

Fire Island National Seashore

**THREATENED & ENDANGERED SPECIES
MONITORING PROGRAM
2016 SUMMARY**



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THREATENED & ENDANGERED SPECIES MONITORING PROGRAM 2016 SUMMARY

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 several federal and state-listed threatened and endangered (T&E) species were observed in 2016. Through daily monitoring and a collaborative park effort, a total of 9 piping plover (*Charadrius melodus*) nesting pairs were recorded within the park. With a total of 16 successful piping plover fledglings, nesting productivity reached an average of 1.8 piping plover chicks fledged per pair. Annual population surveys for waterbirds were conducted this season in areas specified by the New York State Department of Environmental Conservation's Long Island Colonial Waterbird surveys. In addition, 62 seabeach amaranth (*Amaranthus pumilus*) and 11 seabeach knotweed (*Polygonum glaucum*) plants were documented throughout FIIS. Some information on piping plover nests used in FIIS records was also obtained through contact with researchers from Virginia Tech studying/monitoring piping plovers. Educational and outreach efforts directed towards park visitors, island residents, cooperating agencies and essential services is critical for the continued success of this program.

2. INTRODUCTION

Fire Island National Seashore (FIIS) was established as a unit of the National Park Service on September 11, 1964 (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). 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.

Fire Island National Seashore provides suitable breeding/germination habitat for a number of federal- and state-listed threatened and endangered (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*). Most of these species can be found nesting or growing on Fire Island's oceanside beaches and bay islands.

Of the several 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. Due to limited resources the only threatened and endangered plant species monitored this year were 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.

Hurricane Sandy in October 2012 caused a breach in the Old Inlet area and this breach remains open and dynamic. Practically the entire area in OPWA East was overwashed from Hurricane Sandy, which can be seen in the aerial photography used to produce the maps in Appendix B.

Some information on piping plover nests used in FIIS records was also obtained through contact with researchers from the Virginia Polytechnic Institute and State University (Virginia Tech), who have been conducting research on piping plovers since the summer of 2013. Their study (from 2013-2015) was titled, “The Response of Piping Plovers and their Invertebrate Prey to Habitats Created by Hurricane Sandy” and their final reports can be found on NPS IRMA (in the References section). Most of their work from 2013-2015 at FIIS was focused on areas around the Old Inlet breach, and in the OPWA East.

In 2016 Virginia Tech continued studying piping plovers, but with funding through the Fire Island Inlet to Moriches Inlet (FIMI) project, which is designed/funded by the Army Corp of Engineers. The FIMI project is a one-time, stand-alone placement of sand to stabilize Fire Island until the larger Fire Island to Montauk Point (FIMP) project is implemented. The actual placement of sand only occurred at the Fire Island Lighthouse (on federal tracts); however, their research continued into the 2016 season with monitoring of piping plover birds and broods at Fire Island Lighthouse and in OPWA, from Bellport Beach east to the Wilderness Visitor Center. Virginia Tech was also responsible for studying piping plovers at Robert Moses State Park and Smith Point County Park. The NPS continued to coordinate with Virginia Tech researcher’s schedule during the monitoring season, to efficiently monitor piping plovers throughout FIIS.

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 2016 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 2016, 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 of habitat.

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 15th 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.

5. MONITORING PROTOCOLS

5a. PIPING PLOVER 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. In accordance with USFWS guidelines, pre-season habitat fencing (symbolic fencing) is erected for the purpose of protecting nesting habitat and potential vegetative species habitat. Areas to be fenced on federal tracts were determined through the compilation of nest/plant data collected from previous years, early season plover observations, and through visual assessments of the beach.

Areas where birds are seen regularly are more intensely monitored and symbolic fencing is erected and adjusted accordingly. For example, the Wilderness area has in years past consistently yielded the highest piping plover productivity and is thus monitored closely beginning in early April. The west-end of the island is also monitored closely by FIIS staff due to high volume of visitation and beach driving. Off-road vehicles (ORV) may be utilized as a means of transportation to these areas. 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).

Upon discovery of a nest, an alphanumeric tag is used to identify each nesting pair and nest; a number and year are assigned chronologically, using an “A” for first nesting attempt, “B” for second, and so on (eg. 1A-16). Regardless of nest location along FIIS shore, all nests were protected within symbolic fencing borders creating a buffer zone of no less than 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.

In past seasons, wire exclosures (“predator exclosures”) were erected and placed around the plover nest site in order to protect nests from avian and mammalian predators. However, in 2015 no nests were exclosed due to a high rate of nest abandonment observed in the 2014 season along with evidence that exclosures may contribute to adult piping plover mortality (Neuman et. al, 2004). This decision was made by the FIIS Wildlife Biologist based on observations from the researchers at Virginia Tech and based on recommendations from USFWS Biologists, Anne Hecht and Steve Papa. For the 2016 season the FIIS Wildlife Biologist decided to exclose all nests (except for one) due to the high rate of predation

of nests in the 2015 and because 1A-16 was predated before it even reached a full clutch. The decision to stop using exclosures would be made within the nesting season (rather than before the beginning began) if more than one nest abandonment occurred, which could be contributed to red fox presence/pressure.

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. This effort helps ensure 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.

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 week after hatching. Data collected for each brood consists of: number and behavior of adults, number of chicks observed, and location. 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 35 days after they have hatched or when a sustained flight of 15 meters is observed before then. When a nest is situated near a vehicle beach access route, a fledge date of 35 days is implemented and driving restrictions are extended to ensure the safety of the brood (USFWS 1996).

Additional information on nest or brood statuses was received from a group of Virginia Tech (VT) researchers conducting a multi-year study on piping plovers. For the purposes of their own research, the VT group banded each adult and chick in OPWA to allow the identification of individual plovers. The information recorded for this project helped FIIS staff to confirm data on outcomes of plover nests and broods.

5b. COLONIAL WATERBIRD SURVEY

Population counts for colonial waterbirds were conducted during various survey windows during the 2016 season. The Gull and Wading bird population survey is conducted first during the May 17-31 survey window. Piping plover and American oystercatcher surveys populations were each conducted once during their survey windows, June 1 – June 9 and May 17 – June 9, respectively. Two tern and black skimmer population surveys were conducted in June, once June 1-15, and once June 15-June 30. 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. Several bay islands that fall within the boundaries of the park are also monitored for waterbirds, including: 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 motorboat, canoe or kayak, and access may be limited by inclement weather, remoteness of location, and time constraints.

5d. VEGETATION MONITORING

Amaranth and knotweed begin to germinate on FIIS in early July. These plants 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 the 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. This year the survey windows were as follows: Survey window 1: 7/13 – 7/27, Survey window 2: 8/3 – 8/17. In past year's a third sweep survey has been conducted however it was determined to be ineffective in locating a significant number of additional plants. A GPS unit is used to collect data points for the locations of amaranth and knotweed plants. All plants located outside of existing symbolic fencing are marked, enclosed within fencing, and recorded with a GPS. Due to the increased rarity of amaranth plants and the browsing data from previous years, new protocol dictates all individual plants are to be exclosed to prevent herbivory until population growth makes this unfeasible. Other data collected include location, plant condition, evidence of browsing as well as percent browsed, maximum lateral spread, reproductive status, cluster number, potential threats, weather conditions, and general observations in accordance with data sheets provided by the U.S. Fish and Wildlife Service and The Nature Conservancy. We continue to monitor existing amaranth plants throughout August and early September until plant growth and reproduction ceases.

6. RESULTS

6a. PIPING PLOVERS (*Charadrius melodus*)

Monitoring for the 2016 piping plover breeding season on Fire Island began when the first piping plovers were observed in early March and continued through the beginning of August. In the months between April and June, piping plover nests were discovered and documented throughout FIIS.

A total of 9 nesting pairs were documented, from which there came 10 nesting attempts throughout FIIS. Eight nests hatched and 16 total fledglings were successfully produced. The other two nest attempts were lost due to predation and abandonment due to predator disturbance. (Table 2, Figure 7). Another brood, referred to as 9A, was discovered shortly after hatching. They were only observed on one day, and could not be located after the initial observation. This brood will be included in data calculations to the fullest extent; however, due to the limited observations a number of factors cannot be determined such as if this was the first nesting attempt, how many eggs were laid, and how many chicks hatched.

A total of 37 eggs were laid and of these 25 total eggs hatched, with the remainder failing as a result of predation or other circumstances (Figure 2). Sixteen chicks went on to fledge, yielding a productivity of 1.8 for 9 breeding pairs (Table 2).

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 (Figure 3). Maps of nest locations can be located in Appendix B.

i. **Summary of piping plover nests**

During the 2016 piping plover season, a summary of nest activity on Fire Island west of the Otis Pike Fire Island High Dune Wilderness Area (OPWA) is as follows: 1 nesting pair at Lighthouse Beach (6A).

The OPWA yielded 7 plover pairs and 8 nesting attempts which were divided by location: OPWA West (Watch Hill to Old Inlet) and OPWA East (Old Inlet to the Wilderness Visitor Center). There was 1 nesting pair in OPWA West (8A) and there were 6 nesting pairs in OPWA East (1A, 1B, 2A, 3A, 4A, 5A, 7A). Below is a summary of each attempt:

Nest **1A-16** was found on April 23rd with 1 egg in OPWA-East (section 9) by Virginia Tech researchers. On the morning of April 28th – the day we came out to exclose the nest – the nest had failed. Both adults were present, walking around and sitting in several locations, and the male plover was observed marching. The nest had just been checked the afternoon of April 27th (and the adults were incubating), so it failed sometime in that 18 hour period. Virginia Tech researchers reported that some yolk was found near the nest site, so the nest was lost due to assumed predation.

Nest **1B-16** was found with 1 egg on April 30th in OPWA-East (section 9), just southeast of the first nest attempt. It was exclosed on May 9th with a full clutch of 4 eggs. Virginia Tech researchers reported that all 4 eggs hatched on June 4th. When the nest was checked on June 6th, only 2 chicks were seen with both parents. The other 2 chicks were presumed lost due to severe weather (thunderstorms) after they hatched. The 2 chicks that survived were seen consistently with the adults, and were determined fledged on July 2nd.

Nest **2A-16** was found on April 27th in OPWA-East (section 8), between the symbolic fencing and the dune grass. The nest was exclosed on May 9th with a full clutch of 4 eggs. Virginia Tech researchers reported 2 hatched eggs on June 1st. A third egg eventually hatched from the clutch, but there was 1 dud egg. On June 7th, all 3 chicks were spotted with the adults. The 3 chicks were consistently seen with adults and were determined fledged on July 2nd.

Nest **3A-16** was found on May 18th with 2 eggs in OPWA-East, in section 8, close to the breach. The nest was exclosed on May 20th with 3 eggs and was confirmed to have a full clutch of 4 eggs when checked on June 1st. On June 16th, 2 eggs hatched and the chicks were found in the nest bowl along with the 2 remaining eggs, which hatched on June 17th. All 4 chicks were seen consistently with adults and were determined fledged on July 23rd.

Nest **4A-16** was found on May 27th with 1 egg in OPWA-East, in section 10, just east of the high dunes. The nest was exclosed on June 1st with a full clutch of 4 eggs. On June 25th, there were 2 chicks and 1 egg found in the nest bowl. All the eggs hatched, but only 1 chick was seen with adults after June 27th. The other chicks were probably lost during inclement weather in the days after they hatched. On July 18th, Virginia Tech reported that the one remaining chick was adopted by the 5A-16 brood and the 4A-16 adults were no longer around. This chick was observed with the 5A-16 brood on the fledge date of July 20th but not on July 23rd. The chick would have been 2 days older than the 5A brood; therefore it is presumed fledged.

Nest **5A-16** was found on May 27th with 2 eggs in OPWA-East, in section 9, between the high dunes and Nest 1B-16. It was decided on June 1st that this nest would not be exclosed as it demonstrated natural camouflage. The number of eggs was not checked until June 18th, when it was determined to have a full clutch of 4 eggs. On June 27th, 3 chicks hatched and 1 egg remained in the nest (it was later determined to be a dud egg). On July 18th, Virginia Tech reported that the 5A-16 brood adopted the one remaining chick from 4A-16 since its parents were no longer around. Several or all of the chicks were consistently seen with parents up to the July 20th fledge date and after on July 23rd.

Nest **6A-16** was found on May 27th with 2 eggs at Lighthouse Beach, at the top of the dune almost directly south of the Checkpoint. The nest was exclosed on June 2nd with 4 eggs. Upon arrival, the bird popped off the nest when viewed from the symbolic fencing so the adults were left alone for an hour. When the nest was about to be exclosed, the adult didn't pop off until we were almost on top of it, and the adult didn't stay close while exclosing. The plover returned immediately to inspect the exclosure but would not sit on the nest to incubate within an hour. The nest was checked several hours later and an adult was observed incubating. On June 9th the nest was being incubated, but by June 10th no adults were observed. There were fox tracks nearby and some digging around the exclosure (Figure 7). A fox was seen leaving the fenced area and walking onto the dirt road the next day. The nest was determined to be abandoned (due to red fox pressure/presence) with 4 eggs still in the nest bowl.

Nest **7A-16** was found on May 28th with 1 egg in OPWA-East, in section 9, between Nests 1B-16 and 2A-16. The nest was exclosed on June 1st with 3 eggs. A 4th egg was eventually laid to make it a full clutch. On June 27th, 3 eggs and 1 chick were found in the nest bowl. The 3 remaining eggs were checked every day for about a week, but were determined to not be viable. Virginia Tech collected the 3 eggs a week after the first hatched. The 1 chick was seen consistently with adults until July 14th. One parent and significant peeping was discovered near the water parallel to the nest on July 16th. Unidentified chicks were found along the stretch of beach during the next week, many presumed fledglings from further East or potentially the chick from 7A. Virginia Tech researchers were unable to locate the banded chicks on the beach. The expected fledge date would have been July 22nd.

Nest **8A-16** was found on June 7th with 3 eggs in OPWA-West, in section 7, just west of the breach on the sand spit closer to the bayside. The nest was exclosed on June 8th. Fox tracks were consistently spotted around the fencing and exclosure, and there was some digging found around the exclosure on June 17th. On July 6th, 1 egg and 2 chicks were found in the nest bowl, and the third egg hatched the next day. All 3 chicks were consistently seen with adults and were determined fledged on August 8th, 2016.

Nest **9A-16** was never located directly nor exclosed. NPS Park Rangers spotted two piping plover adults and 3 chicks on July 24th near the westernmost staircase on Sailors Haven beach. The chicks were later observed on that same day, more towards the eastern end of Sailors Haven beach. The beach and surrounding areas were surveyed for the next five days (and the beach closed to driving) but no other sightings of the birds, tracks, or potential nest were recorded. The high scarp in the area, in addition to the inclement weather (storms on several nights) and heavy traffic were also included as potential causes of the brood's mortality.

6b. COLONIAL WATERBIRDS (*Sterna* spp)

Long Island Colonial Waterbird Surveys were conducted on Fire Island and its surrounding 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). Despite various circumstances such as weather events, motorboat activity and remoteness of location all survey sites were visited during both survey windows.

In total, 15 different sites were surveyed throughout the month-long effort (Table 4) including 9 bay islands and 6 sections of Fire Island. COTE colonies were observed on East Fire Island, Sexton Island, Ridge Island and Long Cove. A small number of LETE (4-8) were noted nesting in the Otis Pike Wilderness Area East of the breach. No BLSK colonies were observed in the survey area for 2016. Annual population surveys for LETE, COTE, and ROST species resulted in total maximum counts (the greatest number counted during a survey period for each site) of 8, 488, and 0 respectively. COTE and ROST populations are comparable to that of recent years, while LETE populations are on the rebound after none have been observed in the last three years. The last time FINS reported a LETE population was in 2013 with 16 individuals nesting. In 2015 a single pair of COTE was recorded on Sexton Island. This year 60 COTE were recorded during the first survey window. After a four year hiatus from the island this population could represent a successful attempt to recolonize the area.

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

A total of 62 seabeach amaranth plants were found in several sweep counts on FIIS throughout July and August. These plants were then surveyed every two weeks until senescence. Sites from the LICWS were recognized and reported as such for seabeach amaranth: Fire Island Lighthouse (19 plants), Fire Island Villages (0 plants), Fire Island Sunken Forest (23 plants), Fire Island Pines (6 plants), and the Fire Island Wilderness (14 plants).

This year a tropical storm brought high tides immediately following the third survey completed August 29th-30th. In addition, most exclosures were removed from plants before the storm, so plants were only protected from browsing through late August. A post-storm survey was conducted - in addition to the regular scheduled resurveys - to determine the effect of the storm on the survival of amaranth plants (Figure 7).

An exclosure was constructed around 62 out of 63 plants (99%) to protect them from browsing by white-tailed deer (*Odocoileus virginianus*). Protocol dictates that we try and exclose all amaranth plants; however, we were unable to exclose amaranth plant #16 due to its proximity to the cluster of amaranth plants #31- #44. All 15 plants (#31-44) were located under the eastern staircase on Sailors Haven Beach and appear to have occurred as the result of an exclosure being left behind from last year's survey. This appeared to help contain the seeds and create a cluster of amaranth plants in close proximity.

Thirty-five plants (56%) demonstrated signs of herbivory throughout the season (Figure 5). Sixteen plants (26%) already showed signs of browsing before being exclosed, while twenty-seven plants (44%) showed signs of herbivory after exclosures had been constructed. During subsequent surveys 29% of individuals experienced an increase in browsing, 34% revealed browsing but to a lesser degree than

previously noted and thirteen plants (37%) experienced just one incident of browsing after which they rebounded (Figure 5). A range of plants were observed; the largest was 47 cm in diameter at the widest point and the smallest was 2 cm. This resulted in an average size of 12.7 cm. Thirty-five out of 62 plants showed signs of reproduction (44% of all plants). All seabeach amaranth data is located in Appendix C.

Surveying for seabeach knotweed was concurrent with that for seabeach amaranth during the survey windows. A total of 11 knotweed plants were counted and marked throughout FIIS (Figure 4). Sites found with knotweed include Fire Island Lighthouse (6 plants), Fire Island Villages (0 plants), Fire Island Sunken Forest (0 plants), Fire Island Pines (0 plants) and Fire Island Wilderness (5 plants). Both federal and non-federal tracts of land were surveyed in 2016. All plants were reproductive (i.e., flowering). All seabeach knotweed data is located in Appendix C.

7. DISCUSSION

7a. DISTURBANCE ISSUES IN 2016

7ai. ANTHROPOGENIC DISTURBANCES

There were several anthropogenic and natural disturbances to T&E species in 2016. Anthropogenic disturbances refer to direct and indirect human interactions with T&E species. This includes foot traffic through fenced off areas and driving adjacent to suitable habitat areas. Natural disturbances refer to other wildlife interactions that negatively impact the species. This includes predation and competition for beach resources.

FIIS staff follows USFWS (1996) guidelines: full-sized vehicles shall not be permitted on beaches where unfledged chicks are found, and that beach access points/dune crossings found within 1000 meters of a nest with chicks be closed to all traffic until those chicks are fledged (35 days after hatching for chicks near vehicle areas). The FIIS Wildlife Biologist continued the Plover Hotline (631-687-5030), first established in 2010, 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, when possible. However, no dune crossings were closed because plovers did not successfully nest west of Watch Hill in 2016, (6A-16 was abandoned before restrictions on driving were enforced). Although driving is always prohibited on Sailors Haven Beach certain individuals such as law enforcement will drive the beach when necessary. After the 9A-16 brood was discovered on July 24, driving along the beach was prohibited from the Ocean Bay Park cut through to the Cherry Grove cut. Following USFWS protocol the area was surveyed multiple times per day for a five day period but no subsequent signs of the brood were discovered and the area returned to its normal driving restrictions. However during our surveys to locate the new brood at least one truck was noted driving along the closed beach area.

Dogs were frequently seen off their leash, sometimes in areas where dogs were entirely prohibited including Sailors Haven beach, OPWA-West (along the breach at Old Inlet when boats moored) and at OPWA-East. In 2016 we experienced two separate incidents in OPWA-East where a Polaris was driving on the beach during peak plover activity and drove through the fencing near nest 3A-16. All the signage on the OPWA-East border by the Wilderness Visitor Center (large yellow “No Vehicles Beyond this Point” signs, “No Dogs” signs and informational plover signs) were also knocked down for a short

period of time mid-summer potentially allowing unknowing individuals to walk dogs, drive vehicles, and fly kites in the area. On the western breach side of the Old Inlet area boaters frequently beach or moor their boats on the weekends and spend the day along the shore, sometimes bringing their dog in close proximity to the 8A-16 nest. Feral and domesticated cats living within the communities in previous years have posed a threat to plovers. Cats act as predators and will hunt and harass nesting birds and chicks. This season no cat tracks were observed near plover nests.

7a.ii. NATURAL DISTURBANCES

Gulls, raccoons, red foxes, ghost crabs, and a variety of avian wildlife in FIIS can pose a threat or disturbance to nesting piping plovers and their broods.

Based on field observations, the predominant predator for the nesting piping plover on Fire Island during the past several years has been the red fox (*Vulpes vulpes*). Red fox tracks were frequently recorded inside the symbolic fencing. Evidence and sightings of red fox were especially prevalent in the OPWA and at Lighthouse Beach. Red fox tracks were often observed at the toe of the dune throughout the 5-mile stretch between Watch Hill and the Old Inlet breach. Nest 6A-16 at lighthouse was abandoned due to predator pressure (Figure 7) and fox tracks were frequently observed around the 8A nest in the OPWA-West area. No other predator was as prevalent as red fox on Fire Island in 2016.

In past seasons, wire exclosures (“predator exclosures”) were erected and placed around the plover nest in order to protect nests from avian and mammalian predators. However, in 2015 no nests were exclosed due to a high rate of nest abandonment observed in the 2014 season along with evidence that exclosures may contribute to adult piping plover mortality (Neuman et. al, 2004). This decision was made by the FIIS Wildlife Biologist based on observations from the researchers at Virginia Tech and based on recommendations from USFWS Biologists, Anne Hecht and Steve Papa. For the 2016 season the FIIS Wildlife Biologist decided to exclose all nests (except for one) due to the high rate of predation of nests in the 2015 and because 1A-16 was predated before it even reached a full clutch. The decision to stop using exclosures would be made within the nesting season (rather than before the season began) if more than one nest abandonment occurred which could be contributed to red fox presence/pressure.

Significant browsing of seabeach amaranth individuals has been observed in past seasons, which led to the decision to exclose almost all plants in 2016. Some instances of slight browsing were observed after the exclosing of plants but this was likely due to foraging by insects and other small animals. This year we did have a number of exclosed nests ripped open and the plants removed. This could be due to human interaction but is more likely aggressive foraging by white-tailed deer. This new potential impact will need to be considered and taken into consideration for how to proceed in future years. Due to an approaching storm (Post-Tropical Cyclone Hermine) most of the exclosures were removed and not replaced. As a result of overwashing (from the storm) there was a significant increase in mortality of plants after the storm, due to high tides (Figure 6). In addition, remaining plants were not protected from browsing which may have caused an increasing in browsing of those plants throughout the rest of the season.

8. RECOMMENDATIONS

This section is provided to highlight specific suggestions and concerns pertaining to the T&E species monitoring effort.

- The observations from this season and previous ones implicate red fox as a major threat to piping plover breeding and productivity success. Virginia Tech has been funded through the Fire Island to Moriches Inlet (FIMI) interim project to research red foxes and their impacts on listed species (piping plovers) on Fire Island, from Democrat Point through Smith Point County Park. Their study is titled, “Red Fox (*Vulpes vulpes*) Movements, Habitat Selection, and Demography, on Fire Island, New York”. It began in the summer of 2015 and will continue through the summer/fall of 2017. Information on the project can be accessed at: <http://vtshorebirds.fishwild.vt.edu/projects.html> and <https://irma.nps.gov/rprs/Permit/Profile/42421>
- Observational data has shown white-tailed deer to be a possible threat to the survival and reproduction of seabeach amaranth. Significant browsing of plants was recorded prior to the 2014 season, and since then all/most amaranth individuals have been exclosed. However, this year it appears browsing occurred on exclosed amaranth plants. A number of exclosures were found to be ripped open and the plants removed. It’s recommended to continue exclosing plants next season, as staffing allows, and particularly until the implementation of the Deer Management Plan/EIS which calls for a reduction of the deer herd on Fire Island, which could possibly alleviate browsing pressure on this federally threatened plant.
- Annual reports have been written for T&E species in the past several years. However, trend data for each species needs to be evaluated. The FIIS Wildlife Biologist will collect, summarize and evaluate population data for all T&E species and species of special concern in a separate report. In addition, she will try and identify future management efforts to improve the success of T&E species on Fire Island.
- All of this information will be used in an updated planning document, for threatened and endangered species management plan. The previous EA is from 1998 and park management agrees that it needs to be updated. The Superintendent has approved the Wildlife Biologist to begin this process, which will begin sometime in the fall of FY17. In the interim it’s suggested that a review be done to assess whether red fox pose a significant threat to threatened and endangered species through reviewing literature, summarizing preliminary data from Virginia Tech’s red fox study, and statistically summarizing the park’s monitoring data and analyzing existing data. In addition, trend data (previously described) will also better inform the new planning document.
- Bats have been experiencing precipitous declines during the past several years. White-Nose Syndrome (WNS) is an emerging disease that has killed more than 6 million bats since its discovery in 2007, reducing regional populations of some bat species by more than 90 percent. The northern long-eared bat (*Myotis septentrionalis*) was listed as federally threatened by the USFWS in April 2015. FIIS has worked with researchers on bat research/monitoring (Michael Fishmann in 2014, SUNY-ESF in 2015, self-funded/staffed in 2016) and has detected a significant number of northern long-eared bats at the William Floyd Estate. The Wildlife

Biologist suggests continued research but also incorporating bats – especially the northern long-eared bat – into the T&ES Monitoring Program effort and developing a long-term monitoring plan for this species. This data will be incorporated into future annual reports.

Experience 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.

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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	1.2	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	0.5	0.7
2010	16	23	9	38	2.2	17	0.7	1.1
2011	14	16	10	38	2.7	21	1.3	1.9
2012	12	17	8	35	2.9	15	0.9	1.3
2013	11	13	3	35	3.2	7	0.5	0.6
2014	8	12	3	15	1.9	7	0.6	0.9
2015	3	5	2	6	2.0	5	1.0	1.7
2016	9	10	6	25	2.8	16	1.6	1.8
Average	10.4	12.6	6.2	32.0	2.2	14.2	1.2	1.3

¹Data from previous nesting seasons are incomplete

Table 1: Historic Productivity of Piping Plovers on FIIS

¹Data from previous nesting seasons are incomplete

Nest	Area	Status	Exclosed?	# of eggs laid	Actual hatch date	# of eggs hatched	# of chicks fledged	Date of failure	Fledge date (+25 days)
1A	Wilderness East (section 9)	Failed-Predated	No	3	5/26	0	0	4/29	
1B	Wilderness East (section 9)	FLEDGED	Yes	4	6/4	4	2		6/29
2A	Wilderness East (section 8)	FLEDGED	Yes	4	6/1	3	3		6/26
3A	Wilderness East (section 8)	FLEDGED	Yes	4	6/16	4	4		7/11
4A	Wilderness East (section 10)	FLEDGED	Yes	4	6/25	4	1		7/20
5A	Wilderness East (section 9)	FLEDGED	No	4	6/25	3	3		7/20
6A	Lighthouse Beach	Failed-Abandoned	Yes	4	6/27	0	0	6/10	
7A	Wilderness East (section 9)	Hatched/Failed	Yes	4	6/27	1	0	7/14	7/22
8A	Wilderness West (section 7)	FLEDGED	Yes	3	7/6	3	3		7/31
9A	Sailors Haven	Hatched/Failed	No	N/A	N/A	3	0	7/25	

Table 2: FIIS 2016 Overall Piping Plover productivity

NPS Nest #	Female	Male	Chick1	Chick2	Chick3	Chick4	Chick1_fate	Chick2_fate	Chick3_fate	Chick4_fate
7a	UNBANDE D_F	GF(LYA)	-	-	-	-	-	-	-	-
1a	GF(97)	GF(06)	-	-	-	-	-	-	-	-
2a	GF(6UP)	GF(4EE)	GF(7X1)	GF(10X)	GF(L9U)	-	FLEDGED	FLEDGED	FLEDGED	-
1b	GF(97)	GF(06)	GF(JJJ)	GF(U0P)	GF(N66)	GF(P8A)	DIED	FLEDGED	DIED	FLEDGED
3a	GF(JCY)	GF(88)	GF(HN8)	GF(02H)	GF(9TT)	GF(0UL)	FLEDGED	FLEDGED	FLEDGED	FLEDGED
4a	GF(LAT)	GF(PNX)	GF(6A2)	GF(29C)	GF(1EL)	UNBANDED	DIED	DIED	FLEDGED	DIED
5a	GF(4EV)	GF(E2T)	GF(V7L)	GF(6J3)	GF(L3Y)	-	FLEDGED	FLEDGED	FLEDGED	-
7a	GF(TNT)	GF(PY3)	GF(K5M)	-	-	-	DIED	-	-	-
8a	GF(2AN)	GF(NK0)	GF(Y0T)	GF(C2K)	GF(4H0)	-	FLEDGED	FLEDGED	FLEDGED	-

Table 3: Piping Plover Banding Information for 2016 from Virginia Tech Study. GF = Green Flag. Please refer to Virginia Tech's Annual Report 2016 for more information (when available can be found on NPS IRMA site).

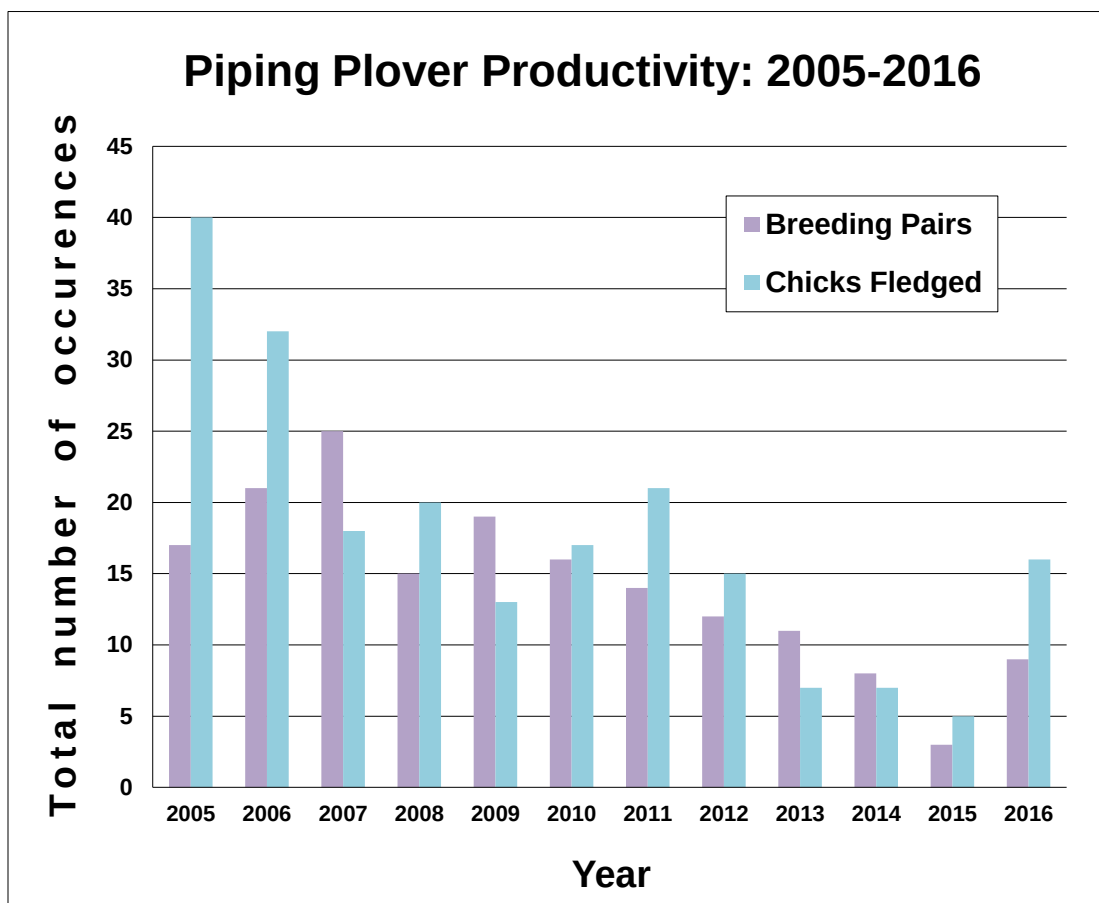


Figure 1: The number of Piping Plover breeding pairs and the number of chicks fledged at FIIS, 2004-2016

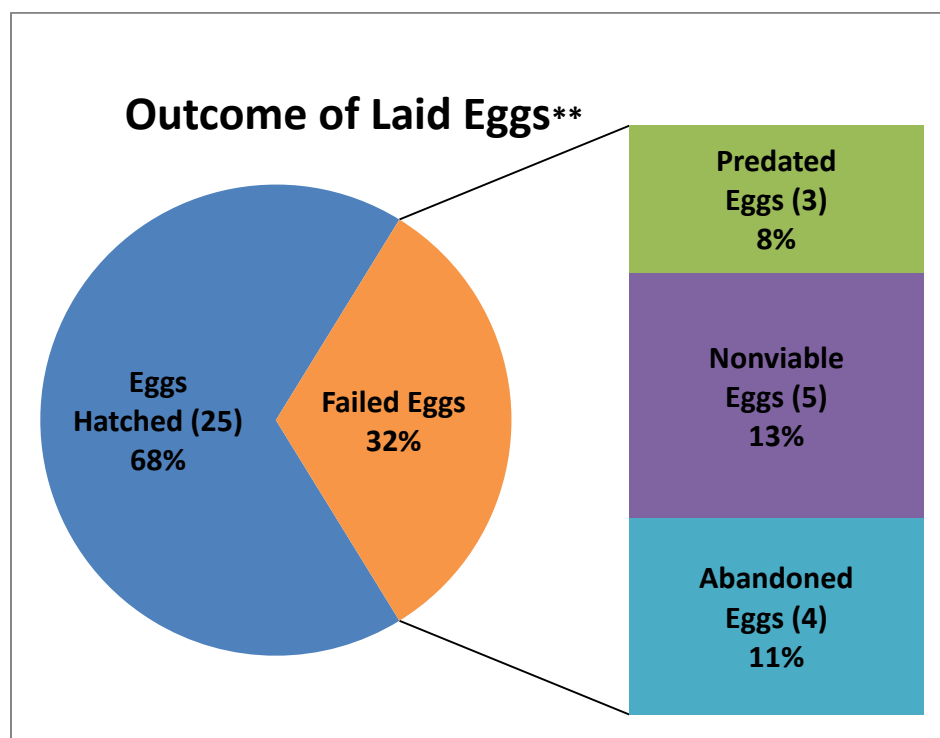


Figure 2: Pie graph displaying the outcome of all laid Piping Plover eggs at FIIS in 2016 (total = 37).

**Data for nest 9A-16 is incomplete; figures have been calculated based off known 3 hatched eggs.

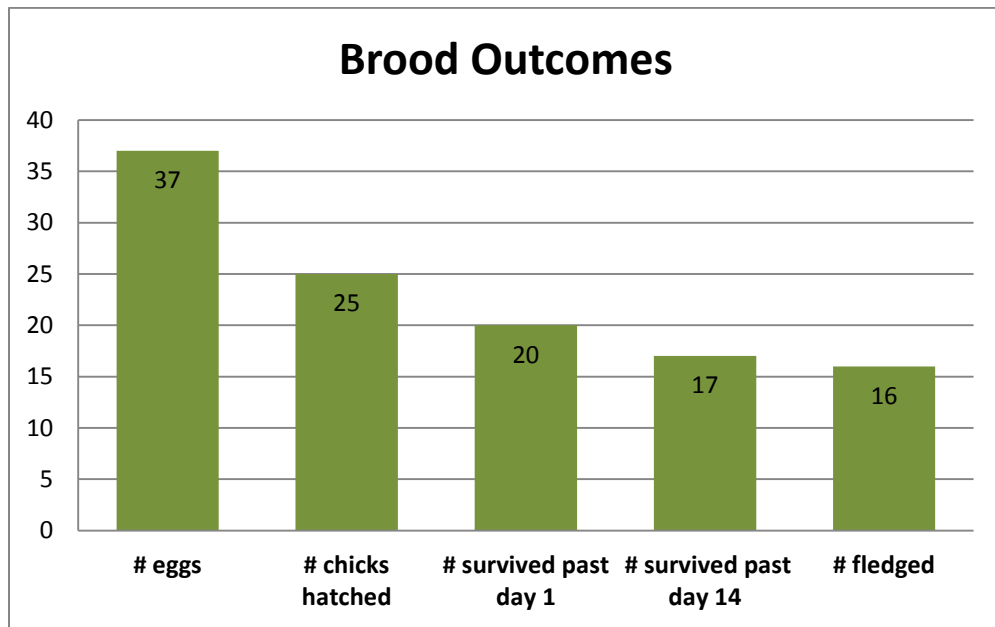


Figure 3: Bar graph of brood outcome for 2016 Piping Plovers at FIIS

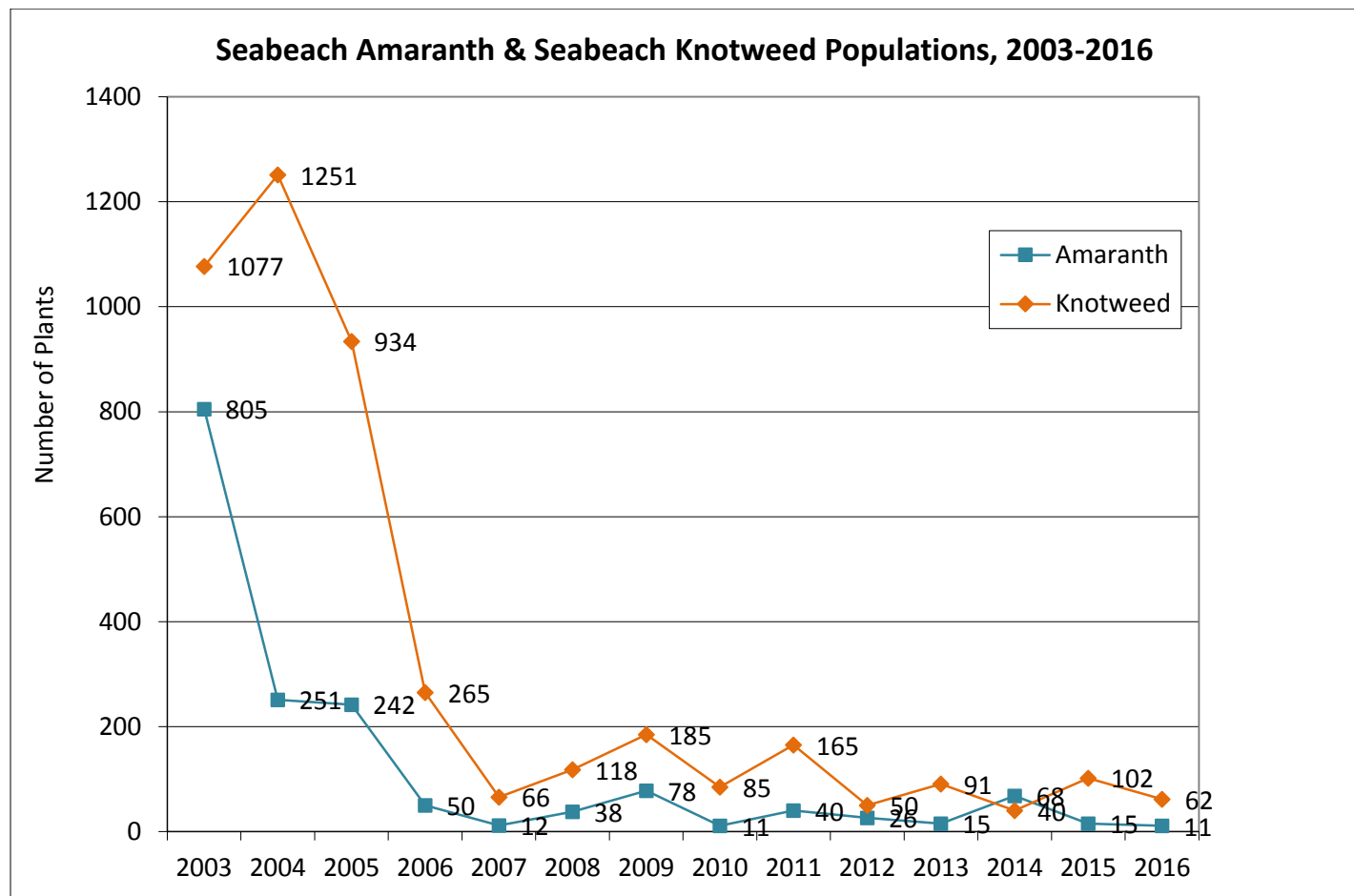


Figure 4: Chart displaying historical values for Seabeach Amaranth & Seabeach Knotweed on FIIS (2003-2016). The y-axis is the total number of plants counted that year.

Browsing of Seabeach Amaranth

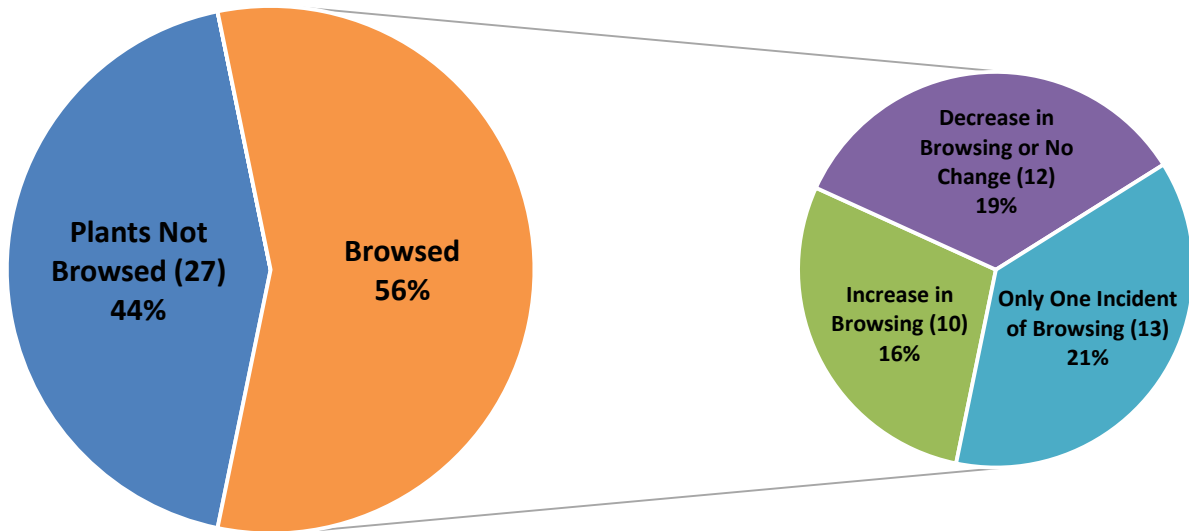


Figure 5: Pie graph displaying the relationship between browsed (n=35) and unbrowsed (n=27) Seabeach Amaranth plants in regards to erected exclosures in the 2016 survey season.

SEABEACH AMARANTH MORTALITY

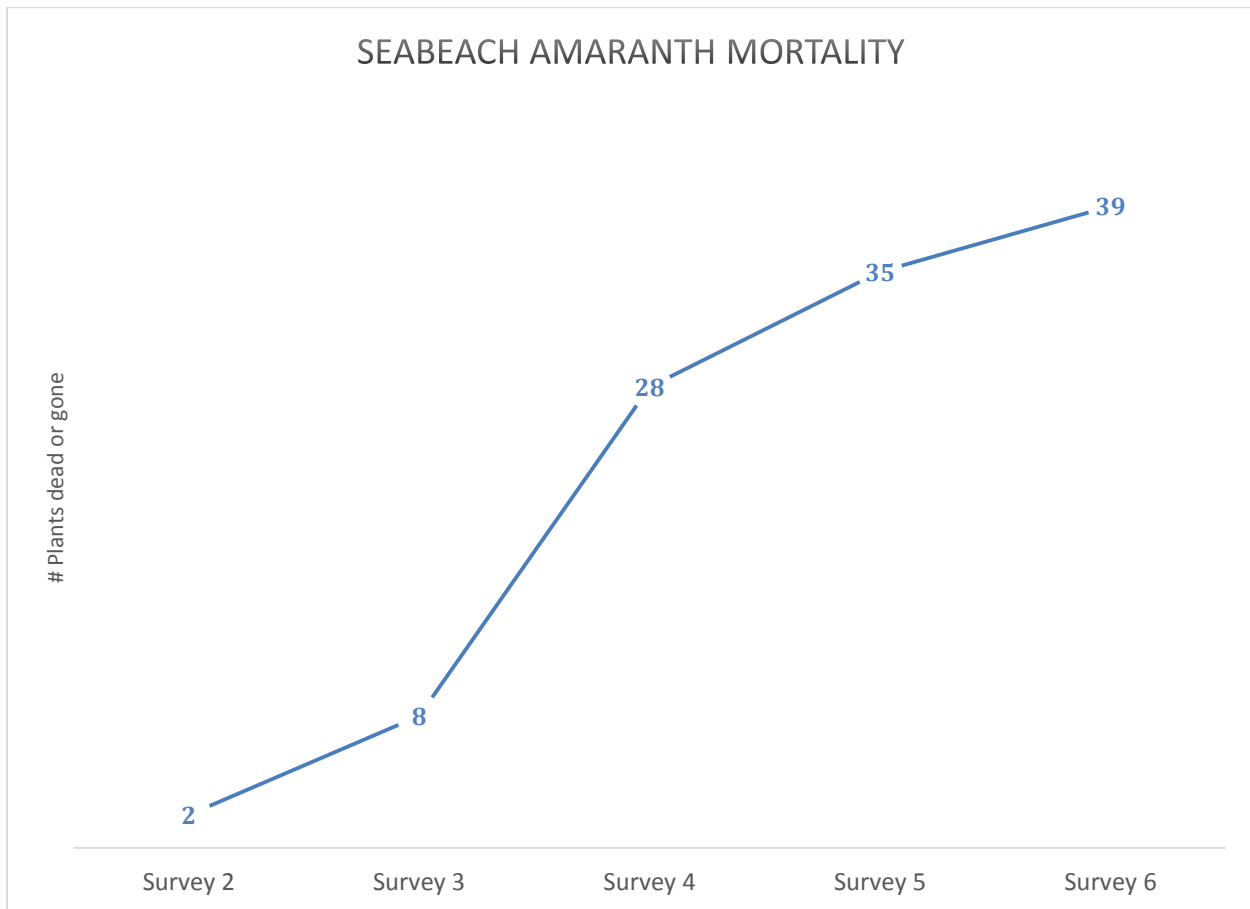


Figure 6: Line graph demonstrating the senescence of Seabeach Amaranth plants after each survey. Post-tropical cyclone Hermine occurred immediately following Survey 3.



Figure 7: Photo of piping plover enclosure for nest 6A-16 post-abandonment. This nest was determined to be abandoned due to red fox presence/pressure. It Disturbed sand (with tracks) on both the north and south sides of the predator enclosure, in addition to fox tracks leading up to enclosure the enforce suspicions of abandonment due to predator pressure.

Site / Species	COTE	LETE	SNEG	GREG	GLIB	DCCO	GBBG	HEGU	LAGU	BCNH
Islip Spoil Island	-	-	6	35	39	-	25	250	-	22
Sexton Island	-	-	-	-	-	18	8	120	200	-
East Fire Island	300-325	-	-	-	-	-	-	-	-	-
Ridge Island	-	-	-	-	-	69	60	210	-	-
John Boyle Island	-	-	4	11	5	-	60	100	-	1
Long Cove	-	-	-	-	-	7	-	-	-	-
Inactive Sites: West Fire Island, Pelican Island, Hospital Island, Lighthouse, Fire Island Villages, Sailors Haven, Fire Island Pines, Watch Hill Bay, OPWA*										

Table 4: Long Island Colonial Waterbird Surveys for Gulls and Wading Birds in 2016. Sites are listed from west to east and separated by whether they are bay islands or on Fire Island. Species codes: COTE = Common Tern, LETE= Least Tern, SNEG = Snowy Egret, GREG = Great Egret, GLIB = Glossy Ibis, DCCO = Double Crested Cormorant, GBBG = Great Black-Backed Gull, , HEGU = Herring Gull, LAGU= Laughing Gull, BCNH = Black Crowned Night Heron (* = Davis Park included in Wilderness survey)

Site / Species	AMOY	PIPL
Islip Spoil Island	4	-
Sexton Island	2	-
East Fire Island	4	-
Ridge Island	5	-
John Boyle Island	6	-
Lighthouse	-	2
OPWA	-	14
Inactive Sites: West Fire Island, Pelican Island, Hospital Island, Fire Island Villages, Sailors Haven, Fire Island Pines, Watch Hill Bay, Long Cove		

Table 5: Surveys for American Oystercatchers and Piping Plovers in 2016. Sites are listed from west to east and separated by whether they are bay islands or on Fire Island. Piping plover survey conducted during June 1 – June 9 window. American oystercatcher survey conducted during May 17 – June 9 window. Species codes: AMOY = American Oystercatcher, PIPL = Piping Plover (* = Davis Park included in Wilderness survey)

Term Survey Window	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd						
Site / Species	COTE		LETE		AMOY		GREG		BCNH		MALL		GLIB		DCCO		GBBG		HEGU		SNEG		LAGU		MUSW		WILL		CAGO		DUNL		LIBH					
Islip Spoil Island	-	-	-	-	4		-		-		-		2		-		39		185		-		-		-		-		-		-		-					
Sexton Island	60	2	-	-	2	2	-	-	-	-	-	-	-	-	2	-	8	4	40	40	-	-	85	45	-	-	-	-	-	-	-	-	-	-				
East Fire Island	235	175	-	-																																		
Ridge Island	200	300	-	-	6	2	-	-	-	-	3	-	-	-	50	65	135	60	224	65	1	-	-	-	-	-	4	-	3	-	-	-	-	-				
John Boyle Island	-	-	-	-	-	4	3	6	2	1	3	-	2	-	5	-	45	30	140	75	1	1	27	-	11	-	-	-	-	-	-	-	-	1				
Long Cove	8	11	-	-	2	-	-	-	-	-	2	-	-	-	-	-	-	-	1	-	-	-	-	-	-	3	-	-	-	-	-	-	-					
OPWA	-	-	4	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
Hospital Island**	-		-		-		1		-		-		-		-		-		1		-		-		-		2		-		1		-					
Inactive Sites: Islip Spoil Island**, West Fire Island, Pelican Island, Lighthouse, Fire Island Villages, Sailors Haven, Fire Island Pines, Watch Hill Bay, Hospital Island**																																						
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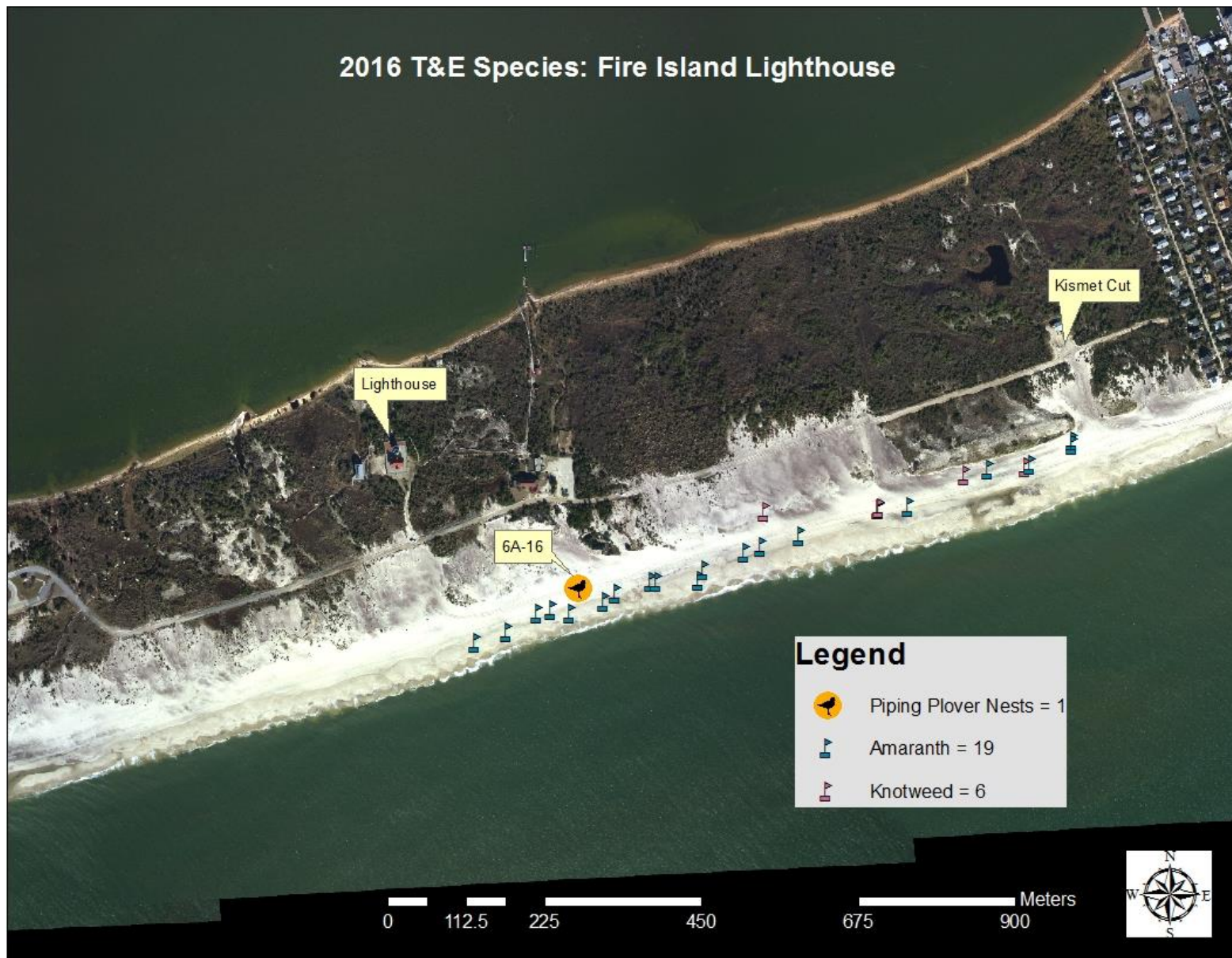
Table 6: Long Island Colonial Waterbird Surveys for Terns and Black Skimmers in 2016. Sites are listed from west to east and separated by whether they are bay islands or on Fire Island. Tern and black skimmer surveys are conducted twice in June, Window 1: June 1-15 and Window 2: June 15-30. Species codes: COTE = Common Tern, LAGU= Laughing Gull, AMOY = American Oystercatcher, DCCO = Double Crested Cormorant, LETE= Least Tern, WILL = Willet, GBBG = Great Black-Backed Gull, OSPR = American Osprey, GLIB = Glossy Ibis, GREG = Great Egret, SNEG = Snowy Egret, HEGU = Herring Gull, MALL = Mallard, BCNH = Black Crowned Night Heron, LIBH = Little Blue Heron, GRBH = Great Blue Heron, MUSW = Mute Swan, DUNL = Dunlin, CAGO = Canadian Goose (* = Davis Park included in Wilderness survey) (**= Inactive site for Terns and Black Skimmers)

Appendix B: Maps

Map 1: Map of Fire Island National Seashore



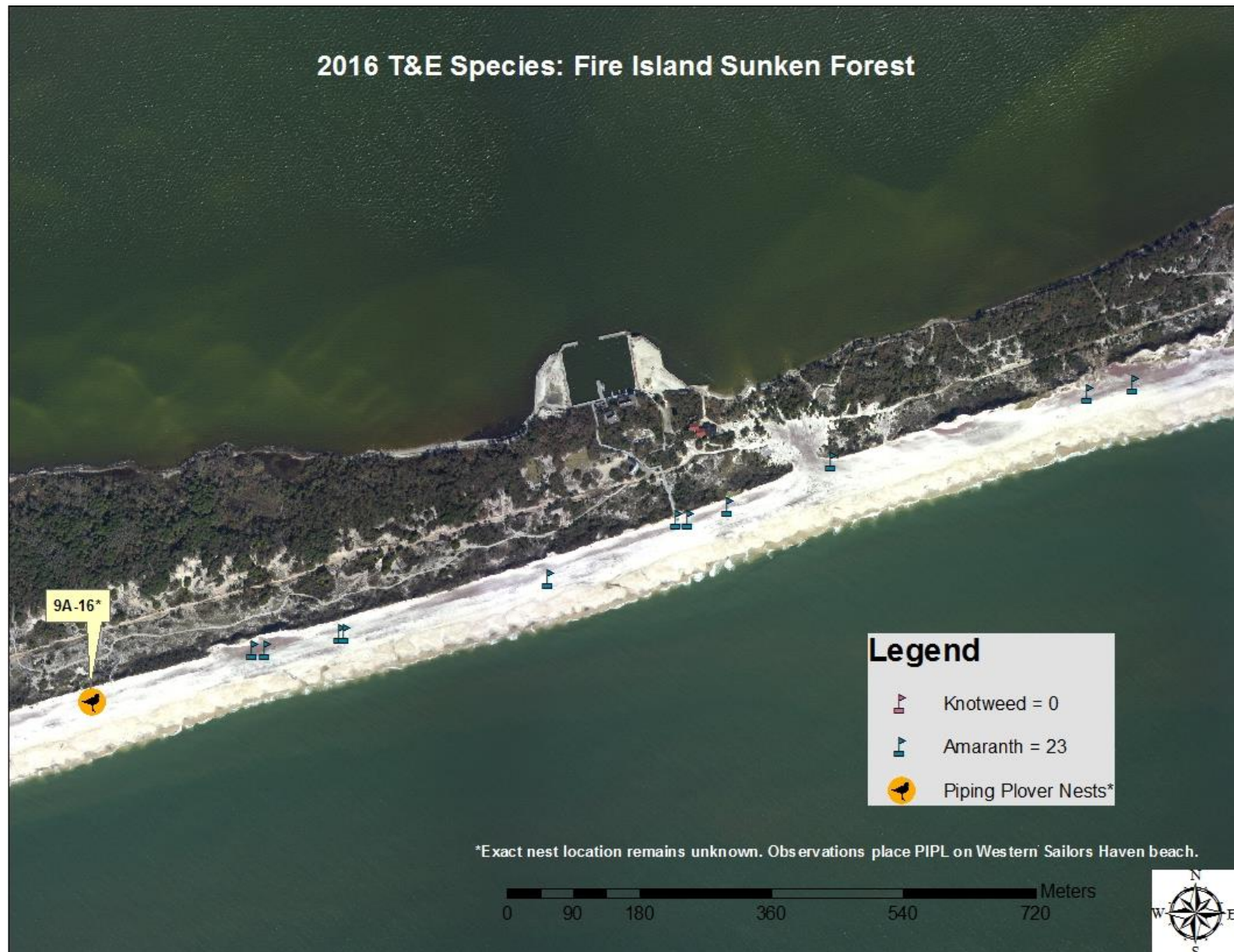
Map 2: Fire Island Lighthouse locations of threatened and endangered species in 2016. Maps are organized by Long Island Colonial Waterbird Survey areas and include piping plover nests, seabeach amaranth and seabeach knotweed individuals for each area



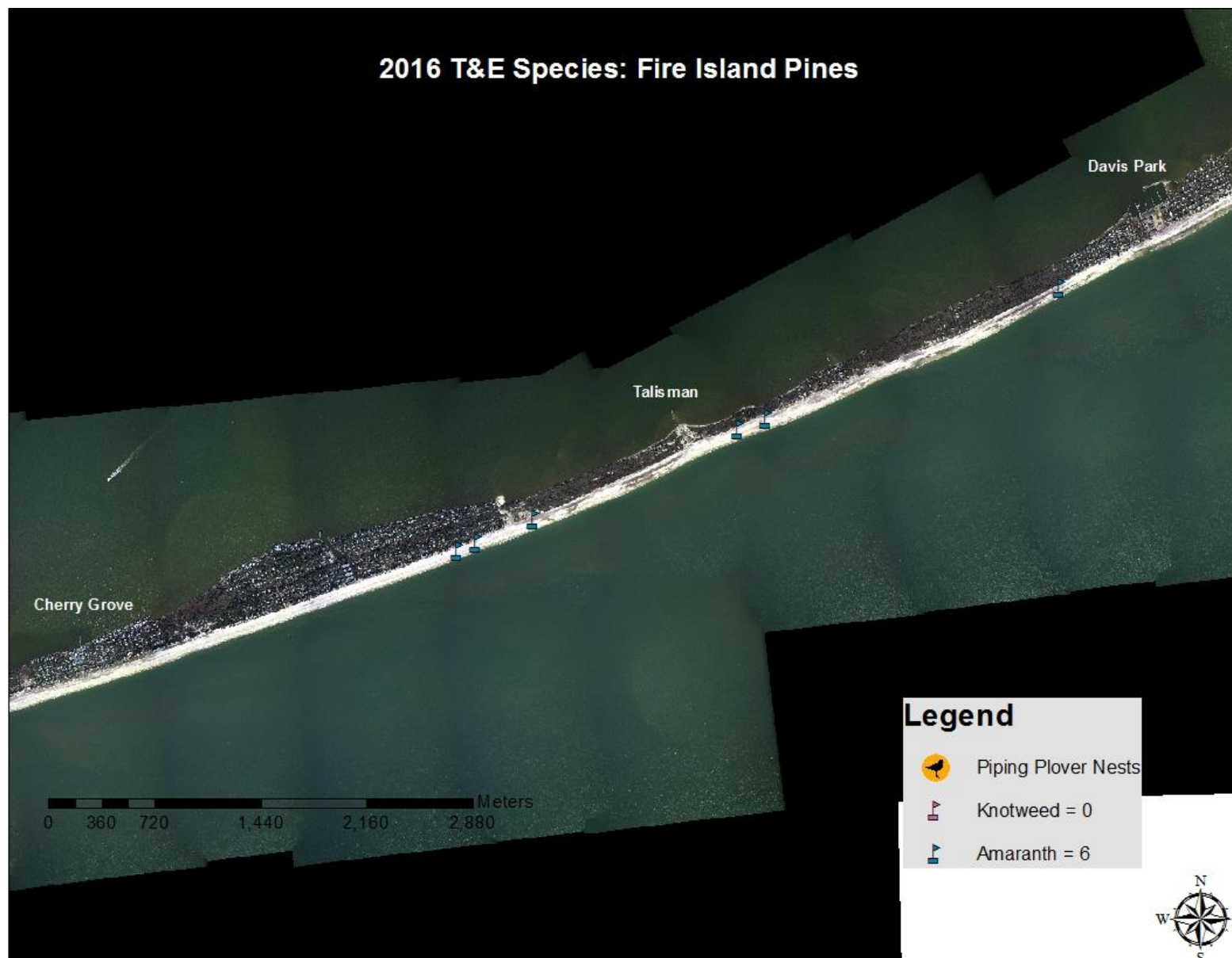
Map 3: Fire Island Villages locations of threatened and endangered species in 2016. Maps are organized by Long Island Colonial Waterbird Survey areas and include piping plover nests, seabeach amaranth and seabeach knotweed individuals for each area



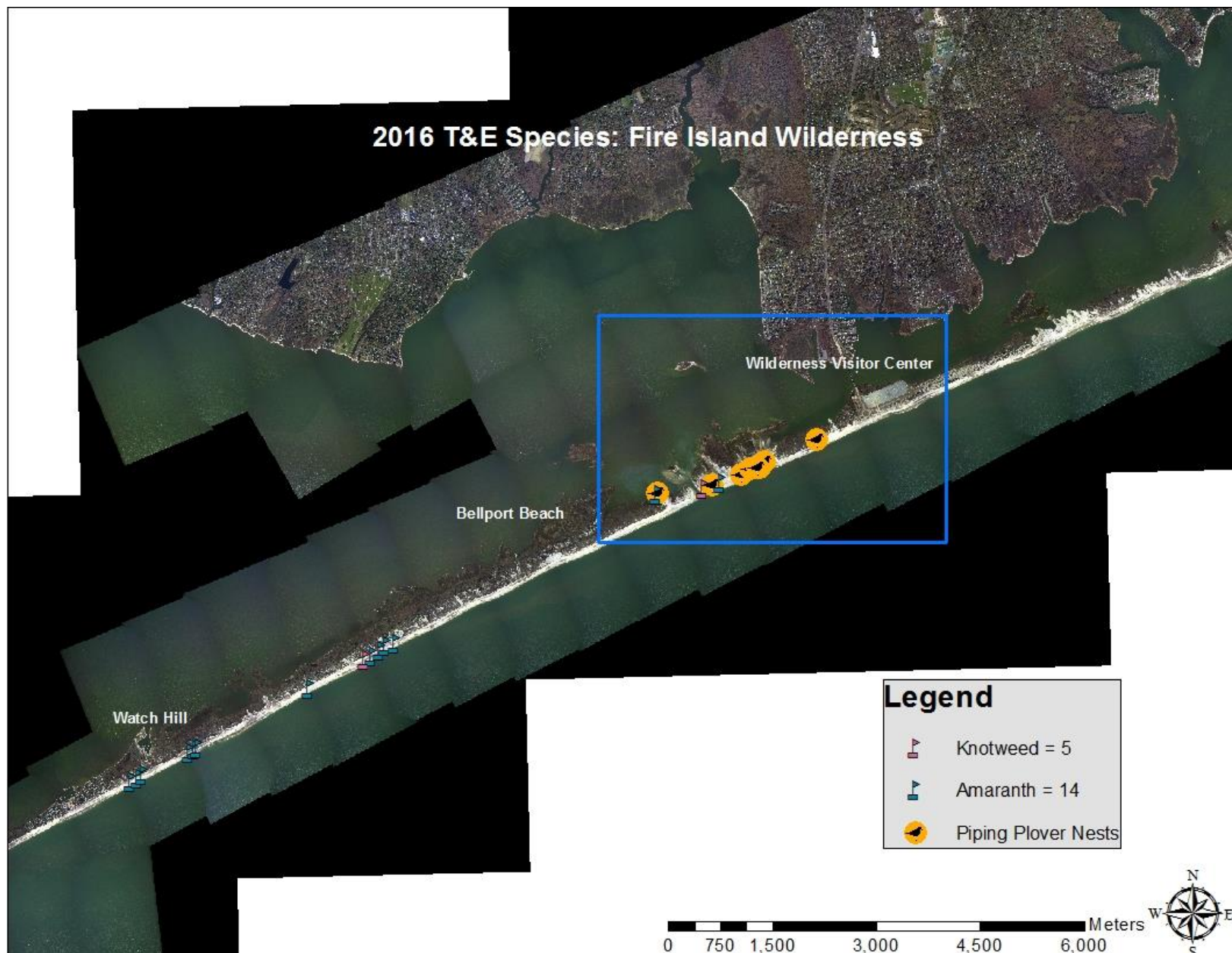
Map 4: Fire Island Sunken Forest locations of threatened and endangered species in 2016. Maps are organized by Long Island Colonial Waterbird Survey areas and include piping plover nests, seabeach amaranth and seabeach knotweed individuals for each area



Map 5: Fire Island Pines locations of threatened and endangered species in 2016. Maps are organized by Long Island Colonial Waterbird Survey areas and include piping plover nests, seabeach amaranth and seabeach knotweed individuals for each area



Map 6: Fire Island Wilderness locations of threatened and endangered species in 2016. Maps are organized by Long Island Colonial Waterbird Survey areas and include piping plover nests, seabeach amaranth and seabeach knotweed individuals for each area



Map 7: Fire Island Wilderness (East of Old Inlet) locations of threatened and endangered species in 2016. Maps are organized by Long Island Colonial Waterbird Survey areas and include piping plover nests, seabeach amaranth and seabeach knotweed individuals for each area



Appendix C: GPS locations

Piping Plover Nests

Nest	Species	SiteName	LocationDescription	UTMx	UTMy	Exclosed?	HatchDate	Productivity
1A-16	Piping Plover	Fire Island Wilderness	Wilderness East (section 9)	678641	4510554	No	N/A	0
1B-16	Piping Plover	Fire Island Wilderness	Wilderness East (section 9)	678672	4510551	Yes (5/9/2016)	6/4/2016	2
2A-16	Piping Plover	Fire Island Wilderness	Wilderness East (section 8)	678403	4510453	Yes (5/9/2016)	6/1/2016	3
3A-16	Piping Plover	Fire Island Wilderness	Wilderness East (section 8)	677990	4510305	Yes (5/20/2016)	6/16/2016	4
4A-16	Piping Plover	Fire Island Wilderness	Wilderness East (section 10)	679495	4510954	Yes (6/1/2016)	6/25/2016	1
5A-16	Piping Plover	Fire Island Wilderness	Wilderness East (section 9)	678750	4510640	No	6/25/2016	3
6A-16	Piping Plover	Fire Island Lighthouse		650913	4499279	Yes (6/2/2016)	6/27/2016	0
7A-16	Piping Plover	Fire Island Wilderness	Wilderness East (section 9)	678539	4510530	Yes (6/1/2016)	N/A	0
8A-16	Piping Plover	Fire Island Wilderness	Wilderness West (section 7)	677196	4510192	Yes (6/8/2016)	7/6/2016	3
9A-16	Piping Plover	Sailors Haven		-	-	No	N/A	0

Seabeach amaranth individuals

Amaranth Site ID	Site Name (LICWS)	Location Description	Date found /resurveyed	# of plants	Max size (cm)	Evidence of Browsing (date(s)/none)	Reproductive (date(s)/none)	Dead/Go ne date	Exclosed (Y/N)	UTM (x)	UTM (y)
FIL-1	Fire Island Lighthouse	Lighthouse Beach	8/29/2016	1	6		8/10-FL	29-Aug	yes - 7/15	650876	4499251.3
FIL-2	Fire Island Lighthouse	Lighthouse Beach	9/21/2016	1	19.5	8/29-10% browsed	8/10-FL/FR; 8/29-PR; 9/9-PR	21-Sep	yes - 7/15	651502.4	4499452
FIL-3	Fire Island Lighthouse	Lighthouse Beach	10/11/2016	1	15	7/15-25% browsed; 8/29-80% browsed; 9/8-60% browsed; 9/21-95% browsed	9/21 - FR	11-Oct	yes - 7/15	651622.7	4499488.4
FIL-4	Fire Island Lighthouse	Lighthouse Beach	9/21/2016	1	9	8/10-20% browsed; 8/29-55% browsed; 9/8-<5% browsed	8/10-FL; 8/29-PR	21-Sep	yes-8/12	650766.8	4499204.7
FIL-5	Fire Island Lighthouse	Lighthouse Beach	9/8/2016	1	7	8/29-98% browsed	8/10-FL	8-Sep	yes-8/12	650856.5	4499246.4
FIL-6	Fire Island Lighthouse	Lighthouse Beach	10/11/2016	2	10.5	8/10-25% browsed; 8/29-5% browsed; 9/8-1% browsed	8/10-FL; 8/29-FL/FR; 9/9- FR/PR; 9/21 - FR; 10/11-FR/PR		yes-8/12	650902.5	4499245.8
FIL-7	Fire Island Lighthouse	Lighthouse Beach	10/11/2016	1	15	8/10-15% browsed; 8/29<5% browsed; 9/8-<5% browsed; 9/21 -98% browsed	8/10-FL; 8/29-FL/FR; 9/8-FR/PR	11-Oct	yes-8/12	650952.4	4499263.5
FIL-8	Fire Island Lighthouse	Lighthouse Beach	9/8/2016	1	11	8/10-10% browsed; 8/29-10% browsed	8/10-FL; 8/29-PR	8-Sep	yes-8/12	650968.2	4499274.8
FIL-9	Fire Island Lighthouse	Lighthouse Beach	9/8/2016	1	5.5	8/10-<5% browsed	8/10-FL; 8/29-FL/FR	8-Sep	yes-8/12	650967.1	4499328.9
FIL-10	Fire Island Lighthouse	Lighthouse Beach	9/8/2016	1	14		8/10- FL; 8/29-FL/PR	8-Sep	yes-8/12	650966.6	4499351.8
FIL-11	Fire Island Lighthouse	Lighthouse Beach	10/11/2016	1	11	8/10-8% browsed; 9/21-40% browsed; 10/11-30% browsed	8/29-FL/FR; 9/8-PR; 9/21-FR/PR; 10/11-FR/PR		yes-8/12	651387.8	4499399.5
FIL-12	Fire Island Lighthouse	Lighthouse Beach	10/11/2016	1	15	8/29-10% browsed; 9/13-7% browsed	8/12-FL; 8/29-FL/FR; 9/13-FL/PR; 9/21 - FR/PR; 10/11-FR/PR		yes-8/16	651018.6	4499291.9
FIL-13	Fire Island Lighthouse	Lighthouse Beach	10/11/2016	1	5.5		8/12-FL; 8/29-FL; 9/21-FR; 10/11-FR/PR		yes-8/16	651028	4499291.7
FIL-14	Fire Island Lighthouse	Lighthouse Beach	9/13/2016	1	6.5		8/12-FL; 8/29-FL/FR	13-Sep	yes-8/16	651563.1	4499458.8

FIL-15	Fire Island Lighthouse	Lighthouse Beach	9/13/2016	1	5.5		8/12-FL; 8/29-FL	13-Sep	yes-8/16	651623.1	4499492.3
FIL-16	Fire Island Lighthouse	Lighthouse Beach	10/11/2016	1	13	8/29-<5% browsed; 9/8-15% browsed	8/29-FL/FR; 9/8-FL/FR/PR; 9/21-FR/PR	11-Oct	yes-8/31	650846.245	4499202.25
FIL-17	Fire Island Lighthouse	Lighthouse Beach	9/8/2016	1	5	8/29-10% browsed	8/29-FL/FR	8-Sep	yes-8/31	651094.05	4499308.61
FIL-18	Fire Island Lighthouse	Lighthouse Beach	10/11/2016	1	16	8/29-30% browsed; 10/11-30% browsed	8/29-FL/FR; 10/11 - FR/PR	8-Sep	yes-8/31	651088.02	4499293.94
FIL-19	Fire Island Lighthouse	Lighthouse Beach	9/8/2016	1	4.5	8/29-<5 browsed		8-Sep	yes-8/31	651203.962	4499305.967
FISF-1	Fire Island Sunken Forest	Sailor's Haven	9/20/2016	1	10.5		8/31-FR/PR; 9/9-FR	20-Sep	no	660334	4502256.2
FISF-2	Fire Island Sunken Forest	Sailor's Haven	9/20/2016	1	24		8/9-Tiny buds; 8/31-FR; 9/9-FR/PR	20-Sep	yes-7/14	660159.5	4502175.3
FISF-3	Fire Island Sunken Forest	Sailor's Haven	8/31/2016	1	14.5		8/9-Tiny buds; 8/31-PR	31-Aug	yes-7/14	659882.3	4502101.7
FISF-4	Fire Island Sunken Forest	Sailor's Haven	8/31/2016	1	21		8/9-Tiny buds; 8/31-PR	31-Aug	yes-7/14	659876.1	4502100.6
FISF-5	Fire Island Sunken Forest	Sailor's Haven	10/19/2016	1	11.5	8/31-netting torn, 95% browsed; 9/9-netting return, 70% browsed; 9/20-40% browsed	8/9-FL; 8/31-PR; 9/9- FR; 9/20-PR; 10/19- FR/PR		yes-7/15	659774.4	4502078.4
FISF-6	Fire Island Sunken Forest	Sailor's Haven	9/20/2016	1	3.5	8/9-15% browsed	8/31-PR	20-Sep	yes-7/15	659756.8	4502078.5
FISF-7	Fire Island Sunken Forest	Sailor's Haven	10/19/2016	1	8	7/18-<5% browsed (insect); 8/8-10% browsed; 10/19-<5% browsed	8/9-FL; 8/31-PR; 9/9-FR/PR; 9/20-PR		yes-7/18	660545.6	4502336.1
FISF-8	Fire Island Sunken Forest	Sailor's Haven	10/19/2016	1	16.5	7/18-<5% browsed (insect), 8/9- <5% browsed; 9/20-<5% browsed	8/9-FL; 8/31-FR/PR; 9/9-FR/PR; 9/20-PR; 10/19-FR/PR		yes-7/18	660894.5	4502428.9
FISF-9	Fire Island Sunken Forest	Sailor's Haven	9/9/2016	1	5	8/9-<5% browsed	8/31-PR	9-Sep	yes-7/18	660957	4502441.2
FISF-10	Fire Island Sunken Forest	Sailor's Haven	10/19/2016	1	13		8/31-FR; 9/9-FR; 9/20 -FR/PR; 10/19-FR/PR		yes - 7/14	660334	4502256.2
FISF-11	Fire Island Sunken Forest	Sailor's Haven	10/19/2016	1	3.5		9/9 -FR; 9/20 - FR/PR; 10/19- FR/PR		yes - 7/14	660334	4502256.2
FISF-12	Fire Island Sunken Forest	Sailor's Haven	10/19/2016	1	47	10/19- 15% browsed (whole stack missing)	8/31-FR/PR; 9/9-FR/PR; 9/20 - FL/FR/PR; 10/19-FR/PR		yes - 7/14	660334	4502256.2
FISF-13	Fire Island Sunken Forest	Sailor's Haven	8/31/2016	1	6.5			31-Aug	yes - 7/14	660334	4502256.2

FISF-14	Fire Island Sunken Forest	Sailor's Haven	10/19/2016	1	2.5		9/9 - FR; 9/20 - FR/PR; 10/19-FR/PR		yes - 7/14	660334	4502256.2
FISF-15	Fire Island Sunken Forest	Sailor's Haven	10/19/2016	1	32		8/9-tiny buds; 8/31 -FR/PR; 9/9 - FR/PR; 9/20 - FL/FR/PR; 10/19- FR/PR		yes - 7/14	660334	4502256.2
FISF-16	Fire Island Sunken Forest	Sailor's Haven	10/19/2016	1	9		8/31 - FR; 9/9 - FR/PR; 9/20- FR/PR; 10/19- FR/PR		yes - 7/14	660334	4502256.2
FISF-17	Fire Island Sunken Forest	Sailor's Haven	10/19/2016	1	21.5		8/9-FL; 8/31-FL/FR; 9/9- FR/PR; 9/20- FR/PR; 10/19- FR/PR		yes - 7/14	660334	4502256.2
FISF-18	Fire Island Sunken Forest	Sailor's Haven	10/19/2016	1	21		8/9-FL; 8/31-FR; 9/9 -FR; 9/20 - FR/PR; 10/19-FR/PR		yes - 7/14	660334	4502256.2
FISF-19	Fire Island Sunken Forest	Sailor's Haven	10/19/2016	1	19		8/31 - FR; 9/9 - FR/PR; 9/20 -FR/PR; 10/19 - FL/FR/PR		yes-8/9	660334	4502256.2
FISF-20	Fire Island Sunken Forest	Sailor's Haven	10/19/2016	1	3		9/20 - PR; 10/19- FR/PR		yes-8/9	660334	4502256.2
FISF-21	Fire Island Sunken Forest	Sailor's Haven	10/19/2016	1	15.5		8/31 -FR; 9/9-FR; 9/20- FR/PR; 10/19 - FR/PR		yes-8/9	660334	4502256.2
FISF-22	Fire Island Sunken Forest	Sailor's Haven	8/31/2016	1	6.5		8/9-FL	31-Aug	yes-8/9	660350.7	4502257.1
FISF-23	Fire Island Sunken Forest	Sailor's Haven	10/19/2016	1	3	8/9-20% browsed; 9/9- <5% browsed; 9/20-<5% browsed	9/9-FR/PR; 9/20-PR	31-Oct	yes-8/9	660404.5	4502274.8
FIP-1	Fire Island Pines	Bluepoint	8/9/2016	1	19.5			8-Aug	yes-7/13	668086.7	4505245.9
FIP-2	Fire Island Pines	Pines	10/19/2016	1	45.5	7/18-<5% browsed (insect), 8/9-10% browsed; 8/31-<5% browsed; 9/9-<5% browsed	8/9-FL/FR; 8/31- FR/PR; 9/9-FR/PR; 9/20-FR/PR; 10/19 - FR/PR		yes-7/14	664141.1	4503521.5
FIP-3	Fire Island Pines	Pines	10/19/2016	1	35	8/31-<5% browsed; 9/20-<5% browsed	8/9-FL/FR; 8/31- FR/PR; 9/9-FR/PR; 9/20-FR/PR; 10/19 - FR/PR		yes-7/14	664010.2	4503466.8
FIP-5	Fire Island Pines	Pines	9/20/2016	1	9	8/31-10% browsed	8/31-FL/FR; 9/9-FR	20-Sep	yes-8/31	665912.2	4504286.7
FIP-4	Fire Island Pines	Water Island	10/19/2016	1	6.5	7/18-<5% browsed (insect); 9/9-<5% browsed	8/31-PR/FR; 9/9- FR/PR; 9/20-FR/PR	19-Oct	yes-7/18	666447.8	4505888.6
FIP-6	Fire Island Pines	Water Island	9/20/2016	1	14.5	8/31-10% browsed; 9/9- <5% browsed	8/31-FR; 9/9-FR/PR	20-Sep	yes-8/31	664525.6	4503674.7

FIW-1	Fire Island Wilderness	Watch Hill	9/15/2016	1	17	8/8-<5% browsed (insect)	8/31-FR/PR	15-Sep	yes-7/8	669618.7	4506035.9
FIW-2	Fire Island Wilderness	Watch Hill	9/15/2016	1	16	8/8-<5% browsed (insect)	8/31-FR/PR	15-Sep	yes-7/8	669720	4506086.3
FIW-3	Fire Island Wilderness	Watch Hill	9/15/2016	1	4.5	8/8-40% browsed		15-Sep	yes-7/8	669789.5	4506137.1
FIW-4	Fire Island Wilderness	Western Wilderness	9/15/2016	1	10.5		8/8-FL; 8/31-FL/PR	15-Sep	yes-7/8	670454	4506464.5
FIW-5	Fire Island Wilderness	Western Wilderness	9/15/2016	1	13.5	8/8-<5% browsed, 8/31-<5% browsed	8/8-FL, 8/31-FR/PR	15-Sep	yes-7/8	670454	4506464.5
FIW-6	Fire Island Wilderness	Western Wilderness	8/31/2016	1	4.5			31-Aug	yes-7/8	670532.4	4506504.4
FIW-7	Fire Island Wilderness	Western Wilderness	9/15/2016	1	5	8/8 -<5% browsed; 8/31-5% browsed	8/31-PR	15-Sep	yes-7/8	670566.1	4506521.3
FIW-8	Fire Island Wilderness	Western Wilderness	9/15/2016	1	25	8/8-<5% browsed; 8/31-90% browsed	8/8-tiny buds; 8/31-PR	15-Sep	yes-7/12	672178.6	4507376.9
FIW-9	Fire Island Wilderness	Western Wilderness	9/15/2016	1	17	8/8-<5% browsed; 8/31-<5% browsed	8/31-FR/PR	15-Sep	yes-7/12	673086.6	4507852.5
FIW-10	Fire Island Wilderness	Western Wilderness	8/8/2016	1	7			8-Aug	yes-7/13	673212.2	4507935.3
FIW-11	Fire Island Wilderness	Western Wilderness	9/15/2016	1	9		8/8-tiny buds; 8/31-FR/PR	15-Sep	yes-7/13	673296	4508000.3
FIW-12	Fire Island Wilderness	Western Wilderness	9/15/2016	1	21	9/15-8% browsed	8/8- FL; 8/31-PR; 9/15-FR/PR		yes-7/13	677198	4510179.8
FIW-14	Fire Island Wilderness	Western Wilderness	9/15/2016	1	27	8/8-5% browsed; 8/31-65% browsed (exclosure absent)	8/8-FL	15-Sep	yes-8/8	673429.7	4508031.2
FIW-13	Fire Island Wilderness	Eastern Wilderness	9/28/2016	1	6.5	8/30-<5% browsed	9/12-FR; 9/28 -FR/PR; 10/17 -FR/PR		yes-7/16	678120.1	4510351.9

Seabeach knotweed individuals

Knotweed ID (FID)	Site Name (LICWS)	Location Description	Date	Size (cm)	Cluster size	Reproductive status	X	Y
FIW-1	Fire Island Wilderness	Western Wilderness	7/12/2016	33cm	1	Flowering	671663.10061000000	4507150.71868000000
FIW-2	Fire Island Wilderness	Western Wilderness	7/12/2016	51cm	1	Flowering	671662.74765200000	4507152.34785000000
FIW-3	Fire Island Wilderness	Western Wilderness	7/12/2016	19.5cm	1	Flowering	671889.44637600000	4507216.67569000000
FIW-4	Fire Island Wilderness	Western Wilderness	8/8/2016	23.5cm	1	Flowering	672982.12690000000	4507793.11647000000
FIW-5	Fire Island Wilderness	Eastern Wilderness	8/8/2016	20 cm	1	Flowering	677868.56323000000	4510276.40368000000
FIL-1	Fire Island Lighthouse	Lighthouse Beach	7/15/2016	9.5cm	1	Flowering		
FIL-2	Fire Island Lighthouse	Lighthouse Beach	7/15/2016	25cm	1	Flowering	651469.56374400000	4499444.26627000000
FIL-3	Fire Island Lighthouse	Lighthouse Beach	8/10/2016	20cm	1	Flowering	651344.73389900000	4499395.82429000000
FIL-4	Fire Island Lighthouse	Lighthouse Beach	8/10/2016	14cm	1	Flowering	651346.50884400000	4499398.07126000000
FIL-5	Fire Island Lighthouse	Lighthouse Beach	8/10/2016	34cm	1	Flowering	651555.19852700000	4499456.63447000000
FIL-6	Fire Island Lighthouse	Lighthouse Beach	8/10/2016	13cm	1	Flowering	651346.79252400000	4499394.88616000000