

Long Island is mostly flat and elevations are low. High Hill, south of Huntington, about 420 feet above sea level, is the highest point. Aside from a few small outcrops of ancient bedrock near the East River in Queens, the island is composed of unconsolidated materials. The basal layers are Cretaceous in origin, but these are covered nearly everywhere by glacial deposits of gravel, sand, clay, boulders, and till. Long Island was built primarily by the glacier; that is, without the extensive deposits left by the ice, the area above sea level today would be much smaller.

Long Island and Staten Island mark the southern limit on the coast of the Wisconsin stage, the most recent advance of the Pleistocene ice. Two distinct terminal
moraines (accumulations of debris dropped by the ice) were formed at the melting edges of the halted ice margins during two different substages of the Wisconsin. These moraines, existing as two ranges of low hills, are prominent topographic features of Long Island. The older moraine runs through the center of the island and then east along the south fork to Montauk Point and islands beyond. Later, another moraine was developed. On western Long Island this moraine overlaps the earlier one, but eastward the ice did not reach as far south and the moraine forms most of the hilly north shore and extends on to Fishers Island and Cape Cod.

Much of Long Island's surface consists of outwash sediments which form extensive, flat, and often sandy plains south of the moraines. Lesser, but striking, reminders of the glacier are the occasional large boulders, or erratics, some as big as a house, which were carried down from farther north, and the numerous kettle holes (now ponds or hollows) which formed where detached blocks of ice, partly or completely buried, finally melted away.

The sea level fluctuated during the Pleistocene. Marine waters covered most of the Long Island area prior to the Wisconsin advance. Later, during the Wisconsin glacial stage of low sea level (within the last 25,000 years), much of the present continental shelf was evidently a broad emerged coastal plain; teeth of mastodons (Mammuthus americanus), mammoths (Mammuthus sp.), and remains of other large Pleistocene mammals which lived on the plain have been dredged up by fishermen south of Long Island (off New Jersey), and east of Long Island (on the Georges Banks) (Whitmore et al., 1967). With the melting of the ice, the sea level rose again. The Long Island area was probably freed of ice by about 15,000 years ago. The gradual post-glacial submergence of the coastline, which followed, formed Long Island Sound, New York Bay, and Raritan Bay, and also flooded the narrow valley of the East River (Schubert, 1968). The approximate present outline of Long Island thus was established.

Besides land erosion by streams and wind in post-glacial times, the shape of the coastline has been greatly modified by the actions of ocean waves, shore drifting, and tidal currents; this has caused, for example, much land loss at Montauk, and the buildup of miles of barrier beach islands along the south shore. The construction of these low, sandy beaches and the growth of salt marshes behind them have added many square miles to the island in Recent times, although probably more than counterbalanced by land lost to erosion and subsidence (Fuller, 1914). Where higher ground meets the coast, as on the north shore, the shores between the forks, and in the Montauk region, bluffs and rocky beaches face the water.

Plant life covered Long Island following the melting of the ice, the species composition changing as the climate ameliorated (temperate conditions may have arrived about 9,000 years ago). Mammals could have reached the island in various ways, such as by swimming, flying (bats), being transported on floating debris or by man, and walking across seasonally frozen bodies of water and early land connections. A broad expanse of the coastal plain now under water probably remained exposed for a while after the ice front receded, and this would have permitted rapid invasion of the Long Island area. But the rising sea level eventually flooded the shelf and finally severed all land connections between the island and the mainland.

Surface soils of the island, which are well to excessively drained, and tend to be acid, vary from gravels to sands to silt loams. Although the climate (temperature, precipitation) is generally quite favorable, about one-half of the soils are so sandy and porous and of such low water-holding capacity that they are nonagricultural (Cline, 1955; Free et al., 1957). The extensive pine-oak barrens and abandoned fields of central and southern Suffolk County are on such soils. The more fertile areas are on the western end (now under intensive urban pressure) and along the north shore. The production of potatoes is an important industry on soils with good water-holding capacity in northeastern Suffolk County, and locally elsewhere.

There are no large streams on Long Island. Much of the rain water sinks through the deep, porous ground materials to form ground water. The Peconic River, flowing east into the depression between the north and south forks, is the largest stream. Ponds and swamps are rather numerous, however. The coast is indented with many tidal inlets, bays, and estuaries.

Climate

Much of the following is from Taylor (1927). Long Island has a milder climate than the remainder of New York State, and has a long growing season which averages between 180 and 210 days in length. The climate in general resembles that of the nearby mainland, but the ocean has a moderating influence here, reducing to some extent the extremes of summer heat and winter cold. The climate differs somewhat at the two ends of the island. Spring is later on the eastern end, where the influence of the cold ocean water retards the growth of vegetation (leafing of trees, etc.), and this difference,
which may be as much as 2 weeks, is very noticeable if
one travels from Brooklyn to Montauk at this season.
There is, however, a long frost-free season on the east
end, since killing frosts rarely occur late in spring, and
the moderating effect of the ocean also tends to delay fall
frosts. Central Long Island occasionally experiences very
hot periods in summer; the heat may be especially op-
pressive in the pine barrens where the open canopy lets
down much more sunlight than other forest types.

The average annual precipitation is 40-50 inches
over most of the island, and somewhat less than 40 inches
in the Napeague-Montauk region. Snowfall averages about
20-40 inches, less than mainland New York, and a snow
cover rarely lasts because of the relatively mild climate
(winter of 1960-61 unusually severe). There is a good
dead of rain during the winter. Summer months are the
driest, the lack of rain producing occasional droughts
destructive to plants on the highly porous soils, especially
when combined with high temperatures and winds.

Long Island is a windy place, and where there are
no obstructions, as at Montauk, Shinnecock Hills, and
along the outer barrier beaches, wind has a pronounced
local effect on the vegetation. In such areas during winter
the wind makes it feel much colder than the thermometer
indicates. Weather Bureau records show that Montauk
Point is one of the windiest spots along the Atlantic
Coast. In summer, regular, cooling "sea breezes" make
eastern Long Island and the outer beaches pleasant.

Severe coastal storms such as hurricanes (usually in
late summer) and northeasters (usually in winter), occa-
sionally batter the coast. At times they break through
the outer beach strip to create new tidal inlets, which
may increase the salinity and affect the life of the bays.
The inlets may become sealed off again naturally or shift
from east to west; man has worked to keep some of them
open for boating by building jetties and dredging. Some
of our field work was conducted in the vicinity of Shin-
necock Inlet, which was created during the exceptionally
destructive hurricane of September 21, 1938, and Mor-
iches Inlet, which was opened during a storm in March
1931. Helmhut (1954) wrote a fascinating account,
based on his personal field observations, of the great
hurricane of 1938 on eastern Long Island and its effect
on the bird and small mammal populations of the area.

Western Atlantic coastal waters between far northern
tropical seas may be considered to belong to three
main zones or faunal provinces, significant in the distribu-
tion of many marine invertebrates and vertebrates.

There is a cold-water zone north of Cape Cod and a warm-
water zone south of Cape Hatteras; Long Island is in
the northern part of the temperate-water zone between
the two capes.

Vegetation

The vegetation of Long Island has been profoundly
affected by the activities of modern man, especially on the
urbanized western end, where very little remains of the
original flora. Indians had been living on Long Island
for many centuries prior to the arrival of the white men.
Undoubtedly the former had some effect on the vegeta-
tion through their deliberate burning of the woods, help-
ful in hunting game, and their clearing of the ground to
plant corn and other crops. But the big change began in
the 1600's when the whites replaced the aboriginal in-
habitants. The first Dutch farm was established in what
is now Brooklyn in 1625, and English settlers, by way
of Connecticut, arrived on eastern Long Island in 1640.
The English spread west rather rapidly along the coasts
of Long Island, while the Dutch for a time controlled
the western portion.

By 1670 Denton was able to write: "Long Island
. . . is inhabited from one end to the other. On the west
end is four or five Dutch towns, the rest being all Eng-
lish to the number of twelve, besides villages and farm
houses." He also wrote of meadows and hayfields which
supported a plentiful supply of cattle and other livestock.
As for the Indians, Denton stated that in his own time
they were reduced from six towns to two small villages,
although the survivors still went hunting and fishing and
raised crops of corn.

Svenson (1936) discussed the early vegetation of
Long Island, quoting extensively from Denton (1670)
and other writers of long ago. In early Colonial days
there were tall and impressive stands of timber, espe-
cially on the western end and along the north shore;
tall red oak, white oak, hickory, black walnut, American
chestnut, and beech abounded. Much of the valuable
timber was removed very early. Long Island was praised
by the settlers for its wild fruits, an abundance of straw-
berries, blueberries, huckleberries, cranberries, grapes,
and beach plums; the wild strawberries were large and
eagerly sought.

The vast pine and oak barrens, typical of central and
southern Long Island today, were mentioned by early
travelers. Apparently much of this forest became de-
graded, however, by heavy cutting and ever more fre-
cquent fires. Swamps of southern white cedar formerly
were much more widespread than at present, and typi-
cally bordered the heads of tidal streams all along the
south shore. The Hempstead Plains, unusual in being
considered a true natural prairie in the East, originally
comprised an area 16 miles long, covered with tall grass.
Denton (1670) stated that it was being mowed for hay,
and used to graze sheep and other livestock and for rac-
ing horses. A sizable portion of the Plains remained until a few decades ago, but now only a small remnant has survived the spread of suburban housing. According to Taylor (1923), early Colonial documents described the hilly coastal grasslands still existing in the windy Montauk area, known as the Montauk Downs. The grassy, rolling Shinnecock Hills apparently are more stabilized than formerly; older writings refer to a lack of vegetation and drifting sand in this area. The woods of Gardiners Island reportedly grew the largest trees in all of the Long Island area up until the destructive hurricanes of 1938 and 1944. According to Taylor (1923), woods in a relatively sheltered area near Montauk Point had trees as large as those of Gardiners Island before a severe storm in 1815. The barrier beach and salt marsh habitats, once relatively inaccessible, are endangered by steadily increasing recreational use of the entire south shore.

The climate and elevation are fairly uniform throughout Long Island and small differences are of minor importance in the distribution of plants. Underlying geological materials, soil types, and moisture are significant. The pine barrens, for example, grow largely on the sandy, gravelly outwash plains, while a mixed deciduous forest covers richer, moister sites on the north shore moraine. Brodo (1968) points out that there is a strong correlation between soil types and vascular vegetation on the island. Fires play an important role in the barrens, favoring fire-resistant pitch pine and scrub (bear) oak; where fires are especially frequent the pines and oaks are low and shrubby.

Brodo (1968) described the vegetation types of Long Island, and referred to the many botanical papers dealing with local areas and plant associations. Peters (1949) gave an account of the dominant types of vegetation. A brief and sketchy classification, based on these and other references and my own field work is given below. All of the 14 major categories listed were searched for small mammals except for the nearly vanished Hempstead Plains; some of the study areas were in miscellaneous or edge habitats not resembling any of the major types. Habitats where the various mammals were found are mentioned in the species accounts, and some of the collecting areas are shown in the photographs (figures 1 to 26).

**Mixed deciduous forests.** The forest of the richer soils of western Long Island (now surviving only in parks and other small areas) and also on the north shore (in estates and woodlots). Large trees, growing especially tall in the western areas—black oak (*Quercus velutina*), white oak (*Q. alba*), red oak (*Q. rubra*), beech (*Fagus grandifolia*), tuliptree (*Liriodendron tulipifera*), black birch (*Betula lenta*), hickory (*Carya spp.*), and others.

**Oak forests.** These occupy extensive areas on drier soils in central Long Island and on the south fork (both west and east of the pine barrens, and elsewhere). Scarlet oak (*Q. coccinea*), black oak, white oak, and other oaks.

**Pine barrens (or Pine-oak barrens).** The typical pine barrens on Long Island consist of nearly pure stands of pitch pine (*Pinus rigida*), with an extensive undergrowth of scrub oaks, especially the species known as bear or barren oak (*Quercus ilicifolia*). Also blueberries, huckleberries, and the low ground cover, bearberry (*Arctostaphylos uva-ursi*) may be found. This habitat is especially characteristic of dry, very well-drained soils, and high incidence of fire. Areas where all the vegetation is low and scrubby are sometimes called “pine plains” or “oak brush plains.” The pine region extends from eastern Nassau County east to Riverhead and Hampton Bays.

**Pine-oak forest.** Similar to the pine barrens, but more mature, with older trees and a large proportion of treesized oaks, such as white oak and scarlet oak. Pitch pine, the dominant conifer of Long Island, and the various scrub and tree oaks, the dominant deciduous trees, also are found growing in all sorts of complex combinations. The predominantly oak woods in turn merge with the mixed deciduous forests.

**Other forests.** Of interest are certain woodlands near the coast of eastern Long Island and on the outer barrier beach, which are relatively small in extent but apparently long-established and unlike woods elsewhere. Most publicized is the Sunken Forest, where holly (*Ilex opaca*), tupelo (*Nyssa sylvatica*), sassafras (*Sassafras albidum*), shadbush (*Amelanchier*), and other species form a deeply shaded woodland sheltered behind the inner dunes on Fire Island. In Hither Hills there is a woodland (“Hither Woods”) of old oak trees somewhat dwarfed by the wind and formerly festooned with lichens. A stretch of woods near Montauk Point (“Point Woods”) contains a beautiful stand of beech, oaks, holly, red maple, etc. Other rich woods with large beech and oaks on eastern Long Island are on Shelter Island and Gardiners Island. On the survey, we collected in the woods of Hither Hills, and to a lesser extent in the woods of Montauk and Shelter Island, and only visited the Sunken Forest and Gardiners Island.

**Southern white cedar swamps.** Coast or southern white cedar (*Chamaecyparissus thyoides*), growing closely together, is the dominant tree. Ground cover consists of sphagnum moss. Now of very limited distribution on Long Island, cedar swamps are found mainly near ponds and streams in the eastern part of the pine barrens region.

**Red maple swamps.** This is the most frequent type of swampy woods; common along streams throughout
the island. Red maple (*Acer rubrum*) is numerous, and tupelo is often present.

**Sphagnum bogs.** Small areas of leatherleaf (*Chamaedaphne calyculata*), sedges, sphagnum, and other bog plants are found in wet areas of the pine barrens and eastern Long Island. *Chamaecyparis* may be present as scattered trees or along the edge. Abandoned cranberry bogs also are present locally.

**Fresh marshes.** Fresh-water marshes, with grasses, sedges, cattails, and the like, are found mainly along south shore streams, around ponds, and in kettle holes.

**Hempstead plains.** This natural prairie land, formerly extending across much of central Nassau County, is (or at least was) dominated by a species of beardgrass (*Andropogon scoparius*).

**Downs (grassy coastal uplands).** The Montauk Downs, described in detail by Taylor (1923), are grassy, rolling hills with occasional islands of shrubs and a very few widely scattered trees. Here the wind seems to be principally responsible for preventing or greatly slowing down the development of trees. The Shinnecock Hills are somewhat similar and are exposed to winds blowing across the ocean and Great Peconic Bay. The vegetation consists of *Andropogon* spp. and other grasses, with clumps of bayberry (*Myrica pensylvanica*), beach plum (*Prunus maritima*), etc., and some scattered trees (pitch pine, red cedar).

**Dunes (grass and thickets).** Sand dunes are the backbone of the outer beach strip, and also occur in some other areas. Probably the largest dunes on Long Island are the spectacular moving or “walking” dunes on the east side of Napeague Harbor. Desert-like conditions prevail on the dry sandy dunes; beachgrass (*Ammophila breviligulata*) is the most vigorous dune plant in exposed situations, while certain shrubs (bayberry, beach plum) are frequent. Along the ocean, primary or outer dunes lie just behind the beach, while a bit farther back are the more stable secondary or inner dunes. In the interdune valleys, and in depressions and hollows, may be found moist, protected situations where the vegetation is relatively dense (and small mammals numerous).

**Salt marshes.** Located primarily in the bays along the south shore, these marshes are still fairly widespread. They are covered periodically by salt water during very high tides, and contain certain plants, such as salt-meadow grass (*Spartina patens*) and marsh-elder (*Iva frutescens*), not found in other habitats.

The extensive Napeague Meadows, situated between Napeague Harbor and the ocean dunes, does not seem to fit any of the above categories exactly. Quite a few small mammals were collected in this flat, open, maritime area containing both moist meadow (fresh to salt) and dry sandy ground.

**Abandoned fields.** Dry, sandy, abandoned farm fields with grasses (especially *Andropogon virginicus*) and various weeds, are frequent on the poor soils of central Long Island and were covered in this survey.
Opossum

*Didelphis marsupialis virginiana* Kerr

The opossum is generally common on Long Island, but apparently it has been a resident here only during the past 100 years or so. It became established late in the 1800's, probably as the result of repeated accidental introductions and releases. Seemingly contrary to the prevailing evidence is a statement by Denton (1670) naming the opossum as a food of Long Island Indians; however, Denton did not include this marsupial in a list of Long Island mammals presented elsewhere in his publication.

Audubon and Bachman (1851) predicted that the opossum would in time become established on Long Island, and in other areas east of the Hudson River, because the living animals were constantly being carried there. Helme (1902) mentioned accumulating reports of opossums in the early 1880's and stated that in a few years they became common with a wide distribution the full length of the island. Opossums were quite common at Montauk in 1893, but had become common there only a few years earlier (Dutcher and Dutcher, 1893). By the late 1880's several towns were paying bounties for the destruction of opossums, but this seemed to have no appreciable effect on their abundance, even though thousands were reported killed in some years.

Nowadays, this is one of the mammals frequently found dead along many of the highways on Long Island, indicating a high population present. The opossum seems to thrive in the more thickly settled areas, and is even found within the limits of New York City. In our field work, this species was frequently noted along the south shore, throughout much of the south fork, in the central pine-oak region, and in some north shore areas. We regularly saw opossums in sandy and marsh-edge habitats on the outer barrier beach between Moriches Inlet and Shinnecock Inlet.

However, in comparing today's abundance with that suggested in the early reports, and judging from the records of experienced observers extending over many years, there are fewer opossums in some sections of the island at present than during their first decades of explosive increase. Roy Latham (personal communication) writes that opossums were common in Orient and throughout the north fork from 1900 to 1930, but have become scarce within the past 10 years, while red foxes and raccoons have increased dramatically since 1930. Our field work in 1963, and conversations with local residents, indicated opossums to be quite rare on Shelter Island; opossums were formerly common there, according to Latham, and he has records for Shelter Island up to 1943. The opossum seems to have had a checkered career on Staten Island, including a marked increase late in the past century.

Masked Shrew

*Sorex cinereus cinereus* Kerr

Distribution and habitat. The masked or common shrew is rarely seen and is not as familiar to Long Island residents as the eastern mole, short-tailed shrew (also often called "mole"), and the various kinds of mice. Nevertheless, it is quite possible that this is the most numerous mammal on Long Island. Trapping results indicated this to be the case at least for the less developed areas of Suffolk County. *Sorex* was outnumbered in our total Long Island catch by *Blarina*, *Peromyscus*, and *Micototus*, but these last three are more easily trapped than this tiny *Sorex*, which, when it does encounter a trap may often escape untouched or fail to spring it. Furthermore, on Long Island this species is found in a great variety of environments, as discussed below. This is the smallest mammal found here; in New York State only the pigmy shrew (*Microsorex*) is smaller, and it is not known to occur on Long Island.

Trapping results indicated the presence of this species in just about every habitat on Long Island with sufficient ground cover, including both damp and dry situations, and areas with or without woody growth. Grasslands of every description, except where the grass was too sparse, were especially productive; over half of the specimens were taken in grass. Such habitats included abandoned fields, the Shinnecock Hills, fresh marshes (along streams, etc.), salt and brackish marshes, moist and dry grassland at Montauk Point, and dry sandy places near the shore (such as depressions among the dunes, meadows at Napeague, etc.). In these habitats various shrubs, sedges, and miscellaneous herbs were often present, but grass of
MAP 3. LONG ISLAND, SHOWING MOST OF THE AREAS AND LOCALITIES MENTIONED.
one kind or another was the dominant feature. This shrew and Microtus were frequently found together, the former often traveling the runways of the latter.

This little shrew occurs all along the outer barrier beach of the south shore, such as Jones Beach, Fire Island, and between Moriches and Shinnecock inlets. Individuals have been found under old logs and other driftwood on the upper beaches of both the north and south shores and at Montauk Point.

Sorex cinereus was also common in the woods. Oak woods, mixed deciduous woods, pitch pine barrens, swampy woods of red maple and other trees, southern white cedar swamps, and both dry and damp coastal woods near Montauk Point, all yielded their quotas of this shrew. Probably it occurs in the Sunken Forest on Fire Island, although we did not trap that part of Fire Island. In the woods the shrews were trapped under the leaf litter and fallen branches, about stumps and logs, in mole tunnels, and in mossy cavities in maple swamps and at the base of cedar trees (figure 8). Hamilton (1949) wrote of trapping many in woods at Roslyn (north shore of Nassau County), and they are still found in wooded parks in eastern Queens.

Sphagnum bogs were also good for finding Sorex (figure 9). Here, leatherleaf, other shrubs, and sedges grow above the thick sphagnum carpeting the ground; the shrews were found in runways and cavities on and under the moss. In several of the cool cedar swamps and sphagnum bogs Sorex cinereus was the only species of small mammal collected. These habitats are very reminiscent of areas in the New Jersey pine barrens, many of the same plants being found in both regions. But the New Jersey region has a richer mammal fauna in that the cedar swamps and sphagnum bogs there are inhabited also by the red squirrel (Tamiasciurus), red-backed mouse (Clethrionomys), bog lemming (Synaptomys), and meadow jumping mouse (Zapus) which do not occur on Long Island, except for the jumping mouse, which is scarce.

Sorex cinereus is present on Staten Island and Shelter Island. I do not know of any records of this shrew on Gardiners Island, Plum Island, or Fishers Island, but would not be surprised if it was found on these islands off the east end of Long Island.

Reproduction. Masked shrews were found to produce young on Long Island for at least half the year, from April through October. On April 27, one female examined was carrying seven embryos, while five other females in April were already nursing litters—April 18 (1), April 26 (3), and April 27 (1). Reproduction continued through the summer and in October as well, although at a reduced rate since there was evidence of fewer pregnancies after June. On October 14, a female carried six quite small (about 2.5 mm.) embryos, and another one on October 20 was lactating. Litter size based on eight embryo counts averaged 5.9 (range four to seven); embryo size ranged from about 1 mm. (diameter of swellings) to 11 mm. (crown to rump length). Adult males in evident breeding condition (reproductive structures markedly enlarged) were collected from March 18 to October 14. The first juveniles out of the nest were trapped June 7 and 8.

Measurements. Forty adult males, collected from March to October at various localities in Suffolk County, and all in apparent breeding condition, average: weight, 4.7 grams (3.4-6.4); total length, 99.3 mm. (92-105); tail, 38.7 mm. (35-42); hind foot, 12.0 mm. (11-12.5). Females are closely similar in size and 30 adult females (eight with embryos) from March to November (same localities) average: 4.8 grams (3.2-7.9); total length, 99.2 mm. (92-105); tail, 38.2 mm. (33-41); hind foot, 11.9 mm. (10-12.5). If the eight pregnant females are excluded, the 22 remaining adult females weigh slightly less, averaging 4.5 grams (3.2-6.0).

Individuals taken. 216

Short-tailed Shrew

Blarina brevicauda talpoides (Gapper)

Distribution and habitat. On Long Island, Blarina is distributed from Brooklyn to Montauk Point and on some of the offshore islands. This large shrew is generally abundant in many different habitats throughout its range, which blankets much of eastern North America. On the island we found Blarina most numerous in woods with deciduous trees (133 taken), such as oak or mixed deciduous woods, oaks with pines, and red maple swamps; and in inland fields (91 taken). Only a relatively small number (26), were taken in all other habitats, that is, seven or less were taken in each of the following: pine barrens, southern white cedar swamps, sphagnum bogs, fresh marshes, salt marshes, and coastal dunes and grasslands. Several extensive traplines in these habitats did not yield a single specimen, and also we failed to find any at our outer barrier beach localities.

This was quite different from our experience with Sorex cinereus. Especially in sandy grasslands near the shore (including the outer beaches), in salt marshes, and in sphagnum bogs, Sorex was much more numerous than Blarina. The following are some examples of this among trap returns in the period 1961-63: Napeague Meadows...
on the south fork (traps mostly in dry sandy grassland) —40 Sorex, no Blarina; Hither Hills (in grassy depressions near Napeague Harbor)—20 Sorex, two Blarina; various sphagnum bogs—17 Sorex, four Blarina. Many of the traps were set in Microtus runways in these areas. On the other hand, in woods and also in many fields away from the immediate vicinity of the coast Blarina seemed to be the more numerous shrew. Blarina also was common on wooded bluffs of the north shore, overlooking Long Island Sound.

In woods and fields, short-tailed shrews were frequently taken in close association with pine mice, in the same burrows in the humus or sandy soil. Also, mouse traps set in tunnels of the eastern mole took many of these shrews. Nineteen were caught in star-nosed mole tunnels in red maple swamps at Belmont Lake State Park, Babylon. Of course, being so numerous in general Blarina was also found living together with the other small mammal species in one area or another.

Blarina was common during this survey in 1963 on Shelter Island, in both woods and fields. Richard Van Gelder (verbal communication) has trapped this species on Gardiners Island. The short-tailed shrew occurs at Orient Point and also on Fishers Island, but I do not know of any records for Plum Island. This island is a quarantined animal disease laboratory and few naturalists visit. Blarina is common on Staten Island, where the least shrew (Cryptotis parva) also occurs.

Reproduction. Only five pregnant females were taken, the earliest on March 22. Embryo counts ranged from five to eight (average 6.7). Males in apparent breeding condition were collected from January 16 (1962) and March 9 through the first half of October.

Measurements. Fifty adult males from various months average: weight, 17.9 grams (13.4-24.1); total length, 119.4 mm. (109-129); tail, 24.9 mm. (21-30); hind foot, 14.2 mm. (13-16). Twenty nonpregnant adult females (various months) average: weight, 16.1 grams (12.9-20.9); total length, 119.5 mm. (112-128); tail, 25.4 mm. (23-28); hind foot, 14.3 mm. (13-15).

Individuals taken. 250

Eastern Mole

Scalopus aquaticus aquaticus (Linnaeus)

Distribution and habitat. This is the common species of mole on Long Island, and it is also present on Staten Island. The hairy-tailed mole (Parascalops) which is the common mole in woods and drier ground in most of "upstate" or mainland New York, has not been found in this region.

The eastern mole occupies most of Long Island where the ground is not too wet. Probably it is most numerous in some of the mixed deciduous woods along the north side of the island where richer soils accommodate high populations of invertebrates. However, the mole also occurs in the sandy ground throughout the pine and oak areas, and in abandoned fields, of the central and south shore portions of Suffolk County. The conspicuous ridges, marking the course of the shallow subsurface tunnels, may be seen even in exceedingly barren situations, such as under scrubby waist-high "pine plains" vegetation south of Riverhead. The mole also invades suburban yards, where its tunnels and mounds disfigure lawns to some extent.

East and west, its range extends nearly the full length of the island—from parks within New York City limits to well out on both the northern and southern peninsulas, or forks, of eastern Long Island. On the north fork a mole was collected within 3 miles of Orient Point. On the south fork we did not find the eastern mole in the immediate vicinity of Montauk Point, but it was common in the Hither Hills region a few miles from the point. In their mammal survey of the Montauk region before the turn of the century, Dutcher and Dutcher (1893) wrote: "No moles of any kind were observed east of Napeague Beach, although careful search was made, nor did we hear of any mole ridges ever being seen on Montauk. Napeague seems to them to be an impenetrable barrier." In the present survey (early 1960's) we found mole tunnels numerous at Hither Hills, which is east of the narrow neck at Napeague. Perhaps Scalopus is extending its range eastward in this sector.

Scalopus is present on Shelter Island, according to Roy Latham (personal communication). Moles have not been collected or reported on Fire Island, Gardiners Island, Plum Island, or Fishers Island, as far as I know. It seems likely that moles are absent from some if not all of these islands.

This mole frequently digs through pure sand in the vicinity of tidal water. The tunnel ridges may be seen in sandy ground along the very edge of salt marshes or meandering across dunes near the ocean. Such areas seem insufficiently provided with food, and are probably not permanently occupied by the moles, but the tunnels in these situations are conspicuous. Near Moriches Bay (in April) I noted a mole tunnel in a rather high, sandy bank bordering a salt marsh stream. Long, raised mole tunnels across the surface of the smooth sand are fre-
quent in the moving dunes area at Hither Hills State Park. At nearby Napeague Harbor in June, mole tunnels were seen which traversed the rolling surface of beach dunes and wandered over the level upper beach. Near East Hampton I trapped a mole during December in a sand tunnel on inner dunes about 800 feet from the ocean; cover consisted of bare sand alternating with patches of woody hudsonia (Hudsonia tomentosa) and lichens. A remarkable spot to see a mole tunnel was on a sandbar about 1,000 feet long separating Peconic Bay from a pond and salt marsh. Here (in March) a mole had tunneled for hundreds of feet through low sand dunes, with beach-plum (Prunus maritima) and beach-grass (Ammophila) for scattered cover. The mole finally stopped upon encountering an outlet stream which crossed the beach. Some of the tunnels, such as those at Napeague Harbor, were in locations which would occasionally be covered by salt water during storms or exceptionally high tides. But I did not see Scapanus tunnels in the true intertidal zone of beaches, such as have been reported by McCully (1967) for the California mole (Scapanus latimanus).

Fresh swamps and meadows on the island are mostly without moles, since the semi-aquatic Condyllura is extremely local here, and the present species generally avoids water. Occasionally though, tunnels of Scapanus penetrate a short distance into the damp soil of creek banks and wet woods. In the shrubby grassland of Shinnecock Hills, moles seemed scarce; tunnels were noted only in a few depressions among the hills. On the grassy, hilly Montauk Downs I did not find any evidence of mole activity.

Moles seemed to be uncommon in some cultivated areas, such as farmlands on the north fork. In this section moles were found primarily in the lighter soils of hilly, wooded areas, such as Browns Hills, where they are common. Roy Latham (personal communication) explains further: "Scapanus is restricted to the hills in Orient and dry soil on the north fork. I never saw it in the heavy farm land that is cultivated. It is uncommon in Greenport and Orient. Common in most sections of eastern Long Island." In Browns Hills, in June 1963, in a woodland of hickory, hackberry, and other deciduous trees, with an undergrowth of rank weeds, the loose, fertile soil teemed with earthworms, insects, and other invertebrates, and was riddled with mole tunnels (one Scapanus was collected).

Specimens were trapped in the different habitats mentioned above, such as various types of deciduous woods, pine barrens, fields, suburban yards, and sand dunes. Most specimens were caught with ordinary mouse snap traps placed crossways in the tunnels, level with the lower surface, and the opening above covered over with cardboard, although they are harder to catch this way than Parascalops or Condyllura. Some were collected in each of the four seasons; in cold, midwinter weather, trapping was possible in tunnels where the ground was not frozen, such as those under deep pine-needle litter. Moles remained active in winter in tunnels near the surface as long as the ground was not deeply frozen.

Also at this season (December, January) I occasionally noted in yards and gardens, large, conspicuous "mole hills," larger and more numerous than usually made by this species. These mounds probably consisted of earth brought up from deep burrows undergoing excavation. The ground often had a lumpy appearance in such areas, apparently the result of irregular up-and-down tunneling or shifting of earth, instead of the usual horizontal digging. In the warmer months a surge of increased activity near the surface was common when it rained following a dry period, especially in sandy areas.

Short-tailed shrews and pine mice were found to travel through the mole tunnels frequently and to make holes opening up on the surface. Other species such as masked shrews, meadow mice, and white-footed mice also used the tunnels in some localities.

**Food habits.** Eighteen stomachs were examined (five spring, four summer, six fall, three winter). Insects are foremost in the diet in much of the area judging from this small sample, being found in all the stomachs checked and comprising 68.8 percent of the total volume. Earthworms have been reported as the primary food of this mole in many regions, but I found them in only two stomachs (6.7 percent of volume). A mole from a north shore locality where earthworms were numerous, however, had been feeding almost entirely on these animals (June).

In most other Suffolk County localities where moles were collected, such as Riverhead, Hampton Bays, etc., earthworms are not so common, and insects were first in the diet. Most important in this category were "white grubs," the large larvae of June beetles (Scarabaeidae: Phyllophaga), 26.1 percent of total volume and present in 10 stomachs; and ants (Formicidae), 21.2 percent of total volume and in 11 stomachs. Over 100 ants were counted in one stomach (March). Other insects eaten included other Coleoptera (adults and larvae) and larvae of Lepidoptera and Diptera. Other invertebrates, which were present in only small numbers were slugs, sow-bugs (Isopoda), spiders, and centipedes.

The only vertebrates detected as food were two red-backed salamanders, (Plethodon cinereus, lead-back color phase), in the stomach of a mole collected at Flanders
The only record he had was one he found lying dead in the street at Miller Place on the north shore, about 4 miles east of Port Jefferson; Helme thought perhaps the animal had been dropped by a hawk which had carried it over from the Connecticut mainland. Jackson (1915) listed other New York, but no Long Island localities for this species, and he did not include Long Island in his map showing the geographic range of *Condylura*.

Three specimens, all males, collected on western Long Island after Helme's publication are in the American Museum of Natural History. Two are from Baldwin in Nassau County—September 1, 1907 (A.H.H.), No. 35155, and September 28, 1908 (D. Franklin), No. 73626; the third specimen was taken north of Jamaica in Queens, May 17, 1913 (H. Boyle), No. 37271. Apparently these specimens did not come to the attention of Jackson and others. Suitable habitat probably no longer exists in those localities. There are also some published references attesting to the presence of this species on Long Island. Audubon and Bachman (1851) stated they had received specimens from a collector on Long Island. Nichols (1907) on April 18 received a star-nosed mole (caught by a cat), from Great Neck, north side of Nassau County. Turrell (1939) termed the star-nosed mole as "fairly abundant" in the Smithtown region but gave no additional details. Probably he found the species present in this area without realizing its general scarcity on the island. The star-nosed mole is present on Staten Island, where some have been found in barred owls (*Strix varia*) nests and pellets (Chapin, 1908; Davis, 1908).

On our survey, a very few reports were received of animals seen (or found dead) which were recognized as this species by the observer, or consisted of a convincing description of it. Reports represented both north and south shores of western Long Island—Nassau County and into Suffolk County as far east as the Connetquot River. Because *Condylura* is so distinctive in appearance, such reports are considered reliable. Gilbert S. Raynor and Richard Van Gelder (verbal communications) also have received a few sight reports of this species on Long Island.

In and near Belmont Lake State Park, at Babylon, I collected six star-nosed moles and found numerous signs of this species. Whenever visiting meadows, wooded swamps, or streamside areas on the island which looked suitable for *Condylura* I examined the ground closely, but never found definite signs of its presence other than in this one locality. Favorable-looking but apparently uninhabited spots were examined at Carmans River, Eastport, East Hampton, East Quogue, Flanders, Forge River, Hauppauge, Middle Island, Nissequogue River, North Hills, Peconic River, and Westhampton Beach. On Great Hogs Neck, on the north fork of eastern Long Island, mole tunnels were present in wet, black, swamp soil where there were many earthworms, tunnels which may have
been the work of this species. This seems somewhat questionable, however, since no specimens were taken and tunnelings of the eastern mole were abundant in dry soil nearby.

Thus it appears that the star-nosed mole is, or was, most common towards the western end of the island; however, in this section probably most of its habitat has been destroyed by the expanding metropolitan area. Evidently its range extends eastward in a spotty manner along both the north and south shores of the island. If it occurs in eastern Suffolk County, it must be very local, since we did much field work there without finding the species. Possibly the widespread boggy, acid conditions in the wet areas, with an accompanying scarcity of earthworms or other food, is unfavorable. However, Christopher McKeever has shown me an unpublished list of Long Island mammals by William T. Helmuth (consisting of marginal notes written in a copy of Hamilton, 1943) which records East Hampton as a locality for *Condylura*. This is far to the east of other specimens and reports, although I have not learned of any star-nosed moles actually collected at East Hampton.

The Babylon habitat was situated along a small stream, tributary to Carlls River (figures 13, 14). The moles were found inhabiting the ground at least one-fifth of a mile along the stream, in the vicinity of the west boundary of Belmont Lake State Park (on both sides of the boundary line). Most of the mole activity was found within a few yards of the creek, which was shallow, sluggish, and about 2 to 3 feet wide. The ground was wet, mucky, and black and contained many earthworms. The site was rather heavily wooded with red maple and tupelo, and many shrubs and vines such as highbush blueberry, arrow-wood, common elderberry, *Smilax*, etc. Skunk cabbage and cinnamon fern also were plentiful.

No evidence of mole activity was detected in this area at first glance. The colony was located by probing the ground by hand until some rather deep tunnels were located. No surface ridges of pushed up soil were present. Eventually, small, inconspicuous "mole hills" were noticed—mounds of mucky soil pushed up from tunnels below and partly covered by fallen leaves. The larger mounds were about 2 inches high and 6 inches in diameter. These mounds apparently were made in the fall; by spring they had almost entirely disappeared, although the moles were still numerous in the area. Also, shallow tunnels of *Condylura* were noticed when setting traps—these were typically along the sides of logs and were merely furrows covered by leaves and other debris. From some of the tunnels vertical shafts led down to the water level a short distance below.

Two individuals were trapped on December 1, 1961, and four were caught on April 24, 1963. All were taken using standard wood pedal mouse traps set down in the tunnels in spaces excavated with a knife. Other small mammals present were *Blarina*, *Peromyscus*, and *Microtus*; *Blarina* and *Microtus* frequently used the *Condylura* tunnels. Other wildlife along the creek included woodcock, raccoon, opossum, cottontail, and gray squirrel. I have since learned that this creek area has been scheduled for drainage and other "improvements," which probably means the end of the colony of star-nosed moles.

**Food habits.** Earthworms ranked first in the stomach contents of the six moles examined, comprising 55 percent of the total volume and occurring in five stomachs. Insect larvae, including numerous craneflies (Tipulidae), were second at 26 percent of volume, present in five stomachs. Other foods included beetles, spiders, and plant material.

**Reproduction.** All three males taken on April 24 were in apparent breeding condition, with much enlarged reproductive structures (testes 20-21 mm.).

**Measurements.** Three April adult males average:

- weight, 49.4 grams (48.3-50.0);
- total length, 185.7 mm. (185-186);
- tail, 68.0 mm. (64-71);
- hind foot, 26.8 mm. (26-27.5).

An adult female, in April, without embryos, measured:

- weight, 58.5 grams;
- total length, 185 mm.;
- tail, 67 mm.;
- hind foot, 27 mm.

**Individuals taken. 6**

**Little Brown Myotis**

*Myotis lucifugus lucifugus* (Le Conte)

**Distribution and habitat.** At the present time the little brown appears to be the most numerous summer bat over most of Long Island. Evidently it has increased considerably in numbers since the early part of the century. Helme (1902) does not mention this species, except for stating, under a brief account of the big brown bat, that a smaller unidentified brown species is of occasional but rare occurrence on Long Island. Murphy and Nichols (1913) stated that *Myotis lucifugus* was scarce at that time, that it rarely frequented houses or towns on the island, and that the species was not collected here until 1900, when three were shot from a flock of a dozen or more at Cold Spring Harbor.

The little brown myotis was known to be common in many mainland regions of New York State before 1900—such as the Adirondacks, Catskills, and Oneida...
Lake region, and to form large colonies in buildings, at least locally, as summarized by Miller (1899). DeKay (1842) in his account of the little brown bat, which probably refers to *Myotis* in general, but this species primarily, stated that it was “very numerous... in the southern counties” (of New York). However, neither author mentions Long Island in his account of this species.

Today, summer colonies are well established at scattered localities over most of Long Island. During the survey, small bats observed hunting over ponds or clearings in most sections of the island usually appeared to be this species. Some accounts for the 1930’s indicate it was common then: Nichols and Nichols (1934) found this species the most plentiful bat in summer evenings near Mastic on the south shore in 1934; Turrell (1939) had little to say about bats but remarked that this species was familiar in the Smithtown region near the north shore of the island. Roy Latham, in a personal communication, writes that the little brown species is common on Shelter Island.

Reports and complaints of colonies of brownish bats in houses (especially attics), churches, and other buildings during the summer were frequent. Such cases are generally referable to either this species or the big brown bat, but I did not visit very many of the sites. Most observing and collecting of this species was done at a readily accessible summer maternity colony discovered in the attic of an old abandoned house near Manorville, in central Suffolk County. However, one other summer colony was visited, situated in a large, old, inhabited house north of Southampton. Also, reports of colonies which were probably *Myotis lucifugus*, or were identified as this species by the observers, were received from localities representing the central, north shore, and south shore sections of Suffolk County. I did not learn of any really large summer colonies, consisting of many hundreds or even thousands of individuals, such as have been reported for some regions.

In evening observations we never discovered large concentrations of hunting little brown myotis such as are frequently encountered in many areas of mainland New York State. Observations, mainly at certain ponds and clearings in eastern and central Suffolk County, only occasionally produced as many as three or four individuals in a group. At some localities none at all were seen, at others only a single one, even when weather and insect conditions seemed very favorable. This may indicate a relatively small population, in spite of the known colonies present, or the better hunting grounds may have been overlooked. More little browns were seen in August and September than in June and July, probably reflecting increase in the population and dispersal after raising of young. Habitats where bats identified as this species were seen hunting included large ponds in both wooded and residential areas, small pond hidden in dense maple swamp, clearing in pine barrens, field near pond and house, vicinity of a dump, and once or twice at a street light.

*Myotis lucifugus* is also present on Staten Island; in fact all the species of bats which occur on Long Island have also been collected or reported on Staten Island, except perhaps *Myotis keenii*, for which I have been unable to locate any Staten Island records.

The little brown myotis hibernates chiefly in caves and mines, situations lacking on Long Island. Judging from what is known of seasonal movements of *Myotis lucifugus* in New England and elsewhere, most of the Long Island population probably migrates north or west to mainland cave regions for the winter. There is very little evidence of hibernation in situations other than caves and mines in the Northeast, although this possibility has not been fully investigated. Of interest in this connection is a personal communication from Roy Latham; he reports finding little brown bats (*Myotis*), thought to be this species (or possibly *M. keenii*?), in winter in the cellar of an old house near a swamp on Shelter Island, and some flying activity on mild days in February.

Reproduction (maternity colony). Occasional observations were made in 1962 and 1963 at a maternity colony, where, as is the custom of these bats, females gather in summer to give birth and raise their young. The colony was discovered May 23, 1962, in a low attic of an old abandoned farmhouse (figure 10) near Manorville. About two dozen bats of different ages were collected here and in outlying buildings during the two seasons. The attic had a broken window at each end, and was about 6 feet high at the center; the bats commonly clustered just under the peak of the roof on top of the ridgeboard. They were readily visible through a narrow space on either side, between the roof and ridgeboard.

The colony was not large; usually 30 to 50 little browns were visible. A maximum number of 51 adult females was counted on June 26; I believe this was most of them, and allowing for a few probably missed, the colony of adult females probably numbered about 60 in both years. Later in the season, the number was increased somewhat by the addition of young. Numbers remained high into the first week of August in 1962 but by August 9 there was a definite decline in the population as the bats dispersed. Some bats were present at least until September 25, when six remained. Visits in
October (9th and 18th) revealed no little browns, indicating the site had been deserted for the season. In 1963 no bats were found in mid-April (visits on the 12th and 18th), but the next visit, on May 15, revealed some of the bats had arrived, with about a dozen or more on hand, suggesting that the colony had begun to form at the end of April or in early May.

It appeared that most young probably were born in June. Nine females, each bearing a single embryo, were examined between May 15 and June 26. Embryos ranged from 5 to 20 mm. in size; the largest (20 mm.) were examined on June 2 and 26. The first small young, two which were probably a few days old, were seen June 26. These were nursing, were partly furled, and could crawl but not fly (weight of one: 3.7 grams, total length, 62 mm.). One large young close to early flight stage (weight 6.4 grams, total length 78 mm.) and probably 2-3 weeks old, was collected June 29; it could flap its wings strongly but was still nursing and had not yet begun to feed on insects. By August, active, approximately fully grown young bats at least a month old were noted in the colony.

A few bats occupied a large shed 50 yards away from the house. Most of the time only one or two males plus an occasional *Eptesicus* were to be seen. But on June 2 an adult female carrying an embryo was found tucked away in a crack, well removed from the main colony. Also from late August to late September some females and many of the active young were present, and had presumably moved over from the main building.

In the fall of 1962 the chimney of the house collapsed, leaving a gaping hole in the roof, which admitted much more light and air into the attic. This change in the environment did not seem to adversely affect the bats, and their production of young the following year, although observations were terminated July 2, 1963; on this date over 40 adult females and several crawling young were seen.

On the evening of June 8, 1962, (weather warm and calm) I watched from outside for bats to emerge, but saw only 20 fly out of the house, fewer than were actually present. Some may have been missed, since the bats came out of several openings beside one of the windows. After 9:15, when it was completely dark, I went inside and found several flying about within the house and at least nine still inactive in the roost. The bats were carrying embryos at this time, and may have been less active for that reason. On August 29, 1962, after two nights with much wind and rain associated with a tropical storm ("Alma"), three bats collected had virtually empty digestive tracts.

**Measurements.** Fifteen adult females in summer (May 23 to September 25) average: weight, 10.0 grams (7.7-12.0); total length, 94.2 mm. (90-101); tail, 40.2 mm. (37-44); hind foot, 9.5 mm. (9.0-10.0); ear from notch, 15.1 mm. (14-16); tragus, 6.9 mm. (6.5-7.0); forearm, 38.8 mm. (36.5-40); wingspread, 264.1 mm. (250-275). Eight of the May and June females carried embryos; some of the August and September bats were quite fat—the heaviest individual (12.0 grams) was one of those collected on September 12. An adult male on June 26, 1962: weight, 8.5 grams; total length, 87 mm.; wingspread, 252 mm.; forearm, 37.5 mm.

**Individuals taken.** 34

**Keen's Myotis**

*Myotis keenii septentrionalis* (Trouessart)

**Distribution and habitat.** Very little is known about this species on Long Island, and few specimens have been collected here previously as far as I know. The first published occurrence was of an individual found in a house at Mastic, Suffolk County, on August 18, 1933 (Nichols and Nichols, 1934). Two other specimens from Long Island, collected in August 1886 (R. Waldo) and at Mt. Sinai, July 1940 (E. A. Williams, Jr.) are in the American Museum of Natural History. Roy Latham collected one at Mattituck, September 19, 1931 (skin and skull in his collection). The mapped range for *Myotis keenii* in Hall and Kelson (1959) seems misleading in that it does not include Long Island; the island is small on the range maps, which are designed to show much of the continent, but the other bats occurring here are correctly indicated.

This long-eared, northern myotis is not considered a rare species but it never seems to be abundant either, and it has been studied only casually. Most Keen's bats have been encountered in caves and mines in winter and during the late summer swarming period; relatively few have been observed on the summer range away from such retreats. Thus a large concentration of this species discovered on a Long Island feeding ground seems noteworthy and is described here in some detail.

All of our specimens were collected at Fresh Pond, Hither Hills State Park, on the south fork near the east end of the island (figure 22). Here Keen's myotis was found hunting in the evenings throughout the summer and early fall season and appeared to be the most numerous bat. Using Japanese mist nets, 11 (three males, eight females) were taken on June 26, 1963; two (one male, one female) on August 22, 1963; and nine (four males, 5 females) between October 2 and 18, 1962. During these operations about 15 other myotis were netted and re-
leased, and all of them were Keen's; no other species of myotis was taken. Besides those netted, additional scores of small bats were seen flying about in a similar manner; probably many or all of these also were M. keenii. Such information suggests that Keen's may be the commonest summer bat in sections of extreme eastern Long Island, replacing the little brown and big brown bats of farther west. Recent reports received of small brown bats in summer on Gardiners Island just a few miles north of Hither Hills may possibly indicate the presence of this species there.

Fresh Pond, about one-half mile long and two-tenths of a mile wide, is completely surrounded by woods, chiefly oaks (especially black oak, white oak) with a fairly dense shrub layer. The area is rather hilly. There are some fields and meadows within half a mile of the pond, where an occasional small bat (Keen's?) was seen. The peninsula is a little more than a mile wide here, with the bat collecting site situated about three-tenths of a mile from its north coast. Keen's bats are known to live in summer in such retreats as cottages, barns, and beneath the bark of trees. No buildings were noted in the immediate vicinity of the pond, and I did not find any bats in a hurried check of a few park buildings in the general region, although small colonies could easily be overlooked. The Keen's bats at the pond may represent a gathering from small colonies scattered in trees in the surrounding woods, or they may spend the day in buildings farther away, outside the park.

This species was first encountered in October 1962, when mist-netting was tried out at Fresh Pond after some red bats were seen. Much of the pond was bordered by impenetrable bushes and small trees, but netting was possible at a tiny shallow cove with a sandy bench. The nets (about 40 feet long, 3/4 inch mesh) were set at right angles, approximately, to the shoreline. Usually one pole was placed on shore a few feet back from the water's edge, the other pole out in the shallow water; the net was attached between the poles, the lower edge of it a few inches above the water, the upper edge about 8 feet high. One to three nets were set up on netting nights; they were up by early twilight and taken down before midnight. Netting was restricted by the weather—often the evenings were windy here, rendering the nets ineffective.

On most evenings Keen's myotis did not appear before dark. On October 11, for example, none was seen during twilight in more or less continuous observation; yet four were netted after it was thoroughly dark (8:00, 8:30, 10:00, and 10:15 p.m., E.D.T.). After becoming active, these bats often hunted very low over the water close to shore, sometimes flying in tight circles in the cove and frequently touching the water. Also they were seen at times closely following the shoreline, and flying above the bushy foliage at the water's edge. Individuals were caught above both water and land, from several inches above the surface to 4 feet high. Often these bats were seen to avoid the nets repeatedly, while at other times they flew directly into the nets. On one occasion a Keen's bat was observed chasing another one, and thus off-guard both plunged headlong into a net.

Bats were not sought here after October 18, although conditions remained warm and favorable for another week. Late in the month the weather turned much colder, with strong winds, light snow, and frosty nights. This species, like Myotis lucifugus, generally hibernates in caves during the winter, and all or most of the Long Island individuals presumably cross to the mainland for this purpose.

In the following year Fresh Pond was first visited on June 26, a warm and calm evening with many insects visible in the air. Many Keen's bats were about, but I was unable to detect any other species. Eleven keenii were collected using two mist nets placed near the wooded shore, in the usual manner, between 9 and 11 p.m., E.D.T. Scores of the bats were seen; many bounced off the nets, others were caught and released. All females collected carried well-developed embryos.

The pond was next visited on August 22, and again Keen's myotis, but no other species, was recorded. No bats at all were seen until late, darkening twilight (8:30 p.m., E.D.T.), when suddenly two were flying about close by, often to within a foot or two of my head and shoulders as I stood in shallow water. Soon more appeared. Three were caught in a mist net. The bats on this date hunted about 2 to 6 feet above the water and shore. Also they sometimes entered the woods by flying very low along paths leading away from the shore. It was not determined how far into the woods they went, but under the canopy of the trees seemed to be part of their "beat," at least on this evening.

The flight of feeding Keen's myotis showed a fairly steady course (in straightaway or when circling), with occasional sudden veering to one side; it would not be termed a fluttering flight. Regarding voice, these bats usually seemed silent in flight except for an infrequent short high-pitched squeak. When alarmed or excited, as when caught in a net or being handled, they gave a squeaking chatter very reminiscent of Myotis lucifugus.

In partial summary of the above observations on their foraging habits at Hither Hills, Keen's myotis are active in the area at least from June to October, appear late in the evening when it is quite dark, are numerous and associate together when feeding, and have a direct
manner of flight; both summer and fall they hunt low over the water (often 1 to 6 feet); and they also fly low over the shore, close to foliage, and low under the canopy of woodland trees. In this locality heiniti seemed to be the commonest bat and was the only Myotis taken. Stomach contents, containing the remains of many insects have been saved, but not as yet examined closely to determine the identity of the insects.

Reproduction. Apparently small nursery (maternity) colonies are formed, but essentially nothing is known of reproduction in this species (Barbour and Davis, 1969). Reproductive females netted at Fresh Pond in late June indicated the presence of such colonial roosts in the area, but we did not locate them. Each of the eight females taken on June 26 contained a single, fairly large embryo, suggesting birth of young mainly in July (embryo crown to rump measurements, in millimeters, were 8, 13, 13, 14, 14, 15, 15, 16). The date seems a little later than with most of our local bats, and agrees with Hamilton’s (1943) information for elsewhere in New York (he mentioned 3 females with single large embryo taken in late June and early July, indicating parturition in July).

Measurements. Eight adult females in June with embryos average: weight, 8.3 grams (6.4-9.2); total length, 91.6 mm. (86-96); tail, 38.1 mm. (36-40); hind foot, 9.6 mm. (9.0-10.5); ear from notch, 17.6 mm. (17.0-19.0); tragus, 9.1 mm. (8.5-9.5); forearm, 36.0 mm. (34.5-37.5); wingspread, 249.8 mm. (241-253). Three adult males in June average: weight, 6.0 grams (5.5-6.4); total length, 85.7 mm. (83-88); tail, 39.0 mm. (38-40); hind foot, 9.2 mm. (8.5-9.5); ear from notch, 17.3 mm. (16.5-18.0); tragus 9.0 mm. (all about 9.0); forearm, 34.7 mm. (34.0-35.0); wingspread, 243.3 mm. (232-237). Weights of nine specimens of both sexes in October average: 7.2 grams (5.9-9.7). All of the above bats had food in their stomachs. The October specimens had accumulated considerable body fat.

Individuals taken. 22.

Silver-haired Bat

Lasiomycteris noctivagans (Le Conte)

DeKay (1842) termed the silver-haired bat as common on Long Island (season not stated). Since then, various writers (Helme, 1902; Murphy and Nichols, 1913; Nichols and Nichols, 1934) have shown that this northern bat is rare on Long Island in spring and early summer, is occasionally plentiful in late summer and early autumn (period of southbound migration), and that, singly or in groups, a few remain to hibernate during the winter in hollow trees, in ships, and in buildings of every description. It has been reported from Staten Island, New York Harbor, and Brooklyn east to Orient Point, Montauk Point, and over the ocean.

Nichols and Nichols (1934) collected five specimens between June 17 and July 10, 1933, at Mastie, establishing the first definite information on the presence of Lasiomycteris through the summer. The authors, experienced in collecting bats on Long Island, were surprised to encounter this species in June, outside the period of southward migration; two of the June ones were females carrying well-developed embryos.

As with the red bat, the highly migratory silver-haired bat has been encountered migrating south along our beaches (both north and south shores) and even out over the ocean. Migrating individuals may linger to hunt over woods, clearings, and bodies of fresh water; on the coast quite a few have been found resting on vessels at anchor. Helme (1902) stated that in some years during migration this species even outnumbers the red bat, but that in other years very few are seen. Large numbers have been seen gathering in late summer in Prospect Park, Brooklyn, and flying over the lake there (Murphy and Nichols, 1913). We did not collect or positively identify this species on the survey; some of the bats seen in the Hither Hills area in October 1962, may have been silver-hairs—if so, they were apparently outnumbered by Keen’s bats and red bats. Roy Latham has in his collection several Lasiomycteris secured during the month of September on the north fork of eastern Long Island and on Shelter Island; two specimens from Shelter Island were found drowned in a pail of water on September 3, 1929, by W. W. Worthington. Latham’s latest fall record is October 10 (1939).

Robert Cushman Murphy has made many observations on the migration of this species along our coast. Early in the morning of September 6, 1907, while in a boat 4 or 5 miles off Sandy Hook, New Jersey, in blustery weather, he saw several individuals struggling towards the Staten Island shore (Murphy and Nichols, 1913). A specimen in the American Museum of Natural History was collected by Murphy while 3 miles at sea off Long Beach, Nassau County, on September 7, 1918. Murphy and Nichols also wrote that silver-haired bats have been seen in September evenings flying above the beaches of Long Island Sound and circling high over Mt. Sinai Harbor and other salt water inlets. A far-offshore record is one collected on August 19, 1953, after it circled about and landed on the rigging of a vessel in 39°36' N, 71°03' W, about 95 miles SSE of Montauk Point, the nearest land (Mackiewicz and Backus, 1956).
Long Island seems to be near the northern limit of the winter range of this species. Regarding winter habits in our area, Murphy and Nichols (1913) wrote: “Silver-hairs . . . are not infrequently found in hollow trees cut in winter for firewood, and they also have been discovered hibernating in sky-scrapers, churches, wharf-houses, and the hulls of ships in New York City and Brooklyn, during the months between December and March.” The authors also referred to over 20 “black bats” found in January in Port Jefferson Harbor aboard a yacht, and then thrown overboard by the captain, as probably belonging to this species. Roy Latham (personal communication) has one winter record for Orient, a lone individual found in a building on January 23, 1946. Another winter record is a female Lasionycteris in the American Museum of Natural History which was collected at Mastic in February 1937, by David G. Nichols.

Eastern Pipistrelle

Pipistrellus subflavus subflavus (F. Cuvier)

The little pipistrelle is apparently uncommon on Long Island. Helme (1902), Murphy and Nichols (1913), and Nichols and Nichols (1934) did not mention this species. But Hamilton (1949) wrote that one summer evening he nearly succeeded in capturing one with an insect net. Roy Latham collected a male pipistrelle at Montauk on August 25, 1931; preserved as skin and skull in his collection, this is the only Long Island specimen I have examined.

During our survey, a bat identified as a pipistrelle was observed on the night of October 10, 1962, at Bellows Pond near Hampton Bays. At 8:00 p.m., E.D.T., in bright silvery moonlight, I watched a tiny bat with an erratic and moth-like fluttering flight hunting back and forth above the tops of tall bushes near the pond. It appeared smaller and had a different manner of flight than the little brown, Keen’s and other bats that were observed on the island.

Known hibernation sites of the pipistrelle are chiefly caves and mines, and the deficiency of such sites on Long Island may account for the scarcity of this species. Not much is known about distances traveled by this small bat to and from its winter quarters.

On Staten Island, pipistrelles have been found in barns and other buildings during the summer. Several which have been collected there are in the American Museum of Natural History.

Big Brown Bat

Eptesicus fuscus fuscus (Palisot de Beauvois)

Distribution and habitat. This large bat may be seen anywhere on the island, and since it is hardy and often hibernates in buildings, it may also be encountered during any month. Eptesicus fuscus is a rather sedentary species, as stated by Barbour and Davis (1969), and it seems likely that most of the population remains on Long Island throughout the year. Maternity colonies as well as hibernating sites appear to be most frequent in the western part of the island, and this bat is not uncommon in the urban areas of Brooklyn and Queens. Murphy and Nichols (1913) wrote that Eptesicus frequents large parks and cemeteries in Brooklyn, and hibernates abundantly in city buildings of the area. Several old publications indicate that the big brown was also common on Long Island during the last century, and DeKay (1842) obtained this species in Kings County (Brooklyn). Eptesicus also raises young (at least locally) and hibernates in Suffolk County, but becomes less common towards the east end of the island.

Complaints about bats in buildings frequently came from western Suffolk and eastern Nassau Counties. On investigating a few of these reports, some big brown bats were found. In a small village in eastern Nassau County, a maternity colony was located high in a house (where 20-30 bats were shot in the previous year in an unsuccessful attempt to eliminate them). The bats were not readily accessible, but big brown bats were seen peering out of holes near the roof on July 27. On the previous day, which was very hot, the bats had been reported hanging on the outside surface of the house with their young. Also, bats were heard squeaking during the day in woods near the house, possibly in hollow trees, although we were unable to locate them.

At another house nearby in the same village, during late May, 25 bats (Eptesicus?) were reported shot while flying out of the attic at dusk, after which no bats were seen there. In a nearby town up to 60 bats had been reported emerging at dusk in May from the attic of a large building. On entering the attic June 2, I found the floor littered with many droppings which seemed to be of this species, but the site appeared to be almost deserted, even though these bats had not been shot or molested as far as I know; only a solitary male Eptesicus was present. Big browns occasionally leave a nursery roost at least temporarily; one reason, as mentioned by Barbour and Davis (1969), is that this species is not as tolerant of high temperatures as Myotis lucifugus, and during a hot spell may move to a cooler part of the building or
abandon it altogether. Or possibly this was a recently abandoned winter roost.

A maternity colony of big brown bats has occupied a large barn near Yaphank in central Suffolk County for some years (LeRoy Wilcox, verbal communication).

At the attic colony of little brown bats near Manorville, one or two adult male *Eptesicus* were often found in small sheds near the main house, from May to October. Although maternity colonies of these two species do not occur together, individual male big brown bats were apparently attracted to the vicinity of the *Myotis* colony. In October, after the little brown had abandoned the location for the season, single big brown were occasionally seen hanging in the attic itself (where the smaller species had raised young).

The big brown bat was frequently detected in an area by seeing lone individuals, just before dark, flying rather high on a straight, steady course to their feeding grounds. Localities in eastern Suffolk County where *Eptesicus* was seen or collected, although maternity colonies were not found, include Amagansett, Calverton, Flanders and Squiretown. Near Amagansett, well out on the south fork, several were seen in late June hunting around street lights near the ocean. Solitary individuals were noted on two or three occasions flying before dark near buildings on the outer beach strip (between Shinnecock and Moriches inlets).

Summer maternity colonies and wintering individuals have been found on Staten Island.

**Food habits.** Only two stomachs were examined, and these were filled almost entirely with beetles (Coleoptera), including large June beetles of the family Scarabaeidae; some remains of moths (*Lepidoptera*) were noted in one of the stomachs.

*Individuals taken.* 4

**Red Bat**

*Lasiurus borealis borealis* (Müller)

**Distribution and habitat.** Helme (1902) designated this species as the most abundant bat on Long Island. Likewise, Murphy and Nichols (1913) stated that "During most of the summer a bat seen anywhere on Long Island is, nine times out of ten, a red bat. The species is abundant from the busy streets of Brooklyn to Orient and Montauk ..." As far as I have been able to determine, this no longer seems to be true on most of the island, although the red bat is not rare. In many areas the little brown *Myotis*, which was found to be scarce by Murphy and Nichols, is the bat most likely to be encountered. Locally, other species, namely Keen's and big brown bats, appear to be first in abundance. Also, in some apparently favorable situations, such as certain ponds and fields on still summer nights when insects were abundant, we failed to detect any bats at all.

There does not seem to be much information on the status of this bat during the early summer season (June, July), before the fall migration, except that it appears to be widely distributed but not abundant then. In 1933, four red bats were collected between July 3 and August 7 among more plentiful *Myotis lucifugus* at Mastic (Nichols and Nichols, 1934). Lanyon (1961) termed the red bat a regular but uncommon summer resident on the Kalbsliech Field Research Station in the Dix Hills area of western Suffolk County, and mentioned a specimen collected on July 12, 1961.

Red bats have been collected on Long Island in every month from late May to late November; many specimens are in the American Museum of Natural History. Murphy and Nichols (1913) stated that the red bat appears on Long Island on the first warm spring days, and that there is a Staten Island record as late as December 5. Kimball and Nichols (1940) have recorded this species flying about at Mastic, Suffolk County, on mild days in December (as late as December 26, 1936, and December 25, 1937). I do not know of any winter records later than December. Most red bats move well to the south of Long Island for the winter; but the late December sight records suggest that a few individuals, hidden and dormant, may remain this far north all winter, emerging to fly only during unusually warm spells. The red bat does not hibernate in caves, and generally roosts in trees throughout the year.

The red bat is most frequently observed in this region during late summer and early fall. This species, like the silver-haired and hoary bats, is highly migratory, and southbound flights and concentrations are often noticed along the coast at this season. Red bats may be seen flying by day over the beach or ocean, or found roosting in unusual locations. Carter (1950) reported on a flight of 200 bats seen around a ship en route to New York, about 65 miles offshore (40°10' N, 71°00' W) on September 29, 1949; three individuals collected were red bats. Several reports we received, from south shore localities in the fall, of bats hanging in trees and bushes during the day or found dead on the ground, seem to refer mainly to this species. LeRoy Wilcox and Walter Terry have informed me that they usually catch one to several red bats in mist nets each fall, while banding migratory birds on the outer barrier beach strip near
Quogue. These bats probably come across Long Island Sound, too, and during October many have been found hanging asleep on exposed roots under the overhang of the beach cliffs which fringe the north shore (Murphy and Nichols, 1913). The seven specimens I collected were taken between August 21 and October 18; also all of my field observations of this species were made during August, September, and October.

**Field observations.** Red bats were seen in August in the area of Shinnecock Bay and adjacent barrier beach. Individuals were occasionally seen flying over the bay in all directions at twilight, apparently dispersing to feed rather than migrating on these flights. Here, on the outer beach strip near Shinnecock Inlet, I watched one migrating by day on August 10, 1968, at 4:30 p.m., E.D.T., in bright sunlight. The bat flew over the marshy bay side of the strip, heading in a generally southwesterly direction, that is, following the coast. When "on course" it flew high with a steady flight, but also it occasionally interrupted its progress to dip down low, perhaps to feed. Once it flew low around a small salt marsh pond close by; the red color was striking in contrast to the green of the marsh grass. Numerous birds, including terns, shore birds, starlings, and swallows were present, but they showed no interest in the bat. After a few moments the bat resumed its trip. I followed its course with binoculars as it flew, occasionally dipping down again, before it was lost to sight. Also on this date there was a nearly continuous passing of barn swallows (*Hirundo rustica*), tree swallows (*Iridoprocne bicolor*), and monarch butterflies (*Danaus plexippus*), all migrating in the same direction as the bat.

During our survey, these bats were most regularly encountered on the eastern part of the south fork, hunting over ponds and clearings and around certain street lights during the early fall season. Here they seemed to gather and linger, and could be seen whenever the weather was not too bad. Rather intensive searching in these same areas in June, however, failed to indicate the presence of red bats.

Red bats were observed on mild October evenings at Fresh Pond (figure 22), the large pond at Hither Hills described in the account of Keen's myotis. Here they were seen flying high over the pond and adjacent woods, and also hunting close to dense vegetation along the shore or skimming over the water. Occasionally one was seen early, while it was still quite light, but normally red bats did not appear until late twilight or after dark, when they were caught in Japanese mist nets or spotted momentarily in the light of a strong flashlight. The presence of hunting red bats seemed to be determined in part by the occasional large concentrations of moths along the shore of the pond. Bats of both sexes appeared to be common.

Migrating hawks of various species were occasionally noted in this area in the fall, and as many as seven pigeon hawks (*Falco columbarius*) were seen in one afternoon flying over or perching near the pond. One of the early flying red bats observed was apparently pursued by a pigeon hawk. As I watched a red bat circling above the pond late in the afternoon, on October 11, 1962, a pigeon hawk darted from its lookout perch on a tree on the opposite side of the pond and headed directly toward the bat. The bat turned toward the woods, the hawk followed, and both disappeared behind the trees without my learning the outcome of the brief episode. But it seems likely that this swift little falcon, a fairly common coastal migrant in early fall, may at times prey on migrating or other day-flying bats, as well as birds.

At Fresh Pond, red bats were taken in mist nets placed along the shoreline over the water and beach; net captures were made from just a few inches above the water to over 6 feet high. Sometimes these bats were observed to detect the nets as they hunted low over the water, veering off at the last possible moment and again. Once one was seen to collide with a net, and then fall into the water; but it managed to fly up into the air after flapping its wings on the water for a few moments. These bats occasionally gave rather loud hissing screams when caught or handled.

Near some villages on the south fork red bats were seen hunting around bright street lights, often quite near the ocean. Usually they were seen repeatedly at certain lights to the exclusion of other similar lights nearby, probably indicating rather fixed hunting territories of individual bats. At the lights the bats made swift passes at the clustering insects, then disappeared into the dark for a while before returning.

**Food habits.** The stomachs of four red bats collected at Fresh Pond during October 1962, contained many moths. Many, perhaps most, of the moths belonged to the family Geometridae, and numerous moths of this family were also observed swarming over the water and near shore during warm evenings. Small beetles and other insects were also eaten.

**Measurements.** Four October specimens average: weight, 10.6 grams (9.2-11.8); total length, 102.3 mm. (96-106); tail, 44.5 mm. (42-48); hind foot, 8.6 mm. (8.0-9.0); forearm, 39.3 mm. (37.0-40.5); wingspread, 301.0 mm. (275-313).

**Individuals taken.** 7
Hoary Bat

*Lasius cinereus cinereus* (Palisot de Beauvois)

On Long Island this large, handsome bat is the rarest of the three highly migratory species, which (like birds) fly south in the fall and north in spring. As with the red and silver-haired, most occurrences are in late summer and autumn. Murphy and Nichols (1913) knew of records of hoary bats being collected on Long Island in August, September, and October, including one discovered under a driftwood plank on a north shore beach. Kimball and Nichols (1940) reported an individual hanging on the porch of a cottage facing the sea at Oak Island, south shore of Suffolk County, on December 2, 1939, apparently the first published record later than October. It was assumed by the authors that this individual was still migrating on this late date, not disturbed from hibernation.

This heavily furred species may be considered a rare possibility any time during the colder months. There are a few December, January, and February records for the general latitude of Long Island (Connecticut, New Jersey, and Pennsylvania). DeKay (1842), in his discussion of this bat in New York State, mentioned seeing two individuals actively flying about shortly before noon on December 12, 1841; he did not mention the locality, but I assume it was somewhere in the State, possibly even Queens, Long Island, then DeKay’s place of residence. In the American Museum of Natural History there is a female hoary bat, preserved in alcohol, which was collected on January 16, 1969, at Far Rockaway, southern Queens, by John Bull; this is the only midwinter record for Long Island, as far as I know. Such records may indicate that a few individuals hibernate in this region, well to the north of most of their fellows. Hoary bats, like red bats, normally roost among the twigs and foliage of trees and generally do not frequent caves or buildings. Perhaps trees serve as winter retreats also, with the bats leaving them to fly after insects on warm days, although practically nothing is known for certain about the winter habits of this species.

There seems to be no information on spring migration of hoary bats in the Long Island area. Nor do I know of any records of these elusive bats during the period from about late May to early July when they give birth to young. They appear to be more common farther north at this season, but a few may occur here since Roy Latham has recorded this species as early as July 14, and specimens have been collected in nearby New Jersey and Pennsylvania during June.

Our only observation on the museum survey was of one flying low, near a street light after dark, at Hampton Bays on September 29, 1962. For Orient, Roy Latham (personal communication) has four records, dates ranging from July 14 (1963), as mentioned above, to October 29 (1919).

Eastern Cottontail

*Sylvilagus floridanus mallurus* (Thomas)

Distribution and habitat. Two cottontail rabbits, the New England cottontail (*Sylvilagus transitionalis*) and the eastern cottontail (*S. floridanus mallurus*) occur on Long Island, as indicated by Nelson (1909), Hamilton (1949), and others. Both kinds appear to be rather widely distributed on the island, based on specimen records. But the exact status of the two species—relative abundance and patterns of distribution, perhaps in the process of change—awaits clarification. Nelson (1909) and others have shown that *transitionalis* was probably the only native cottontail in an extensive area of the Northeast, including all of New York State and adjacent states to the north and south, and that *floridanus* has extended its range into this region rather recently. Possibly *floridanus* is in the process of replacing *transitionalis* on Long Island, as it has in some mainland areas of eastern New York and southern New England.

Also, cottontail rabbits of other subspecies of *S. floridanus* from certain midwestern states have been introduced on Long Island. Very likely some of these arrivals survived to interbreed with the local stock (*S. f. mallurus*), although presumably the native form tends to prevail in most areas of the island. Western cottontails became very numerous on Fishers Island following introduction (Joseph Dell, verbal communication).

Although fluctuating in abundance from year to year, cottontails are generally common from highly developed residential areas and parks in eastern Queens and even parts of Brooklyn to the very tip of Montauk Point, and near both the north and south shores. They are numerous on some outlying islands, including Shelter Island, Gardiners Island, and the full length of the outer barrier beach of the south shore, including Fire Island. Apparently *S. floridanus* is the common cottontail in most of these areas, judging from the many museum specimens of this species (American Museum of Natural History, U.S. National Museum, N.Y. State Museum, and elsewhere) from more than 30 localities throughout the island. The eastern cottontail is also common on Staten Island.
On the field survey, we collected 17 cottontail rabbits in the area south and southwest of Great Peconic Bay, that is, from Riverhead and Flanders south to Moriches, and outer beach near Quogue, Hampton Bays, and Mecox Bay. These animals all proved to be *Sylvilagus floridanus* (based primarily on skull characters commonly used in separating this species from *transitionalis*). Additional eastern cottontails collected included specimens from Shelter Island and Hither Hills.

It seems amazing that these fairly sizable, defenseless animals manage to survive in many built-up areas where their habitat consists solely of the yards of suburban homeowners. Here they thrive in spite of the many dogs, cats, people, and automobiles. Although not often noticed during the day, a visit to such areas at night may reveal rabbits feeding in the open on grass, clover, and weeds, or sometimes on the more valuable plants of yard and garden.

In the less developed countryside cottontails are widespread, wherever suitable food is found, and they feed on a vast array of shrubby and herbaceous plants. We found rabbits present in all sorts of woods, from dry to swampy, as well as in fields, bogs, and various grassy and bushy areas. Cottontails are found throughout the pine barrens and dry oak woods, although presumably in fewer numbers than in areas endowed with a greater variety of food plants. Often they were seen in or along the edge of red maple swamps; here there was evidence of their browsing heavily in winter on young red maples and other plants, such as greenbrier (*Smilax*).

On the highly agricultural north fork of the island, cottontails were very numerous wherever there were trees or bushes, at least in 1963.

Cottontails do well in the maritime areas. A walk through the grass and low shrubs among the oceanfront dunes often results in one to several individuals being startled from their forms and hiding places. Their droppings often seem to be "nearly everywhere" on the sand. The rabbits are even found in the beachgrass on the very summits of the outer or primary dunes, one of the few mammals regularly found in this environment. They may be encountered here any time during the year, although they probably withdraw somewhat towards the better cover about the inner dunes and edge of salt marshes during winter. In many sections, the salt marsh edge, with its rather good variety of food and cover plants is home for numerous cottontails. They also venture out into these marshes to a limited extent. On Fire Island we saw cottontails (and abundant signs of their presence) among the dunes, including the vicinity of the Sunken Forest.

**Measurements.** Four winter adults average: weight, 1,167.5 grams (984-1,279); total length, 407.8 mm. (398-421); tail, 43.5 mm. (40-45); hind foot, 93.5 mm. (91-96); ear from notch, 62.0 mm. (59-67).

**Individuals taken.** 20

**New England Cottontail**

*Sylvilagus transitionalis* (Bangs)

The New England cottontail is a small rabbit which is very similar in external appearance to the eastern cottontail, the two differing only slightly in pelage and form. But the two cottontails are distinct and separate species, even though closely related, and apparently they rarely hybridize in the wild. The New England cottontail does not presently appear to be as common on Long Island as the eastern cottontail. Nevertheless, in various museums there are specimens of *transitionalis* which have been collected at localities in Nassau County and east through Suffolk County (including some north shore and south shore localities) to Shelter Island and Montauk Point. During the 1930's about 20 were collected at Mastic by David G. Nichols and John G. Nichols (specimens in American Museum of Natural History). This species has also been collected on Staten Island.

The various locality records indicate that the two species of cottontail may be found in the same general area on Long Island. But I have no information on habitat differences, if any, although it has been shown that on the mainland *transitionalis* tends to prefer wooded and brushy areas, as opposed to more open areas often favored by *floridanus*.

Nelson (1909) observed that specimens of *S. floridanus mallurus* from New Jersey and southeastern New York, including Long Island, are especially close to *S. transitionalis* in size, and often in color. Benton and Atkinson (1964) add that identification of the two species is virtually impossible in the field and is difficult in the hand. This situation is frustrating to the active naturalists of the island who observe and study the local fauna. During the survey, we occasionally observed rabbits at very close range, encouraging tentative species identification based on several external characters such as apparent length and shape of ear (shorter and more rounded in *transitionalis*). Individuals thought to be *transitionalis* were observed at several south shore localities from Babylon to Montauk Point, and also on the north fork of eastern Long Island. However, one such individual was collected and it proved to be *floridanus* instead, thus
our field identifications cannot be relied on, although perhaps some of them were correct.

A close examination of key skull characters, which are consistently different in the two species, is the dependable way to distinguish the cottontails; Hamilton (1943) and Fay and Chandler (1955) are helpful references for identifying specimens. Recently, Hinderstein (1969) made a comparative study of skull characters of the eastern and New England cottontails in the region of northern New Jersey to Connecticut, including Long Island; she also studied geographical variation between Long Island and mainland specimens of each species.

Woodchuck

*Marmota monax rufescens* A. H. Howell

Woodchucks are only locally common, being distributed in a spotty manner over an extensive portion of central Long Island. I saw very few woodchucks during the survey, these primarily in fields and scrubby woods in the Peconic River region of Suffolk County. However, woodchucks occur westward about as far as central Nassau County, and are still common enough to cause complaints from gardeners in some areas of that county. They are also seen regularly along the Northern State Parkway north of Hicksville. Lanyon (1961) terms this species as regular and fairly common on the Kalbfleisch Field Research Station, in the Dix Hills area near Huntington, with daily observations (including den sites and juveniles) from mid-April to late November. Several writers have mentioned various habitats frequented by woodchucks on Long Island, including fields, meadows, wooded fence rows, brush, scrub oak woods, oak-hickory woods, hillsides, and highway and railroad embankments.

Woodchucks are found near the north and south shores in places, but today are rare towards the eastern end of Long Island as well as in the built-up areas of the western part of the island. Evidently the species was formerly much more numerous, but has declined in numbers; the reasons for this are not entirely clear. Helme (1902) maintained that woodchucks, although still common at the turn of the century, had become greatly reduced in numbers in many localities after several towns began paying bounties for their destruction. Also the rather barren, sandy pine and oak areas with their abandoned fields, although wild enough, may be capable of supporting only a low population of chucks.

According to Roy Latham (personal communication) years ago woodchucks were very abundant and widespread on the east end of Long Island, including Shelter Island; there were many in the agricultural Orient region before 1910, but Latham recorded his last one there in 1915. He reports that they are still present in the Sound Avenue section north of Riverhead and are found eastward from there, in small numbers, as far as Great Peconic Bay. Latham’s earliest seasonal record of this hibernator on the north fork was one caught near Orient on February 1, 1902.

Long Island specimens (skins and skulls) are preserved in the American Museum of Natural History, in the U.S. National Museum, and in the collection of Roy Latham. Although uncommon now, woodchucks have been on the island for a long time, and their remains have been found in Indian archaeological sites dating back many centuries before the white men arrived.

Eastern Chipmunk

*Tamias striatus fisheri* A. H. Howell

*Distribution and habitat*. Chipmunks are moderately common to conspicuously abundant in most wooded areas of Long Island. We saw them in and near parks in Queens and in residential areas on the north shore of Nassau County, eastward to Hither Hills State Park well out on the south fork. Also, chipmunks are reported as still present in Prospect Park, Brooklyn [where they are less common than formerly] and to occur as far east as Montauk (Anon., 1968a). Roy Latham collected one at Montauk in June 1927 (in his collection). Possibly this species is relatively new in the Montauk area, since Dutcher and Dutcher (1893) stated that there were no chipmunks in the woods of Montauk. *Tamias* is also present on Staten Island.

Chipmunk distribution appears to be “spotty” compared with many mainland regions, however, since we were unable to find it in several seemingly suitable areas near both the north and south shores. Also, *Tamias* shuns the immediate vicinity of the ocean beaches here, and is absent from most if not all of the small outlying islands off the east end and south shore of Long Island.

The majority of the specimens were collected in central Suffolk County south of Riverhead and Manorville, in pine barrens, and in oak woods and other deciduous growth. They are quite common in the pine barrens, especially near the ponds and streams found in parts of this region; pitch pine, bear oak, and blueberry comprised the principal woody cover in many of the pine-region localities. Chipmunks were noted as common in oak woodlands, also locally in various scrubby woods and residential areas near bays along the south shore.
Chipmunks were numerous throughout the period of this survey on the south fork of eastern Long Island in woods composed primarily of various species of oaks (white, black, scarlet). In contrast, this species seemed to be very rare on the north fork, at least during the summer of 1963 when observations were made in a number of wooded areas, including Browns Hills and Great Hog Neck (none seen, although probable burrow noted on Great Hog Neck). Gray squirrels, however, were recorded as being very numerous in the same north fork areas. Roy Latham (personal communication) writes that there are no chipmunks in Orient, and he has never seen them in Greenport, although he reports that a few chipmunks are found between those localities, at East Marion. From this it appears that Tamias striatus is quite scarce and local in this northeast section of the island.

Shelter Island appears to lack chipmunks altogether. In a week of active field work in June 1963, no chipmunks were found. Roy Latham adds that as far as he knows there are no Shelter Island records.

Food habits. Chipmunks feed on many kinds of nuts, seeds, fruit, and other plant material, and also on invertebrates and small vertebrates. Our observations were few and casual. Chipmunks were noted as consuming acorns and hickory nuts, the former probably an important staple here. In the pine barrens they feed on the seeds of pitch pine, as do gray squirrels and flying squirrels. During August I saw chipmunks climb wild black cherry trees (Prunus serotina) to feed on the fruit. In September some were seen joining robins and catbirds to feed on the fruit of tupelo (Nyssa sylvatica). Wild grapes and blueberries also were eaten in season.

Remarks. Little information was gathered relating to reproduction. A few females were collected in June and September with three to six placental scars, probably indicating spring and summer litters (there are two breeding periods in the eastern chipmunk).

Chipmunks sleep underground through the winter, although occasionally individuals are active above ground at this season. We did not see any chipmunks between November 22 and April 5, and most of our records were from May to October.

We received two or three reports of all-white chipmunks on Long Island. However, albino chipmunks are rare and were not seen by us.

One day during June, a red-tailed hawk (Buteo jamaicensis) was observed to catch a chipmunk in low, scrubby pine plains habitat just inland from Napeague Beach, an area, incidentally, where I had not previously suspected the presence of chipmunks. The hawk watched from the top of a telephone pole for several minutes, then it dove down, disappearing briefly among some bushy pitch pines, before emerging with a chipmunk in its talons. It flew off with its prey, pursued by a pair of noisy sparrow hawks (Falco sparverius) which apparently had their headquarters nearby.

Measurements. Eight adult males (Suffolk County; April to September) average: weight, 88.8 grams (79.0-105.3); total length, 237.7 mm. (230-251); tail, 87.3 mm. (85-90); hind foot, 34.0 mm. (31.5-36). Eight non-pregnant adult females (Suffolk County; June to September) average: weight, 82.5 grams (75.5-86.6); total length, 233.3 mm. (228-238); tail, 86.7 mm. (83-97); hind foot, 34.0 mm. (31.38).

Individuals taken. 26

Grey Squirrel

Sciurus carolinensis pennsylvanicus Ord

Distribution and habitat. This large squirrel is the conspicuous diurnal tree squirrel of Long Island; the red squirrel (Tamiasciurus) does not occur. We observed gray squirrels in all types of woodland: coniferous pitch pine barrens and small stands of southern white cedar as well as deciduous types such as oak, mixed deciduous, and swampy woods of red maple and tupelo. An adaptable species, it is found in city parks and crowded suburbs as well as in predominately open agricultural land, provided there are scattered trees, groves, or small woodlots. Occasionally individuals were encountered traveling on the ground at considerable distances from trees in both suburban and farm areas.

As one would expect, general observations indicate that gray squirrels are more numerous in the richer and more diversified leafy woods such as occur on the north shore, than in the pine barrens region. The former provides a more plentiful and dependable food supply. The species was noted as very numerous—at least in 1963—on eastern Long Island's north fork, where it was seen or heard almost every place where there was woody vegetation. For example, in Browns Hills, which extend to within 3 miles of the tip of Orient Point, it was noted as very numerous in June of that year, in scrubby areas as well as among tall trees. There is a great variety of trees here, including much hickory.

On the south fork in the same year, gray squirrels seemed much less numerous, although they were observed in various areas east to Montauk Point State Park. These squirrels were also recorded on Shelter Island and on outlying Gardiners Island. In the pine barrens of Suffolk County gray squirrels are fairly common; they are found
throughout the region wherever the trees are of appreciable size and they are often seen near streams or other bodies of water. Occasionally gray squirrels were noted in bushy pine plains habitat, probably foraging for food or passing through rather than residing in such areas. These squirrels are probably hard pressed to find food in the pine barrens during years of failure in pine cone or oak acorn production.

Gray squirrels are found near the ocean towards both ends of the island, but they become very rare and local on the barrier beach strip where it is widely separated from the mainland by Great South Bay and other bays.

Gray squirrels were noted to inhabit cavities in trees and also to build conspicuous outside leaf nests (often of oak leaves), as is the custom of this species. Reports were received of gray squirrels causing rather severe damage inside buildings, by chewing holes through walls in the attics of houses, and in summer camp and gun club buildings in the woods.

Food habits. Casual observations indicated gray squirrels feed on such items as nuts of hickory and black walnut, acorns of various oaks (including white oak, black oak), and seeds of pitch pine. Many of the feeding signs seen under pitch pines—little piles or scattered litter of scales and stripped cores of cones—were probably the work of gray squirrels. Nichols (1927, 1958) made interesting observations on the food habits of gray squirrels in a suburban area of western Long Island.

Color. Gray squirrels in the black color phase are uncommon here, but are occasionally observed. Several individuals essentially black throughout, although often with a noticeable brownish tinge to the pelage, were noted in Queens, Nassau, and Suffolk Counties. Apparently the black form is especially scarce on eastern Long Island, but I saw one at Hampton Bays in October 1961; Hatt (1930) reported on a melanistic gray squirrel from East Hampton (in the collection of Roy Latham). No white (albinistic) gray squirrels were seen, but reports were received of partially and completely white squirrels in certain areas, including Shelter Island and central Suffolk County; Roy Latham reports two white ones observed on Shelter Island in the winter of 1951.

Measurements. Seven adult males from Suffolk County average: weight, 609.7 grams (528.5-661.0); total length, 491.5 mm. (488-496); tail, 215.7 mm. (208-230); hind foot, 69.7 mm. (68-74).

Individuals taken. 11

Southern Flying Squirrel

*Glaucomys volans volans* (Linnaeus)

Distribution and habitat. This nocturnal species is still common in the more heavily wooded sections of central Long Island. There we found flying squirrels in woods with assorted oaks or other deciduous trees, pitch pine, mixed pitch pine and oaks, and southern white cedar. *Glaucomys* is present also on the north side of the island, near the Sound, and on the south side, near the bays, wherever there are suitable woods.

Eastward, however, the flying squirrel apparently extends only as far as Riverhead and Hampton Bays. It seems to be absent from woods on both the north and south forks and on the neighboring islands, such as Shelter Island and Gardiners Island; at least I have not heard of any records for these areas. Roy Latham (personal communication) has never encountered this species in years of field work on the north fork. In the present survey, many hours of evening observations and rodent trapping in the extensive oak woods of Hither Hills failed to indicate the presence of flying squirrels, although gray squirrels and chipmunks were common enough; the last two are evidently much more accomplished in crossing treeless ground and necks of land to reach such areas.

To the west, *Glaucomys* is restricted mainly by the expanding metropolitan area. Flying squirrels are present on the Kalbfleisch Field Research Station, in the Dix Hills area of western Suffolk County (Lanyon, 1961). In Nassau County a few are still present locally, and they also occur, or formerly occurred, within the limits of New York City, including Queens and Staten Island.

Flying squirrels were observed (a few collected), and seemed to be fairly common, well out in the extensive sandy pine barrens of Suffolk County south of the Peconic River (figure 3). They were not noted in the low, shrubby so-called "pine plains," but frequented areas where the pine trees were of fairly good size. But there was rarely much variety in the flora in these localities—mainly just the rather well-spaced pitch pine (*Pinus rigida*), some low understory oak, usually bare or scrub oak (*Quercus ilicifolia*), with the prostrate shrub, heathberry (*Arctostaphylos uva-ursi*) covering much of the ground. There was evidence of flying squirrels feeding on the seeds of pitch pine, and it may be that in this sparse habitat much of the diet consists of pine seeds, acorns, and perhaps fungi and insects or other animal food. Evening parties of flying squirrels were observed in stands of southern white cedar (*Chamaecyparis thyoides*)
in this region, especially along the edge of a large (for Long Island) cedar swamp near Riverhead (figure 7).

Remarks. Flying squirrels live in hollows of trees and stubs and also may build outside nests. One January day in a pitch pine and oak woodland near Hampton Bays I briefly shook a tall pine stub which had a conspicuous hole about 11 feet above the ground. A flying squirrel immediately came out of the hole and scurried to the top of the stub, after which a second one appeared at the entrance and gazed down at me, without emerging. After I backed off a short distance, they both settled back down in the cavity. Woodcutters reported up to a dozen or so flying squirrels found together in one large hollow tree or stub, and also we heard that they occasionally take up residence in buildings near woods, habits characteristic of this species.

At another locality, near Flanders, two females were caught during April at the base of an old pine stub (which had numerous holes). This area was of interest in that the stub was on a dry slope just above a small white cedar swamp, and in some of the cedars were outside nests somewhat resembling in general appearance the work of red squirrels (which do not occur on Long Island). The nests, most of which were fairly high up and on branches near the trunk, were globular, compact, and constructed mainly of shredded cedar bark with some cedar twigs and leaves included. These nests may have been constructed by flying squirrels rather than gray squirrels, at least the nests differed considerably from the usual leaf nests built by gray squirrels.

Measurements. The following figures are for specimens taken in Suffolk County during winter and spring. Four adult males average: weight, 72.3 grams (65.3-76.1); total length, 231.5 mm. (221-237); tail, 99.5 mm. (96-101); hind foot, 31.5 mm. (30.5-34). Three adult females without embryos average: weight, 67.9 grams (63.1-73.3); total length, 234.3 mm. (230-238); tail, 100.0 mm. (97-105); hind foot, 31.7 mm. (30.5-34.5).

Individuals taken, 10

White-footed Mouse

*Peromyscus leucopus noveboracensis* (Fischer)

**Distribution and habitat.** The white-footed mouse probably is the most widespread or generally distributed mammal on Long Island, although perhaps not the most numerous. This species was taken on more traplines than any other small mammal; very often only one or two *Peromyscus* were caught in a given area, but this was enough to indicate its presence. It seems to be rivaled only by the masked shrew in its adaptability to the various environments here.

Woods of every general type trapped were occupied by *Peromyscus*, including oak woods, mixed deciduous woods, maple swamps, pine barrens, and cedar swamps; dry, damp, mature, and second-growth woods were all inhabited. *Peromyscus* was numerous in the dry, sandy pine and oak woods of Suffolk County, and was definitely the most abundant mammal in the drier barrens, under pitch pine and low bear oak (figure 3). Also this is the common mouse of the cedar swamps, generally avoided by the other mice. Other moist areas inhabited included sphagnum bogs near woods, and bushy zones around ponds and along streams in wooded areas.

Open, treeless areas of various sorts were also occupied, and accounted for approximately one-fourth of the total catch. These areas were predominately grassy and often included low shrubs. The areas were primarily in two categories—abandoned inland fields and various coastal habitats.

In the coastal areas, trees were often far away and of no apparent significance to *Peromyscus*. Here the ground was usually dry and sandy, rarely marshy (fresh to salt), where these mice were collected. Little valleys and depressions among the sand dunes, such as are found at Hither Hills and at East Hampton Beach (figure 17), were found to harbor many white-footed mice. Fewer were found on the harsh outer dunes, a habitat of sand and beachgrass. Also *Peromyscus* was present in extensive, level, open areas at Napeague Meadows, on Shelter Island, etc.; beachgrass and other grasses, plus low shrubs (bayberry, beach plum, etc.), formed low cover in these areas. On the outer strip, *Peromyscus* was found in grassy and grassy-shrubby areas far from any trees; areas included Fire Island and the strip east of Moriches Inlet.

*Peromyscus* was common in various types of vegetation at the very end of Montauk Point, including the vicinity of the old lighthouse. Dutcher and Dutcher (1893, in their survey at Montauk, found this species present in woods, wet and dry meadows, and even under logs and rocks just above the tidal zone, in fact everywhere except on the open uplands.

Three white-footed mice were taken well out in salt marshes, one on the north shore (Mt. Sinai) and two in the Moriches Inlet area, but probably the mice had wandered out from drier, sandy areas. Salt marsh appeared to be the least preferred by *Peromyscus* of all the major habitats on the island.
Peromyscus has been collected on various smaller islands in this region besides Fire Island and Shelter Island. This species is present on Plum Island off Orient Point, and one collected by A. H. Howell in 1898 is in the U.S. National Museum. It is common on Fishers Island, and three collected by G. G. Goodwin in 1924 are in the American Museum of Natural History. For Gardiners Island, Richard Van Gelder (verbal communication) found Peromyscus abundant in woods there during a brief period of trapping. White-foots are common on Staten Island, where I have found individuals living in roofed-over bird nests.

Remarks. This species, in common with many other rodents, fluctuates in abundance, being much more numerous some years than others. This may be why our trapping indicated white-footed mice to be rare or apparently absent in many seemingly favorable woodland areas. In the winter and spring of 1962, especially, these mice were notably scarce in woods throughout much of eastern Long Island. Roy Latham (personal communication) reports a marked low at Orient during 1968. Usually, many white-footed mice come into Orient houses during the winter. But they were so scarce in the winter of 1967-68 that not one came into Latham’s house, and he did not see any of these mice during 1968; Peromyscus seemed to be virtually extinct locally. By the spring of 1969, however, Latham found Peromyscus to be on the increase again, becoming common in 1970.

White-footed mice were usually trapped on the surface of the ground, but a few (mainly in winter) were caught underground in tunnels of the eastern mole; also catches were made several feet above ground on the trunks of leaning trees. A few individuals from tunnels were dirty white or grayish beneath, presumably a stain from contact with the soil. This species is found in many houses and other buildings in the more rural areas, but is not as much of a nuisance as the house mouse.

An amusing instance of the wide variety of nest sites utilized was noted near Great Peconic Bay in late September 1960. I found an old wooden kitchen table standing on bare ground under some oak trees, evidently the abandoned remnant of a summer campsite. When the drawer was pulled out, four more or less fully grown white-foots looked up from a cozy nest within. One scurried out of a hole in the back of the drawer and then down to the ground, but the others remained in place in the nest as I shut the drawer. Helme (1902) on two different occasions on Long Island found as many as 16 individuals of this species in one nest.

Reproduction. The reproductive season extended at least from March to October (female with embryos on March 29, 1961, lactating individuals in mid-October, 1960). First young juveniles out of the nest were trapped April 24 (1961). Average litter size based on 12 embryo counts (March 29 to August 23) is 4.3, with a range of three to six. Thirty females showed placental scars; individual counts ranged from three to 16, some of the higher counts apparently representing two litters. Males in evident breeding condition were collected from late March through most of September.

Measurements. Seventy adult males from all seasons (fall, 1960 to summer, 1963) average: weight, 22.0 grams (16.8-27.8); total length, 175.3 mm. (155-197); tail 81.2 mm. (67-93); hind foot, 20.8 mm. (19.5-22); ear from notch, 16.9 mm. (15.5-18.5). Thirty-eight non-pregnant adult females in the same period average: weight, 21.2 grams (16.3-29.5); total length, 175.0 mm. (156-197); tail, 81.0 mm. (71-92); hind foot, 20.6 mm. (19-22); ear from notch, 16.8 mm. (15.5-18). Localities range from western Nassau County to Montauk Point.

Individuals taken. 219

Meadow Mouse

Microtus pennsylvanicus pennsylvanicus (Ord)

Distribution and habitat. The meadow mouse, also commonly known as field mouse or meadow vole, is abundant in many grassy areas, from the outer dunes and salt marshes to inland fields and bogs. This is one of the most numerous mammals of Long Island, but it is not found in as many different habitats, and thus probably does not equal in total numbers such species as the masked shrew, short-tailed shrew, and white-footed mouse. As far as is known, all meadow mice in the Long Island region today are the same as those on the mainland (M. p. pennsylvanicus); the recently exterminated subspecies on tiny Great Gull Island, M. p. nesophilus, is discussed at the end of this account. A surviving insular form just outside this region is M. p. provectus, confined to Block Island, Rhode Island, about 15 miles east of Montauk Point.

Microtus is especially numerous (and far outnumber other mammals) in the extensive salt marshes which fringe the south shore bays and which also dot the edge of Peconic Bay (figure 6) and the north shore. In these marshes, areas of low grass, such as Spartina patens, are highly favored by the mice. Surface runways, cuttings, and nests of meadow mice are usually the only signs of mammals in the mole-shrew-mouse size range to be seen in the Long Island salt marshes. Occasionally we caught a few masked shrews or individuals of other species in the meadow mouse runways, but often Microtus appeared
to be the only small mammal present. As a general indication of meadow mouse abundance in this habitat, 25 single-catch live traps which were set in a small area of salt marsh near Moriches Inlet (figure 16) for two nights and the intervening day in August 1962, and checked three times during this period, caught a total of 49 different individuals.

Dry, sandy, coastal areas, with assorted grasses and shrubs, also produce many meadow mice. They are common on the tops of the outer dunes which border south shore beaches (figure 17). Here there is little vegetation save beachgrass (Ammophila breviligulata), but it grows in fairly dense stands where the ground is reasonably level along the summits of the dunes. To judge from the abundant cuttings and other signs, Microtus feeds on the leaves, stems, and seeds of beachgrass, but generally no distinct runways are to be found in this habitat, just the grass cuttings littering the bare sand where meadow mice are present. Signs of Microtus were found even on the summits of the steep moving or “walking” dunes in Hither Hills State Park near Pequeague Harbor (figure 19). These dunes are much higher than the ocean beach dunes, and yet the mice were present, at least periodically, wherever there were stands of beachgrass growing on the tops of these otherwise bare peaks of sand.

Microtus was common in fields island, especially where the grass was thick and luxuriant. It was often present in the same sandy field with Pitymys, but Microtus generally favored the denser stands of Andropogon or other grasses, while the more fossorial pine mouse was less restricted, and was apt to occur in the more open, sparsely covered field areas, and in adjoining woods as well.

Fresh-water habitats included moist places adjacent to ponds and streams, cattail marshes, meadows, and sphagnum bogs; usually sedges or grasses were present. In the bogs, covered with shrubs, sedges, and the like, Microtus was locally abundant (figure 9); here it tunnels through and under the sphagnum moss. In central and eastern Long Island the shrubby, sedge bogs strikingly resemble those on the New Jersey coastal plain, where Synaptomys and Clethrionomys live, but on the island Microtus seems to be the only microtine present in such areas.

This species was rare in wooded areas in general, and apparently nonexistent in the dry oak and pine woods covering much of the region. Only six were collected in areas that were classified as woods—three in a red maple swamp, three in grass under a stand of black locust trees.

We collected specimens of Microtus on Fire Island and Shelter Island, and found abundant signs of these mice on Gardiners Island, but we did not work farther offshore. Frank M. Chapman collected this species on Gardiners Island in 1902 (specimens in American Museum of Natural History). Eight specimens collected on Plum Island by A. H. Howell in 1898 are in the U.S. National Museum. This form also occurs on Fishers Island. Meadow mice are common on Staten Island, although landfill operations in salt marshes have destroyed much of their habitat. In Roy Latham’s collection there is an all-white meadow mouse from moist woods on Shelter Island.

Food habits. Many kinds of plants are eaten by meadow mice. Food habits were not studied, except that we could hardly avoid noticing signs of feeding, such as the many cuttings of grass or sedges where these mice were present. Frequently noted examples of this included cuttings of cord-grass (Spartina alterniflora, S. patens) and bulrush (Scirpus sp.) in salt marshes, beachgrass (Ammophila breviligulata) on the ocean dunes, and broomsedge (Andropogon virginicus) in sandy fields. In a few salt marsh areas many cuttings were found of the odd succulent plant, glasswort (Salicornia sp.). Also we observed extensive diggings by meadow mice in stands of reed (Phragmites communis) on the barrier beaches, suggesting feeding on the rhizomes of this large plant.

Meadow mice of the genus Microtus are noted for storing quantities of food, especially underground parts of plants belonging to the buckwheat, pulse, morning-glory, and composite families. In North America this habit is especially developed in certain northern and western areas. In March 1961, on Long Island, I found rather striking accumulations of the tuberous enlargements from rootstocks of the groundnut or wild bean (Apios americana); apparently these had been gathered by meadow mice, rather than pine mice, which also store plant roots. The tubers, about an inch long when dry, resembled tiny sweet potatoes in general shape and color (figure 24). Groundnut grows in moist ground and thickets, often in or near areas frequented by Microtus, although it is not an abundant plant. Most of the stores were found east of Hauppauge in an area of ponds, and moist meadows near the northeast branch of the Nissequogue River. Piles of the tubers were found on the surface of the ground in grass, and associated with Microtus runways. Two piles were examined closely: one contained over 100, the other about 175 tubers. One of the piles was next to a well-used Microtus runway, the other was at the end of a short spur connecting with a main runway.

Remarks. Meadow mice are destroyed by a host of vertebrate predators. We found their remains in pellets
of several species of hawks and owls. Short-eared owl pellets were noted as especially numerous in salt marshes and fields along the south shore in the winter and early spring of 1961, and they contained many meadow mice. On one occasion a short-eared owl was observed to catch and eat a meadow mouse during the day on snow-covered dunes at Tiana Beach. There was also much evidence of red foxes preying on meadow mice in different areas of the island.

Occasional hurricanes and other severe storms undoubtedly drove many meadow mice in the shore areas, although the reduction in the numbers of these mice is only local and temporary. A prolonged and devastating east-northeast storm which reached its peak on March 6, 1962, washed over or broke through the outer barrier beach in several places between Moriches Inlet and Shinnecock Inlet. A week later along this same strip I noticed several dead meadow mice that had apparently drowned or died of exposure. Also some beachgrass and salt marsh areas were buried under a deep layer of sand probably carried by storm waves from the beach and outer dunes. One depression back of the dunes, formerly grassy and with a population of meadow mice, when revisited after the storm was found to be covered with 2 to 4 feet of new sand resembling a vast snow-drift. However, in the summer and fall of 1962 meadow mice were generally numerous along this strip of barrier beach. The experienced Long Island observer, Dr. William T. Helmuth (1954) wrote that meadow mice were still plentiful on eastern Long Island near the shore after the destructive 1938 hurricane, even though many storm-killed mice were noted.

Reproduction. Average number of young based on 57 spring, summer, and fall embryo counts (Suffolk County) is 4.3, with a range of one to seven; three to five was usual (four the most frequent number). These figures are somewhat smaller than usually reported for this prolific species. Size of embryos ranged from small swellings 3 mm. in diameter to large embryos near birth about 30 mm. in length (crown to rump).

A long breeding season was indicated, with some individuals probably breeding in winter. Embryo dates ranged from April 16 to December 15. Also, females which had already given birth (lactating, placental scars) were collected on the south fork in mid-April. Males in breeding condition were trapped primarily in the period March 22 to December 19, but two such males were also collected in central Suffolk County on February 7 and 8, 1962.

Measurements. The following refers to specimens taken at various Suffolk County localities during all seasons of the year. One hundred and twenty-five adult males average: weight, 44.5 grams (28.4-75.7). Eighty adult males average: total length, 171.3 mm. (151-211); tail, 50.9 mm. (35-67); hind foot, 21.7 mm. (20-24). Fifty-eight adult females average: weight, 39.5 grams (28.3-65.4). Seventy-two adult females average: total length, 167.6 mm. (150-197); tail, 48.3 mm. (42-59); hind foot, 21.3 mm. (19-23).

Individuals taken. 396

Gull Island Mouse. The Gull Island subspecies (Microtus pennsylvanicus nesophilus V. Bailey) apparently became extinct 9 or 10 years after its discovery. Formerly it was considered a separate species, but it appeared to differ only in minor skull and pelage characters (skull shorter and wider, color of pelage darker) from the common meadow mouse of Long Island and the mainland. This form was evidently confined to Great Gull Island. This island, and nearby Little Gull Island are located at the entrance to Long Island Sound between Plum Island and Fishers Island. Great Gull is long and narrow, slightly over one-half mile long, and is about 2 miles east of much larger Plum Island, which in turn is about 1½ miles off the end of Orient Point across Plum Gut. Plum Island mice, however, resemble the mainland form rather than nesophilus (Miller, 1899).

Dutcher (1889) collected the first known specimen of nesophilus on August 6, 1888, and he described the birdlife, habitats, and dimensions of the two Gull Islands. Great Gull, 14 or 15 acres in extent, was composed of sand, with a shoreline and outlying reef of rocks; it was hilly (probably 25 feet high at highest point), covered with coarse grass and some clumps of bushes, and had a small fresh-water marsh. Dutcher stated that Great Gull Island was purchased by the Government to serve as a garden for the keepers of Little Gull lighthouse, but it was so overrun with the mice that it was useless for that purpose. Little Gull Island was only about 100 by 50 yards in size, and consisted mainly of gravel and boulders, with a lighthouse.

Dutcher also wrote that in the summer of 1888 common terns (Sterna hirundo) were nesting in abundance on Great Gull Island, and that song sparrows (Melospiza melodia) were quite common, especially in and near the marsh on Great Gull. Marsh hawks (Circus cyaneus) visited the island and apparently preyed on the mice. Dutcher secured one of these hawks on Great Gull Island on August 12 and the stomach contents included the remains of a mouse (I presume nesophilus); he also stated that the marsh hawk was known as "mouse hawk" to the keepers of Little Gull Light.
More of these mice were collected on Great Gull Island in the years immediately following Dutcher's 1888 visit. Frank M. Chapman collected seven in July 1889 (skins and skulls in American Museum of Natural History) and Basil Hicks Dutcher returned to collect more specimens in 1890 (deposited along with type specimen in U.S. National Museum). Bailey (1898, 1900), who examined 15 specimens, published a description of the new mouse. During 1897, fortifications were erected on the island and in conjunction with this the entire surface of the island was disturbed, wiping out the original habitat. Reed (1898) described the rapidly changing environment, and its effect on the tern colony, on Great Gull Island during the summer of 1897. On August 8, 1898, Arthur H. Helme and Arthur H. Howell visited Great Gull Island, searched every part of the island, noted the nearly complete destruction of the vegetation, and found no trace of the voles; they concluded that the Gull Island mouse was probably extinct (from Miller, 1899, who quoted notes furnished by Howell). At the present time the introduced house mouse is the only mouse on Great Gull Island as far as I know.

Pine Mouse

_Pitymys pinetorum scalopsoides_ (Aud. and Bachman)

_Distribution and habitat._ The pine mouse, or pine vole, spends much of its life underground, is highly adaptable, and is one of the common mammals of Long Island. Perhaps it is exceeded in numbers only by the masked shrew, short-tailed shrew, white-footed mouse, and meadow mouse. The pine mouse has long been known to occur on Long Island, the type locality of _scalopsoides_; Audubon and Bachman (1841) obtained many Long Island specimens, on which they based their original description of this form, naming it _Arvicola scalopsoides_.

_Pitymys_ is found in most of New York State, but becomes progressively less common northward, where it is confined mainly to the humus of the forest. In southern mainland New York (such as lower Hudson Valley, Delaware River drainage), and on Long Island and Staten Island it is quite common, even abundant in places. On Long Island this mouse is widely distributed in the light sandy soils of fields and woods.

Eastward on the island we found it common as far as Hither Hills on the south fork and Great Hog Neck on the north fork, and it is known to occur all the way to Montauk Point, where William Dutcher collected this species in 1893 (specimen in American Museum of Natural History). I was unable to find the pine mouse in several days spent collecting on Shelter Island. It is possible that it was overlooked on this large island, although Roy Latham, in a personal communication, writes that he has no record of _Pitymys_ on Shelter Island either. He also writes that this species has not been recorded on the north fork east of Southold. _Pitymys_ also appears to be absent from Gardiners Island and Plum Island, judging from the lack of records.

Pine mice and meadow mice may occur together on Long Island (figure 11), but there are so many differences in habitat preference that more frequently only one is found in an area. The pine mouse is scarce in the immediate vicinity of the ocean front along the south shore. This fossorial species avoids the salt marshes (where _Microtus_ abounds), although it is locally common at the dry edge of this habitat. Also _Pitymys_ was not found in grassy dunes and hollows behind the ocean beaches of eastern Long Island, even though _Sorex, Blarina, Scalopus, Peromyscus, Microtus, Mus_, and _Zapus_ were found in such areas. We were unable to find _Pitymys_ on the outer barrier beaches, where our collecting localities included Moriches Inlet, Tiana Beach, and Fire Island opposite Smith Point.

Inland in Suffolk County, however, _Pitymys_ finds more territory suitable to it than _Microtus_ does. The pine vole tunnels under the leaf litter of oak and pine-oak woods; also it finds satisfactory the dry sandy ground of pine barrens, and old sandy fields where ground vegetation is too sparse for _Microtus_. The latter often does predominate where the grass is thick, and invariably does so where the ground is wet, as along streams and in marshes and bogs.

Around some of the bays, pine mice may be found living right up to the edge of tidewater. We found this to be especially true in the vicinity of Great Peconic Bay, which penetrates far inland (figure 6). Here _Pitymys_ was associated with _Microtus_ in a dry sandy zone (often 30-40 feet wide) along the very border of the salt marsh under beachgrass (_Ammophila breviligulata_), a tall unidentified grass growing in tussocks, groundsel-tree (_Baccharis halimifolia_), bayberry, and the like. The pine mice were found occupying subterranean burrows, and also surface runways in the grass. Windrows of old storm debris from the bay were conspicuous in this zone. This edge zone was a clear-cut area of overlap for the two microtines: _Microtus_ alone occurred out in the wet tidal marsh, while inland, under pines and oaks, only _Pitymys_ was found.

This species is sometimes said to be poorly named and rarely found under pines. Probably it would be more accurate to say that _Pitymys_ does not appear to be restricted to pines in any region, and it is also found in regions where there are no pines. In the Long Island pitch-
pine region *Pitymys* is actually rather common; in fact, it is only microtine present in this environment (figure 3). Here it is found even in rather barren areas, with few green plants besides pitch pine, an undergrowth of bear oak, and, for ground cover, bearberry and some scattered sedge. Pine mice were also taken in tunnels under fallen leaves in deciduous woods. At Hither Hills it was trapped under black oaks and white oaks (figure 21), many stunted and bent by the wind, near the shore of Block Island Sound.

In old sandy fields, formerly cultivated and now covered with broomsedge (*Andropogon virginicus*), composites, and other herbs, and sometimes scattered young pitch pine, wild black cherry, etc., pine mice are often abundant, and easily trapped because the holes leading to their tunnels are numerous and readily seen. Occasionally we found *Pitymys* in parts of a field where the ground was nearly bare, with only a scanty growth of grass, while the less fossorial *Microtus* and *Sorex* were rather closely confined to dense grass cover. The burrows appeared to be smaller than those of meadow mice, and in fields were more apt to be seen in bare, open ground, as mentioned above. In one small field surrounded by woods, where no meadow mice were taken, pine mice frequented surface runways in dense broomsedge. I had mistaken the runways for those of *Microtus* before trapping, but they did seem to be narrower than those of *Microtus*.

*Blarinia* appeared to be the most regular mammal associate of *Pitymys*, both showing a somewhat similar habitat distribution, and often found in the same tunnels. The eastern mole was also quite characteristic of the same areas, pine mice often using the larger mole tunnels. Because of a more subterranean existence than *Microtus*, probably relatively fewer pine mice are destroyed by predators, although various birds, mammals, and snakes eat them. We did see remains of pine mice apparently killed and eaten by red foxes and other wild predators, and at Hampton Bays our pet cat occasionally caught them.

**Food Habits.** This omnivorous and rather voracious vole is of economic importance, although its mainstay may be said to be succulent roots and other underground parts of wild plants, with seasonal variation. At times this species causes considerable damage in orchards and nurseries on Long Island and elsewhere by eating the bark and cambium of tree roots, girdling them. Some damage to potatoes and other root crops of farm and garden may occasionally be caused by *Pitymys*. Roy Latham, an experienced potato farmer, writes (personal communication) that on Long Island pine mice nibble on potatoes, carrots, rutabagas, and other roots in weedy fields but apparently do no notable damage. Moles, which make more conspicuous tunnels, are frequently blamed for the depredations of underground pine mice.

Some green foliage is consumed, although the cuttings are generally not as numerous and conspicuous as those of meadow mice. In a number of abandoned fields visited there was evidence of pine mouse feeding on various herbaceous plants. For example, goldenrod (*Solidago* sp.) was being eaten during May in some fields in central Suffolk County; many tender shoots and small plants a few inches high were cut off and carried into the burrows. Also, daisy fleabane (*Erigeron* sp.) was similarly used, and cuttings were found in the burrows. In June in the same region it was noted that a cinquefoil (*Potentilla* sp.) had apparently been added to the diet, with fresh cuttings in burrows frequented by *Pitymys*.

Some individuals, especially in spring, gave off strong odors from feeding on pungent herbs, including wild onion (*Allium* sp.). Seventy stomachs were saved but most have not been examined at the time of this writing. A few that were examined contained only plant material —the roots and green parts of grasses and other vegetation. These mice are also inclined to eat animal food; quite a few specimens were destroyed in the traps, many presumably eaten by their own kind.

**Reproduction.** Litters are small in *Pitymys*, and this was borne out in our Suffolk County information based on 14 embryo and placental scar counts. The average was 2.4, with a range of two to four. The season of reproduction extended at least from early April (female with embryos on April 17, another nursing on April 18) to September (one recently nursing on September 27, several with placental scars in October). Although litters are small, Raynor (1960) found three litters and a pregnant female in a single nest at Manorville, Long Island, in April; it was assumed that at least one of the nest litters belonged to another female.

**Color.** The only noticeable color variants collected were two adult females near Flanders in October 1960, which tended to melanism, showing a dark grayish-brown (nearly blackish) hue on the upper parts, rather than the bright chestnut-brown characteristic of this species. Buffy specimens have been found at Mattituck and nearby Cutchogue, as described by Hatt (1930) from a skin in Roy Latham’s collection.

**Measurements.** The following pertains to specimens collected in central and eastern Suffolk County at all seasons of the year. Thirty adult males average: weight, 25.2 grams (21.2-30.7); total length, 123.9 mm. (120-129); tail, 23.1 mm. (19.5-26); hind foot, 16.5 mm. (15-
Thus Hamilton
Fair. Roy Latham (personal communication) used to be
All the earlier references dealing with the mammals of the
the black phase each trapping season at Orient.

The salt marshes and creeks (Flushing Meadows area in
sphagnum bogs, old cranberry bogs, and wooded maple
encircle the bays along the south shore (including Fire
area wherever their modest aquatic requirements are met.
Through the years, many thousands have been trapped
for their fur. At the time of DeKay (1842) the skins
sold for 25¢ apiece and were extensively used in the manu-
facture of hats. Muskrats are still present in Brooklyn
(Jamaica Bay) and Queens, and on Staten Island; east-
ward they extend to Montauk Point, Orient Point, Shelter
Island, and Gardiners Island (we saw several on Gardin-
ers Island in 1962).

Their most extensive habitats, and where they flour-
ish, are the great salt and brackish tidal marshes which
encircle the bays along the south shore (including Fire
Island). The similar but more scattered marshes around
the Peconic bays and on the north shore also harbor many
muskrats. Inland, muskrats live in almost all fresh-water
localities, especially in marshy areas along the major
streams (figure 5), but also in the many ponds in the
pine barrens (figure 4) and elsewhere, and in bushy
sphagnum bogs, old cranberry bogs, and wooded maple
swamps.

The overall muskrat population is much smaller than
in the past, because of the many acres of aquatic en-
virontment which have been drained or otherwise lost.
Thus Hamilton (1949) remarked that in the winter of
1919, when the rats brought up to $4.25 a pelt, over a
thousand dollars' worth of the furs were harvested from
the salt marshes and creeks (Flushing Meadows area in
Queens) that later became the site of the 1939 World's
Fair. Roy Latham (personal communication) used to be
able to trap about 80 muskrats in a season on the agri-
cultural north fork at Orient, an area where they are
now scarce.

Hatt (1935) described an unusually dark muskrat
(black phase) collected by Roy Latham at Orient on
December 28, 1929. Formerly, Latham (personal com-
munication) saw or obtained about two individuals in
the black phase each trapping season at Orient.

There seem to be relatively few muskrat houses, or
lodges, compared with the many muskrats obviously pre-
sent in the various areas. Many must make their homes
in burrows dug into banks. We did see some houses in
marshes, both tidal and inland, also on ponds, and in
overgrown bogs.

House Mouse

Mus musculus Linnaeus

Distribution and habitat. This familiar species, intro-
duced from the Old World about two centuries ago, is
numerous in and around buildings in cities and towns and
on farms, where it lives in association with man. Since
little field work was done in such situations, we did not
collect many house mice. This species is sometimes found
in fields and less often in woods in this region; also it
lives along the seashore and on outlying islands in vari-
ous parts of its worldwide range, including the Long
Island area.

In winter, at least in 1960-61, feral or wild-living
house mice seemed to be rather numerous and widespread
on the outer ocean dunes along the south fork of eastern
Long Island. At East Hampton Beach, in December, sev-
eral were trapped on the outer dunes (figure 17) just
back of the beach in nearly pure stands of beachgrass
(Ammophila breviligulata) with some scattered herbs,
chiefly composites. This was during severe weather, a
period of low temperatures followed by unusually heavy
falls of snow. I do not know how dependent this hardy
colony was on the presence of buildings; the nearest in-
habited houses were about one-half mile inland, although
several summer cottages were somewhat closer.

The beach individuals were probably feeding on
seeds (and perhaps green parts) of beachgrass; several
were trapped on the sand next to little piles of the seed
heads. Microtus was the only other small mammal col-
clected on the outer dunes at East Hampton Beach; the
two species appeared to be living closely together on the
same ground. Some of these outdoor house mice were
breeding during the winter, and a female on December 8
contained five small embryos.

House mice also were found living on the barrier
beach strip near Moriches Inlet in rather wild, deserted
dunes country far removed from any buildings. Here they
were considerably outnumbered by Microtus and Pero-
myscus. One January day in this area we saw a sparrow
hawk (Falco sparverius) feeding on a freshly caught
house mouse. House mice are present on remote Great
Gull Island (specimens in American Museum of Natural
Bay region in salt and brackish marshes and in adjacent boulders at the base of the cliff at the very end of daylight foraging on the beaches of the Smithtown Bay here even in the bitter, windy midwinter season. Turrell Point, and judging from the many tracks, are present ever necessary. Jetty rats may take refuge during storm tides and what similar situation. They live among the nearby sand dunes.

On the bay side of the inlet there are fishing stations and assorted buildings which probably shelter many other rats of the area, and where the jetty rats may take refuge during storm tides and whenever necessary.

Rats are also found at Montauk Point in a somewhat similar situation. They live among the rocks and boulders at the base of the cliff at the very end of the point, and judging from the many tracks, are present here even in the bitter, windy midwinter season. Turrell (1939) mentions that rats are occasionally seen in broad daylight foraging on the beaches of the Smithtown Bay region on the north shore.

A few individuals were trapped in the Great Peconic Bay region in salt and brackish marshes and in adjacent dry grassy areas (figure 6). Norway rats are said to be a problem in some Peconic localities (and probably elsewhere) when exceptionally high tides or storms drive them out of the marshes, at which times they appear in abundance in and around houses. Rats are also present in fresh-water areas, and individuals were seen foraging along the shores of ponds in the evening, tracks were seen along streams in red maple swamps, tracks were numerous around waterways in certain parks, and the like. A few even frequent small streams in the dry pine-oak woods. Norway rats inhabit muskrat burrows in some of the marsh and pond areas.

Norway rats are present on most of the eastern islands, including Shelter, Gardiners, Plum, and Fishers, and, reportedly, even Great Gull Island.

Food habits. Rats eat all sorts of animal and vegetable food, including carrion, garbage, and food stored by man. In the shore and marsh areas of Long Island, rats probably feed extensively on certain readily available forms of animal life (both living and dead). Rats living among rocks at the ocean, such as inlet jetties and boulders at Montauk, may subsist mainly on dead birds, fish, and other marine life washed ashore, and probably also eat the remains of bait and fish discarded by fishermen. One January morning I saw a Norway rat feeding on the carcass of a herring gull on the beach beside the Shinnecock Inlet jetty. Audubon and Bachman (1851) told of Norway rats along the East River which were reported to dig up and feed on a small (3½-inch long), thin-shelled species of clam which was then abundant in sandy places below high-water mark.

Individuals taken. 3

Black Rat

Rattus rattus Linnaeus

The black rat (also called ship rat or roof rat), like the Norway rat, lives in human habitations and was accidentally introduced from the Old World. However, the black rat arrived much earlier than the Norway, probably with the first colonists. The latter species is said to have been introduced to the seaboard states during or about the time of the Revolutionary War; it spread rapidly in the Northeast, replacing the black rat, which seemed to disappear entirely from most areas where it had been numerous.

The two species of Rattus cannot be distinguished by color alone, regardless of common names; melanic (black) Norway rats are not rare, and also R. rattus has
different color phases or variants, some closely resembling typical Norways in color. Such features as the longer tail, larger ears, and smaller body size of *R. rattus* are more reliable.

The present status of the black rat in the Northeast is not clear; perhaps it may be described as either very rare or very local. This species may have been abundant on Long Island at one time, as it seems to have been in some other areas of New York and neighboring states, but practically nothing is known of its history here. It has certainly long since disappeared from most of the island. Very likely the black rat in this region has continued to exist in city waterfront areas (e.g., Brooklyn), where its numbers are maintained by new arrivals brought in by ships. Naturalists rarely visit or collect in such areas.

Helme (1902) wrote that "many years ago" some specimens of *Rattus rattus* were caught in a stable in Brooklyn. The only existing Long Island specimen I know of was collected at Douglaston on the north shore of Queens near the Nassau County line, March 13, 1921 (Dr. Fisher). It is a male in the black color phase, preserved as skin and skull at the American Museum of Natural History, No. 42978. Kieran (1959) stated that this species is far behind the house mouse and Norway rat in abundance in all five boroughs of New York City, but that recent collecting by professional exterminators has revealed that sizable numbers of *Rattus rattus* are present. I do not know if any specimens collected in this manner have been preserved.

**Meadow Jumping Mouse**

*Zapus hudsonius americanus* (Barton)

**Distribution and habitat.** The meadow jumping mouse is rather rare and local on Long Island; it seems to be more numerous on the adjacent mainland. This species has been collected from Brooklyn and Queens east to Montauk Point, and is still found thinly spread throughout the full length of Suffolk County, but at the present time appears to be common only near the eastern end of the island. There jumping mice are found in very dry, as well as moist, open areas with grasses and other low vegetation. They thrive in sandy areas near salt water marshes and bays, and in the grassy hollows just back of the ocean dunes. But even though we found these mice in places along the very edge of salt marshes, they rarely venture out into this habitat.

Fourteen individuals were collected in dry, sandy areas east of Amagansett, in the region of Napeague Meadows and Hither Hills (figure 18). The vegetation consisted of a variety of grasses, including much beachgrass (*Ammophila breviligulata*), and also many shrubs and vines, especially bayberry (*Myrica pensylvanica*), poison ivy (*Rhus radicans*), and wild rose (*Rosa carolina*). One was collected on Shelter Island in similar habitat, adjacent to a salt marsh (figure 25). Such areas of excessively drained ground (nearly pure sand), often remote from any standing fresh water, appeared to be the most productive habitat for *Zapus* on eastern Long Island judging from our trapping results.

The remaining four jumping mice were collected in moist, somewhat boggy situations with grasses and sedges. *Sorex cinereus* and *Microtus pennsylvanicus* were common in all of the *Zapus* collecting areas, but other small mammals were scarce. In the pine barrens of Suffolk County, jumping mice are found in some of the more luxuriant areas near water, and we saw one or two among shrubs and grass on the edge of a pond near Flanders.

Dutcher and Dutcher (1893) reported *Zapus* to be the "least numerous" species of mouse at Montauk, but they found it widespread there, present in swamps and wet and dry meadows, and also on the Montauk Downs. Eight meadow jumping mice (and other mammals) collected by the Dutchers at Montauk are in the U.S. National Museum. Although found at Montauk and on Shelter Island, *Zapus* has not been recorded from the more outlying eastern islands, such as Gardiners Island and Plum Island, as far as I know; nor do I know of any records for Fire Island, although there appear to be extensive areas of suitable habitat there. This species is a resident of Staten Island, where it has been collected in several localities.

**Reproduction.** Several breeding females were collected in June: one with six tiny embryos on June 8, one lactating and with four placental scars on June 22, and two lactating and with placental scars on June 27.

**Measurements.** The following refers to specimens taken on the southern fork of eastern Long Island and on Shelter Island. Nine adult males without hibernation fat (May and June specimens) average: weight, 15.0 grams (11.6-17.3); total length, 201.3 mm. (194-205); tail, 116.3 mm. (101-128); hind foot, 27.9 mm. (26-29). Five nonpregnant adult females without hibernation fat (June and August) average: weight 17.4 grams (14.7-19.3); total length, 208.4 mm. (193-227); tail, 122.2 mm. (112-134); hind foot, 27.8 mm. (26-30). The heaviest individual, weighing 24.9 grams, was a nonbreeding female with much fat on October 19.

**Individuals taken.** 18
Common Dolphin

*Delphinus delphis* Linnaeus

This graceful and beautifully marked dolphin, which reaches a maximum length of about 8½ feet, frequents New York waters on occasion, and is fairly common well offshore. Schevill and Watkins (1962), who point out that *Delphinus delphis* is known as the saddleback porpoise by fishermen (because of the shape of the dark dorsal area), encountered a group of 20 individuals and made sound recordings in August of an unstated year some 60 miles south of Martha's Vineyard, Massachusetts; in relation to Long Island, this general location is the open sea several score miles southeast of Montauk Point. Edwards and Livingstone (1960) observed two in mid-winter 1959, feeding on fish escaping from an otter trawl net, depth of water 200 feet, lat. 39°48' N, long. 72°28' W (about 65 miles off the south shore of Long Island).

The New York coastal records (sightings and strandings) now available are more numerous than when Stoner (1938) documented a remarkable movement of common dolphins far up the Hudson River in October 1936. Roy Latham has numerous records of this species in the waters about the east end of Long Island; he writes (personal communication) that it is recorded every year and is more frequent than *Tursiops*. Some of his locality records are as follows: East Marion, January 24, 1947; Orient, Gardiners Bay, May 26, 1947; Robins Island, Great Peconic Bay, September 11, 1947; Plum Island, July 14, 1951. Latham also has records for Shelter Island and Gardiners Island. Specimens in Latham's collection include one from Orient, Gardiners Bay, April 1928, and one from Cutchogue, Peconic Bay, 1923.

On December 6, 1960, an individual 7 feet 2 inches long stranded alive on the eastern shore of Staten Island and was transported to the New York Aquarium, where it lived 4 days (Ray, 1961).

Long Island specimens (skulls and skeletal material) of the common dolphin, presumably strandings, in the American Museum of Natural History include the following: Montauk Point, September 9, 1931; Jones Beach, August 1938 (H. C. Raven); Fire Island Beach, November 1, 1908 (skull found on beach) (H. C. Raven). Also in the collection are the Staten Island individual mentioned above and specimens from the Hudson River, 1911 and 1936. Another record for Montauk (Dead Mans Cove) is a skull in the Cornell University collection dated January 2, 1951 (M. Gordon). True (1899) listed common dolphins taken in the last century near both ends of Long Island, including New York Harbor and off Block Island, Rhode Island (specimens in U.S. National Museum).

This species, common enough in the North Atlantic, is a particularly conspicuous inhabitant of many warm-temperate regions, such as the Mediterranean Sea, where it is regularly seen playing about ships and leaping high out of the water. This is the dolphin most frequently depicted and written about in the ancient art and literature of the Old World; the ancients of the Mediterranean area also knew the next species, *S. coeruleoalbus*, judging from surviving portrayals of it on vases and other works of art.

Striped Dolphin

*Stenella coeruleoalbus* Meyen

This little-known pelagic species, which is about the same size as the common dolphin, but with a different color pattern and heavier beak, has not often been reported on the east coast of North America. The striped (or Gray's or euphrosyne) dolphin infrequently comes near shore or strand, but it is not really rare. A group of about 200 was noted passing by in deep water over the lower Hudson Canyon about 140 miles out from New York (south of Long Island) in August of an unstated year, when sound recordings were made (Schevill and Watkins, 1962).

At least two striped dolphins have been found on Long Island. A male weighing about 85 lbs. was found alive on the beach at the foot of the Throgs Neck Bridge on May 6, 1957, and was transported to the New York Aquarium, but it had a broken neck-vertebra and died on May 9, 1967 (Robert A. Morris, personal communication). This locality is on the north shore of Queens, where the East River meets Long Island Sound. The skeleton is preserved at the American Museum of Natural History. Another one (skull at the same museum) was found at Bellport, on the south side of Suffolk County, in May of 1929 (P. White). A previously published locality record which is close to eastern Long Island—some 30 miles northeast of Montauk Point—is Narraganssett Town Beach, Rhode Island, where a male 7 feet 9 inches in length stranded on December 5, 1966 (Cronan and Brooks, 1968).

The taxonomy of *Stenella*, a large genus of dolphins, is poorly known; it is being studied by F. C. Fraser of the British Museum according to Rice and Scheffer (1968). Striped dolphins of northern oceans, including our Atlantic coast, have been called *Stenella euphrosyne* (= *S. styx*), but apparently just one worldwide species of striped dolphin exists. There are two strongly marked
Bottle-nosed Dolphin

*Tursiops truncatus* (Montagu)

The bottle-nosed dolphin, a large grayish species which may attain a length of 12 feet, is a common coastal species of the Atlantic, and is especially abundant along the shores of our southern and mid-Atlantic states. It is migratory along the coast and visits the Long Island area, including Long Island Sound and various bays, in the warmer months.

Roy Latham (personal communication) writes that this species is recorded every year at various stations along the eastern Long Island coast from May 28 (year?), Greenport, Long Island Sound, to November 17 (1937), Bay View, Peconic Bay, and also in 1932 a single one was present as late as December 2, at Southold, Peconic Bay. He has records of *Tursiops*, as well as *Delphinus*, at Shelter Island and Gardiners Island. Latham (1954) reported on an adult female *Tursiops truncatus* 9 feet long, and bearing an unborn young 43 inches in length, which stranded and died on the Sound beach at Orient, June 11, 1953. Specimens (chiefly skulls) in his collection include the above female and young, and also one from Mattituck, Peconic Bay, May 1928, and another from Shelter Island, Gardiners Bay, 1921.

Helme (1902) wrote that dolphins in general, either this species or *Delphinus*, may be seen as early as April and as late as December, and are plentiful in Long Island Sound from June to late October. Some of the reports we received in the 1960's of "dolphins" or "porpoises" observed in Gardiners Bay, Peconic Bay, and lower New York Bay may refer to the present species. On October 17, 1960, we found a bottle-nosed dolphin, which was about 8 feet long and had been dead for several days, on Tiana Beach, ocean side of Suffolk County.

A highly unusual account by Stone (1964) tells how the author, during many July and August days in 1945 and 1946 when she was a girl of 13 and 14, played with a group of about six dolphins in Long Island Sound near a boat 2 or 3 miles off the north shore of Suffolk County. By the end of the second summer the play developed to the point where on several occasions she grasped a fin of a dolphin and was actually towed around on the surface. Late in the day the boat was sometimes taken into Port Jefferson Harbor, and the dolphins would follow far into the harbor. These animals were apparently small (young) *Tursiops truncatus*.

Two specimens collected near western Long Island are in the American Museum of Natural History: one (skeleton preserved) from Pelham Bay, New York, mainland side of extreme western Long Island Sound, August 16, 1906, (W. Dolan), and another (skull only) from Navesink River, New Jersey, May 25, 1960. A group of five to eight *Tursiops* was observed in the tidal Shrewsbury River, New Jersey, in an area 3½ miles from the mouth of the river at Sandy Hook Bay, from April 17 to June 16, 1965, (Clark, 1965). The Shrewsbury River, its tributary the Navesink, and Sandy Hook Bay are not indicated on the map but are just south of Lower New York Bay on the west side of Sandy Hook. A few have over-wintered in the Navesink River (Ulmer, 1961).

Dolphins, especially those of the genus *Tursiops*, are called "porpoises" in America by many cetologists as well as by most mariners and landmen. The word "dolphin," although an old name for small beaked cetaceans, is confusing in that it is also used for two species of fast, colorful, warm-water ocean fishes (genus *Coryphaena*); the species *C. hippurus* grows to about 5 or 6 feet in length and is popular with offshore sport fishermen as far north as our region. *Tursiops truncatus* is the species of dolphin or porpoise which has become especially familiar in recent years as a performer in public oceanariums and as a much written-about experimental subject in studies of echolocation, intelligence, etc. Dolphins and porpoises feed largely on fishes, squids and other marine animals.

The Atlantic white-sided dolphin (*Lagenorhynchus aca tus*) is a northern species found at times in schools as far south as the ocean waters off Cape Cod. Apparently it is unknown in the Long Island area, although it would be possible to find a dead or stranded one on this coast. The nearest record I know of is a dead one found in the Town of Narragansett, Rhode Island, on July 22, 1967, (Cronan and Brooks, 1968).

Killer Whale

*Orcinus orca* Linnaeus

The killer whale is a large (males up to 30 feet long) relative of the dolphins which is noted for its attacks on
other marine mammals. Prey includes seals and porpoises, many of the larger cetaceans ranging in size up to the huge but defenseless whalebone whales, and also schooling fishes, squids, and seabirds. It has a strikingly tall dorsal fin, up to 6 feet high in the large adult males. Grampus, finner, and killer are among the various common names that have been applied to this species. The range of the killer whale is essentially worldwide, but it is most numerous towards the Arctic and Antarctic regions where large warm-blooded prey is plentiful.

Few killer whales have been captured or stranded along the Atlantic coast of the United States, although they are sighted offshore fairly regularly at least as far south as New Jersey, where two stranded specimens have also been found. A small number have been found beached in recent years on the southern coasts of nearby Rhode Island and Massachusetts. For Long Island, Roy Latham (personal communication) reports that a killer 24 feet in length stranded alive on a clam flat in Orient Harbor, January 11, 1944, and then died. Cook and Wisner (1963), in an exaggerated but profusely illustrated account of the killer whale, reported on one which followed a 28-foot fishing boat one July day in 1958, from 35 miles off Montauk Point towards land to about 15 miles off the point; included in the book are several photographs of this individual, apparently a large male. Orcinus was probably more abundant in earlier days when various other cetaceans and seals abounded. DeKay (1842) mentioned seeing killer whales off the coast of Long Island on several occasions, but asserted that they were formerly more numerous here, at a time when right whales were also abundant.

**Gray Grampus**

*Grampus griseus* G. Cuvier

The gray grampus, white-headed grampus, or Risso's dolphin, is about the size of the bottle-nosed dolphin, but is beakless, with a blunt rounded snout, and a rather high, recurved dorsal fin. This species is widely distributed in the oceans of the world, but is not very well known. It appears to be a deep-diving form which feeds on cephalopods (squids and relatives). In the western North Atlantic this small whale has been recorded, though rarely, from Massachusetts to the coast of New Jersey. Schevill (1954) made observations suggesting greater abundance than previously suspected off our coast; on August 20, 1952, a group of over 60 grampus was watched from a ship near Lat. 40°00' N, Long. 71°31' W. The animals consorted in small bunches of four to six within the larger grouping, and they were quite playful, often leaping out of the water. The position indicated is roughly 75 statute miles out to sea in a southeasterly direction from Southampton, Long Island.

**Blackfish**

*Globicephala melaena* Traill

Blackfish, or pilot whales, which are related to dolphins and killer whales, are almost entirely black, have a high, bulging forehead, and frequently travel in large migratory schools. Maximum length is about 28 feet. Squids, cuttlefish, and various fishes are eaten by pilot whales. This is one of the more numerous cetaceans, and it is common offshore in this region, especially during the warmer months. Helme (1902) and other observers have mentioned frequent sightings of blackfish off the coast of eastern Long Island. There are also records for western Long Island and Long Island Sound. Strandings of pilot whales are frequently reported, and occasional mass live strandings of many individuals at one time are known to occur, although in this area, at least, usually only single individuals come ashore.

On May 13, 1960, a five pilot whale, a female 12 feet 9 inches long, was found stranded alive on Brighton Beach, Coney Island, Brooklyn, about half a mile from the New York Aquarium; it was retrieved and lived at the aquarium for 29 days (Ray, 1961). At Atlantic Beach (west end of Long Beach strip), Nassau County, a male 13 to 14 feet long came ashore on April 15, 1966, and died later the same day (Robert A. Morris, personal communication). An immature female was collected near Massapequa, south shore of Nassau County, on April 28, 1960, (skeleton preserved in American Museum of Natural History). That blackfish penetrate extreme western Long Island Sound and even the East River is indicated by one which stranded in Flushing Creek, Queens, off the upper East River, June 13, 1944, (Anon., 1956) and others which have grounded on the Sound shore of the Bronx.

The name “blackfish” is also used by fishermen for a popular salt-water fish less than 3 feet long, the tautog (*Tautoga onitis)*.

The Short-finned blackfish (*Globicephala macrorhynchus*) may visit; difficult to distinguish from the common blackfish, it ranges north at least as far as New Jersey.

**Harbor Porpoise**

*Phocoena phocoena* Linnaeus

The harbor porpoise is smaller than the dolphins, reaching a maximum size of 6 feet. It seldom leaps clear
of the water, and the head is blunt and rounded, lacking the beak characteristic of the dolphins. *Phocoena* frequents coastal waters and enters inlets, bays, and even rivers; New York is near its southern limit of abundance on the coast. Miller (1899) termed this species the commonest cetacean in New York tidal waters. Perhaps this is still true today, although for a long time now the porpoise has been gradually declining in numbers in our area. Apparently the harbor porpoise no longer forms large schools here of up to 100 or even "hundreds" of individuals such as were occasionally reported late in the last century.

There are numerous published reports of harbor porpoises in Long Island Sound. Rowley (1902), for example, stated that *Phocoena* was then very common in summer in this body of water, and that schools could be seen on almost any clear day, while Goodwin (1935) also mentioned the presence of this species in the Sound. Turrell (1939) wrote that harbor porpoises enter Smithtown Bay on the north shore of Suffolk County in large schools in summer. We received verbal reports for the 1950's and 1960's of sightings of porpoises in summer in Long Island Sound and also Great Peconic and Little Peconic Bays, although some of these reports may refer to dolphins (also called "porpoises") rather than *Phocoena*.

For the Orient region, Roy Latham (personal communication) writes that *Phocoena* is recorded every year at all stations, but that the big schools which were recorded yearly up to 1920 are no longer seen. The last sizable group recorded in this area, in Long Island Sound near Orient, was 25 individuals on December 7, 1921. Latham also reports that one came ashore, chilled, in the Sound at Orient on January 12, 1943; two specimens from the Orient region are in Latham's collection. Gilbert S. Raynor informs me that a harbor porpoise was found dead on the beach near Orient Point (Gardiners Bay side) about 1960.

Harbor porpoises may still be seen on occasion in Lower New York Bay and in Raritan Bay (waters bounded by Long Island, Staten Island and New Jersey). I have seen small groups in the summer months (during the 1940's) in this area. Porpoises also ascend rivers in this general region (New Jersey, Connecticut, and Hudson River), although I have no definite reports of this for the small rivers of Long Island. On the south shore of the island stranded individuals have been collected during various months of the year from Brooklyn to Montauk Point (specimens from Montauk Point in American Museum of Natural History and N.Y. State Museum). Anthony S. Thormina (personal communication) has many Long Island records, including photographs, of both the harbor porpoise and the harbor seal.

Of interest is DeKay's (1842) account of this species. He related that, although still common in his day, the harbor porpoise was formerly so abundant on the shores of Long Island that it was avidly pursued for its oil (from the blubber), and also for its durable leather (from the hide). He described in detail the procedure used in seining schools of harbor porpoises at the east end of Long Island based on a paper published in 1792 by E. L'Hommedieu. At the time of DeKay's publication harbor porpoises were evidently being killed in Long Island Sound, on the Connecticut coast at Stratford (opposite Port Jefferson), according to Linley (1842), who wrote: "Numbers of the common (harbor) porpoises are taken in this town for the sake of the oil, which is usually from three to seven gallons."

**White Whale**

*Delphinapterus leucas* (Pallas)

The white whale, or beluga, a small whale usually 11-14 and rarely up to 18 feet in length, and which (after early life) is completely milk-white in color, inhabits arctic and subarctic seas including the northern North Atlantic. It occurs regularly in the Gulf of St. Lawrence and adjacent bays and rivers. But southwards this species is rare, occurring as a straggler only as far as Cape Cod, Massachusetts, according to Miller and Kellogg (1955) and other recent authorities. There are two century-old records for that area—outer Cape Cod—but no recent records (Waters and Rivard, 1962).

Although never collected on Long Island as far as I know, *Delphinapterus* has probably visited the area at least once judging from the following sight report. A small whale, white in color, which was believed to be this species was observed in Long Island Sound off the north fork for 4 days in June 1942 (Roy Latham, personal communication). Latham first observed the whale off Orient, noted that it was moving west, and estimated the animal to be 10-12 feet long. He immediately alerted a friend in Mattituck who observed a white whale there the following day, presumably the same individual, 25 miles west of Latham's first sighting; this second observer reported the whale moving east.

In earlier years Roy Latham had heard of fishermen seeing white whales in the Sound, but he was unable to establish a record for one prior to 1942. Latham has considered the possibility of albinos of other species of whales being responsible for at least some of the
sightings. Albinism in whales is rare but has been reported in a number of species ranging in size from the huge sperm whale (*Physeter catodon*) to the little harbor porpoise (*Phocoena phocoena*); Tomilin (1967) wrote that rare instances of partial to complete albinism (one specimen out of tens of thousands) occur in the harbor porpoise. Also, increasing whiteness comes with age in some species, and old individuals of the bottlenosed whale (*Hyperoodon ampullatus*) may be encountered which are yellowish-white in color. For Latham’s sight record, however, his original field identification, the estimated size of the animal, and his familiarity with the common small cetaceans (dolphins, porpoises), as well as the white coloration, all strongly indicate *Delphinapterus leucas*. The bottlenosed dolphin (*Tursiops*), although rarely over 10 feet long here, overlaps *Delphinapterus* in size, but the latter is shaped differently and lacks the conspicuous dorsal fin of *Tursiops*.

**Sperm Whale**

*Physeter catodon* Linnaeus

This species is the largest of the toothed whales, the males, which are much larger than the females, attaining a length of about 60 feet. The massive squarish head and relatively small lower jaw are distinctive. Food of this deep-diving whale is primarily squids, also sharks, skates, and fishes. This is essentially a whale of tropical and warm temperate seas, but it is migratory, and some of the males go far to the north in summer.

According to DeKay (1842) and some other accounts sperm whales were formerly abundant “along” or “on” our coast. Also, some sperm whales were taken in Long Island waters during the early days of American whaling (Murphy, 1918). But unlike finback whales and right whales, probably the sperm whales only occasionally came close enough to be sighted from shore, even in the early days of whale abundance. Sperm whales generally avoid shallow waters of sandy coasts, although they may approach shore closely where the water is deep, such as near the Azores.

Today, sperm whales are very rare near the shores of Long Island, and are uncommon offshore although occasionally reported from ships out at sea. Some inshore records are as follows. On March 13, 1928, a young male 15 feet 3½ inches long strayed into New York Harbor (Upper New York Bay), where it was captured alive, but it died soon after being towed to Gowanus Canal, Brooklyn (Raven and Gregory, 1933). A female 39 feet long became stranded on Great South Beach (Fire Island) opposite Bellport on February 28, 1918 (Murphy, 1918); this individual came ashore alive during the night but died before daylight as the tide receded. On December 9, 1894, a sperm whale 40 feet long was captured in Fishers Island Sound, between Fishers Island and the Connecticut coast. No very recent Long Island records have come to my attention, but according to Cronan and Brooks (1968) the only authentic record for Rhode Island is a 14 foot 5 inch individual which washed ashore in Charleston, Quonochontaug Beach, February 20, 1967; this locality is in the southwestern corner of Rhode Island, near eastern Long Island (about 12 miles east of Fishers Island).

New England whalers, seeking the sperm whale primarily, ushered in a famous era of American whaling. They extended the fishery from coastal waters, where the right whale had been pursued, out on to the open sea, eventually leading to lengthy voyages to other oceans. Sag Harbor on Long Island also became one of the leading deep-sea whaling ports during this period, along with New Bedford and Nantucket, Massachusetts, and New London, Connecticut. This enterprise began early in the eighteenth century, and finally declined after the middle of the nineteenth century. This period was for the most part still one of harpoons thrown by hand from open boats which were carried to sea by a mother ship, before modern methods used in pursuit of the fast blue and fin whales were put to use.

Sag Harbor was established as a whaling port before the Revolutionary War and its peak whaling years came in the late 1830’s and in the 1840’s (biggest year—1847); a rapid decline followed the peak years, and it is said the last whaling ship set sail from this port in 1871. It was not until 1785 that the first successful trips were made from Sag Harbor by ships fully equipped for long (South Atlantic) whaling voyages (Willey, 1949). Before this time the ships made short voyages lasting no more than a few weeks, often near shore, then returned to Sag Harbor to process the blubber for oil. According to Howell (1941) in this period the ships ventured out only two or three hundred miles from port, usually to the southeast of Montauk. Although I am uncertain which species of whale comprised the bulk of the catch on these early offshore trips, such a voyage in summer would have taken whalers into an area of sperm whale abundance, as described below.

Although the sperm whale is almost cosmopolitan, there were favored feeding areas or “grounds” known to the whalers. Townsend (1935) studied whale distribution based on whalers’ logbook records dating from 1761 to 1920; the logs indicate positions and dates of whales
taken by seagoing whaling vessels from New England and Long Island, enabling Townsend to plot on maps the location of the take by month. An extensive sperm whaling ground centered roughly southeast of Long Island and northwest of Bermuda (approximately 33° - 40°N, 60° - 75°W), where sperm whales may still be observed, was known as the "Southern Ground." The western edge of this ground coincided approximately with the edge of the continental shelf; and like other North Atlantic grounds it was influenced by the Gulf Stream. This was a summer whaling ground, sperm whales being taken here primarily from May to September (especially May to July at the northern limit of this ground, near the latitude of Long Island). Few were taken in winter here; at that season attention was directed chiefly to waters below 25°N latitude.

**Pigmy Sperm Whale**

*Kogia breviceps* Blainville

Although related to the great sperm whale, *Kogia* is very small (maximum length 13 feet), and in outward appearance somewhat resembles a porpoise. Also the protruding snout and underslung lower jaw with sharp teeth are suggestive of a shark, for which it is sometimes mistaken by fishermen. The rather sluggish pigmy sperm whale is rarely observed and is little known, although it appears to be rather widely distributed in the tropical and temperate waters of the world. Evidently *Kogia* was never common in historic times; however, it has stranded fairly frequently along the east coast of the United States, where more than 50 records are now known (Handley, 1966).

Since 1914, at least eight specimens of *Kogia* have become stranded on the New York coast or captured a short distance offshore, and information is available on several. A large female with an unborn young (male fetus) stranded at Long Beach, on the south shore of Nassau County, Long Island, on February 28, 1914 (Schulte, 1917; Schulte and Smith, 1918; Allen, 1941). A pigmy sperm whale 9 feet long and weighing 700 pounds was captured off South Beach, Staten Island, on March 2, 1920 (Davis, 1920); this individual was reported as a porpoise in the local newspapers. Another one, a female, was captured 10 miles south of Shinnecock Inlet, near Hampton Bays, Long Island, in July 1941 (J. Carter). A specimen has also been collected at Westhampton Beach, Long Island (H. Raven). All of the above specimens (skulls and/or other skeletal material) are in the American Museum of Natural History.

In August 1942, Roy Latham collected the skull and some other bones of a *Kogia breviceps* about 9 feet long. This animal had become caught 10 days earlier in the leader of a fish trap at Major Bank, Orient Harbor, and then washed ashore dead. Latham also recalls another *Kogia* taken near shore at Hampton Bays about 1930.

James W. Romansky, Jr. (personal communication) reported on a pigmy sperm whale he found on the south shore of Captree Island, approximately 200 feet east of Fire Island Inlet Bridge, on the morning of November 24, 1968. Total length of the animal, measured 32 hours after it was found, was 157.5 cm. (less than 6 feet); it was an immature male. The cause of the death was an apparent gunshot wound just behind the left pectoral fin. It is believed the wound was inflicted by commercial fishermen, since the skin had parallel marks as if caused by rubbing against metal trawling rigs or offshore pound-nets. Careful measurements and notes were taken, and an articulated skeleton and internal organs in formalin are being kept at the Bay Shore High School. This individual was identified by Romansky as *K. breviceps* (identification confirmed at Smithsonian Institution and American Museum of Natural History).

It is possible that some of the smaller New York specimens of *Kogia* are referable to the closely related dwarf sperm whale, *K. simus* Owens. As shown by Handley (1966), *simus* is a strongly differentiated species of *Kogia*, which, like *breviceps*, commonly straddles along the coasts of eastern United States. Considerable taxonomic confusion has existed regarding members of this genus, and *simus* has been overlooked and not distinguished from *breviceps* by most authors and collectors. Long Island may fall within the geographical range of *simus* as well as of *breviceps*, but I do not know if the former has been collected here. *Kogia simus* is even smaller than *breviceps*, adults under 9 feet in total length, while the latter commonly ranges from 9 feet to 11 feet when adult. Size and skull differences and other distinguishing characteristics are tabulated by Handley (1966). I have closely examined only one Long Island specimen of *Kogia*, the Orient Harbor skull collected by Roy Latham in 1942 (now at the N.Y. State Museum), and identified it as *breviceps*. Besides this one and Romansky's *breviceps*, probably the Long Beach and Staten Island specimens cited above are also *breviceps*, judging from available measurements and illustrations.
Dense-beaked Whale

Mesoplodon densirostris Blainville

This species is frequently called the Atlantic beaked whale or Blainville beaked whale. Members of the genus Mesoplodon are small, mostly rare whales, the life histories of which are very little known; food is chiefly squids and fishes. Some species are known only by a small number of stranded specimens. Moore (1966) discusses distinguishing skull characters and apparent distributions of species of Mesoplodon which strand in North America. On May 12, 1925, a young female densirostris was found stranded on eastern Long Island at Southampton (Raven, 1942). A few other individuals of this species have come ashore to the north and south of our area, including Massachusetts and New Jersey.

Antillean Beaked Whale

Mesoplodon eurypaetus Gervais

The Antillean beaked whale is also known in the literature as Gervais' beaked whale or Gulf Stream beaked whale. This rare whale, of which a total of 14 verifiable records of occurrence are known, is principally southwestern North Atlantic in distribution (Moore, 1966). An adult female 15 feet 4 inches in length became stranded on the south shore of Long Island at Rockaway Beach, Queens County, on December 22, 1933 (Raven, 1934, 1937). This is the northernmost record for the western North Atlantic, although another one came ashore in 1905 on the nearby northern New Jersey coast at North Long Branch.

True's Beaked Whale

Mesoplodon mirus True

The principal range of True's beaked whale appears to be the North Atlantic, from which about a dozen stranded specimens are known. Raven (1934, 1937) reported on an adult female mirus about 16 feet long stranded at Edgemere, Rockaway Beach, on January 14, 1934, less than a month following the discovery of the specimen of eurypaetus, also at Rockaway Beach. Another adult female (15 feet, 6 inches long) stranded alive and died on Mason Island, off Mystic, Connecticut, on November 19, 1937 (Thorpe, 1938); this locality is near the entrance to Long Island Sound and about 3 miles north of Fishers Island, New York.

As mentioned by Moore (1966), the North Sea beaked whale (Mesoplodon bidens) is even rarer on this side of the Atlantic (two strandings known) than the three other members of the genus discussed above. M. bidens is unrecorded on Long Island; the nearest record is a stranded male found on Nantucket, Massachusetts, in 1867.

Cuvier's Beaked Whale

Ziphius cavirostris G. Cuvier

This whale, also known as the goose-beaked whale, is somewhat larger than the species of Mesoplodon, adults generally ranging from 18 to 28 feet in length. Cuvier's beaked whale is nearly worldwide in distribution, but is rather scarce and little known. Two, a female 17 feet 6 inches in length, and a recently born young measuring 8 feet 3 inches, came ashore alive and then died at Long Beach, on the south shore of Nassau County, on August 15, 1914 (Rockwell, 1914; Ulmer, 1941). A third individual reportedly ran ashore briefly, but escaped capture by lifeguards who secured the other two as soon as they beached. Skeletons of the two Long Beach specimens of Ziphius as well as the New York individuals of Mesoplodon mentioned above, are in the American Museum of Natural History. A goose-beaked whale 18 feet 11 inches long beached to the northeast of Long Island at Newport, Rhode Island, on March 14, 1961 (Cronan and Brooks, 1968).

The North Atlantic bottle-nosed whale (Hyperoodon ampullatus), another member of the family of beaked whales, is a far northern species which has not, apparently, been recorded this far south on the western side of the Atlantic. According to Miller and Kellogg (1955), Hershkovitz (1966), and others, the bottle-nosed whale is unknown south of Rhode Island, where it is an extremely rare visitor. However, it is worth noting that this species is often mentioned in the literature as having occurred in the Long Island region, locations cited including Lower New York Bay, the south shore of Long Island, and also the nearby Connecticut coast of Long Island Sound; but, for one reason or another, all such published reports are incorrect as far as I know. Of course, there is always the possibility of a straggler being found here.
**Little Piked Whale**

*Balænoptera acutorostrata* Lacépède

Least rorqual and minke whale are among the many vernacular names for this species. The little piked whale is the smallest of the rorquals or fin whales of the genus *Balænoptera*; rarely does it exceed 30 feet in length. A broad white band on the outer side of the front flippers is a distinctive identifying mark. As with many other whales, the minke whale is widely distributed in the oceans of the world, and is most frequently encountered in colder waters. It is generally considered to be rare south of the latitude of Long Island. There are quite a few records for the Cape Cod-Nantucket-Rhode Island area to the east and north. Southward the story is different. For many years a single record for New Jersey (Long Beach, fall 1866) was the southernmost known occurrence; however, it is now known to occur occasionally as far south as Florida. The first recorded instance of the little piked whale in the Long Island area appears to be an individual captured in 1822 in the Lower Bay of New York. DeKay (1842), under the name beaked rorqual (*rorqualus rostratus*) gives a detailed description of this specimen, indicating a fin whale 18 feet long with "swimming paws white in the middle." At the other end of the island, Helmuth (1931) examined a specimen about 25 feet long which was killed off Montauk Point and towed to shore on August 16, 1931.

**Finback Whale**

*Balænoptera physalus* Linnaeus

The various species of *Balænoptera* are known collectively as fin, finner, or finback whales or rorquals. They are streamlined and mostly very large whales, with a small dorsal fin in contrast to the right whales which lack this fin. The spout, or blow, of rorquals is single and vertical (if not deflected by the wind); sperm whales have a single spout directed forward at an angle, while right whales have a double V-shaped spout. *B. physalus*, the commonest rorqual, is huge (commonly 60-70 feet long), and exceptionally fast. This species feeds on planktonic crustaceans, also herring, mackerel, and other fishes.

The finback whale appears to be migratory, as are the other rorquals. In the North Atlantic this species moves northward in spring to feed at the higher latitudes during the summer, and southward in autumn to warmer waters, although its movements are imperfectly known. Finback whales were rarely taken by whalers in the early period when right whales were sought, the former being faster and more difficult to handle, with a lower yield of oil and whalebone. Finbacks were caught in large numbers following the development of faster ships and more efficient equipment; there was an active fishery in the New England area from 1850 to 1896, as described by Allen (1916).

The finback whale has been greatly reduced in numbers by whaling, but is still generally the most numerous of the large whales off the coast of northeastern United States, including the latitude of Long Island, and also is the one most commonly stranded. Although probably not as common here as in the vicinity of Cape Cod, which extends farther out to sea, finbacks are occasionally seen near the Long Island shore. They are reported fairly frequently from fishing boats off Montauk Point. Finbacks are most frequent in summer, although they may be encountered in any month. Whales this large only rarely penetrate Long Island Sound beyond its eastern end, however.

Finback whales were frequently sighted, but rarely tackled, by eastern Long Island shore whalers who pursued right whales in small open boats launched from the shore as recently as the early 1900's. Edwards and Rattray (1932), who stated that finback whales often approach the Long Island shore closely in pursuit of small fish, related an instance of a crew fastening a harpoon to a finback off Amagansett; they were reportedly towed 3 miles away from shore in a fast and frightening "sleighride" until the whale broke free of the iron. Murphy (1918) wrote that finback whales regularly fed offshore in the Long Island area in summer, and reported that six finbacks came inside the inlet to Jamaica Bay in July 1916; one of these, 50 feet long, perished after becoming stranded on a bar. Other strandings include one at Huntington Harbor (inside Huntington Bay, western Long Island Sound) on October 22, 1946, and another at Sheephead Bay, south shore of Brooklyn, on November 14, 1936. (Anon., 1956).

**Sei Whale**

*Balænoptera borealis* Lesson

This species resembles in general appearance the finback whale (*Balænoptera physalus*), but is somewhat smaller, attaining a maximum length of 50 or 60 feet. The word sei, correctly pronounced "say," is from the Norwegian, and refers to a kind of fish with which this whale often associates, both feeding together on the same crustaceans. The sei whale is widespread throughout the
oceans of the world, and is numerous at times along the Norwegian coast and also off Newfoundland. Generally, though, it is considered to be rare in the western North Atlantic.

I have no records for the sei whale on the Long Island coast, but probably it is a rare visitor; it has been recorded from Labrador south to Florida and Mexico, and has stranded on the Massachusetts coast at least twice in this century. Also, although borealis is smaller and darker than the more numerous physalus, it is so similar to the latter that it is difficult to identify at sea. Thus it is possible that undetected schools of sei whales are present at times offshore. This species is migratory but is more irregular in its occurrence than the otherrorquals.

Blue Whale

Balaenoptera musculus Linnaeus

This species, also known as the sulphur-bottom, is the largest of all mammals. Total length of fully grown adults in the Northern Hemisphere is about 75-95 feet (females somewhat larger than males); blue whales grow even larger in the Antarctic, where specimens over 100 feet long have been recorded. Very large individuals are now rare, however. Food is almost entirely shrimp-like crus-taceans less than 3 inches long which swarm in the cooler oceans of the world. The blue whale is pelagic and highly migratory, those in the Northern Hemisphere moving to far northern waters in spring or early summer to feed, and then southward in autumn for the winter breeding season. The breeding grounds have not been pinpointed, and most blues may spend this period far out in the central or southern North Atlantic; apparently only a few occasionally migrate as far as the tropics.

In the North Atlantic this species has been so over-exploited that probably only a very few hundred remain, and it is the most endangered of all the large whales. The blue whale is rare everywhere along the east coast of the United States, although it has been found off Newfoundland at times, and there is a sparse scattering of records of individuals which have stranded, or beached, as far south as Ocean City, New Jersey. I know of only one record of a blue whale on the Long Island coast. An individual came ashore at Sagaponack several decades ago (date unknown to me). This stranding is mentioned by Edwards and Rattray (1932), who also provide a photograph of the dead whale lying on the ocean beach.

Humpback Whale

Megaptera novaeangliae Borowski

This species is closely related to the rorquals but has a stout body and long pectoral fins; adults are about 40 to 50 feet in length. It occurs in all oceans and is highly migratory along often rather well-defined routes, spending the winter in tropical and subtropical waters and migrating to high latitudes for the summer. In spring, northbound humpbacks pass our region, and large herds have been seen in April moving north some 200 miles east of the North American coast. Kellogg (1929) provides a distribution map with probable migration routes. Humpback whales may be seen in spring near the coasts of the northeastern states, and a few may also be encountered in summer and fall, but the fall migration south appears to be farther offshore. Also, the larger schools are usually fairly well offshore at all times according to Allen (1916). Formerly common, Megaptera has been badly depleted and is now considered to be rare in the North Atlantic, although increasing slightly in recent years and more numerous on the western side (Kenyon, et al., 1965; Simon, 1966).

In the Long Island area, probably a few humpbacks were taken by early shore whalers pursuing right whales, with more attention being directed to this species from boats cruising offshore following the decline of the right whale. According to Allen (1916) a favorite whaling ground for humpbacks was on the Nantucket Shoals, which are about 100 miles due east of Montauk Point. They were killed here, and also on the Georges Banks farther east, during the eighteenth and nineteenth centuries, Everett J. Edwards, who participated in 15 late period shore whaling expeditions for right whales off the Long Island beaches, and whose father, Captain Josh Edwards, led the Amagansett whaleboats for nearly 50 years, until 1915, recalled only one humpback sighted locally. According to the younger Edwards (in Edwards and Rattray, 1932) about 1913 his father headed a boat which fastened a harpoon to a humpback which had been sighted from the Amagansett beach. But the bomb failed to go off, and the whale towed the boat at high speed until the line parted.

Humpback whales rarely become stranded and I do not have any such records for Long Island, although undoubtedly this has happened. One stranded at nearby Matunuck, Rhode Island, June 1957 (Cronan and Brooks, 1968).
Right whales, like the rorquals, are huge whalebone whales which lack teeth but have horny plates of whalebone or baleen, which are frayed on the inner side and serve to strain small food organisms from the water. Right whales lack both a dorsal fin and grooves on the throat characteristic of the fin whales, but have a relatively larger head and chunkier appearance; adults may be 45 to 55 feet long. This species was the main object of pursuit by the early North Atlantic shore whale fishery, in the day of small boats and hand-held harpoons, because of its slowness, buoyancy when dead, and high yield of oil and whalebone.

The coastal area from Massachusetts to Long Island, where this whale was numerous in season, was one of several important centers of the right whale fishery in the North Atlantic. One after the other these various areas of abundance became depleted, until the right whale verged on extinction. The species survived, is now protected by international law, and appears to be slowly increasing; but in all the North Atlantic perhaps only a few hundred right whales exist (Anon., 1968b).

Shore whaling, using open boats launched from the shore, became established on Long Island during the 1640's and 1650's, and was particularly active along the southern coast of the east end of the island, although right whales were taken as far west as Brooklyn. Also larger boats were used to hunt right whales a short distance from shore. In the early decades of whale abundance scores were caught in some years, and also the many "drift whales," those which had been cast up on shore, were utilized; probably many of these had been disabled by harpoons, others may have been driven ashore by storms or illness. Native Long Island Indians were skillful whalers willing to work for low wages, and thus were frequently employed in manning the whaleboats. After the early part of the eighteenth century, intensive shore whaling rapidly declined here (1707 peak year for amount of oil sold).

A few right whales continued to appear along this coast, and sporadic shore whaling continued through the eighteenth and nineteenth centuries, even though the major whaling effort was then far at sea in larger vessels. Especially in the region of Amagansett, East Hampton, and Southampton, where Long Island shore whaling began, whales were still pursued whenever sighted from shore. At times this amounted to only one or a few taken at intervals of several years. DeKay (1842) wrote: "The right whale was formerly captured in great numbers from sloops and whaleboats, along our whole coast, chiefly from February to May, although they appeared occasionally at all seasons of the year. Along the southern coast of Long Island, whaleboats are still kept in readiness; and upon the appearance of a whale, the people in the vicinity quickly assemble, and soon are in pursuit of the animal."

Four which were harpooned on January 30, 1885, near Southampton attracted collectors attempting to salvage skeletal material, including Frederick W. True from the U.S. National Museum (True, 1885). The skeletons of a few other right whales killed off eastern Long Island in the late 1800's found their ways to various museums. Some were still being killed along this same coast early in the twentieth century; one of these, an adult female 54 feet long (from tip of snout to notch of flukes) captured off Amagansett on February 22, 1907, and the skeleton collected for the American Museum of Natural History, was one of the largest American specimens ever recorded (Andrews, 1908, 1916). A young whale 38 feet long believed to be the calf of the large one, was captured, nearby. Andrews (1909) also studied another small specimen captured by shore whalers off Amagansett on December 10, 1908.

A lively firsthand account of this late period (1890's -1918) of shore whaling from open whaleboats in the Amagansett region is included in the book by Edwards and Rattray (1932). According to the authors the year 1918 was the last in which a right whale was caught and tried out for oil (30 barrels, but never sold); two were sighted off the East Hampton shore early one summer morning and the larger of the two was pursued to Napeague and killed. According to Sleight (1931) right (?) whales were sighted off Southampton and elsewhere in 1923, but the era was definitely over, and no boats were launched. Still to be seen on some old houses in the same region is the "scuttle," a trapdoor in the roof where a person could look out over the ocean and watch for whales.

True (1904) and Allen (1916) compiled reports of right whales captured off the Long Island shore, gleaned from state and local histories and records, and newspapers such as the Nantucket Inquirer, which kept its readers well posted on whaling matters. Years covered range from 1669 to 1908, with most data from the 1800's. Such reports often indicate date of capture, number of whales seen or killed, approximate location along the coast, number of barrels of oil produced or expected, and occasionally length of animal and if calves seen. Dates given indicate that right whales through the years have been most numerous from about late February to late May, with a few appearing earlier (November, De-
In recent years right whales have reappeared in Cape Cod. The Town Marine Museum at Amagansett has a right whale record by the projecting coasts of Long Island and Cape Cod. Thus they converge on the south and east shores of Long Island and Massachusetts to round Cape Cod.

In the ocean off Shinnecock by Stanley E. Poole (William E. Schevill, personal communication). The East Hampton Town Marine Museum at Amagansett has a right whale skull found on the beach there in the summer of 1965. Although frequenting temperate rather than tropical or arctic seas, in the western Atlantic these whales summer well to the north of Long Island, and many of them winter some distance to the south. In fall, most southbound ones pass by well out to sea. As Allen (1916) points out, in spring right whales apparently migrate fairly close to the coast and are turned abruptly eastward by the projecting coasts of Long Island and Cape Cod. Thus they converge on the south and east shores of Long Island and Massachusetts to round Cape Cod.

Red Fox

*Vulpes vulpes fulva* (Desmarest)

The red fox is surprisingly common at the present time in most parts of Suffolk County, and it is frequent also in the less developed areas of Nassau. Writing well over a century ago, DeKay (1842) mentioned a large male red fox killed in Queens, and evidently this species was common enough then, as it had been at least as far back as the late 1700's, although DeKay did not comment on the relative abundance of the red fox to the then very numerous gray fox. Later, at the turn of the century, Helme (1902) briefly noted that the red fox was very common throughout Suffolk and portions of Nassau counties. Through the years red foxes have been popular in furnishing sport for hunters, and also many have been killed for their pelts, which were formerly in demand and brought good prices.

The gray fox was more numerous on Long Island in prehistoric times than the red fox, judging from finds at Indian archaeological sites. I do not know of any published information confirming the presence of the latter on Long Island during Indian times. Waters (1967), who discussed archaeological finds of *Vulpes* and *Urocyon* on Martha's Vineyard, knew of no records of *Vulpes* from archaeological sites on Long Island or farther south. Thus the fact that *Vulpes* is represented in Roy Latham's archaeological collection from eastern Long Island is of interest. He writes (personal communication) that although more gray foxes were found in his excavations, both species were recorded from sites at Three Mile Harbor, Southold, and Shelter Island.

European red foxes, representing a different geographical race of *V. vulpes*, are said to have been released on Long Island for hunting purposes during the 1700's. Apparently such introductions, here as elsewhere, did not take hold, or at least had little effect on the natural increase and spread of the native American form, *fulva*, which extended its range southward into the middle Atlantic and southern states during Colonial times. Assuming the red fox was present on Long Island when the European settlers arrived, the changing environment which followed may have favored the increase of this species (or if it disappeared during late Indian or early Colonial times it could have reinvaded the island during the spread southward).

During the survey, we saw red foxes or signs of their presence in a great variety of habitats. Red foxes cover most of the wilder open country on the island in their
search for such food as cottontail rabbits, meadow mice, birds, carrion, insects, and other varied items. They are very common on the outer beach strip, such as Fire Island and the section between Moriches and Shinnecock inlets; here they patrol the dunes, thickets, and salt marshes, and even forage along the water’s edge on the ocean beach. Inland, red foxes are present in woods, near streams, and around large fields.

Eastward on the island they seem especially common, and are very much at home at Montauk, Hither Hills, Shinnecock Hills, Napeague meadows and dunes, and on Shelter Island, and elsewhere. Apparently eastern Long Island is one of many regions where this species has shown a general increase in recent decades. According to Roy Latham (personal communication) red foxes were encountered only occasionally in the Orient region during four decades or more prior to 1930, but have become very common since then. During the late 1800’s the wilder Montauk region was noted for its red foxes, and it attracted hunting parties from farther west on the island. Naturally, the fox has not fared so well on western Long Island, but it still thrives in some built-up areas near New York City. It was common in now densely settled eastern Queens at least as late as the 1920’s and still is plentiful as far west on the south shore as Jones Beach (Anon., 1968a).

Dens, some actively in use, were found in various situations: on shrubby, grassy hillsides in the Shinnecock Hills (figure 15), in a dike crossing an old, abandoned cranberry bog, in sandy pitch pine barrens, and in the sand of the more sheltered inner dunes on the barrier beaches. In the Long Island sand dunes red foxes are reported to favor the concave face of a wind-carved and overhanging dune as a burrow site (Anon., 1968a). In an area of woods and estates on the north shore of Nassau County, in June, we were shown where red foxes had apparently raised four or more young in a long drainpipe under a paved drive; remains of cottontail rabbits and other prey were present when we visited the site.

Latham (1954) wrote: “Probably the food of the red fox is more varied than that of any other wild mammal on Long Island, and no other is so clever in the methods of obtaining it.” In the same article he wrote about two different occasions at Montauk when he observed red foxes catch a weasel and a muskrat. Hamilton (1935, 1940), drawing partly on information supplied by Roy Latham and others, mentioned some of the diverse foods of red foxes on the island, such as various kinds of frogs, birds, and mammals, and also discarded marine fish, snapping turtle eggs, blueberries, and other tidbits. Audubon and Bachman (1851) wrote an interesting acount of the abundance of red foxes, and their food habits, on the New Jersey outer beaches, an environment similar to the south shore of Long Island; rabbits, water-fowl, wading birds, and crabs and fish thrown up by the surf were reportedly eaten.

Near the entrances to red fox burrows in the Shinnecock Hills, in the spring of 1963, I noted conspicuous remains of various food species, including eastern cottontail, meadow mouse, pine mouse, muskrat, pheasant, and meadowlark. A nursing red fox, examined after being shot by a hunter in central Suffolk County, was found to be carrying three adult meadow mice in its mouth. In unusually deep snow present in January and February 1961, we found a number of cottontails which had been cached by red foxes, several near small streams in the pine barrens. Scats (droppings) are a good indication of what foxes actually eat; only a small number were examined, and they contained cottontail and meadow mouse remains. Of course, the diet of red foxes on Long Island does not differ basically from those living elsewhere in the State, except for their propensity to feed on available marine organisms and sea birds.

**Gray Fox**

*Urocyon cinereoargenteus cinereoargenteus* (Schreber)

Originally the common native fox of Long Island, the gray fox became greatly reduced in numbers during the past century and it has remained rare and local since then. DeKay (1842) stated that the gray fox was then very abundant on Long Island, where it was often called the “plain fox” or “grass fox.” Helme (1927) wrote that although formerly common, this species had become extinct on the island, and that few if any grays were to be found later than 1880; he thought that any instances of their occurrence in the present century must be attributed to introduction or escape from captivity.

However, the status of the gray fox remained in doubt, with a scattering of sightings reported since 1927, while perhaps a majority of the interested field naturalists believed the species had disappeared. I do not know of any specimens actually collected and preserved in recent years, and at least some reports of gray foxes killed have turned out to be red foxes. A few gray foxes have been included in the reported take of foxes by hunters and trappers on Long Island, as were mapped for the year 1940 by Seagears (1944). Even assuming that all of the reported grays were correctly identified, these records indicate that this species comprises only a very small percentage of the total number of foxes killed here.
Hamilton (1949) maintained that the gray fox is generally distributed (or at least was then) in the scrub oak and pine of the central portion of Long Island. Also, this fox apparently still exists in the Montauk-Hither Hills area according to Sam Yeaton (Anthony Taormina, personal communication). In recent years, gray foxes and their trails have been reported in dense thicket country at Montauk (Anon., 1968a). During our field survey we glimpsed single individuals believed to be this species on two occasions, although both of the sightings were disappointingly fleeting; localities were wooded areas near Hampton Bays and Montauk Point.

From the scanty evidence, it seems likely that the gray fox declined drastically in numbers without entirely disappearing from the island. It apparently survives today in the wilder sections of central and eastern Long Island, especially in the pine barrens region and the eastern part of the south fork. However, so little seems to be on record regarding this species here that any additional information, if made known, would be of considerable interest. It should be noted that the gray fox tends to be more nocturnal and secretive than the red, and less inclined to frequent the open country and beaches.

**Raccoon**

*Procyon lotor lotor* (Linnaeus)

The familiar raccoon, like the red fox, is a sizable member of the Carnivora which is more than holding its own on much of Long Island. It is common in various parts of the heavily settled western portion, including certain areas in eastern Queens, and ranges eastward to Montauk Point, Orient Point, and Shelter Island. While it has fluctuated in abundance through the years, probably according to the degree of persecution (many have been killed for sport and for their pelts) and in response to a rapidly changing environment, the raccoon has persisted; evidently it has been well served by its intelligence, adaptability, and highly omnivorous food habits.

The raccoon has been more or less widespread on Long Island throughout a long period of man’s existence here. Helme (1902) stated that it was common in most parts of the island. For the Montauk region, Dutcher and Dutcher (1893) found raccoons common, especially around the various ponds there. On the north shore, Turrell (1939) reported raccoons numerous in the swamps of the Smithtown region, and also along the Nissequogue River and various brooks. DeKay (1842) did not mention Long Island specifically, but stated that the species was well known and found in every part of the State.

Going back three centuries, Denton (1670), in his account of Long Island, listed the raccoon as a member of the fauna, and also stated that it was eaten by the Indians. Also, bones have been found at prehistoric Indian sites of different periods.

In recent decades raccoons have been on the upswing in the area, becoming very common and spreading into new or reoccupying old neighborhoods. For example, Roy Latham (personal communication) writes that for at least 40 years, from about 1888 to 1930, there were no raccoons in the Orient region, but that they have become very common since 1930. Latham states further that they have become exceptionally numerous and locally troublesome to the farmer in the past 20 years. They eat potatoes by digging into the hills, and destroy corn, fruit, and other crops, and even damage buildings by pulling shingles off roofs to get inside. Other writers and observers also tell of a general increase of raccoons elsewhere on Long Island, especially since about 1940.

We saw tracks and other signs of “coons,” and sometimes the animals themselves, in a variety of situations. These included margins of streams and ponds throughout the island, swampy maple woods, bogs, pine and oak bars near water, small patches of deciduous woods in suburban areas, woods near brackish and salt marshes, grassland at Montauk and Napeague, and even the bare sand of the “walking dunes” (although near trees and marshes) at Napeague Harbor. Although frequenting the edge of protected salt water areas, such as Long Island Sound, and the Peconics and other bays, the raccoon does not seem to be as common on the ocean barrier beaches (with their dunes and salt marshes) as the red fox; this may be because of the lack of trees or other denning sites in many of these areas. Raccoons are on Fire Island, however. Inland, raccoons often survive in a patch of woodland trees, especially if a stream or pond is present, after it has been largely transformed into a suburban area or a developed park; their characteristic footprints are still to be seen long after most of the larger forms of wildlife have disappeared.

**Long-tailed Weasel**

*Mustela frenata novempraeccensis* (Emmons)

Distribution and habitat. This is the common weasel found more or less throughout Long Island, except in the heavily built-up areas. Helme (1902) recounted his experiences with weasels on the island—family of young found under a pile of wood, one shot from a squirrel’s nest about 20 feet above ground in a cedar tree, etc. In Queens this species was formerly common and probably
still occurs locally; Hamilton (1949) once observed a 
est with young at Bayside in Queens. Quite a few Long 
Island specimens are in other museums and private 
collections, localities recorded including Flushing in Queens, 
various north shore and south shore points, and east to 
Orient and Shelter Island.

In eastern Suffolk County we occasionally observed 
long-tailed weasels, trapped a few, and found others killed 
on the highway; localities were Flanders, Hampton Bays, 
Montauk Point, Quogue, Riverhead, Sagaponack, South-
ampton, Squiretown, Tiana Beach, Wainscott, and Water 
Mill. Several of our specimens were caught at two trap 
sites near Flanders, one located at the base of a fallen 
tree in a densely wooded, bushy area by a fresh stream, 
the other in the base of a hollow stub in woods bordering 
a salt marsh.

It is not unusual to encounter this species near the 
ocean shore and on the outer barrier beaches. At Tiana 
Beach near Shinnecock Inlet a long-tailed weasel was 
observed in a salt marsh and another was found dead 
on Dune Road; this area is chiefly salt marsh, sand 
dunes, and flats. Tracks judged to be of this species were 
noted in the sand on Fire Island (opposite Smith Point 
and near the Sunken Forest), and on the east side of 
Moriches Inlet in salt marsh and sand. One January day 
in grassy ocean dunes near Wainscott, Christopher Mc-
Keever and I found a large adult male weasel which had 
been killed just a short while previously, apparently by 
a marsh hawk (Circus cyaneus). The weasel, decapitated 
and partially eaten, was found lying on the ground near 
a summer cottage, after we had startled a marsh hawk 
into flight from the spot. Next to the weasel were several 
pellets probably cast by the hawk, three of which 
contained the remains of weasel, others the remains of mead-
row mice.

Tracks and other signs of weasels (probably frenata) 
were also noted in the following habitats; large field near 
Manorville with many meadow mice and pine mice pres-
ent, bog near Speonk with many meadow mice, pine 
barrens near Flanders, and red maple swamp at East 
Hampton. Two were found dead on roads next to duck 
farms—the weasels may very well have been seeking 
Norway rats often abundant in such areas.

*Mustela frenata* is the species of weasel usually found 
on Staten Island, too, although it no longer seems to be 
very common. Some years ago (1941) I saw one hunting 
far out in a salt marsh there, near New Springville.

My impression, in limited trapping for this species, 
was that it is much less common on Long Island than in 
many “upstate” (mainland) New York areas. Roy 
Latham, in a personal communication, writes that weasels 
were common and widespread up to about 1950, but he

believes they have become very scarce, at least on eastern 
Long Island, during the last two decades.

**Remarks.** All the winter individuals collected or ob-
served were in brown pelage. Although most long-tailed 
weasels in northern and central New York turn white in 
winter, virtually all of them remain brown on Long Island. 
Helme (1902) and Hamilton (1949), both familiar with 
this species on Long Island, never recorded any in white 
winter pelage. During the survey, we received a few sight 
reports of white weasels in winter in Suffolk County. This 
could indicate that a small proportion of the population 
assumes a white winter coat, or that the observations refer 
to *Mustela erminea* (which turns white throughout its 
eastern range). Based on what is already known, the 
latter seems more likely, although *erminea* is rare on 
Long Island.

Most of the stomachs examined were empty, but one 
held the partial remains of a gray squirrel. Some of the 
prey species on record as having been caught by weasels 
on Long Island are *Sorex cinereus* (Nichols and Nichols, 
1935); moles, *Scalopus Aquaticus* (Helme, 1902); cot-
tontail rabbits; chipmunks; meadow mice; white-footed 
mice; and Norway rats.

A female on April 17, 1961 (Flanders, Suffolk 
County) contained six embryos, the swellings 8 to 9 mm. 
in diameter.

**Measurements.** Data for the female with embryos 
mentioned above are: weight, 109.5 grams; total length, 
298 mm.; tail, 90 mm.; hind foot, 34 mm. An adult male 
on the same date: weight, 205.4 grams; total length, 397 
mm.; tail, 138 mm.; hind foot, 45.5 mm.

**Individuals taken.** 9

**Short-tailed Weasel**

*Mustela erminea cicognanii* Bonaparte

The short-tailed weasel, or *ermine*, a smaller and 
more northern species than the long-tailed weasel, is very 
rare in the coastal plain portion of New York State. An 
individual in white winter pelage has been taken at 
Babylon, Suffolk County, and was the only Long Island 
record known to Hamilton (1949), who obtained a 
photograph of the specimen. Some nineteenth century 
publications refer to possible but not well substantiated early 
records of this species on Long Island (summarized by 
Helme, 1902). *Mustela erminea* is also rare on Staten 
Island, where it has been collected by Crowe (1939). 
There are a few sight reports by biologists of *erminea* on 
both Long Island and Staten Island. This region is not
included in the range of *erminea* as described by Hall and Kelson (1959); for the east coast they state only that this species occurs south to Rhode Island, although they also note an inland Maryland record.

We did not obtain any firsthand information regarding short-tailed weasels on this survey, although reports received from Suffolk County residents of "very small" weasels and white winter weasels may refer to this species. It is said that one or two least weasels (*Mustela nivalis*) have been collected on Long Island and the skins mounted or otherwise preserved, but I have been unable to locate the whereabouts of any such specimens. Weasels so labeled and actually from Long Island may be *Mustela erminea*, since this rather small weasel has, in the past, been called "least weasel," as it was in Crowe's paper cited above; the range of the true least weasel, *nivalis*, is not known to extend this far east.

**Mink**

*Mustela vison* mink Peale and Palisot de Beauvois

Although the mink is not often seen and is much less common than formerly, it is not really rare and in fact has a rather wide distribution in the region. This species may be encountered near water, mainly in the less populated areas, for almost the full length of Long Island and on both the north and south shores. Like the muskrat, the mink is at home in the coastal salt marshes as well as fresh water areas inland.

Quite a few mink live on the open stretches of the outer barrier beaches, especially Jones Beach, Fire Island, and the strip between Moriches Inlet and Shinnecock Inlet. In these areas I noted their footprints quite frequently in mud, sand, and snow, and also occasionally found troughs in the snow made by traveling mink when coasting for short distances. In the salt marshes on the bay side of the outer beaches (figure 16) the mink appear to spend much time following the many creeks and ditches, judging from the tracks. In these marshes are many muskrats, meadow mice, birds, fishes, and aquatic invertebrates, while cottontail rabbits abound in the adjacent areas, all potential food for hunting mink.

Regarding eastern Long Island, Roy Latham (personal communication) writes that mink are still on Montauk Point, at Three Mile Harbor, and on Shelter Island (12 taken in winter of 1962) and are not uncommon around the Peconic River. At Orient, mink were formerly common, but Latham's last record in that area was one collected on November 28, 1910; before 1910 he averaged about two per winter on his traplines. In Hither Hills State Park, I saw a mink skirting the shore of Fresh Pond one October evening in 1962 (figure 22). As an indication of former abundance, Dutcher and Dutcher (1893) remarked that mink were very common on Montauk Point, with some trappers securing as many as 50 skins apiece in the winter of 1892-93.

The status of this species on Gardiners Island was not determined. Chapman (1908), in a chapter devoted to Gardiners Island, referred to a lack of minks, weasels, and other mammalian carnivores. However, Roy Latham was informed by an earlier caretaker there that mink were present before 1900. On a 1-day visit on July 22, 1961, we found partial remains of what appeared to be a mink on the south point of Gardiners Island, but this material was lost on the return boat trip before being definitely identified.

For the New York metropolitan area, Hamilton (1949) mentioned trapping mink as a boy near Douglas- ton, north side of Queens, as well as nearby in western Nassau County. A few mink survive on Staten Island, although much of their habitat has been destroyed in recent years.

Study skins and skulls from Long Island are represented in various collections, including the U.S. National Museum, the American Museum of Natural History, Cornell University, and the collection of Roy Latham.

**Striped Skunk**

*Mephitis mephitis nigra* (Peale and Palisot de Beauvois)

The skunk, like the woodchuck, is a medium-sized mammal which has decreased markedly on Long Island in this century and is generally much less common here than in the mainland portions of New York State. Formerly common the length of the island, apparently the skunk has declined in numbers over a long period. At the time of Helme (1902) it was still numerous, although less so than formerly. Helme suggested that perhaps the Paris green poison used to control the Colorado potato beetle ("potato bug"), which arrived in the 1890's, was reducing its numbers; it was thought that the skunks ate the poisoned beetles and suffered a rather abrupt decline at about this time. Murphy (1964) and some other veteran observers agree, although there is not unanimity of opinion on this point. Skunks seemed to remain common much longer in certain wilder, nonagricultural sections, such as Montauk and in pine-oak barrens but have gradually become scarce there too. This animal is a frequent victim of automobile traffic, and the dense network of roads and ever-increasing traffic on the island has possibly been one cause of continued reduction in more recent years.
Hamilton (1949) mentioned that 20 years earlier skunks were common, even in sections of western Long Island. Roy Latham informs me that when he was a boy, skunks used to make burrows in potato fields at Orient; his last record for that area was in the year 1911, but he noted skunks as still common in some other Long Island areas where potatoes are commonly grown, many years after they were gone from Orient. Several residents of eastern Long Island, from Hampton Bays to Montauk, told us (in the early 1960's) they believed skunks were much more numerous 15 to 20 years earlier. Skunks were formerly abundant on Shelter Island, and specimens collected there are at the U.S. National Museum and in the collection of Roy Latham. In the 1920's Roy Latham occasionally saw albino or white skunks at Montauk, including two observed together on June 14, 1928, in the daytime. On Staten Island, a few skunks were present at least as late as 1940, but evidently they have become extirpated or very rare (I have no recent information).

It is possible that the skunk is holding its own or even increasing slightly in a few of the less developed areas of eastern and central Long Island. The only specimen we obtained was one killed by a car, but in good condition when found, near Sag Harbor in October 1961. No other road kills were seen, although some were reported to us from the Montauk area. I noted signs of skunks including a den, odor, tracks, and droppings, in an area of fields and pine-oak barrens near Manorville in 1962 and 1963. The den, a burrow occupied by skunks in the winter of 1962, was in level, sandy ground under scrubby oak trees, near the edge of a large field. Tracks were seen in the smooth sand of the moving dunes in Hither Hills State Park (figure 20) in 1962. Skunks are reported to be common in the Hither Hills section where they sometimes raid the garbage cans at the beach camping grounds (Anon., 1968a). Various observers reported seeing skunks in the following localities in the early 1960's: Montauk, Calverton, and Yaphank in Suffolk County, and North Hills in Nassau County.

Three hundred years ago, Denton (1670) listed the skunk as one of the wild animals of Long Island. He also mentioned this species as an article of food of the local Indians. In his account of the Indians, by then considerably reduced in numbers, Denton wrote: "The meat they live most upon is Fish, Fowl, and Venison; they eat likewise Polecats, Skunks, Raccoon, Possum, Turtles, and the like." Roy Latham (personal communication) writes that the skunk was one of the more common mammals discovered in his Indian archaeological excavations on eastern Long Island, found at most sites, as were muskrat, raccoon, deer, beaver, and wolf.

River Otter

*Lutra canadensis* (Schreber)

The time is long past since the otter was common on Long Island. Denton (1670) included the otter in his brief listing of Long Island land mammals, but 172 years later DeKay (1842) wrote that this species, although formerly numerous throughout the State, had become extirpated on Long Island and Staten Island. Nevertheless, during the past 100 years or so, a few otters have been observed at various localities on Long Island and some have been killed. Possibly the otter was never completely extirpated here, but it has certainly been very rare, at least, for a long time nearly everywhere on the island. Most of the locally active field naturalists have never seen it.

According to Helme (1902) at least four otters were killed, then mounted by taxidermists, between 1875 and 1901, as follows: Yaphank, about 1875; Carmans River, 1893; Peconic River near Calverton, winter of 1900-01, also other individuals seen; Patchogue, 1901. Roy Latham (personal communication) states that one trapped at Three Mile Harbor in 1881 may have been the last one taken at that south fork locality. Another record is an otter shot in Great South Bay near Smith Point in 1902.

In Roy Latham's collection is the skin of an otter trapped on March 5, 1929, at Oyster Pond on Montauk Point; it was a male weighing 20 pounds and had been skinned for the fur market before Latham acquired it. Latham writes that otters were present on Montauk for years before this one was trapped, and he saw them there on several occasions in the 1920's when this was still wild country. He first saw them in 1925 at Oyster Pond and Great Pond (Lake Montauk or Montauk Harbor on recent maps) before the latter was opened to the sea; he also saw them at Big Reed Pond, a smaller body of water in the same area. In the fall of 1928 he saw two otters at Great Pond and the slide they were using. Otters still persist in this general area; in a recent communication Roy Latham writes that in February 1969, an adult female otter was caught in a fishtrap at a Montauk Point locality.

Otters were on Shelter Island in the late 1920's, and one was seen several times by a reliable observer during the winter of 1940-41, according to Latham. Also, Latham writes that otters were sighted in the Peconic River near Calverton in the 1920's and 1930's. No otters were encountered during the museum survey, but several reports were received from reliable persons of single otters seen during the 1950's: Shelter Island (about 1955), locality
near north shore of Nassau County (about 1957), Peconic River, and two south shore localities near Great South Bay.

Many otter reports, especially certain recent ones and those from western Long Island, can perhaps best be explained as individuals which have come across the Sound from Connecticut, where the species has been increasing in numbers. On the other hand, Roy Latham has shown that the otter has had a long history at Montauk, and the frequency of reports from certain other areas suggests additional centers where this species may have become at least temporarily established from time to time.

**Harbor Seal**

*Phoca vitulina* Linnaeus

This is the only seal which regularly visits the area and, as its name implies, it frequents harbors, bays, and inlets, and also even enters rivers on occasion. *Phoca vitulina* is a small (up to 6 feet), densely spotted species. Here, in the southern part of its range, where it is a migratory visitor, it is most numerous during winter and early spring, is occasionally observed during the fall, and is rare in summer. This species may be seen swimming along with its head out of the water, when it appears somewhat dog-like, or intermittently diving beneath the surface; also the harbor seal may be found hauled out on the more deserted beaches, islands, rocks, marshy banks, and points of land.

Harbor seals in New York State are most numerous about the east end of Long Island, where even in recent years up to half a dozen or more together on shore have been reported. Roy Latham (personal communication) writes that seals, (usually singles, sometimes three to five in a group) are recorded every winter in Long Island Sound, Gardiners Bay (from Orient west to Cutchogue), and from all the islands of the east end region, including Gardiners Island and Shelter Island. His dates are from November 30 (1929) to May 5 (1932), the latter record at Orient Harbor. Also, 50 seals were counted on a single sailing trip around Plum Island on February 2, 1933. Christopher McKeever informs me that reports he has received indicate fairly large numbers of harbor seals still inhabit the bight on the south side of Plum Island every winter. Dutcher and Dutcher (1893) reported harbor seals as present every winter on rocks that lie off Montauk Point, usually arriving in the area in late November or early December and remaining until spring.

Robert A. Morris, Curator at the New York Aquarium, has been keeping records in recent years of reported sightings of harbor seals in the Long Island area. He writes (personal communication) that over the past 2 years—1968 and 1969—the first reports of seals have come early in January. These reports continue until the end of April. Only one report was received of a harbor seal in August, one at Montauk Point on August 12, 1968.

Harbor seals may be seen just about anywhere along the entire Long Island coast, and small groups are occasionally noted in western Long Island Sound and along the south shore (ocean and bays). It is more usual to see lone individuals (as mentioned by Latham) and I have seen singles in winter swimming in Shinnecock Bay and in Lower New York Bay. During periods in the winters of 1960-61 and 1962-63 coast guard observers at the Shinnecock Inlet station reported seeing a seal, probably this species, swimming every morning in the inlet (figure 12). We also received reports of seals in winter in Moriches Inlet and Great South Bay. The tendency for harbor seals to enter rivers and fresh waters is well known, which explains sightings in the Hudson River.

In the collection of the American Museum of Natural History are several specimens (skins, skulls, skeletons) taken between 1928 and 1959, mainly during winter, also one in late October, at both ends of Long Island. Localities include New York Harbor and Rockaway Beach on the west and Montauk Point on the east; a few are from Long Island Sound. Richard Van Gelder informs me that harbor seals still occur regularly in the vicinity of Montauk Point, and that quite a few have been shot there in recent years. Many are short for sport. Some fishermen are prejudiced against seals, which do little harm, but eat the common and more available fishes, mollusks, and crustaceans, and also occasionally damage nets. But, as Van Gelder and others have urged, it would be desirable to pass a law protecting all seals on Long Island, while this interesting species is still present, for the benefit of the vast numbers of people who enjoy seeing seals.

For many years the harbor seal has been scarce compared with its former abundance in days before the heavy settlement of the coast, its history paralleling many of the cetaceans in this respect. Thus DeKay (1842) mentions the comparative scarcity of harbor seals in his time compared with their former great abundance, while much earlier Denton (1670) wrote of the "innumerable multitude of seals" present at winter on the marshes, beaches, and sandbars of the south shore of Long Island.

Harbor seals in the western North Atlantic are usually designated *P. v. concolor*. The type locality of this form is Long Island Sound, near Sands Point, Nassau County, New York. However, the seals frequenting our coastline are very similar to those of the eastern North Atlantic and Europe, which are designated a different subspecies, *P. v. vitulina*. 
Harp Seal

*Pagophilus groenlandicus* (Erxleben)

There seem to be few records for the Long Island area of seals other than the harbor seal. The harp seal, gray seal, and hooded seal undoubtedly visit these shores on occasion; a few stray individuals of all three have been recorded along the New Jersey coast south of Long Island. These seals have centers of abundance in the region of Newfoundland and the Gulf of St. Lawrence. Harp seals and hooded seals migrate to that region from farther north each winter. Gray seals and the now much depleted hooded seals number a few thousand each, while the harp seals are more numerous but even they are declining. Long Island is situated south of the regular range of these northern seals and only an occasional wanderer can be expected.

According to Linsley (1842) the harp seal was very rare on the Connecticut coast and was seen only at Stonington a few times on the rocks; he was told of an unsuccessful attempt to take a seal there, which from the description he believed to be this species, during the winter of 1841-42. This area is less than 3 miles from Fishers Island, New York, near the entrance to Long Island Sound. Kieran (1959) briefly mentions that the harp seal has been seen offshore at Coney Island in winter; I do not have additional information on this report. Stragglers have occurred as far south as Virginia. The gray seal and hooded seal are large spotted species (larger than the harbor seal), while the harp, which is about the size of the harbor seal, is pale grayish or yellowish, usually distinctively marked when adult with a large irregular, dark band on the back.

Gray Seal

*Iliichoerus Grypus* (Fabricius)

An interesting find, confirmed in 1958, was that of a small southern outpost colony of gray seals located in the vicinity of the west end of Nantucket (Andrews and Mott, 1967). The gray seals, or "horseheads" as they are known locally, are present year round there. The Nantucket locality is some 80 miles east-northeast of Montauk Point. Southward, a gray seal appeared at Atlantic City, New Jersey, after a severe northeast storm in March 1931 (Goodwin, 1933).

I know of no definite reports of this species on Long Island, but it should be looked for around the east end of the island. The relatively deserted coasts and subsidiary islands favored by harbor seals in this area may very likely shelter an occasional wandering gray seal from the Nantucket colony or elsewhere. Young gray seals are known to disperse widely. This species may be distinguished from the harbor seal by its larger size, heavier head, and longer, more pointed snout, and by its slower, more deliberate manner; the color is variable, but usually it is a shade of gray, marked with spots or blotches.

Archaeological finds indicate Indians killed gray seals in prehistoric times as far south as Block Island, about 15 miles from Montauk Point, and also on the Connecticut coast (Waters, 1967). Harp seal remains have also been found on Block Island, but as far as I know, the harbor seal (*Phoca vitulina*) is the only seal which has been reported from material collected at Long Island archaeological sites.

Hooded Seal

*Cystophora cristata* (Erxleben)

At least two hooded seals have been found near western Long Island. According to DeKay (1824, 1842), an adult male over 7 feet long was killed at Eastchester and then put on exhibition in New York City. DeKay (1824) wrote: "It was taken in a small creek emptying into Long Island Sound at Eastchester, about 14 miles from this city. The animal made considerable resistance, but exhibited no symptoms of fear. The captor succeeded in diverting his attention by means of a dog, and was thus enabled to destroy him by repeated discharges of his musket." This fearless, even pugnacious, behavior in face of attack is characteristic of male *Cystophora*. Eastchester, which is not shown on the map, is located on the New York mainland side of the Sound, a few miles across from western Nassau County. Also, within just the last few years a hooded seal was found in a tributary of New York Harbor, according to unpublished information, but I have been unable to locate specific details on this recent record.

White-tailed Deer

*Odocoileus Virginianus* Zimmerman

The white-tailed or Virginia deer has had a long and varied history on Long Island. Archaeological finds and early Colonial records show that for centuries this was the principal big game species hunted by Long Island Indians and was one of their important sources of food. Van der Donk (1656) in referring to New York
in general (Colony of New Netherlands), wrote: "The deer are incredibly numerous in the country. Although the Indians throughout the year and every year (but mostly in the fall) kill many thousands, and the wolves, after the fawns are cast, and while they are still young, also destroy many, still the land abounds with them everywhere, and their numbers appear to remain undiminished." On Long Island, the number of deer declined with the spread of white settlers throughout the area; this was followed by enactment of various laws designed to conserve the deer herd.

DeKay (1842) claimed that, in New York State, attacks of men and wolves were daily decreasing the number of deer, but then went on to say: "In some insulated districts, as on Long Island, where the wolf has been extirpated and the deer are placed under the protection of the laws during the breeding season, although more than a hundred are annually killed by sportsmen, yet it is believed that their number is actually on the increase." Audubon and Bachman (1851) likewise remarked that on Long Island, where the game laws were strictly enforced, deer seemed to be increasing.

The deer population continued to decline later in the 1800's, however. According to Helme (1902) the deer had by then become restricted to a small area (6 x 4 or 5 miles) near the south shore of Suffolk County in the townships of Islip and Brookhaven. Protection afforded by game preserves and private estates enabled the deer to survive in this area. White-tailed deer were also introduced from the mainland. In recent decades deer have increased again, and have spread widely over much of the island, although the expanding metropolitan area restricts their numbers in the western portion.

At the present time deer are numerous on the eastern half of Long Island wherever there is suitable cover, in fact they have become a nuisance in some areas. Hamilton (1949) wrote that the Suffolk County deer herd, then numbering between 1,500 and 2,000 animals and increasing, causes considerable damage to vegetables, principally potatoes, and to nursery stock, such as the growing sprouts of young apples and other fruits. Hamilton predicted that in a few years radical measures would have to be considered to control the number of deer. Mild winters, abundance of food, no large predators except dogs, and the general absence of hunting have favored deer abundance in the more thinly settled areas of Long Island. Many are killed by dogs and automobiles, but the deer have continued to increase and now number several thousand individuals.

In January 1969, a special deer hunt was held on Long Island, the first deer hunt since 1928; with permits carefully regulated by the State Conservation Department, 162 deer were taken by hunters using shotguns during two 5-day periods (Jackson and Miller, 1969).

We saw deer or their tracks at most of our trapline localities in Suffolk County. Deer were encountered in all sorts of woods, including the inland pine barrens, where they are numerous, and around fields, ponds, and bogs. Occasionally they were seen in woods on the very edge of large residential areas. Deer are abundant all through the Montauk area. Here they are easily observed and often appear quite tame in the extensive open and shrubby areas such as the Montauk Downs; we noted groups of up to 16 or more here in the evening. Signs of deer were even found on the ocean shore at the very end of Montauk Point.

At Hither Hills, deer are common in oak woods and other habitats. In Peconic Bay, deer were met with on Jessup Neck, and I understand they are present on Robins Island. On the north shore they are present locally in deciduous woods overlooking Long Island Sound, east to the vicinity of Orient. Roy Latham, in a recent personal communication, writes: "Orient is overrun with white-tailed deer. We counted 28 in a field east of us early in the spring (1970) and I had a herd of nine in my little garden; they have done much damage to plants and small trees." In western Suffolk County, deer are regular but uncommon in the vicinity of the Kalbfleisch Research Station, Dix Hills near Huntington (Lanyon, 1961) and are said to be numerous in Heckscher State Park on Great South Bay.

Deer were seen on visits to Gardiners Island, Shelter Island, and Fire Island (including the Sunken Forest). Controlled marketing is practiced on Gardiners Island, where deer are very abundant (Anon., 1968a). Gardiners Island, incidentally, has had a uniquely long record of one-family ownership, and the deer were carefully protected in the days when they had disappeared elsewhere on eastern Long Island. I am not familiar with the history of this deer herd, but Dutcher and Dutcher (1893) in their account of the mammals of Montauk wrote, "Deer sometimes swim across from the Gardiners Island game preserve some three miles away, causing tremendous excitement and great loss of breath among all the native inhabitants of Montauk."
OTHER MAMMALS

Vanished Recent Mammals

A number of modern-day species of mammals which evidence indicates lived (or probably lived) on Long Island, have become extirpated. Several members of the original mammalian fauna which coexisted with the Indians, including all of the larger carnivores, disappeared early in the settlement of Long Island by the Dutch and English. Little is known about these formerly important species, which include the gray wolf (Canis lupus), bobcat (Lynx rufus), black bear (Ursus americanus), and beaver (Castor canadensis). Because this area is coastal and insular, and was heavily settled early in Colonial times, most of the large wild animals were rather quickly exterminated. A few mountain lions, or panthers (Felis concolor), may have been present then, too, but there seems to be no information about them on Long Island; if a few of these large cats roamed the island originally, they probably disappeared very early in the Colonial period, which is apparently what happened in various other areas along the East Coast. The white-tailed deer is the one large land mammal which managed to survive to the present, although severely restricted at one time to one or two small protected areas of Suffolk County, and the present stock is much diluted by animals introduced from the mainland.

Denton (1670) mentioned the presence of deer, bears, and wolves on Long Island, besides various small fur bearers. A number of early documents and accounts refer to the great abundance of wolves and bobcats, upon which the settlers made war for many years. In the 1600's and beginning of the 1700's bounty payments for wolves killed were made by towns throughout Long Island from Brooklyn to East Hampton (Thompson, 1839, and other sources). Often it was required that the heads of the wolves be displayed in public, such as having them nailed to the door of the constabulary. Large pits and guns set overnight were among the methods used in effecting their capture. As for the bobcat, DeKay (1842) related that it was believed to be extirpated on Long Island then, but that it was so numerous 130 years earlier that the General Assembly passed an act [regarding bounty payments] to encourage the destruction of wildcats in Suffolk County, and that this act was renewed in 1745. Very little is on record concerning bear and beaver here, except that apparently they did occur in early historic times. Thompson (1839) recounts that beavers were reportedly common at a well-known body of water called Beaver Pond near an Indian settlement not far from present-day Jamaica in Queens, during the time of first settlement of the area. Murphy (1964) has been unable to find anything in the literature about beaver trapping on Long Island, but has found the term "beaver dam" in written records. Latham (1940) lists beaver, bear, wolf, and bobcat as recorded for the Town of Southold during the Colonial period, but with dates of latest captures uncertain.

Van der Donk (1656) described in much greater detail than Denton the abundance and habits of animals in early Colonial days. Van der Donk, however, wrote not about Long Island or of any one area in particular, but of the entire New Netherlands colony, the area now consisting of southern and eastern New York State and parts of adjacent states. But his words help give some idea of the abundance of certain species in the general region in the early and mid-1600's, including the following mammals then present on Long Island as well as on the mainland: beavers—"numerous," wolves—"numerous," and preying on deer, calves, sheep, etc.; and bears—"many." Mountain lions, however, were evidently very scarce or absent near the settled areas and coast according to Van der Donk, although known to the Dutch settlers from skins brought in by the Indians to sell.

Scanty remains of some large game mammals have been found at Indian archaeological sites on the island, species which did not exist on the island in colonial times, but which are still found today on the North American mainland. These include wapiti or elk (Cervus canadensis), moose (Alces alces), and apparently bison (Bison bison). These species, as well as some others which survived to early Colonial days, are in Latham's archaeological collection from eastern Long Island. He writes (personal communication), in response to a request for information on vanished species, as follows: "I have teeth from the black bear from Indian village sites on Shelter Island, Three Mile Harbor, and Southold. I have a section of an antler from a wapiti from a pit on an Indian site in Noyack near Sag Harbor and a section of a moose antler from an Indian site in Accquebogue. These antlers were determined by [Robert T.] Hatt. I have the leg bone of a bison from Noyack. This member was identified at the U.S. National Museum as 'either a bison
or a domesticated cow.' It could not have been a cow as it was in the bottom of a 4-foot deep pit in ground not disturbed since the Indian occupation in the prehistoric period. Remains of beaver have been found in all Indian sites from Montauk to Riverhead. None of the Indian sites excavated have been contact sites. We found wolf remains, but we know that they were common in early settler times. We must take into consideration that antlers and even bear teeth could have been brought to Long Island in trade.” In a later letter Latham adds that the Shelter Island bear has been dated at about 1,000 B.C.; also he recorded a bobcat from a Shelter Island site. Latham feels that the wapiti, moose, and bison remains, being of late prehistoric times (200-300 years before white settlement), were probably brought over from the mainland by the Indians.

Moose remains have been found on Fishers Island; Goodwin (1935) mentioned a fragment of an antler found in an Indian shell heap there, and Robert Cushman Murphy (personal communication) recalls that the late Harry Ferguson uncovered moose teeth on Fishers Island and had them identified by a qualified authority. Remains of Indian dogs have also been reported from Long Island archaeological sites.

The Dutch settlers of New Netherlands in the early 1600's had knowledge of living wapiti, moose, and bison, but not in the immediate vicinity of their coast. For example, it is well known that Van der Donk (1656) was familiar with bison. At the beginning of a rather long passage on this species, he wrote: “Buffaloes are also tolerably plenty. These animals mostly keep towards the southwest where few people go.”

A well documented example of a small mammal (subspecies) which became extinct quite recently (late 1800's) in the Long Island area because of the complete destruction of its habitat by man is the Gull Island mouse (Microtus pennsylvanicus nesophilus), which is discussed in the species account. Other small, inconspicuous mammals may have disappeared without notice in the years following European settlement of Long Island. Fox squirrels vanished during the last century from the Northeast; the subspecies known as the eastern red fox (Scirius niger vulpinus) once ranged north to Connecticut and New York. But Bangs (1896) wrote that this shy form could not withstand persecution, and clearing and settlement of the land. For Long Island, there seems to be little information available concerning vulpinus, and also much confusion existed in the past regarding the various races and color forms of fox and gray squirrels. But Audubon and Bachman (1849) apparently had this subspecies primarily in mind when they wrote that the “cat squirrel” (Scirius cinereus), which they explain is the fox squirrel of New York, Pennsylvania, and New Jersey, and intermediate in size between the gray squirrel and the fox squirrel of the southern states, “is rather a rare species—and is met with on Long Island and some other portions of the state of New York.”

**Introduced Mammals**

The Norway rat and house mouse are familiar associates of man which came over from the Old World. So did the black rat, which is now rare. At least one and probably more native American species also made their way to Long Island by one method or another during the historic period. This is fairly well documented in the ease of the opossum. Other species, such as the eastern cottontail, and possibly the little brown bat, also may have invaded the island and prospered in response to changing ecological conditions since the coming of the white man. All of these well-established mammals are discussed in the species accounts.

But in addition to these, Long Island has played host to an unusually large number of deliberately imported and escaped exotic mammals, some of which have become temporarily established locally. The many wealthy landowners and sportsmen, with their private estates and game preserves, and numerous travelers returning from other lands have contributed to this situation. Also certain outlying islands have proved to be havens for some of the newcomers. None of the species has become widely distributed, as far as I know, and lacking details on the history and status of most of them, they will be discussed only briefly. But the possibility of encountering such animals is something to be kept in mind by the student or observer afield in this area.

Various hares and rabbits have been introduced, besides western races of Sylvilagus floridanus, and some of these may be found locally in small numbers. These include—European rabbit (Oryctolagus cuniculus), said to be on Great Gull Island and possibly one or two areas on Long Island proper; black-tailed jackrabbit (Lepus californicus), reported in some limited areas of western and central Long Island in recent years; European hare (Lepus europaeus), a few reportedly in Nassau County, possibly also central Suffolk County; and varying hare (Lepus americanus), introduced in several localities years ago. Some varying hares introduced into Orient in 1915 lasted about 4 years (Roy Latham, personal communication). Among the hares (Lepus), authentic recent records (within the past 2-3 years) are known only for the black-tailed jack, of which two skins have been examined.
(Joseph Dell, Anthony Taormina, personal communications).

As far as I know, the varying hare was not a native resident of Long Island during historic times. The citing of Locust Grove, Nassau County, as a peripheral locality record for this species by Hall and Kelson (1959) appears to be an error. After tracing this record back to Nelson (1909), who did not include Long Island in the range of this species, I believe the probable location for this record is the very small village of Locust Grove in Lewis County (northwestern New York), where C. Hart Merriam collected many specimens in the late 1800's, rather than the much larger town of the same name on Long Island.

For deer, there are black-tailed deer (Odocoileus hemionus) on Shelter Island and sika deer (Cervus nippon) near the Carmans River. The former, which are well known to the local residents, were introduced in 1910 and still survive in an undeveloped area of Shelter Island; I noted several black-tailed and white-tailed deer associating together and feeding in an open field there in June 1963. The sika deer were introduced at Suffolk Lodge (the Hard property on the Carmans River, now a county park) many years ago; the small herd remains in a wild state, but is largely confined to the park (Anthony Taormina, personal communication).

Beavers (Castor canadensis) have been reintroduced and established locally and temporarily, but I have no knowledge of any presently-existing colonies. Other oddities include escaped hedgehogs (Erinaceus europaeus) in central Long Island, and thirteen-lined ground squirrels (Citellus tridecemlineatus) on Fishers Island; I have not heard of any recent reports of these species. The hedgehogs are said to have escaped from greenhouses where they were kept to control insects (as is done in Europe).

Even escaped California sea lions (Zalophus californianus) have been encountered. In July 1965, about 15 escaped from a marineland at Ocean City, Maryland, and although most of them eventually headed south, two of them were recovered as far north as the Long Island area (Robert A. Morris, personal communication).

**Missing Land Mammals**

Long Island lacks several kinds of small mammals presently found on the nearby mainland or in similar terrain along the New Jersey coastal plain. For some of the species this seems surprising, but probably the situation is about what one might expect for a large island near the mainland—the island fauna is mostly similar, but has somewhat fewer species. Certain forms apparently did not make the short jump from the mainland at the western end of the island, or if they occurred earlier, conditions may have become unsuitable for them in the limited Long Island area. With the paved metropolis now blocking this approach, Long Island seems more effectively isolated than previously to natural invasion by four-footed land mammals (although not to accidental or intentional introduction by man).

The red squirrel (Tamiasciurus hudsonicus) is missing, without any evidence that it ever occurred here as far as I know, although it is found in southern New England and also abundantly southwards on the New Jersey coastal plain in pitch pine—oak woods resembling those growing on Long Island. The red squirrel formerly occurred as close as Bronx and Manhattan on the other side of the East River. The red-backed mouse (Clethrionomys grapperi) has never been found either, although it is present in southern New England and southern New York and also south of Long Island in the coast white cedar swamps and sphagnum bogs of New Jersey; if it existed on Long Island one would expect it in these same habitats and possibly also in red maple swamps.

The hog lemming (Synaptomys cooperi) has apparently escaped all search for it on Long Island. This species is often local and uncommon where it occurs and there is the possibility of it having been overlooked, but it seems unlikely that Synaptomys remains undiscovered in such a heavily settled area as Long Island. The scattered sphagnum bogs of the pine region would be the most likely habitat. There are no records of the least shrew (Cryptotis parva), to my knowledge, although there is still some chance it may be found here. More than most small mammals it is apt to go unnoticed, and it appears to be rare and local this far north. Cryptotis has been found twice on the Connecticut coast, at Darien and Westbrook (see Jarrell, 1965) and several have been collected on Staten Island (Chapin, 1908).

Two small bats, the Indiana myotis (Myotis sodalis) and the small-footed myotis (Myotis leibii) have not been found on Long Island as far as I know. Both are rare in the Northeast and known primarily from winter hibernating sites in caves. If a few individuals occasionally visit Long Island or even spend the summer here they would be difficult to detect.
Figure 1. Woods of large beech, tuliptree, oaks, etc., surviving near North Hills, western Nassau County, but encircled by the expanding metropolitan area. March, 1961. Short-tailed shrew, eastern mole, cottontail, chipmunk, gray squirrel, white-footed mouse, pine mouse, and raccoon recorded.

Figure 2. Same woodland area as figure 1, with small stream.
Figure 3. Pine barrens near Flanders. November 1962. Opossum, masked shrew, short-tailed shrew, eastern mole, eastern cottontail, chipmunk, gray squirrel, southern flying squirrel, white-footed mouse, pine mouse, red fox, long-tailed weasel, and whitetailed deer present.

Figure 4. Pond in pine barrens near Flanders. October 1962. Muskrat common, mink occasional. Also all species as in figure 3, with some kinds more numerous in the vicinity of the pond.
Figure 5. Peconic River, near Calverton, July 1963. Masked shrew, meadow mouse, and muskrat numerous in cattails and other marsh vegetation. Otters have been reported in this general area of the river.

Figure 6. Looking towards Great Peconic Bay marshes from pine land east of Flanders. November 1962. Eastern mole, chipmunk, and pine mouse common under the pines, but not venturing out into salt marsh (the home of many meadow mice). Also masked shrew, eastern cottontail, Norway rat, white-footed mouse, raccoon, long-tailed weasel, and white-tailed deer found in the general area.
Figure 7. Edge of southern white cedar swamp (pine-oak woods to right), near Riverhead. November 1962. Flying squirrels observed in the cedars; masked shrew, short-tailed shrew, eastern cottontail, gray squirrel, and white-footed mouse collected under the cedars. Eastern mole tunnels in dry ground near edge. Also chipmunk, woodchuck, red fox, and white-tailed deer recorded in the general area.

Figure 8. Within cedar swamp shown in figure 7. Masked shrews numerous in cavities at the base of cedar trees and mounds.
Figure 9. Small sphagnum bog with southern white cedar, leatherleaf, and a large sedge, near Flanders. October 1962. Masked shrew and meadow mouse numerous. Also eastern cottontail, southern flying squirrel, white-footed mouse, muskrat, raccoon, long-tailed weasel, and white-tailed deer recorded.

Figure 10. Abandoned farmhouse near Manorville. November 1962. Summer maternity colony of little brown bats in attic, just under peak of roof; bats flew in and out of upper window. Also a few big brown bats present in fall.
Figure 11. Weedy, sandy field with black oak and young pitch pines, Hampton Bays. November 1962. Short-tailed shrew and pine mouse abundant, meadow mouse uncommon. Also eastern mole tunnels throughout the area.

Figure 12. Shinnecock Inlet, from base of jetty on west side. Harbor seals in inlet and vicinity during winter, bottle-nosed dolphin found stranded nearby. Also records of pigmy sperm whale, finback whale, and Atlantic right whale off the inlet in recent years. Norway rats live among the jetty rocks.
Figure 13. Red maple swamp with small stream, cinnamon fern, skunk cabbage, vines, etc., near Babylon. April 1963. Several star-nosed moles (very local on Long Island) collected in area shown, in tunnels near the stream. Short-tailed shrew and meadow mouse used the mole tunnels. Also opossum, cottontail, gray squirrel, white-footed mouse, and raccoon listed.

Figure 14. Star-nosed mole above deep tunnel where caught (in area shown in figure 13). April 1963.
Figure 15. Grassland with clumps of shrubs and scattered trees, in Shinnecock Hills. November 1962. Masked shrew, short-tailed shrew, and meadow mouse numerous; eastern mole in some depressions. Red foxes observed and dens found in area shown. Opossum and white-tailed deer common.

Figure 16. Salt marsh on outer strip about 1 mile east of Moriches Inlet. November 1962. Meadow mouse abundant, masked shrew present. Also muskrat, long-tailed weasel, and mink recorded in this marsh, with opossum, eastern cottontail, and red fox common in general area.
Figure 17. View from outer dunes (with beachgrass) across interdune valley to inner dunes, East Hampton Beach. November 1962. Meadow mouse, house mouse, and cottontail rabbit frequented the outer dunes. More mammals were found in the interdune valley, including the above species and also masked shrew, short-tailed shrew, eastern mole, and white-footed mouse. Opossum, red fox, and long-tailed weasel in the area.

Figure 18. Sandy, tall-grass area near the moving dunes (background) at Hither Hills. Meadow jumping mouse, as well as meadow mouse and masked shrew, very common in the tall grass here.
Figure 19. View across extensive marshes and Napeague Harbor (left) from summit of high moving dune in Hither Hills State Park, November 1962. Meadow mice everywhere here, even in clumps of beachgrass on the high dunes. Red fox common.

Figure 20. Moving dunes, showing active edge of a dune encroaching on a patch of woods, Hither Hills State Park: November 1962. Tracks of cottontail, red fox, raccoon, striped skunk, and white-tailed deer frequent on the smooth sand.
Figure 21. Woods of white oak and black oak with bayberry undergrowth, in Hither Hills near shore of Block Island Sound. October 1962. Our easternmost locality for the eastern mole. Also chipmunk and pine mouse present, local this far east. Both shrews, gray squirrel, white-footed mouse, and white-tailed deer common.

Figure 22. Fresh Pond, Hither Hills State Park. October 1962. Keen’s bats abundant and active over the pond and vicinity at least from June to October. Red bats common in late summer and fall. Both species mist-netted over water and shoreline on left. Red fox and mink observed along the shore.
Figure 23. Typical scene under a pitch pine in the pine barrens—husked cones and litter left by squirrels feeding on the pine seeds.

Figure 24. Tubers of groundnut or wild bean, from a large pile accumulated by meadow mice, near Hauppauge. Collected in March 1961. Individual tubers about 1 inch long.
Figure 25. Sandy area with beachgrass, bayberry, etc., in foreground, near salt water bay on Shelter Island. June 1963. Meadow jumping mouse present, also short-tailed shrew, white-footed mouse, meadow mouse, and raccoon listed. (osprey nest on dead tree in distance).

Figure 26. Field on Shelter Island. June 1963. Black-tailed deer (introduced) and white-tailed deer observed feeding here. Red fox sat on rock under lone tree in center distance. Short-tailed shrew, meadow mouse, and eastern cottontail common.
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APPENDIX

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Siphonaptera From Long Island, New York

During the study of Long Island mammals, Paul Connor collected 421 fleas which form the material for this study. We are grateful to Mr. Connor and the New York State Museum and Science Service for the opportunity to study this interesting collection.

The 421 specimens include only 11 species, a remarkably small number. In comparison, a study of material collected by Connor in Lewis County (Benton, 1966) produced 118 individuals of 13 species, while a study of Connor's Schoharie County material (Kuczek, unpub.) produced 606 specimens of 19 species. It appears that the flea fauna of Long Island is impoverished. In part, this is due to the absence of a number of northern forms associated with such mammal species as Clethrionomys gapperi and Tamiasciurus hudsonicus. In other cases, the host species may have been present but not collected or collected in such small numbers that a representative sample of the fleas was not obtained. For example, both Tamias striatus and Glaucomys volans were collected in small numbers, but such flea species as Megabothris acerbus and Tamiophila grandis from the chipmunk, and Epitedia fuscata, Conorhinopsylla stanfordi, and Odontopsyllus multispinosus from the flying squirrel were not taken. Geary (1959) lists three additional mammal fleas from Long Island localities: Ompsylla arctomys, the common flea of woodchucks; Megabothris asio, usually found on Microtus, and Odontopsyllus multispinosus, a parasite of rabbits. Possibly, the relatively small number of species reflects the very limited altitudinal and ecological variability on the island. Certainly, one might expect more than one-third of New York's flea fauna to be found on such a large land area. Selective collecting from species poorly represented in the State Museum collection might add several species of fleas to the list of species which follows:

FAMILY PULICIDAE

Cediopsylla simplex (Baker)

Fourteen specimens of this rabbit flea were collected from two specimens of Sylvilagus floridanus. This is a common flea on Leporids, particularly cottontails, throughout the east except in high areas where cottontails do not exist. (2 males, 12 females)

FAMILY HYSTRICHOPSYLLIDAE

Atyphloceras bishopi (Jordan)

Three specimens were taken from Microtus pennsylvanicus at Shinnecock Hills, December 15, 1961. This is primarily a winter flea, usually taken in larger numbers from nests of the field mouse. It is known from only a few localities in New York, but probably occurs throughout the State. (3 females)

Stenoponia americana (Baker)

Forty specimens of this species were taken, with 35 of them (87.5 percent) having been taken in the months of September-March. Six hosts were represented, with the largest numbers being found on Peromyscus leucopus (35 percent), and Microtus pennsylvanicus (20 percent). In New York, this species has been found only on Long Island and up the Hudson Valley as far north as Albany. (15 males, 25 females)

Epitedia wenmanni testor (Rothschild)

Seven specimens were taken from November-March, four from Peromyscus leucopus, three from Microtus pennsylvanicus. The distribution of this southern subspecies in New York is similar to that of Stenoponia americana. (2 males, 5 females)

Ctenophthalmus pseudagyrtes pseudagyrtes (Baker)

By far the commonest flea species collected, this flea made up 30 percent of the fleas collected, with 128 specimens from 10 host species. It was taken throughout the year, with 80 percent occurring in the September-March collections. (76 males, 52 females)

Doratopsylla blarinae (C. Fox)

Forty specimens of this species were taken, 39 of them from Blarina brevicauda. This species is thus the most host-specific flea taken during this study. The specimens were quite evenly distributed throughout the year, except for a surprising gap during the months of July-October. Possibly this gap was caused by a low population of the host species, or by limited collections during this time period, since it has been taken commonly during these months in other parts of New York. (18 males, 22 females)
Nearctopsylla genalis genalis (Baker)
Eleven specimens were taken, six from Blarina brevicauda, five from Scalopus aquaticus. All were taken between December and March. (5 males, 6 females)

FAMILY CERATOPHYLLIDAE

Orchopeas howardii howardii (Baker)
This common squirrel flea is represented by 113 specimens, seven from Glaucomys volans, the rest from Sciurus carolinensis. No specimens were taken from September to February (37 males, 76 females)

Orchopeas leucopus (Baker)
The 54 specimens of this species were well distributed throughout the year, with peaks in November-December. Forty-eight (88 percent) were taken from Peromyscus leucopus. (22 males, 32 females)

Nosopsyllus fasciatus (Bosc)
The common rat flea was taken only once, a single specimen from Didelphis marsupialis. This was undoubtedly due to an accidental transfer to the opossum from a barn or outbuilding where rats were present. (1 female)

FAMILY LEPTOPSYLLIDAE

Peromyscopsylla scotti (I. Fox)
Ten specimens of this species were taken from October-December, substantiating previous reports that this is an autumn flea. All except one were from Peromyscus leucopus. (4 males, 6 females)

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