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

2007 SUMMARY REPORT

NATIONAL PARK SERVICE
CAPE LOOKOUT NATIONAL SEASHORE
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Introduction

Piping plover monitoring at Cape Lookout National Seashore (CALO) began with a baseline study in 1989. The park is a significant nesting area, containing about 3/4 of the nesting pairs in the state of North Carolina. Monitoring focuses on identifying factors limiting nesting success and implementing methods to increase the productivity of this threatened species. This report contains a summary of monitoring results for 2007, comparisons to results from previous years and discussions based on long-term monitoring of piping plovers at CALO.

Methods

Bird sanctuary signs were used to close all known piping plover nesting habitat to pedestrian and vehicular entry by April 1. Beginning in mid 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 was completely closed to vehicles (except for NPS monitors) from June 18-July 26. A second ocean beach closure to all vehicles, NPS monitors walked, was established on the west side of Cape Point from June 22-August 7. 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 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. Counts near Ocracoke Inlet were also done twice a week between July 31 and September 30.

Results

Nesting Pairs

A total of 45 pairs of piping plovers nested or held a territory at CALO in 2007, the most recorded since monitoring began in 1989. Seventeen pairs nested on North Core Banks (NCB), five pairs on Middle Core Banks (MCB), two pairs on Ophelia Island (OI), and twenty pairs on South Core Banks (SCB). One pair on SCB at the power squadron spit held territory, but no nest was found. Birds nested in seven distinct areas (Table 1 and Figure 1). The area around Ophelia Inlet contained the highest number of nesting pairs. The birds at CALO accounted for 74% of the nesting pairs in North Carolina in 2007.

Table 1. Number of Nesting Pairs by Nesting Areas

ISLAND	NESTING AREA	NUMBER OF PAIRS
North Core Banks	Portsmouth Flats	14
North Core Banks	Kathryn-Jane Flats	3
Middle Core Banks	New Drum Inlet	5
Ophelia Island		2
South Core Banks	Plover/Ophelia Inlet	17
South Core Banks	Cape Point	2
South Core Banks	Power Squadron Spit	2

Table 2. Piping Plover Breeding Pairs at Cape Lookout National Seashore 1989-2007

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

Nests

At least 58 nesting attempts were made in 2007. 24 nests were on NCB, five on MCB, two on OI, and 27 on SCB. One nest on SCB was discovered outside the posted area at Ophelia Inlet and it was posted immediately. Refer to Figures 2-8 for detailed maps of nests and nesting sites. 29 of the nests hatched and 11 chicks were fledged from 9 different broods. The average clutch size was 3.07 eggs and 79 of 172 eggs hatched. Productivity for CALO was 0.24 chicks fledged per nesting pair (Table 3 and Appendix 4).

Table 3. Piping Plover Nesting Success at CALO 1989-2007

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

Predator Exclosures

In 2007, predator exclosures were used to protect 35 nests. 60% of the nests with exclosures hatched. Eight of the 23 nests without exclosures hatched (35%). Four nests with predator exclosures were lost to ghost crab predation. Predator exclosures were not used on the seven nests on MCB and Ophelia Island. Of the seven nests five nests hatched, one was lost to ghost crabs, and one nest was lost to storm flooding (Appendix 1).

Table 4. Likely Causes of Piping Plover Nest Losses in 2007.

NESTING AREA	# NESTS	# LOST	PREDATORS	STORM	ABANDONED	UNKNOWN
Portsmouth Flats	20	13	5	2	4	2
Kathryn-Jane Flats	4	2	1	0	1	0
New Drum Inlet (MCB)	5	2	1	1	0	0
Ophelia Island	2	0	0	0	0	0
Plover Inlet (Mile 23.6)	24	11	1	7	2	1
Cape Point	2	0	0	0	0	0
Power Squadron Spit	1	1	0	1	0	0
Total	58	29	8	11	7	3

Brood Foraging

One brood foraged on the ocean beach in 2007. One chick was observed foraging in the intertidal surf zone on the west side of Cape Point. 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

No predator removal was done in 2007. A predator/raccoon population study began in the spring on SCB. A removal effort will take place in 2008 to study the ecological response.

Non-nesting Piping Plover Surveys

Surveys in 2007 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. Due to staff turnover counts were missed from January to March, Table 5. Appendix 3 lists non-nesting counts from 2000-2007.

Table 5. Non-Nesting Piping Plover Counts at Cape Lookout National Seashore, 2007.

	August	September	October	November	December
NCB	46	52	18	12	10
SCB	46	27	26	8	9
SB	11	2	17	22	14
Total	**103**	**81**	**61**	**42**	**33**

To investigate the movement of birds through the area around Ocracoke inlet, counts were made twice a week from the mid August to the end of September.

An average of 37 birds was counted in the area south of the inlet. The number of birds found on the North Core Banks side was lowest at high tide with the birds using an unknown roost site. No banded plovers were seen on the North Core Banks side of the inlet during this time period.

Table 6. Counts of Piping Plovers near Ocracoke Inlet during Fall Migration.

Date	Number of Piping Plovers	Tide
15-Aug	43	mid+
19-Aug	22	mid+
21-Aug	55	low
28-Aug	51	low+
4-Sept	40	low+
7-Sept	29	low
11-Sept	49	low
15-Sept	25	high
21-Sep	27	low
25-Sep	15	low

Banded Piping Plovers

Seven observations of three banded birds were made in the park in 2007 (Table 6). The three birds were from the Great Lakes breeding population.

Table 6. Band Combinations of piping plovers observed at CALO, 2007.

DATE	LEFT LEG-TOP	LEFT LEG-BOTTOM	RIGHT LEG-TOP	RIGHT LEG-BOTTOM	ISLAND	COMMENTS
10/15	USFWS	red	orange flag	yellow, red	NCB	Great Lakes bird
10/17	orange flag	blue, orange	USFWS	light blue	SB	Great Lakes bird
11/14	USFWS	red	orange flag	yellow, red	NCB	Great Lakes bird
11/14	-	-	-	green/orange/green, USFWS	NCB	Great Lakes bird
11/15	orange flag	blue, orange	USFWS	light blue	SB	Great Lakes bird
12/5	USFWS	red	orange flag	yellow, red	NCB	Great Lakes bird
12/12	orange flag	blue, orange	USFWS	light blue	SB	Great Lakes bird

Discussion

Nesting Habitat

The large overwash fans created by Hurricane Isabel in 2003 in the New Drum Inlet area held the highest density of nesting piping plovers in the park (and in North Carolina) with 24 pairs in a three mile area. Unfortunately this habitat is revegetating and reducing the habitat quality. 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 two nesting pairs at Cape Point. Katherine Jane and Portsmouth flats continued to provide nesting habitat on NCB.

Pair Numbers

The number of nesting pairs in the park 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 44 nesting pairs in the park, a non-nesting pair was recorded at Power Squadron Spit during the breeding census (Appendix 2). The pair occupied a low elevation site that experienced two major flooding events. A nest may have been lost before it had a chance to be recorded.

Nest Success

2007 brought low success for piping plover nests in the park. Only 50% of the nests and 46% of the eggs hatched successfully. Sub tropical storm Andrea in early May and tropical storm Barry and a strong low pressure in mid June accounted for 11 (38%) of nest lost. Predation took eight (28%) nests, seven nests were ghost crab predation and one nest was raccoon predation (*Procyon lotor*). Seven (24%) nests were abandoned. Two of those seven abandoned after a cat (Felis *domestica)* and an unknown mammal visited the nest site. Three were abandoned after high winds sanded in the eggs, one abandonment was linked to human disturbance, and one was an unknown cause. Three (10%) nest losses were recorded as unknown.

In 2007, predator exclosures were effective in protecting nests from all predators except for four nests lost to ghost crabs. Since 1997, at least 26 nests protected by exclosures have lost eggs to ghost crabs. A total of 11 nests protected by predator exclosures were approached by mammals. Eight nests had raccoons circle and/or dig at exclosures on SCB. Two nests were visited by unknown mammals and one nest by a feral cat on NCB.

Predator exclosures have generally been effective in increasing hatch success. From 1997-2007, 68% 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 third lowest ever recorded in the park. Though the nesting pair count was high this year, productivity was low. The 0.24 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 1994 with 39 pairs and a 0.23 fledge rate (Table 3 and Appendix 4).

Only six 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 0.24 chicks per nesting pair.

Portsmouth Flats produced four fledglings and Cape Point one fledgling. Katherine Jane Flats and Power Squadron Spit had no fledgling success. Katherine-Jane Flats has revegetated and the ephemeral pools used for foraging were almost surrounded with thick vegetation. These nesting sites combined for an average of 0.24 chicks per pair. Fledgling success was low throughout all the nesting sites in 2007.

Predators

Some new predators to the seashore in 2007 include documented mink (*Mustela vison*) on SCB and red fox (*Vulpes vulpes*) on NCB. Unconfirmed reports of a likely bobcat (*Canis latrans*) and a possible coyote (*Canis latrans*) on NCB have surfaced this year as well. On NCB there were two instances of an unknown mammal digging at a predator exclosure. Feral cat tracks at nest sites were also documented on NCB. As mentioned before eight nests with predator exclosures were visited by raccoons and one nest was destroyed without a predator exclosure. The above mammals have the potential to negatively impact the plover population in the seashore. Red fox and coyote are particularly troublesome as the have the ability to dig under predator exclosures and cause harassment.

The presence of boat-tailed grackles at the Plover Inlet nesting site may have contributed to low fledgling success. Although predation was not witnessed grackles were observed watching plover chicks and were commonly seen near broods. At New Drum Inlet five piping plover pairs shared the nesting area with 59 pairs of nesting gull-billed terns. Gull-billed terns (*Sterna niloteca)* predation was recorded in the seashore in 2005. Of the three piping plover nests that hatched no chicks survived the first week. The state listed

threatened gull-billed terns however produced numerous fledglings. 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. A total of 174 violations of bird nesting closures by pedestrians and 76 by off-road vehicles were documented by resource management staff in 2007. These numbers are conservative since footprints and tire tracks disappear, before they are recorded, after moderate wind, tide changes, and or rain. One pedestrian violation of the bird nesting area at Ophelia Inlet may have caused abandonment of the nest due a pedestrian walking right over a 2 egg nest. Footprints lead right over the nest and only missed actually stepping on the nest by a few inches. This area also had violations by boaters that landed on the sound side and walked across the posted nesting area to the ocean. A pedestrian walk way was provided, yet people still crossed illegally.

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 initiated in 2007. A local press release and posted signs informed the public of the seashore's leash law before the nesting season began. A total of 367 observations of dogs on or off leash were recorded. 256 dogs (70%) were on leash and 113 dogs (30%) were off leash and in violation of the park's leash law.

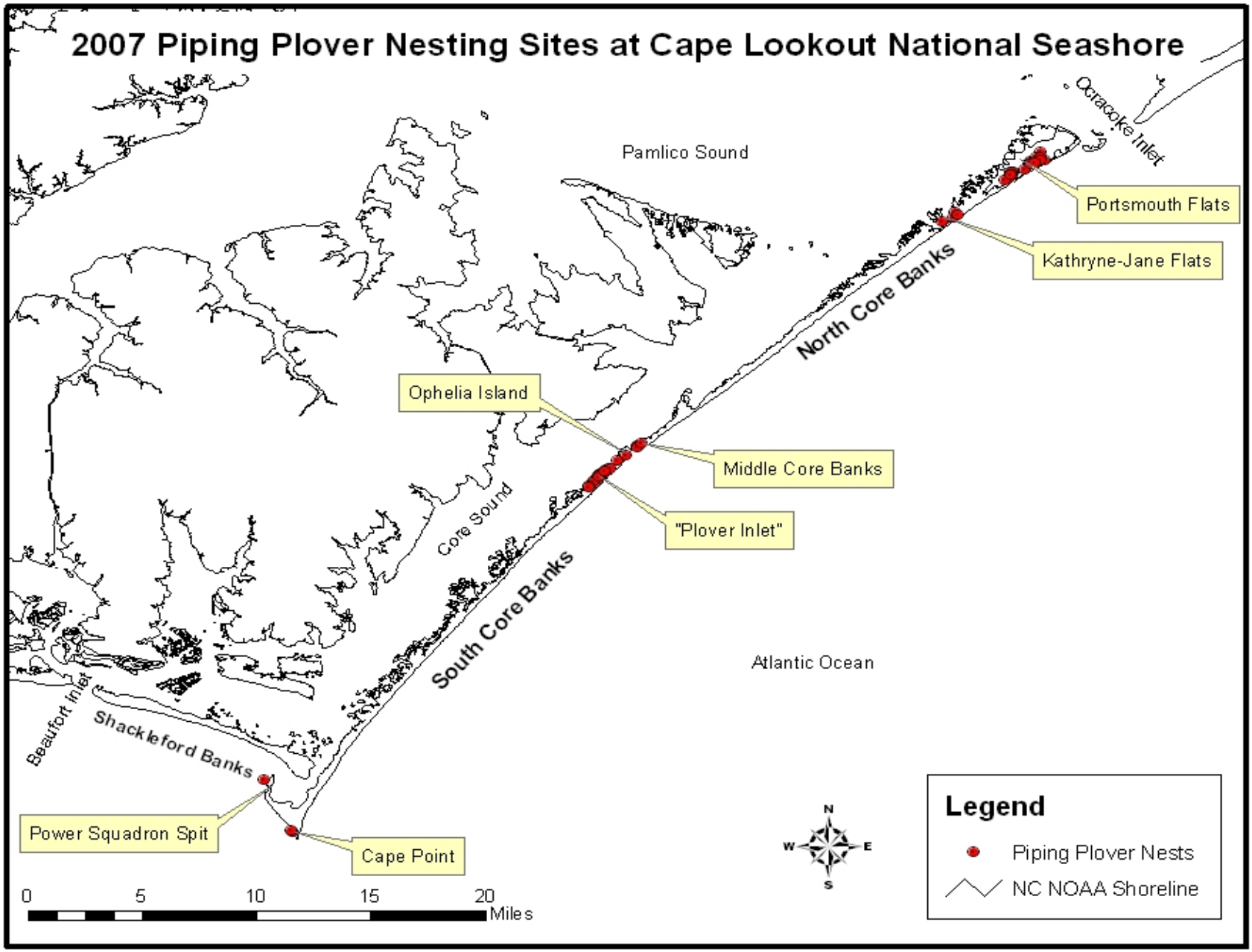


Figure 1. Map of 2007 Piping Plover Nesting Sites at Cape Lookout National Seashore.

Appendix 1- 2007 PIPING PLOVER NEST DATA

NORTH CORE BANKS

Nest #	MILE	DATE FOUND	CLUTCH SIZE	EXCLOSURE	HATCH DATE	EGGS HATCHED	# FLEDGED	COMMENTS
1	3.1	1-May	1	n/a	n/a	0	0	Lost 5/9, flats flooded by storm
2	3.35	28-Apr	2	n/a	n/a	0	0	Lost 5/9, flats flooded by storm
3	1.85	19-May	4	21-May	n/a	0	0	Abandoned 6/3, cat tracks around exclosure
4	3.23	19-May	3	24-May	n/a	0	0	Lost 5/26, ghost crab predation
5	2.35	22-May	2	n/a	n/a	0	0	Lost 5/26, ghost crab predation
6	6.48	23-May	4	24-May	19-Jun	4	0	adults very protective, no chicks seen, lost in first week
7	5.85	25-May	unknown	n/a	n/a	0	0	nest found after nest lost to raccoon
8	1.95	29-May	4	30-May	19-Jun	4	0	Lost 6/25, chicks lost in first week
9	2.18	29-May	3	30-May	15-Jun	3	1	foraged at ponds
10	2.29	30-May	4	30-May	21-Jun	2	0	chicks lost in first week
11	6.02	1-Jun	3	2-Jun	n/a	0	0	Abandoned 6/5, nest sanded in with 1 egg present on top
12	3.08	1-Jun	2	n/a	n/a	0	0	Abandoned 6/4, nest sanded over
13	2.3	1-Jun	1	n/a	n/a	0	0	Abandoned 6/4 nest sanded over
14	1.88	6-Jun	3	6-Jun	28-Jun	3	2	foraged at ponds, and flats
15	3.18	10-Jun	3	11-Jun	5-Jul	3	0	chicks lost in first few days, mammal tracks around exclosure and area on 7/7
16	3	10-Jun	2	n/a	n/a	0	0	nest empty, lost 6/17, no predator tracks, no predator exclosure
17	2.3	10-Jun	3	11-Jun	n/a	0	0	nest sanded over and pair dug out nest several times, no chicks seen
18	3.2	11-Jun	3	11-Jun	n/a	0	0	Lost 7/8 ghost crab holes with one right at nest
19	5.84	13-Jun	3	15-Jun	12-Jul	3	0	chicks lost in first week
20	3.46	17-Jun	4	19-Jun	n/a	0	0	nest lost 6/26, large ghost crab hole under nest, 1 egg out of nest, large mammal tracks surrounding predator closure with some digging at fence
21	2.63	21-Jun	3	24-Jun	n/a	0	0	nest lost 7/7, ghost hole crab hole under nest, initially lost 2 eggs and then one, crow roosting on exclosure and near nest.
22	1.78	24-Jun	1	n/a	n/a	0	0	nest lost 6/29, ghost crab tracks near nest
23	1.9	26-Jun	3	29-Jun	7-Jul	1	1	foraged at ponds, flats, and towards the backside of flats
24	2.3	9-Jul	3	n/a	12-Jul	1	0	chick lost in first few days

MIDDLE CORE BANKS

Nest #	MILE	DATE FOUND	CLUTCH SIZE	EXCLOSURE	HATCH DATE	EGGS HATCHED	# FLEDGED	COMMENTS
1	21	19-May	3	n/a	18-Jun	2	0	chicks lost in first few days
2	21	2-Jun	4	n/a	18-Jun	3	0	chicks lost in first few days
3	21	2-Jun	4	n/a	n/a	0	0	2 eggs lost unknown and no chicks seen on 6/15 and 2 eggs lost to ghost crabs on 6/23
4	21	2-Jun	3	n/a	n/a	0	0	Lost to Tropical Storm Barry, 6/7
5	21	9-Jun	3	n/a	7-Jul	3	0	chicks lost in first few days

OPHELIA ISLAND

Nest #	MILE	DATE FOUND	CLUTCH SIZE	EXCLOSURE	HATCH DATE	EGGS HATCHED	# FLEDGED	COMMENTS
1	22.23	7-Jun	3	n/a	28-Jun	2	0	chicks probable lost in second week
2	22.7?	n/a	unknown	n/a	~6/22	unknown	1	found chick at about 7 days old

SOUTH CORE BANKS

Nest #	MILE	DATE FOUND	CLUTCH SIZE	EXCLOSURE	HATCH DATE	EGGS HATCHED	# FLEDGED	COMMENTS
1	23.64	18-Apr	4	23-Apr	n/a	0	0	lost to storm 5/8
2	23.65	18-Apr	2	24-Apr	n/a	0	0	lost to storm 5/8
3	23.6	25-Apr	3	26-Apr	n/a	0	0	lost to storm 5/8
4	23.48	1-May	3	4-May	n/a	0	0	lost to storm 5/8
5	23.14	1-May	2	n/a	n/a	0	0	abandoned 5/4, human footprints walked right over nests, didn't step on, 1 egg remains in nest, no signs of predation
6	23.5	3-May	4	n/a	n/a	0	0	lost to storm 5/8
7	23.36	4-May	1	n/a	n/a	0	0	lost to storm 5/8
8	23.42	15-May	3	21-May	18-Jun	3	1	one chick lost in first week, second chick lost after day 19, fledged at day 30 on 7/17, raccoon tracks at exclosure on 6/1 and 6/11
9	23.49	21-May	4	24-May	18-Jun	3	0	chick last seen on 7/3, raccoon tracks at exclosure on 6/11, adult leading grackle away on 7/6
10	23.57	21-May	4	22-May	18-Jun	4	1	fledged chick on 7/13, day 26, raccoon tracks around exclosure on 6/1

11	23.65	24-May	4	28-May	25-Jun	4	2	fledged chick on 7/20, day 26, raccoon tracks at exclosure on 5/29
12	23.86	25-May	4	25-May	19-Jun	4	0	chicks lost after first week
13	24.07	25-May	3	28-May	20-Jun	2	0	chicks lost in first few days
14	44	27-May	4	27-May	22-Jun	2	0	chicks lost at end of first week, foraged at ephemeral pool, raccoon tracks around exclosure on 6/20 and 6/22 (hatch day)
15	23.26	28-May	3	n/a	25-Jun	1	0	chick lost in first week, terrain and vegetation prevent predator exclosure
16	23.21	29-May	4	4-Jun	28-Jun	4	0	chick last seen on 7/12, day 15
17	23.7	29-May	4	29-May	n/a	0	0	Abandoned 6/21, nest sanded over, raccoon tried to dig under exclosure on 6/1-unsuccessful
18	23.83	29-May	3	29-May	22-Jun	1	1	fledged on 7/26, day 27
19	23.91	29-May	4	5-Jun	25-Jun	4	0	chicks lost in first few days
20	24.19	29-May	4	31-May	18-Jun	4	0	chicks lost in first few days, raccoon tracks around exclosure on 6/11
21	24.2	29-May	4	31-May	25-Jun	3	0	chicks lost in first few days, 1 egg lost to ghost crab,
22	23.35	2-Jun	4	n/a	22-Jun	4	0	chicks lost in first week, terrain and vegetation prevent predator exclosure
23	23.1	5-Jun	3	8-Jun	n/a	0	0	lost to new moon tide and swell on 6/16, very close to inlet high tide line on an eroding beach, shoreline closed for nest
24	44	8-Jun	3	8-Jun	28-Jun	2	1	lots of raccoon tracks at exclosure on 6/29, only 1 chick on 6/29, primarily foraged on ephemeral pool, forage at ocean tide line on 7/26 and 7/27, considered fledged on 8/1 (day 35), but still weak flyer on 8/6 (day 40) opened shoreline on 8/7- chick was not present
25	23.6	8-Jun	1	n/a	n/a	0	0	ghost crab predation
26	47.12	12-Jun	2	12-Jun	n/a	0	0	nest lost to tide and swell on 6/16
27	23.31	14-Jun	4	n/a	n/a	0	0	on 6/18 0 eggs, no predator tracks, no chicks, unknown loss

Appendix 2- 2007 PIPING PLOVER WINDOW CENSUS

2007 Piping plover breeding census results: June 1-9

North Core Banks: 17 nesting pairs

Portsmouth Flats	14 Pairs
KJ/Whalebone Flats	3 Pair

Middle Core Banks: 5 nesting pairs

New Drum Inlet	5 Pairs

Ophelia Island: 2 nesting pairs

New Drum Inlet	1 Pair
Ophelia Inlet	1 Pair

South Core Banks: 20 nesting pairs

Plover Inlet	17 Pairs
Cape Point	2 Pairs
Power Squadron Spit	2 Pair

Shackleford Banks: 0 piping plovers

Appendix 3. Monthly counts of non-nesting piping plovers 2000-2007

Date	North Core Banks	South Core Banks	Shackleford Banks	CALO Total
March-00	43	13	13	69
August-00	75	29	12	116
September-00	43	16	3	62
October-00	28	2	14	44
November-00	27	4	16	47
December-00	18	4	5	27
January-01	1	9	19	29
February-01	15	7	24	46
March-01	?	9	25	?
August-01	18	2	4	24
September-01	21	4	6	31
October-01	37	3	22	62
November-01	14	11	14	39
December-01	14	20	29	63
January-02	25	1	13	39
February-02	4	6	10	20
March-02	41	1	19	61
August-02	31	7	6	44
September-02	42	8	9	59
October-02	40	7	16	63
November-02	16	5	13	34
December-02	17	11	18	46
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

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

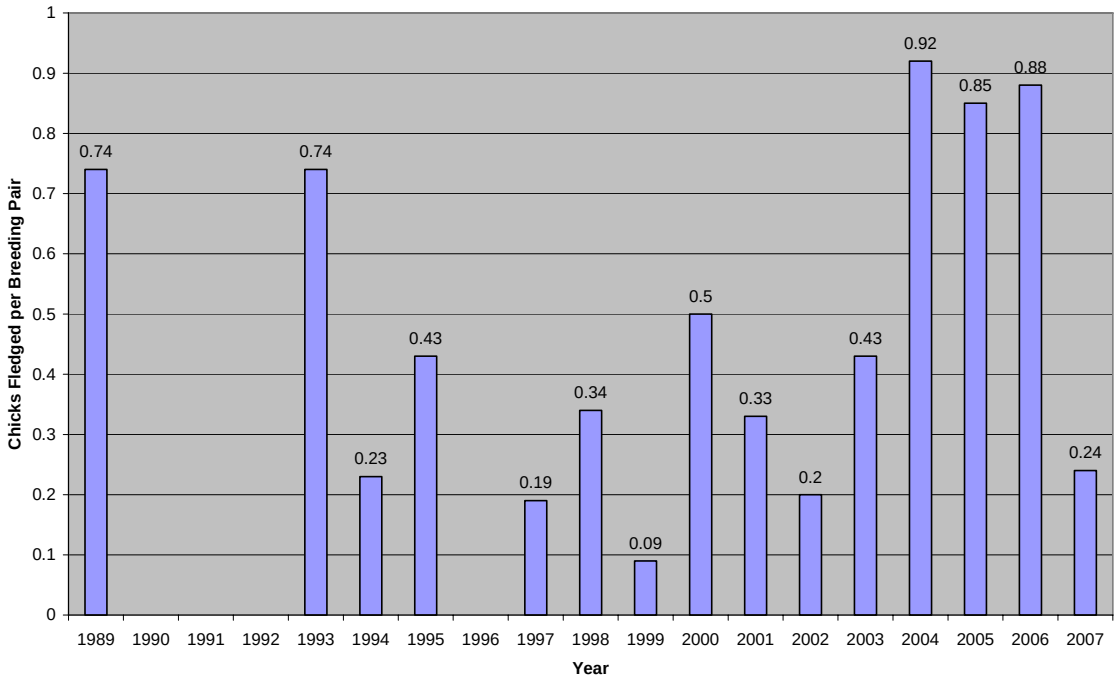


Figure 2. North Portsmouth Flats Nesting Site

National Park Service
Cape Lookout National Seashore
Resource Management Division

Legend

- Piping Plover Nests
- Posted Bird Area

Map Locatioin

Figure 3. South Portsmouth Flats Nesting Site

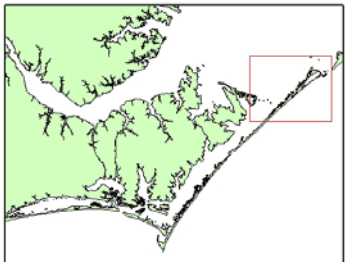
N
W
E
S

National Park Service
Cape Lookout National Seashore
Resource Management Division

Legend

Piping Plover Nests

Posted Bird Area



Map Locatioin

Figure 4. Kathryne-Jane Flats Nesting Site

N
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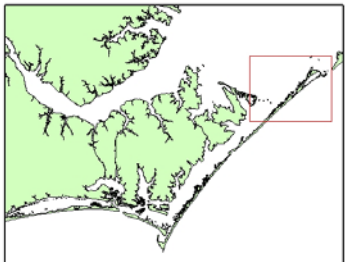
National Park Service
Cape Lookout National Seashore
Resource Management Division

Legend

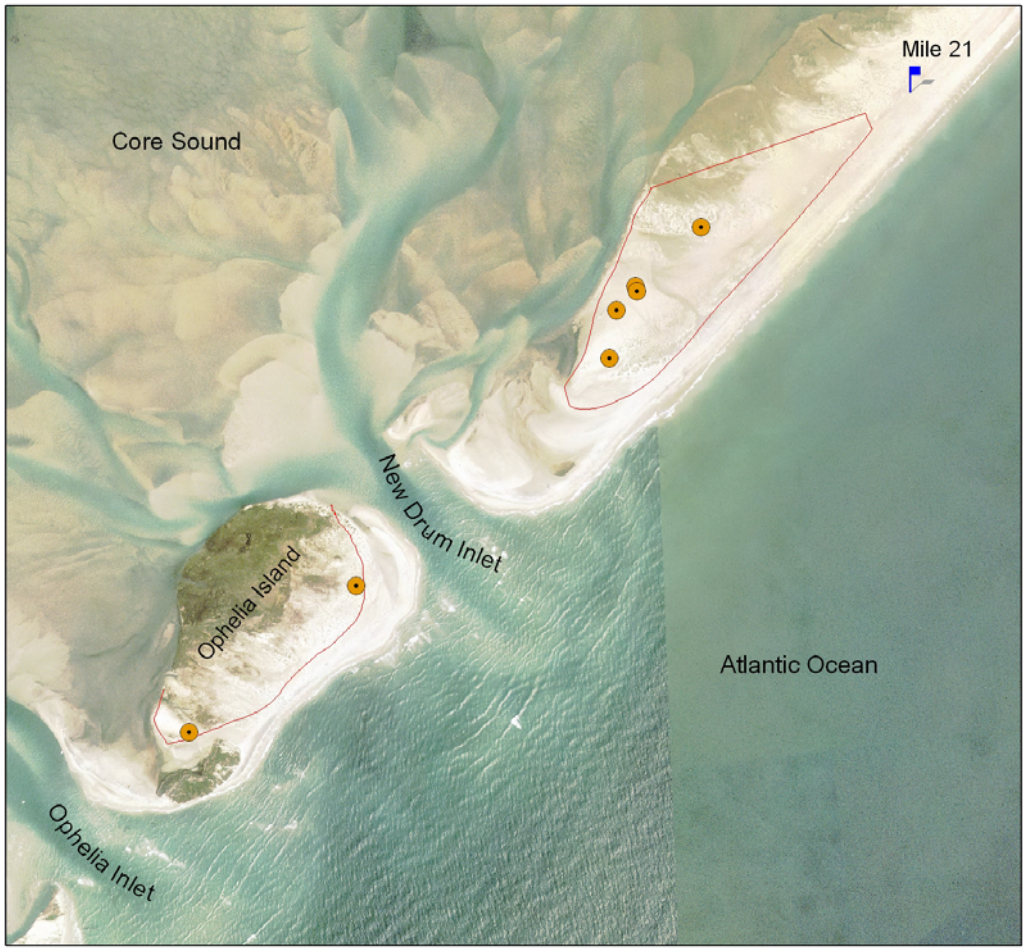
Piping Plover Nests

Posted Bird Area



Map Locatioin

Figure 5. Middle Core Banks and Ophelia Island Nesting Sites



N
W
E
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National Park Service
Cape Lookout National Seashore
Resource Management Division

Legend

Piping Plover Nests

Posted Bird Area

Map Locatioin

Figure 6. Plover Inlet Nesting Site

National Park Service
Cape Lookout National Seashore
Resource Management Division

Legend

- Piping Plover Nests
- Posted Bird Area

Map Locatioin

Figure 7. Cape Point Nesting Site

National Park Service
Cape Lookout National Seashore
Resource Management Division

Legend

- Piping Plover Nests
- Posted Bird Area

Figure 8. Power Squadron Spit Nesting Site

National Park Service
Cape Lookout National Seashore
Resource Management Division

Legend

- Piping Plover Nests
- Posted Bird Area

Map Locatioin