PIPING PLOVER (*Charadrius melodus*) MONITORING AT CAPE LOOKOUT NATIONAL SEASHORE

2010 SUMMARY REPORT

A piping plover chick foraging at the rock jetty ephemeral pool. NPS Photo 2010

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Abstract

A total of 43 pairs of piping plovers nested at Cape Lookout National Seashore (CALO) in 2010. The birds at CALO accounted for 70% of the nesting pairs in North Carolina. Twenty nine pairs nested on North Core Banks and 14 pairs on South Core Banks. Egg-laying was initiated on April 15th and a total of 58 nest attempts were documented. Thirty four nests hatched and 31 chicks fledged. Productivity was 0.72 chicks fledged per nesting pair. Four broods foraged on the oceanside in 2010.

Introduction

The piping plover is listed as a federal threatened species by the U.S. Fish and Wildlife Service. Piping plover monitoring at CALO began with a baseline study in 1989. The park is a significant nesting area, containing 70% of the nesting pairs in the state of North Carolina. CALO is also an important wintering and migratory site. There are three designated wintering critical habitat units within the seashore. Monitoring focuses on documenting reproductive success, implementing methods to increase the productivity of this threatened species, and non-breeding use surveys. This report contains a summary of monitoring results for 2010, comparisons to results from previous years and discussions based on long-term monitoring of piping plovers at CALO.

Site Description

Cape Lookout National Seashore is located in the southern Outer Banks of North Carolina between Beaufort and Ocracoke Inlets. With the natural closing of Old Drum and New Drum Inlets in March 2009 the seashore is currently divided into three barrier islands. The northernmost island, North Core Banks (NCB) is now approximately 23 miles long, extending from Ocracoke Inlet to Ophelia Inlet. South Core Banks (SCB) extends southward from Ophelia Inlet to almost 24 miles to Barden Inlet. The Core Banks have a northeast to southwest orientation and exhibit a low profile landscape. The third island, Shackleford Banks (SB) is nine miles long and has an east-west orientation with a higher dune system and larger areas of vegetation. All islands in the park are subject to constant and dramatic change by the actions of wind and waves.

Methods

Bird sanctuary signs were used to close all known piping plover nesting habitat to pedestrian and vehicular entry by April 1. Beginning in early April, nesting areas were surveyed daily for territorial pairs and nests. Potential habitat outside posted areas was monitored and posted as necessary with a minimum 150 foot buffer distance from scrapes and nests. The locations of nests were recorded, and the nests were monitored daily until they hatched or were lost. The Interim Protected species Management Plan/ Environmental Assessment, March 2006, developed for CALO provides guidance for monitoring and management.

Nests were protected with predator exclosures if the topography of the location was suitable and monitoring was sufficient. Exclosures were circular, 10 feet in diameter, made of 4"x 2" mesh wire fence anchored with steel rebar. Exclosures were topped with ¾" mesh bird netting. Because of high rates of losses to raccoons, nest exclosures were sometimes constructed before the clutch was complete.

After nests hatched, broods were monitored daily until the chicks fledged or were lost. Any ocean beach foraging areas were closed to vehicle traffic while the chicks were present.

The area between Ophelia Inlet and Ramp 24, 1 mile in length, was completely closed to vehicles (except for NPS monitors) from May 13th to August 6th. A second ocean beach closure to vehicles was established on the west side of Cape Point, 0.5 mile in length, from June 6th to July 11th specifically for piping plover chicks. The third ocean beach closure to vehicles was established at New Drum creek from mile 22.2 to Ophelia Inlet, 0.5 mile in length, from June 8th to July 8th. A forth ocean beach closure to vehicles was posted at Old Drum Flats from mile 18.4 to mile 19.3, from July 11th to July 28th. The closures began the day of expected hatch of the first nest at Ophelia Inlet (SCB) or when chicks were present on the ocean beach and remained in place until the last chick was fledged, confirmed lost, or moved out of area.

Counts of wintering and migrating piping plovers were made monthly from August to March. The counts were made near the 15th of each month in the non-nesting season. The ocean beach, inlets and soundside sandy beaches were surveyed. Banded birds were searched for more frequently during the fall migration.

Results

Nesting Pairs

A total of 43 pairs of piping plovers nested at CALO in 2010 (Table 1 and 2). Twenty nine pairs nested on North Core Banks (NCB), and fourteen pairs on South Core Banks (SCB). Birds nested in seven distinct areas (Figure 1). The area around Ophelia Inlet contained the highest number of nesting pairs. The birds at CALO accounted for 70% of the nesting pairs in North Carolina in 2010.

Table 1. Number of Pairs by Nesting Areas

ISLAND	NESTING AREA	NUMBER OF PAIRS
North Core Banks	Portsmouth Flats	13
North Core Banks	Old Drum Inlet	6
North Core Banks	New Drum Inlet	8
North Core Banks	Ophelia Island	2
South Core Banks	Plover/Ophelia Inlet	11
South Core Banks	Cape Point	2
South Core Banks	Power Squadron Spit	1

Table 2. Piping Plover Breeding Pairs at Cape Lookout National Seashore 1989-2010

	1989	1992	1993	1994	1995	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Ocracoke Inlet	0	2	0	2	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0
Portsmouth Flats	14	8	9	7	8	17	15	9	11	9	8	6	4	6	8	14	14	12	13
Kathryn-Jane Flats	7	11	9	12	11	10	8	2	1	1	2	1	1	2	1	3	0	1	0
Old Drum Inlet	3	2	1	1	2	1	1	0	0	0	0	1	0	0	0	0	2	3	6
New Drum Inlet (NCB/MCB) Mile 21 to 22	4	5	9	10	6	3	2	3	1	2	2	2	2	3	3	5	6	5	8
New Drum Inlet (SCB)/ Ophelia Island Mile 22 to 23	3	3	4	5	4	2	3	3	2	3	2	2	2	2	2	2	2	2	2
Plover Inlet/ Ophelia Inlet Mile 23 to 24	0	0	0	0	0	1	1	1	1	1	1	1	4	8	15	17	18	11	11
Cape Point	0	0	0	0	0	0	0	1	0	0	0	0	0	4	3	2	3	2	2
Power Squadron Spit	3	2	3	2	2	1	2	1	0	0	0	1	0	1	1	2	1	1	1
Shackleford Banks														1	0	0	0	0	0
CALO Total	34	33	35	39	35	36	32	21	16	16	15	14	13	27	33	45	46	37	43

Nests

There were 58 nesting attempts made in 2010. The earliest nest initiation was believed to be on 15 April and the latest on 24 June. Thirty seven nests were on NCB and 21 on SCB. Of the 58 nests, 15 were re-nests. Refer to Figures 2-8 for detailed maps of nests and nesting sites, 2009 DOQQ base layer. Thirty four of the nests hatched and 31 chicks were fledged from 19 different broods. The average clutch size was 3.51 eggs and 98 of 204 eggs hatched. Productivity for CALO was 0.72 chicks fledged per nesting pair (Table 3 and Appendix 4).

Table 3. Piping Plover Nesting Success at CALO 1989-2010

YEAR	NESTING PAIRS	NESTS	CHICKS FLEDGED	FLEDGE RATE
1989	34	56	25	0.74
1992	33	39 (NCB only)	7 (NCB only)	0.25
1993	35	56	26	0.74
1994	39	66	9	0.23
1995	35	43	15	0.43
1997	36	41	7	0.19
1998	32	39	11	0.34
1999	21	22	2	0.09
2000	16	18	8	0.50
2001	16	19	5	0.33
2002	15	20	4	0.27
2003	14	15	6	0.43
2004	13	13	12	0.92
2005	27	31	23	0.85
2006	33	37	29	0.88
2007	45	58	11	0.24
2008	46	57	9	0.20
2009	36	45	30	0.83
2010	43	58	31	0.72

Predator Exclosures

In 2010, predator exclosures were used to protect 46 (79%) nests. Thirty (65%) of the nests with exclosures hatched. Five nests with predator exclosures were lost to flooding, seven nests were lost to mink predation, one nest was lost to raccoon predation, one nest was lost to ghost crab predation, one nest was abandoned, and one nest was lost for unknown reasons. Predator exclosures were not used on 12 nests. Of these four nests hatched, two were lost to ghost crabs, two nests were lost to unknown causes, two were lost to flooding, one nest was lost to mink predation, and one was lost to unknown predation (Appendix 1). Table 4 below shows likely causes of nest losses for all nests. The predator column includes eight mink losses, three ghost crabs losses, one raccoon loss, and one unknown predator.

Table 4. Likely Causes of Piping Plover Nest Losses in 2010.

NESTING AREA	# NESTS	# LOST	PREDATORS	STORM	ABANDONED	UNKNOWN
Portsmouth Flats	15	3	0	2	0	1
Old Drum Inlet (NCB)	10	5	3	2	0	0
New Drum Inlet (NCB)	9	2	0	1	1	0
Ophelia Island (NCB)	3	0	0	0	0	0
Plover Inlet (Mile 23.6)	17	13	10	1	0	2
Cape Point	3	1	0	1	0	0
Power Squadron Spit	1	0	0	0	0	0
Total	58	24	13	7	1	3

Brood Foraging

Four broods foraged on the ocean beach in 2010. Two of these broods were observed foraging on both the oceanside and soundside at Ophelia Inlet and Old Drum Flats. One brood at Cape Point foraged at both the west oceanside and the ephemeral pool on the upper beach. The other brood at Cape Point foraged at the ocean beach and moved 1.74 miles during a spring storm to forage at an ephemeral pool at the Rock Jetty. All other chicks foraged on soundside beach, sand flats, mudflats and ephemeral pools in areas closed to vehicles and in most cases all entry.

Predator Control

In response to mink (*Mustela vison*) predation on nests at Plover Inlet eight small live traps were deployed for a month period. No mink were trapped.

Non-nesting Piping Plover Surveys

Surveys in 2010 covered the entire seashore. Table 5 below list this year's counts. Appendix 3 lists non-nesting counts from 2003-2010. Figure 9 illustrates non-breeding piping plover observations and critical habitat units.

Table 5. Non-Nesting Piping Plover Counts at Cape Lookout National Seashore, 2010.

	January	February	March	August	September	October	November	December
NCB	17	8		125	70	35	8	4
SCB	8	5	10	23	32	13	19	3
SB	11	11	6	4	17	4	9	6
Total	**36**	**24**	**16**	**152**	**119**	**52**	**36**	**13**

Banded Piping Plovers

Thirty eight re-sight observations of 21 banded birds were made in the park in 2010. Wintering birds from the endangered Great Lakes breeding population were recorded in the seashore throughout the non-breeding season, except March 2010.

Discussion

Nesting Habitat

The natural inlet closing process at Old Drum and New Drum Inlets has created good nesting habitat at those sites. As these inlets migrated to the southwest large sand flats developed in their wake. The closing of Old Drum inlet in 2009 has allowed for increased monitoring, from once weekly to daily, of the New Drum flats and Ophelia Island sites for the last two breeding seasons. It also allowed public beach traffic to drive and recreate at these sites. The area has been limited to boat access for the previous ten years (1999-2009). The mudflats on the soundside side of these former inlets and recently created Ophelia Inlet continue to be productive for piping plovers and used by many other shorebird species. On the north end of SCB at Ophelia Inlet a large open sand flat has developed over the last three years. As revegetation has taken hold of much the northern end of SCB, nesting pairs have moved to this new sand flat and out to the oceanside in front of the dunes. Three nests were located in front of the dunes on the oceanside from mile 23 to mile 24. Each of these nests required enlarging the original bird closure to give the 150 feet buffer. This high quality nesting habitat from Old Drum to Plover Inlet contained 63% (27 pairs) of the nesting pairs in 2010. Another important area, Portsmouth flats continued to provide nesting habitat on NCB for 13 pairs (30%). In 2010, there were no nests on the beach berm, but there were three nests on the middle Portsmouth flats in between mile 2 and mile 3. An ephemeral pool, intertidal flats, and sand flat supported two nesting pairs at Cape Point. Heavily revegetated Kathryn-Jane flats did not attract any nesting pairs in 2010. Power Squadron spit only contained one nesting pair.

Pair Numbers

The number of breeding pairs in the seashore increased from 37 in 2009 to 43 in 2010. This may be due to good productivity in 2009. The fledging success was 0.83 (30 fledglings) in 2009. The pair increases primarily occurred at Old Drum flats and New Drum flats. These areas have gained in micro elevation and have stabilized. It appears that these habitats could even support more pairs.

Nest Success

2010 brought low hatch success for piping plover nests in the park. Only 58% of the nests and 48% of the eggs hatched successfully. The thirteen predator related nest losses accounted for 54% of total losses. Mink predation took eight nests, three were ghost crab predation, one was raccoon predation, and one was lost to an unknown predator. One (4%) nest was abandoned. Three (12%) nest losses were recorded as unknown. Nest hatch success by area for the time period of 1998 to 2010 is presented in Table 6.

In 2010, predator exclosures were effective in protecting nests from predators except for mink and ghost crab. Seven nests with predator exclosures were lost to mink at Plover Inlet on SCB. The mink were able get in the 2X4 inch wire mesh to get the eggs. Since 1997, at least 33 nests protected by exclosures have lost eggs to ghost crabs. Predator exclosure use decreased slightly from 80% in 2009 to 79% in 2010. There was concern that the exclosures maybe attracting mink to eggs at Plover Inlet and use was discontinued for the season. A nest that the adults moved to the edge of the predator exclosure was predated by a raccoon on NCB. There were no observations of raccoons circling or digging at predator exclosures on SCB or NCB.

Predator exclosures have generally been effective in increasing hatch success. From 1997-2010, 66% of the nests protected with exclosures hatched, compared with 38% of the nests left unprotected.

Fledging Success

The fledging success for piping plovers at CALO was the sixth highest recorded for the seashore at 0.72 chicks fledged per nesting pair in 2010 (Chart 2). The actually number of chicks fledged, 31 fledglings, is the highest on record for CALO.

Traditionally unproductive, Portsmouth Flats continues to produce chicks for the second year in a row in 2010 with 10 fledglings from 13 pairs for a productivity of 0.77. The Old Drum Flats nesting site has grown from one nesting pair in 2008 to six nesting pairs in 2010. The six pairs hatched five nests and produced one fledgling for a productivity of 0.17. The New Drum site, which includes old Ophelia Island, had 10 pairs, 12 nests and fledged 16 chicks for a productivity of 1.6 in 2010. At the Plover Inlet site three fledglings were produced from 11 pairs for a fledge success of 0.27. At Cape Point two pairs fledged one chick for a productivity of 0.5. Power Squadron Spit had no fledgling success in 2010. Kathryn-Jane Flats had no nesting activity in 2010. These site by site reproductive successes for 2010 can be compared to the long term averages in Table 6. In 2010 Portsmouth Flats and New Drum had a significantly higher fledge success than the 13 year average for these same sites. Table 6 reflects positive numbers only, Kathryn-Jane, Old Drum, and Cape Point have multiple years with zero pairs and nests.

In 2010, oceanside foraging areas contributed to fledgling success. At Ophelia Inlet on NCB two chicks from one brood foraged both on the oceanside and soundside. One of these chicks fledged. At Cape Point six chicks of two broods foraged on the west ocean tide line. One of these chicks fledged. The brood from nest SCB 5 moved 1.74 miles from the Cape Point nest to an ephemeral pool near the rock jetty. Unfortunately after this long journey the chicks were lost to unknown reasons. At Old Drum two chicks from one brood foraged at both the oceanside and soundside. The two chicks were only seen twice on the oceanside and were not seen again after a strong wind event. Chicks at the above areas received ocean beach closures.

Table 6. Differences in Reproductive Success between Major Nesting Areas for the Period of 1998-2010.

Nesting Area	Hatch Success	Fledge Success
Portsmouth Flats	47%	0.37 chicks per pair
Kathryne-Jane Flats	47%	0.61 chicks per pair
Old Drum Flats	53%	0.23 chicks per pair
New Drum& Ophelia Island	66%	0.61 chicks per pair
Plover Inlet	59%	0.75 chicks per pair
Cape Point	75%	0.23 chicks per pair

Predators

Although there has been some suspect tracks on NCB and one unconfirmed report of an adult on SCB, red fox (*Vulpes vulpes*) continues to be absent in the seashore in 2010. There has been no confirmed evidence and no impacts to piping plovers. Mink impacted nesting success at Plover Inlet on SCB. Evidence points to mink predation on eight nests at this site. The mink have learned to get through the wire mesh. This may explain some unknown nest losses at this site in the previous two years as well. Mink were first recorded on SCB in 2007. Raccoon and feral cat tracks at nest sites continue to be a concern. One nest was taken by raccoon on NCB. In 2010 no attempts were made to dig into predator exclosures by raccoons. This has been a concern on SCB in previous years.

Human Disturbance

Posted closures for bird nesting areas were not always respected by park visitors. Law enforcement rangers issued five citations for pedestrians in bird area and two citations for vehicles in bird areas in 2010.

Dogs were also a potential source of disturbance to nesting birds. Law enforcement rangers issued 32 dogs off leash citations, 19 written warnings, and 196 verbal warnings in 2010.

Non-nesting piping plovers

CALO continues to be an important migration stopover location and wintering site for piping plovers. In 2010, 517 observations of piping plovers were recorded in the seashore during the non-nesting season. The area on NCB near Ocracoke Inlet again had high numbers of birds in spring and fall migrations; as well the area from Old Drum Inlet flats to Ophelia Inlet had high numbers of birds. On NCB, 125 piping plovers were counted on August 15th and 70 on September 13th. Nineteen banded piping plovers from the endangered Great Lakes population were re-sighted in 2010. In addition two birds banded in the Bahamas were re-sighted in 2010.

US Fish and Wildlife Service Biological Opinion

The USFWS provided CALO a biological opinion that included four performance measures for the Interim Protected Species Management Plan. Forty three breeding pairs were found in CALO in 2010 surpassing the target of 25 or more pairs of performance measure one. Forty three pairs produced 58 nests (1.34 nest per pair) surpassing the target of at least one nest per breeding pair of performance measure two. The 43 nesting pairs produced 31 fledglings for a fledge rate of 0.72, which is slightly below the target of 0.75 of performance measure three. Winter plover surveys at CALO were conducted at least once monthly from August until March to meet performance measure four.

Conclusions

2010 was a record year for the number of piping plover fledglings, 31 in total. This surpasses the 2009 high of 30 fledglings. The majority of the fledglings were produced from North Core Banks at two sites, New Drum and Portsmouth Flats. New Drum Flats raised 16 chicks and Portsmouth Flats produced 10 chicks. In 2009 cool wet weather was initially thought to have helped fledgling success, yet 2010 proved to be a hot dry summer and fledgling success remained relatively high. Further study of the environmental/weather's role in reproductive success is needed.

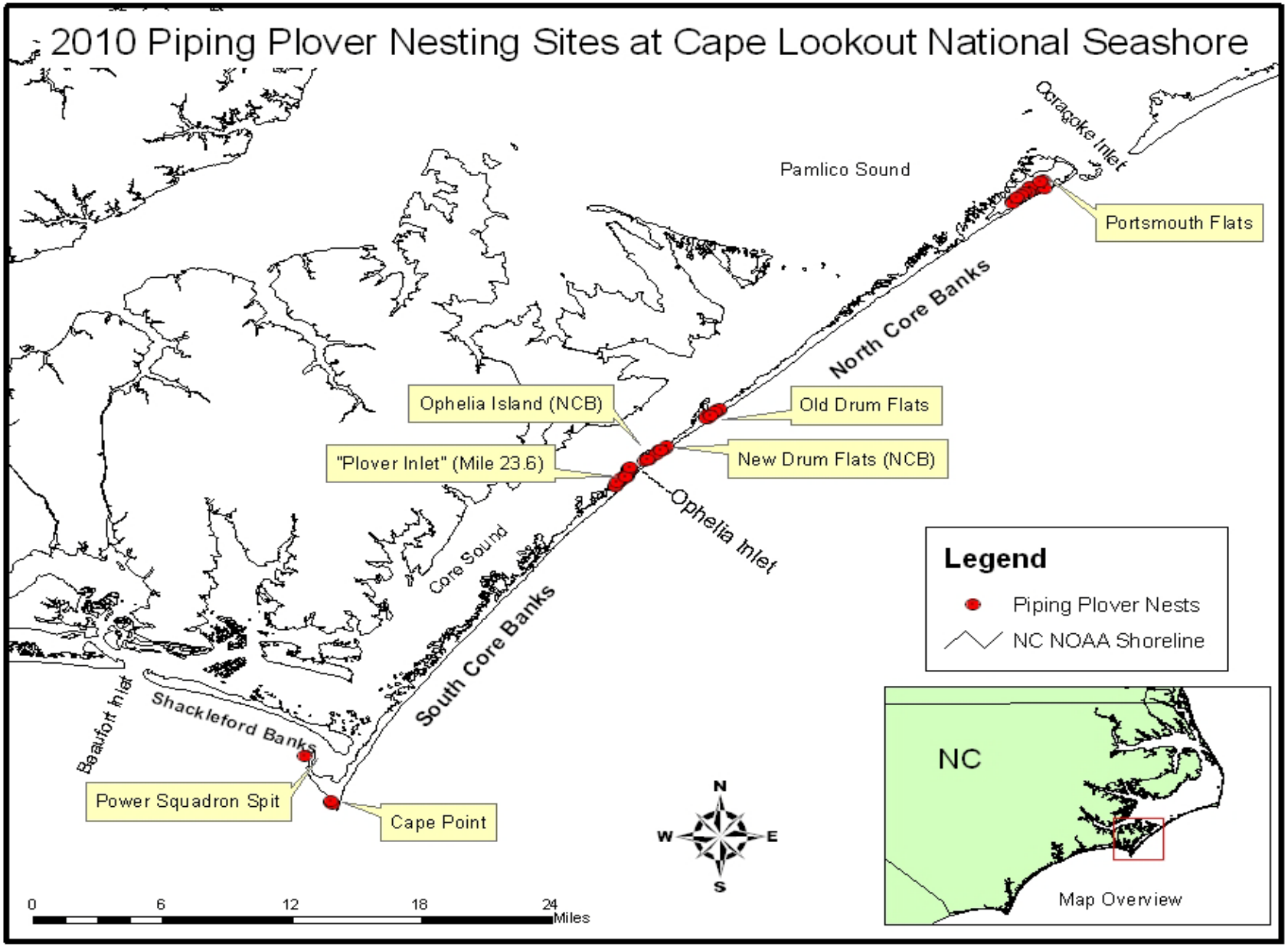

Figure1. Map of 2010 Piping Plover Nesting Sites at Cape Lookout National Seashore.

Appendix 1- 2010 PIPING PLOVER NEST DATA

NORTH CORE BANKS

Nest #	Pair #	MILE	DATE FOUND	CLUTCH SIZE	EXCLOSURE	HATCH DATE	EGGS HATCHED	# FLEDGED	COMMENTS
1	1	21.49	17-Apr	4	22-Apr	15-May	4	3	fledged at day 27 on 6/11, foraged on soundside of washover fan
2	2	18.77	27-Apr	3	29-Apr	25-May	2	0	nest flooded during hatching on 5/25 and 5/26, chicks lost
3	3	19.15	29-Apr	4	29-Apr	29-May	1	0	nest flooded on 5/26, 1 chick, 1 broken egg, 1 egg in nest, 1 dead developed chick still egg shaped, chick last seen on 6/11
4	4	22.21	29-Apr	4	30-Apr	25-May	1	0	nest flooded during hatching on 5/25 and 5/26, chick lost
5	5	21.35	1-May	4	4-May	28-May	4	3	flooded on 5/26, nest maintained, fledged at day 27 on 6/23
6	6	3.15	1-May	2	14-May	22-May	2	1	fledged at day 27 on 6/18, foraged on back flats
7	7	21.48	4-May	3	7-May	27-May	3	3	fledged at day 27 on 6/23, foraged on soundside
8	8	21.96	5-May	4	5-May	28-May	1	1	fledged at day 30 on 6/27, foraged on soundside
9	9	1.76	6-May	4	14-May	na	0	0	nest flooded on 5/26
10	10	2.79	6-May	4	7-May	na	0	0	nest flooded on 5/26
11	11	18.5	3-May	4	7-May	na	0	0	nest flooded on 5/26
12	12	22.38	8-May	3	15-May	7-Jun	3	2	fledged at day 31 on 7/8, Tracy saw chick at wrack line on 6/8-closed ocean beach, foraged on ocean beach and soundside
13	13	19.05	25-May	3	na	na	0	0	flooded on 5/26
14	14	2.14	9-May	4	15-May	9-Jun	4	3	fledged at day 27 on 7/7, foraged at pond 3
15	15	21.54	12-May	4	14-May	na	0	0	nest flooded on 5/26
16	16	3.05	13-May	4	21-May	16-Jun	4	0	chicks moved to back creek/ grass, chicks lost by 6/20
17	17	2.07	20-May	4	21-May	9-Jun	4	0	chicks not seen, confirmed lost by 6/18
18	18	2.07	20-May	3	na	20-May	3	3	fledged at day 29 on 6/18, foraged at pond 3
19	19	2.32	29-May	3	31-May	4-Jun	3	1	fledged at day 25, on 6/29, foraged at pond 3
20	20	1.61	31-May	3	2-Jun	27-Jun	2	1	fledged date unknown, foraged at pond 1

21	21	1.76	2-Jun	4	4-Jun	na	0	0	nest is gone by 6/9
22	22	21.84	3-Jun	3	8-Jun	na	0	0	abandoned 6/15, nest sanded in
23	23	18.64	3-Jun	3	4-Jun	na	0	0	incubated 27 days beyond hatch date, raccoon depredation on 7/28 after nest was move to edge of exclosure by adults.
24	24	2.59	4-Jun	4	7-Jun	28-Jun	3	0	chicks lost by 7/5, searched flats and ocean tideline on 7/6
25	25	2.73	4-Jun	4	6-Jun	29-Jun	4	0	chicks lost by 7/5, searched flats and ocean tideline on 7/6
26	26	21.38	2-Jun	4	8-Jun	30-Jun	4	2	fledged by 8/5, foraged on soundside
27	27	21.2	6-Jun	4	8-Jun	4-Jul	3	0	chicks not seen, confirmed lost by 7/14
28	9	1.7	9-Jun	4	15-Jun	4-Jul	4	1	foraged at pond 1
29	11	18.55	7-Jun	4	8-Jun	5-Jul	4	0	foraged on oceanside and soundside, beach closed on 7/11, chicks disappeared after 5 days of strong SW winds
30	4	22.26	8-Jun	4	12-Jun	6-Jul	1	1	fledged at day 30 on 8/5, foraged on soundside
31	2	18.73	11-Jun	3	14-Jun	7-Jul	1	1	fledged at day 29 on 8/5, foraged on soundside, chick not seen for 14 days, reappears at inlet creek-moved 0.5 mile
32	15	21.54	11-Jun	2	16-Jun	4-Jul	1	1	fledged at day 32 on 8/5, foraged on soundside, adults seen on oceanside on 7/22, but chicks not seen
33	13	19.1	12-Jun	3	na	na	0	0	nest on shell flat west of Old Drum, posted on 6/14, predated on 6/16-unkown
34	28	3.25	15-Jun	4	16-Jun	6-Jul	3	0	cat tracks at nest on 7/6, chicks went south of nest , chicks lost by 7/9
35	10	2.93	18-Jun	4	21-Jun	9-Jul	3	0	chicks lost by 7/13
36	3	19.2	23-Jun	3	26-Jun	na	0	0	6/25 one egg out of nest at ghost crab hole, down to 2 eggs by 7/1, 1 egg on 7/7, nest lost on 7/26 with yolk at egg out of nest-G.C.
37	29	19	24-Jun	3	27-Jun	21-Jul	1	0	chick lost by 8/3

29 nesting pairs, 37 nests, 27 hatched nests, 27 chicks fledged

SOUTH CORE BANKS

Nest #	Pair #	MILE	DATE FOUND	CLUTCH SIZE	EXCLOSURE	HATCH DATE	EGGS HATCHED	# FLEDGED	COMMENTS
1	1	23.21	19-Apr	4	22-Apr	na	0	0	lost by 5/13-no PE problems, no eggs, no visible tracks, mink?
2	2	23.42	26-Apr	4	30-Apr	na	0	0	lost by 5/22-small mammal tracks at PE
3	3	23.29	28-Apr	4	28-Apr	na	0	0	lost by 5/8-eggs gone-mink?
4	4	44.48	30-Apr	4	na	na	0	0	flooded nest on 4/30, full moon tide
5	5	43.63	4-May	4	5-May	22-May	4	0	foraged on ocean beach, during a spring storm brood moved over 1.74 mile in 2 days from nest at Cape Point to ephemeral pool at rock jetty, all chicks lost by 5/29
6	6	23.24	6-May	4	10-May	na	0	0	camera on nest on 5/22, nest flooded on 5/25
7	7	23.61	6-May	4	8-May	20-May	4	2	fledged at day 27 on 6/17, foraged on soundside
8	8	24.12	6-May	3	10-May	na	0	0	nest lost by 5/19-no clues, suspected mink predation
9	9	23.89	7-May	4	8-May	na	0	0	camera on nest on 5/15, nest lost by 5/21, mink tracks at nest
10	10	23.65	7-May	3	8-May	na	0	0	nest lost by 5/13, one broken egg outside nest-mink?, BF,B/BL:-,W adult-Bahama Bird
11	11	23.38	7-May	4	8-May	na	0	0	nest lost by 5/13, eggs gone, PE Ok, no tracks, Mink?
12	3	23.3	21-May	3	na	na	0	0	nest lost by 6/3, no clues/unknown, nest not exclosed
13	4	44.54	22-May	4	24-May	7-Jun	4	1	fledged at day 35 on 7/11, foraged on ocean beach on west side of point
14	8	24.12	3-Jun	3	na	na	0	0	no PE since nest in vegetation, nest lost by 6/7,small mammal tracks nearby
15	6	23.27	5-Jun	3	na	na	0	0	no PE, egg loss on 6/10, and 6/17, no eggs on 6/30
16	9	23.9	5-Jun	4	na	5-Jul	4	0	chicks foraged on soundside, one dead chick found on 7/9, all chicks lost by 7/13

17	12	47.16	6-Jun	3	12-Jun	3-Jul	2	0	chick foraged on soundside, chick lost by 7/13-day 9
18	1	23.19	10-Jun	2	na	na	0	0	nest in low grassy dunes, no PE
19	13	23.21	17-Jun	3	na	1-Jul	3	0	chicks foraged on soundside, chicks lost by 7/10
20	2	23.45	22-Jun	2	na	na	0	0	one egg lost on 6/24, ghost crab hole nearby, all eggs lost by 6/28
21	14	23.26	26-Jun	4	na	10-Jul	4	1	fledged at day 25 on 8/4, foraged on soundside

14 nesting pairs, 21 nests, 7 hatched nests, 4 chicks fledged

2010 Piping plover breeding census results: June 1-9

North Core Banks: 27 pairs

Portsmouth Flats	12 Pairs
Old Drum Inlet	5 pair
New Drum Inlet	8 pair
Ophelia Island	2 pair

South Core Banks: 10 pairs

Plover Inlet	7 Pairs
Cape Point	2 Pairs
Power Squadron Spit	1 Pair

Shackleford Banks: 0 piping plovers

Cape Lookout National Seashore: 37 pairs

Appendix 3. Monthly counts of non-nesting piping plovers 2003-2010

Date	North Core Banks	South Core Banks	Shackleford Banks	CALO Total
August-03	54	42	4	100
September-03	74	?	?	74+
October-03	28	12	7	47
November-03	7	14	7	28
December-03	6	10	7	23
January-04	0	10	9	19
February-04	0	15	12	27
March-04	16	3	29	48
August-04	49	14	6	69
September-04	50	15	13	78
October-04	18	11	18	47
November-04	13	7	16	36
December-04	16	4	12	32
January-05	26	5	6	37
February-05	0	1	6	7
March-05	7	0	10	17
August-05	29	14	1	44
September-05	44	25	6	75
October-05	18	3	9	30
November-05	4	2	9	15
December-05	2	2	2	6
January-06	3	5	9	17
February-06	0	0	10	10
March-06	0	21	7	28
August-06	16	22	6	44
September-06	27	7	5	38
October-06	22	6	7	35
November-06	14	0	8	22
August-07	46	46	11	103
September-07	52	27	2	81
October-07	18	26	17	61
November-07	12	8	22	42
December-07	10	9	14	33
January-08	0	2	11	13
February-08	0	6	10	16
March-08	6	6	10	22
August-08	41	28	17	86
September-08	16	20	10	46
October-08	25	9	20	54
November-08	11	4	9	24
December-08	9	7	8	24
January-09	6	18	13	37
February-09	2	9	12	23
March-09	10	17	?	≥27
August-09	83	26	2	111
September-09	144	33	10	187
October-09	22	19	13	54
November-09	18	12	12	42
December-09	12	14	23	49
January-10	17	8	11	36
February-10	8	5	11	24
March-10		10	6	≥16
August-10	125	23	4	152
September-10	70	32	17	119
October-10	35	13	4	52
November-10	8	19	9	36
December-10	4	3	6	13

Appendix 4. Chart 1 Piping Plover Nesting and Chart 2 Piping Plover Productivity.

Chart 1. Piping Plover Nesting at Cape Lookout National Seashore

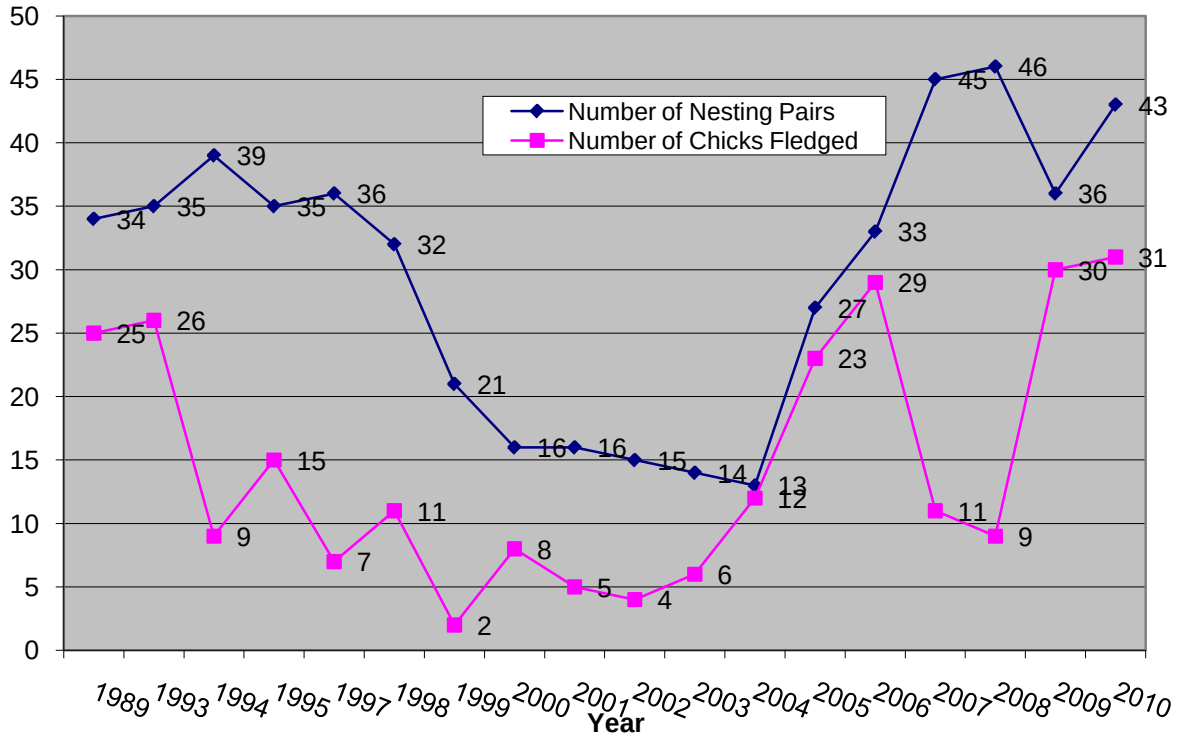

Chart 2. Piping Plover Productiviy

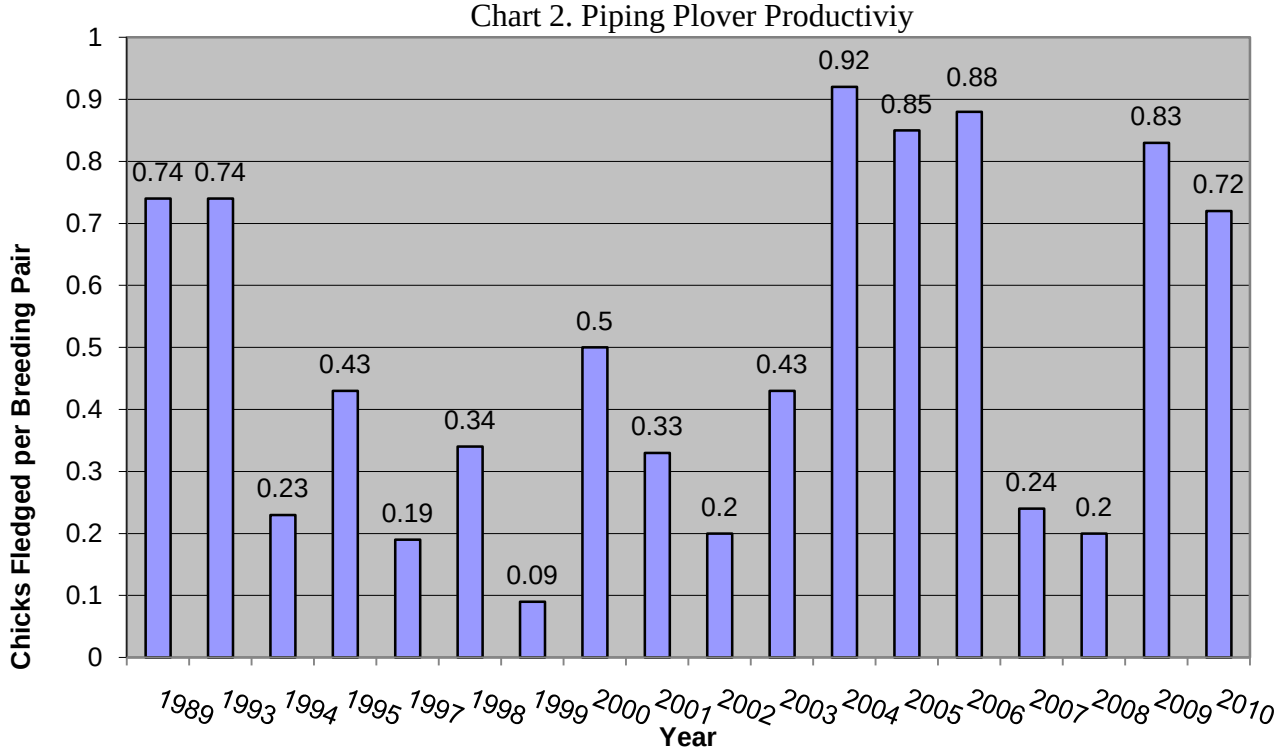

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Figure 2. North Portsmouth Flats Nesting Site

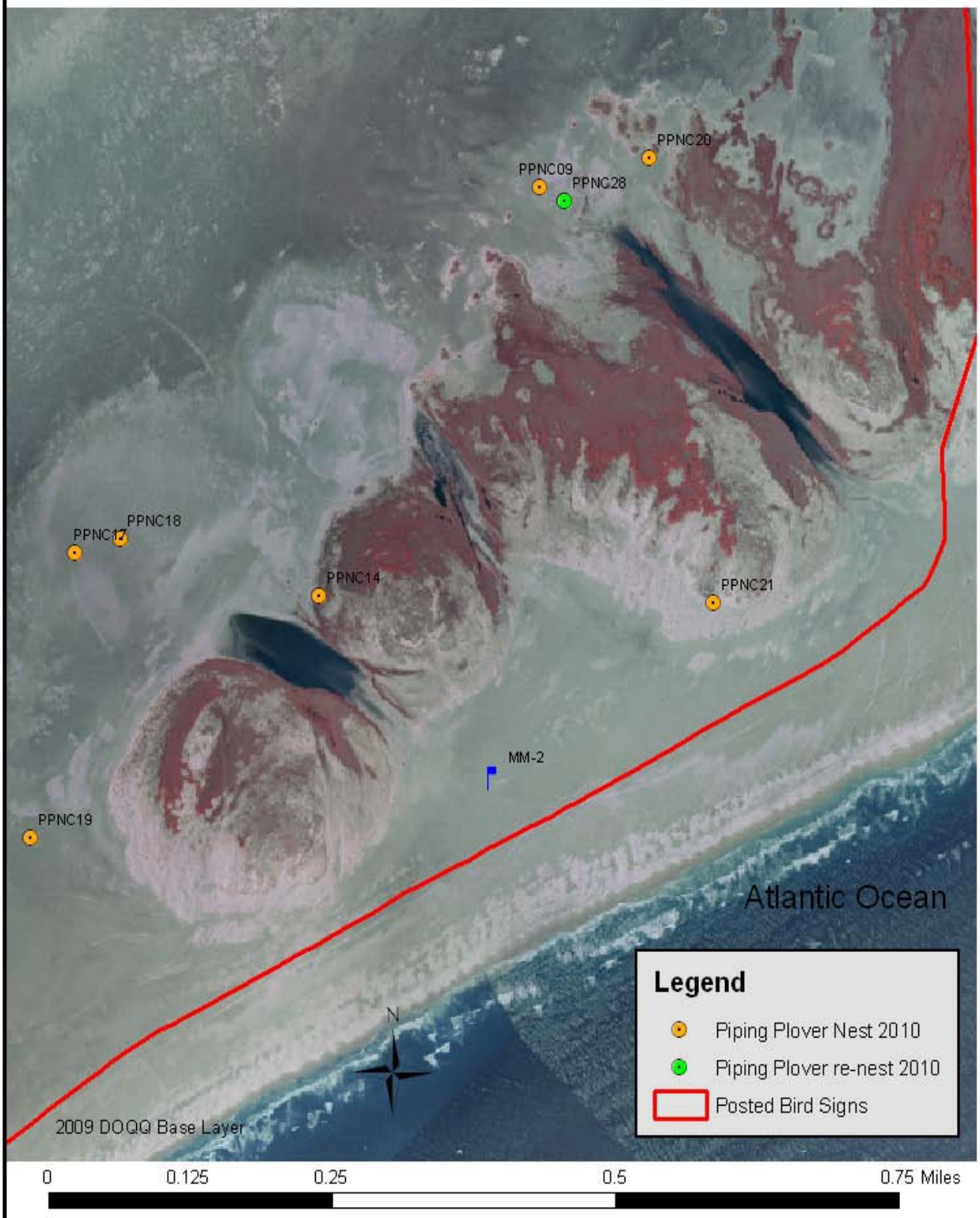

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Figure 3. South Portsmouth Flats Nesting Site

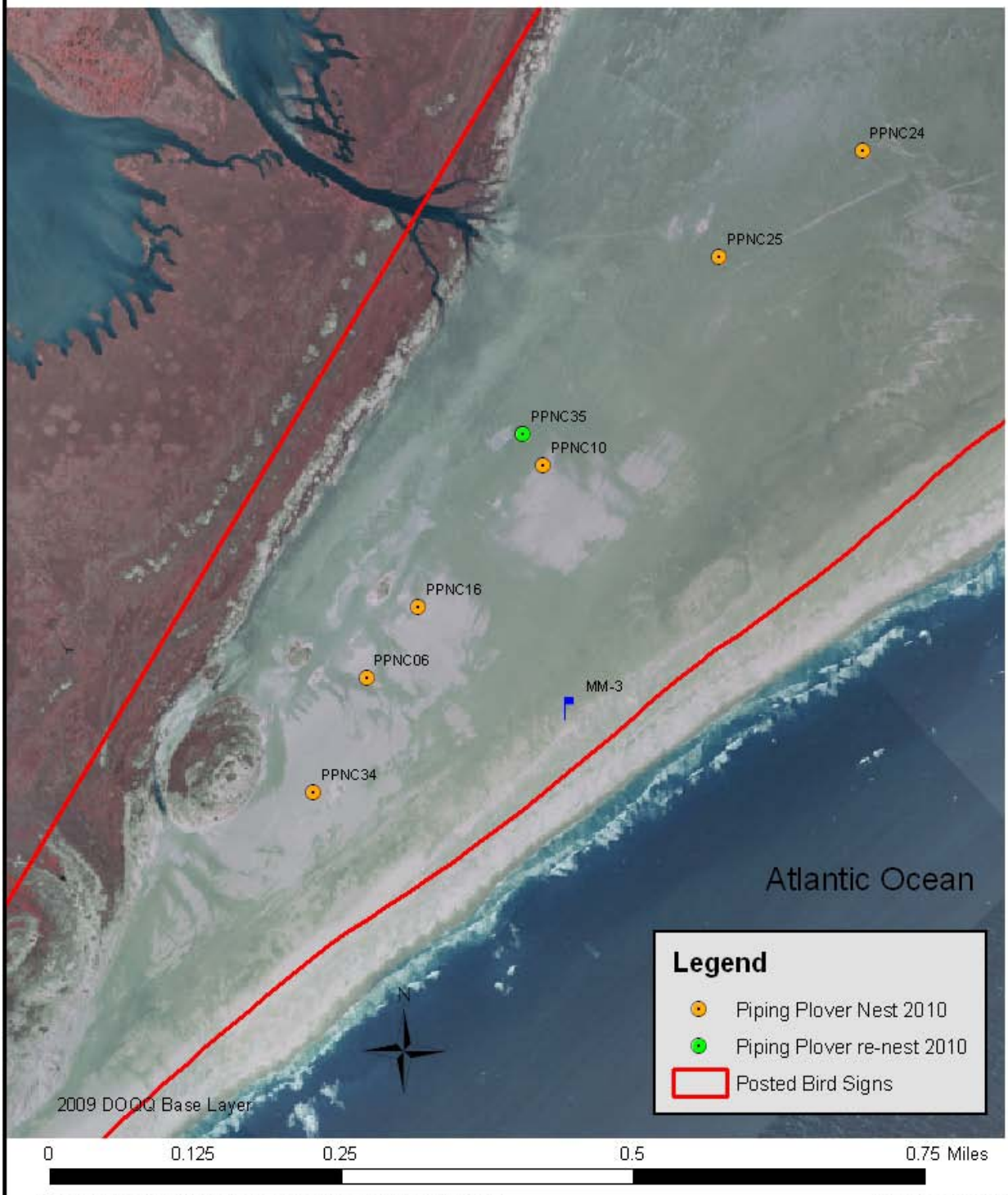

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Figure 4. Old Drum Flats Nesting Site

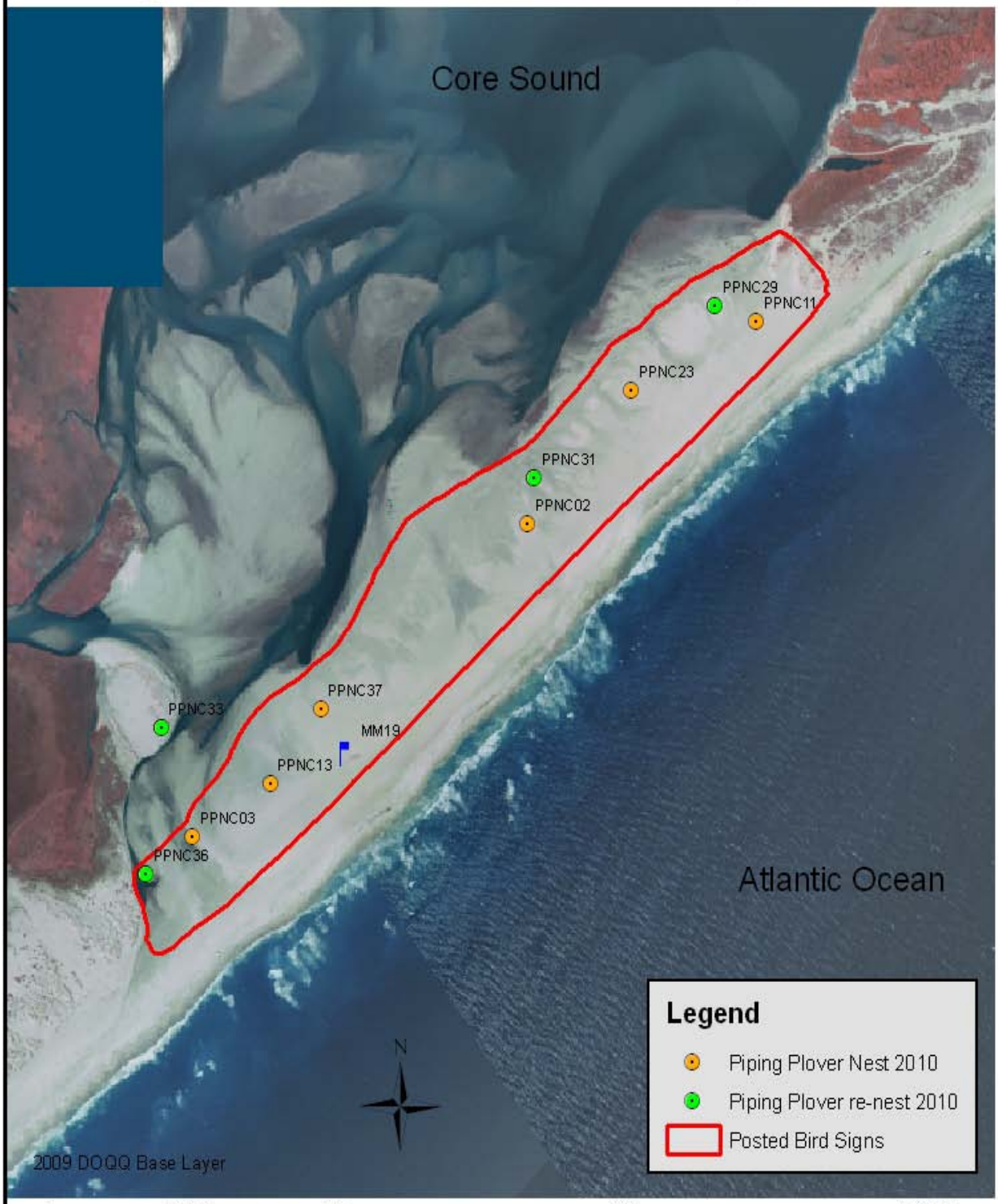

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Figure 5. New Drum Flats and Ophelia Island Nesting Site

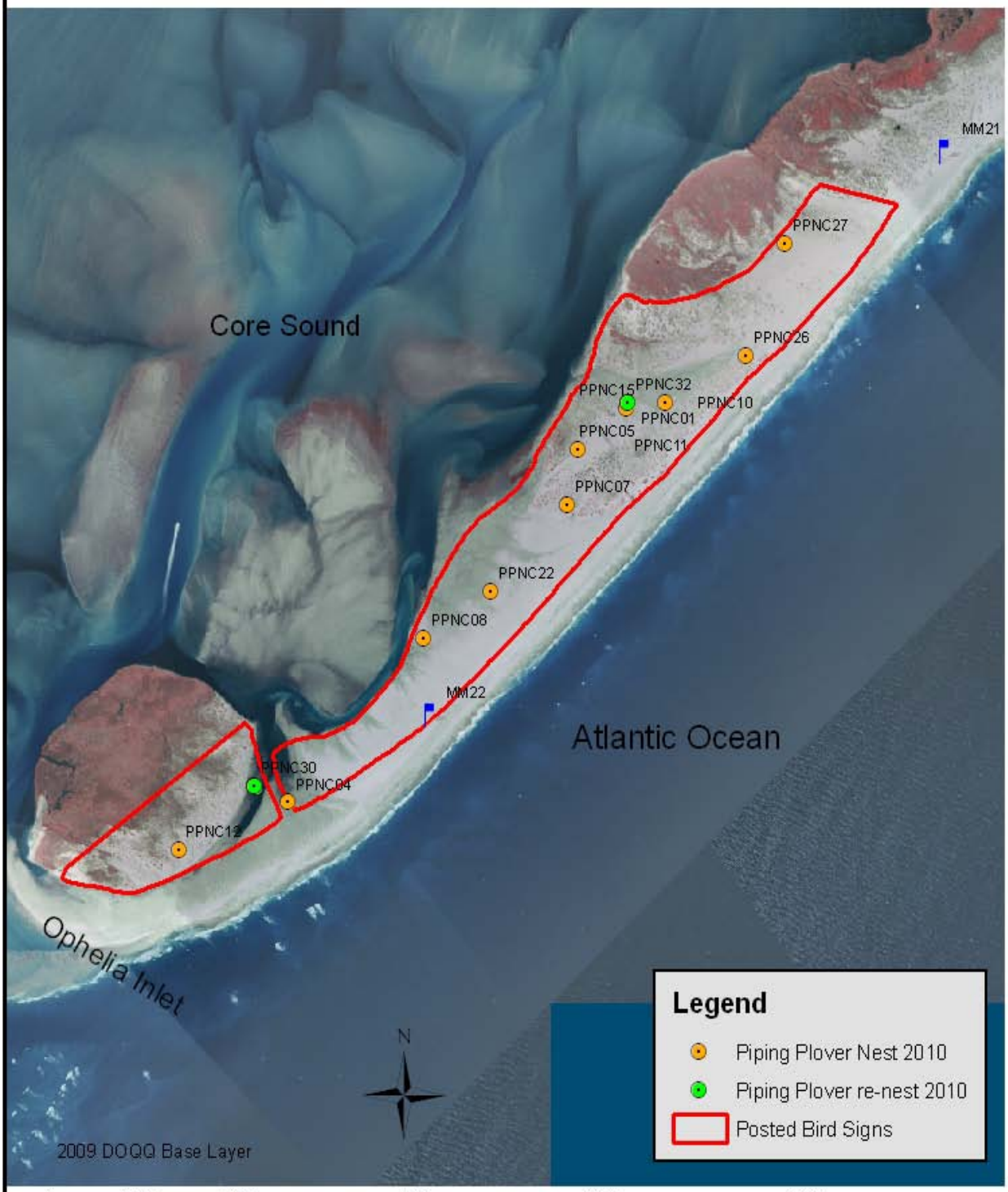

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Figure 6. Plover Inlet Nesting Site

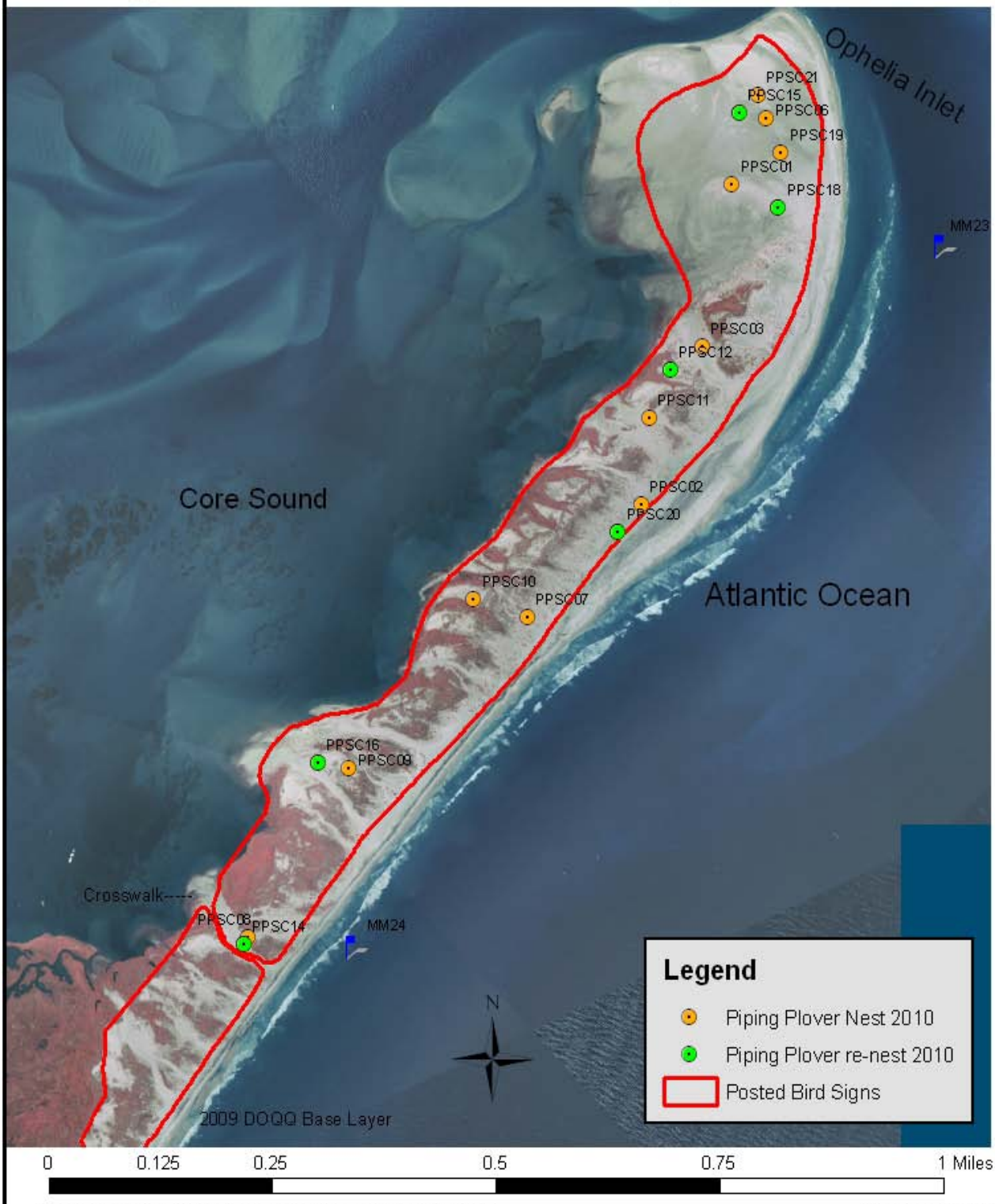

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Figure 7. Cape Point Nesting Site

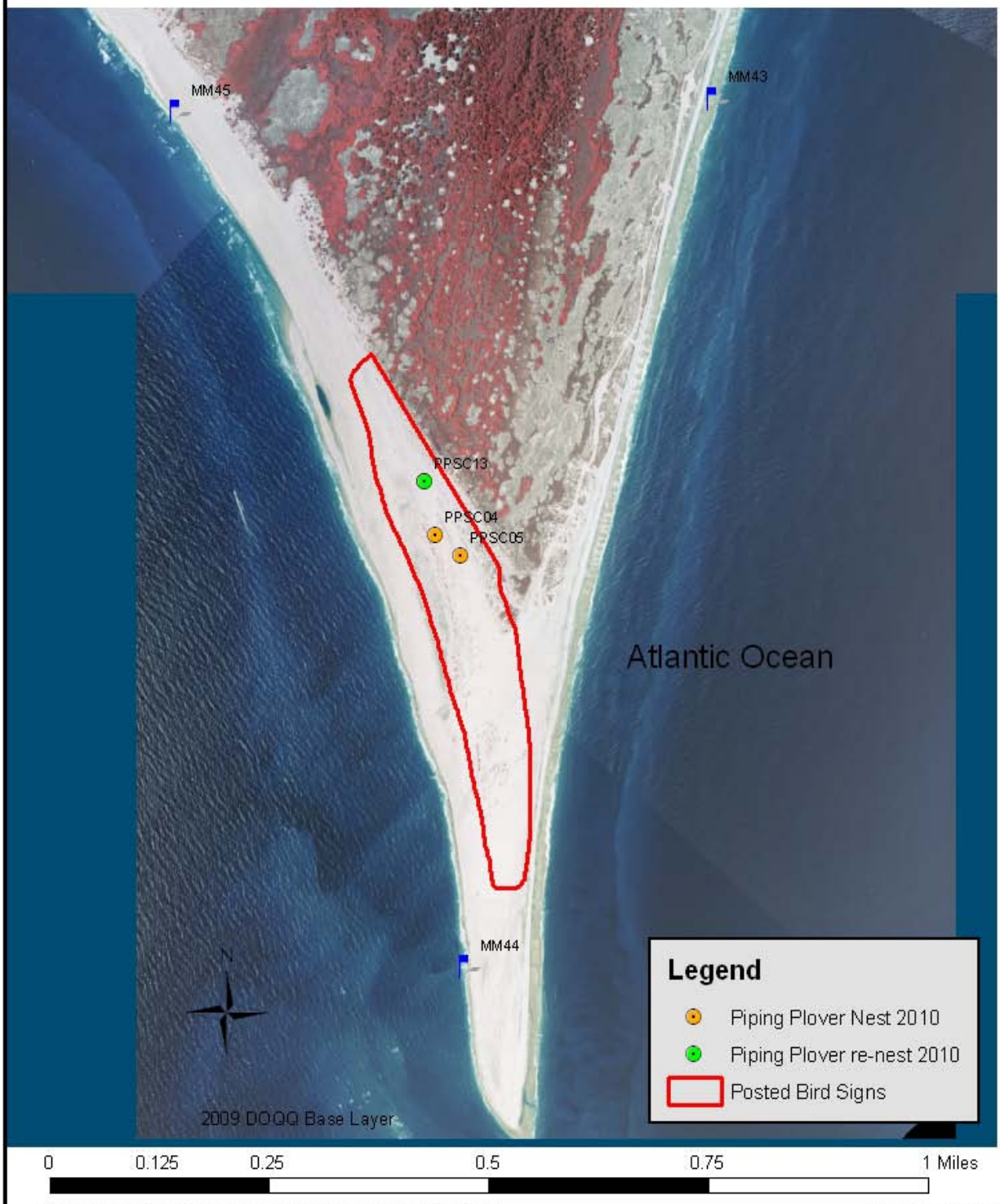

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Figure 8. Power Squadron Spit Nesting Site

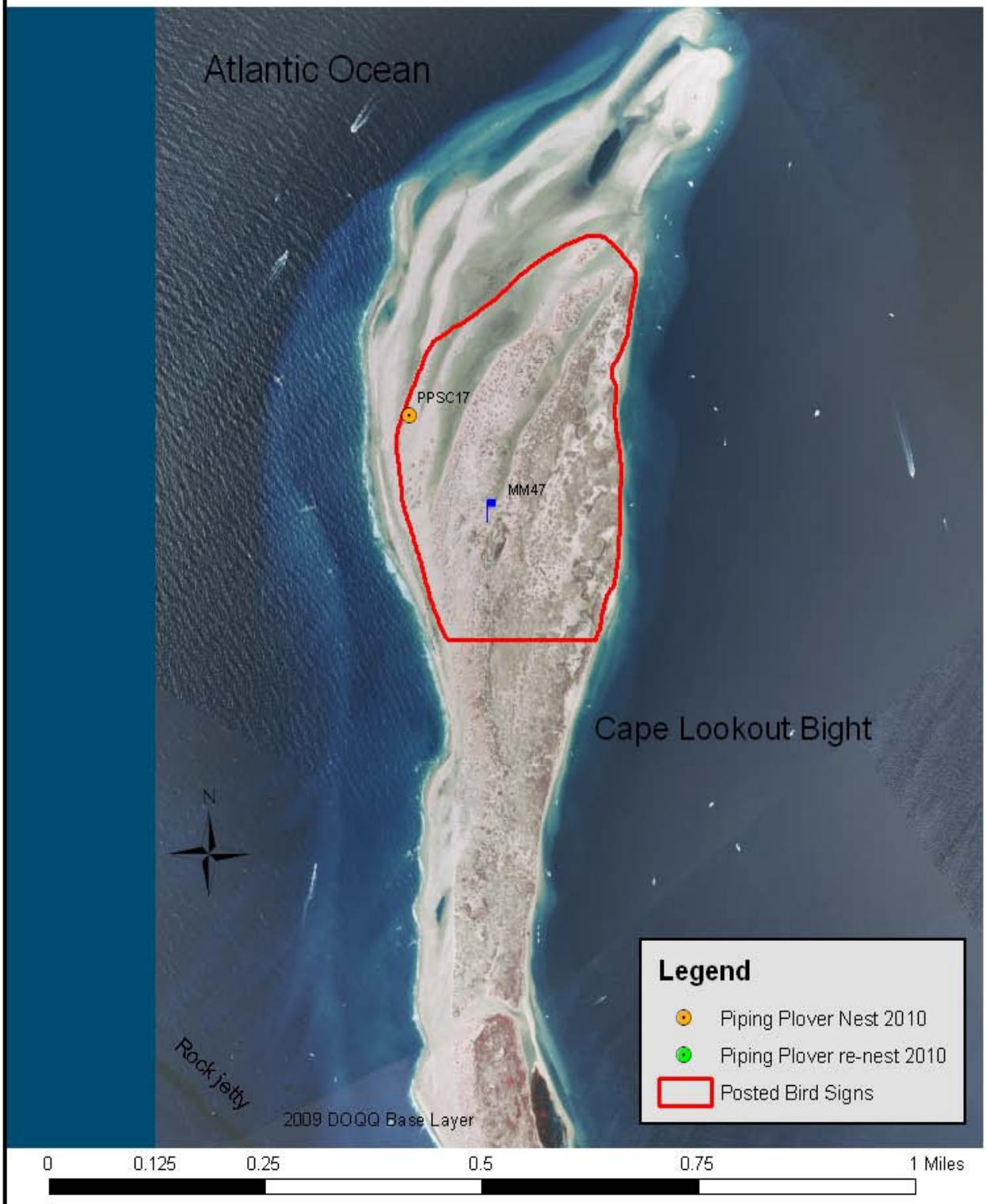

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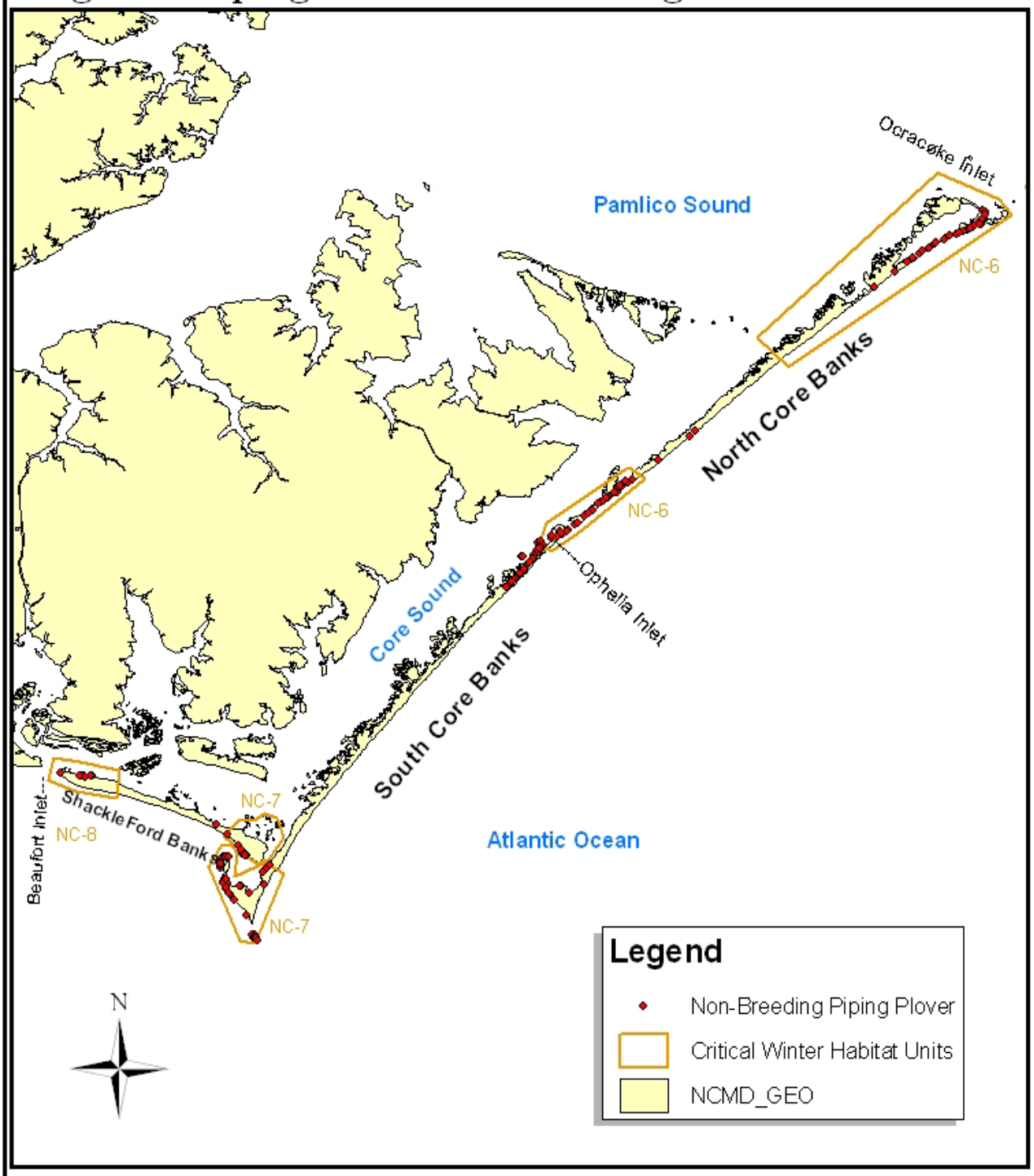
Figure 9. Piping Plover Non-Breeding Observations 2010



0 3 6 12 18 24 Miles

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