

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 the birds.

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 was isolated when Old Drum Inlet re-opened in September 1999, preventing vehicle access to this area.

Nests were protected with predator exclosures if the topography of the location was suitable. Exclosures were circular, 10 feet in diameter, made of four feet high 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 15 pairs of piping plovers nested or held a territory at CALO in 2002, one fewer pair than in 2001. 12 pairs nested on North Core Banks (NCB) and 3 pairs on South Core Banks (SCB). Birds held territories in 5 distinct nesting areas (Table 1). Portsmouth Flats contained the highest number of nesting pairs. The birds at CALO accounted for 2/3 of the nesting pairs in North Carolina in 2002.

Table 1. Number of Nesting Pairs by Nesting Areas

ISLAND	NESTING AREA	NUMBER OF PAIRS
North Core Banks	Portsmouth Flats	8
North Core Banks	Kathryn-Jane Flats	2
North Core Banks	New Drum Inlet	2
South Core Banks	New Drum Inlet	2
South Core Banks	Plover Inlet (Mile 23.4)	1

Table 2. Piping Plover Breeding Pairs at Cape Lookout National Seashore 1989-2002

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

Nests

20 nests were found in 2002. 16 nests were on NCB and 4 on SCB. 13 of the nests hatched and four chicks were fledged from four nests. The average clutch size was 3.25 eggs. At least 43 of 65 eggs hatched. Productivity for CALO was 0.27 chicks fledged per nesting pair (Table 3). No chicks fledged anywhere else in North Carolina in 2002.

Table 3. Piping Plover Nesting Success at CALO 1989-2002

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

Predator Exclosures

Predator exclosures were used to protect 13 nests. 85% of the nests with exclosures hatched. Only two of seven nests without exclosures hatched (28%). Two nests with predator exclosures were lost to ghost crabs. Since 1997, at least 14 nests protected by exclosures have lost eggs to ghost crabs.

Table 4. Likely Causes of Piping Plover Nest Losses in 2002.

NESTING AREA	# NESTS	# LOST	PREDATORS	STORMS	ABANDONED	UNKNOWN
Portsmouth Flats	12	5	4	0	0	1
Kathryn-Jane Flats	2	0	0	0	0	0
New Drum Inlet (NCB)	2	1	0	0	0	1
New Drum Inlet (SCB)	3	0	0	0	0	0
Plover Inlet (Mile 23.6)	1	1	1	0	0	0
Total	20	7	5 (71%)	0 (0%)	0 (0%)	2 (29%)

Brood Foraging

Two broods foraged on the ocean beach at Kathryn-Jane Flats in 2002. The area was closed to unescorted vehicles until the chicks fledged. Vehicles were escorted through the area by park staff twice a day to allow access the northern end of North Core Banks. Chicks in other nesting areas foraged on soundside beach and sandflats in areas closed to all entry.

Predator Control

In an effort to reduce depredation of piping plover eggs and chicks some potential predators were removed from nesting areas. In 336 trap nights 44 raccoons and 2 feral cats were relocated from Portsmouth Flats, Kathryn-Jane Flats and New Drum Inlet.

Non-nesting Piping Plover Surveys

Surveys in 2002 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. Appendix III lists non-nesting counts since 2000.

Table 5. Non-Nesting Piping Plover Counts at Cape Lookout National Seashore, 2002.

	January	February	March	August	September	October	November
NCB	25	4	41	31	42	40	16
SCB	1	6	1	7	8	7	5
SHACK	13	10	19	6	9	16	13
Total	39	20	61	44	59	63	34

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, and the east and west ends of Shackelford Banks. The south side of New Drum Inlet was not as commonly used this year. The mudflats that were often used by wintering birds in the past have been almost completely washed away.

Banded Piping Plovers

44 observations of at least 15 different banded birds were made in the park in 2002 (Table 6). Three of these birds were identified as members of the Great Lakes breeding population. Two of these birds were banded in northern Michigan (RXOO and LXRO) and one was banded in southern Michigan (OBYX). All three birds also were seen in the park in 2001.

22 observations of birds banded in Canada were made. Birds banded in Newfoundland, Prince Edward Island, New Brunswick and Quebec 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, 2002.

Date	Upper left	Lower left	Upper right	Lower right	Island	Comments
1/14		red/? bicolor metal		metal	NCB	banded at Newfoundland or PEI
1/16	orange	blue	yellow	USFWS	SHACK	female banded in S. Michigan (OBYX)
1/16			orange	USFWS	SHACK	
1/16		red/green bicolor metal		metal	SHACK	banded at Prince Edward Island
2/8	orange	blue	yellow	USFWS	SHACK	female banded in S. Michigan (OBYX)
2/8			orange	USFWS	SHACK	
2/13		metal		red/blue bicolor metal	NCB	juvenile banded in Newfoundland
2/14	black	USFWS	red	orange	SCB	female banded in N. Michigan (LXRO)
2/15			orange	USFWS	SHACK	
2/15		metal		red/blue bicolor metal	SHACK	juvenile banded in Newfoundland
3/13	black	USFWS	red	orange	SHACK	female banded in N. Michigan (LXRO)
3/13	red	USFWS	orange	orange	SHACK	banded in Northern Michigan (RXOO)
3/13		metal		red/blue bicolor metal	SHACK	juvenile banded in Newfoundland
4/12			orange	USFWS	SHACK	
4/12		?bicolor metal		metal	SHACK	? Canadian bird
8/14		metal		blue/green bicolor metal	SCB	alpha code "HR" banded in New Brunswick
8/15			red	metal	NCB	
8/15		red/green bicolor metal		metal	NCB	banded at Prince Edward Island
9/12			orange	USFWS	SHACK	
9/13		black flag			SCB	
9/17		metal		red/blue bicolor metal	NCB	banded in Newfoundland
9/17		metal		blue/green bicolor metal	NCB	banded in New Brunswick
9/17			red	metal	NCB	
9/17		blue/purple?bicolor metal		metal	NCB	banded in Quebec?
10/16	black	USFWS	red	orange	SCB	female banded in N. Michigan (LXRO)
10/17				black/orange split	NCB	
10/17			red	metal	NCB	
10/17		red/green bicolor metal		metal	NCB	alpha code "EY" banded in PEI
10/17		metal		faded bicolor metal	NCB	probable Canadian bird
10/17		metal		red/blue bicolor metal	NCB	banded in Newfoundland
10/17		metal		blue/green bicolor metal	NCB	banded in New Brunswick
10/17		blue/green bicolor metal		metal	NCB	banded in New Brunswick
10/18		metal		red/blue bicolor metal	SHACK	alpha code "CB" banded in Newfoundland
10/18				metal	SHACK	
10/18	red	USFWS	orange	orange	SHACK	banded in Northern Michigan (RXOO)
10/18		red/green bicolor metal		metal	SHACK	banded at Prince Edward Island
11/14		blue/? bicolor metal		metal	NCB	banded in New Brunswick or Quebec
11/14		metal		blue/green bicolor metal	NCB	banded in New Brunswick
11/14		metal		red/green bicolor metal	NCB	banded at Prince Edward Island
11/14		metal		blue/green bicolor metal	NCB	banded in New Brunswick
11/15			orange	USFWS	SHACK	
11/15		blue/? bicolor metal		metal	SHACK	banded in New Brunswick or Quebec
11/15	red	USFWS	orange	orange	SHACK	banded in Northern Michigan (RXOO)
11/15		black/orange split			SHACK	

Discussion

Nest Success

In 2002 predator exclosures were effective in protecting nests from all predators but ghost crabs. Nothing has been found to successfully deter ghost crabs from depredating nests. Predator exclosures have generally been effective in increasing hatch success. From 1998-2002, 64% of the nests protected with exclosures hatched, compared with 17% 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 2002 the productivity of piping plovers in the park was only 0.38 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. The removal of raccoons and feral cats from nesting areas this year failed to improve fledging success.

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 has piping plovers on each island during every month of the year. Key foraging areas have been identified and monitoring will continue to document yearly variations. The park is a wintering site for the endangered Great Lakes population as well as birds that nest in Canada. CALO is also an important stopover location for piping plovers and many other shorebirds migrating along the Atlantic coast.

Conclusions

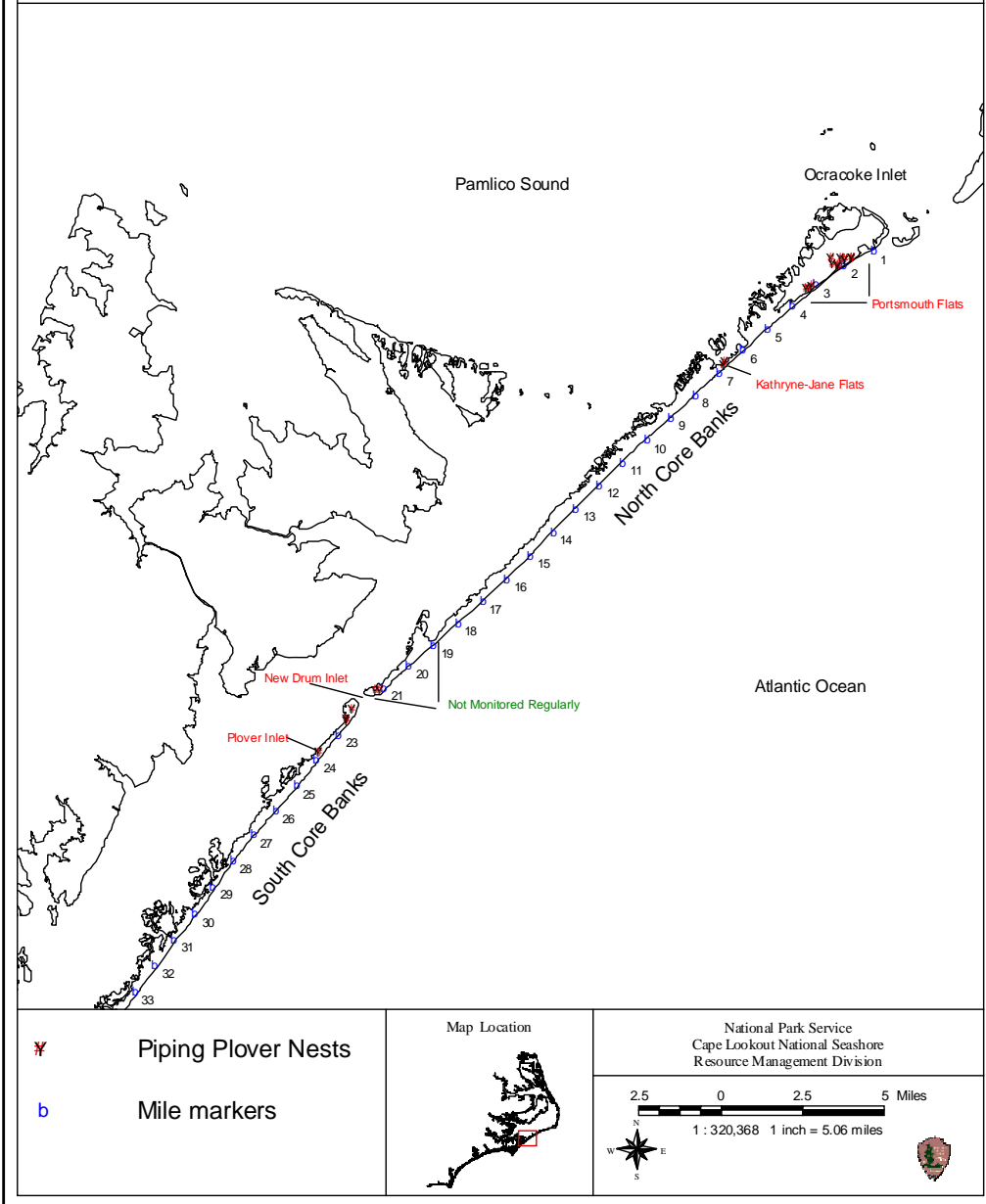
In 2002 piping plovers nested on 9 different islands in North Carolina. Each of the 9 nesting islands had a different combination of predators, susceptibility to flooding and amount of disturbance from people. Productivity continued to be dismal throughout the state (0.17 chicks fledged per nesting pair) despite the use of predator exclosures and some predator control at Cape Lookout and Cape Hatteras National Seashores.

It is logical that some broad environmental factor, such as prey availability for chicks, is the reason for the poor productivity in North Carolina instead of depredation. 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
2002**



Plot date: October 25, 2001 c:\my documents\gis\piping plover\plover_01.apr

APPENDIX I. PIPING PLOVER NEST DATA

North Core Banks

Nest #	SITE	MILE	DATE FOUND	CLUTCH SIZE	EXCLOSURE	HATCH DATE	EGGS HATCHED	# FLEDGED
1	PF	2.1	20-Apr	4	23-Apr	25-May	4	0
2	KJ	6.8	26-Apr	3	29-Apr	28-May	3	1
3	PF	1.7	3-May	3	7-May	3-Jun	2	0
4	PF	1.9	8-May	4	9-May	n/a	0	0
5	PF	3.2	26-May	3	n/a	n/a	0	0
6	KJ	6.8	30-May	4	4-Jun	1-Jul	4	1
7	PF	3.1	4-Jun	4	5-Jun	1-Jul	4	0
8	PF	2.1	4-Jun	2	n/a	21-Jun	1	0
9	PF	2.0	6-Jun	1	n/a	n/a	0	0
10	PF	1.9	11-Jun	4	11-Jun	8-Jul	4	0
11	PF	2.1	12-Jun	4	18-Jun	11-Jul	4	0
12	PF	2.1	24-Jun	3	25-Jun	17-Jul	2	0
13	PF	1.8	26-Jun	1	n/a	n/a	0	0
14	PF	3.3	26-Jun	3	n/a	n/a	0	0
15	ND	21.2	4-Jun	3	n/a	n/a	0	0
16	ND	21.1	2-Jul	4	n/a	2-Jul	3	1

South Core Banks

Nest #	SITE	MILE	DATE FOUND	CLUTCH SIZE	EXCLOSURE	HATCH DATE	EGGS HATCHED	# FLEDGED
1	ND	22.5	30-Apr	4	6-May	24-May	4	0
2	ND	22.4	30-Apr	4	6-May	5/28?	4	1
3	PI	23.7	30-Apr	3	6-May	n/a	0	0
4	ND	22.5	10-Jun	4	14-Jun	10-Jul	4	0

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

Appendix II- 2002 PIPING PLOVER WINDOW CENSUS

2002 Piping plover breeding census results: June 1-8

North Core Banks: 9 nesting pairs

Portsmouth Flats 7 Pairs

Kathryne Jane 2 Pairs

Old Drum Inlet 0 Pair

Middle Core Banks: 2 nesting pairs

New Drum Inlet 2 Pairs

South Core Banks: 2 nesting pairs

New Drum Inlet 2 Pairs

Mile 23.6 1 unpaired male

Spit 0 Pairs

Shackleford Banks: No birds present

Total for Cape Lookout National Seashore: 13 Nesting Pairs.

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

