

Fire Island National Seashore

**THREATENED & ENDANGERED SPECIES
MONITORING PROGRAM
2010 SUMMARY**



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1. ABSTRACT

Fire Island National Seashore (FIIS) is a National Park unit located just south of Long Island, New York. As part of the Threatened and Endangered Species Program monitoring effort conducted at FIIS, the status of six threatened and endangered (T&E) species were observed in 2010. Through daily monitoring and a collaborative park effort, a total of 17 piping plover (*Charadrius melodus*) nesting pairs were recorded within the park. With a total of 17 successful piping plover fledglings, nesting productivity reached an average of 1.00 piping plover chicks fledged per pair. Annual population surveys for least tern (*Sterna antillarum*), common tern (*Sterna hirundo*), roseate tern (*Sterna dougallii*) and black skimmer (*Rynchops niger*) species were conducted this season in areas specified by the New York State Department of Environmental Conservation's Colonial Waterbird surveys. Eleven seabeach amaranth (*Amaranthus pumilus*) plants were documented throughout FIIS, and 85 seabeach knotweed (*Polygonum glaucum*) plants were documented throughout the federal tracts of land. FIIS staff worked cooperatively with Land Use Ecological Services staff (LUES); LUES is a contracting firm partially responsible for monitoring symbolically fenced areas within particular Fire Island communities for Threatened & Endangered Species as specified in the 2009 community beach nourishment project. Educational and outreach efforts directed towards park visitors, island residents, and cooperating agencies, is critical for the continued success of this program.

2. INTRODUCTION

Fire Island National Seashore was established as a unit of the National Park Service on September 11, 1964, as authorized by United States Congress (Public Law 88-587). Fire Island is a 32-mile long barrier island located off the south shore of Long Island, N.Y. (Map 1, see page 26). Fire Island National Seashore occupies 26 miles of this island, punctuated by 17 private communities located predominately on the western half. There are no continuous paved or unpaved roads running the length of Fire Island, therefore, most of the Island's beaches are open to driving with some internal routes through various communities. The National Seashore land is bordered on the west by Robert Moses State Park and on the east by Moriches Inlet. Smith Point County Park, managed by Suffolk County, is within the boundary of FIIS and makes up the eastern seven miles of Fire Island.

The Lighthouse beach, so named for the Fire Island Lighthouse that once marked the western tip of the island, is bordered to the west by Robert Moses State Park. It expands eastward for approximately one mile to the town of Kismet, the westernmost community of Fire Island. This area sees exponential seasonal visitation increases due to its proximity to the Robert Moses Bridge (one of two vehicle access points to the island), the State Park with five large parking lots, and the ferry terminal in Kismet. For this reason, monitoring for threatened and endangered (T&E) species becomes increasingly difficult as the visitor season progresses.

The private communities on Fire Island run east from Kismet for 11.5 miles to Davis Park and punctuate the Park's land. Some of the more well known National Park owned tracts of land nestled between the

different communities are Sailor's Haven, Carrington Tract (located between the communities of Cherry Grove and Fire Island Pines), Talisman/Barrett Beach, and Blue Point Beach. Since the communities are inholdings that fall within the National Seashore boundaries, they must comply with NPS and other federal regulations. When T&E species are discovered on beaches in front of communities, outside contractors such as LandUse Ecological Services are often contacted to monitor these areas. In 2009, LandUse placed symbolic fencing in communities that supported the beach nourishment project in the spring of 2009 and played a key role in monitoring efforts this year.

Situated in the middle of the dense community area is a 1.3 mile stretch of land known as Sailors Haven. It is one of two stretches of beach on which no vehicles are allowed, but the internal vehicle route allows access to the east and west. It is bordered on the west by Oakleyville and on the east by Cherry Grove, which has no internal vehicle access. Within this natural area lies the Sunken Forest, one of only two examples of the globally threatened holly maritime forest in the world. The Sunken Forest and surrounding area are ribboned with paths and boardwalks for visitor use. The marina and visitors center located here also attract high visitation during the summer months.

Talisman/Barrett Beach is located approximately two miles east of Sailors Haven, between the Fire Island Pines and Water Island. This 1.4 mile stretch of beach is generally less visited than other prominent FIIS beaches due to its remote location and limited access.

The Watch Hill area marks the boundaries of Davis Park, the easternmost community on Fire Island, and the Otis Pike High Dune Wilderness Area. Located here are a visitor center, marina with ferry terminal, campground, trails, and other visitor amenities, as well as a ranger station and employee housing. This area is often the home base from which FIIS biologists work and live during the T&E species monitoring season.

The land between Watch Hill and Smith Point County Park is the Otis Pike High Dune Wilderness Area (OPWA). This seven mile stretch of beach is the only federally designated wilderness area in the state of New York, established for the purposes of maintaining wilderness character and preserving a variety of natural barrier island ecosystems. Historically, this area has contained the majority of piping plover nests as well as seabeach amaranth and seabeach knotweed plants. For the purposes of mapping, the OPWA is often divided into several sections: OPWA West and OPWA East extend over the entire area, bisected by the narrow inholding of Bellport Beach. The OPWA East is further distinguished by the Old Inlet and Overwash areas.

The area referred to as the Overwash once included some of the largest dunes on Fire Island. It was these dunes that helped name the wilderness as the Otis Pike High Dune Wilderness Area. A Nor'easter event in 2005 washed over these dunes to its current state as a sandy, mostly flat area. The Nor'easter event on April 16, 2007 further widened the Overwash in many areas. Consequently, the most recent aerial photographs (2004) do not reflect the current Overwash area. It expands east from Old Inlet for approximately 1.5 miles with a 0.25 mile width sprawling north from the former dune line. Primary dune regeneration has been observed though no official measurements have been taken. Sparse vegetation communities occur throughout this area, and it is characteristic of prime habitat for nesting shorebirds and germinating seabeach amaranth and seabeach knotweed.

Included in Fire Island National Seashore land is the historic William Floyd Estate, a 613 acre parcel of

land donated to the Park in 1965. This section of the park is located on the south shore of mainland Long Island, in the town of Mastic Beach. Although Cultural Resource and Invasive Plant Management efforts are implemented, no populations of federally listed T&E species have been observed to date, and therefore no T&E species monitoring occurs here.

Several small islands located in the Great South Bay fall within FIIS boundaries. During waterbird and shorebird breeding season, biologists conduct colonial waterbird surveys on these islands and other areas of Fire Island. Point counts of various colonial waterbird species were conducted twice during the season in conjunction with the NY State Department of Environmental Conservation (NYSDEC).

Sections of Fire Island National Seashore provide suitable breeding/germination habitat for a number of federal- and state-listed T&E species. Protected avian species observed on FIIS are the piping plover (*Charadrius melodus*), least tern (*Sterna antillarum*), common tern (*Sterna hirundo*), roseate tern (*Sterna dougallii*) and black skimmer (*Rynchops niger*). Protected vegetative species include seabeach amaranth (*Amaranthus pumilus*) and seabeach knotweed (*Polygonum glaucum*).

Of the six species observed, the piping plover constitutes the largest portion of the monitoring program effort. Listed as a federally threatened species in 1986, FIIS has worked extensively toward the recovery of the piping plover. FIIS works in collaboration with the US Fish and Wildlife Service (USFWS) within the parameters of their Piping Plover Recovery Plan to ensure the long-term viability of the Atlantic Coast piping plover population in the wild, thereby allowing possible future removal of this population from the Federal List of Endangered and Threatened Wildlife and Plants (USFWS 1996). One of five recovery criteria for the piping plover states that 2,000 breeding pairs must be successfully monitored and maintained for five consecutive years. Of the 2,000, 575 of those must be located within the states of New York and New Jersey. Other important delisting criteria for the piping plover species include achieving a five-year average productivity of 1.5 fledged chicks per nest and instituting long-term agreements among cooperating agencies, landowners, and conservation organizations in order to maintain population and productivity.

Prior to the federal listing of the piping plover, the interior population of least tern was listed as federally endangered in 1985 and in New York State the Atlantic Coast population is listed as threatened. The roseate tern was listed in 1987 as endangered both federally and statewide. According to the USFWS, once the Northeast nesting populations of roseate terns reach 5,000 in at least six large colonies with high productivity, they will be removed from the endangered species list.

Encompassing FIIS threatened and endangered vegetative species are seabeach amaranth (amaranth) and seabeach knotweed (knotweed). Amaranth was believed to have been extirpated in New York for over three decades until isolated populations began to appear on Long Island in the early 1990s. Amaranth was listed as federally threatened in 1993 and knotweed is listed as a New York State species of concern.

3. OBJECTIVE

It is the objective of Fire Island National Seashore to follow the management goals set forth in the Endangered Species Act (1973), Endangered Species Habitat Management Plan (1998), and the US Fish & Wildlife Piping Plover Atlantic Coast Population Revised Recovery Plan (1996) for the protection and productivity of nesting threatened and endangered species. These guidelines include monitoring breeding/germination populations, documenting productivity, limiting human disturbance to areas with suitable habitat, protecting listed species from potential predators, and educating the public. The purpose of this report is to present the results of the 2010 T&E species program conducted on Fire Island National Seashore and discuss areas of improvement for the upcoming field season.

4. PRESEASON PROTOCOL

In accordance with USFWS guidelines, preseason habitat fencing (symbolic fencing) is erected for the purpose of protecting avian species nesting habitat and potential vegetative species habitat. In 2010, symbolic fencing was constructed and established in early April, prior to the onset of the piping plover breeding season. Areas to be fenced were determined through the compilation of nest/plant data collected from previous years, early season plover observations, and through visual assessments.

All symbolic fencing on FIIS for 2010 was constructed using 5.5 ft Carsonite™ fiberglass posts, biodegradable or nylon flagging and sisal twine or nylon string. Carsonite™ posts' light weight offers an efficient alternative to steel posts used in years past, and the use of biodegradable materials in certain sections of beach (particularly the OPWA) helped reduce the environmental impact of lost fencing. Posts are placed approximately 12 paces apart and are connected using twine/string; strips of orange flagging are secured along the twine/string to visibly identify symbolic fencing. For every fourth post, an informative 'plover habitat' or 'endangered species area' sign provided by the USFWS is posted, notifying the public of the reason for symbolic fencing. Larger interpretive signs were situated at public access entrances to inform beachgoers about the piping plover.

Throughout sections of FIIS, restrictions and/or beach closures are implemented regarding vehicles and pets. While some beaches on Fire Island are open to driving, vehicles are prohibited from a 0.7 mile section of the beach at Sailors Haven year-round, and the OPWA is closed to vehicular traffic from March through September to coincide with the piping plover breeding season. Additional closures of areas to ORVs occur when nesting/hatching of nests is imminent, due to the documented negative effects vehicular driving on the beach has on the nesting success of breeding shorebirds, as well as the germination of threatened/endangered plants. As with driving, domestic dogs (*Canis lupus familiaris*) have also proven harmful to the success of some shorebirds and are thereby ordered to be restrained at all times on a leash which shall not exceed six feet in length while on the beaches of a NPS unit (36 CFR2.15). Pets are entirely prohibited from areas of beach with unfledged chicks of piping plover or other protected species present on federal tracts. Executive Orders (EOs) by the Town of Brookhaven were issued on non-federal tracts within FIIS in 2010 to protect nesting and unfledged piping plovers from unleashed dogs on the beach.

At the beginning of the nesting season, additional preventative measures are implemented for the protection of the piping plovers. In order to protect nests from avian and mammalian predators, wire

exclosures are erected and placed around the nest site. Exclosures are ten feet in diameter and are constructed using 2 x 4 inch galvanized welded mesh fencing. The fence is then buried approximately 12 inches deep and supported by four Carsonite™ posts which are buried and attached to the fencing using multi-purpose zip ties. In order to deter avian predators, a ¾ inch nylon mesh is placed over the top of the exclosure and tied down with zip-ties.

5. POPULATION MONITORING

5a. Piping plover monitoring

i. Preliminary monitoring

Piping plover migration to Fire Island occurs between late February and March, with tern species arriving in late April and early May. During these early weeks when plovers are establishing nesting territories, the entire island is scanned for activity. Areas where birds are seen regularly are more intensely monitored and symbolic fencing is erected and adjusted accordingly. The OPWA, which in years past has consistently yielded the highest piping plover productivity, is monitored closely beginning in late March. By mid-April, monitoring is conducted at least five times a week by foot throughout the Wilderness Area. Possible piping plover activity on federal tracts: Watch Hill, Talisman, Sailors Haven and the Lighthouse beach are also closely monitored, as well as non-federal tracts. Off-road vehicles (ORV) may be utilized as a means of transportation to these areas.

Daily monitoring surveys and biological data are conducted and collected by qualified field biologists walking along the beaches. Before nesting occurs, observations of individuals or pairs of piping plovers are recorded. Information recorded includes: time/date, weather conditions, number of birds, displayed behaviors, and geographic coordinates using a handheld Global Positioning System (GPS) unit.

This preliminary monitoring process continues until the discovery of the first nests, usually in early May. Breeding pairs of plovers are identified using binoculars and observed for specific territorial, courtship and nesting behaviors. These behaviors include (but are not limited to) parallel runs, aerial displays, scraping, broken-wing display, and vocalization (Cairns 1982).

ii. Incubation monitoring

Piping plovers generally lay one egg every other day until they reach a complete clutch size of 4 eggs, though in some instances a nest may contain 3 eggs. The latter are typically re-nests of unsuccessful nests by a breeding pair. Regardless of nest location along FIIS, all plover nests were exclosed and protected within symbolic fencing borders, creating a buffer zone of no less than then 50 meters on all sides. In areas that were heavily populated by beachgoers, the buffer zone was enlarged in order to decrease the amount of human disturbance and allow for greater habitat protection.

Upon discovery of a nest, an alphanumeric tag is used to identify each nest; a nest number and year are assigned chronologically, using an “A” for first nesting attempt, “B” for second, and so on (eg.1A-09). Universal Transverse Mercator (UTM) North American Datum (NAD) 83 coordinates are recorded for each nest site using a Garmin™ Global Positioning System (GPS) unit and extracted onto an ArcGIS™

(Geographic Information System) aerial image of Fire Island for monitoring and data management purposes.

Monitoring efforts for nesting activity are increased after pairing or copulation is observed. Field biologists lead intensive daily monitoring observations for the purpose of quickly identifying nests and exclosing them at full-clutch status. This effort helps ensure minimal disturbance towards breeding pairs and allows for accurate estimation of hatch and fledge dates. An average hatch date of 27 days from the full clutch date is determined utilizing a chart produced by New York State Department of Environmental Conservation (NYSDEC). Each day, a nest is carefully observed with binoculars from a distance no less than 50 meters, and the activity of the birds is recorded. Daily nest site observation information is recorded on individual data sheets for each nest then transferred to an Excel spreadsheet.

iii. Brood monitoring

Daily brood monitoring is initiated after the first piping plover egg is hatched. Cautious attention is given to all plover chicks, since chicks are most vulnerable to predation during their first one or two weeks after hatching. Data collected for each brood consists of: number and behavior of adults, number of chicks observed, and location. Careful efforts are made to properly distinguish amongst chicks, especially where nests are in close proximity to each other. Age, size, and plumage are the major factors in differentiating chicks. During instances of missing chicks, field biologists are to scan the vicinity of the nest site for those unaccounted for a period of five days in accordance with USFWS guidelines. It takes 25-35 days after hatching for a plover chick to fledge. Chicks are either considered fledged when witnessed thirty-five days after they have hatched or when a sustained flight of fifteen meters is observed before then. When a nest is situated near a vehicle beach access route, a fledge date of thirty-five days is implemented and driving restrictions are extended to ensure the safety of the brood (USFWS 1995).

5b. COLONIAL WATERBIRD SURVEY

Population counts for colonial waterbirds were conducted twice during the 2010 season in June, once before the 15th and once after. Sponsored by the NYSDEC, the Long Island Colonial Waterbird Survey (LICWS) monitors the presence and populations of various colonial waterbirds. Many of the sites surveyed are located on Fire Island's ocean and bay beaches between the Lighthouse Tract and Smith Point County Park. These areas were monitored by qualified field biologists and accessed by either ORV or on foot. Several bay islands that fall within the boundaries of the park are also monitored for waterbirds, including (but not limited to): Sexton Island, West Fire Island, East Fire Island, Long Cove, Ridge Island, Pelican Island, John Boyle Island, and Hospital Island. These bay islands can only be reached by either motorboat or canoe, and access may be limited by inclement weather, remoteness of location, and time constraints.

5c. VEGETATION MONITORING

Amaranth and knotweed begin to germinate on FIIS in early July. These species tend to grow in clusters, but isolated plants have been observed as well. These plants also tend to grow in early successional beach/dune habitat—the same type as preferred by piping plovers and least terns for nesting. For this reason, symbolic fencing established for plover and tern nesting habitat remain up

during germination period for amaranth and knotweed. Fencing may be adjusted after initial sweep counts to provide a buffer around plants. Field biologists conduct vegetation monitoring sweep counts throughout FIIS, both on foot and using an ORV, traveling parallel to the toe of the dune. A Garmin™ GPS unit is used to collect data points for the locations of amaranth and knotweed plants, and individuals or clusters are marked with pinflags or stakes. All plants located outside of existing symbolic fencing should be marked, enclosed within fencing, and recorded with a GPS. Other data collected include location, plant condition, size, reproductive status, cluster number, potential threats, weather conditions, and general observations in accordance with data sheets provided by The Nature Conservancy. GPS data are transferred to a computer, corrected, and displayed on an ArcGIS™ aerial image of Fire Island. Sweep counts for amaranth and knotweed continue throughout August and early September until plant growth and reproduction ceases.

6. RESULTS

6a. PIPING PLOVERS (*Charadrius melodus*)

Monitoring for the 2010 piping plover breeding season on Fire Island began when the first piping plovers were observed in early April and continued through mid August. In the months between April and July, piping plover nests were discovered and documented throughout FIIS.

A total of 16 nesting pairs were documented, from which there came 23 nesting attempts throughout the island. Eleven nests hatched and nine successfully fledged chicks. Nests were lost due to abandonment, predation, and overwashes. Three nests hatched chicks, however, no chicks survived to fledge (1A, 3B, and 14B).

A total of 76 eggs were laid and 38 of these total eggs hatched, with the remainder failing as a result of predation, abandonment, overwash or other circumstances (Figure 2, *see page 22*). Seventeen chicks total went on to fledge, yielding a productivity of 1.06 for 16 breeding pairs (Table 2, *see page 21*).

A breakdown of the number of eggs that hatched and their survival rate is displayed in a bar graph showing the number of chicks that survived past 1 day, those that lived past 2 weeks and those that went on to fledge. Ten chicks did not survive past day 1 (Figure 1, *see page 22*).

i. Summary of piping plover nests

A summary of plover nest activity on the western half of the island is as follows: two at Lighthouse Beach (3A, 3B), one at Fire Island Summer Club (13A), two at Point O' Woods (12A, 12B), one nesting attempt at the Fire Island Pines (4A), and one nesting attempt at Watch Hill (1A).

The Otis Pike High Dune Wilderness Area (OPWA) yielded 16 nesting attempts which were divided by location: OPWA West (Watch Hill to Bellport Beach) and OPWA East (Bellport Beach to the Wilderness Visitor Center). There were 4 nesting attempts in the OPWA West (5A, 14A, 14B, 16A). In the OPWA East there were 12 nesting attempts, 4 of which were in the overwash (2A, 2B, 2C, 6A) and 7 between Bellport and Old Inlet (7A, 8A, 8B, 10A, 10B, 11A, 15A). Finally there was one nest east of the overwash (9A). Below is a summary of each attempt:

Nest **1A-10** was found with 4 eggs on April 28th just east of the Watch Hill driving cut. The nest was exclosed the following day. On May 24th there were very heavy winds and Park Ranger Czachor reported 1 chick had hatched but was buried by sand in the scrape. It eventually became unburied but was barely moving. The next day the chick was found dead inside the exclosure. USFWS was contacted and FIIS biologists removed the exclosure to search for the other 3 eggs. The remaining eggs (or possibly hatched chicks) were not found and it was concluded that high winds, burial and/or overwash caused the chick to be buried, along with the 3 unhatched eggs.

Nest **2A-10** was discovered on May 4th with 3 eggs, located approximately ~300 meters east of Old Inlet. However, on May 6th the nest was planned to be exclosed but was discovered predated with broken egg shells found nearby. No predator tracks could be seen near the nest site.

Nest **2B-10** was found ~25 meters west of **2A-10** on May 17th with 3 eggs. The nest was exclosed the same day. However, on May 19th extreme high tides caused the nest to be overwashed.

Nest **2C-10** was discovered with 1 egg on May 25th. The nest was exclosed on May 28th with 2 eggs. A full clutch was recorded on May 30th. On June 24th the chicks began to hatch. Three chicks were mobile in the exclosure but 1 egg had not hatched. From June 25th through June 29th only 3 chicks were recorded always in close proximity to the exclosure and the fourth egg had hatched leading us to believe 1 chick had been predated. However, on June 30th a fourth chick was spotted and 4 chicks were observed until July 9th. Only 3 chicks were continuously observed and reached 25 days old on July 20th.

Nest **3A-10** was discovered with 2 eggs on May 4th on Lighthouse beach. On May 7th there was a full clutch and the nest was exclosed. On May 26th the nest was checked and only 1 egg was found just of the exclosure. One plover was making a new scrape and doing mandibulate behavior (picks at or picks up substrate and shell fragments from ground) while the other bird was foraging nearby. The previous night extreme high tides had washed out the nest leaving only this 1 egg. The following day the nest and egg were deemed abandoned. The plovers were foraging by the water and upon closer examination the remaining egg was slightly cracked.

Nest **3B-10** was discovered on June 8th with 2 eggs. The nest reached a full clutch of 3 eggs on June 10th. On July 7th 1 hatched chick was observed. However, July 16th was the last day FIIS biologists observed the chick. A West District Ranger reported seeing the chick as late as July 23rd which would have made the chick 16 days old on its last sighting.

Nest **4A-10** was found with 1 egg on May 5th on the beach of Fire Island Pines by FIIS staff. However, the nest was abandoned the very next day. Human disturbance is the most likely reason for the disturbance. LandUse staff reported fresh footprints leading from a house where construction was occurring, through the symbolic fencing and to the beach, approximately 10' from the nest location. The birds abandoned the area immediately and did not attempt to re-nest.

Nest **5A-10** was discovered on May 7th with 2 eggs located in the west end of OPWA West. The nest was successfully exclosed on May 11th with 4 eggs. On June 8th FIIS biologists noticed that the exclosure had been dug around and there were numerous fox tracks. All eggs hatched but only 3 chicks were observed until June 14th. Two chicks were observed from June 15th - 27th although 1 chick was

injured and struggling to walk. Only 1 chick was observed thereafter until it was observed doing flights > 15 meters on July 10th.

Nest **6A-10** was found in the east end of the OPWA at the eastern edge of the overwash area. It was further north between a dune and the diverted walking path on May 7th with 2 eggs. The nest reached a full clutch of 4 eggs on May 10th and was exclosed on May 11th. On June 6th the nest hatched yielding 3 chicks. Three chicks were observed throughout the next 21 days, but only 2 chicks fledged after 25 days.

Nest **7A-10** was found on May 10th with 2 eggs west of Old Inlet in the middle of fencing section 6. On returning to exclose the nest on May 13th FIIS biologists found it predated. One egg shell and fox tracks were found near the original nest site. This pair did not attempt to re-nest and left soon after the predation.

Nest **8A-10** was first observed on May 16th with 2 eggs about 200 meters west of Old Inlet, far back in an overwash area. Campers had originally reported the nest and East District Rangers asked them to relocate. However, FIIS biologists went to the site on May 17th to confirm the location of the nest. The campers had been in the area for more than 24 hours and had not moved far enough from the nest as to avoid disturbance and ultimately, abandonment.

Nest **8B-10** was found on June 6th with 4 eggs just west of Old Inlet but closer towards the beach in the dune grass. It hatched on July 2nd with 3 chicks observed the first day and 4 chicks observed for the next 7 days. Two chicks were observed after that until they fledged on July 26th.

Nest **9A-10** was discovered on May 16th with 2 eggs in between the diverted walking path (Overwash area) and the Wilderness Visitor Center. The nest reached a full clutch of 4 eggs on May 20th and was exclosed the same day. Three chicks hatched (1 egg never hatched) and were observed every other day until fledging. This brood was rarely observed far from their original nest site due to the beach being relatively crowded.

Nest **10A-10** was found on May 16th with 1 egg west of Old Inlet. Three eggs were recorded on May 21st and an exclosure was erected. However, by May 26th the nest had been washed out by an extreme high tide.

Nest **10B-10** was found on June 8th only ~20 meters east of 10A and ~10 meters west of 8B. The nest was found with 2 eggs, was exclosed on June 11th, and by June 12th still only had 2 eggs. However, when the approximate hatch date was approaching the nest was checked again on July 2nd and there were 3 eggs. On July 6th hatching began. By July 9th all 3 chicks were observed, but only 2 chicks survived past that date. By July 20th only 1 chick was observed and survived to fledge on August 1st.

Nest **11A-10** was found with 1 egg on May 16th ~200 meters west of nests 10B and 8B. It reached a full clutch on May 21st and was exclosed on May 20th. On June 16th the nest began hatching, with 1 chick in the scrape, 1 chick mobile, and 2 un-hatched eggs. The following day there was only 1 chick observed and 1 egg remaining in the nest. This 1 chick went on to fledge and was observed in its usual area as late as 35 days.

Nest **12A-10** was discovered ~75 meters west of the Oakleyville driving cut on May 17th with 4 eggs. The area receives regular vehicle traffic and fresh tire tracks were seen as close as 10 feet from the nest. Symbolic fencing and an enclosure were erected that same day. However, on May 22nd no adults were seen in the area and the nest was declared abandoned.

Nest **12B-10** was an elusive nest, with 1-2 reports of plover sightings coming in from West District Park Rangers. However, the nest was not detected until July 5th. It was found with 2 un-hatched eggs ~400 meters west of the Oakleyville cut. Tracks looked fresh but no adult plovers were sighted. The nest was originally thought abandoned but on July 11th 2 adults and 2 chicks were spotted in the west end of Sailors Haven. These chicks were estimated to be 1 week old so it was concluded that the nest was not abandoned but hatched with 2 chicks (abandoned the 2 un-hatched eggs) and their brood initially moved to the Sailors Haven area. By July 15th the brood had moved closer to Point O' Woods (just east of the sand bags) and stayed in this area, foraging in the pools, until the 2 chicks fledged on July 30th.

Nest **13A-10** was found by LUES monitors and was exclosed as a collaborative effort (FIIS and LUES biologists) on May 20th with a full clutch of four eggs. It was located just east of the Corneille Estates cut, in front of the Fire Island Summer Club. The nest hatched on June 5th with 3 chicks observed on hatching day and 4 chicks observed the day after. Two to 3 chicks were reported but only 2 chicks successfully fledged. The birds moved west from their nesting site to a less crowded section of beach west of the Corneille Estates cut and east of Robbins Rest.

Nest **14A-10** was found behind fencing section 2.5 (in the west end of OPWA, east of Watch Hill) on May 24th with 1 egg. On May 26th no birds were seen and the nest was searched for but could not be re-located. The nest was declared predated the following day due to the inability to relocate the nest and the many fox tracks in the area. The birds were not sighted again and did not re-nest.

Nest **14B-10** was found and exclosed on June 7th with a full clutch of 4 eggs. It was monitored regularly until July 2nd when the nest appeared to have hatched, however, there were no eggs in the scrape and no birds observed. The area was monitored closely during the next couple of days but the pair and chicks were not sighted again. The chicks were assumed to have been immediately predated due to the heavy and immediate proximity of fox tracks around the enclosure.

Nest **15A-10** was discovered on May 29th east of Bellport Beach with 1 egg; the nest was high on the dune and surrounded by American beachgrass. It was exclosed with a full clutch on June 3rd. The birds were incubating regularly until June 23rd. No birds were observed and by June 24th the scrape was partially filled with sand. At this time it was determined to be abandoned. The birds were not sighted again and did not re-nest.

Nest **16A-10** was located with 1 egg on June 11th after the pair had been observed in the area, just west of Bellport beach, courting and scraping for several weeks. On June 16th FIIS biologists went to exclose the nest but no birds or eggs remained. Red fox and gull *spp* tracks were found in the vicinity and the nest was deemed predated.

6b. COLONIAL WATERBIRDS (*Sterna* spp)

Efforts were made to conduct Long Island Colonial Waterbird Surveys on Fire Island and its smaller islands in the Great South Bay. Although all breeding bird species were identified by FIIS staff, the NYSDEC is most interested in breeding least terns (*Sterna antillarum*; LETE), common terns (*Sterna hirundo*; COTE) and black skimmers (*Rynchops niger*; BLSK). Almost all areas were covered, but unfortunately some of them were not surveyed in both time windows due to various circumstances such as weather events, motorboat activity and remoteness of location. The first window was from June 1st through June 14th and the second window was from June 15th through June 30th.

In total, 16 different sites were surveyed throughout the month-long effort (Table 3, *see page 25*) including 9 bay islands and 6 sections of Fire Island. COTE and/or LETE colonies were observed in the following areas: Sexton Island, East Fire Island, Long Cove, Ridge Island, and the Otis Pike High Dune Wilderness Area beach (which includes Davis Park and Watch Hill beach). Annual population surveys for least tern, common tern, and roseate tern species resulted in total maximum counts (the greatest number counted during a survey period for each site) of 38, 1395, and 0 respectively.

Relative to past years, Ridge Island was a new site to support a tern colony, with a maximum of 350 COTEs observed during the second window. In addition, the number of COTE breeding individuals increased at Sexton Island and East Fire Island relative to 2009. From 2009 to 2010 Sexton Island's COTE numbers went from 60 to 140 and East Fire Island from 300 to 495. In addition, there was a LETE colony of 75 individuals on East Fire Island in 2009; however, no LETEs were sighted during both counts this year. The survey in 2009 was done after the 2nd window on July 14th, which may underline the importance of consistent surveying during the survey windows throughout Long Island for the LICWS (Table 3, *see page 25*).

As for sections on Fire Island, the OPWA was the only site to support tern colonies, with 38 LETEs, primarily in Davis Park, counted on June 29th. In Davis Park there were 19 nests, with a total of 37 eggs laid. Unfortunately an extreme high tide event on July 11th - 12th caused a majority of the nests in Davis Park to overwash. It's estimated that only 1 chick successfully fledged from the 5 chicks that hatched. In 2009 there were several small colonies of LETEs observed throughout Fire Island, with only 1-4 breeding birds. In 2010 no LETEs were observed outside of the OPWA site (Table 3, *see page 25*).

6c. VEGETATION (*Amaranthus pumilus* and *Polygonum glaucum*)

A total of 11 seabeach amaranth plants were found in the several sweep counts on FIIS throughout July and August (Figure 6, *see page 24*). Sites from the LICWS were recognized and reported as such for each species: Lighthouse, Fire Island Villages, Sailors Haven, Fire Island Pines, and the Otis Pike Wilderness Area. Sites found with amaranth include Lighthouse beach (2 plants), Fire Island Villages (6 plants), Fire Island Pines (1 plant) and OPWA (2 plants). Four out of 11 plants showed signs of herbivory, presumably from white-tailed deer (*Odocoileus virginianus*): the 2 plants in OPWA, 1 plant in Saltaire (Fire Island Villages) and the 1 plant in Fire Island Pines. A mixture of large and small plants was observed and a majority was located inside the symbolic fenced areas designated initially for piping plover and least terns.

Surveying for seabeach knotweed was concurrent with that for seabeach amaranth (July-August). A total of 84 knotweed plants were counted on the federal tracts of FIIS (Figure 6, *see page 24*). Sites found with knotweed include Lighthouse beach (51 plants), Sailors Haven (15 plants), Fire Island Pines (14 plants) and OPWA (4 plants). Unfortunately, only federal tracts were surveyed within each of these sites, so the reported numbers may be an underestimate of the number of plants for the 2010 season. Most of the plants were a mix of large and small sizes and located inside the symbolic fenced areas designated initially for piping plover and least terns. Tropical Storm Earl caused severe high tides on southern Long Island on September 3rd – 4th; this caused burial or sustained salt water inundation of amaranth and knotweed plants at most sites on Fire Island which resulted in the death of most plants.

7. DISCUSSION

7a. T&E SPECIES

Large differences in the total numbers of pairs, nests and fledglings as well as the overall productivity have been observed just in the past 4 years. Although population dynamics of species needs to be assessed over 10-20 years to effectively identify trends there are a few anecdotal trends from the data gathered for piping plovers at FIIS. Table 1 displays the trend in the number of fledglings and the number of nests throughout a span of 10 years on FIIS. It illustrates that the total number of nest attempts had been steadily increasing from the 1990s to 2007, but that the total number of fledglings had taken a sharp decline since 2005. This trend appeared reversed between the 2007 and 2008 seasons, as there were fewer nest attempts but more fledglings yielded in 2008. Chicks fledged per pair as well as chicks fledged per nest have been declining from 1997 to 2007 (Table 1, *see page 20*).

In 2009 there was a large number of nesting pairs on non-federal tracts (5 out of 19 nesting pairs). This may have been caused by the increase in suitable habitat and symbolically fenced areas in front of the communities due to the beach nourishment event in the spring of 2009. In 2010 there were 3 nesting pairs: 4A in Fire Island Pines, 13A in Fire Island Summer Club and 12A/12B in Point O'Woods. No nesting pairs were observed in Davis Park in comparison to 3 pairs in 2009. Although there were fewer nesting pairs this year within non-federal tracts, fledglings and productivity both increased from 2 to 4 and from 0.4 to 1.33, respectively.

The low productivity and distribution of least tern colonies on the island may have been a factor contributing to the lower number of chicks successfully fledging in 2009 and 2010 relative to 2008. In 2008 the average fledge rate for pairs located in tern colonies was 3.0 chicks per pair. Least terns are a highly defensive species, known to swoop and vocalize at potential attackers as they approach the colony. It is possible that these aggressive birds could have deterred predators and limited human disturbance from the colony, indirectly protecting nesting plovers and chicks. Established tern colonies could contribute to higher chick survival for piping plovers although this still remains unclear.

As for T&E plants, numbers are surprisingly low this year, particularly for seabeach amaranth. Although seabeach amaranth is an annual species and experiences dramatic population dynamics, only finding 11 relatively small plants throughout FIIS may be a cause for alarm. In addition, 4 plants were severely browsed, presumably by white-tailed deer. Past years have also noted browsing impacts on amaranth individuals. FIIS should consider incorporating the protection of amaranth from browsing in the park's T&E Species program, similar to Assateague Island National Seashore protocols (NPCA

2007). The majority of seabeach amaranth and seabeach knotweed individuals were located inside the symbolic fenced areas designated initially for piping plover and least terns. Several plants located before the survey day were found later dehydrated and likely dead. Tropical Storm Earl caused severe high tides on southern Long Island from September 3rd – 4th; this caused burial or sustained salt water inundation of amaranth and knotweed plants at most sites on Fire Island and the death of a majority of plants.

7b. DISTURBANCE ISSUES

Numerous pairs chose to nest in areas with high seasonal visitation. Nesting pairs 1, 3, 4, 12 and 13 were all located on beaches where visitor populations increased exponentially between the time the nesting territory was established and the time the eggs were laid. As in previous years, nests were subject to disturbance in these areas due to human activity. Disturbance caused by off-road vehicles (ORV) was minimized by closing certain dune crossings and sections of beach and providing signage for alternative routes through the interior of the island. This occurred on several occasions in 2010.

Another regulation issue involved driving and dune crossing closures. Several beach access points (dune crossings) were closed by FIIS based on USFWS (1996) guidelines. USFWS recovery guidelines for the piping plover explicitly state that full-sized vehicles shall not be permitted on beaches where unfledged chicks are found, and that beach access points/dune crossings found within 1000 feet of a nest with chicks be closed to all traffic until those chicks are fledged. This year FIIS biologists also established a Plover Hotline (631-687-5030) which was regularly updated with information on dune crossing/beach closures to vehicles. Adequate warning of closures (2-3 weeks) was given for established nests; however, an undetected re-nest and hatching of 2 chicks by 12B near Point O'Woods/Oakleyville area caused an immediate dune crossing closure on July 12th. The Oakleyville cut was closed and FIIS biologists worked with Visitor & Resource Protection (V&RP) staff to quickly put up signage at the Lighthouse checkpoint and at dune crossings.

Two nests were found in the communities of Point O'Woods (12A) and Fire Island Summer Club (13A) this season as full clutches. It is preferred for nests to be located before the 4th egg has been laid so a hatch date can be estimated for dune crossing closures for vehicles. 12A abandoned shortly after exclosing, however, FIIS and LUES biologists monitored 13A twice a day for signs of hatching based on USFWS (1996) guidelines. Additional monitoring was necessary and this prevented the crossing to be closed immediately. Based on observational data the crossing was estimated to close on June 7th. This date was shared publicly on the hotline along with the uncertainty of the hatch date due to the nest being found as a full clutch. The nest hatched on June 5th, and the area was closed immediately. In addition, the Kismet cut was closed on July 5th but was re-opened earlier than expected (August 1st) because the lone chick from 3B was not sighted for 7 days and was assumed dead. Clear signage was posted at the Lighthouse checkpoint, on the beach and the Plover Hotline number was shared with all summer FIIS vehicular drivers and updated regularly. However, full-sized vehicles were seen driving on closed beaches and using closed vehicle cuts, particularly near pair 13 in the mid-island community beaches. In addition, FIIS biologists were not contacted regarding large equipment that was approved to be driven on the beach by LUES. This lack of communication put 2 unfledged chicks from 12B at a high risk for mortality. This event is unacceptable and communication amongst all agencies and stakeholders needs to continually improve for operations to run smoothly and to increase the effectiveness of species protection on FIIS.

Dogs, cats, gulls, raccoons, red fox, ghost crabs, and other natural or introduced animals to FIIS can pose a threat or disturbance to nesting piping plovers and their broods. Avian predators seen disturbing piping plover adults and broods include great black-backed gulls (*Larus marinus*), herring gulls (*Larus argentatus*), crows (*Corvus* spp.) and oystercatchers (*Haematopus palliatus*). Adults from several nests were seen defending territories and chicks from groups of great black-backed and herring gulls. In addition, intraspecific defensive behavior was observed. Because of the close proximity of 10B to 8B, we noticed many interactions between the two nests, usually with 8B adults behaving aggressively. One noteworthy example of this was when an 8B adult was seen pecking and attacking a 10B chick. The chick returned to its enclosure and the 8B adult retreated. Other avian species recorded as having a negative impact on piping plover breeding in years past (particularly in 2007) include willets (*Tringa semipalmata*) and terns (*Sterna* spp). However, the presence of least tern colonies was positively correlated with successful plover nests during the 2008 season.

Of these non-avian predators, red fox (*Vulpes vulpes*) and feral cat (*Felis catus Domesticus*) tracks were recorded inside the symbolic fencing and at times circling the enclosures. Evidence of red fox was especially prevalent in the OPWA, specifically in the Overwash area. Red fox tracks were often observed at the toe of the dune throughout the 7-mile stretch of wilderness. Furthermore, several nests were predated or abandoned after red fox tracks were seen in the vicinity of nests. Fox tracks were observed in close proximity to 8 nests (1A, 2C, 5A, 6A, 7A, 14A, 14B and 16A) and attempted digging around enclosures was observed at 1 nest (5A). Only 2 of these 8 nests went on to fledge chicks. In addition, no nests occurred at Talisman despite initial observations of plover activity. The presence of predators may be accountable for the high occurrences of abandonments and assumed predation of chicks in the OPWA. However, other disturbance factors are also affecting the productivity of T&E species and it's difficult to determine one cause for failure.

Dogs were frequently seen off their leash, sometimes in areas where dogs were entirely prohibited. Every day, particularly at the peak of the summer season, there were several dogs observed both on and off their leash on community beaches. This became a major regulation issue and a cause for concern, especially for broods in the communities.

8. RECOMMENDATIONS

This section is provided to highlight specific suggestions and concerns pertaining to the T&E species monitoring effort. Pre-season activities are the most critical time period for the program to establish an efficient and organized pre-season protocol. This sets the foundation for the upcoming year. One of these protocols is the construction of pre-season symbolic fencing.

The essential purpose of symbolic fencing is to preserve suitable habitat, as well as provide safe breeding/germination grounds, for all T&E species. In the non-federal tracts, symbolic fencing was erected and maintained by LUES. Biodegradable string and flagging were used instead of traditional synthetic materials in certain sections throughout the federal tracts as a conscious effort by the park to reduce the amount of waste produced by fencing lost in storm events. Sisal twine and flagging made from wood pulp were purchased from Home Depot and Forestry Suppliers, respectively. Biodegradable flagging was used on Lighthouse beach and biodegradable flagging and string was used throughout the OPWA. Though the benefits of biodegradable materials for the environment are plentiful, the drawbacks as far as maintenance and ease of use should be noted. The twine tended to sag as it aged,

and became significantly weaker when it was wet. Repairs were common, almost daily at some points, and all of the string had to be replaced multiple times cyclically throughout the season. Biodegradable flagging was damaged and faded quickly, especially when wet, compared to traditional plastic flagging. It's suggested that non-biodegradable string and flagging be used in high visitor use areas due to their appearance through time. This would include areas such as Lighthouse beach, Sailors Haven and Watch Hill. Areas with fewer visitations, such as the OPWA, may be a good place to continue using the biodegradable products.

Other issues associated with the T&E species program involve predators and other threats. The results of this and previous seasons implicate red fox as a major threat to piping plover breeding. While tracks indicate that fox are present at predated nests, there is no direct observational evidence to prove they are the direct cause of the mortality. Ghost crabs and avian predators pose a similar threat, and although no direct predation was witnessed, several accounts from this year and years past document interactions between plovers and ghost crabs, gulls and oystercatchers. In addition to predators to birds, data indicate white-tailed deer as a possible threat to seabeach amaranth. Several plants in 2008 and 2010 showed signs of intense herbivory. In the future, it is suggested that motion sensitive cameras are used for a more conclusive way to determine the exact occurrence of predator and disturbance activities near FIIS's protected species. In addition, a red fox monitoring or management effort should be implemented to conclude whether red fox pose a significant threat to threatened and endangered species and their nests.

During the 2010 field season, vehicle dune crossing routes had to be closed due to the close proximity of piping plover nests and chicks. This is all in accordance with the USFWS recovery effort guidelines for managing recreational activities in piping plover breeding habitat. It will be beneficial to continue the effort to give prior warning to vehicle route closures so there is less confusion and fewer complications. It will continue to be critical that efforts are made to warn island residents, essential service agencies, local police, and park staff of upcoming vehicle route closures. Although proper warning was given and signage was posted, enforcement of beach closures was not sufficient in eliminating beach driving as a threat to protected species. All driving regulations would need to follow USFWS guidelines for essential vehicles. In the future, different communication methods and possibly more stringent enforcement measures should be considered.

V&RP Rangers play a crucial role in educating and informing visitors, residents, and others about their responsibilities with regard to protection of threatened and endangered species. Because the OPWA is a secluded 7-mile stretch of beach, it is suggested, for the safety of the field biologists, that they conduct surveys in pairs. If driving should commence, it is suggested that vehicle types be reduced to only small ORVs (Polaris) and/or ATVs (quads), permits only be approved for NPS and emergency vehicles, speed regulations be set at five miles per hour especially during chick season, and all staff be trained in identifying shorebirds. Since the most current FIIS management plan requires 2 people in an ORV when unfledged chicks are present, 1 biologist could travel with 1 V&RP Ranger during patrol of the OPWA. This would free up another V&RP Ranger to patrol/work in a different area and lead to greater staff presence in the OPWA during the summer season.

Cooperation with Concessions staff also plays a crucial role in informing the public of regulations. It is important for visitors to know about pet regulations before coming to Fire Island National Seashore and

the Ferry concessions are oftentimes the first contact for people with pets. The continued improvement of communication, including formal and informal efforts, is integral to the efficacy of this program.

Experience over the last ten years has shown that threatened and endangered species populations can increase dramatically in response to intensive protection efforts. These efforts are time-consuming, costly, and sometimes require temporary restrictions of off-road vehicles and/or recreational activities. Nevertheless, they are highly effective and extremely rewarding.

9. ACKNOWLEDGEMENTS

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Appendix A: Tables and Figures

<u>Year</u>	<u>Breeding Pairs</u>	<u>Nest Attempts</u>	<u>Productive Pairs</u>	<u>Eggs Hatched</u>	<u>Hatchlings per Breeding Pair</u>	<u>Chicks Fledged</u>	<u>Chicks Fledged per Nest Attempt</u>	<u>Chicks Fledged per Pair</u>
1993	7	7	0	0	0	0	0	0
1994	3	4	0	0	0	0	0	0
1995	9	2	1	N/A ¹	N/A	2	1	0.2
1996	2	1	1	N/A	N/A	1	1	0.5
1997	1	1	0	0	0	0	0	0
1998	1	1	1	N/A	N/A	1	1	1
1999	3	2	2	N/A	N/A	5	2.5	1.7
2000	3	3	3	N/A	N/A	9	3	3
2001	4	4	4	N/A	N/A	11	2.8	2.8
2002	10	11	9	33	3.3	28	2.6	2.8
2003	20	22	15	64	3.2	35	1.6	1.8
2004	17	18	15	57	3.4	37	2.1	2.2
2005	17	20	14	54	3.2	40	2	2.4
2006	21	26	15	46	2.2	32	1.23	1.5
2007	25	35	11	45	1.8	18	0.5	0.7
2008	15	26	8	32	2.1	20	0.8	1.3
2009	19	24	9	53	2.8	13	0.54	0.68
2010	16	23	9	38	2.2	17	0.74	1.06
Average	10.4	12.8	6.5	35.2	2.02	14.8	1.3	1.3

¹Data from previous nesting seasons are incomplete

Table 1: Historic Productivity of Piping Plovers on FIIS

Nest #	Location	# Eggs Laid	# Chicks Hatched	# Chicks Fledged	Result
1A	Watch Hill	4	1	0	Overwashed
2A	OPWA- E (overwash)	3	0	0	Predated
2B	OPWA- E (overwash)	3	0	0	Overwashed
2C	OPWA- E (overwash)	4	4	3	FLEDGED
3A	Lighthouse Beach, East	4	0	0	Overwashed
3B	Lighthouse Beach, East	3	1	0	Hatched/Failed
4A	Fire Island Pines	1	0	0	Abandoned
5A	OPWA- W	4	4	1	FLEDGED
6A	OPWA- E (overwash)	4	4	2	FLEDGED
7A	OPWA- E	2	0	0	Predated
8A	OPWA- E	2	0	0	Abandoned
8B	OPWA- E	4	4	2	FLEDGED
9A	OPWA- E	4	3	3	FLEDGED
10A	OPWA- E	3	0	0	Abandoned
10B	OPWA- E	3	3	1	FLEDGED
11A	OPWA- E	4	4	1	FLEDGED
12A	Point O'Woods	4	0	0	Abandoned
12B	Point O'Woods	4	2	2	FLEDGED
13A	F.I. Summer Club	4	4	2	FLEDGED
14A	OPWA- W	1	0	0	Abandoned
14B	OPWA- W	4	4	0	Hatched/Failed
15A	OPWA- E	4	0	0	Abandoned
16A	OPWA- W	3	0	0	Predated
Totals		76	38	17	
Productivity (chicks fledged per pair)= 1.06					
*Otis Pike Wilderness Area. Nest designated West/East depending on its location from Bellport Beach.					

Table 2: FIIS 2010 Overall Piping Plover productivity

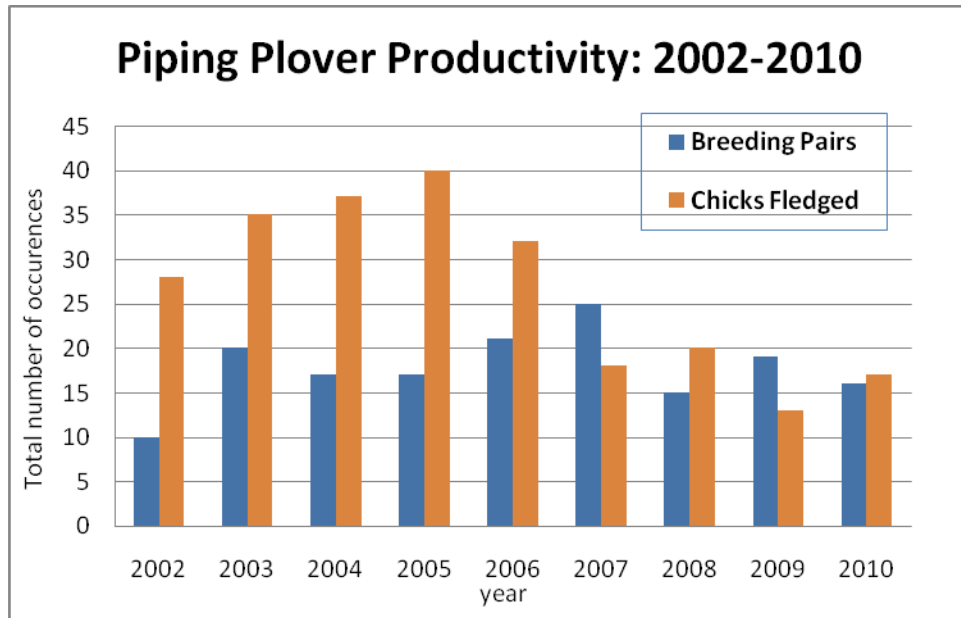


Figure 1: The number of Piping Plover breeding pairs and the number of chicks fledged at FIIS, 2002-2010

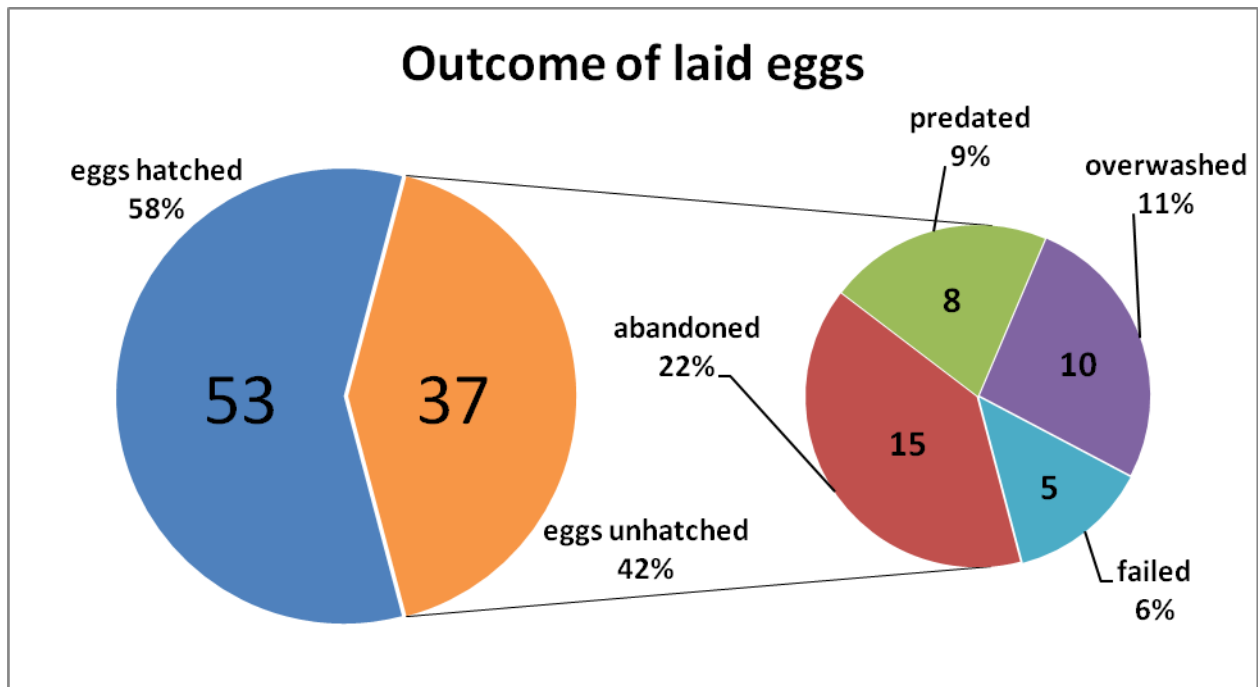


Figure 2: Pie graph displaying the outcome of all laid Piping Plover eggs at FIIS in 2010

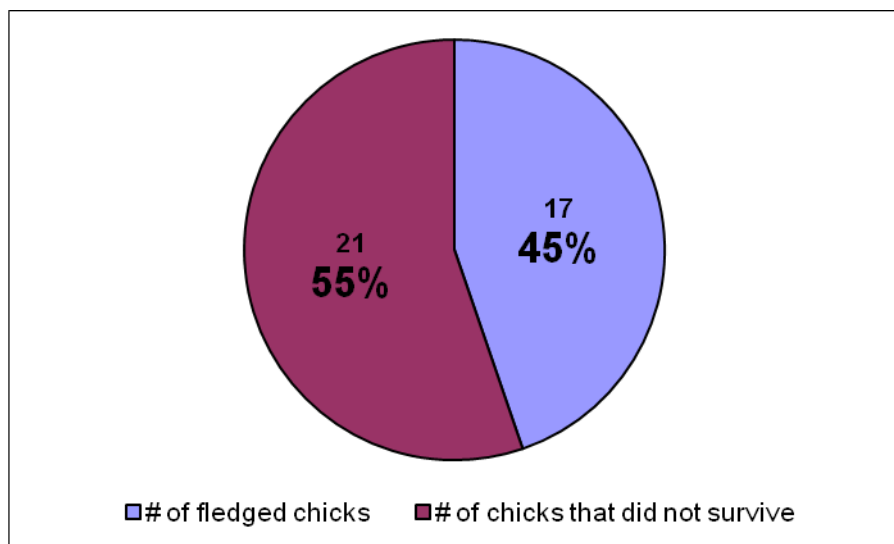


Figure 3: Pie graph displaying the outcome of all hatched Piping Plover chicks at FIIS in 2010

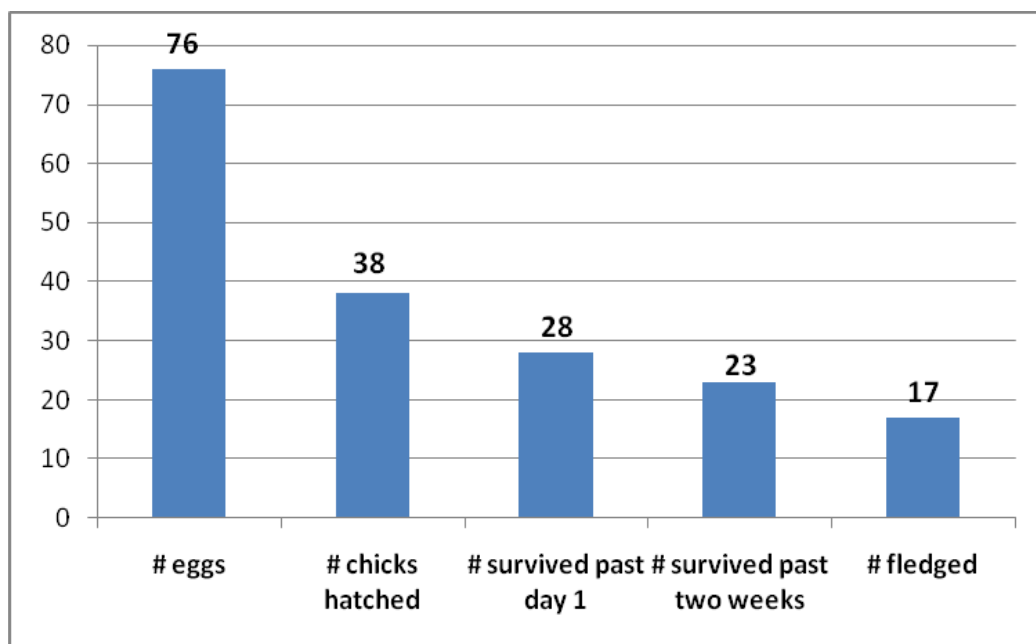


Figure 4: Bar graph of brood outcome for 2010 Piping Plovers at FIIS

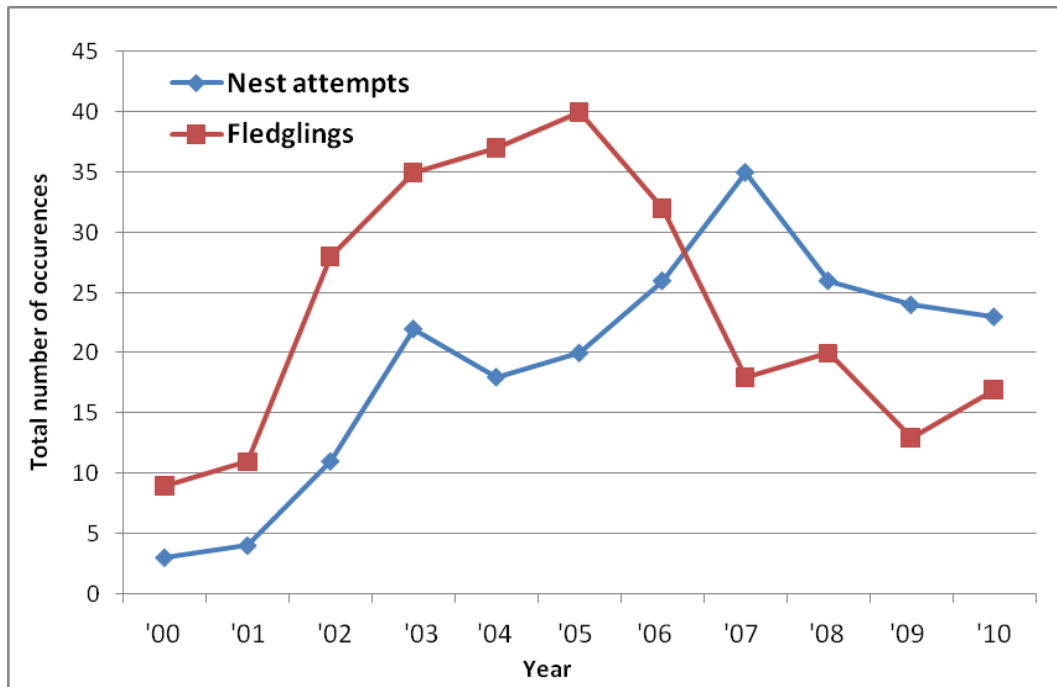


Figure 5: Chart displaying historical values for Piping Plover nests & fledglings on FIIS (2000-2010)

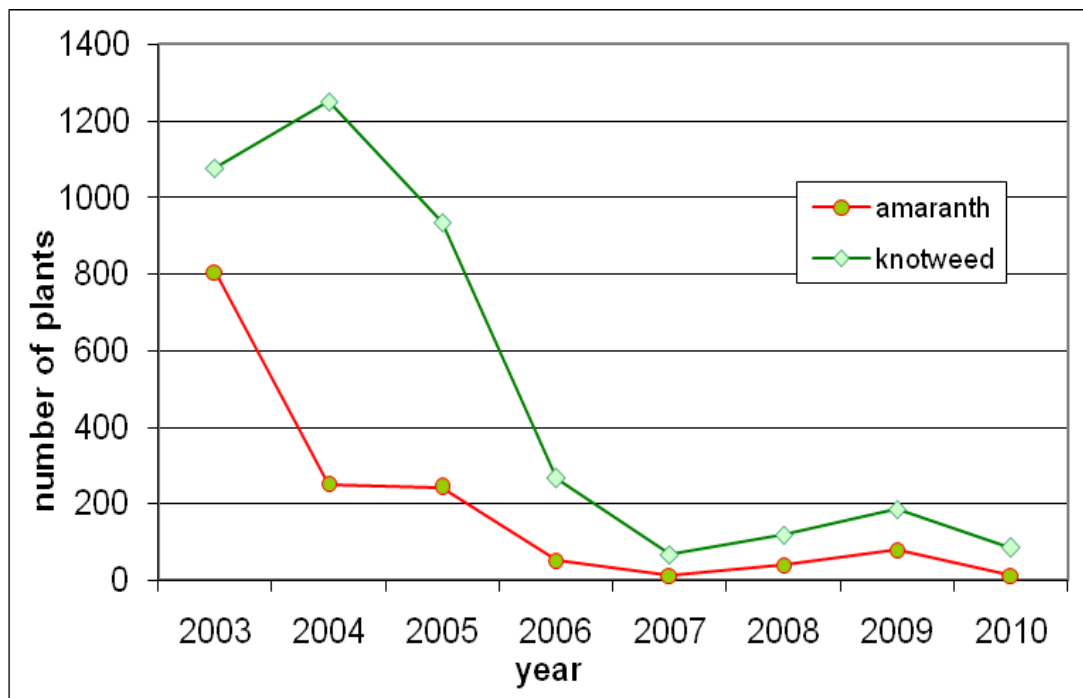


Figure 6: Chart displaying historical values for Seabeach Amaranth & Seabeach Knotweed on FIIS (2003-2010)

Site	Surveys Conducted (1 st and/or 2 nd window?)	Number of Breeding Birds by Species
Islip Spoil Island	2 nd	100 BLBA, 50 HEGU, 1 GLIB, 2 GREG
Sexton Island	2 nd	6 AMOY, 30 DCCO, 55 HRGU, 300 LAGU, 2 OSPR, 140 COTE
West Fire Island	1 st	-----
East Fire Island	Both	1 st : 50 DCCO, 10 LAGU, 6 WILL, 495 COTE
		2 nd : 6 WILL, 20 DCCO, 55 COTE
Long Cove	Both	1 st : 410 COTE
		2 nd : 360 COTE
Ridge Island	Both	1 st : 25 DCCO, 55 BLBA, 250 HEGU, 3 COTE
		2 nd : 40 HEGU, 15 BLBA, 32 DCCO, 350 COTE
Pelican Island	Both	1 st : 12 HEGU, 2 BLBA, 4 DCCO, 1 OSPR
		2 nd : 1 HEGU, 2 WILL, 2 OSPR
John Boyle Island	Both	1 st : 45 BLBA, 60 HEGU, 20 GREG, 10 SNEG, 25 GLIB, 6 AMBI, 6 AMOY
		2 nd : 12 SNEG, 55 BLBA, 100, HEGU, 21 GLIB
Hospital Island	Both	1 st : 4 HEGU
		2 nd : -----
Lighthouse	Both	-----
Fire Island Villages	Both	-----
Sailors Haven	Both	-----
Fire Island Pines	Both	-----
Watch Hill Bay	Both	-----
OPWA*	Both	1 st : 3 LETE
		2 nd : 38 LETE, 2 COTE

Table 3: Long Island Colonial Waterbird Surveys for the 2010 season at FIIS. Sites are listed from west to east and separated by whether they are bay islands or on Fire Island. Species codes: COTE = Common Tern, LAGU= Laughing Gull, AMOY = American Oystercatcher, DCCO = Double Crested Cormorant, LETE= Least Tern, WILL = Willet, BLBA = Black-Backed Gull, OSPR = American Osprey, GLIB = Glossy Ibis, AMBI = American Bittern, GREG = Great Egret, SNEG = Snowy Egret (* = Davis Park included in Wilderness survey)

Appendix B: Maps



Map 1: Map of Fire Island National Seashore

