

FIRE ISLAND NATIONAL SEASHORE
THREATENED & ENDANGERED SPECIES
MONITORING PROGRAM

2004 SUMMARY

Daniel Barrera, Jr.
Wildlife Biologist
Fire Island National Seashore
120 Laurel Street
Patchogue, NY 11772
(631) 687-4768

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ABSTRACT

The status for three of five area-threatened and endangered (T&E) species were observed in 2004 as part of the T&E species monitoring effort conducted on Fire Island National Seashore (FIIS), New York. Through attentive monitoring and a collaborative park effort, a total of 17 piping plover (*Charadrius melodus*) nests, 251 seabeach amaranth (*Amaranthus pumilus*) plants, and 1251 seabeach knotweed (*Polygonum glaucum*) plants were recorded along the national seashore. With a total of 35 successful piping plover fledglings, nesting productivity reached an average of 2.2 piping plover chicks fledged per nest site. Population surveys for least tern (*Sterna antillarum*), common tern (*Sterna hirundo*) and roseate tern (*Sterna dougallii*) species were unable to be conducted this year. Critical factors for the continued success of the T&E species program include persistent educational and outreach efforts directed towards park visitors, island residents, and cooperating agencies.

INTRODUCTION

Fire Island National Seashore was established as a division 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. (Figure 1). Fire Island National Seashore occupies 21 miles of barrier island that consists of 17 communities predominately on the western part of the island. The Otis G. Pike Federal Wilderness Area (OPWA) is a seven-mile stretch located on the eastern half of the national seashore and is the only federally designated wilderness area in New York State.

Sections of Fire Island National Seashore provide suitable breeding/germination habitat for a number of federal and state listed threatened and endangered species. Protected avian species observed on FIIS are the piping plover, least tern, common tern and roseate tern. Protected vegetative species include seabeach amaranth and seabeach knotweed.

Of the five species observed, the piping plover constitutes a large portion of the monitoring program effort. Listed as a federally threatened species in 1986 and state listed as endangered, FIIS has worked extensively toward the piping plover recovery effort.

In order to do so, the recovery plan objective is to ensure the long-term viability of the Atlantic Coast piping plover population in the wild, thereby allowing removal of this population from the Federal List of Endangered and Threatened Wildlife and Plants (FWS 1995). One of five recovery criteria for the piping plover will be attained when 2,000 breeding pairs can be successfully monitored and maintained for five consecutive years. Of the two thousand, 575 of those must be located within the states of New York and New Jersey. In 2004, 367 breeding pairs were recorded throughout NY and NJ.

Other important delisting criteria for the piping plover shorebird 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 listing of the piping plover, the least tern was listed federally endangered in 1985 and is also a state listed threatened species in New York. The roseate tern was listed in 1987 as endangered both federally and state wide. According to the US Fish and Wildlife Service (USFWS), once the northeast nesting populations of roseate terns reach 5000 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 and seabeach knotweed. Seabeach amaranth was believed to have been extirpated from New York for over three decades, until the early 1990's, when populations began to exist on Long Island. Listed as federally threatened in 1993, seabeach amaranth has since been on its way to recovery. Seabeach knotweed is on the New York State vegetation species of concern list and is also monitored throughout the island.

OBJECTIVE

It is the objective of FIIS to follow the management goals set forth in the Endangered Species Habitat Management Plan (1998), Endangered Species Act (1973), and the US Fish & Wildlife Piping Plover 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 2004 T&E species program and discuss areas of improvement for upcoming field seasons.

PROTECTION PROTOCOL METHODS

In accordance with USFWS guidelines, pre-season habitat fencing (symbolic fencing) is erected for the purpose of protecting potential vegetative species habitat and avian species nesting habitat. In 2004, symbolic fencing was constructed, prior to the piping plover arrival in March. Areas to be fenced were determined through the compilation of nest/plant data collected from previous years and through visual assessments. All symbolic fencing on FIIS was constructed using 5.5ft CarsoniteTM fiberglass posts. The posts light weight offers an efficient alternative to steel posts used in previous years.

Posts are placed approximately 30ft apart and are connected using twine; strips of fluorescent flagging are secured along the fencing to visibly identify symbolic fencing. For every fourth post, an informative 'restricted area: plover habitat' sign is posted, notifying the public of the reason for symbolic fencing; these informative signs were provided by the USFWS. Larger interpretive signs were situated at public access entrances to inform beachgoers about the piping plover.

Throughout sections of FIIS, restrictions and/or beach vehicle closures are implemented regarding vehicular access and pets. While some beaches on Fire Island are open to driving, OPWA is closed to vehicular traffic from March through September due to the piping plover breeding season. As of 2004, OPWA driving was made accessible to law enforcement vehicles as a result of homeland security protection issues. Driving for Suffolk County Police Department (SCPD) and NPS-Visitor & Resource Protection (V&RP) rangers was made possible from March 1st until the season's first piping plover nest hatched in June 2004. Driving was prohibited thereafter with the exception of emergency response vehicles.

Off-road vehicle (ORV) driving in front of Sailors Haven beach is closed year round between the Oakleyville access road and east, towards the vehicle access road situated in the middle of Sailors Haven. Year-round driving is prohibited from this mid access route east towards the eastern most vehicle access route found at Sailors Haven, near Cherry Grove. Closures to ORV areas occur due to the documented negative effects they have on the nesting success of breeding shorebirds, as well negative impacts on the germination of threatened/endangered plants. As with driving, dogs have also proven harmful to the success of threatened and endangered shorebirds and are thereby ordered to be restrained on a leash which shall not exceed six feet in length (36 CFR2.15) on the beaches of a national seashore, unless stated otherwise in the Superintendents Compendium. Pets are entirely prohibited from areas of beach with piping plover chicks present.

With the onset of the nesting season, added preventative measures are implemented for the protection of the piping plovers. In order to protect piping plovers from avian and terrestrial predators, predator exclosures are erected and placed around the piping plover nest site. These exclosures are ten feet in diameter and are constructed using 2X4 inch galvanized welded mesh fencing. The fence is then buried approximately 8 to 10 inches deep and supported by 4 CarsoniteTM posts which are buried and attached to the fencing. In order to deter avian predators, a ¾ inch nylon mesh is placed over the top of the exclosure and tied down using multi-purpose zip-ties.

All Resource Management field staff members were required to attend a 1-day T&E species stewardship training session offered by the New York State-Department of Environmental Conservation (NYS-DEC) and the USFWS-Long Island Field Office.

SHOREBIRD POPULATION MONITORING

Piping plover migration to FIIS occurs between late February and March, while both the least tern and roseate tern species arrive later in the season in late April and early May. By mid-April, monitoring was conducted at least five times a week by foot throughout the OPWA location. Possible piping plover activity along Sailors Haven beach and the Lighthouse beach were also closely monitored. All-terrain vehicles (ATV) were utilized as a means of transportation to these areas.

Daily monitoring surveys and biological data were conducted and collected by qualified field biologists walking parallel to symbolic fencing. Before nesting occurred, observations of individuals or pairs of piping plovers were recorded. Information recorded included: time/date, weather conditions, number of birds, displayed behaviors, and geographic coordinates using a handheld Global Positioning System (GPS) unit. This continued until the end of April when the nesting season began with the first nest (1A-04) being observed on May 5, 2004 at the Lighthouse beach (Map 1). Breeding pairs of plovers were identified using binoculars and observed for specific courtship and nesting behaviors. These behaviors include (but not limited to): aerial displays, scraping, broken-wing display, vocalization and territoriality. The tern species on FIIS were unable to be monitored in 2004 as a result of staff turnover.

SHOREBIRD 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 later occurs for re-nests; recent nests considered lost as a result of possible predation or abandonment. 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 each side. In areas that were heavily populated by beachgoers, the buffer zone was enlarged in order to decrease the amount of human disturbance towards the nest and allow for greater habitat area and protection.

Upon a nest discovery, an alphanumeric system was used to identify each nest. A two-digit nest number and year were assigned chronologically, using an “A” for first nesting attempt, “B” for second, and so on (eg.1A-04). Universal Transverse Mercator (UTM) North American Datum (NAD) 83 coordinates were recorded for each nest site using a GarminTM Global Positioning System (GPS) hand-held unit; extracted and converted onto an ArcGISTM (Geographic Information System) aerial image of Fire Island for monitoring and data management purposes.

Increased monitoring efforts towards piping plovers commenced with the onset of incubation in early May. Field biologists lead intensive daily monitoring observations for the purpose of immediately identifying and exclosing a full-clutch nest site. This effort helped ensure minimal disturbance towards breeding pairs.

An average hatch date of 28 days would be determined utilizing a 'hatch and fledge date' chart produced and distributed during stewardship training. Each day, a nest would be carefully observed from a distance no less than 50 meters. Daily nest site observation information was recorded on individual data sheets for each nest then transferred to an Excel spreadsheet template.

SHOREBIRD BROOD MONITORING

Brood monitoring was initiated after the first piping plover egg had hatched. Broods were monitored daily. Cautious attention was given to all plover chicks, since piping plover chicks are unable to fly and most vulnerable to predation throughout their first few weeks. Data collected for each brood consisted of: number of adults and chicks observed, location specification, and behavior observed. In areas of coexisting nest sites, careful efforts were made to properly distinguish amongst broods; age of chicks was the primary factor in differentiating broods. During instances of missing chicks, field biologists would closely scan the vicinity of the nest site for those unaccounted for, for a period of five days in accordance with USFWS guidelines. In accordance with USFWS recovery plan guidelines (1996), a plover chick was considered fledged at 25 days or when a sustained flight of 15 meters was observed. In instances where a nest was situated near a vehicle beach access route, a maximum fledge date of 35 days was implemented to ensure the safety of the species.

Monitoring for piping plover chicks throughout the vehicle-free, 7 mile stretch of the OPWA became an extremely strenuous and daunting task for the field staff. In order to effectively and efficiently overcome this hurdle, collaborative efforts between FIIS law enforcement officers and field staff were initiated. Through the use of a 3-passenger ATV, FIIS-V&RP rangers would provide transportation along OPWA for field biologists. Upon encountering a nesting area, the biologist would walk in front of the ATV and escort through the area, while a V&RP ranger monitored for plover activity and the other operated the vehicle.

VEGETATION POPULATION MONITORING

Seabeach amaranth and seabeach knotweed began to germinate on FIIS during late June to early July. Generally, these species tend to grow in large clusters, but isolated plants have been observed as well. Not all plants were protected behind symbolic fencing, although areas which possessed densely populated vegetation were protected with a buffer zone of 25 meters. Field biologists conducted vegetation monitoring sweep counts throughout sections of FIIS, either on foot or through the use of an ATV, traveling parallel to the toe of the dune. A TrimbleTM GeoExplorer3 was used to collect data points for the location of specified vegetative species. This data was then transferred to a computer, differentially-corrected, and displayed on an ArcGISTM aerial image of Fire Island. Sweep counts for seabeach amaranth and seabeach knotweed continued throughout August and early September.

A limited number of vegetative species were counted along the eastern-end of Fire Island as a result of sand deposition from a Nor'easter weather event in early September 2004. These efforts continued until surveying ceased in mid-September.

MONITORING RESULTS

A total of 18 piping plover nests, one being a re-nest, were observed and documented throughout FIIS. Earliest piping plover activity on FIIS was observed along OPWA on March 22, 2004. Of the 17 exclosed nest sites, 12 were situated throughout OPWA (Map 4, 5, 6, 7), 3 were located along Sailors Haven Beach (Map 2, Map 3), 1 was located at the Lighthouse beach, and another brood between the 'Fire Island Pines' community and Talisman Beach.

The first nesting pair of the season (1A-04) was observed at the Lighthouse beach on April 27, 2004. This nest was at a full clutch size of 4 eggs by May 5th and hatched on June 3, 2004; this continued until July 9, 2004 when the last nest hatched (nest 16A-04). Since nest 1A-04 was situated near a vehicle access route a 1000 meter buffer area on each side of the nest was established and fenced for protective habitat once eggs hatched; in accordance with USFWS recovery effort guidelines (USFWS, 1994). This access route, located west of the community of Kismet, was immediately closed to vehicular traffic. Driving through the dune crossing resumed 35 days later when the chicks successfully fledged. Nest 17A-04 hatched in front of the community of Fire Island Pines and was monitored by *Land Use Ecological Services, Inc.* as part of a beach nourishment agreement. After being notified by *Land Use Ecological Services, Inc.*; one nesting adult along with one chick were observed in front of Talisman Beach on July 25, 2004. The two were observed for another week and a half before finally being absent from August 5, 2004 on.

FIIS saw a total of 69 piping plover eggs, 57 of which hatched (Table 1); 12 did not hatch. Out of 17 total nests, 15 nests successfully fledged chicks. Of the 57 initial chicks, 37 chicks survived to fledge at the end of the summer season with an overall piping plover chick productivity of 2.2 chicks fledged per nest site (Table 1). While the number of nests decreased from 2003, the number of nests found in 2004 along with the productivity recorded, surpassed those of previous years (Table 2). Piping plover monitoring continued until August 12, 2004 when the final chick fledged.

Seabeach amaranth began emerging on FIIS in late July. Surveying started on August 13 and continued until September 16, 2004 within five locations: OPWA, Watch Hill to Cherry Grove, Sailors Haven, Point O'Woods to Kismet, and the Lighthouse track (Map 8-13). The numbers of amaranth plants throughout these five locations were 64, 104, 16, 37, and 30 respectively. The total amaranth population for the length of FIIS was 251. The abundance of amaranth plants for the 2004 season was lower than that of the 2003 season, which had a total number of 803 plants.

Seabeach knotweed began to bloom in late July with surveying also being conducted from August 13 until September 16; occurrence of knotweed was surveyed within the same boundaries as the amaranth. The total number of knotweed plants for the length of FIIS was 1251. The exact number of plants that reached germination is unknown due to several occurrences of large clusters making it difficult to assess exact counts. Ultimately, this year proved to be successful for seabeach knotweed, in comparison to 2003 which produced 1077 plants.

DISCUSSION

The 2004 T&E species monitoring program was unlike any year prior due to a variety of circumstances. Pre-season preparations began in early March, with monitoring beginning soon after. Several details in effectively executing procedures were overlooked, mostly due to new personnel on-board between the months of February and June. No colonial waterbird data were recorded this year.

Pre-season ORV closures in OPWA occurred in early March for the purpose of migrating plovers safely establishing their breeding habitat. Due to issues dealing with homeland security, Suffolk County Marine Bureau was allowed to drive in the OPWA until early May, after the first nest hatched.

Daily monitoring began in early April, and continued until August when the last chicks had fledged. In order to better monitor chick activity, awareness towards potential premature hatchlings should be initiated one week before a nest's estimated hatch date. In a few instances this summer, a nest hatched prior to its estimated hatch date. As a result, it became extremely difficult to accurately account for all chicks. By utilizing the effort of 4 SCA interns, 2 biological technicians and 2 biologists; FIIS witnessed its highest piping plover productivity for the total amount of nests recorded.

Sailors Haven and Lighthouse Beach has always maintained suitable breeding habitat for the piping plover, however, only one nest had been located prior to the 2003 season. This was believed to have occurred because of the abundance of recreational activities. Because of this, these areas required special attention. In 2004 two nests were found at Sailors Haven, one of which was located near the Oakleyville dune crossing where driving was permitted (Map 2). In order to protect these birds, additional symbolic fencing was assembled and ORV closures were put into effect. Furthermore, intensive monitoring of the nests began once the chicks had hatched.

At Lighthouse Beach one nest successfully hatched and soon after made their way east towards the nearby dune crossing, just west of the town of Kismet (Map 1). The dune crossing was immediately closed, in compliance with USFWS recovery guidelines, and symbolic fencing was extended accordingly on both sides of the nest.

Human (*Homo sapiens*) and domestic dog (*Canis lupus familiar*) activities were the most documented form of nest disturbances. The highest productivity and success rates occurred in areas where little or no human or dog activity was present. This area located approximately 1km east of Bellport Beach contained 28 hatchlings and 19 successful fledglings.

Predators and tracks that were witnessed by field biologist included: great black-back gulls (*Larus marinus*), herring gulls (*Larus argentatus*), crows (*Corvus spp.*), red fox (*Vulpes vulpes*), white-tailed deer (*Odocoileus virginianus*), and ghost crabs (*Ocypode Quadrata*). Avian predators were often seen disrupting piping plover broods. In particular, crows were recorded harassing nest 9A-04 in Sailors Haven (Map 2).

There were numerous accounts of large groups of gulls perched along the berm of the beach, flushing the parents from their nests. Of possible terrestrial predators, red fox and white-tailed deer not visually observed, however, red-fox tracks were recorded inside the symbolic fencing and at times circling the exclosures. Potential disturbance caused by ghost crabs will be strongly incorporated towards future monitoring efforts.

There were no observations of roseate terns recorded for the 2004 season. With regards to least terns, several adult terns were observed in July in the area east of Bellport Beach, along OPWA beach. No GPS or specific nesting data was recorded.

As previously mentioned, the number of recorded seabeach amaranth plants dropped dramatically compared to the previous year. Monitoring efforts for 2005 must be carefully conducted to ensure a stable population trend. As a result of the conservative population of plants over the years, there was little or no structured protocol for protecting vegetation. Additional symbolic fencing was constructed and found practical to support the extensive amount of plants. Symbolic fencing was found effective against vehicle and human damage, however, it did not deter predation by white-tailed deer and/or herbivorous insects. White-tailed deer were observed grazing on the amaranth on more than one occasion. In addition to predators, natural weather elements buried and/or removed some of each plant species, specifically throughout OPWA.

RECOMMENDATIONS

Pre-season activities are the primary concern and the most critical time period for the program. Establishing an efficient and organized pre-season protocol sets the foundation for the upcoming year. The most important of these protocols is the construction of pre-season fencing. The essential purpose of symbolic fencing is to preserve suitable habitat, as well as provide safe breeding/germination grounds for all threatened and endangered species. Given that beach closures occur during March, it is suggested that pre-season fencing be erected prior to this date. However, if circumstances such as inclement weather and lack of habitat do not facilitate fencing, materials should be stowed in designated areas throughout the OPWA. These materials should consist of posts, string, flagging, and all public awareness signs. Fencing material should also be stored for any adjustments that need to be made throughout the season.

It is anticipated that the abundance for the 2005 season will continue to increase and additional fencing will be essential. In conjunction with the extra fencing, increased monitoring will also be required. Incorporating volunteer assistance and increased inter-division cooperation should suffice in preparing for a possible increase in T&E species. Having three interns housed at Watch Hill and another at the Lighthouse Dormitory in 2004 proved to be extremely effective in completing daily monitoring activities. It would be most beneficial to continue this housing arrangement for future field seasons if possible. Increased efforts will be made to better monitor colonial waterbird activity throughout the boundaries of the park.

At two locations during the 2004 field season, vehicle dune crossing routes had to be closed due to the close proximity of piping plover young as mentioned in the USFWS recovery effort guidelines for managing recreational activities in piping plover breeding habitat. While the closings did not exceed 1 month, the lack of preparation and prior notification to essential service agencies and residents complicated daily activities and caused confusion. In the best interest of the overall success of the program, all groups possibly affected by a vehicle dune crossing must be made aware of the potential for upcoming road closures if a piping plover nest is discovered within the vicinity. Protocols must be created and alternate routes must be planned utilizing input from those groups affected by such closures.

The program found that it was not viable to individually record every plant this year because of the unexpected number of plants. It is highly recommended that if the combination of both plant species exceeds 500 that a procedure known as sweep counting be put into practice. Boundaries should be distinguished, approximately 50' by 50'; in which each plant species can be tallied. It should then be within these margins that UTM coordinates are recorded

Visitor & Resource Protection Rangers play a crucial role in educating landowners, user groups, 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 understandable that V&RP Ranger attendance may be minimal. 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 quads, and/or ATV's, 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 of special concern. All driving regulations would need to follow USFWS guidelines for essential vehicles as well as NPS-FIIS driving regulations.

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 on off-road vehicles, and/or recreational activities. Nevertheless, they are highly effective and extremely rewarding.

ACKNOWLEDGEMENTS

The 2004 Threatened and Endangered Species Program personnel consisted of The Chief of Resource Management: Michael Bilecki, Park Biologist: Marie Lawrence, Park Biologist Technician: Tim Troccoli, Wildlife Biologist Technician: Richard Wahlfeld, and Student Conservation Interns: Erica Mahlmberg, Melissa Henneman, Brendan Van Mater and Kara Goodwin. Without the daily commitment and dedication of our student conservation interns, this program may not have been as successful.

We extend our sincere gratitude to all FIIS staff. To the Maintenance Division for their assistance and input in utilizing park equipment, to the Interpretation Division for helping fulfill the mission of the National Park Service by informing the residents and visitors of FIIS and our overall duty in protecting T&E species, to the Visitor and Resource Protection Division in helping enforce those policies implemented to ensure the well being of the species as well as the protection of our field staff, and to the Administrative Division for your constant support in sharing our purpose and goals with other cooperating agencies.

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Figure 1. Fire Island National Seashore, LI, NY

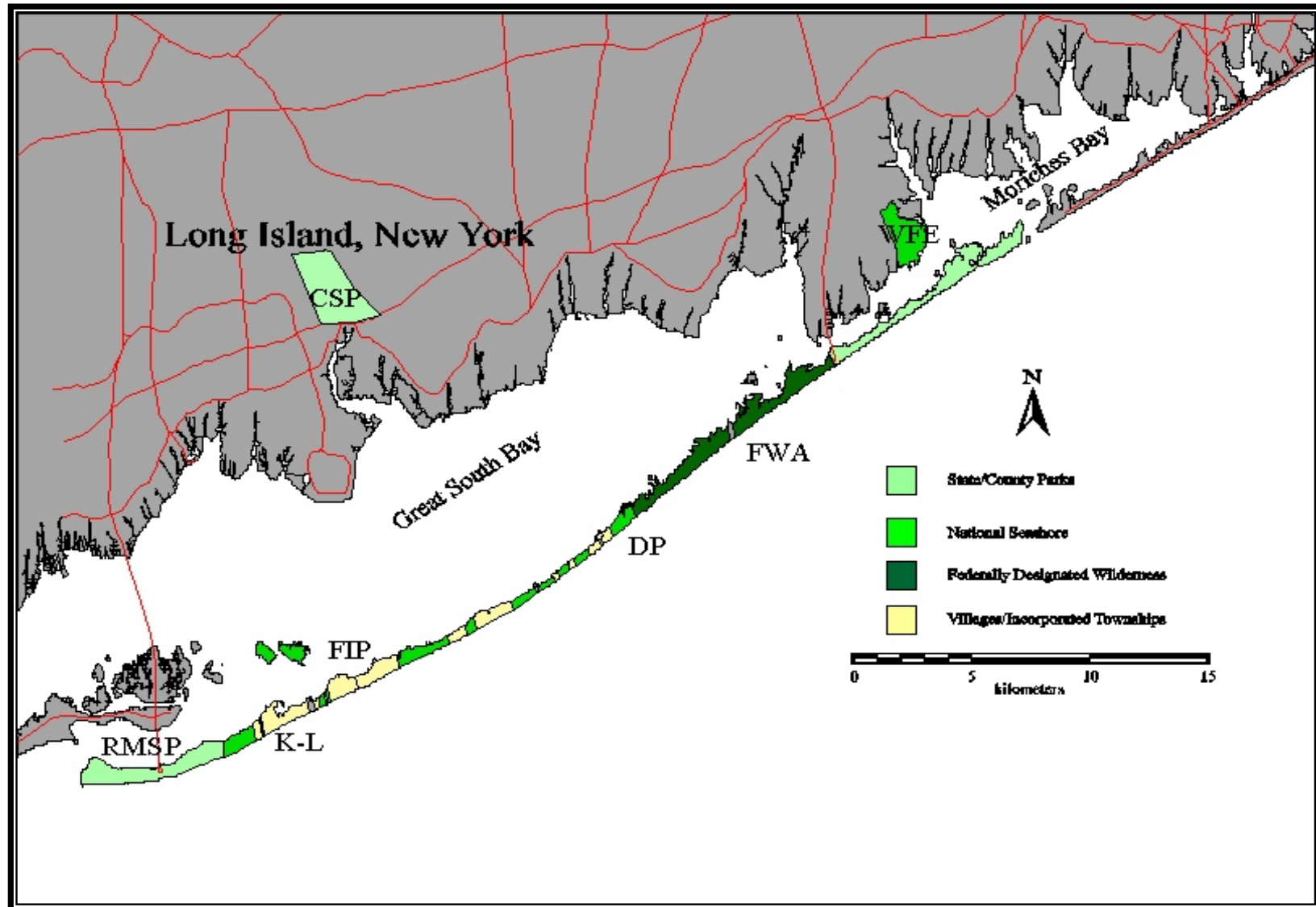
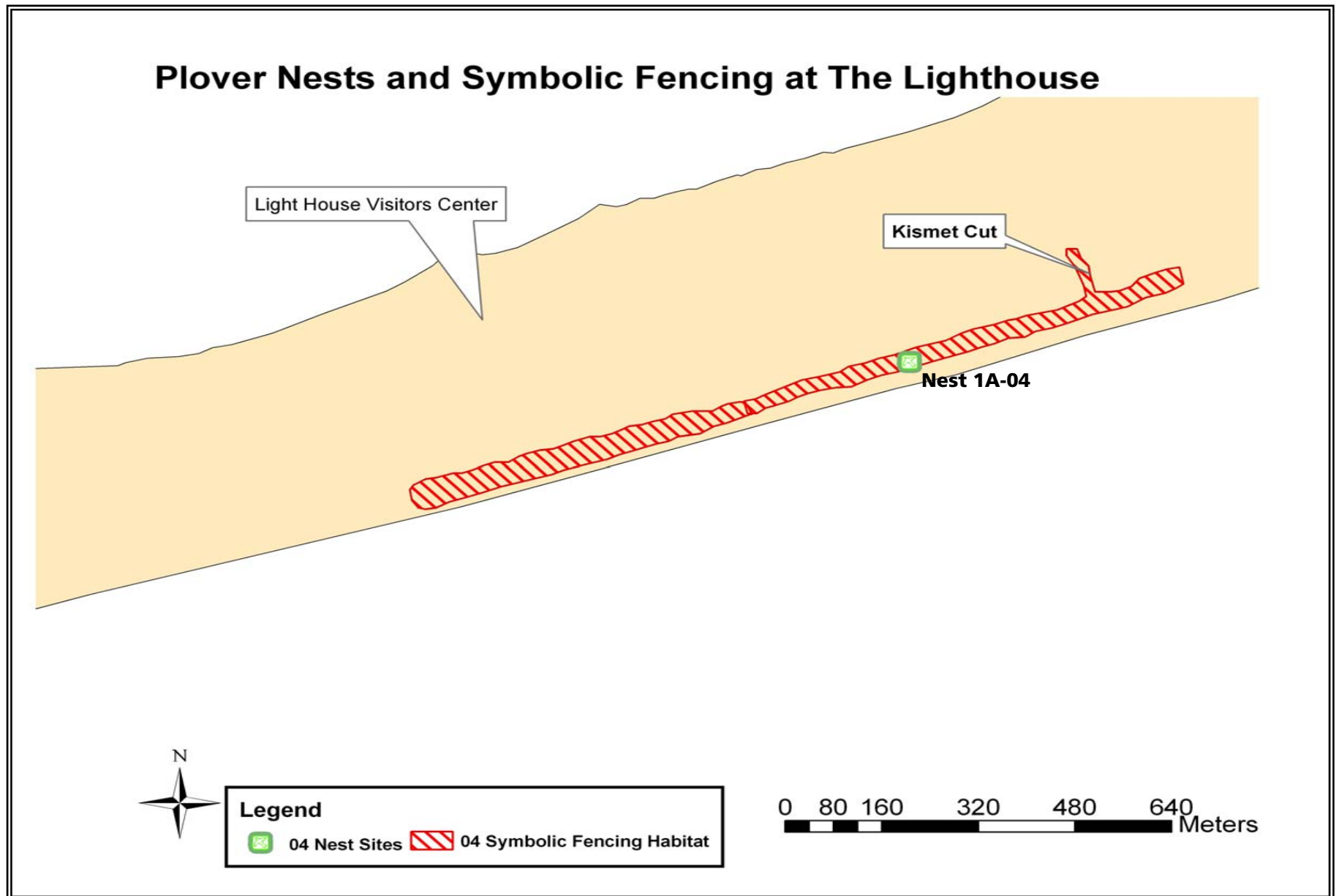


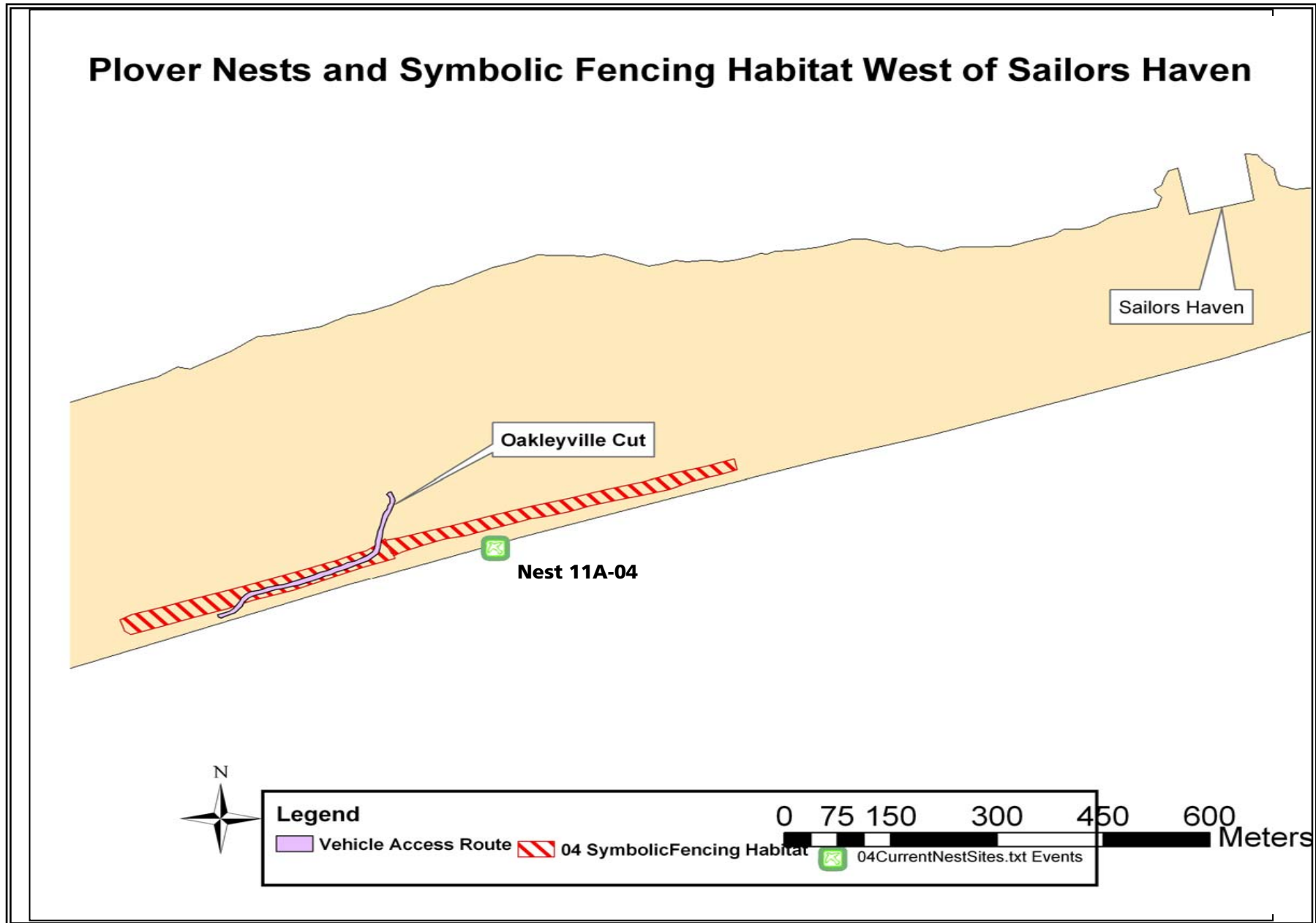
Table 1: FIIS 2004 Overall PiPl nest productivity

Nest#	Location	# Eggs Layed	# Eggs Hatched	# Chicks Fledged
1A	Lighthouse Beach	4	4	1
2A	Sailors Haven Beach	4	4	3
3A	OPWA	4	4	2
4A	OPWA	3	0	0
5A	OPWA	4	4	3
6A	OPWA	4	4	4
7A	OPWA	4	4	4
8A	OPWA	4	0	0
8B	OPWA	4	4	2
9A	OPWA	4	4	4
10A	Sailors Haven Beach	4	3	2
11A	Sailors Haven Beach	4	3	1
12A	OPWA	4	3	1
13A	OPWA	4	4	3
14A	OPWA	4	4	3
15A	OPWA	4	3	3
16A	OPWA	4	3	1
17A	Fire Island Pines	2	2	0
		Eggs Layed	Eggs Hatched	Chicks Fledged
Totals:		69	57	37
Productivity (chicks fledged per pair)		2.2		

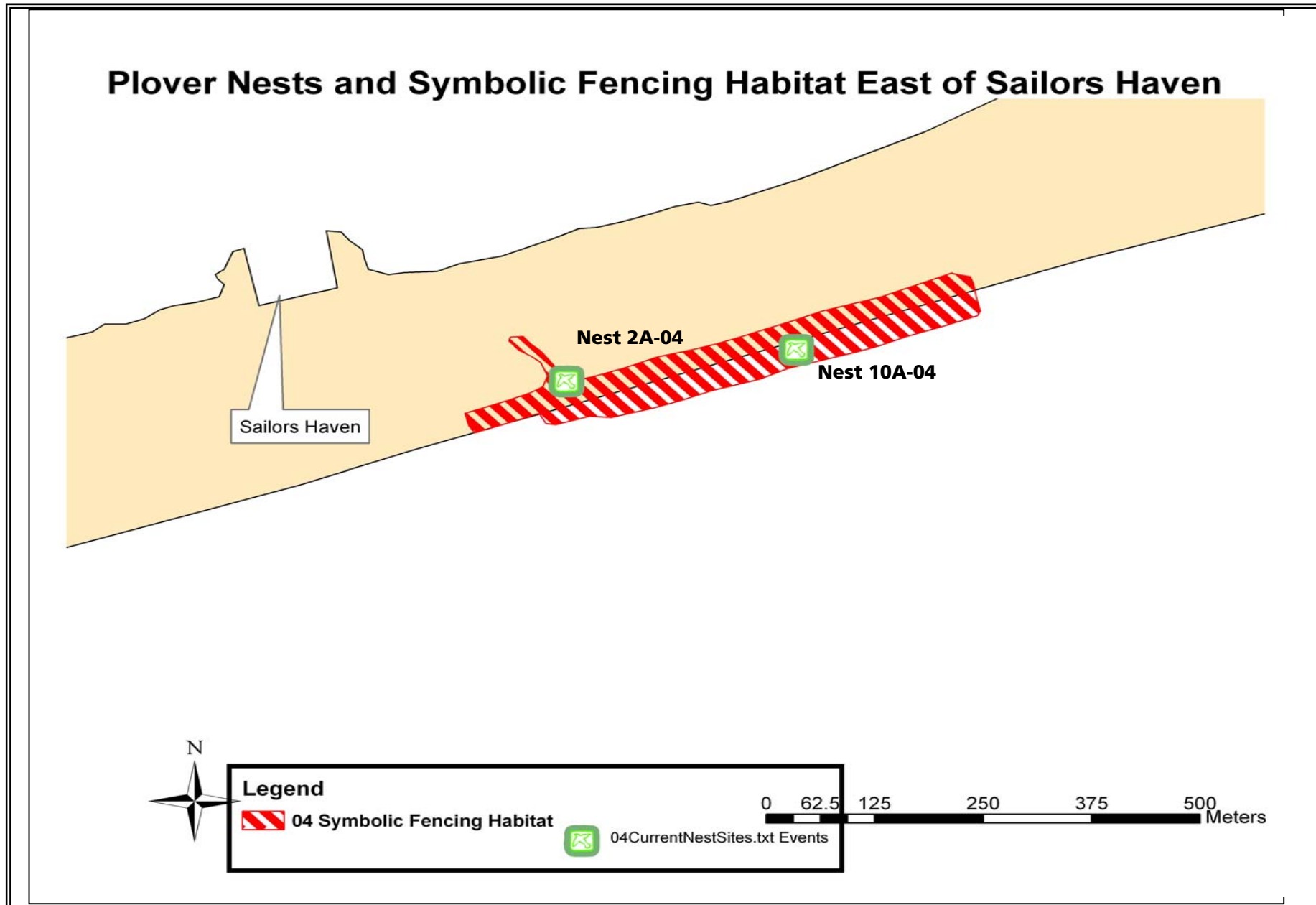
Map 1:



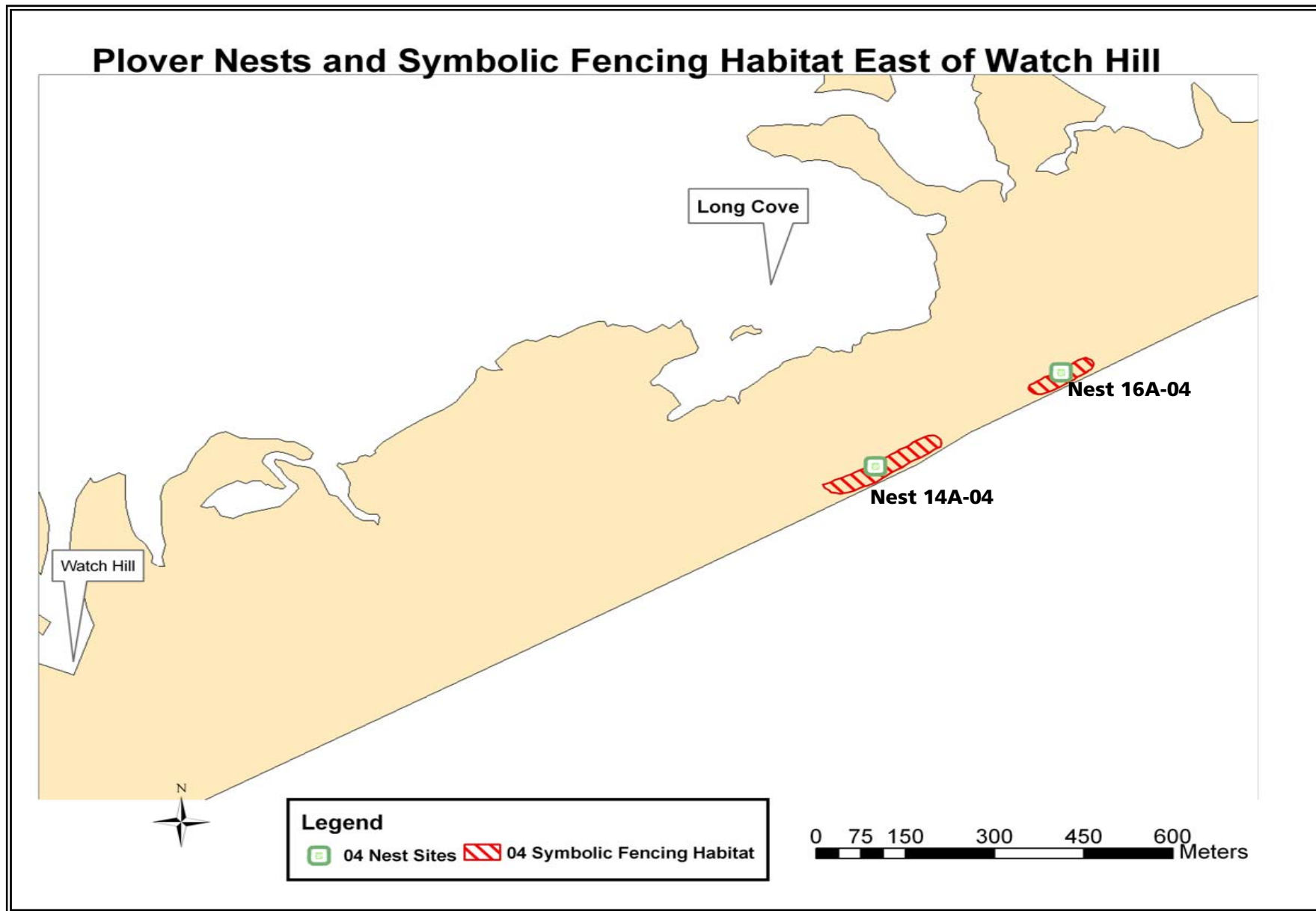
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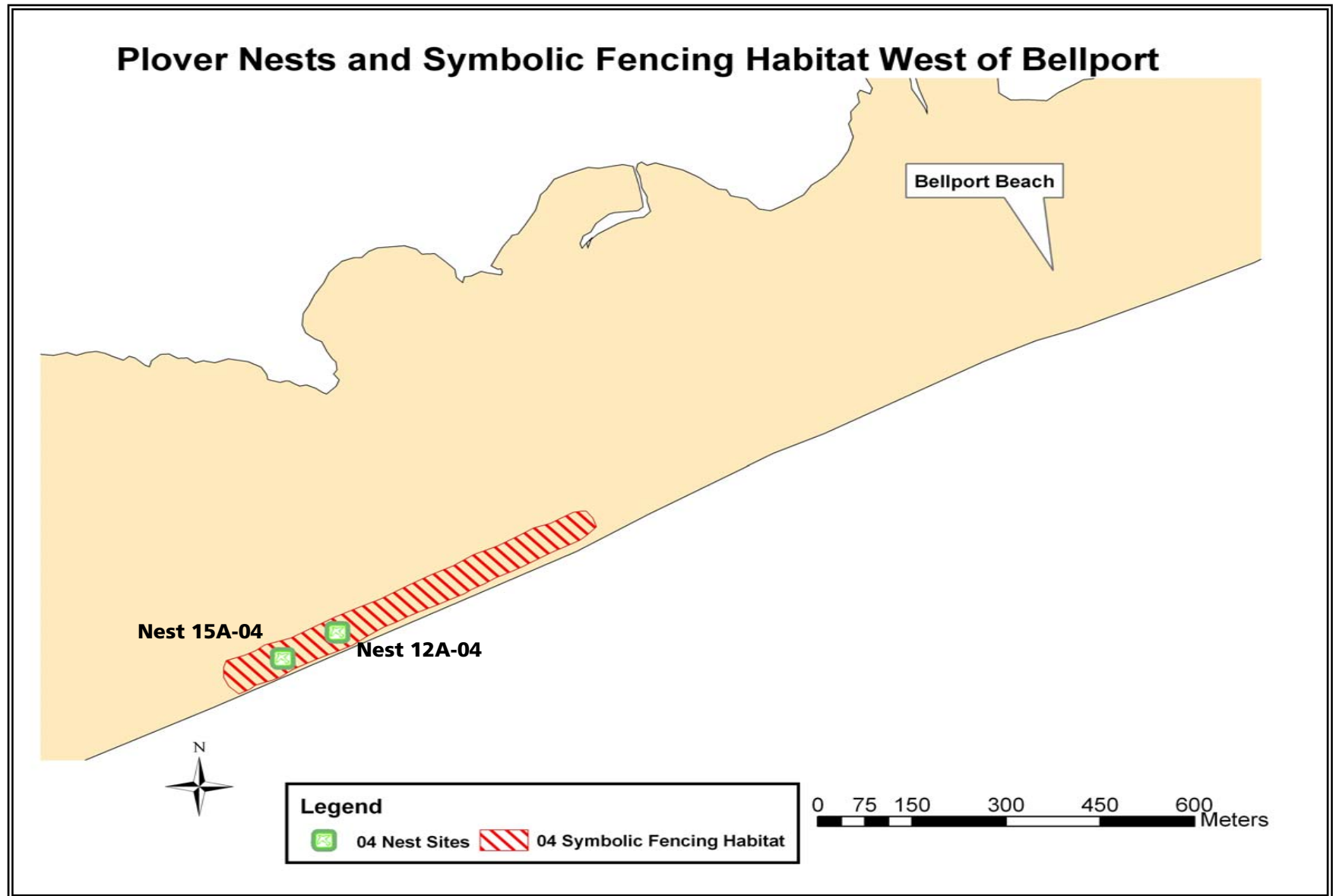
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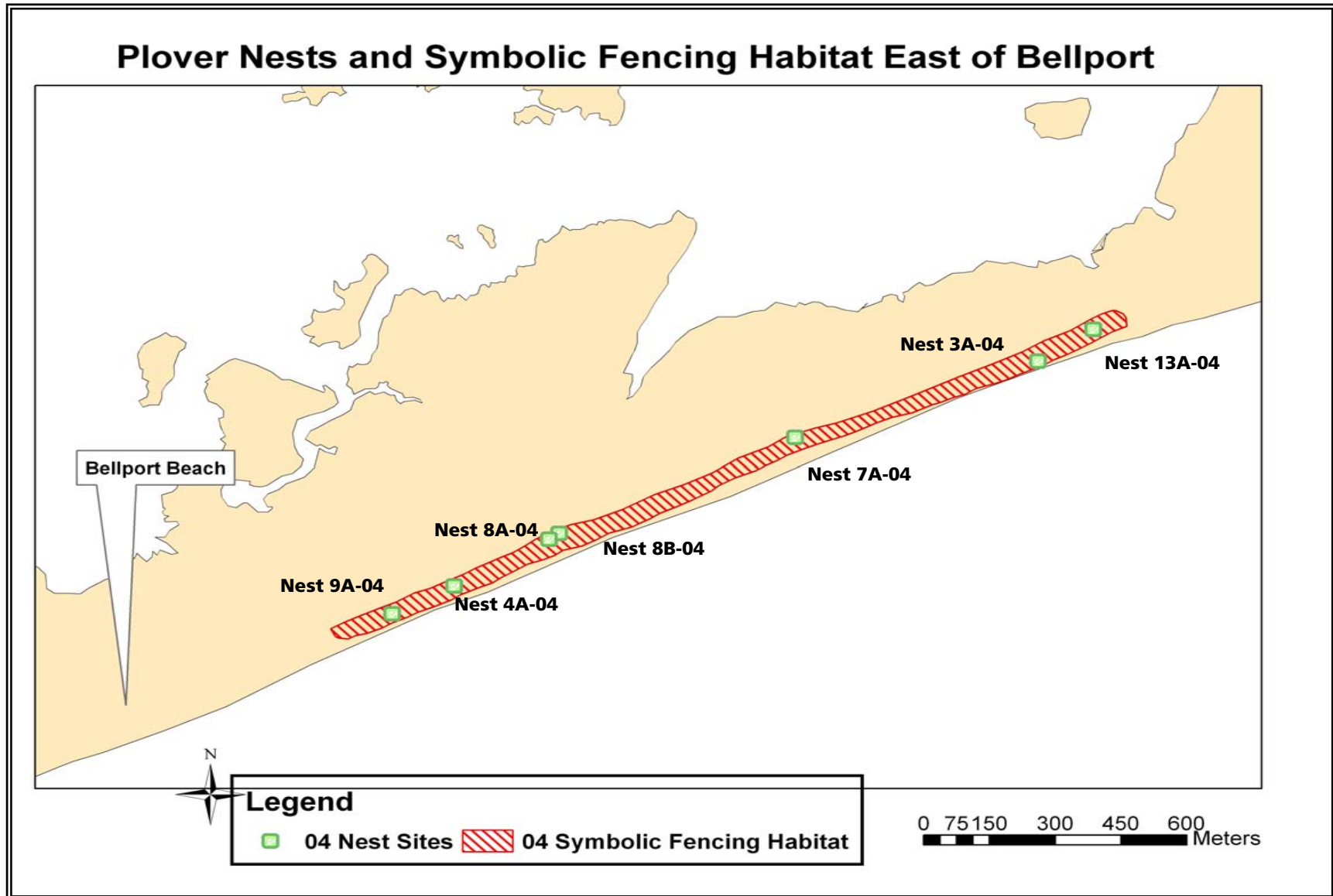
Map 4:



Map 5:



Map 6:



Map 7:

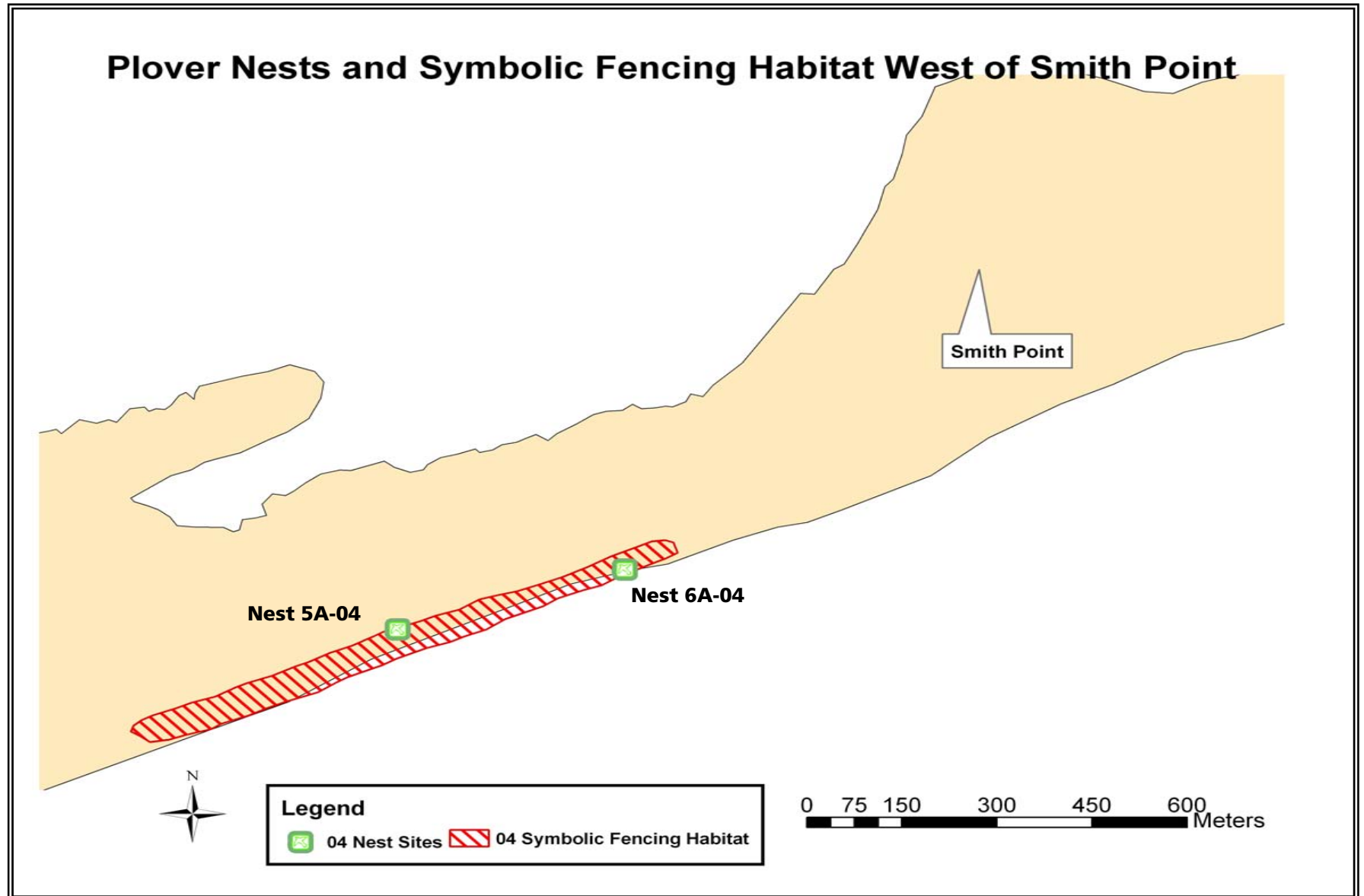


Table 2. Historic Success of Piping Plover Breeding Activity on Fire Island National Seashore, NY, 1993-2004

<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	0.0
1994	3	4	0	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	0.0
1998	1	1	1	N/A	N/A	1	1	1.0
1999	3	2	2	N/A	N/A	5	2.5	1.7
2000	3	3	3	N/A	N/A	9	3	3.0
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
Average	6.7	6.3	4.3	N/A	N/A	10.8	1.5	1.3
¹ Data from previous nesting seasons are incomplete								

Map 8:

2004 Ameranth and Knotweed Survey Robert Moses/FIIS Border to Kismet Dune Crossing



0 110 220 440 660 880 Meters

Legend

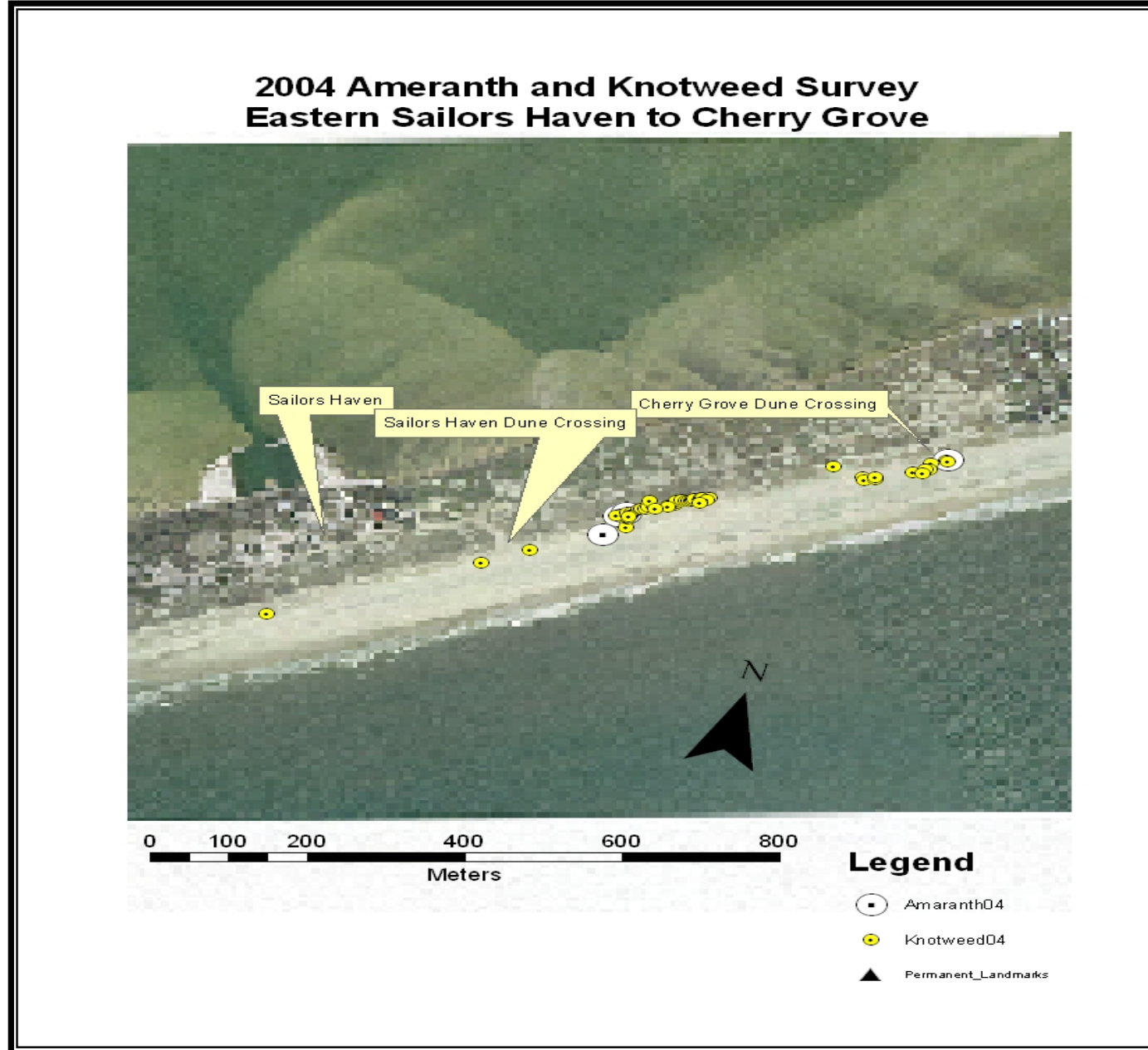
- ◻ Amaranth04
- Knotweed04
- ▲ Permanent_Landmarks

Map 9:

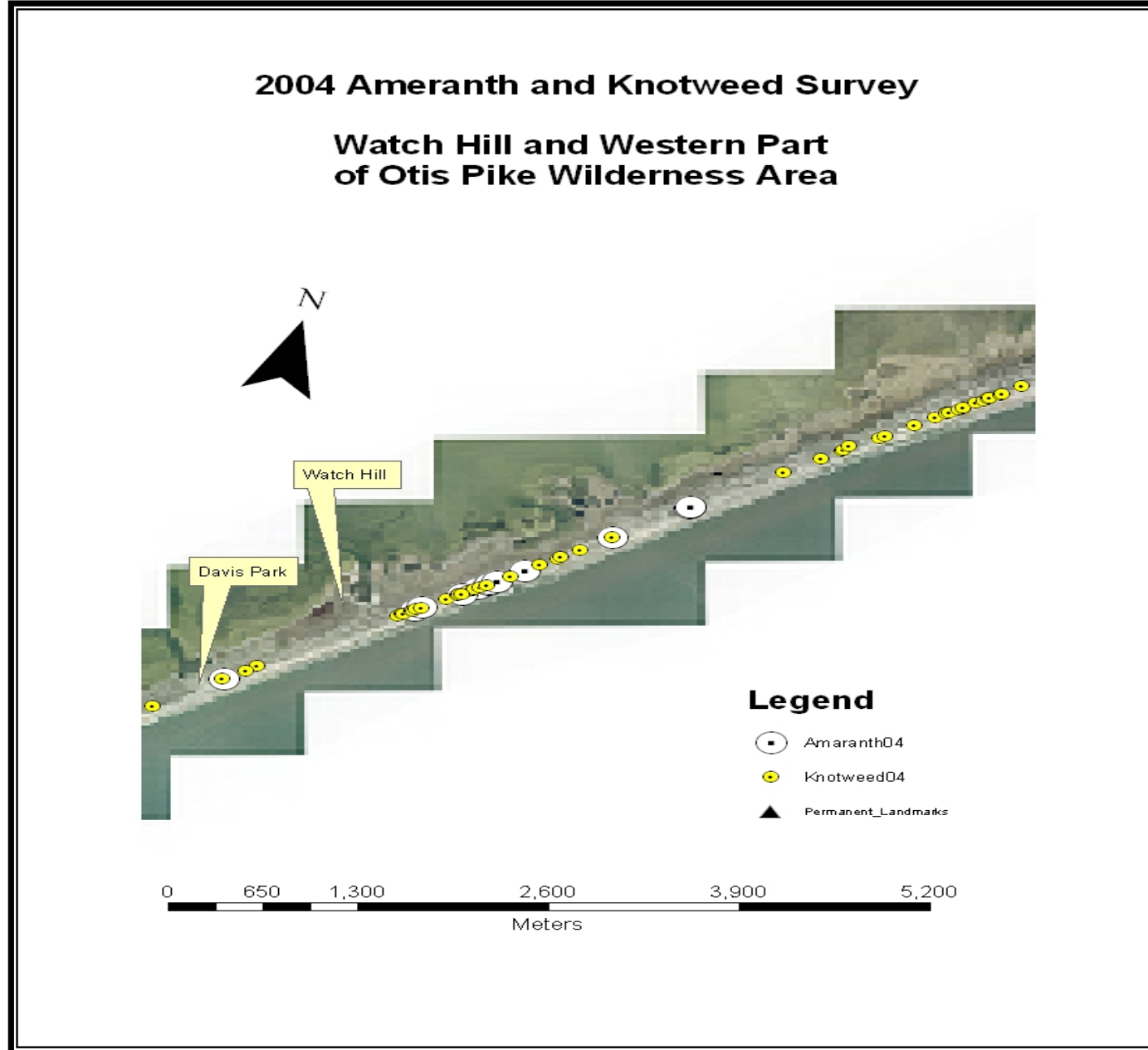
2004 Ameranth and Knotweed Survey Oakleyville Dune Crossing and Western Sailors Haven



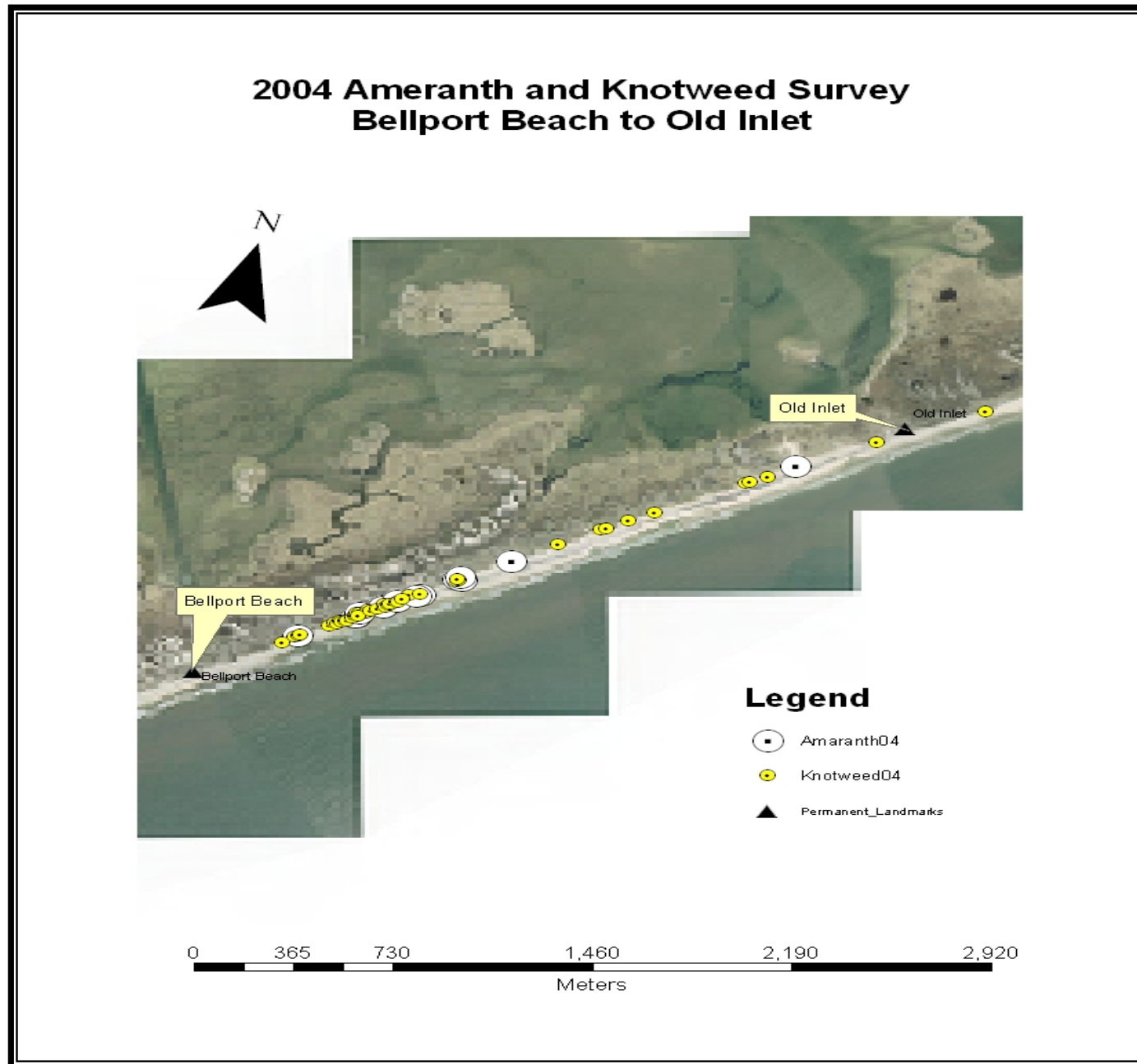
Map 10:



Map 11:



Map 12:



Map 13:

