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

2008 SUMMARY REPORT

Old Drum Inlet spit fledgling with luxated wing joint. NPS Photo 2008

Prepared by:
Jon Altman
NATIONAL PARK SERVICE
CAPE LOOKOUT NATIONAL SEASHORE
131 CHARLES STREET
HARKERS ISLAND, NC 28531

Abstract

A total of 46 pairs of piping plovers nested or held a territory at Cape Lookout National Seashore (CALO) in 2008, the most recorded since monitoring began in 1989. The birds at CALO accounted for 70% of the nesting pairs in North Carolina in 2008. Fifteen pairs nested on North Core Banks, six pairs on Middle Core Banks, two pairs on Ophelia Island, and twenty two pairs on South Core Banks. Sixty percent of nesting pairs were located within 3 miles of New Drum Inlet. Egg-laying was initiated on 8 April and a total of 57 nest attempts were documented. Thirty one nests hatched and nine chicks fledged. Productivity was 0.20 chicks fledged per nesting pair. Significant nesting site changes include Old Drum Inlet spit holding two breeding pairs while Kathryn-Jane Flats had no breeding pairs.

Introduction

The piping plover is listed as a federal threatened species by the U.S. Fish and Wildlife Service. Piping plover monitoring at Cape Lookout National Seashore 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 2008, 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. The park is currently divided into five barrier islands. The northernmost island, North Core Banks (NCB) is approximately 19 miles long, extending from Ocracoke Inlet to Old Drum Inlet. From Old Drum Inlet to New Drum Inlet is a 3-mile long island of land formerly connected to NCB known unofficially as Middle Core Banks (MCB). In 2005 an inlet formed during Hurricane Ophelia creating a ¾ mile long island south of New Drum Inlet known as Ophelia Island (OI). South Core Banks (SCB) extends southward from Ophelia Inlet almost 25 miles to Barden Inlet. The Core Banks have a northeast to southwest orientation and exhibit a low profile landscape. The fifth island, Shackleford Banks (SB) is 9 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 searched at least three times per week for territorial pairs and nests. Potential habitat outside posted areas was monitored and posted as necessary. The locations of nests were recorded, and the nests were monitored daily until they hatched or were lost. The area between Old Drum Inlet and Ophelia Inlet was only monitored about once a week.

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 (except once a week in the area between Old Drum and Ophelia Inlet) 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, length was 1mile, was completely closed to vehicles (except for NPS monitors) from May 9 to August 11. A second ocean beach closure to all vehicles, NPS monitors walked, was established on the west side of Cape Point, length was 0.45 mile, from May 28 to June 9 and from July 18 to August 11. The third ocean beach closure to vehicles (except for NPS monitors) was established from ramp 18 to Old Drum Inlet, length was 0.6 mile from July 1 to August 5. The closures began the day of expected hatch of the first nest in that area and remained in place until the last chick was confirmed lost or fledged. A seasonal vehicle closure for Middle Core Banks and Ophelia Island, length approximately 3 miles, was in effect from April 1 to August 31.

Counts of wintering and migrating piping plovers were made monthly from August to March. The counts were made near the fifteenth 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 46 pairs of piping plovers nested or held a territory at CALO in 2008, the most recorded since monitoring began in 1989 (Table 1 and 2). Two male individuals were also recorded. Fifteen pairs nested on North Core Banks (NCB), six pairs on Middle Core Banks (MCB), two pairs on Ophelia Island (OI), and twenty two pairs on South Core Banks (SCB). On NCB one pair left after the nest failed at Portsmouth Flats in May, one non-nesting pair occupied a territory at Old Drum Inlet and the two individual males held territory at Kathryn-Jane but didn't attract mates. 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 2008.

Table 1. Number of Pairs by Nesting Areas

ISLAND	NESTING AREA	NUMBER OF PAIRS
North Core Banks	Portsmouth Flats	14
North Core Banks	Old Drum Inlet	2
Middle Core Banks	New Drum Inlet	6
Ophelia Island		2
South Core Banks	Plover/Ophelia Inlet	18
South Core Banks	Cape Point	3
South Core Banks	Power Squadron Spit	1

Table 2. Piping Plover Breeding Pairs at Cape Lookout National Seashore 1989-2008

	1989	1992	1993	1994	1995	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Ocracoke Inlet	0	2	0	2	2	1	0	1	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
Kathryn-Jane Flats	7	11	9	12	11	10	8	2	1	1	2	1	1	2	1	3	0
Old Drum Inlet	3	2	1	1	2	1	1	0	0	0	0	1	0	0	0	0	2
New Drum Inlet (NCB/MCB)	4	5	9	10	6	3	2	3	1	2	2	2	2	3	3	5	6
New Drum Inlet (SCB)/ Ophelia Island	3	3	4	5	4	2	3	3	2	3	2	2	2	2	2	2	2
Plover Inlet/ Ophelia Inlet (Mile 23.6)	0	0	0	0	0	1	1	1	1	1	1	1	4	8	15	17	18
Cape Point	0	0	0	0	0	0	0	1	0	0	0	0	0	4	3	2	3
Power Squadron Spit	3	2	3	2	2	1	2	1	0	0	0	1	0	1	1	2	1
Shackleford Banks														1	0	0	0
CALO Total	34	33	35	39	35	36	32	21	16	16	15	14	13	27	33	45	46

Nests

At least 57 nesting attempts were made in 2008. The earliest nest initiation was believed to be on 8 April and the latest on 22 June. Seventeen nests were on NCB, eight on MCB, three on OI, and 29 on SCB. Of the 57 nests 13 were re-nests. Nesting sites on NCB experienced some changes. Kathryn-Jane flats had no nest this year. Old Drum Inlet spit hosted one nest this year, not used since 1998. Refer to Figures 2-8 for detailed maps of nests and nesting sites, 2006 DOQQ base layer. Thirty one of the nests hatched and nine chicks were fledged from eight different broods. The average clutch size was 3.28 eggs and 87 of 174 eggs hatched. Productivity for CALO was 0.20 chicks fledged per nesting pair (Table 3 and Appendix 4).

Table 3. Piping Plover Nesting Success at CALO 1989-2008

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

Predator Exclosures

In 2008, predator exclosures were used to protect 31 nests. Eighteen (58%) of the nests with exclosures hatched. Thirteen of the 26 nests without exclosures hatched (50%). Five nests with predator exclosures were lost to ghost crab predation. Predator exclosures were not used on the eleven nests on MCB and Ophelia Island. Of these eleven nests five nests hatched, one was lost to ghost crabs, one nest was lost to unknown cause, and four nest were lost to mammal predation (Appendix 1). Table 4 below shows likely causes of nest losses. The predator column includes 8 ghost crabs losses and 3 raccoon losses and 1 mink loss.

Table 4. Likely Causes of Piping Plover Nest Losses in 2008.

NESTING AREA	# NESTS	# LOST	PREDATORS	STORM	ABANDONED	UNKNOWN
Portsmouth Flats	16	9	4	2	1	2
Old Drum Inlet (NCB)	1	0	0	0	0	0
New Drum Inlet (MCB)	8	4	3	0	0	1
Ophelia Island	3	2	2	0	0	0
Plover Inlet (Mile 23.6)	23	9	2	2	1	4
Cape Point	5	2	1	1	0	0
Power Squadron Spit	1	0	0	0	0	0
Total	57	26	12	5	2	7

Brood Foraging

Two broods foraged on the ocean beach on the west side of Cape Point in 2008. One brood was observed foraging/moving on the upper ocean beach. The other brood used a tidal pool mudflat on the lower beach. This area was closed to vehicles. 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

As part of an experimental removal, 83 raccoons **(***Procyon lotor*) were removed from South Core Banks in December 2008. Another removal effort will take place in the spring of 2009 in an attempt to remove 50% of the total raccoon population by April.

Non-nesting Piping Plover Surveys

Surveys in 2008 did not include the area from south of Old Drum Inlet to the north side of Ophelia Inlet. These areas were, in past years, important migratory stops for piping plovers so our surveys are likely undercounting the number of birds in the park. Table 5 below list this year's counts. Appendix 3 lists non-nesting counts from 2003-2008. Figure 9 illustrates piping plover observations and critical habitat units.

Table 5. Non-Nesting Piping Plover Counts at Cape Lookout National Seashore, 2008.

	January	February	March	August	September	October	November	December
NCB	0	0	6	41	16	25	11	9
SCB	2	6	6	28	20	9	4	7
SB	11	10	10	17	10	20	9	8
Total	**13**	**16**	**22**	**86**	**46**	**54**	**24**	**24**

Banded Piping Plovers

Nine observations of five banded birds were made in the park in 2008 (Table 6). The four color banded birds were from the Great Lakes breeding population. The one metal number string that was photographed was from Canada.

Table 6. Band Combinations of piping plovers observed at CALO, 2008.

DATE	LEFT LEG-TOP	LEFT LEG-BOTTOM	RIGHT LEG-TOP	RIGHT LEG-BOTTOM	ISLAND	COMMENTS
1/14	orange flag	red, blue/orange	USFWS-metal	yellow	SB	Great Lakes bird
8/15	USFWS-metal	red	orange flag	yellow, red	NCB	Great Lakes bird
8/30	-	-	-	811 40263-metal	NCB	Canada bird
8/31	USFWS-metal	red	orange flag	yellow, red	NCB	Great Lakes bird
8/31	-	-	-	green/orange/green-USFWS metal	NCB	Great Lakes bird
9/15	USFWS-metal	red	orange flag	yellow, red	NCB	Great Lakes bird
10/14	USFWS-metal	red	orange flag	yellow, red	NCB	Great Lakes bird
10/15	orange	-	USFWS-metal	black/orange/black	SCB	Great Lakes bird
12/15	USFWS-metal	red	orange flag	yellow, red	NCB	Great Lakes bird

Discussion

Nesting Habitat

The large overwash fans created by Hurricane Isabel in 2003 in the New Drum Inlet area continue to hold the highest density of nesting piping plovers in the park (and in North Carolina) with 26 pairs in a three mile area. Unfortunately the majority of this habitat is revegetating and reducing the habitat quality. However in 2008, accretion of the north tip of SCB and of New Drum Inlet spit on MCB has helped create new habitat. Figures 4, 5, and 6 include the 2008 shoreline on a 2006 image base layer. The mudflats on the north and south side of recently created Ophelia Inlet continued to be productive for piping plovers and used by many other shorebird species. A large ephemeral pool, intertidal flats, and sand flat supported three nesting pairs at Cape Point. Suitable nesting habitat at Old Drum Inlet spit was occupied by two pairs, one pair nested. It has been 10 years since a nest was last laid at this site. Portsmouth flats continued to provide nesting habitat on NCB. Kathryn-Jane flats have heavily revegetated to the point that no nesting occurred in 2008. Up until 2008 this habitat has supported pairs since monitoring began in 1989.

Pair Numbers

The number of nesting pairs in the park has continued to increase to the highest total since monitoring was initiated in 1989. Improved productivity from past years in the park and the creation of nesting and foraging habitat by storms were likely factors in the increase. There was also a small increase in the number of nesting pairs throughout North Carolina this year.

In addition to the 45 nesting pairs in the park, a non-nesting pair was recorded at Old Drum Inlet Spit after the breeding census (Appendix 2). It was observed building nest scrapes and defending a territory, but no nest was found. One of the nesting pairs left the seashore after its nest failed in mid-May at Portsmouth Flats and apparently moved across Ocracoke Inlet to Ocracoke.

Nest Success

2008 brought low success for piping plover nests in the park. Only 54% of the nests and 50% of the eggs hatched successfully. A strong low pressure storm in early May accounted for 5 (19%) of nest lost due to flooding. Predation took twelve (46%) nests, eight nests were ghost crab predation, three nests were raccoon predation, and one nest was mink (*Mustela vison*) predation. Two (7%) nests were abandoned. These two were abandoned after high winds sanded in the eggs. Seven (30%) nest losses were recorded as unknown.

In 2008, predator exclosures were effective in protecting nests from all predators except for five nests lost to ghost crabs. Since 1997, at least 31 nests protected by exclosures have lost eggs to ghost crabs. A total of five nests protected by predator exclosures were

approached by mammals. Four nests had raccoons circle and/or approach predator exclosures on SCB. One nest with predator exclosure was visited by a feral cat on NCB.

Predator exclosures have generally been effective in increasing hatch success. From 1997-2008, 67% of the nests protected with exclosures hatched, compared with 41% of the nests left unprotected.

Fledging Success

The fledging success for piping plovers at CALO was the forth lowest ever recorded in the park. Though the nesting pair count was high this year, productivity was low. The 0.20 chicks fledged per nesting pair is well below the recovery plan goal of 1.5 chicks per nesting pair. A similar relationship of high pair count and low productivity occurred in 1997 with 36 pairs and a 0.19 fledge rate (Table 3 and Appendix 4).

Only seven chicks fledged from nests within 3 miles of New Drum Inlet. All of those chicks utilized habitat on the soundside beach that was created by Hurricane Isabel or Hurricane Ophelia. This habitat that has produced more chicks in the years following the storms has begun to revegetate. This emergent vegetation at Plover Inlet likely makes hunting easier for predators. Also this marsh vegetation provides nesting habitat for boat-tailed grackles (*Quiscalus major*) which were common and were observed hunting plover chicks. The productivity for this area was 0.27 chicks per nesting pair.

Portsmouth Flats produced only 1 fledgling, 0.07 productivity. Old Drum Inlet produced 1 fledgling, 0.5 productivity. The fledgling from Old Drum Inlet was captured and removed on August 8 at 39 days old due to a wing injury. It was transported to the North Carolina Zoo and diagnosed with a dislocated joint. Unfortunately it died in captivity. The cover page photo was taken the day it was captured. Cape Point and Power Squadron Spit had no fledgling success. Fledgling success was low throughout all the nesting sites in 2008.

Predators

Red fox (*Vulpes vulpes*) tracks were not seen on NCB or anywhere else in the seashore in 2008. In 2007 tracks were located on NCB. Raccoon and feral cat tracks at nest sites continue to be a concern. As mentioned before four nests with predator exclosures were visited by raccoons and three nests were destroyed without predator exclosures. Raccoons continued to be present in the bird area at Cape Point. Raccoon tracks were more numerous at Plover Inlet than in 2007. Boat-tailed grackles at Plover Inlet were discouraged from perching on signs by using diamond shaped signs with the corner pointing upward and with using finishing nails on the top of the stakes. Also natural perches on the soundside were removed. Still grackles were commonly seen near broods. Although predation was not witnessed, grackles were observed watching plover chicks and diving at chicks. The presence of boat-tailed grackles at the Plover Inlet nesting site may have contributed to low fledgling success.

At New Drum Inlet raccoon and mink nest predation was recorded. Raccoon predation destroyed the nearby tern and skimmer colony. Raccoon and mink tracks were not recorded in 2007. Ophelia Island also had a raccoon presence in 2008 where none were recorded in 2007. Observations of predation are difficult to witness and indirect evidence can only provide clues.

Human Disturbance

Posted closures for bird nesting areas were not always respected by park visitors. In 2008 a more formal record of violations was maintained in order to enter these records into the case incident system. There were 42 records of pedestrians or footprints within bird closures and 55 records of vehicles or tracks within bird closures. These numbers are conservative since footprints and tire tracks disappear, before they are recorded, after moderate wind, tide changes, and or rain. Law enforcement rangers issued 1 citation for pedestrian in bird area and 7 citations for vehicles in bird areas.

Dogs were also a potential source of disturbance to nesting birds. An intensive effort to document, educate, and enforce the seashore's leash law was continued in 2008. A local press release and posted signs informed the public of the seashore's leash law. In 2008 a total of 154 observations of dogs on or off leash were recorded. Ninety nine dogs (64%) were on leash and 55 dogs (36%) were off leash and in violation of the park's leash law. Law enforcement rangers issued 21 dogs off leash citations and 34 written warnings. In 2008 there was an increased law enforcement staff presence on the beach.

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 six breeding pairs were found in CALO in 2008 surpassing the target of 25 or more pairs of performance measure 1. Forty six pairs produced 57 nests (1.2 nest per pair) surpassing the target of at least one nest per breeding pair of performance measure 2. The 46 pairs produced 9 fledglings for a fledge rate of 0.20, which is below the target of 0.75 of performance measure 3. Winter plover surveys at CALO were conducted at least once monthly from August until March to meet performance measure 4.

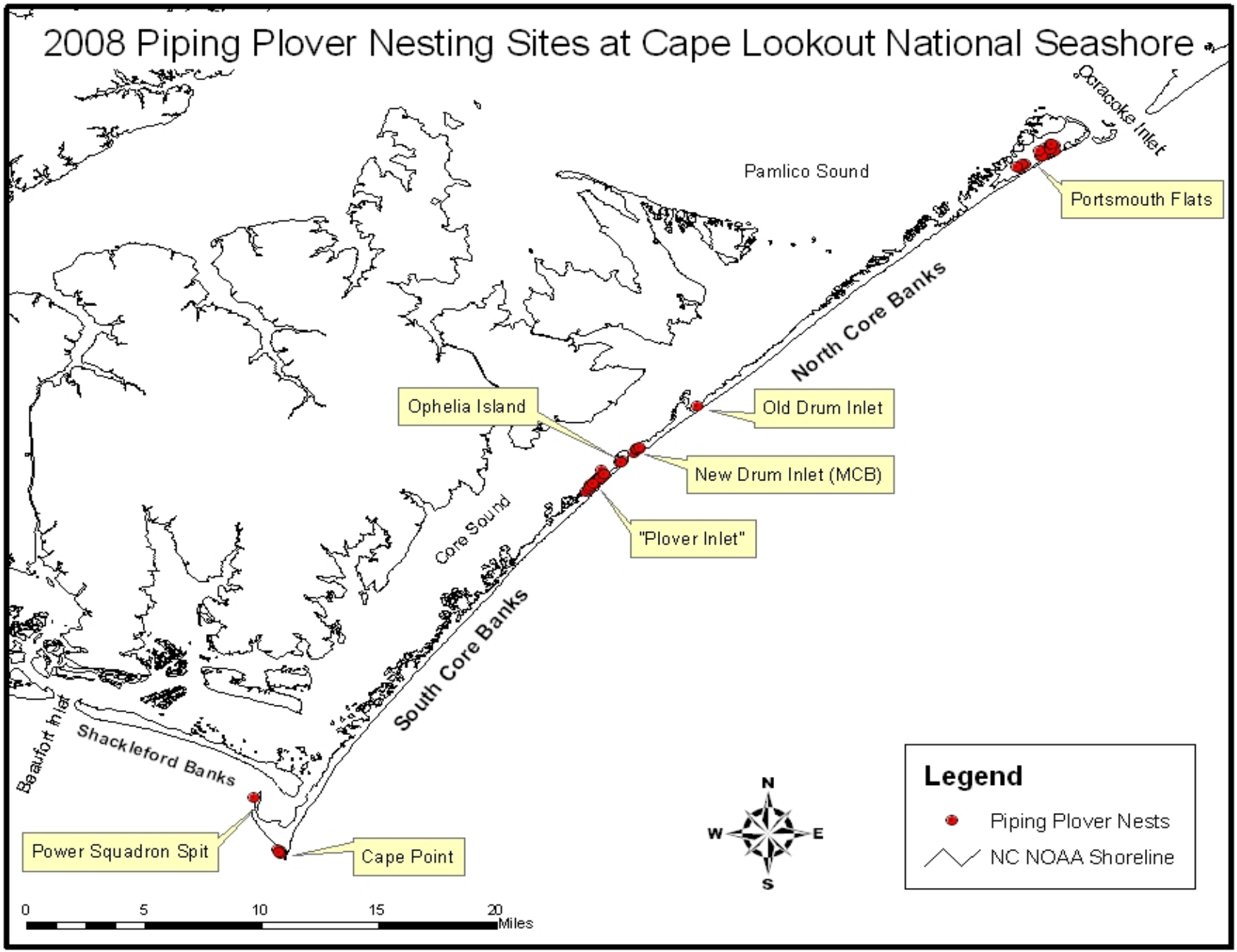


Figure 1. Map of 2008 Piping Plover Nesting Sites at Cape Lookout National Seashore.

Appendix 1- 2008 PIPING PLOVER NEST DATA

NORTH CORE BANKS

Nest #	Pair #	MILE	DATE FOUND	CLUTCH SIZE	EXCLOSURE	HATCH DATE	EGGS HATCHED	# FLEDGED	COMMENTS
1	1	2.11	7-May	4	na	na	0	0	flooded by storm on 5/14, nest behind middle pond on backside of flats on shelly flat
2	2	2.31	7-May	2	na	na	0	0	flooded by storm on 5/14, nest south side of dune ridge on top of dune
3	3	3.2	8-May	3	na	na	0	0	lost 5/25 to ghost crab
4	4	2.15	14-May	3	20-May	na	0	0	lost by 6/9 to ghost crab
5	5	2.95	21-May	3	23-May	na	0	0	lost by 6/9 to ghost crab
6	6	3.0	21-May	2	23-May	na	0	0	one egg predated, unknown, when nest found, other egg lost by 6/7
7	7	1.59	30-May	3	10-Jun	29-Jun	3	0	probable hatch (0eggs) on 6/29, no signs of predation, adults broken wing display on 7/2, no chicks observed-unknown
8	8	1.83	26-May	4	30-May	25-Jun	4	0	2 chicks observed before heavy rains on 7/5, flats flooded and no signs of chicks after
9	9	1.77	27-May	4	30-May	25-Jun	4	0	4 chicks observed before heavy rains on 7/5, flats flooded and no signs of chicks after
10	10	1.89	27-May	4	30-May	23-Jun	1	1	fledged on 7/22, found chick after flooding event
11	2	2.26	27-May	4	30-May	21-Jun	2	0	cat tracks on 6/7, raccoon tracks on 6/25, no chicks observed after 6/21
12	11	18.72	3-Jun	4	10-Jun	1-Jul	3	1	wing injury reported on 7/28, captured on 8/8 for zoo placement
13	12	1.81	16-Jun	4	17-Jun	25-Jun	4	0	1 chick observed before heavy rains on 7/5, flats flooded and no sign of chicks after
14	13	1.8	19-Jun	3	20-Jun	13-Jul	3	0	0 eggs on 7/13, scrape looked fresh, no signs of predation, probable hatch
15	14	2.2	19-Jun	3	20-Jun	na	0	0	abandoned on 7/1, nest sanded over
16	6	2.98	19-Jun	2	20-Jun	na	0	0	lost by 7/4, unknown
17	3	3.2	22-Jun	3	24-Jun	na	0	0	adults not seen after 7/18, ghost crab hole in exclosure

MIDDLE CORE BANKS

Nest #	Pair #	MILE	DATE FOUND	CLUTCH SIZE	EXCLOSURE	HATCH DATE	EGGS HATCHED	# FLEDGED	COMMENTS
1	1	21.58	2-May	1	na	na	0	0	lost 5/21, unknown
2	2	21.76	2-May	2	na	11-Jun	2	0	by 6/20 chick lost, adults calm
3	1	21.6	21-May	3	na	na	0	0	possible mink tracks on 5/21 near nest, lost by 6/5
4	3	21.51	5-Jun	4	na	25-Jun	4	0	no chicks seen after 6/25, unknown
5	4	21.53	5-Jun	3	na	5-Jun	3	0	no chicks seen after 6/5, unknown
6	1	21.58	5-Jun	2	na	na	0	0	ghost crab hole in nest cup, yolky sand on 6/11
7	5	21.55	11-Jun	4	na	24-Jun	4	0	2 chicks at soundside shoreline on 6/25, not seen after
8	6	21.47	20-Jun	1	na	na	0	0	lost to raccoon predation on 6/25

OPHELIA ISLAND

Nest #	Pair #	MILE	DATE FOUND	CLUTCH SIZE	EXCLOSURE	HATCH DATE	EGGS HATCHED	# FLEDGED	COMMENTS
1	1	22.4	5-Jun	4	na	na	0	0	lost to raccoon predation 6/11
2	2	22.3	5-Jun	2	na	na	0	0	2 one egg nests side by side, lost to raccoon predation 6/11
3	1	22.37	13-Jul	?	na	12-Jul	?	0	chick found on 7/13, estimated hatch was 7/12, found nest cup

Nest #	Pair #	MILE	DATE FOUND	CLUTCH SIZE	EXCLOSURE	HATCH DATE	EGGS HATCHED	# FLEDGED	COMMENTS
1	1	23.54	10-Apr	4	21-Apr	21-May	4	0	grackle hunting/diving down at chick, missed on 5/23, chicks gone by 5/28
2	2	44.45	28-Apr	4	5-May	1-Jun	3	0	raccoon tracks circle exclosure, 3 bare footprints at exclosure, chicks lost unknown
3	3	44.5	28-Apr	4	30-Apr	30-May	4	0	raccoon track at exclosure, on 5/31chick in no orv zone, 6/1 tire tracks in no orv zone
4	4	23.17	30-Apr	4	na	7-Jun	4	2	no PE due to nest location on dune, chicks foraged on soundside mudflat, fledged on 7/9
5	5	23.67	30-Apr	4	5-May	na	0	0	5/28 no eggs, no sign of predation, adults defensive, unknown
6	6	23.71	30-Apr	4	2-May	1-Jun	4	0	grackles at site chicks last seen on 6/2, chicks lost by 6/4, fresh raccoon tracks too
7	7	44.55	3-May	3	7-May	na	0	0	lost to storm tide on 5/13
8	8	23.49	7-May	4	7-May	na	0	0	ghost crab hole near on 5/23, eggs gone by 6/2, unknown
9	9	23.44	7-May	4	7-May	9-Jun	4	0	2 chicks seen on 6/9, lost by 6/13
10	10	23.39	7-May	4	8-May	na	0	0	lost to storm tide on 5/12
11	11	23.84	7-May	3	na	na	0	0	lost by 5/14, unknown, no signs, site dry/no water from storm
12	12	23.89	7-May	2	na	na	0	0	lost to storm tides 5/12, 1 egg found in water pool
13	13	47.14	10-May	3	19-May	12-Jun	2	0	chicks foraged on soundside on mudflat, posted on 6/13, chicks lost 6/14
14	14	23.31	14-May	3	17-May	13-Jun	2	0	chicks lost by 6/16, 1 egg remained unhatched in nest
15	15	23.66	14-May	4	14-May	3-Jun	4	0	on 6/4 0 eggs, no signs of predation, probable hatch, chicks not seen, adults defensive
16	11	23.87	19-May	4	29-May	na	0	0	6/18 abandoned, 3 eggs sanded in, 1 egg outside cup, raccoon tracks at PE
17	16	23.37	23-May	4	na	na	0	0	0 eggs on 5/28, unknown, no signs of predation, no chicks seen, no adult behavior
18	17	24.2	29-May	3	2-Jun	na	0	0	0 eggs on 6/9-raccoon tracks, ghost crab hole in PE, no chicks
19	7	43.63	29-May	4	30-May	na	0	0	ghost crab mound at nest cup, egg shell fragments in sand
20	10	23.38	31-May	4	na	na	0	0	6/9- 0 eggs, adults vocal, raccoon tracks near nest, no chicks seen, unknown

21	18	23.29	9-Jun	unknown	na	9-Jun	unknown	0	missed nest, hatched, adult and chick tracks at nest cup, adults vocal, no chicks seen
22	12	23.87	9-Jun	3	na	18-Jun	1	1	no PE due to nest location on dune, fledged on 7/23
23	19	23.16	13-Jun	4	13-Jun	27-Jun	4	1	fledged on 8/1
24	7	43.67	27-Jun	2	30-Jun	20-Jul	2	0	chick lost on 8/2 and 8/7, chicks foraged on open beach mudflat in no orv closure
25	17	23.39	2-Jul	4	na	4-Jul	4	1	fledged on 8/6
26	20	24	5-Jul	4	na	5-Jul	2	1	chicks foraged at crosswalk mudflat, chick fledged on 7/31
27	21	23.89	5-Jul	3	na	5-Jul	3	0	chicks lost by 7/14
28	22	23.19	14-Jul	unknown	na	11-Jul	1	0	GPS taken where adults very defensive on 7/11, chick lost by 7/16
29	6	23.73	14-Jul	unknown	na	7-Jul	2	1	GPS taken where adults very defensive on 7/7, 1 chick fledged on 7/28

Appendix 2- 2008 PIPING PLOVER WINDOW CENSUS

2008 Piping plover breeding census results: June 1-9

North Core Banks: 13 pairs

Portsmouth Flats	12 Pairs
Old Drum Inlet	1 pair
KJ/Whalebone Flats	2 singles

Middle Core Banks: 6 nesting pairs

New Drum Inlet	6 Pairs

Ophelia Island: 2 nesting pairs

New Drum Inlet	1 Pair
Ophelia Inlet	1 Pair

South Core Banks: 22 nesting pairs

Plover Inlet	18 Pairs
Cape Point	3 Pairs
Power Squadron Spit	1 Pair

Shackleford Banks: 0 piping plovers

Appendix 3. Monthly counts of non-nesting piping plovers 2003-2008

Date	North Core Banks	South Core Banks	Shackleford Banks	CALO Total
January-03	11	7	27	45
February-03	6	6	5	17
March-03	34	3	14	51
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

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

Chart 1. Piping Plover Nesting at Cape Lookout National Seashore

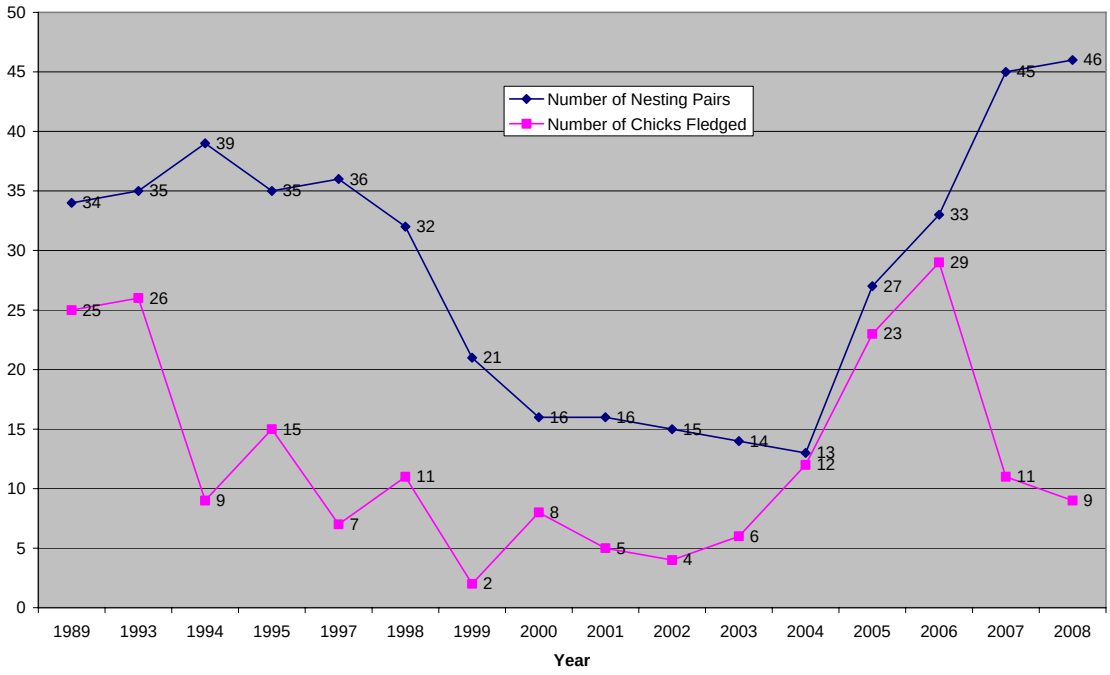


Chart 2. Piping Plover Productiviy

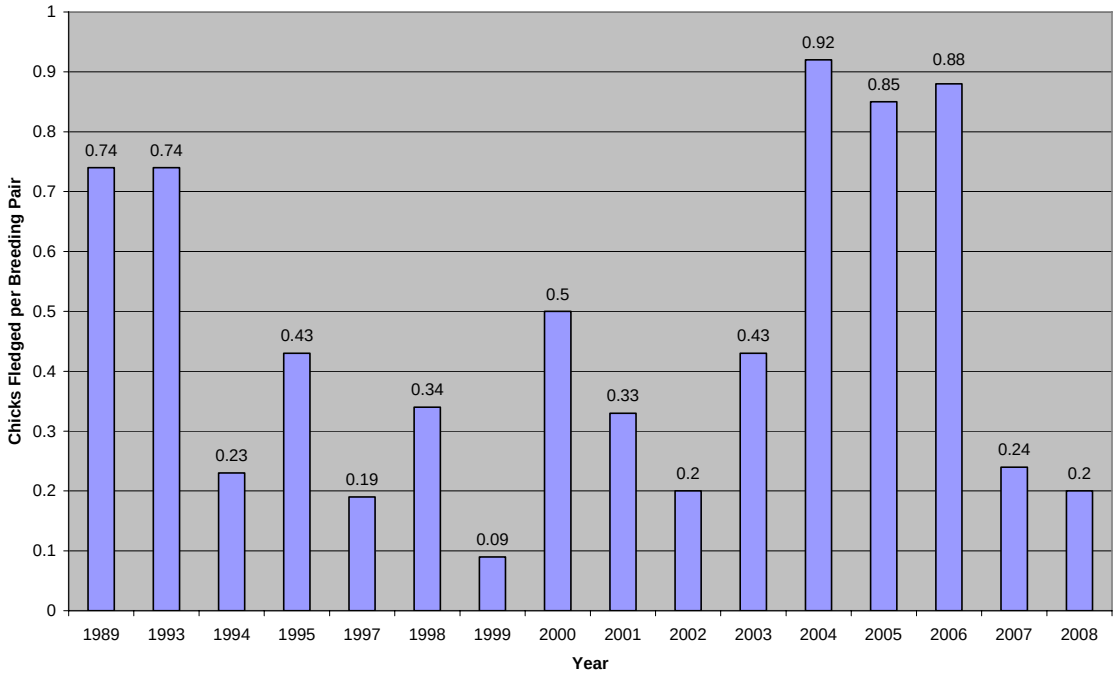


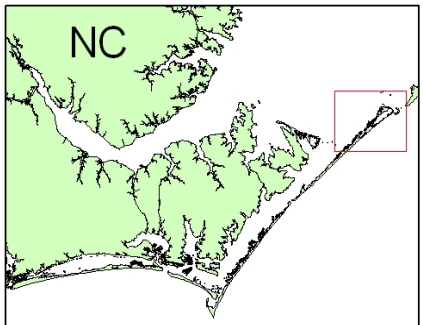
Figure 2. North Portsmouth Flats Nesting Site

N
W
E
S

National Park Service
Cape Lookout National Seashore
Resource Management Division

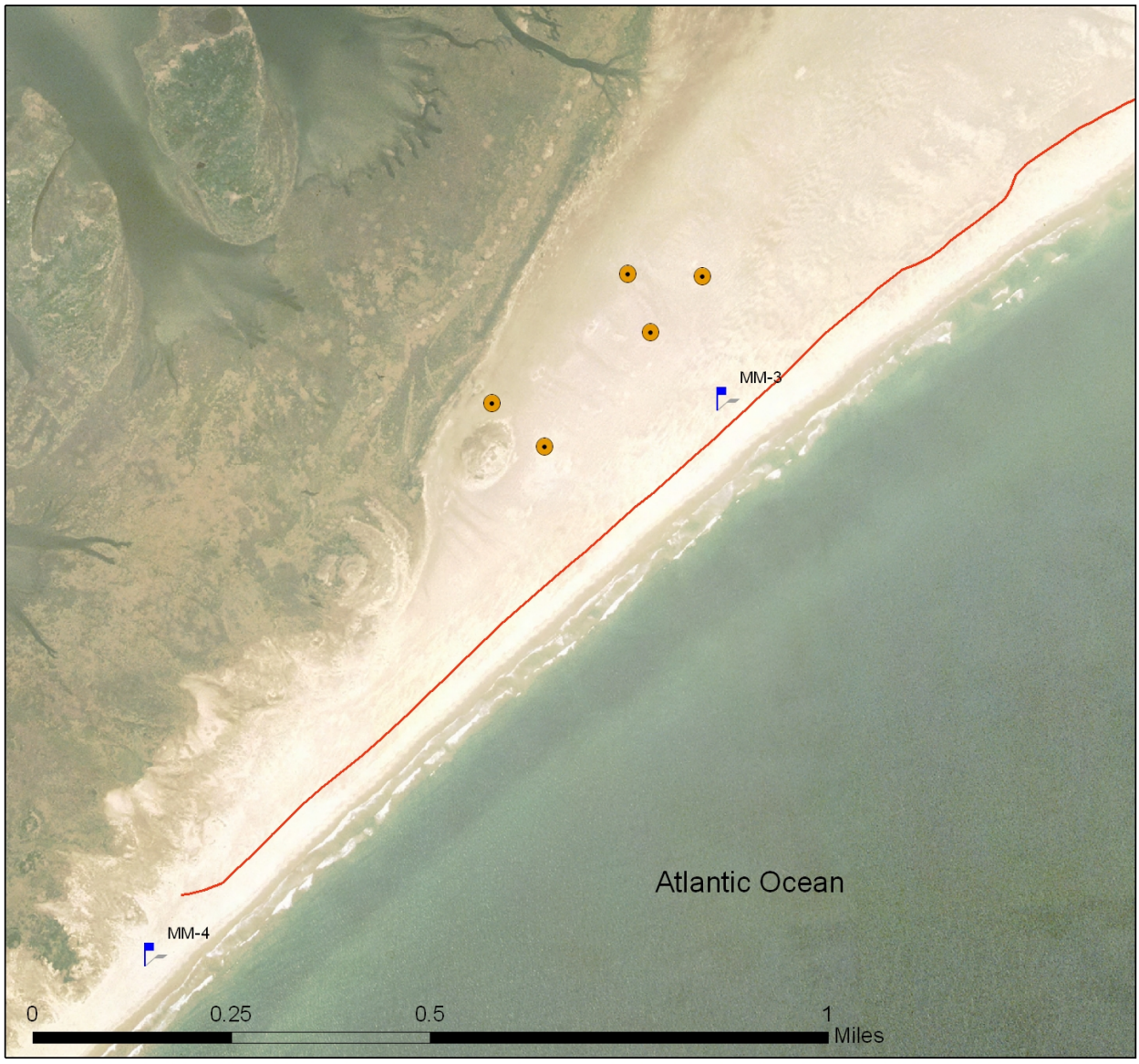
Legend

- Piping Plover Nests 2008
- Posted Bird Signs



Map Location

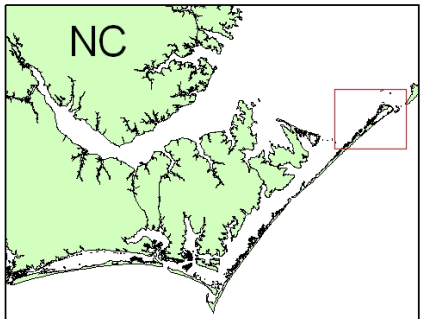
Figure 3. South Portsmouth Flats Nesting Site



National Park Service
Cape Lookout National Seashore
Resource Management Division

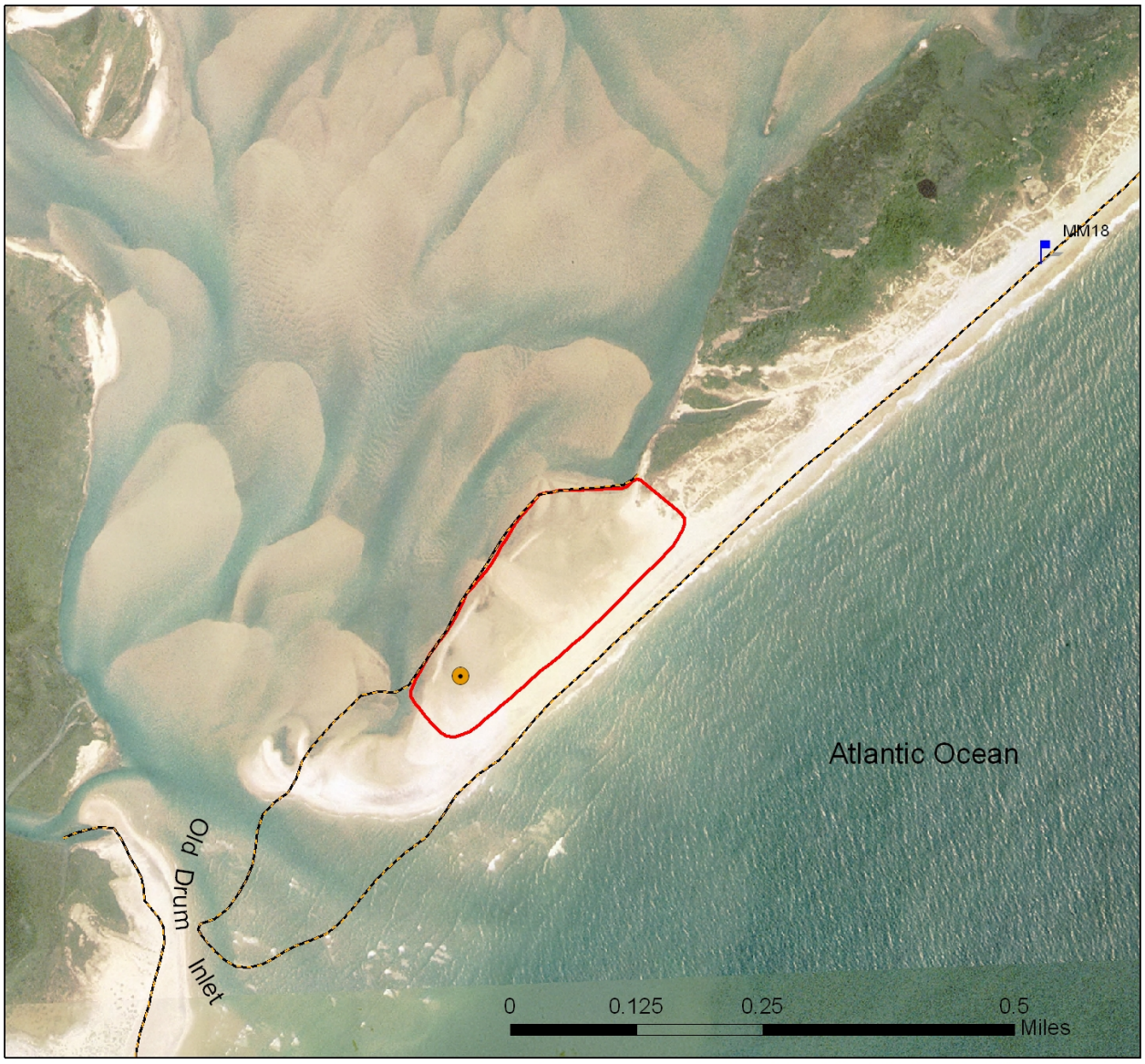
Legend

- Piping Plover Nests 2008
- Posted Bird Signs



Map Location

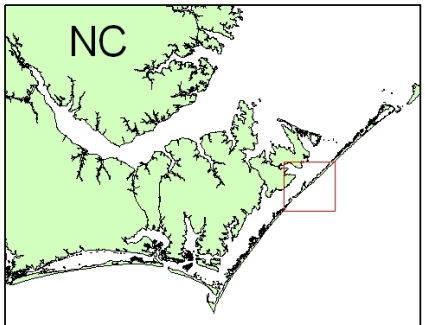
Figure 4. Old Drum Inlet Spit Nesting Site



National Park Service
Cape Lookout National Seashore
Resource Management Division

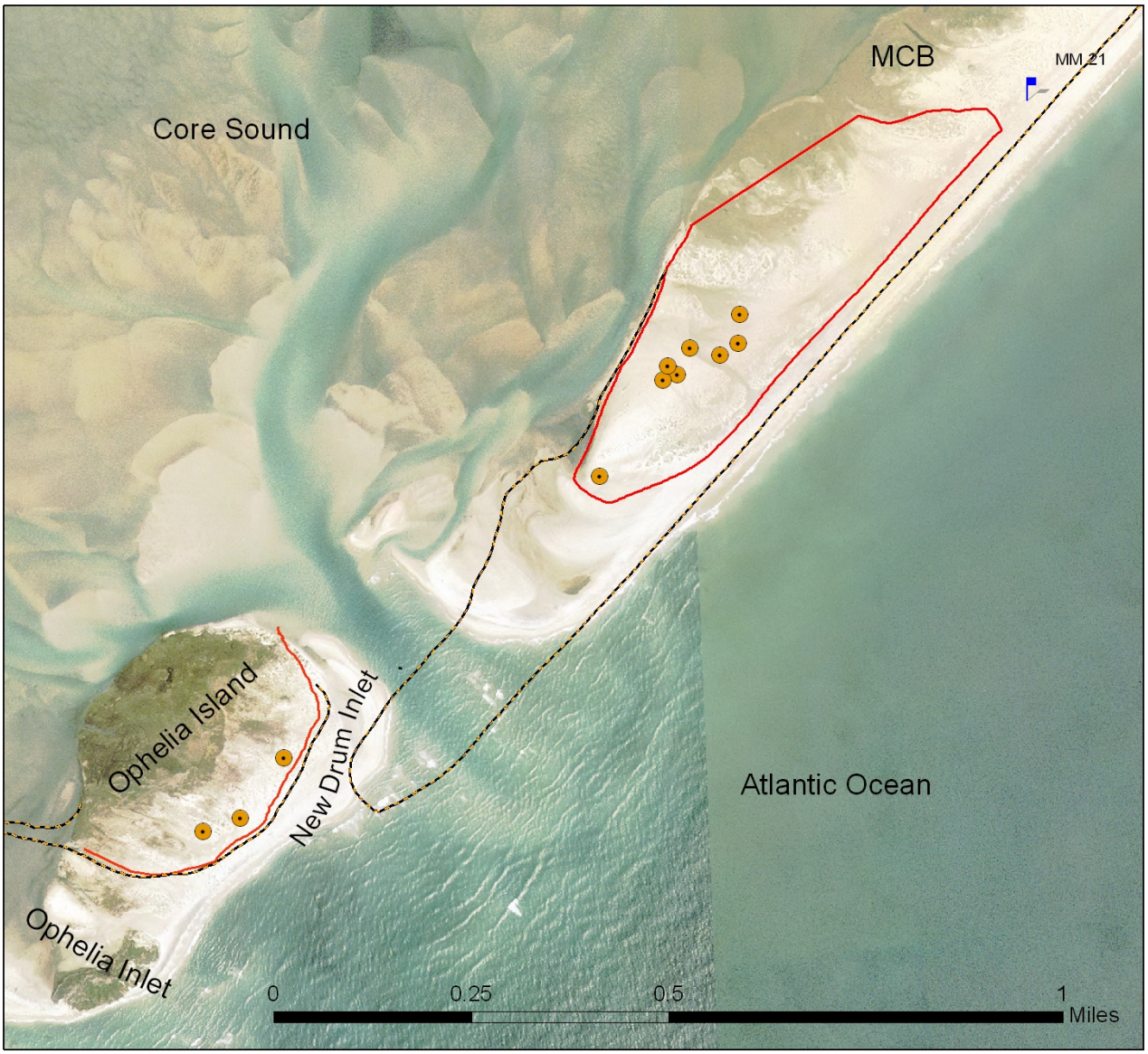
Legend

- Piping Plover Nests 2008
- 2008 Shoreline
- Posted Bird Signs



Map Location

Figure 5. Middle Core Banks and Ophelia Island Nesting Sites

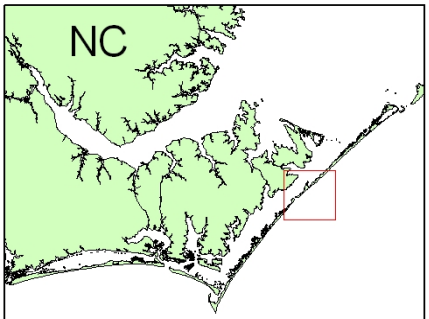


N
W
E
S

National Park Service
Cape Lookout National Seashore
Resource Management Division

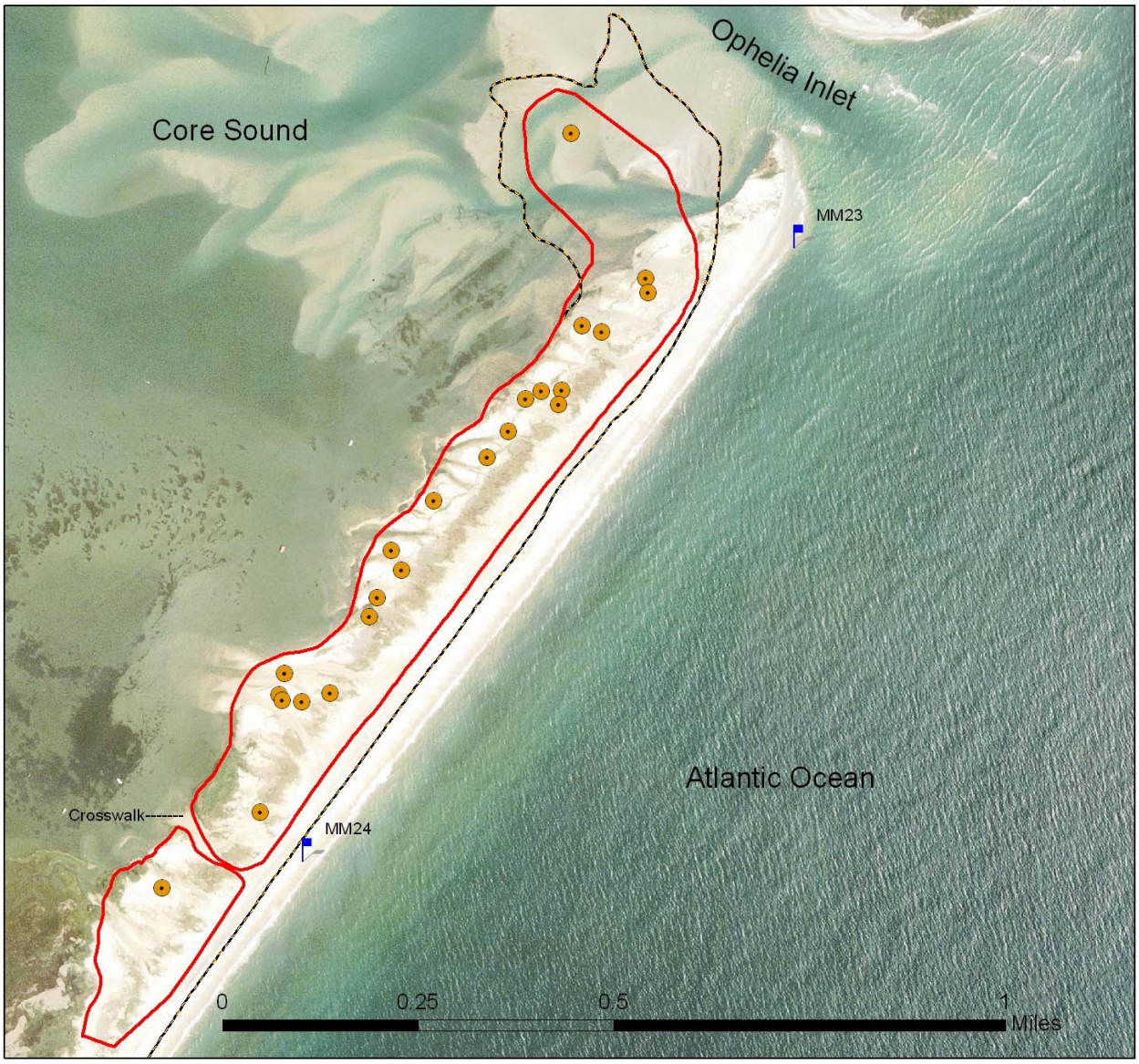
Legend

- Piping Plover Nests 2008
- 2008 Shoreline
- Posted Bird Signs



Map Location

Figure 6. Plover Inlet Nesting Site



National Park Service
Cape Lookout National Seashore
Resource Management Division

Legend

- Piping Plover Nests 2008
- 2008 Shoreline
- Posted Bird Signs

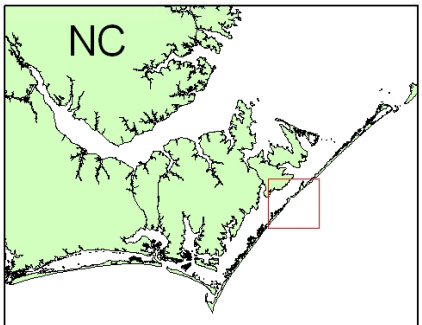
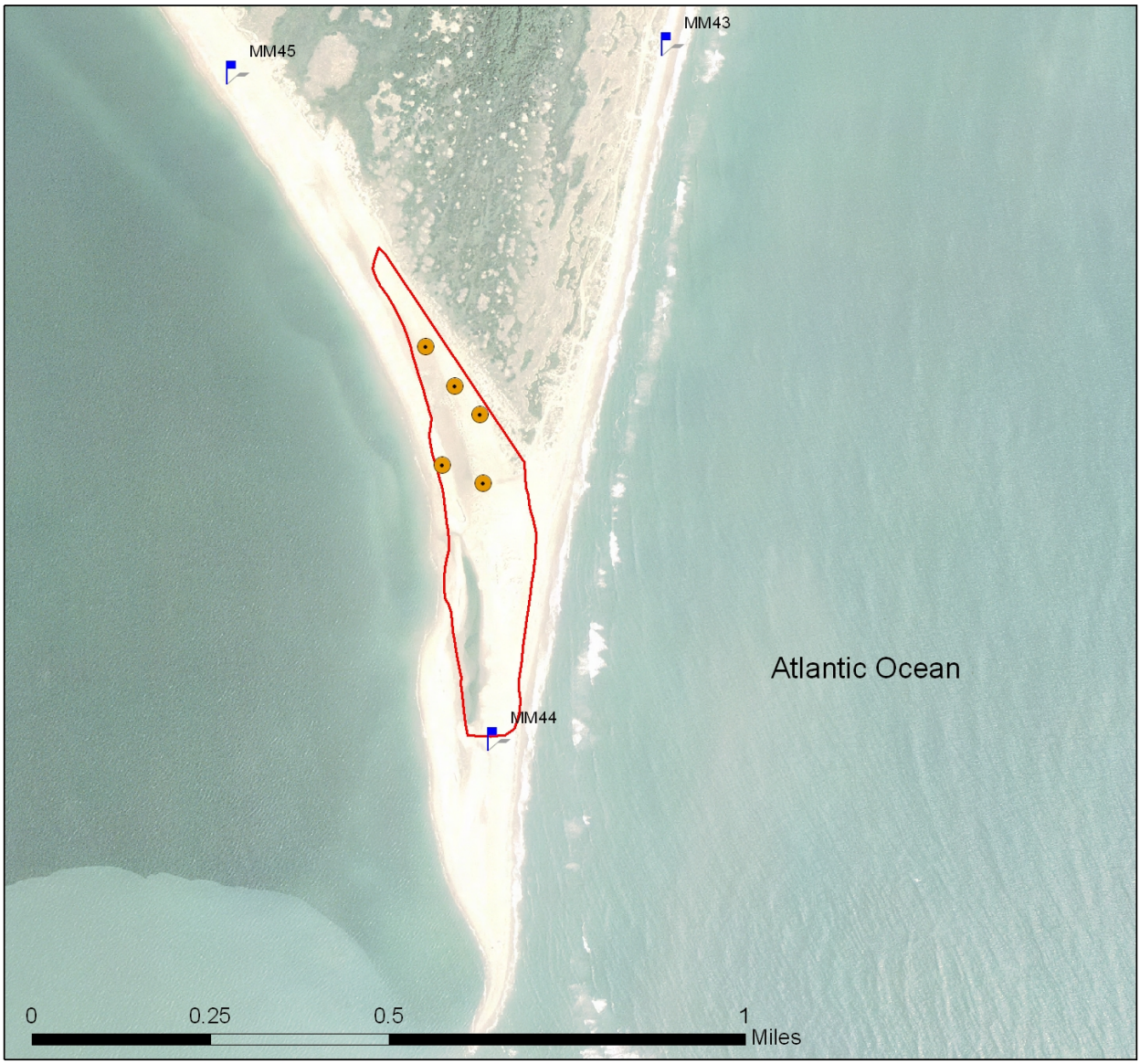


Figure 7. Cape Point Nesting Site



National Park Service
Cape Lookout National Seashore
Resource Management Division

Legend

- Piping Plover Nests 2008
- Posted Bird Signs

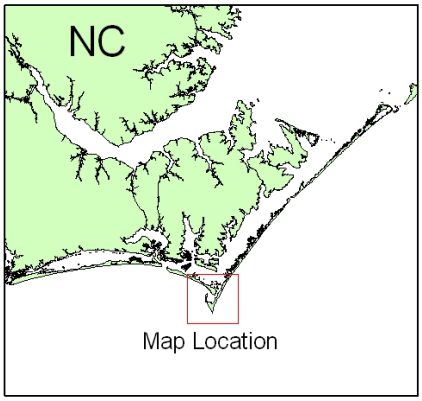
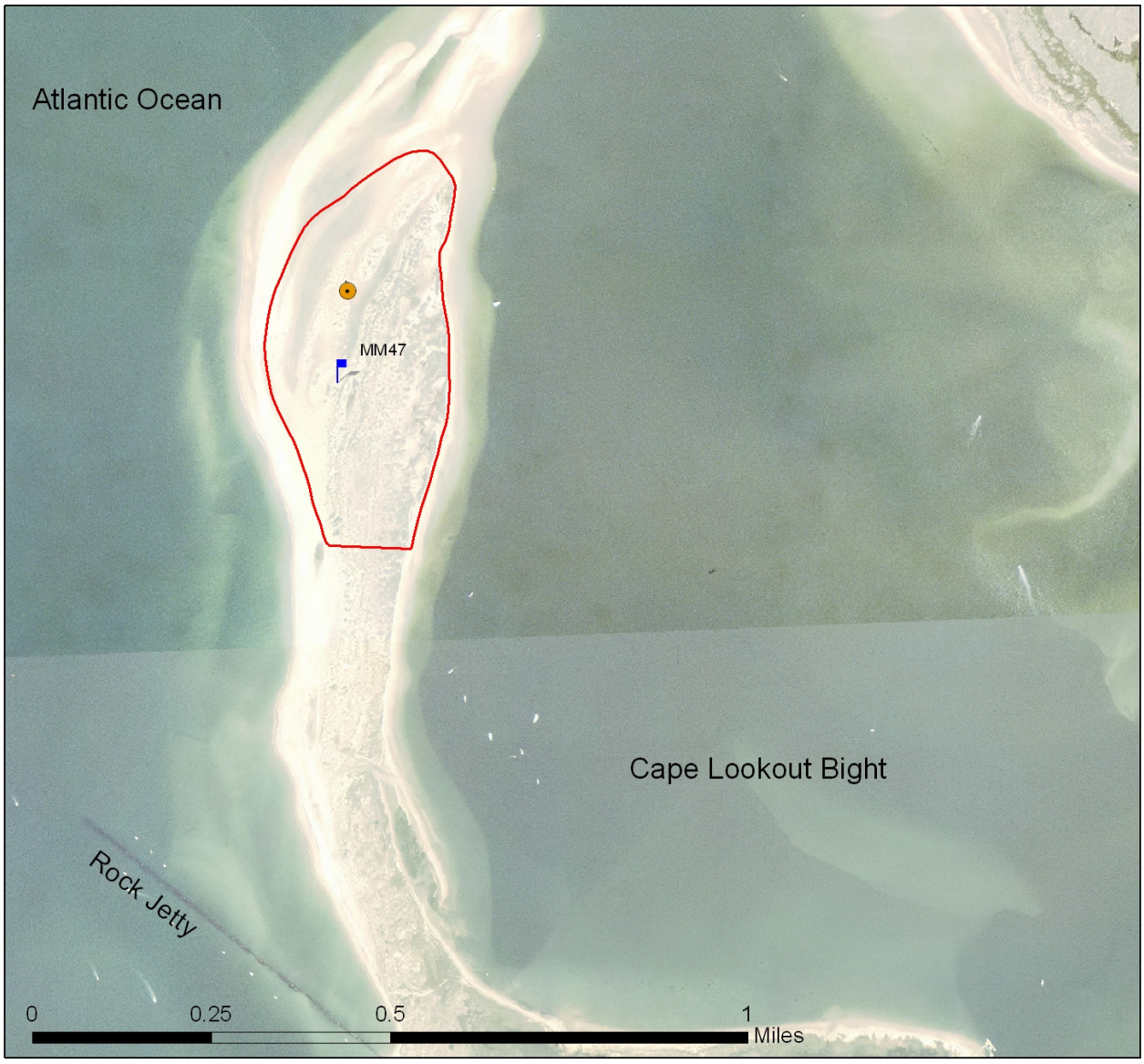
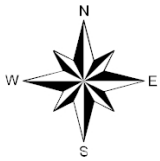


Figure 8. Power Squadron Spit Nesting Site





National Park Service
Cape Lookout National Seashore
Resource Management Division

Legend

- Piping Plover Nests 2008
- Posted Bird Signs

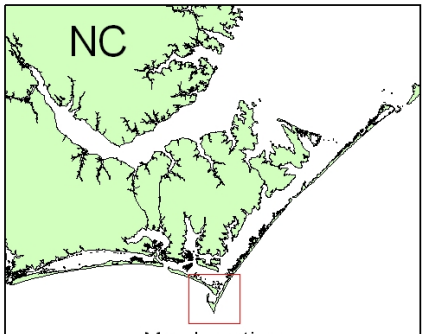
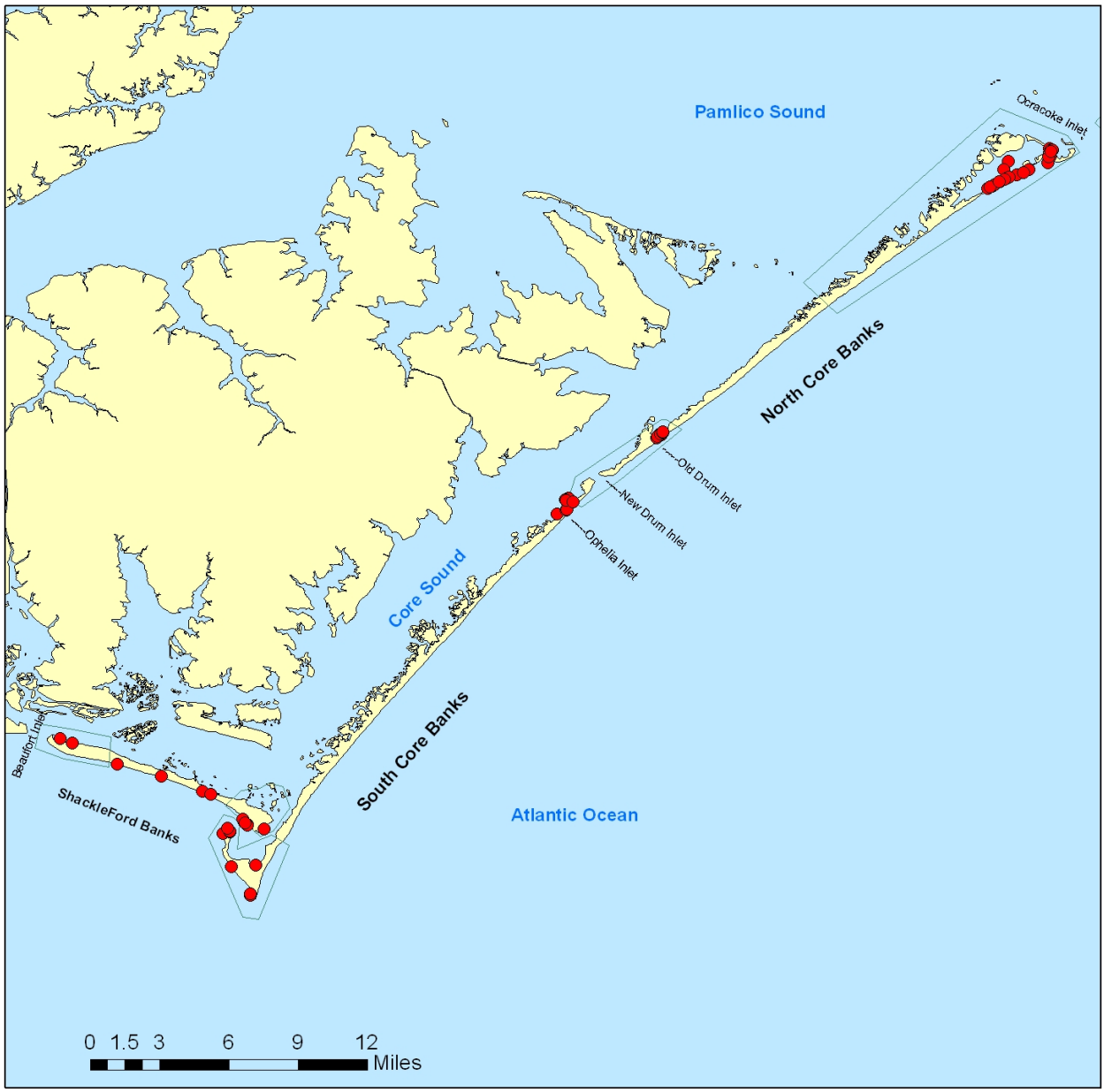
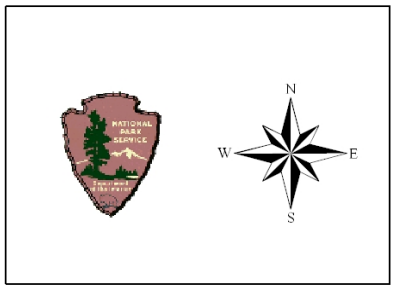


Figure 9. Piping Plover Non-Breeding Observations 2008





National Park Service
Cape Lookout National Seashore
Resource Management Division

Legend

- Piping Plover
- Critical Habitat Units
- NCMD_GEO