Monitoring and Management of Piping Plovers and Colonial Waterbirds at Cape Cod National Seashore

2006

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Abstract. This report summarizes the 2006 shorebird nesting season for Cape Cod National Seashore. Piping plover (*Charadrius melodus*) nesting and brood-rearing were monitored at 18 beaches in Cape Cod National Seashore from Provincetown to Orleans. Observations of piping plovers began mid-March. Egg laying began in the fourth week of April in both the South and the North District. Peak nesting occurred during the first week of June. There were a total of 74 nesting pairs, 33 in the South District and 41in the North. Hatching success was 69%. Fledging success was 52%. A total of 122 chicks fledged. Productivity was 1.65 chicks fledged/pair. Of 96 nests initiated, 26 (27%) failed to hatch at least 1 chick. The causes of nest loss included predation 12 (46%), sanding over 5(18%), overwash 3 (12%), nest abandonment 3 (12%), and unknown reasons 3 (12%). Of 78 exclosed nests, 69 (88%) successfully hatched young. Of the 9 exclosed nests that did not hatch, 4 (44%) failed from being sanded over, 3 (33%) due to overwash, 1 (11.5%) abandoned for unknown reasons and 1(11.5%) to coyote *(Canis latrans)* predation with an adult mortality. Of 18 unexclosed nests, 1 (6%) successfully hatched young. Of the 17 failed unexclosed nests, 10 (59%) were lost to predators, 3 (17%) for unknown reasons, 2 (12%) were abandoned, and 2 (12%) were sanded over. This was the tenth year the 1998 Negotiated Rule (Federal Register 1998) for ORV management was in effect. Thirty-three pairs of plovers nested within the ORV corridor. Fourteen pairs nested within the 2.2 mile section of Race Point North, and six pairs nested on Race Point South, north of Exit 8. Five pairs nested in the 4.9-mile section of Race Point South Beach between Exit 8 and High Head, and eight pairs nested between Head of the Meadow and High Head. Race Point South Beach was closed to some extent for approximately 85 days. Race Point North Beach was closed to ORVs, to some extent, for a total of 98 days. The entire ORV corridor was closed to vehicle access for 14 days. By 24 August all ORV corridors that could legally be opened under the negotiated rule were opened.

INTRODUCTION

Cape Cod National Seashore was authorized by Congress in 1961 as a unit of the National Park Service. The Park preserves approximately 44,600 acres of uplands, wetlands and tide lands located on outer Cape Cod. As reflected in the Seashore's enabling legislation (Public Law 87-126), this unit of the

National Park System was established, in part, to protect the area's outstanding natural resources including Federal and State listed sensitive animals.

The Seashore provides miles of prime feeding, nesting and roosting habitat for beach-nesting birds, including the piping plover. This species was federally listed in 1986 as threatened (Fed. Reg. 1989). At that time, there were 139 pairs estimated to be nesting in the Commonwealth of Massachusetts. In 1985, the Seashore began a piping plover monitoring and protection program and 18 pairs nested on beaches managed by the Seashore. Productivity (number of chicks fledged per pair) in 1985 was less than 1 chick fledged per pair (Figure 1). Over the next several years, numbers of plovers nesting in the Seashore decreased while numbers of plovers nesting in the state remained relatively stable. Eventually, numbers of nesting plovers rose significantly, both at the Seashore and throughout Massachusetts. Productivity at the Seashore rose from 0.3 in 1986 to a high of 2.6 fledged chicks per pair in 1991. This report summarizes the results of the 2006 shorebird monitoring and management program at Cape Cod National Seashore.

STUDY AREA

Piping plovers were monitored on 18 beaches in the Seashore from Provincetown to Eastham encompassing approximately 70 km (30 mi.) of beach. These study beaches are divided between two districts. The North District includes all NPS beaches located in Provincetown and Truro (Wood End - Long Point, Race Point Beach North, Race Point Beach South, High Head, and Ballston). The South District includes all NPS beaches located in Eastham and Wellfleet (Great Island, Jeremy Point, Duck Harbor, Bound Brook, Newcomb Hollow, New Island, Cahoon Hollow, White Crest, LeCount Hollow, Marconi Beach, Marconi Station, Nauset Light, and Coast Guard Beach). Maps of North District and South District piping plover nest sites are located in Appendix A and B, respectively.

MANAGEMENT ACTIVITIES

To ensure protection of nesting shorebirds, Coast Guard Beach was closed to pets and kite flying on 15 April 2006. Kite flying was also prohibited in both the North and South District within 200 meters of shorebird nesting sites as per the Seashore's compendium. Large signs were installed to inform beach-goers of these restrictions, and a press release was submitted to the local media. Coast Guard Beach was re-opened to pets and kites on 20 August after all shorebird nesting activities were complete.

In the South District, all suitable shorebird nesting habitat on Coast Guard beach were closed with symbolic fencing and signs beginning 7 April. Great Island, New Island, and Jeremy Point were similarly posted the third week of April. In the North District, all suitable shorebird nesting habitat on Race Point North were closed with symbolic fencing and signs by 15 April when the ORV corridor becomes open to permit holding visitors. Various shorebird and natural resource informational and regulatory signs were posted at the entrance of most beaches and at the nesting sites.

MONITORING METHODS

Observations of piping plovers began in March, after the plover's arrival and continued through September when plovers are observed in their southward migration. In March, during the period of arrival and courtship, most beaches were visited three to four times per week. The exception was Wood End/Long Point which was monitored every 3 to 5 days. Once nests were established, all beaches were visited at least 5 times per week except for Wood End/Long Point which was visited 3 – 4 times per week.

During the nest location phase, monitors searched the beach for the presence of plovers, nest scrapes, and plover tracks in the sand. All active scrapes (potential nests) were marked with a few pieces of driftwood approximately 2 meter (m) away from the nest so that the scrape could easily be found on return visits. A concentrated area of plover tracks often meant a plover nest or potential nesting site was nearby, as did any plover exhibiting the "broken-wing" behavior. Nests were also found by searching for

birds sitting low in the sand, incubating a nest. Symbolic fencing was placed around all active scrapes and nests not already within posted nesting habitat areas. To provide accurate predictions of hatching dates, efforts were made to find nests before clutch completion. Nest searching continued until no new nesting was detected.

Although there were some exceptions, predator exclosures were installed around most nests upon clutch completion. With permission from the Massachusetts Division of Fisheries and Wildlife, some incomplete clutches were exclosed if (1) the chance of predation on eggs was imminent or (2) the pair was actively incubating an incomplete clutch.

Nests were not exclosed when they were: (1) located in thick vegetation making the adults prone to flying off the nest when disturbed and creating a potential for entanglement in the exclosure top; (2) located on the side of a dune or cliff that precluded us from installing an exclosure due to slope or nest location; or (3) if there were concerns regarding adult plover mortality associated with exclosure use.

Observations of terns began the first week of May when the first least terns arrived and continued through September during which large numbers of terns congregate on Seashore beaches as part of their staging and migration activity. Areas of historic nesting tern habitat were posted with symbolic fencing no later then April 30th. Any areas with terns exhibiting courting and nesting behaviors outside of already posted nesting habitat areas were posted with symbolic fencing. Monitors looked for tern nests and searched the beach for signs of tern scrapes, tracks, and colony behaviors until no new nesting was detected. Tern colonies were observed no less then three times a week on all beaches for signs of continued nesting, abandonment, and predation.

Observations of American oystercatchers began the fourth week of April. Any areas with American oystercatchers exhibiting courting and nesting behaviors outside of already posted nesting habitat areas were posted with symbolic fencing. Monitors looked for American oystercatcher nests and searched the beach for signs of scrapes and tracks until no new nesting was detected. American oyster catcher pairs were observed no less then three times a week on all beaches for signs of continued nesting, abandonment, and predation.

RESULTS AND DISCUSSION

Seasonal Chronology

Piping plovers were first observed on Seashore beaches on 20 March and most beaches had plovers present by mid-April. Plovers continued to arrive into mid-June. It is likely that some of these later arriving birds may have lost nests at other sites before moving to Seashore beaches.

Egg laying began in the fourth week of April in both the South District and North District. The first nest (with one egg) was found on 26 April on Great Island. The nest was lost on 28 April to crow (*Corvus brachyrhyncos*) predation. The first nests to hatch chicks in the South District occurred on 1 June at Jeremy Point and on 3 June on Race Point North in the North District. Peak nesting for the Seashore occurred during the last week of May through the first two weeks in June (Figure 2). The last nest was found with only two eggs on 1 July at Marconi Station. This was also the last nest to hatch on 24 July. One chick fledged from this nest. Hatching dates ranged from 1 June to 24 July. Fledging dates ranged from 28 June to 24 August. These peak nesting, hatching, and fledging dates are similar to those reported over the past several years.

Nesting Pairs

Seventy four pairs of piping plovers were monitored at 18 sites in CACO in 2006. The total number of nesting pairs decreased by 3 pairs from 2005 (from 77 pairs in 2005 to 74 pairs in 2006) (Fig.1). Most beaches saw the same number of nesting plovers in 2006 as in 2005. Six beaches had a decline of one or two nesting pairs and five beaches saw an increase in nesting pairs. These beaches were New Island, Nauset Light, Jeremy Point, Race Point North, and High Head.

Hatching Success

Hatching success (total number of eggs hatched/total number of eggs laid) for all sites combined was 69% and, by site, ranged from 36% to 100% (Table 1). Overall, hatching success was 26% higher than in 2005. Hatching success was greatest at Nauset Light (100%), Newcomb Hollow (100%), New

Island (100%), Bound Brook (100%), and Ballston Beach (91%). The lowest hatching success occurred at Marconi Station (36%), High Head (49 %), Great Island (57%), Race Point South (62%) and LeCount Hollow (67%) (Table 1).

Nest Loss

Twenty-seven percent (26 of 96) of all nests failed to hatch at least 1 chick (Table 2). This is a decrease from 2005 when 58% (69 of 118) nests failed**.** The greater nest success in 2006 is likely because more incomplete nests were protected by exclosures than in 2005, and there were fewer major storms in 2006. Of the 26 lost nests, 9 (35%) had been exclosed and 17 (65%) had not been exclosed. Of these 17, 11 nests were lost to predators, primarily crows (Table 3, 4). Overall, predation (12), overwash (3), sanding over (5), abandonment (3) and unknown reasons (3) were the causes of nest loss (Table 2)

Fledging Success

Total fledging success (total number of chicks fledged/total number of eggs hatched) was 52 % and, by site, ranged from 0 to 100 % (Table 1). Since 1998, fledging success has ranged from a low of 47% in 2000 to a high of 70% in 2001. (Table 5) . The greatest fledging success was on New Island (100%), Bound Brook (100%), Duck Harbor (83%), Marconi Station (80%), and Great Island (75%). The sites with the lowest fledging success were LeCount, Marconi, and Nauset Light (50%), Race Point South (31%) and Jeremy Point (19%). Newcomb Hollow hatched chicks but fledged no chicks (Table 1).

Productivity

Total productivity was 1.65 chicks fledged/nesting pair (122 chicks fledged from 74 pairs) and, by site, ranged from 0 to 4.0 (Table 1, Figure 1). The South District had higher productivity (1.94 chicks/pair) than the North District (1.41 chicks/pair). Productivity was greatest at Bound Brook (4.00), Great Island (3.00), New Island (3.00), Duck Harbor (2.50), and Ballston Beach (2.30). The lowest productivity occurred at Newcomb Hollow where all four chicks disappeared shortly after hatching. Other

sites with low productivy include Jeremy Point (.67), Race Point South (1.00), Race Point North (1.30) and High Head (1.40) (Table 1)

Predator Exclosures

Nests were evaluated according to the guidelines in the Atlantic Coast Piping Plover Recovery Plan (1996) for the use of predator exclosures when determining if an exclosure would be used.

In 2002 and 2003, an increased number of adult mortalities were associated with exclosed nests. In response to this, in 2004, the Seashore began exploring the use of different exclosure designs to help reduce the rate of adult mortalities associated with exclosures. Two exclosure designs were used in 2006 with the approval of the Massachusetts and Federal endangered species coordinators.

1. Single-top Exclosure – This design has been used at the Seashore since the early 1990's. The circular exclosure is 10' in diameter and 3' high, constructed of 2" x 4" wire fencing. A ½" plastic mesh bird netting is secured to the top. This exclosure type was used for 27 North District nests and for 5 nests in the South District.
2. Canopy Exclosure - This design uses 2" x 4" fencing to create a 4' x 4' square exclosure, which is 3 feet high. A heavy gauge plastic 2" x 2" deer netting is secured over the top and extends for 4 feet from all sides creating a canopy. The canopy is secured with wooden and steel posts. An additional 4' x 6' piece of fencing is attached to two of the sides creating a second, domed top. Thirty-one canopy exclosures were used in the South District and on 15 nests in the North District in 2006.

Predator exclosures were installed around 78 of the 96 (81%) nests. Of the 78 exclosed nests, 69 (88%) successfully hatched young. Of the 9 exclosed nests that did not hatch, 4 (44%) failed after becoming sanded over, 3 (33%) were lost to overwash, 1 (11.5%) was abandoned for unknown reasons, and 1 (11.5%) was predated by a coyote. There were a total of 18 unexclosed nests. Of these nests, 17 (94%) failed to hatch (Table 4). Many of these nests were incomplete clutches (with < 3 eggs), or the nest was located where an exclosure could not be used. The greatest number of failed unexclosed nests was

lost to predation which accounted for the loss of 10 (59%) nests. Eight of the unexclosed nests were lost to crow predation (80%) and two to unknown predator (20%). The remaining failed unexclosed nests were lost for unknown reasons (3, 17%), sanding over (2, 12%), or were abandoned for unknown reasons (2, 12%) (Table 4.)

Abandonment of Exclosed Nests

South District - There was no abandonment of exclosed nests in the South District for the 2006 season.
North District – A total of two exclosed nests were abandoned. In one incident, coyote tracks led up to and circled the exclosure. A dead adult was found approximately 12 feet from the exclosure with puncture wounds in its back and chest. The second adult continued to incubate the eggs for 3-4 days before abandoning the nest. The eggs from the nest were collected and all four showed embryonic development. In the second incident, there was no sign of predation and the cause of the abandonment was undetermined. No development could be detected in the clutch of eggs. This pair successfully renested.

Chick Mortality

Chick mortality factors are extremely difficult to assess. In the majority of cases when chicks are lost, there is no evidence as to why. A chick was presumed dead when it was not seen again before the remainder of the chicks in the brood fledged. A brood was considered lost when there was no sign of the chicks after five consecutive days of searching. As in years past, most chick mortality occurred within the first 10 days after hatching, which is consistent with data from previous studies (MacIvor 1990, Brown and Hoopes 1993).

South District - Three chicks were found dead or dying in 2006. The first was on 11 June when a seven day old chick was found dead inside symbolic fencing at the southern end of Coast Guard Beach. There were no external injuries. The second chick was found on 8 July on Jeremy Point. The 17 day old chick was observed inside the symbolic fencing looking weak and one wing was drooping. Within 20

minutes, the chick died and was collected. On 8 July at LeCount Hollow, a 15 day old chick was also found. The chick appeared weak and had trouble walking. It died 30 minutes later.

All chicks were sent to the National Wildlife Health Center in Madison, Wisconsin for analysis. Preliminary necropsy results indicated that the Jeremy Point chick died from an infectious disease. It had a systemic fungal infection caused by *Aspergillus fumigatus*, a common soil fungus, which was isolated from the heart and from the thorax. The chick died from fungal pneumonia. The LeCount chick's death was attributed to suffocation due to malformed blood vessels. Its lungs were congested (blood filled) and there was excess fluid in the tissues. The jugular vein was enlarged, very convoluted and congested (possibly a congenital defect). There were no bacteria or fungi isolated from this chick. The third chick, from Coast Guard Beach, was emaciated and had two bacterial species, a Staphylococcus and a Pantoea isolated from it's remnant yolk sac, however, no bacteria were isolated from the liver making it unclear if there was actually an infection, or if these were postmortem contaminants. The necropsy results attributed the likely cause of death to be starvation due to the unseasonably cold and rainy weather.

North District – On 12 June, two chicks were observed in Hatches Harbor with a single adult. One chick and one pipping egg from the same clutch were observed within the brood's exclosure. On 14 June, the pipping egg was still located within the nest bowl with a dead chick inside the shell. This nest had only one adult incubating the eggs and tending the chicks. Mortality is assumed to have resulted from the adult tending to the already hatched chicks and no longer incubating the pipping egg.

On 4 July a dead chick was found at Head of the Meadow beach by law enforcement rangers. All four chicks of the clutch had been observed on 3 July. The chick had no puncture wounds or signs of predation. No definitive cause of death could be determined.

It is unknown how the majority of chicks were lost. It is probable that the five day period of seasonably hot weather during the middle of July contributed to a number of young chick disappearances during that time. Shorebird personnel have noted an increase in coyote and crow sightings since 2003 (unpublished data) in the areas where mortality occurred; it is possible that these species, along with gulls

(*Larus sp*.) which congregate in large groups on the beachfront), foxes (*Vulpes vulpes*), skunks (*Mephitis mephitis*), domestic dogs and feral cats may also contribute to chick mortality.

Adult Mortality

South District - There were no cases of adult mortality in the South District in 2006. In past years, most cases of adult mortality within the South District occurred in or near exclosures. The replacement of circular exclosures by canopy exclosures is presumed to be the main reason for the decline in recorded adult mortality.

North District - On 20 May, a dead adult was found approximately 12 feet outside of an exclosure on Race Point North. The second adult was incubating four eggs at the time the dead adult was found. Coyote tracks led up to and circled the exclosure. The coyote tracks led away from the exclosure and to the immediate area that the dead adult was found. The tracks exhibited the characteristics of a pouncing action at the carcass of the dead adult. Puncture wounds were located along the chest and back of the plover. The second adult continued to incubate the nest for 3-4 days before abandoning the nests.

South District Beach Pedestrian Restrictions and Detours

Winter storm erosion continued to narrow beaches in the South District. Where beaches were extremely narrow, it was not always possible to provide sufficient buffer within the symbolic fencing (especially at high tide) to prevent pedestrian disturbance of incubating pairs. At sites where this was a problem, beaches were closed at times of high tide or small sections of beach were completely closed. Where possible, detours were established to allow visitors access to other sections of beach. Informational signs were erected informing visitors of these closures. These closures have been very effective, with high visitor compliance.

Jeremy Point - This area was closed at high tide for most of the nesting season (26 May- 3 August). At low tide, there was adequate exposed beach between the nesting birds and the pedestrians, however, at high tide, the symbolic fencing often extended into the water making it impossible for pedestrians to pass.

Great Island– Two-tenths of a mile of beach at the "Gut" was closed to pedestrians at high tide from 17 May through 22 May to protect one nest. A detour was established via the inland trail. The area was re-opened when the nest was lost due to high tides washing over the eggs.

Some isolated nests on both the bay and oceanside were located on remote narrow beaches where human disturbance was minimal. In these cases, pedestrians were allowed to pass under the symbolic fencing at high tide. Signage was posted to explain the need to move quickly and to stay as close to the water's edge as possible. All nests were exclosed so no threat of a visitor accidentally stepping on the nest was possible.

Seasonal Pet Restrictions

Presently, the Seashore follows the recommendation of the U.S. Fish and Wildlife Service's Recovery Plan and provides plover nests with a 50 meter or greater closed area (closed to pedestrian and pets) above high tide to limit disturbance to nesting and courting plovers. How the Seashore manages pets on beaches with nesting shorebirds varies, with intensity of human use, density of nesting birds, and width of beach being determining factors. The guiding principle is one of allowing as much human activity as possible without placing the nesting shorebirds at risk.

South District -*Oceanside:* Since the late 1980's, Coast Guard Beach, south of the former Coast Guard Station in Eastham has been closed to pets from April 15th until all shorebird chicks have fledged. In 2006, pets were allowed back on this section of beach on 15 August. Marconi Beach has been closed to pets since the late 1980's when 3-5 plover pairs and a large least tern colony nested north of the stairs on the protected (lifeguarded) beach. In the late 1990's, this site saw a steady decline of nesting plovers and terns due to the erosion of nesting habitat by winter storms In 2006, for the first time since 2003, a pair of plovers nested on the protected beach at Marconi Beach (south side). This section of beach was closed to pets from 3 May to 20 May. The beach was reopened to pets when the pair relocated 0.4 miles south of the protected beach.

Bayside - In June 2006, the park initiated a pet closure on bayside beaches in Wellfleet where shorebirds nest (Bound Brook to Jeremy Point). This was necessitated by low compliance with the leash law by dog owners combined with the narrowness of the beach increasing the chance of dog/shorebird conflict. Signs informing visitors of these pet closures were installed and moved to reflect current closures. Sections of beach were closed until all shorebird chicks fledged. Areas on the bayside that did not have nesting plovers remained open to leashed pets. The entire bayside was reopened to leashed pets on 12 August. Visitor compliance was high and there was a notable decline of pets (leashed and unleashed) in the general nesting area. Although dogs off leash were still documented, most were observed outside the area closed to pets and away from the nesting birds.

North District - There were no seasonal pet restrictions for the 2006 nesting season.

Dogs off Leash

South District - A total of 263 dogs were documented off leash from 24 April to 20 August by natural resource management staff. Unleashed dogs were encountered most frequently on the oceanside at Nauset Light Beach and LeCount Hollow and on the bayside (before the pet restrictions) at Duck Harbor and Bound Brook.

North District - A total of 44 dogs were observed off leash from 5 April to 26 August. Unleashed dogs were encountered most frequently on Race Point South, Wood End/Long Point, and High Head. Most owners put their dogs on a leash when informed of the National Park Services pet regulations. Increased enforcement and the total closure of Race Point North and Race Point South to vehicles during June and July may reflect the lower number of dogs off leash in these areas.

Environmental Education/Outreach

Educating the public about natural and human impacts threatening nesting Piping Plovers is important in gaining local support and a critical component to the plover's recovery. In 2000, an outreach program that included a slide presentation and an interactive activity about the plight of the plover was

initiated. This program was based on an existing lesson plan from the U.S. Fish and Wildlife Service. Since 2000, in early March through the first week in April, this program has been presented to over 4,000 individuals (mostly elementary grade students and youth groups) throughout the Lower Cape. In 2006, a total of 9 programs (18 classes, 394 individuals) were presented.

ORV Management

Implementation of the Negotiated Rule - ORV management, as it relates to plover management at the Seashore is guided by the Negotiated Rule as finalized in the Federal Register 1998. Section 7.67:2 of the negotiated rule lists a table of where and when vehicles can be operated within the corridor. Section 7.67:4(iii) states that "An oversand route is closed at any time that tides, nesting birds, or surface configuration prevent vehicle travel within the designated corridor." In 2006 there were no documented cases of direct negative impacts from ORVs to piping plover adults or chicks.

Thirty-three of 41 (80%) North District pairs nested within the ORV corridor (the same number as in 2005). Fourteen of these pairs (21 nests) nested in areas seasonally closed to ORV traffic. Nineteen pairs (20 nests) nested in the area open to ORV traffic. As these nests hatched, affected sections of the ORV corridor were closed to vehicles. Closures were imposed only when eggs hatched and were kept in effect through the chick-rearing stage until fledging.

The presence of piping plover chicks caused the closure to ORV traffic on portions of Race Point North beach for a total of 98 days (12 days more than 2005). On 9 August (25 days earlier than 2005) the entire Race Point North oversand route was opened to ORV traffic due to the absence of piping plover chicks. Race Point South beach was closed to some extent between the Race Point South exit and the High Head exit for 85 days and was opened in its entirety on 24 August. The night fishing corridor located at Coast Guard beach (Truro) was not effected due to lack of piping plover nesting. The stretch of beach between Head of the Meadow and High Head was closed to some extent for 35 days. As of August 24, the entire ORV corridor was opened to vehicles. In 2006, the ORV corridor was completely closed to vehicle access for 14 days from 11 June to 24 June. The following is a chronological discussion of the

principal events and responses. This information is summarized in Table 6, written in fulfillment of requirements of the Negotiated Rule.

At Race Point North the location of a Piping Plover nest made it inevitable that upon hatching (expected 27 May – 1 June) the area in which the Race Point North SCV Area and the Race Point North exit would be closed. Likewise on Race Point South, the location of two Piping Plover nests would close the Race Point South entrance upon hatching (expected 31 May – 5 June). On 1 June, a plover nest in close proximity of the Race Point South exit began hatching closing the Race Point South exit and access to all of the Race Point South corridor. On 2 June, in anticipation of the plover nest located within 300 meters of the exit hatching, the Race Point North SCV area was closed. To accommodate the SCV users, a SCV area at Pilgrim Heights was established. On 3 June, a plover nest located within 300 meters of the Race Point North exit began hatching and the exit was closed. Two miles of Race Point North was accessible via the Pole Line Route. On 11 June, a plover nest along the Pole Line Route began to hatch. The Pole Line Route was closed due to this hatching, closing all access points onto Race Point North. This closure resulted in no ORV access to any Seashore beaches. On 24 June, a plover brood moved away from the Race Point South exit; the exit was opened and a parking area of 241 meters (0.15 mile) was established. In accordance with the Negotiated Rule, the corridor between High Head and Head of the Meadow may be opened to ORVs on July 1 provided no plover broods are located on the beach. However, in 2006, the High Head exit was not opened on July 1 due to a plover brood in the immediate area of the exit. The Head of the Meadow exit was opened and a parking area 160 meters (0.1 mile) was established. On 11 July, the Head of the Meadow exit was closed due to a plover nest hatching within 200 meters of the exit. On 11 July, the Race Point South exit opened due to the plover brood fledging from the area. On 12 July the Pole Line Route was opened to the intersection of the Pole Line route with the access road to the beach. This allowed ORVs to access the one half mile of open beach from the Pole Line Route while Hatches Harbor remained closed. The brood at the High Head exit fledged on July 13 opening 1.4 miles south to Head of the Meadow and 0.6 miles north of the High Head exit. A SCV area was established north and south of the High Head exit. A second plover nest located within 300 meters of

the Race Point South exit began hatching on July 14 and the exit was closed. On 23 July, the exit and one-tenth of a mile was opened on Race Point North. On 9 August, all of Race Point North opened to vehicles. On 9 August, the Race Point South exit was opened and a one-tenth of a mile long parking area was established after a brood moved out of the area. On 11 August, 2.8 miles were opened on Race Point South after a plover brood was lost and a second brood fledged. On 24 August, 1.4 miles were opened on Race Point South opening the complete corridor from Race Point South to High Head and Head of the Meadow. The Head of the Meadow exit remained closed due to beach instability at the exit.

COLONIAL WATERBIRDS

Least terns

Least terns began exhibiting nesting behaviors at the Seashore during the third week of May. Egg laying began the first week in June, with most least terns on eggs by 15 June. The first chick hatched on 9 July at Coast Guard Beach. The last chicks hatched the third week of August at Marconi Station. None of these chicks fledged. Since 2004, the number of nesting least terns has declined and productivity has continued to be very low and in many areas there has been no nesting success.

South District- In late June, an estimated 83 pairs nested in small colonies on four sites in the South District (Coast Guard, Marconi Station, Jeremy Point and New Island). Coast Guard Beach had the largest colony with 50 pairs. The other three colonies consisted of 4 to 24 pairs. Due to the narrow beaches, many nests were lost to overwash and predators. Tracks indicated canids (probably coyote) to be the major predators; gull and crow tracks were also observed in the colonies. Renesting attempts continued through late August. Very few chicks hatched and productivity was low at these sites (< 5 chicks fledged from all four sites).

North District - A total of 29 pairs, nested on four beaches (Wood End/Long, Race Point North, Race Point South and High Head) in the North District. Heavy egg predation by coyotes continued throughout the season at Race Point North causing renesting to continue for the duration of the breeding

season; it is unknown if any chicks were fledged on this beach. Historically, a small colony (75 – 125 pairs) was located at Long Point. This colony has steadily declined until only two pairs attempted to nest at the site in 2006. It is unknown if the decline of this colony is due to predation or the result of increased disturbance from pedestrian traffic facilitated by the ferry service to Long Point from Provincetown. Overall, heavy predation led to Least Terns having to renest throughout the season and accounted for their low productivity; six chicks are believed to have fledged from all sites in the North District.

Common terns

Common terns were first sighted on 17 May. For the past five years, historic nesting sites in the South District (New Island, Coast Guard Beach and Jeremy Point) experienced a steady decline in nesting Common Terns and extremely limited productivity due to intense predator pressure from coyotes, crows, gulls, and skunks. In 2006, approximately four pairs nested on the northeast corner of New Island in mid-June. These nests disappeared by late June.

In mid-July, a conservative estimate of 500 immature and post-breeding adult common terns were observed on the mudflats of Nauset Marsh.

No common terns nested along North District beaches during the 2006 nesting season.

Roseate terns

Roseate terns were not found nesting in the Seashore in 2006. In mid to late August, approximately 100 immature and post-breeding adult roseate terns were observed on the mudflats of Nauset Marsh. Roseate terns were commonly observed at Jeremy Point (10-50 individuals) from late July through August.

Arctic terns

For the first time in over 20 years, there were no nesting Arctic terns on New Island or Coast Guard Beach in Eastham.

Black skimmers

There were no nesting black skimmers and only one individual sighted at Jeremy Point on 21 June.

Laughing gulls

No nesting laughing gulls were found in the park in 2006.

American oystercatchers

The first American oystercatcher was observed on 25 April 2006 at the southern tip of Jeremy Point. In 2006, four pairs nested in the South District; two at Jeremy Point and two on New Island. All nests contained three eggs and at least one egg hatched from each nest. One nest from Jeremy Point and one from New Island fledged one chick. The other nests lost their chicks soon after hatching. On 17 May 4 oystercatchers were observed in the North District flying over the water along Race Point North.

MANAGEMENT RECOMMENDATIONS

1. Dogs off leash continue to be a chronic problem in the park. Ground nesting birds like plovers and terns are extremely vulnerable to disturbance and predation by unleashed dogs. Increased patrols, enforcement and citations issued by law enforcement rangers are needed to ensure compliance of the leash law.

In 2007, bayside beaches in Wellfleet should continue to be seasonally closed to pets as soon as plovers exhibit breeding behaviors (scraping, copulating) and sections re-opened when chicks fledge. Areas on the bayside that do not have nesting plovers should remain open to pets.

The south side of Coast Guard Beach and Marconi Beach should remain closed to pets from 1 April until all chicks have fledged.

In 2007, a seasonal pet closure should be implemented at the Hatches Harbor marsh area from 1 April through the end of August. This closure should include the Dike Road and parking lot accessible

from Province Lands Road. Hatches Harbor is an important feeding area for migrating and staging plovers, terns and other water and shorebirds during the spring and fall migrations. It is also an important nursery area for Race Point North plover broods and young migrating fledglings.

In 2007, a seasonal pet closure should be implemented on all sections of oceanside beaches that have nesting plovers. These seasonal beach closures to dogs should be implemented from 20 April until shorebird chicks fledge. Informational signs should be placed at parking lots informing visitors of the closures and identifying the sections of beach (north or south of lot) that remain open to leashed pets. The Seashore should continue to record incidents of dogs off leash in 2007.

2. Loss of exclosed nests to abandonment in both districts needs to be evaluated both by the park and by Massachusetts and Federal endangered species coordinators. The reasons for abandonment also need to be better understood. Changes in exclosure design should continue to be explored.

3. In late summer, thousands of migrating shorebirds and terns (including the federally endangered roseate tern) congregate on the mudflats and shoreline of Nauset Marsh to feed and rest. This area is one of the most important staging and roosting areas for these birds on Cape Cod (Hadden 1999, Trull et al. 1999). To reduce disturbance to the birds using this important staging area, the park should consider extending the pet closure at Coast Guard Beach until use by migrating terns and shorebirds has concluded. Hatches Harbor and Great Island/Jeremy Point marshes also provide important staging and roosting habitat for migrating terns and shorebirds. Post-breeding season pedestrian and pet management should be considered in these areas as well.

4. In recent years, hang gliding and paragliding have become increasing in popularity at White Crest Beach in Wellfleet. The tall bluff at the town's parking lot has become a platform for the gliders to launch from. NPS staff have observed these gliders disturbing nesting plovers and terns when the gliders fly low along the coastline directly over nesting areas. In response to these observations, in 2006, the park requested the town to seasonally ban the launching of hang gliders at White Crest Beach from 15 April until the last shorebird chick hatches. In June, the Wellfleet Board of Selectman voted to support the ban

until Labor Day, and is presently working with the Conservation Commission to amend their by-laws to enforce the ban from April through Labor Day. In 2007, NPS should continue working with the town and assist with enforcement and public relations.

5. Kite surfing is becoming increasing popular at the "Gut" on the bayside in Wellfleet (NPS and town owned beach). These large kites range in size from 2 to 21 square meters and include multiple 25to30 meter long lines to attach the kite. They are launched from the beach on windy days and used to pull a kite surfer over the water on a small board.

As of 2006, there has not been a plover nest near this kite surfing area, however, as the plover population increases and other beaches erode, this potential habitat is likely to become more important for nesting plovers. Presently, the Seashore follows the recommendation of the U.S. Fish and Wildlife Service's Recovery Plan and prohibits kite flying within 200 yards of a plover nesting area. Kites are perceived as predators flying/hovering over the incubating plover disturbing the bird off the nest and/or causing abandonment. Two hundred meters may be adequate for hand held kites (1to 2 meters) but that distance is likely inadequate to prevent the plovers from flushing off the nest if the larger surf kite is launched.

In a letter dated May 1, 2006, the Seashore requested the town of Wellfleet to also consider seasonally closing 175 feet of town owned beachfront at the Gut south of the access path to kite surfing if a plover nest is found nesting within 200 yards of where they launch until plover chicks have hatched. The town of Wellfleet has not yet responded to this request. The Seashore should implement the same restrictions on park beaches.

6. Over the years, increasing numbers of boaters have been landing and recreating on some of the more remote beaches in the park including the southern tip of Jeremy Point, Wood End and Long Point. Jeremy Point was observed to have up to 50 boats on its narrow beach. In addition to private boaters, Flyer's boat rental of Provincetown has a special use permit to ferry people out to Long Point twice hourly during the summer months. These sites are also critical nesting habitat for piping plovers, least terns and American

oystercatchers. Patrols of this area are limited. In 2007, the park should evaluate boating use, numbers of people present on these once-remote beaches, and patterns of use in relation to bird nesting areas. Limiting the numbers of boats and people present or restricting the area open to boat landing should be considered. For example, the area at the southernmost end of Jeremy Point, where nesting has not been observed, could remain open to boaters, but the northern section should be closed to boat landing - this area is also often closed to all visitation due to the narrowness of the beach which does not allow a large enough buffer to protect nesting plovers.

7. The rapid decline in least terns, common terns, and laughing gulls needs to be evaluated both by the park and by Massachusetts and Federal endangered and migratory species coordinators. The use of decoys, electric fencing, predator hazing, or other forms of predator control should be investigated to reestablish historical nesting colonies by these species.

8. In 2007, buffer areas (areas free of Self-Contained Vehicles) should be established between plover nests and established SCV areas on North District beaches. These buffers are needed to reduce disturbance to nesting plovers from dogs and visitors that are present overnight in SCV areas. Dogs that are present overnight contribute an increased level of disturbance due to nighttime barking, an increased incidence of dogs of leash within the area and an increased level of dog presence overall. Visitors present within the SCV areas also increase the level of disturbance through overall increased pedestrian traffic and specifically during important foraging times at early evening hours, night hours, and early morning hours. The presence of campfires, lanterns, and other lights may also disturb nesting plovers.

9. At the Seashore, the use of predator exclosures around plover nests has been a somewhat effective, short term, non-lethal method of predator management since the late 1990's. However, exclosures only protect plover eggs and do not reduce predation on adults, their flightless chicks, or other ground nesting shorebirds. In addition, the effectiveness of exclosures is often of limited duration as "smart" predators learn to associate exclosures with food and seek them out, often digging under or jumping into the top netting to reach the eggs or chicks. Adult mortalities associated with exclosures are of particular concern

since the loss of adults has a more serious impact on population dynamics than the loss of eggs or chicks. Replacing the circular exclosure design with the canopy style has been very effective in reducing predation on nests and incubating adults. So far, there have been no adult plover mortalities associated with use of the canopy style exclosures at the Seashore.

Other predator management methods include protecting colonial nesters with electric fencing, predator hazing, targeted predator removal, and management of anthropogenically enhanced predator populations - none of these methods are currently used at the Seashore. To increase plover adult and chick survival, and to better protect declining tern colonies, these and other methods should be considered for future implementation at the Seashore.

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Table 1. Summary of Piping Plover Breeding Success, Cape Cod National Seashore, 2006

Site	No. Pairs	No. Nests [1]	No. eggs Laid	No. eggs Hatched	No. Fledged per site	Hatching Success [2]	Fledging Success [3]	Productivity [4]
Coast Guard	14	17	59	49	29	0.83	0.59	2.07
Nauset Light	1	1	4	4	2	1.00	0.50	2.00
Marconi Beach	1	2	5	4	2	0.80	0.50	2.00
Marconi Station	2	4	14	5	4	0.36	0.80	2.00
LeCount	1	2	6	4	2	0.67	0.50	2.00
White Crest	0	0	0	0	0	0.00	0.00	0.00
Cahoon Hollow	0	0	0	0	0	0.00	0.00	0.00
Newcomb Hollow	1	1	4	4	0	1.00	0.00	0.00
New Island	1	1	3	3	3	1.00	1.00	3.00
Bound Brook	1	1	4	4	4	1.00	1.00	4.00
Duck Harbor	2	2	7	6	5	0.87	0.83	2.50
Great Island	3	8	21	12	9	0.57	0.75	3.00
Jeremy Point	6	7	27	21	4	0.78	0.19	0.67
Wood End/Long Pt	5	6	19	15	11	0.79	0.73	2.20
Race Point North	14	14	51	35	18	0.69	0.51	1.30
Race Point South	11	16	58	36	11	0.62	0.31	1.00
High Head	8	11	43	21	11	0.49	0.52	1.40
Ballston Beach	3	3	11	10	7	0.91	0.70	2.30
TOTAL	74	96	336	233	122	0.69	0.52	1.65

[1] Includes renests

[2] Total number of eggs hatched/total number of eggs laid

[3] Total number of chicks fledged/total number of eggs hatched

[4] Total number of chicks fledged/total number of nesting pairs

Table 2. Causes of Piping Plover Nest Failures, Cape Cod National Seashore, 2006
(page 1 of 2)

Site	NESTS			Cause	PER SITE	
	Total No.	No. Lost	% Lost		No. Lost	% Lost
Coast Guard	17	4	24%	Sanded over	1	25%
				Overwash	1	25%
				Predation (Net)	1	25%
				Unknown Reason	1	25%
				Predation types		
				Crow (not excl)	1	100%
Nauset Light	1	0	0%	N/A	0	0%
Marconi Beach	2	1	50%	Unknown Reason	1	100%
Marconi Station	4	1	25%	Overwash	1	100%
Le Count Hollow	2	1	50%	Predation (Net)	1	100%
				Predation types		
				Crow (not excl)	1	100%
Newcomb Hollow	1	0	0%	N/A	0	0%
New Island	1	0	0%	N/A	0	0%
Bound Brook	1	0	0%	N/A	0	0%
Duck Harbor	2	0	0%	N/A	0	0%
Great Island	8	5	50%	Predation (Net)	2	40%
				Abandoned (not excl) - unk reason	2	40%
				Overwash	1	20%
				Predation types		
				Crow (not excl)	2	100%
Jeremy Point	7	1	14%	Predation (Net)	1	100%
				Predation types		
				Crow (not excl)	1	100%

*White Crest and Cahoon Hollow had no nest attempts

Table 2. Causes of Piping Plover Nest Failures, Cape Cod National Seashore, 2006 (page 2 of 2)

Site	NESTS			Cause	PER SITE	
	Total No.	No. Lost	% Lost		No. Lost	% Lost
Wood End - Long Point	6	1	17%	Unknown Reason	1	100%
Race Point Beach North	14	2	14%	Abandoned (excl) - unk reason	1	50%
				Predation (Net)	1	50%
				Predation types		
				Coyote - Adult mortality	1	100%
Race Point Beach South	16	5	31%			
				Predation (Net)	3	60%
				Sanded over	2	40%
				Predation types		
				Crow (not excl)	2	67%
				Unknown predator	1	33%
High Head	11	5	45%			
				Predation (Net)	3	60%
				Sanded over	2	40%
				Predation types		
				Crow (not excl)	2	67%
				Unknown predator (not excl)	1	33%
Ballston Beach	3	0	0%	N/A	0	0%

Table 3. Nest Loss Totals, Cape Cod National Seashore, 2006

Nests					Per Cause	
No. Nests	No. Hatched	No. Lost	% Lost	Cause	No. Lost	% Lost
96	70	26	27%	Predation (Net)	12	47%
				Overwash	3	11%
				Abandoned (Net)	3	11%
				Sanded over	5	20%
				Unknown Reason	3	11%
				Abandonment type		
				Abandoned (excl) - unknown reason	1	34%
				Abandoned (not excl) - unknown reason	2	66%
				Predation type		
				Coyote - (excl) Adult mortality	1	8%
				Crow (not excl)	9	75%
				Unknown predator (not excl)	2	17%

Table 4. Fates of Exclosed and Unexclosed Piping Plover Nests, Cape Cod National Seashore, 2006

Nest	Total	No. Successful	No. Not Successful	% Successful	% Not Successful	Cause of Failure	No. Lost	% Lost
Exclosed								
						Sanded over	3	50%
Circular	32	26	6	81%	19%	Overwash	2	40%
						Coyote - Adult mortality	1	10%
Canopy	46	43	3	93%	7%	Abandoned (excl) - unknown reason	1	33%
						Overwash	1	33%
						Sanded over	1	33%
Unexclosed	18	1	17	6%	94%			
						Predation (Net)	10	59%
						Unknown reason	3	17%
						Abandoned (not excl) unknown reason	2	12%
						Sanded over	2	12%
						Predation types		
						Crow	8	80%
						Unknown predator	2	20%

Table 5. Fate of Piping Plover Eggs, Cape Cod National Seashore, 2006 (page 1 of 2)

SITE	No. Nests	Net Laid	No. Hatched	No. Lost	% Lost Per Site	CAUSE	# Eggs Lost	% Lost Per Cause
Coast Guard	17	58	48	10	17%	Sanded over	3	30%
						Non-viable	3	30%
						Unknown reason	2	20%
						Overwash	1	10%
						Predation (Net)	1	10%
						Predation types		
						Crow (not excl)	1	100%
Marconi Beach	2	5	4	1	20%	Unknown reason	1	100%
Marconi Station	4	14	5	9	64%	Overwash	8	89%
						Non-viable	1	11%
Le Count Hollow	2	6	4	2	33%	Predation (Net)	2	100%
						Predation types		
						Crow (not excl)	2	100%
Newcomb Hollow	1	4	4	0	0%	N/A	0	0%
Bound Brook	1	4	4	0	0%	N/A	0	0%
Duck Harbor	2	7	6	1	14%	Non-viable	1	100%
New Island	1	3	3	0	0%	N/A		
Great Island	8	21	12	10	48%	Predation (Net)	4	40%
						Overwash	3	30%
						Abandoned (excl) - unk reason	2	20%
						Non-viable	1	10%
						Predation types		
						Crow (not excl)	4	100%
Jeremy Point	7	27	21	6	22%	Predation (Net)	4	67%
				39		Non-viable	2	33%
						Predation types		
						Crow (not excl)	4	100%

*White Crest and Cahoon Hollow had no nest attempts

Table 5. Fate of Piping Plover Eggs, Cape Cod National Seashore, 2006 (page 2 of 2)

SITE	No. Nests	Net Laid	No. Hatched	No. Lost	% Lost Per Site	CAUSE	# Eggs Lost	% Lost Per Cause
Wood End - Long Point	6	19	15	4	21%	Non-viable	3	75%
						Unknown Reason	1	25%
Race Point North	14	51	35	16	31%	Non -viable eggs	8	50%
						Abandoned (excl) - unk reason	4	25%
						Predation (Net)	4	25%
						Predation types		
						Coyote - Adult mortality	4	100%
Race Point South	16	58	36	22	38%	Predation (Net)	9	41%
						Sanded over	8	36%
						Non-viable	5	23%
						Predation types		
						Crow (not excl)	7	78%
						Unknown predator	2	22%
High Head	11	43	21	22	51%	Predation (Net)	12	54%
						Sanded over	7	32%
						Non-viable eggs	3	14%
						Predation types		
						Crow (not excl)	8	67%
						Unknown predator	4	33%
Ballston	3	11	10	1	9%	Non-viable eggs	1	100%

Table 6. North District Off-Road Vehicle Corridor Openings and Closures, Cape Cod National Seashore, 2006

Date	Beach	Change	Net Mileage Open	Net Closed	Reason
4-May	RPN	0.1	2.1	0.1	Beach impassable at high tide in front of n # 2
15-May	Prot Beach	*	*	*	As per Negotiated Rule, closed for season, RPS open to Exit 8
16-May	RPS				N. of Mission Bell area, impassable at high tide
18-May	RPN	0.1	2.2	0	Opened due to beach widen in front of n # 2
1-Jun	RPS	1.8	0	1.8	Exit closed due to n # 1 hatching within 200m of exit, all of RPS closed
1-Jun	RPS	0	0.5	0	Area open only for commercial dune tours
3-Jun	RPN	0.2	2	0.2	Exit closed due to n # 1 hatching within 200 m of exit, Accessible via Pole Line
8-Jun	RPN	0.8	1.2	1	N. # 9 hatching
11-Jun	RPN	1	0	2.2	N. # 10 along the Pole Line Route and N. # 4 hatching
24-Jun	RPS	0.15	0.15	1.65	N # 4 brood moved away from RPS exit, parking area established
1-Jul	HH/HOM	0.1	0.1	1.4	As per Negotiated Rule. HOM exit opened with parking area
11-Jul	HOM	0.1	0	1.5	N # 10 hatching within 200m of exit
11-Jul	RPS	0.3	0.3	4.6	Exit open n # 4 fledged,
12-Jul	RPN	0.5	0.5	1.7	Pole Line Route opened due to fledged chicks from n #10, n # 3
13-Jul	HH	1.4	1.4	0.1	N. # 2 fledged opening the exit
13-Jul	RPS	0.6	0.9	4	Open from HH exit to Peaked Hill
13-Jul	HH	*	*	*	SCV area open at High Head
14-Jul	RPN	0.4	0.6	1.6	N. # 6 fledged, Hatches Harbor opened
14-Jul	RPS	0.3	0.6	4.3	Exit closed, n. # 13 hatching within 200 m of exit
16-Jul	Inner Dune	*	*	*	Inner Dune route closed to commercial and private vehicles for day
22-Jul	HOM	0.2	2.45	3.1	N. # 5 fledged
23-Jul	RPN	0.1	1	1.2	N. # 7 fledged
4-Aug	HH	0.9	1	0.1	N. #11 chicks lost, HOM exit closed due to impassable beach structure
6-Aug	RPN	0.3	1.3	0.9	N. # 14 moved south
6-Aug	RPN	0.4	1.7	0.5	N. # 13 lost all chicks
9-Aug	RPN	0.5	2.2	0	All of RPN open to vehicles
9-Aug	RPS	0.1	0.7	4.1	Exit opened for parking area, no brood in area
11-Aug	RPS	2.1	2.8	2.1	N. # 13 lost all chicks
11-Aug	RPS	0.7	3.5	1.4	N. # 14 fledged
24-Aug	RPS	1.4	4.8	0	N. # 15 fledged - All of RPS open to vehicles

** All mileage of RPN includes Hatches Harbor

RPN = Race Point North
RPS = Race Point South
HH = High Head
HOM = Head of the Meadow

Figure 1 Number of Piping Plover Breeding Pairs and Nest Productivity at Cape Cod National Seashore, 1986 - 2006

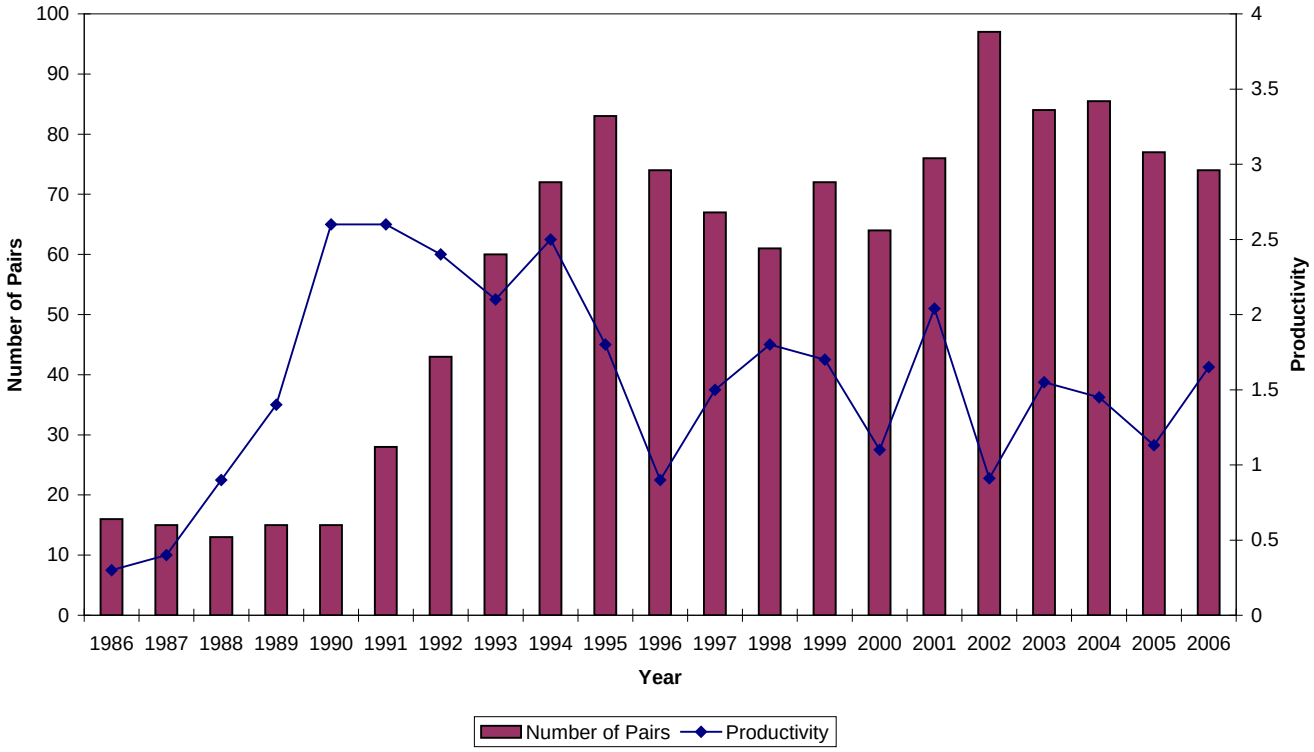
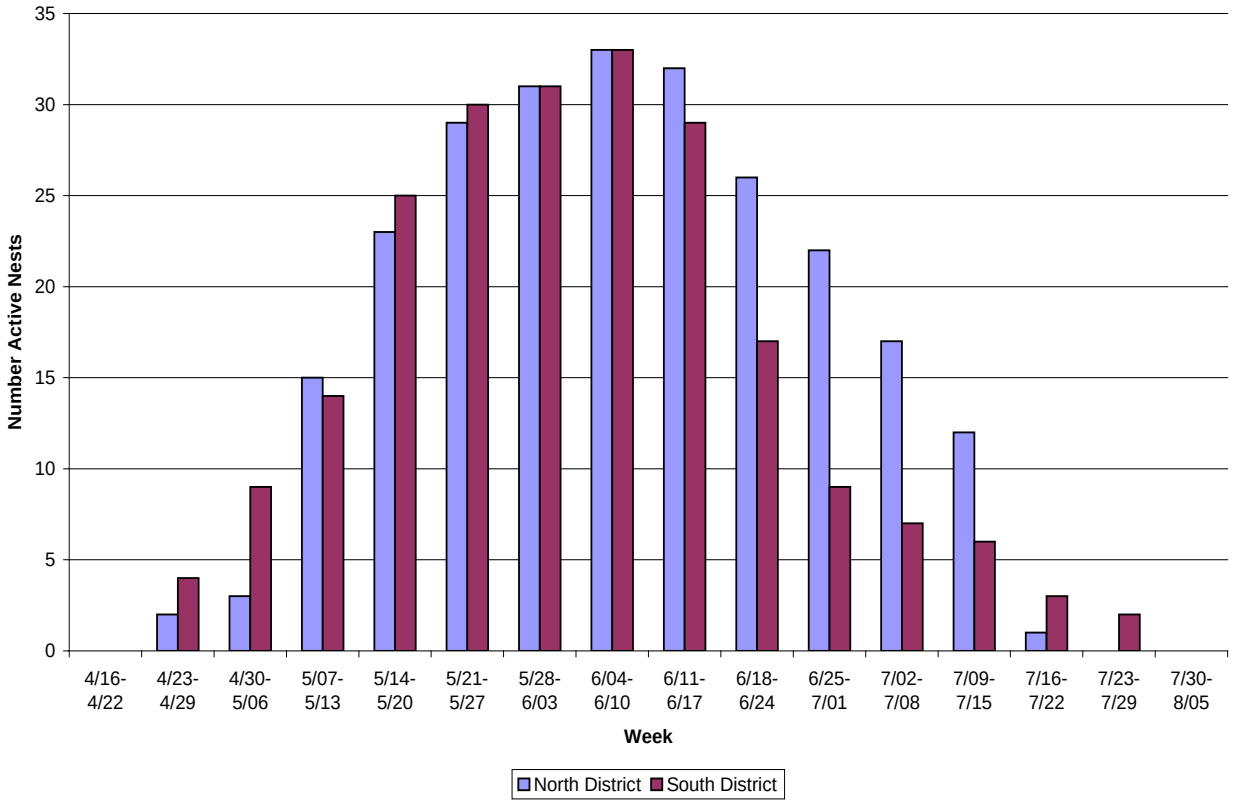


Figure 2 Weekly Active Piping Plover Nests at Cape Cod National Seashore 2006

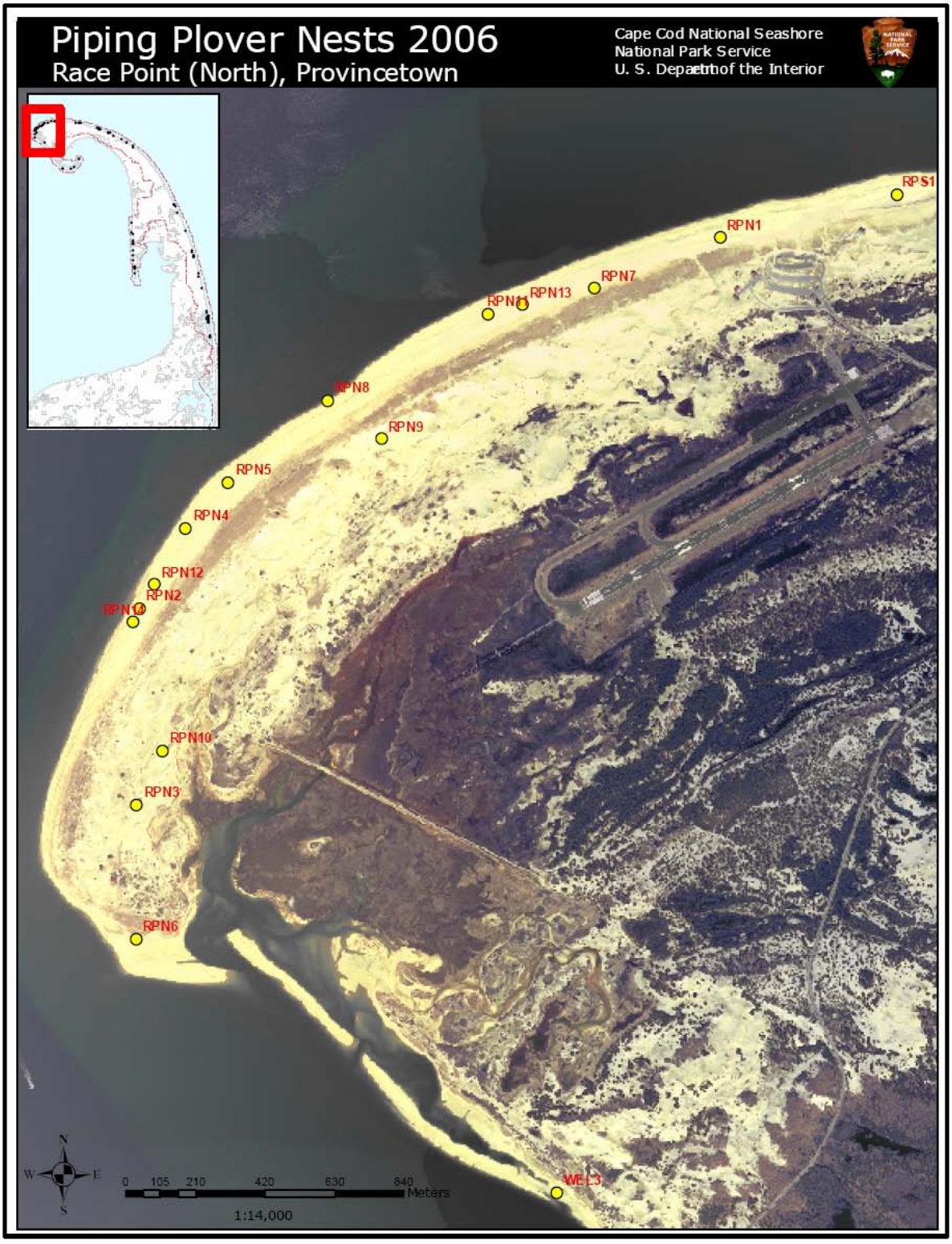


Appendix A

Maps of Cape Cod National Seashore, North District

2006 Piping Plover Nest Sites


Piping Plover Nests 2006
odW End, Provincetown
Cape Cod National Seashore
National Park Service
U. S. Depaetnof the Interior
WEL4
WEL6
WEL5
WEL1
WEL2
N
W
E
S
0 105 210 420 630 840
Meters
1:14,000


Piping Plover Nests 2006
Race Point (North), Provincetown
Cape Cod National Seashore
National Park Service
U. S. Department of the Interior
RPS1
RPN1
RPN7
RPN11
RPN13
RPN8
RPN9
RPN5
RPN4
RPN12
RPN2
RPN14
RPN10
RPN3
RPN6
WEL3
N
W
E
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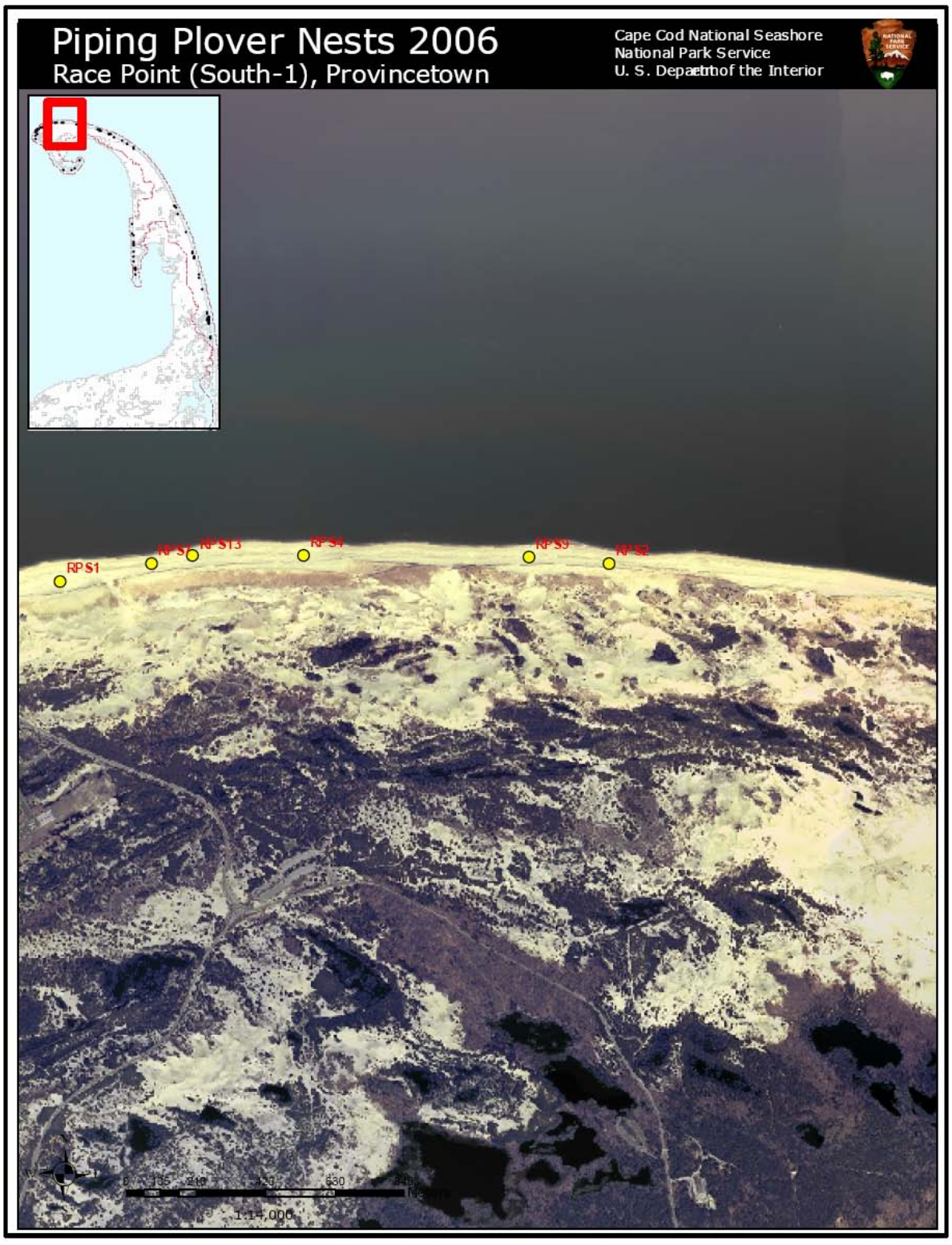
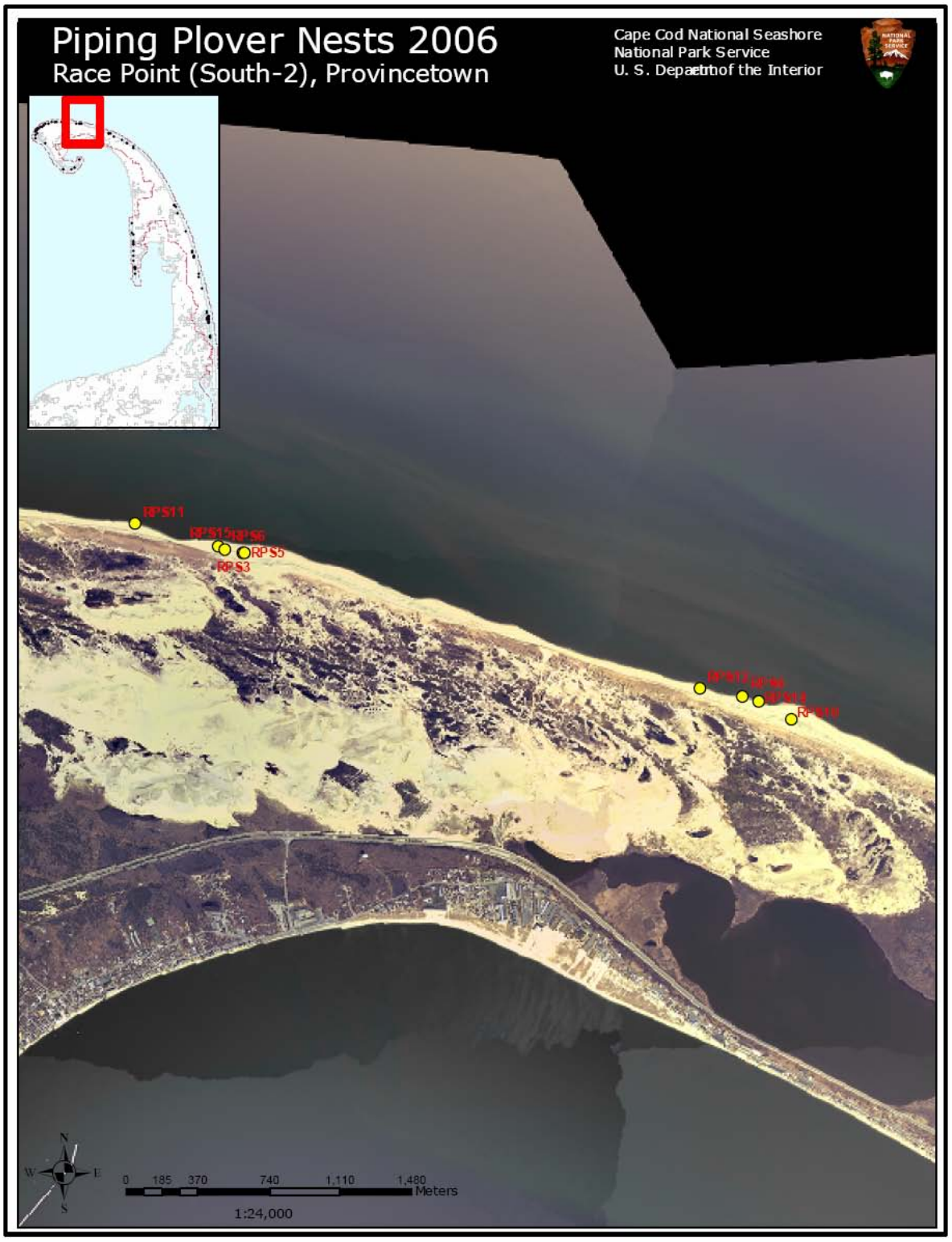
Meters
1:14,000


Piping Plover Nests 2006
Race Point (South-1), Provincetown
Cape Cod National Seashore
National Park Service
U. S. Department of the Interior
RPS1
RPS13
RPS4
RPS9
RPS2
1:14,000


Piping Plover Nests 2006
Race Point (South-2), Provincetown
Cape Cod National Seashore
National Park Service
U. S. Department of the Interior
RPS11
RPS5
RPS3
N
W
E
S
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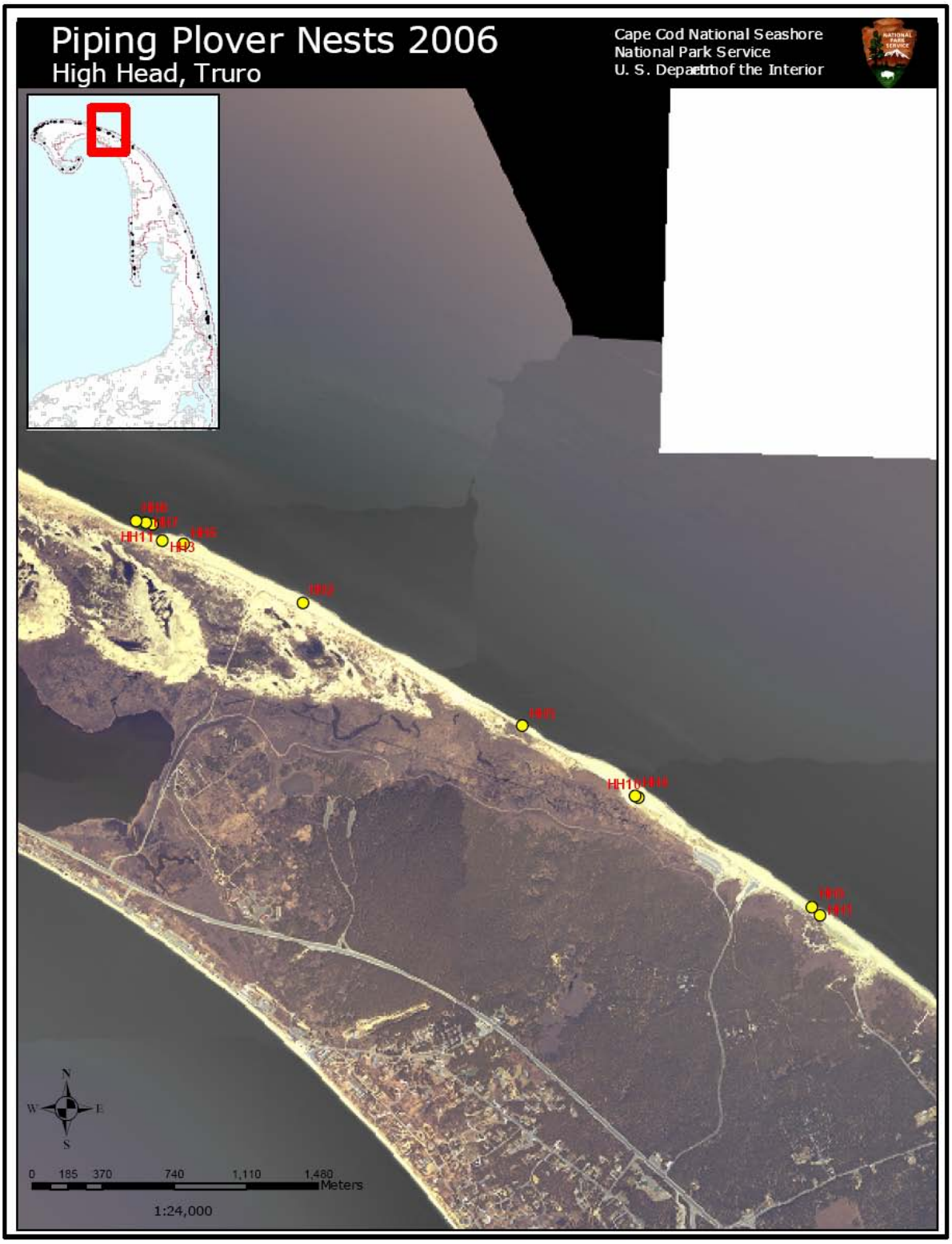
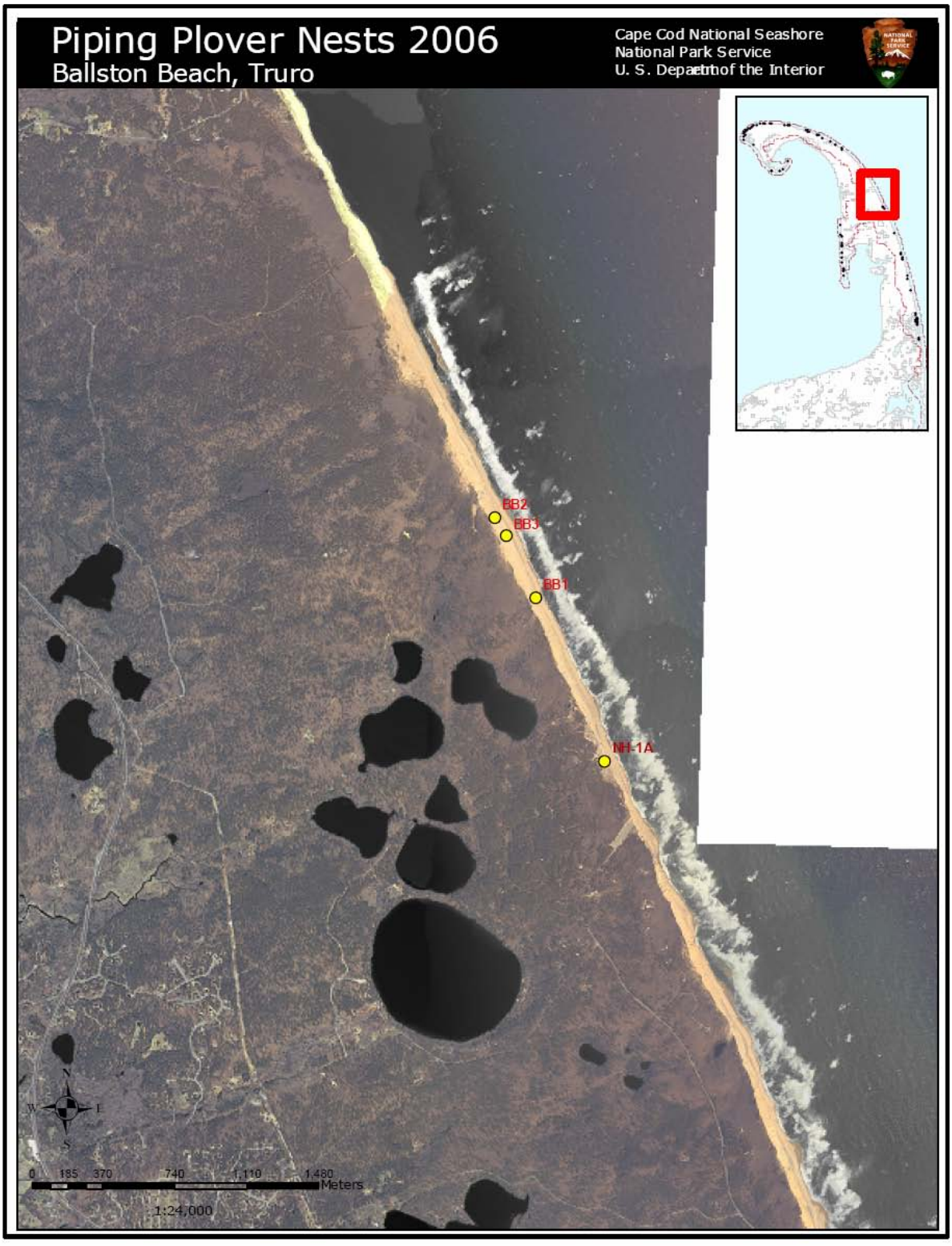
Meters
1:24,000


Piping Plover Nests 2006
High Head, Truro
Cape Cod National Seashore
National Park Service
U. S. Department of the Interior
HH11
HH3
HH12
HH5
HH10
HH9
HH1
N
W
E
S
0 185 370 740 1,110 1,480
Meters
1:24,000


Piping Plover Nests 2006
Ballston Beach, Truro
Cape Cod National Seashore
National Park Service
U. S. Department of the Interior
BB2
BB3
BB1
MH-1A
N
W
E
S
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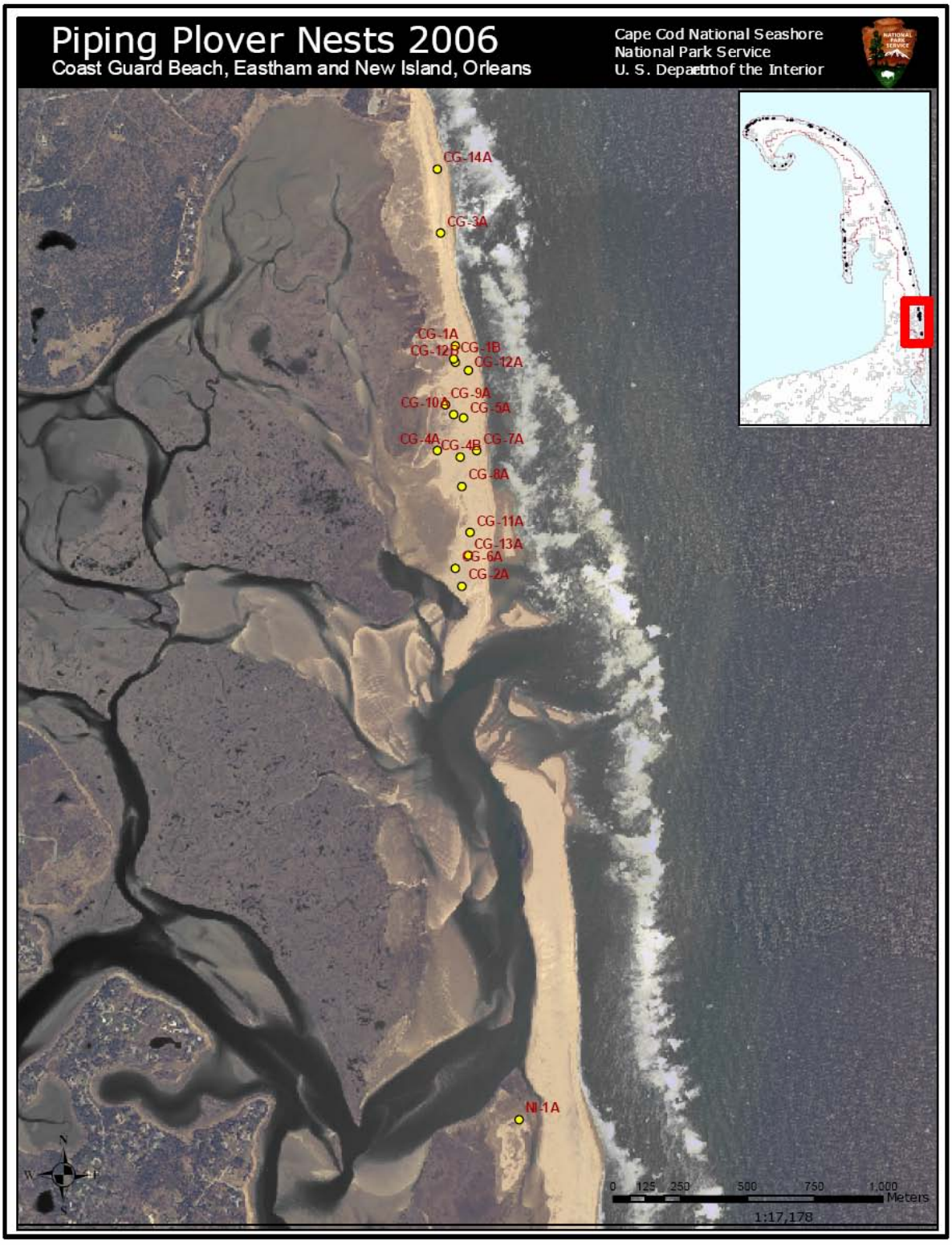
Meters
1:24,000

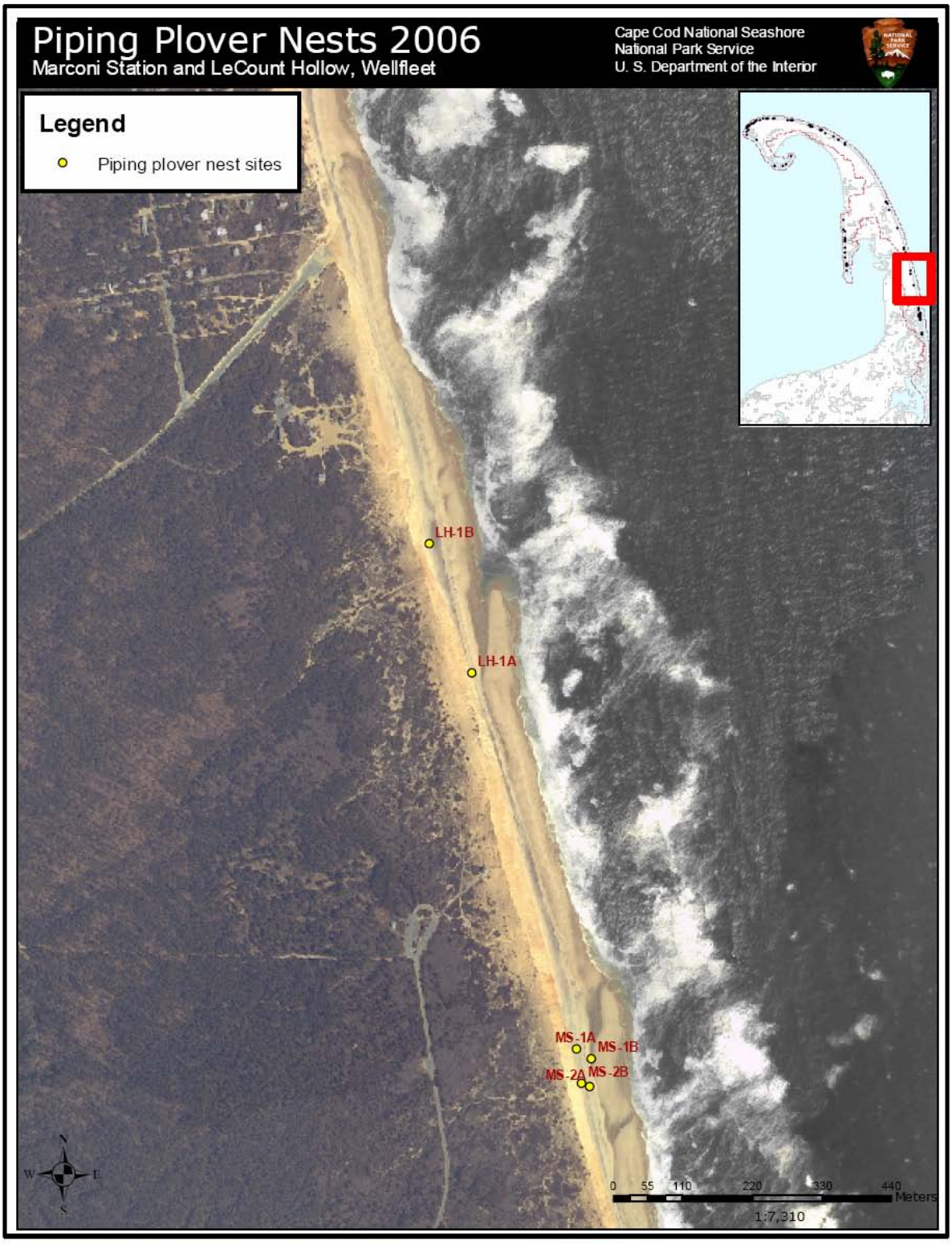
Appendix B

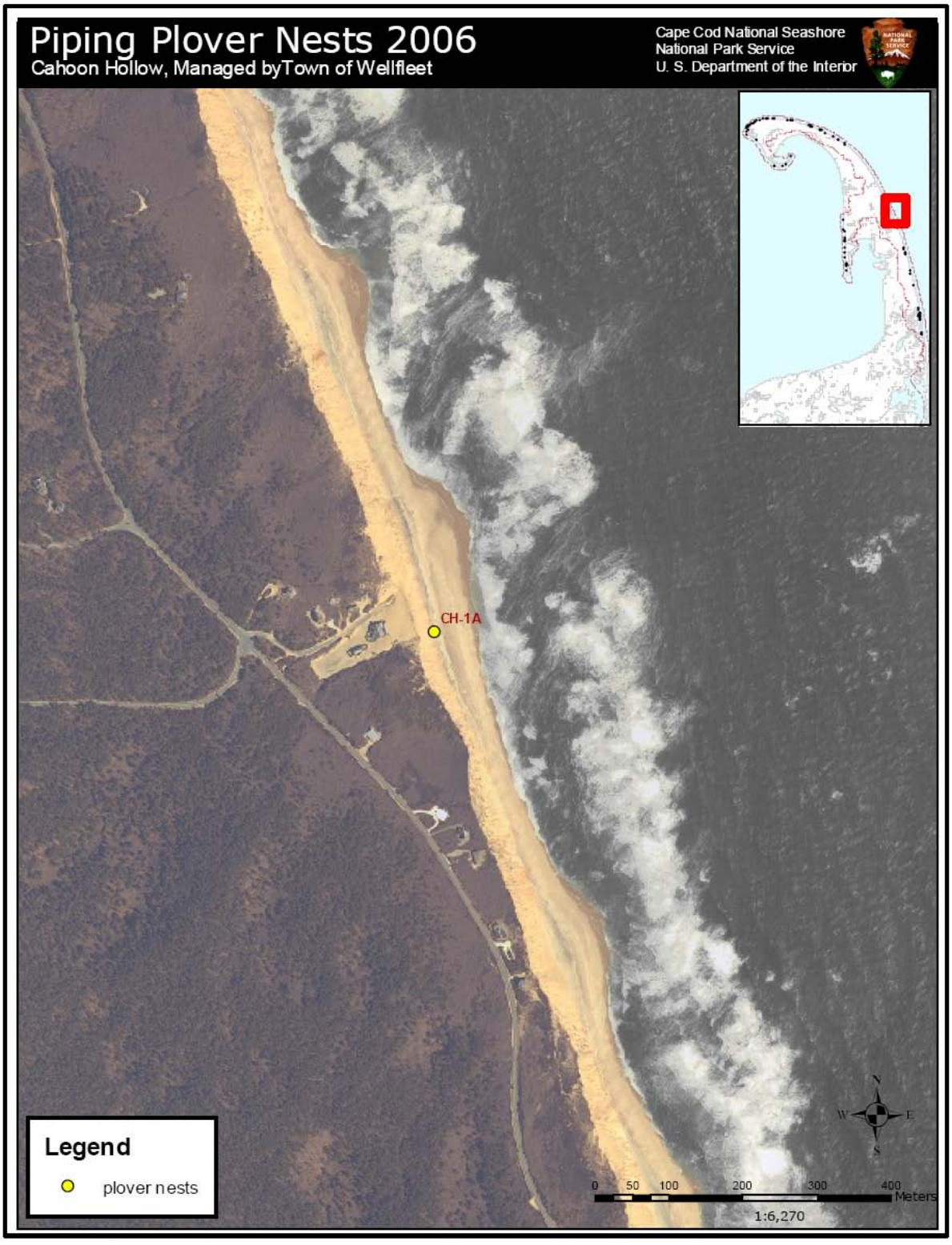
Maps of Cape Cod National Seashore, South District

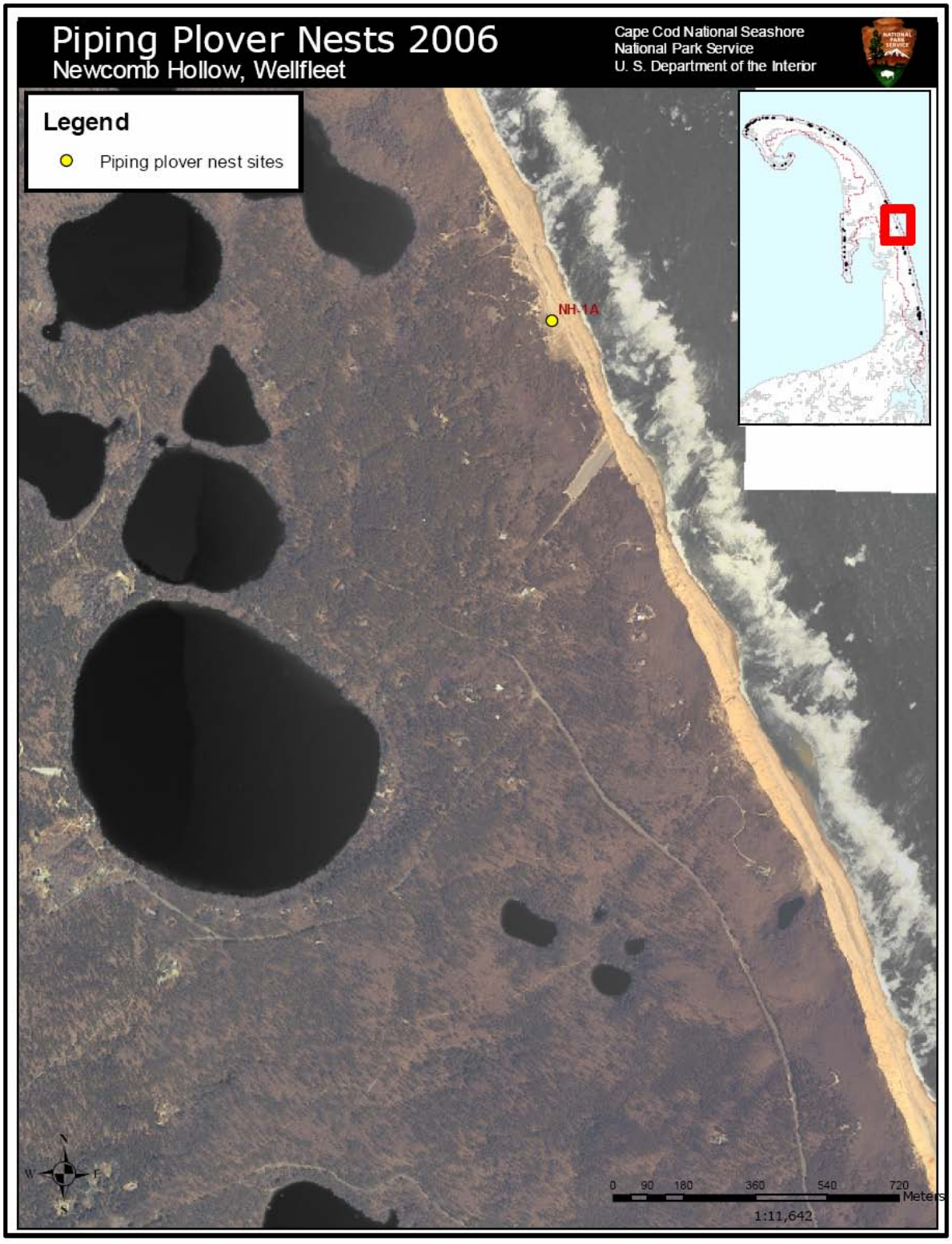
2006 Piping Plover Nest Sites

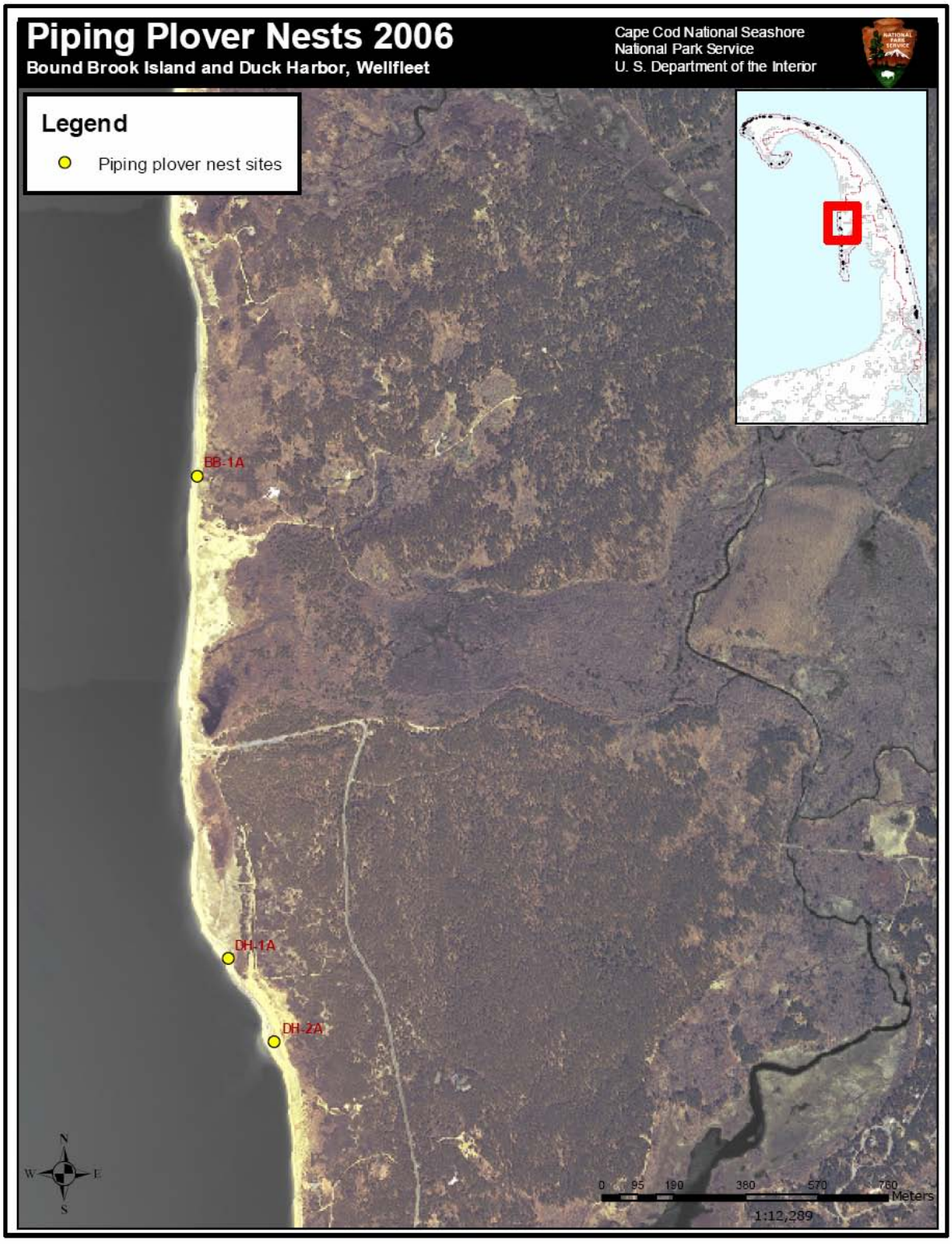

Piping Plover Nests 2006
Coast Guard Beach, Eastham and New Island, Orleans
Cape Cod National Seashore
National Park Service
U. S. Department of the Interior
CG-14A
CG-3A
CG-1A
CG-12B
CG-1B
CG-12A
CG-9A
CG-10A
CG-5A
CG-4A
CG-4B
CG-7A
CG-8A
CG-11A
CG-13A
CG-6A
CG-2A
NI-1A
N
W
E
S
0 125 250 500 750 1,000
Meters
1:17,178

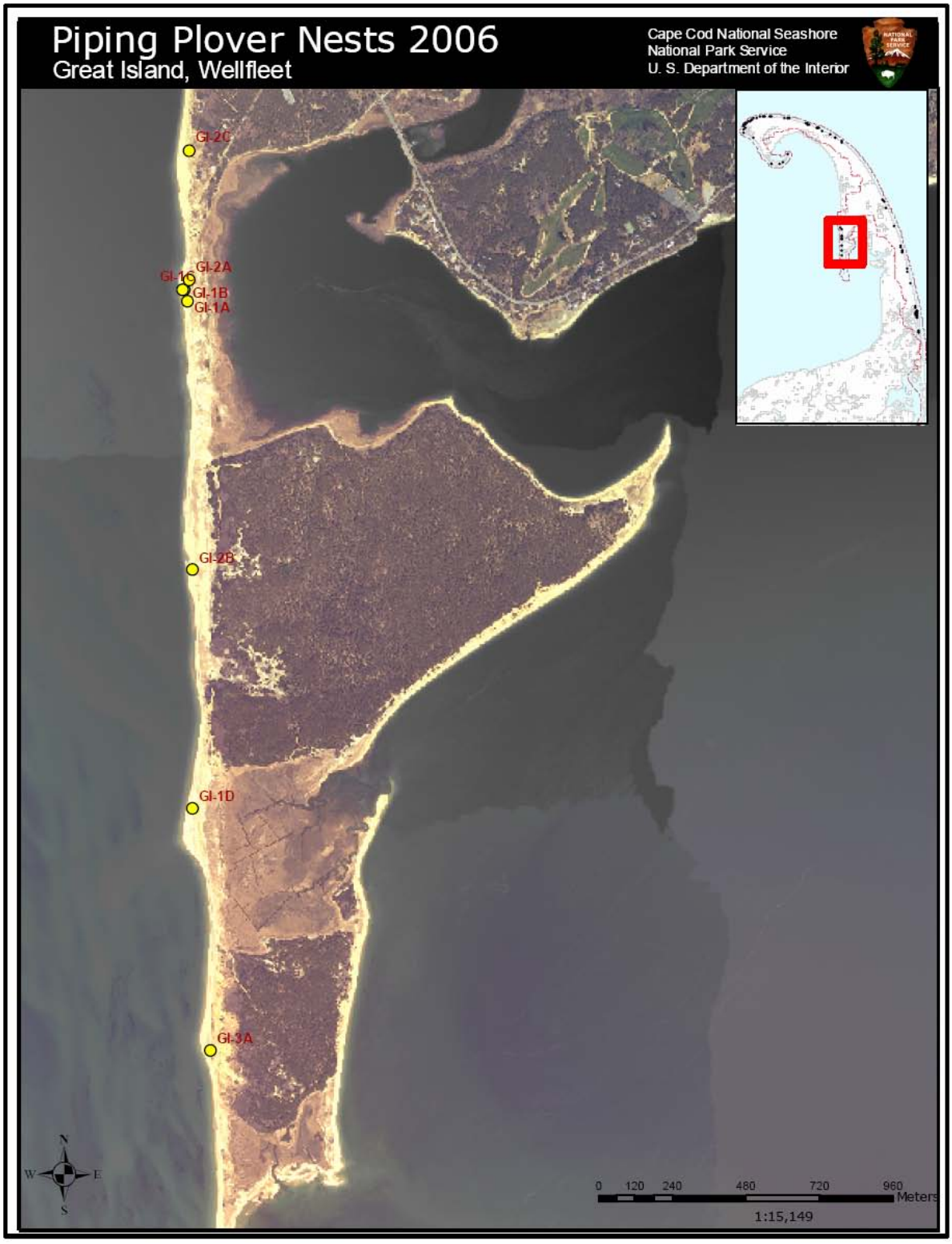

Piping Plover Nests 2006
Nauset Light, Eastham and Marconi Beach, Wellfleet
Cape Cod National Seashore
National Park Service
U. S. Department of the Interior
MB-1A
MB-1B
NL-1A
N
W
E
S
0 125 250 500 750 1,000
Meters
1:17,178

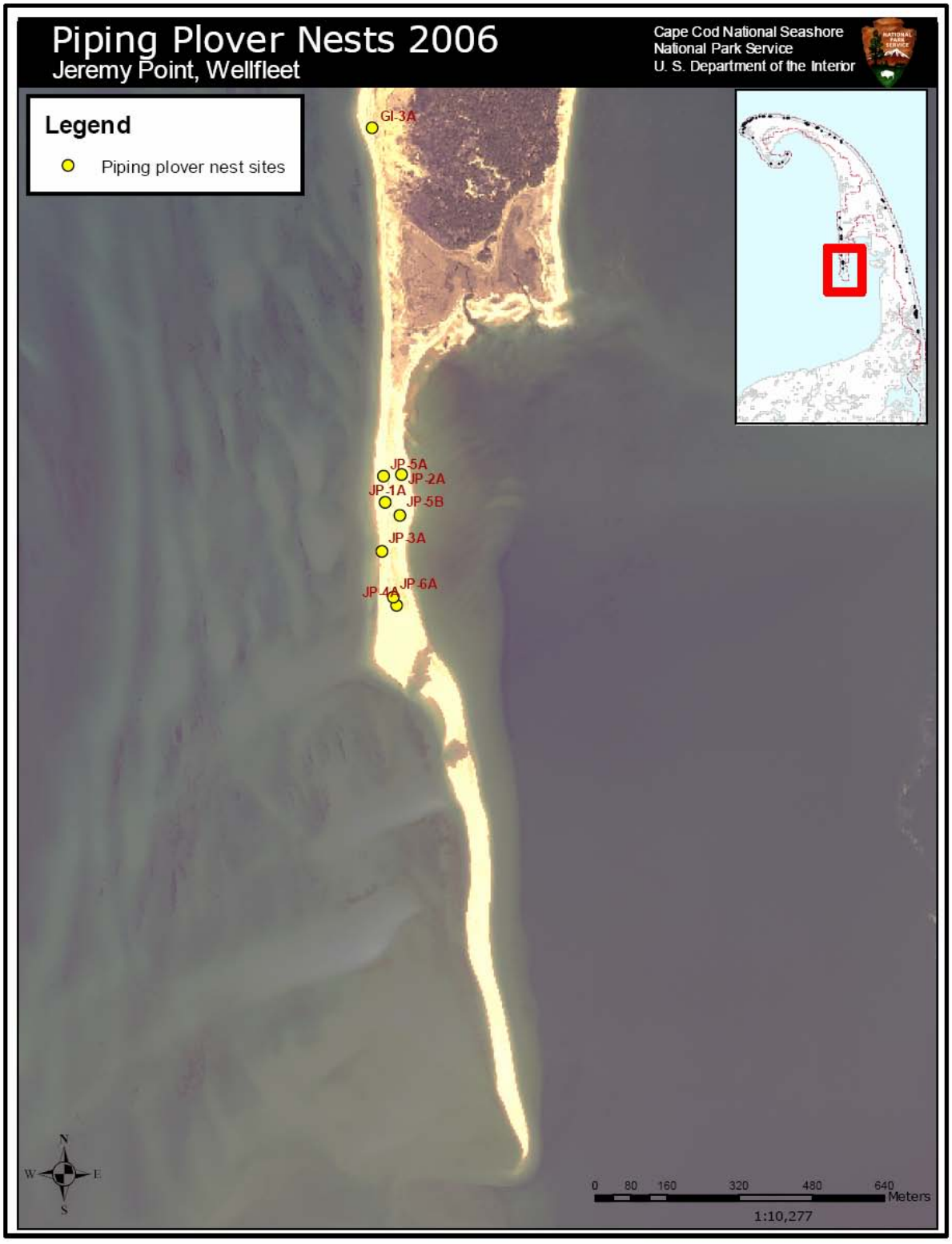

Piping Plover Nests 2006
Marconi Station and LeCount Hollow, Wellfleet
Cape Cod National Seashore
National Park Service
U. S. Department of the Interior
Legend
Piping plover nest sites
LH-1B
LH-1A
MS-1A
MS-1B
MS-2A
MS-2B
N
W
E
S
0 55 110 220 330 440
Meters
1:7,310


Piping Plover Nests 2006
Cahoon Hollow, Managed byTown of Wellfleet
Cape Cod National Seashore
National Park Service
U. S. Department of the Interior
CH-1A
Legend
plover nests
N
W
E
S
0 50 100 200 300 400
Meters
1:6,270


Piping Plover Nests 2006
Newcomb Hollow, Wellfleet
Cape Cod National Seashore
National Park Service
U. S. Department of the Interior
Legend
Piping plover nest sites
NH-1A
N
W
E
S
0 90 180 360 540 720
Meters
1:11,642


Piping Plover Nests 2006
Bound Brook Island and Duck Harbor, Wellfleet
Cape Cod National Seashore
National Park Service
U. S. Department of the Interior
Legend
Piping plover nest sites
BB-1A
DH-1A
DH-2A
N
W
E
S
0 95 190 380 570 760
Meters
1:12,289


Piping Plover Nests 2006
Great Island, Wellfleet
Cape Cod National Seashore
National Park Service
U. S. Department of the Interior
GI-2C
GI-2A
GI-1C
GI-1B
GI-1A
GI-2B
GI-1D
GI-3A
N
W
E
S
0 120 240 480 720 960
Meters
1:15,149


Piping Plover Nests 2006
Jeremy Point, Wellfleet
Cape Cod National Seashore
National Park Service
U. S. Department of the Interior
Legend
Piping plover nest sites
GI-3A
JP-5A
JP-2A
JP-1A
JP-5B
JP-3A
JP-6A
JP-4A
N
W
E
S
0 80 160 320 480 640
Meters
1:10,277