

Introduction

Piping plover monitoring at Cape Lookout National Seashore (CALO) began with a baseline study in 1989. The park is a significant nesting area with about 2/3 of the nesting pairs in the state of North Carolina. Monitoring focuses on factors limiting nesting success and methods that could be used to increase the productivity of this threatened species.

Methods

Signs were used to close all known nesting habitat to pedestrian and vehicular entry by April 1. Beginning in late April nesting areas were searched at least three times per week for territorial pairs and nests. The locations of nests were recorded and the nests were monitored until they hatched or were lost. The area between Old Drum Inlet and New Drum Inlet was not monitored regularly. This section of beach is inaccessible to vehicles.

Nests were protected with predator exclosures if the topography of the location was suitable. Exclosures were circular, 10 feet in diameter, made of 4"x 2" mesh wire fence anchored with steel rebar. Exclosures were topped with 3/4" mesh bird netting. Because of high rates of losses to raccoons, nest exclosures were sometimes constructed before the clutch was complete.

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

Counts of wintering and migrating piping plovers were made monthly. 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.

Results

Nesting Pairs

A total of 14 pairs of piping plovers nested or held a territory at CALO in 2003, one fewer pair than in 2002. 10 pairs nested on North Core Banks (NCB) and 4 pairs on South Core Banks (SCB). Birds held territories in 7 distinct nesting areas (Table 1). Portsmouth Flats contained the highest number of nesting pairs. Pairs held territories at Old Drum Inlet and Power Squadron Spit, but nests were not found in those areas. The birds at CALO accounted for 58% of the nesting pairs in North Carolina in 2003.

Table 1. Number of Nesting Pairs by Nesting Areas

ISLAND	NESTING AREA	NUMBER OF PAIRS
North Core Banks	Portsmouth Flats	6
North Core Banks	Kathryn-Jane Flats	1
North Core Banks	Old Drum Inlet	1
North Core Banks	New Drum Inlet	2
South Core Banks	New Drum Inlet	2
South Core Banks	Plover Inlet (Mile 23.4)	1
South Core Banks	Power Squadron Spit	1

Table 2. Piping Plover Breeding Pairs at Cape Lookout National Seashore 1989-2003

	1989	1992	1993	1994	1995	1997	1998	1999	2000	2001	2002	2003
Ocracoke Inlet	0	2	0	2	2	1	0	1	0	0	0	0
Portsmouth Flats	14	8	9	7	8	17	15	9	11	9	8	6
Kathryn-Jane Flats	7	11	9	12	11	10	8	2	1	1	2	1
Old Drum Inlet	3	2	1	1	2	1	1	0	0	0	0	1
New Drum Inlet (NCB)	4	5	9	10	6	3	2	3	1	2	2	2
New Drum Inlet (SCB)	3	3	4	5	4	2	3	3	2	3	2	2
Plover Inlet (Mile 23.6)	0	0	0	0	0	1	1	1	1	1	1	1
Cape Point	0	0	0	0	0	0	0	1	0	0	0	0
Power Squadron Spit	3	2	3	2	2	1	2	1	0	0	0	1
CALO Total	34	33	35	39	35	36	32	21	16	16	15	14

Nests

15 nests were found in 2003. 12 nests were on NCB and 3 on SCB. Seven of the nests hatched and six chicks were fledged from four nests. The average clutch size was 3.67 eggs. At least 23 of 55 eggs hatched. Productivity for CALO was 0.43 chicks fledged per nesting pair (Table 3).

Table 3. Piping Plover Nesting Success at CALO 1989-2003

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

Predator Enclosures

Predator enclosures were used to protect 11 nests. 54% of the nests with enclosures hatched. Only one of four nests without enclosures hatched (25%). Three nests with predator enclosures lost eggs to ghost crabs. Since 1997, at least 17 nests protected by enclosures have lost eggs to ghost crabs. Two nests protected by enclosures were buried by sand during high winds.

Table 4. Likely Causes of Piping Plover Nest Losses in 2003.

NESTING AREA	# NESTS	# LOST	PREDATORS	STORMS	ABANDONED	UNKNOWN
Portsmouth Flats	8	6	3	1	1	1
Kathryn-Jane Flats	2	1	0	1	0	0
New Drum Inlet (NCB)	2	1	0	0	0	1
New Drum Inlet (SCB)	2	0	0	0	0	0
Plover Inlet (Mile 23.6)	1	0	0	0	0	0
Total	15	8	3 (37%)	2 (25%)	1 (12%)	2 (25%)

Brood Foraging

Two broods foraged on the ocean beach near New Drum Inlet in 2003. The area was closed to all vehicles for nearly three weeks until the chicks fledged. Chicks in other nesting areas foraged on soundside beach and sandflats in areas closed to all entry.

Predator Control

No predator removal was done in 2003.

Non-nesting Piping Plover Surveys

Surveys in 2003 did not include the area from south of Old Drum Inlet to the north side of New Drum Inlet. This 3-mile stretch of beach is currently not accessible by vehicle and difficult to reach by boat. In past years the north side of New Drum Inlet was an important migratory stop for piping plovers so our surveys are potentially undercounting the number of birds in the park. The counts in September were not completed because of Hurricane Isabel. Appendix III lists non-nesting counts since 2000.

Table 5. Non-Nesting Piping Plover Counts at Cape Lookout National Seashore, 2003.

	January	February	March	August	September	October	November
NCB	11	6	34	54	74	28	7
SCB	7	6	3	42	?	12	14
SHACK	27	5	14	4	?	7	7
Total	45	17	51	100	74+	47	28

The highest concentration of wintering birds in the park occurred on the northern end of North Core Banks. The ocean beach from Ocracoke Inlet to Mile 3 regularly had a high number of piping plovers. Other concentrations occurred at Power Squadron Spit, New Drum Inlet and the east and west ends of Shackleford Banks.

Banded Piping Plovers

27 observations of at least 17 different banded birds were made in the park in 2003 (Table 6). One bird was banded at Westhampton, New York. Seven birds were identified as members of the Great Lakes breeding population. Three of these birds (RXOO, --OX and LXRO) also were seen in the park in 2001 and 2002.

16 observations of birds banded in Canada were made. Birds banded in Newfoundland, Prince Edward Island, and New Brunswick were seen in the park. All band sightings were reported to the bander if known.

Table 6. Band Combinations of piping plovers observed at CALO, 2003.

DATE	LEFT LEG-TOP	LEFT LEG-BOTTOM	RT. LEG-TOP	RT. LEG-BOTTOM	ISLAND	Comments
1/16		red/green bicolor metal		metal	NCB	banded at Prince Edward Island
1/17				light green/red split	SCB	Possible Great Lakes bird
1/21	Red	USFWS	orange	orange	SHACK	banded in Northern Michigan (RXOO)
1/21	Black	USFWS	red	orange	SHACK	female banded in N.Michigan (LXRO)
1/21		metal		red/blue bicolor metal	SHACK	banded in Newfoundland
1/21		metal		faded bicolor metal	SHACK	Canadian bird
2/12			orange	USFWS	SHACK	Great Lakes bird (--Ox)
2/14		red/green bicolor metal		metal	NCB	alpha code "EY" banded in PEI
3/13		metal		red/blue bicolor metal	SHACK	alpha code "CB" banded in Newfoundland
3/13		faded bicolor metal		metal	SHACK	? Canadian bird
3/17		red/blue bicolor metal		metal	NCB	banded in Newfoundland
7/4	Gray		yellow		SCB	banded in Westhampton, NY
7/7	Red	USFWS	orange	orange	SCB	banded in Northern Michigan (RXOO)
8/14		blue/green bicolor metal		metal	NCB	alpha code "RH" banded in New Brunswick
8/15		red/green bicolor metal		metal	SCB	banded at Prince Edward Island
8/15		metal		red/blue bicolor metal	SCB	banded in Newfoundland
8/14			orange	USFWS	SHACK	Great Lakes bird (- -Ox)
8/11		blue/?bicolor metal		metal	NCB	? Canadian bird
10/15		red/green bicolor metal		metal	SHACK	alpha code "NC" banded at Prince Edward Is.
10/15		metal		faded bicolor metal	SHACK	? Canadian bird
10/17		blue/green bicolor metal		metal	NCB	alpha code "NM" banded in New Brunswick
10/17		blue/?bicolor metal		metal	NCB	? Canadian bird
10/17		metal		red/blue bicolor metal	NCB	banded in Newfoundland
10/17				black/orange split	NCB	Great Lakes bird (L/O)
10/17	yellow/orange/yellow split	orange	orange	light blue	NCB	Great Lakes bird (Y/O/Y O-X,Ob)
10/17			orange/green split	USFWS	NCB	Great Lakes bird (O/GX)
11/18			orange	USFWS	SHACK	Great Lakes bird (--OX)

Discussion

Nesting Habitat

The nesting areas used by piping plovers were covered by more vegetation than anytime since monitoring began in 1989. Thick vegetation blocked access to much of the soundside beach at New Drum Inlet. Despite the apparent degradation of nesting habitat, piping plovers were most successful at fledging chicks from areas with thick vegetation.

Nest Success

In 2003 predator exclosures were effective in protecting nests from all predators but ghost crabs. Two nests protected by exclosures were buried during high winds. Predator exclosures have generally been effective in increasing hatch success. From 1998-2003, 64% of the nests protected with exclosures hatched, compared with 20% of the nests left unprotected.

Fledging Success

The fledging success for piping plovers at CALO continues to be well below the “Recovery Plan” goal of 1.5 fledged chicks per pair. It is also below the 1.2 chicks fledged per pair estimated to be required to maintain a stable population. From 1989 to 2003 the productivity of piping plovers in the park was only 0.40 chicks fledged per nesting pair. Most of the chicks continue to be lost in the first week after the nest hatches. The cause of the high chick mortality continues to be unknown.

Herring gulls have been the only predator observed taking piping plover chicks at CALO. While raccoons are predators of the eggs of piping plovers and other ground nesting birds in the park they are not proven predators of chicks. No predators were removed from nesting areas this year and productivity was the highest it’s been in the park since 2000.

Starvation due to poor foraging habitat is a more likely possibility. The Portsmouth Flats nesting area, which has most of the nests in the park, lacks the soundside and ephemeral pool foraging areas that are common in northern nesting areas. In a New York study, Elias et.al. found “that brood-rearing quality of beaches with ephemeral pools and bay tidal flats were superior to beaches lacking these habitats.” Most of the foraging areas used by plover chicks on Portsmouth Flats are dry sand flats. In a 2000 study at CALO this habitat type was found to have the lowest level of invertebrate populations present. This area consistently has the poorest productivity in the park.

Non-nesting piping plovers

CALO continues to be an important migration stopover location and wintering site for piping plovers. In 2003, 366 birds were counted in the park during the non-nesting season. Piping plovers from the endangered Great Lakes population, a bird that was banded in New York, and birds that nest in Canada all used the park.

Conclusions

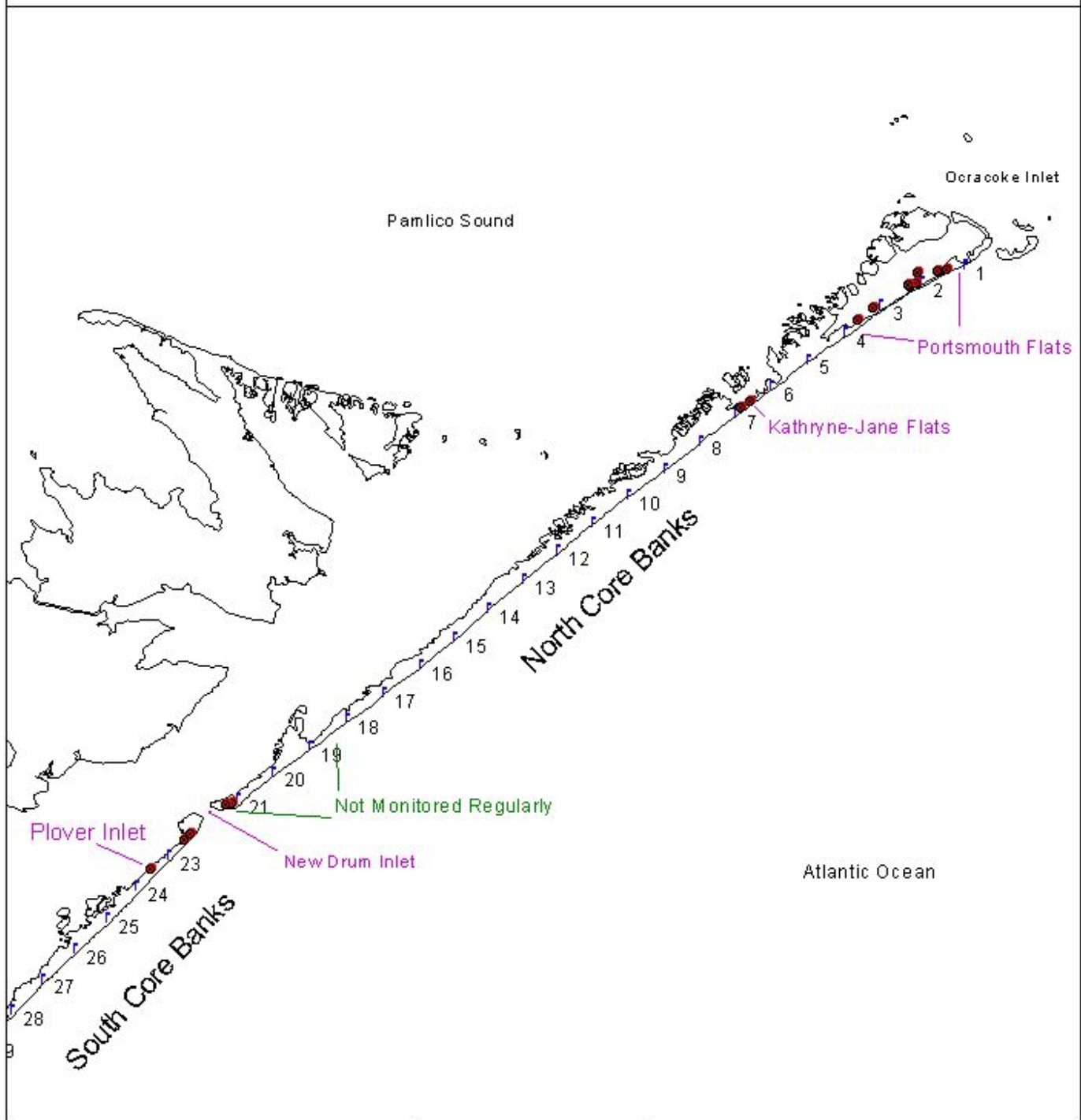
In 2003 piping plovers nested on 9 different islands in North Carolina. Each of the 9 nesting islands had a different combination of predators, susceptibility to flooding and amount of disturbance from people. Productivity continued to be poor throughout the state (0.46 chicks fledged per nesting pair) despite the use of predator exclosures.

It is logical that some broad environmental factor, such as prey availability for chicks, is the reason for the poor productivity in North Carolina. Being at the southern extreme of the piping plover nesting range likely has limiting factors on nesting productivity that may not be overcome by the kind of management that is successful in the heart of the nesting range. CALO and North Carolina contribute more to the survival of piping plovers as a migratory stop over and wintering area than as a nesting area.

Literature Cited

ELIAS, S.P., J.D. FRASER, AND P.A. BUCKLEY. 2000. Piping Plover Brood Foraging Ecology on New York Barrier Islands. *Journal of Wildlife Management* 64(2):346-354.

Figure 1. Piping Plover Nests at Cape Lookout National Seashore 2003



●	Piping Plover Nests
▲	Mile Markers



National Park Service
Cape Lookout National Seashore
Resource Management Division



APPENDIX I. PIPING PLOVER NEST DATA

North Core Banks

Nest #	SITE	MILE	DATE FOUND	CLUTCH SIZE	EXCLOSURE	HATCH DATE	EGGS HATCHED	# FLEDGED
1	KJ	6.6	7-May	4	9-May	n/a	0	0
2	PF	2.2	8-May	2	9-May	n/a	0	0
3	PF	1.6	12-May	4	14-May	n/a	0	0
4	PF	2.1	12-May	4	14-May	6-Jun	2	0
5	PF	3.1	14-May	3	14-May	11-Jun	2	0
6	PF	2.2	27-May	4	n/a	n/a	0	0
7	KJ	6.7	9-Jun	4	9-Jun	2-Jul	4	0
8	PF	3.6	20-Jun	2	23-Jun	n/a	0	0
9	PF	1.5	24-Jun	4	n/a	n/a	0	0
10	PF	1.9	27-Jun	4	30-Jun	n/a	0	0
11	ND	21.2	21-May	4	n/a	?	?	0
12	ND	21.3	11-Jun	4	n/a	1-Jul	4	1

South Core Banks

Nest #	SITE	MILE	DATE FOUND	CLUTCH SIZE	EXCLOSURE	HATCH DATE	EGGS HATCHED	# FLEDGED
1	ND	22.5	7-May	4	9-May	8-Jun	4	3
2	ND	22.3	9-May	4	12-May	10-Jun	3	1
3	PI	23.5	20-May	4	20-May	11-Jun	4	1

PF=Portsmouth Flats
 KJ=Kathryne-Jane Flats
 ND=New Drum Inlet
 PI=Plover Inlet

Appendix II- 2003 PIPING PLOVER WINDOW CENSUS

2003 Piping plover breeding census results: June 1-9

North Core Banks: 7 nesting pairs

Portsmouth Flats 6 Pairs

Kathryne Jane 1 Pairs

Old Drum Inlet 0 Pair

Middle Core Banks: 1 nesting pair + 1 unpaired male

Old Drum Inlet 1 unpaired male

New Drum Inlet 1 Pair

South Core Banks: 4 nesting pairs

New Drum Inlet 2 Pairs

Mile 23.6 1 Pair

Spit 1 Pair

Shackleford Banks: No birds present

Appendix III- Monthly Counts of Non-nesting Piping Plover at Cape Lookout National Seashore 2000-2003

