

Introduction

Piping plover monitoring at Cape Lookout National Seashore (CALO) began with a baseline study in 1989. The park was found to be a significant nesting area with about 2/3 of the nesting pairs in the state of North Carolina. Nesting success was found to be poor compared to other nesting pairs throughout the bird's range.

Monitoring has continued since 1992, focusing on factors limiting nesting success and methods that could be used to increase the productivity of the birds.

Methods

All known nesting habitat was closed to entry with signs and/or symbolic fence by April 1. Beginning in late April nesting areas were searched at least three times a week for territorial pairs and nests. The area between Old Drum Inlet and New Drum Inlet was not monitored regularly due to logistic difficulties. Old Drum Inlet re-opened in September 1999, preventing vehicle access to this area. The locations of nests were recorded and the nests were monitored until they hatched or were lost.

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.

A study of potential piping plover chick prey items was conducted at Portsmouth Flats and Kathryn-Jane Inlet on North Core Banks. Arthropod abundance was sampled in potential brood foraging habitat in 10 randomly selected transects. The methods were the same as a study conducted by Kuklinski and Fraser in 1996 at Cape Hatteras National Seashore. Paint stirrers coated with insect trap coating were placed in pairs in a variety of habitat types along established transects. One stick was set up vertically with its handle buried in the sand. The second stick was laid flat on the ground. The sticks were left in place for three hours. Captured arthropods were identified to Order and counted.

Counts of wintering and migrating piping plovers were made monthly beginning in February 2000. The counts were made near the fifteenth of each month in the non-nesting season.

Results

Nesting Pairs

A total of 16 pairs of piping plovers nested or held a territory at CALO in 2000, the lowest number since monitoring began in 1989. 13 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 2000.

Table 1. Number of Nesting Pairs by Nesting Areas

NESTING AREA	NUMBER OF PAIRS
Portsmouth Flats	11
Kathryn-Jane Flats	1
New Drum Inlet (NCB)	1
New Drum Inlet (SCB)	2
Plover Inlet (Mile 23.4)	1

Table 2. Piping Plover Breeding Pairs at Cape Lookout National Seashore 1989-2000

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

Nests

18 nests were found in 2000. 15 nests were on NCB and 3 on SCB. 12 of the nests hatched and eight chicks were fledged from a total of four nests. The fate of one nest was unknown. The average clutch size was 3.6 eggs. 43 of 65 eggs hatched. Productivity for CALO was 0.5 chicks fledged per nesting pair; the highest recorded in the park since 1993 (Table 3). A total of only 13 chicks survived to fledge in North Carolina in 2000.

Table 3. Piping Plover Nesting Success at CALO 1989-2000

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

Predator Exclosures

Predator exclosures were used to protect 14 nests. 71% of the nests with exclosures hatched. Only one nest without an exclosure was known to hatch. 1 nest had an egg disappear from inside an exclosure. Since 1997, at least 10 nests protected by exclosures have lost eggs during incubation, presumably to ghost crabs.

Table 4. Likely Causes of Piping Plover Nest Losses in 2000.

NESTING AREA	# NESTS	# LOST	PREDATORS	STORMS	ABANDONED	UNKNOWN
Portsmouth Flats	13	5	1	1	1	2
Kathryn-Jane Flats	1	0				
New Drum Inlet (NCB)	1	0				
New Drum Inlet (SCB)	2	0				
Plover Inlet (Mile 23.6)	1	0				
Total	18	5	1 (20%)	1 (20%)	1 (20%)	2 (40%)

Nest Elevations

No nests were elevated to protect them from flooding. The nests at Portsmouth Flats were located in areas less subject to flooding than previous years.

Brood Foraging

Broods foraged on the ocean beach in two locations on South Core Banks. At New Drum Inlet a chick used the ocean beach briefly when soundside foraging habitat was flooded. At Mile 23.6 a brood of three chicks began to use the ocean beach when they were 2 ½ weeks old. Both areas were closed to vehicles while the chicks were present. All other areas used by piping plover chicks were closed to all entry.

Prey Availability

A total of 2,893 arthropods were collected in 42 sampling periods. 94 % of the arthropods captured were Dipterans, followed by Hymenopterans (3%) and Coleopterans (2%). Small numbers of Hemipterans, Orthopterans, and Arachnids were also collected.

Table 5. Groups of Arthropods Collected in Transects on North Core Banks, 2000.

Diptera	Hymenoptera	Coleoptera	Hemiptera	Orthoptera	Arachnidia	Unknown
2,727	83	71	3	1	4	4

The “ocean fresh wrack” habitat had the greatest abundance of arthropods with a mean of 24 collected per sample period. The lowest arthropod abundance was found on dry sand flats with only 1/3 as many arthropods collected. Most of the habitat available at Portsmouth Flats is dry sand flats. Surprisingly the ephemeral pools were found to have a low abundance of 11. Studies at Cape Hatteras and other areas found this habitat type to have the greatest arthropod abundance.

Table 6. Arthropod Abundance in Piping Plover Brood Foraging Habitats.

Habitat Type	# Insects Collected	# Samples	X
Ocean Intertidal Zone	514	38	13.5
Ocean Fresh Wrack	579	24	24.1
Ocean Old Wrack	411	28	14.7
Ocean Storm Wrack	312	32	9.7
Sparse Vegetation	244	15	16.3
Dune	211	11	19.2
Ephemeral Pool	89	8	11.1
Dry Sand Flat	139	16	8.7
Wet Sand Flat	394	28	14.1
All areas	2893	200	14.5

Non-nesting Piping Plover Surveys

Table 7. Non-Nesting Piping Plover Counts at Cape Lookout National Seashore, 2000.

	February	March	August	September	October	November
NCB		43	75	43	28	27
SCB	5	13	29	16	2	4
SHACK	2	13	12	3	14	16

Surveys in 2000 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.

Five banded birds were found in the park in 2000. A bird with black over white color bands on the lower left leg was seen at the southside of New Drum Inlet March 14. This bird may have been from the Great Lakes Population. Another bird was found in the same location on August 17 with a black flag over USFWS band on the lower left leg.

A bird with a USFWS band on the lower left leg was seen a Power Squadron Spit April 7. On November 13 a bird was seen one mile south of Ocracoke Inlet with a green color band on the left leg, light green band on the upper right and USFWS band on lower right. A bird with a red color band on the upper left, a USFWS band on the lower left and an orange color band on the lower right was seen on the east end of Shackleford Banks November 14.

Discussion

Nesting Pairs

The decline in the number of nesting pairs at CALO in 2000 occurred despite greatly improved habitat. Two hurricanes in 1999 removed encroaching vegetation, created new overwash fans, re-opened Old Drum Inlet and cut new creeks at Portsmouth Flats. For the first time since monitoring began a pair did not attempt to nest at Power Squadron Spit or anywhere on the south end of South Core Banks.

Nest Success

Predator exclosures have been used at CALO since 1993. The exclosures have been effective in increasing hatch success. Since 1997, 65% of the nests protected with

exclosures have hatched, compared with 18% of the nests left unprotected. Flooding and eggs lost to ghost crabs were the two main threats to hatch success for nests protected by exclosures.

Fledging Success

Although the fledging success for piping plovers at CALO was the highest its been since 1993 it was still 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. 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.

Conclusions

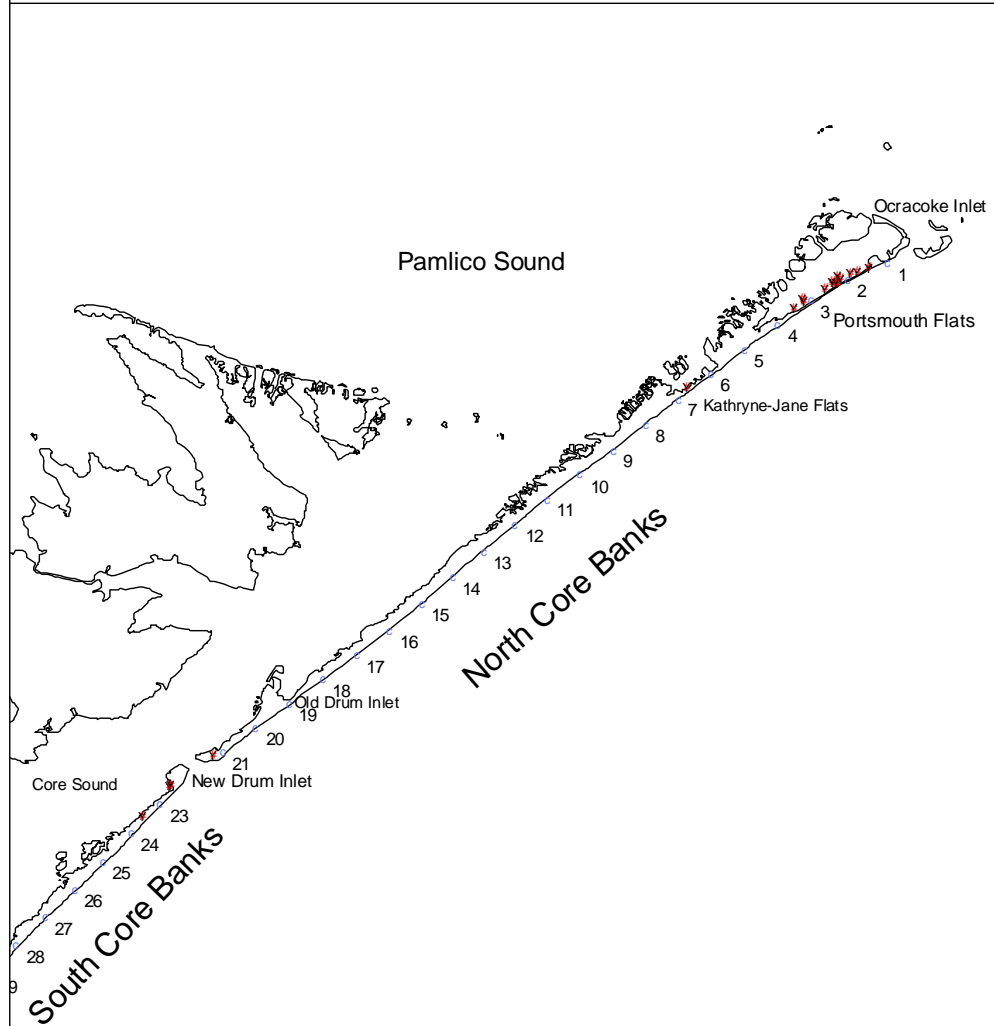
The decline in nesting pairs at CALO may be the result of low productivity the past 11 years. The productivity during that period was only 0.37 chicks per pair, far below the level needed to sustain the population. Without recruitment of birds from other areas piping plover may be in danger of disappearing from CALO and from North Carolina.

The management techniques that have been highly successful in the northern areas of the piping plover nesting range have failed to increase productivity at Cape Lookout. There are most likely some unknown environmental factors that limit reproductive success of the birds, despite apparently pristine and undisturbed nesting habitat.

Literature Cited

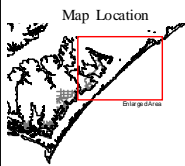
Kuklinski, M., L, Houghton, and J. Fraser. 1996. Piping plover breeding ecology on Cape Hatteras National Seashore with special reference to the effect of temperature on productivity, Department of Fisheries and Wildlife, Virginia Polytechnic Institute and State University, Blacksburg, VA.

Piping Plover Nests at Cape Lookout National Seashore 2000



Y Piping Plover Nests

C Mile markers



National Park Service
Cape Lookout National Seashore



APPENDIX I. PIPING PLOVER NEST DATA

North Core Banks

Nest #	SITE	MILE	DATE FOUND	CLUTCH SIZE	EXCLOSURE	HATCH DATE	EGGS HATCHED	# FLEDGED
1	K. Jane Flats	6.6	24-Apr	4	27-Apr	22-May	3	3
2	Ports. Flats	2.2	1-May	4	3-May	n/a	0	0
3	Ports. Flats	2.3	11-May	1	n/a	n/a	0	0
4	Ports. Flats	3.1	18-May	4	19-May	n/a	0	0
5	Ports. Flats	2.5	18-May	4	19-May	14-Jun	3	0
6	Ports. Flats	2.3	18-May	4	21-May	19-Jun	4	0
7	Ports. Flats	2.1	18-May	4	19-May	n/a	0	0
8	Ports. Flats	1.9	23-May	4	23-May	16-Jun	4	1
9	Ports. Flats	1.7	12-Jun	4	14-Jun	4-Jul	4	0
10	Ports. Flats	2.2	12-Jun	3	14-Jun	11-Jul	3	0
11	Ports. Flats	1.4	12-Jun	4	14-Jun	7-Jul	4	0
12	Ports. Flats	3.5	20-Jun	4	21-Jun	7-Jul	4	0
13	Ports. Flats	2.1	21-Jun	3	n/a	n/a	0	0
14	Ports. Flats	3.1	23-Jun	4	27-Jun	11-Jul	3	0
15	N. Drum Inlet	21.5	10-May	3	n/a	unknown	unknown	unknown

South Core Banks

Nest #	SITE	MILE	DATE FOUND	CLUTCH SIZE	EXCLOSURE	HATCH DATE	EGGS HATCHED	# FLEDGED
1	N. Drum Inlet	22.5	12-May	4	17-May	12-Jun	4	1
2	N. Drum Inlet	22.4	29-May	3	2-Jun	13-Jun	3	0
3	Mile 23.6	23.6	not found	4	n/a	14-Jun	4	3

Appendix II- 2000 PIPING PLOVER WINDOW CENSUS

2000 Piping plover breeding census results: May 27-June 4

North Core Banks: 10 nesting pairs present + 2 unpaired birds

Ocracoke inlet	1 unpaired male
Portsmouth Flats	7 Pairs and 1 unpaired males
Kathryne Jane	1 Pair
Old Drum Inlet	0 Pair
New Drum Inlet	2 Pairs

South Core Banks: 2 nesting pairs + 2 unpaired birds

New Drum Inlet	2 Pairs and 1 unpaired male
Mile 23.6	0 Pairs
Spit	1 unpaired male

Shackleford Banks: No birds present

Total for Cape Lookout National Seashore: 12 Nesting Pairs and 4 unpaired adults.