

CAPE HATTERAS NATIONAL SEASHORE
PIPING PLOVER (*CHARADRIUS MELODUS*) MONITORING
2008 ANNUAL REPORT



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Abstract

Piping plover (*Charadrius melodus*, PIPL) monitoring at Cape Hatteras National Seashore (CAHA) began in 1985. Monitoring efforts focused on identifying nesting habitat, locating and protecting breeding plover territories and nests, and determining nest and brood success. In 2008, 11 PIPL pairs and 13 nests were identified. Seven PIPL chicks successfully fledged for a fledging rate of 0.64 chicks per breeding pair. The 2008 breeding season was the first year that CAHA was managing under the requirements of the Consent Decree.

Introduction

CAHA was authorized as part of the National Park system on August 17, 1937. It was established as our nation's first national seashore on January 12, 1953. CAHA is part of a dynamic barrier island system. Federal ownership consists of more than 30,000 acres including roughly 66.8 miles of oceanside shoreline and includes portions of Ocracoke, Hatteras and Bodie Islands.

CAHA is home to the federally listed piping plover, and provides nesting habitat for several species of state-listed colonial waterbirds, including the common tern, least tern, gull-billed tern, and black skimmer. Solitary nesters, such as the American oystercatcher and possibly the Wilson's plover, also use CAHA as a breeding area. Because PIPL eggs are cryptic and the nesting PIPL population on the seashore is so low, much staff time and effort is geared toward documenting the breeding behavior and nesting efforts of PIPLs when compared to the other nesting shorebirds that occur at CAHA.

The PIPL is a small sandy-colored shorebird with a black band across the forehead and a black ring around the neck. The Atlantic Coast population typically breeds on coastal beaches from Newfoundland and southeastern Quebec to North Carolina. Nesting territories are usually established in late-March or early-April. The first nests are usually found in late-April or early May. PIPL's lay three to four eggs in a small shallow depression, or scrape. Upon completion of a clutch, the pair will incubate until the eggs hatch in about 27-30 days. Chicks are precocial and follow the adults to locations where they forage for invertebrates found in the sand. The chicks usually fledge between 25-35 days after hatching. Both the eggs and chicks are cryptic in coloration, which makes it difficult to see them.

In 1986, the Atlantic coast population of the PIPL was listed as threatened under the Endangered Species Act. Various factors have contributed to the decline of the species including; the loss of habitat due to development; loss of habitat due to erosion; predation; intentional or unintentional harassment by dogs, people, and vehicles; and weather (i.e. tropical storms or late nor'easters that cause extreme high tides).

PIPL monitoring at CAHA began in 1985. Monitoring has focused on identifying nesting habitat, locating and protecting breeding plover territories and nests, and determining nest and brood success. This report contains a summary of monitoring results for the 2008 breeding season (Appendix A), comparisons to results from previous years, and management activities for 2008.

Methods

Consent Decree

In October 2007, a lawsuit was brought by the Defenders of Wildlife and the National Audubon Society against the NPS for failure to provide adequate protection of threatened and endangered species from the impacts of off-road vehicle (ORV) use at Cape Hatteras National Seashore. On April 30, 2008, a settlement agreement was reached between all parties to the lawsuit and Federal District Court Judge Terrence Boyle signed a Consent Decree. The purpose of the Consent Decree was to provide additional protection measures pending the development of an ORV management plan and special regulation. Examples of changes in management resulting from the issuance of the Consent Decree include earlier dates for the establishment of pre-nesting closures and larger buffer requirements for nesting birds and chicks. The consent decree will be in effect until the ORV Management Plan and special regulation are finalized.

Closures

While pre-nesting closures minimize disturbance in potential breeding areas, they also enable birds to establish territories and to nest in their preferred habitat. Because the seashore's shoreline is dynamic in nature, a habitat evaluation was conducted in March of 2008 prior to the onset of the breeding season. This evaluation along with maps of historic nesting locations was used to determine the boundaries for the pre-nesting closures (Appendix B, Maps 1-6). These sites were then posted with symbolic fencing consisting of wooden posts, bird usage signs, string, and flagging tape by April 1st, as recommended in the United States Fish and Wildlife Service's (USFWS) Atlantic Coast Piping Plover Recovery Plan for managing sites used by ORVs (USFWS 1996). The pre-nesting closures included the upper beach, dunes, sand/mud flats, soundside intertidal zone, overwashes, blowouts, and ocean tidal zones. Bodie Island Spit, Cape Point, South Beach, Hatteras Overwash Fans, Hatteras Inlet Spit, North Ocracoke Spit, and Ocracoke Inlet Spit (South Point) all contained potential and/or historic nesting habitat for PIPLs. The spit on north Ocracoke has been accreting over the last few years and although no known nesting has occurred on north Ocracoke since 1996, staff continued to monitor it for potential nesting birds. The Hatteras Overwash Fans have no documented nesting history for PIPLs but have the potential to become nesting habitat especially since the nesting PIPLs at Hatteras Inlet have lost their nesting habitat due to erosion.

Pre-nesting closures were established at Bodie Island Spit, Cape Point, South Beach, Hatteras Overwash Fans, Hatteras Inlet Spit, North Ocracoke Spit, and Ocracoke Inlet Spit (South Point) (Appendix B, Maps 1-6). The pre-nesting closure at Bodie Island Spit was similar to the closure installed in 2007. The pre-nesting closure started at the north end of the Bait Pond overwash area and included the mud flat area to the south of the small dune area and last year's nest site location. The pre-nesting closure at Cape Point and South Beach allowed shoreline access from Ramp 44 to the Point. A full beach closure started on the east side of the Salt Pond drainage area and continued for approximately 1 mile of shoreline. The western end of the full beach closure terminated in the area between Salt Pond Road and Ramp 45 (approximately 100 meters east of Ramp 45). From this area to approximately 1.5 miles west of Ramp 45 only the upper beach was protected. A pre-nesting closure was established at the overwash fans near Hatteras Inlet which included the closure of approximately 0.7 miles of the Pole Road and ORV traffic was routed

from the Pole Road via the spur roads onto the ocean-side shoreline. The oceanside shoreline to Hatteras Inlet Spit was closed to pedestrians and ORVs from 0.1 miles west of the Pole Road exit onto the beach to the inlet (approximately 0.5 miles). Hatteras Inlet could only be accessed via the sound side and the inlet shoreline itself was only open to pedestrians. This was the first year that a pre-nesting closure was established on North Ocracoke Spit because of the accretion that is occurring at this site and because of the loss of habitat at Hatteras Inlet Spit. The closure began 0.3 miles north of Ramp 59. Where the beach starts to open up to form the spit, the closure extended from the duneline to the shoreline in a north-easterly direction. The pre-nesting closure at Ocracoke Inlet Spit (South Point) was similar to the closure installed in 2007 except that the full beach closure started approximately 100 feet east of where Ocracoke Inlet meets the sound.

The pre-nesting closures were modified throughout the season based on observed bird activity, in order to meet the buffer requirements of the Consent Decree and to provide adequate protection for nesting birds and broods. A closure was modified if breeding behavior (territorial behavior, courtship, or mating) was observed close to the edge or outside of a closure or if a scrape, nest or chick was located with inadequate buffers. Closures were also modified if breeding adult plovers were documented foraging outside of established closures. Buffer requirements of the Consent Decree differ for each protected avian species (Table 1). When several species of nesting birds were present, the greatest applicable buffer distance was used.

Table 1. Nesting Buffers Required by the 2008 Consent Decree.

Species	Breeding Behavior/ Nest Buffer (m)	Unfledged Chick Buffer (m)
Piping Plover	50	1000 (ORV only) 300 (pedestrian only)
American Oystercatcher	150	200
Least Tern	100	200
Other Colonial Waterbirds	200	200

Monitoring

Resource management staff began monitoring for PIPL arrival and pre-nesting behavior in late March and early April. Monitoring and surveys of these sites were conducted at least three times per week under the Interim Strategy, then increased to daily at the spits and Cape Point after the Consent Decree was approved on April 30, 2008. Observations were made up until July 15th, as required by the Consent Decree. Monitors looked for various territorial (e.g. aerial flight displays, horizontal threat displays, and parallel runs) and breeding (e.g. high step tattoo, wing-tilt display, scraping, and copulation) behaviors in order to determine where territories were being established. Once a nest was located, a predator exclosure was installed, generally after at least three eggs were laid. The nest was then briefly approached once a week to inspect the exclosure, to count the eggs, and check for predator tracks. Morning and evening observations began shortly prior to when nests were expected hatch.

After hatching, broods were monitored for a few hours in the morning and a few hours in the afternoon until the chicks fledged or were lost. Depending on staff availability, some broods received dawn-to-dusk monitoring. Monitoring was subject to occasional interruptions from unplanned demands on the monitor. During these times, chicks were never at risk of being run over by ORVs because of the size of the buffer distances of the closures. Observers documented in their notes: brood status, behavior, individual bird and/or brood movements, human disturbance, predator interactions, or other significant environmental events.

Predator Exclosures

Predator exclosures have been used at CAHA since 1994 to reduce impacts from predators on nesting plovers. Exclosures are circular in shape (roughly ten feet in diameter), made of two inch by four inch welded-wire fence anchored by steel rebar and topped with a three-quarter inch mesh bird netting. Exclosures were installed following the guidelines established in the USFWS' Piping Plover Recovery Plan (USFWS 1996, Appendix F). Most of the exclosures were installed around nests after at least three eggs were laid. However, because of high predation rates, predator exclosures are sometimes installed prior to three eggs being observed.

Winter Closures

Winter closures were established upon removal of the pre-nesting closures during the end of August or first week of September (Appendix B, Map 17). Although they were established to provide an undisturbed area for over-wintering PIPL populations, migratory PIPLs also utilize these closures. In the fall and to a lesser degree in the spring large numbers of PIPLs migrate through the seashore. The winter closures were installed in preferred foraging and resting locations, which include Bodie Island Spit, Cape Point, Hatteras Overwash Fans, North Ocracoke, and Ocracoke Inlet Spit (South Point). Because PIPLs have not been documented utilizing the Cape Point area during the winter months, the area was opened to pedestrians this winter but remains closed to ORVs. Appendix B, Maps 1-6 include September 2007-March 2008 winter closures and Map 17 includes the winter closures currently in place from September 2008-March 2009.

Migrating and Wintering Piping Plovers

Surveys for the Southeast Coast Inventory Monitoring Network Migratory and Wintering, Shorebird Monitoring Protocol Study were conducted on the 5th, 15th, and 25th of each month from August 2007 through March 2008. Semi-permanent transect locations were established along the spits and Cape Point, including Bodie Island Spit, Cape Point, Hatteras Inlet, North Ocracoke, and Ocracoke Inlet (South Point)(Appendix B, Maps 12-16). Transects were walked (not driven) and were approximately one mile in length. Each survey transect was completed within 30 minutes and all target species were documented. Species, number observed and habitat type was documented. The survey sheets were modified mid-season to document whether the species was inside or outside a resource closure (i.e. protected vs. not protected area) or in a pedestrian only area (i.e. open to pedestrians but closed to ORVs).

The primary objective of the original study was to determine areas of consistent use by target species, which are PIPL, American oystercatcher (AMOY), Wilson's Plover (WIPL) and red knot (REKN). The pilot protocol was designed to systematically collect information pertaining

to the target species and provide up-to-date information to park managers to aid in management decisions.

Results and Discussion

Productivity

Eleven breeding pairs of PIPLs were identified through field observations (Table 2). This represents five more pairs than were found in 2007 and the most known pairs since eleven breeding pairs were identified in 1997. In 2008, nesting occurred at four sites: Cape Point, South Beach, Ocracoke Inlet Spit, and Bodie Island Spit (Appendix B, Maps 1-9). The four pair identified on South Ocracoke are the most ever recorded. The five at Cape Point are the most recorded since 1995. Bodie Island has had one pair consistently over the last three years.

Table 2. Number of PIPL Breeding Pairs by Site at CAHA (1987-2008).

Year	Total Pairs	Bodie Island Spit	Cape Point	South Beach	Hatteras Inlet Spit	Ocracoke (North)	Ocracoke Inlet Spit
1987	10	0	4	0	4	1	1
1989	15	0	0	0	0	0	0
1990	14	0	8	0	4	2	0
1991	13	0	5	0	3	5	0
1992	12	0	4	0	4	4	0
1993	11	0	5	1	3	3	0
1994	14	0	5	1	3	2	0
1995	14	0	6	1	4	2	1
1996	14	1	5	1	5	1	1
1997	11	1	4	1	3	0	2
1998	9	0	4	1	3	0	1
1999	6	0	3	1	1	0	1
2000	4	0	2	0	2	0	0
2001	3	1	1	0	1	0	0
2002	2	1	0	0	1	0	0
2003	2	0	0	0	1	0	1
2004	3	1	0	0	1	0	1
2005	3	0	0	1	1	0	1
2006	6	1	2	1	1	0	1
2007	6	1	4	0	0	0	1
2008	11	1	5	1	0	0	4

The eleven PIPL pairs produced 13 known nests this season (Table 3). Eight nests successfully hatched; four at Cape Point, one at South Beach, and three at Ocracoke Inlet. Average clutch size of the successful nests was 3.5 eggs, with two four-egg and two three-egg nests laid at Cape Point, one four-egg nest laid on South Beach, and two four-egg and one two-egg nest laid at Ocracoke Inlet. Of the 43 eggs laid, 22 hatched including 12 eggs from Cape Point, two eggs from South Beach, and eight eggs from Ocracoke Inlet for a hatch rate of 49% (Table 4, 4a). Seven chicks fledged and the fledging rate was 0.64 chicks/breeding pair (Table 5). The fledge rate is slightly lower than those documented during the 2007 breeding season. Since 1989, productivity rates have ranged from 0.0 to 2.0 chicks/pair. The average rate over the past 17 years is 0.67 chicks/pair (Table 5a). Monitoring efforts and management strategy changed in 2006 with the implementation of the Interim Strategy and then again in 2008 with the Consent Decree. In the last four years, CAHA has had an average fledge rate of 0.77 chicks/breeding pair (Table 5b). Appendix A provides a summary of 2008 PIPL breeding pair observations and contains a brief summary of daily observations recorded by seasonal resource management staff.

Table 3. 2008 PIPL Nesting Season at CAHA.

Location	# Breeding Pairs	# Nests	# Nests Hatched	# Nests Lost	# Chicks Fledged	# Chicks Lost
Bodie Island Spit	1	1	0	1	0	0
Cape Point	5	6	4	2	4	8
South Beach	1	1	1	0	0	2
Hatteras Inlet Spit	0	0	0	0	0	0
Ocracoke (North)	0	0	0	0	0	0
Ocracoke Inlet Spit	4	5	3	2	3	5
Total:	11	13	8	5	7	15

Table 4. PIPL Hatching Success at CAHA in 2008.

Location	# Nests	# Eggs	Nests Lost/ Abandoned		Nests Hatched		Eggs Hatched		Nests w/ Fledged Chicks	
			#	%	#	%	#	%	#	%
Bodie Island Spit	1	3	1	100%	0	0%	0	0%	0	0%
Cape Point	6	22	2	33%	4	67%	12	54%	2	33%
South Beach	1	4	0	0%	1	100%	2	50%	0	0%
Hatteras Inlet Spit	0	0	0	0%	0	0%	0	0%	0	0%
Ocracoke (North)	0	0	0	0%	0	0%	0	0%	0	0%
Ocracoke Inlet Spit	5	14	2	40%	3	60%	8	57%	1	20%
TOTAL:	13	43	5	38%	8	62%	22	51%	3	23%

Table 4a. PIPL Hatching Success at CAHA from 1992-2008.

Year	# Nests	# Eggs	Nests Lost/ Abandoned		Nests Hatched		Eggs Hatched		Nests w/ Fledged Chicks	
			#	%	#	%	#	% (a)	#	%
1992	14	49 (b)	6	43%	8	57%	17	35%	6	43%
1993	21	69	12	57%	9	43%	27	39%	5	24%
1994	18	65(c)	8	44%	10	56%	32(d)	49%	6	33%
1995	19	63	6	32%	13	68%	30	48%	6	32%
1996	16	56(e)	6	38%	10	63%	30	53%	2	13%
1997	16	47(e)	6	38%	10	63%	32	68%	2	13%
1998	8	31	2	25%	6	75%	20	65%	5	63%
1999	6	23	3	50%	3	50%	11	48%	3	50%
2000	6	23	3	50%	3	50%	10	44%	2	33%
2001	3	10	2	67%	1	33%	3	30%	1	33%
2002	3	8	2	67%	1	33%	1	13%	0	0%
2003	2	5(e)	0	0%	2	100%	4(e)	100%	1	50%
2004	2	6	1	50%	1	50%	4	66%	0	0%
2005	2	8	0	0%	2	100%	8	100%	2	100%
2006	4	15	1	25%	3	75%	9	60%	1	25%
2007	10(f)	29	5	45%	6	55%	17	59%	4	36%
2008	13	43	5	38%	8	62%	22	54%	3	23%

(a) - of all known eggs

(b) - assumes 3 eggs from a brood whose nest was not found (See 1992 report)

(c) - assumes 2 eggs from a brood whose nest was not found (see 1992 report)

(d) - includes those presumed hatched (see 1994 report)

(e) - assumes 1 egg from a brood whose nest was not found (see 2003 report)

(f) - based on consultation with FWS it was determined Nest 1 and Nest 2 were a single nesting attempt

Table 5. Fledging Success of PIPL at CAHA in 2008.

Location	# Pairs	# Broods	# Chicks	Ave Brood Size (chicks/ brood)	Chicks Fledged		Broods w/ Fledged Chicks		Fledge Rate (chicks/ pair)
					#	%	#	%	
Bodie Island Spit	1	0	0	0	0	0%	0	0%	0.00
Cape Point	5	4	12	3	4	33%	2	50%	0.80
South Beach	1	1	2	2	0	0%	0	0%	0.00
Hatteras Inlet Spit	0	0	0	0	0	0%	0	0%	N/A
Ocracoke (North)	0	0	0	0	0	0%	0	0%	N/A
Ocracoke Inlet Spit	4	3	8	2.66	3	38%	1	33%	0.75
Total	11	8	22	2.75	7	32%	3	38%	0.64

Table 5a. Fledging Success of PIPL at CAHA from 1992 – 2008.

Year	# Pairs	# Broods	# Chicks	Ave Brood Size (chicks/brood)	Chicks Fledged		Broods w/ Fledged Chicks		Fledge Rate (chicks/pair)
					#	%	#	%	
1992	12	8	17	2.1	8	47%	6	75%	0.67
1993	12	9	27	3.0	8	30%	5	56%	0.67
1994	11	10(a)	32(b)	3.2	9	30%	6	60%	0.82
1995	14	13	30	2.3	7	23%	6	46%	0.50
1996	14	10	30	3.0	3	10%	2	20%	0.21
1997	11	10	32	3.3	3	9%	2	20%	0.27
1998	9	6	20	3.3	12	60%	5	83%	1.33
1999	6	3	11	3.7	7	64%	3	100%	1.20
2000	4	3	10	3.3	3	30%	2	67%	0.75
2001	3	1	3	3.0	2	67%	1	100%	0.67
2002	2	1	1	1.0	0	0%	0	0%	0.00
2003	2	2	5(c)	2.5	1	20%	1	50%	0.50
2004	3	1	4	4.0	0	0%	0	0%	0.00
2005	3	2	8	4.0	6	75%	2	100%	2.00
2006	6	3	9	3.0	3	33%	1	33%	0.50
2007	6	6	17	2.8	4	24%	4	67%	0.67
2008	11	8	22	2.75	7	32%	3	38%	0.64

(a) - includes 2 broods whose nest was presumed hatched (see 1994 report).

(b) - includes 8 chicks from 2 nests that was presumed hatched (see 1994 report).

(c) - includes 1 known chick from nest not found (see 2003 report).

Table 5b. Fledging Success of PIPL at CAHA based on Management Strategy used from 2005 – 2008.

Management Strategy	# Pairs	# Broods	# Chicks	Ave Brood Size (chicks/brood)	Chicks Fledged		Broods w/ Fledged Chicks		Fledge Rate (chicks/pair)
					#	%	#	%	
Prototype IS (2005-2006)	3 + 6	2 + 3	8 + 9	3.4	6 + 3	53%	2 + 1	60%	1.0
Interim Strategy (2007)	6	6	17	2.8	4	24%	4	67%	0.67
Consent Decree (2008)	11	8	22	2.75	7	33%	3	38%	0.64
Total:	26	19	56	2.9	20	36%	10	53%	0.77

Nest Loss/Abandonment

Five nests were either lost to weather, predation, or abandonment during the 2008 breeding season (Table 6). Nest 1, a four-egg nest discovered on Cape Point on April 25th, was determined to be abandoned on June 1st after no PIPL activity had been seen around the nest for at least two weeks. It is unclear as to why the nest was abandoned; however, potential causes are discussed in following sections. Nest 6, a three-egg nest discovered on May 22nd on Bodie Island Spit, suffered several clutch reductions, including the loss of an egg prior to the installation of the predator exclosure. Ghost crabs are thought to have reduced the nest to one-egg by July 4th. The nest was determined to be abandoned on July 19th after the remaining egg was found within inches of a ghost crab hole and the nest cup was not maintained. While the nest was predated, it is believed that the eggs were infertile after it still had not hatched 24 days after the expected hatch date. PIPL nests usually hatch within 27–30 days after the final egg is laid. Nest 7 was discovered on May 23rd on Ocracoke when field staff investigated the location of a former scrape. The single egg had been over washed and covered with sand during a severe weather event prior to staff finding it. Nest 8, a three-egg nest, was found on May 30th on Ocracoke Inlet Spit. The nest suffered a clutch reduction prior to the installation of the predator exclosure. The male was observed incubating the nest after installation of the exclosure; however, the nest was determined to be abandoned when the remaining egg was found buried in the sand the following day. Nest 13, a four-egg nest on Cape Point, was found and exclosed on June 22. Ghost crabs were probably responsible for the loss of these eggs.

Table 6. PIPL Nest Loss/ Abandonment for CAHA in 2008.

Nest #	Date Found	# of Eggs	Reason for Loss
1	April 25th	4	Nest was abandoned and eggs were pulled 6/1.
6	May 22nd	3	5/29: 1 egg lost prior to installation of exclosure, 2 eggs remain. 7/4: 1 egg lost, 1 egg remains. 7/19: egg is 1 m away from nest cup and 5 inches from a ghost crab hole. 7/20: Egg missing. Note: Nest believed to be infertile after incubation exceeded expected hatch date by 24 days.
7	May 23rd	1	Undiscovered nest buried during storm, was discovered on 5/23.
8	May 30th	3	6/4: 2 eggs lost prior to installation of exclosure, one egg remained 6/11: 1 egg still in nest but no PIPL activity in the area.
13	June 22nd	4	7/2: Nest inspection revealed that only 1 egg of the four-egg nest remained. 7/12: Nest inspection revealed that no eggs remained in the nest.

Chick Mortality

Of the 22 chicks that hatched at CAHA, 15 were lost prior to fledging. On Cape Point 12 chicks hatched and eight of those were lost. One chick from Brood 4 was lost on day two. Brood 5 lost one of three hatchlings on day three. The other two chicks from Brood 5 successfully fledged along with two chicks from Brood 4. Nest 9 and 12 hatched on the same day with a total of six chicks. It is unclear how many hatchlings were in each brood, because the chicks moved between the two pairs. One chick was lost on day three, two chicks were lost on day five, two on day seven, and the last chick was lost on day 8. A gull was observed carrying off one of the

seven day old chicks and a crow carried off the last chick on day 8. Nest 10 on South Beach lost its two chicks on day two. On Ocracoke eight chicks hatched and five chicks were lost from two broods. Nest 3 lost its only chick on day eight. Nest 11 successfully hatched four chicks. One chick was lost on day two. The remaining three chicks disappeared on day three, one disappeared in the morning and the other two disappeared when the adults moved the chicks along the duneline and into dense vegetation. In 2008, 67% of the chicks were lost prior to fledging (Table 7). This is a decrease from the 2007 breeding season and is lower than a majority of years recorded. Although a high percentage of chicks were lost, a total of seven chicks fledged, equaling the total for 1999, the highest number of chicks fledged in the last 10 years.

Table 7. PIPL Chick Mortality for CAHA from 1992-2008.

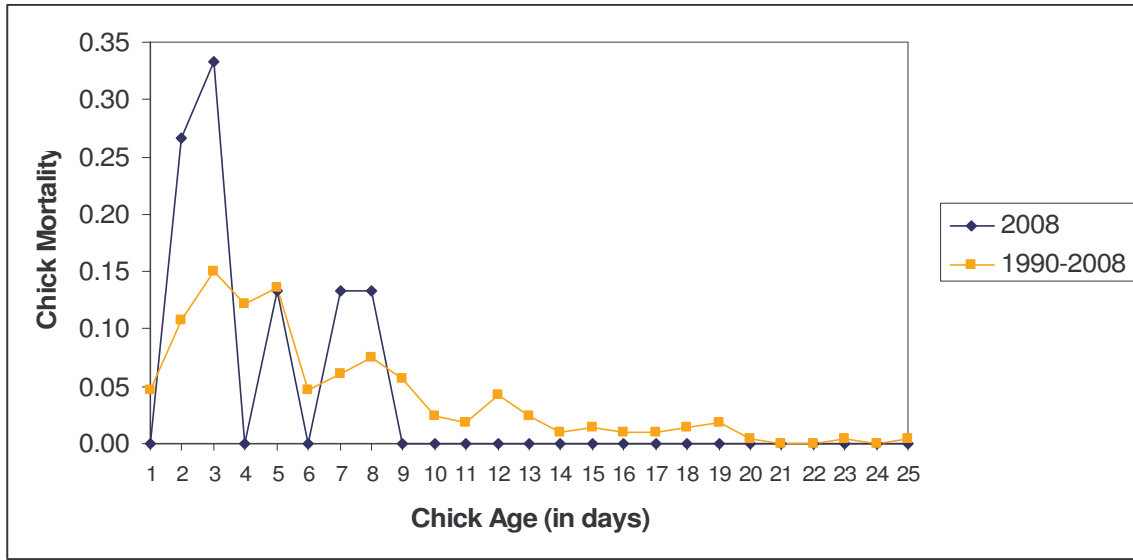
Year	# of Chicks Hatched	Chicks Lost		Chicks Fledged	
		#	%	#	%
1992	17	9	53%	8	47%
1993	27	19	70%	8	30%
1994	32 (a)	23	70%	9	30%
1995	30	23	77%	7	23%
1996	30	27	90%	3	10%
1997	32	29	91%	3	9%
1998	20	8	40%	12	60%
1999	11	4	36%	7	64%
2000	10	7	70%	3	30%
2001	3	1	33%	2	67%
2002	1	1	100%	0	0%
2003	5 (b)	4	80%	1	20%
2004	4	4	100%	0	0%
2005	8	2	25%	6	75%
2006	9	6	67%	3	33%
2007	17	13	76%	4	24%
2008	22	15	68%	7	32%

(a) - includes 8 chicks from 2 nests that was presumed hatched (see 1994 report).

(b) - includes 1 known chick from nest not found (see 2003 report).

Although staff has opinions with varying levels of confidence on what may have caused mortality in different situations, mortality cause is characterized as “unknown” unless specific evidence can support a cause. Potential causes are discussed in following sections of this report. As in past years, the majority of chick mortality occurred within ten days of hatching (Figure 1).

Figure 1. Comparison of Chick Age Mortality at CAHA from 1990-2008.



Chick Movement

As a result of the frequency of observations, staff was able to document preferred foraging areas for the different broods. These maps are estimates of where the chicks were foraging during the observations (Appendix B, Maps 10-11). Chicks were not disturbed to collect the points.

The three chicks from Brood 2 on Ocracoke moved 1000 meters from the nest enclosure southwest along the dunes to the tidal flats on the sound. The brood continued to utilize the tidal flats on the sound side and the mud flats to the south of the main dunes until they fledged (Appendix B, Map 10).

On Cape Point, the brood from Nest 4 foraged near the nesting site for three days. The brood then moved 800 meters east along the duneline and established foraging territory in the ephemeral pools at the mouth of the small Salt Pond (Appendix B, Map 11). They remained in this general area until they fledged.

The brood from Nest 5, on Cape Point, moved a total distance of 800 meters from the nesting area to the east side of the small Salt Pond. Territorial displays were observed between the adults from Broods 4 and 5 as they attempted to establish foraging areas and protect their chicks (Appendix B, Map 11). Post-fledging the chicks and an adult were observed feeding in an ephemeral area caused by Spring tides near the toe of the dunes. The foraging map provided for this brood makes it appear that the chicks were observed foraging on the eastern shoreline post-fledging even though in reality they are near the toe of the dune. The aerial photographs are from 2007 and do not reflect the current shoreline.

After Brood 3 on Ocracoke hatched, the adults and chick traveled 1500 meters from the nest enclosure, south along the dunes to the sound side, on to the mudflats, and over to the twin dunes, where they stayed until the chick disappeared (Appendix B, Map 10).

Broods 9 and 12 on Cape Point merged together once the chicks hatched. The two broods traveled about 500 meters from the nest sites to the small Salt Pond, where they foraged until the chicks disappeared (Appendix B, Map 11).

Brood 10, at Cape Point, traveled approximately 50 meters from the nest site at Salt Pond Road before they disappeared over a ridge and were not seen again (Appendix B, Map 11).

After hatching, Brood 11 on Ocracoke traveled about 500 meters from the nest before the adults led the chicks into dense vegetation, where they were last observed (Appendix B, Map 10).

Predator Exclosures

In 2008, predator exclosures were used to protect 12 of 13 nests. Eleven of the predator exclosures were installed and accepted by pairs within 30 minutes. Incubation had not yet commenced on Nest 1 when the closure was installed. The only nest that was not exclosed had been overwashed and buried in sand by a storm prior to being discovered.

A predator exclosure was installed around Nest 1 (Cape Point) as a three-egg nest on April 25th, the same day it was found, for fear of losing the nest to predation. The female was observed shading/sitting on the nest 30 minutes prior to installation. No bird was observed when the nest was first approached to install the exclosure. After installation, the nest was observed for four hours. Adults did not return to incubate; however, territorial behavior was observed around the nest. The decision was made to leave the exclosure in place. The female was observed incubating the nest the following morning and a nest exchange was observed. It appeared that both birds had accepted the exclosure and a 4th egg was eventually laid (documented during nest check on April 28th).

Nest 8 (Ocracoke) suffered a clutch reduction from three eggs to one egg prior to the predator exclosure being installed. The male accepted the exclosure within 30 minutes; however, the female was never observed entering the exclosure or incubating the nest. The nest was considered lost the next day when the single remaining egg was discovered buried in the sand.

Predation

This year, staff was able to document the loss of two chicks from Cape Point to avian predation. One chick, from Brood 9/12, was taken by a gull and another chick from the same brood was taken by a crow. While documentation occurred on these chicks, the loss of the other 19 chicks is considered “unknown”.

The presence or tracks of crows, ghost crabs, grackles, gulls, opossum, mink, raccoon, red fox, grey fox, and feral cats were documented within many of the PIPL breeding territories. Ghost crab predation was suspected in the loss of three nests (Nest 6 on Bodie Island Spit, Nest 8 on Ocracoke Inlet Spit, and Nest 13 on Cape Point), because ghost crab holes were found inside and around the nests and predator exclosures. The loss of these nests, however, remains “unknown”, because predation or tracks inside the exclosures were never directly observed.

Predator Removal

For the seventh consecutive year, USDA–Wildlife Services removed predators from CAHA. In 2008, Wildlife Services was contracted for two 20–day management sessions on Ocracoke. Predator damage management was completed during February 13th–March 3rd and May 23rd–June 12th. In addition to trapping conducted by Wildlife Services, resource management staff trapped from September 2007 through July 2008. Following is a table of mammals that were removed from the spits and Cape Point areas prior to and during the 2008 PIPL nesting season (Table 8).

Table 8. Mammals removed from piping plover nesting areas from September 2007 through July 2008.

Species	Location			
	Bodie Spit	Cape Point	Hatteras Inlet	South Point
Feral Cat	6	15	26	6
Raccoon	15	40	17	5
Mink	0	0	1	10*
Opossum	16	27	17	0
Muskrat	0	0	0	1
Otter	0	2	2	1
Grey Fox	6	0	0	0
Red Fox	8	1	0	0
Nutria	0	23	6	20

*A total of 31 mink were removed from Ocracoke. We suspect that they can range the entire island.

While predators can not be directly identified as the main cause for loss of PIPL eggs or chicks, their presence in nesting areas has been detrimental to other bird species. For example, Nest 9 on Cape Point was protected by a predator enclosure and was located on the northeast corner of a least tern colony. On June 15th, a raccoon predated more than 15 least tern nests, 2 common tern nests, and one black-necked stilt nest.

CAHA is in the process of formalizing a predator control program for protected species management and environmental assessment. The reduction of predation on nesting threatened and endangered species, colonial waterbirds and shorebirds of management concern would likely result in an increased hatch success rate, increased chick survival, and increased productivity. By reducing predators numbers around known nest locations, the PIPL and other nesting shorebird and waterbird populations at CAHA may start to recover.

Weather

No hurricanes or tropical storms occurred during the breeding season. However, smaller localized events may have affected nesting. A series of sandstorms, with wind gusts over 35 mph, may have caused the pair from Nest 1 (Cape Point) to abandon the nest; however, the loss is characterized as “unknown” because it can not be shown conclusively that weather was the cause. Nest 7 (Ocracoke) was buried during a Nor’easter prior to the nest being located by field staff. One egg was found when compacted sand was removed from a scrape that had been maintained prior to the arrival of the storm.

Human Disturbance

Human disturbance, direct or indirect, can lead to the abandonment of nests or loss of chicks. Throughout the season, resource staff documented 80 pedestrian, 11 ORV, five dog, and one boat violations. The numbers are conservative since sites are not monitored continuously, weather erases tracks, and staff did not disturb an incubating pair or young in order to document disturbance. These numbers indicate violations to closures specifically containing nesting PIPLs. It is important to note that most of the closures contained multiple species, including least terns, American oystercatchers, and PIPLs. Most illegal entries were not witnessed, but documented based on vehicle, pedestrian, or dog tracks left behind. Pedestrian entry required visitors to lift or stoop under the string that connected all posted signs, while vehicular entry required visitors to drive through or around a sign boundary. Visitors' unleashed dogs are a threat to protected species and continue to be a problem.

Disturbance can not be specifically identified as a main cause for the loss of nests or chicks because it is difficult to document the effect on nesting birds, unless the action was directly observed or loss of eggs, chicks, or birds was specifically documented.

The Consent Decree defines a confirmed deliberate act as “an act that disturbs or harasses wildlife or vandalizes fencing, nests, or plants”. Deliberate violations of the established pre-nesting areas and buffers, as determined by NPS staff, were required to be automatically expanded by 50 meters. The second and third deliberate violations required an automatic expansion of 100 and 500 meters, respectively. There were no deliberate violations associated with PIPL nests or broods, however six such violations occurred associated with other species of nesting birds.

Non-breeding Surveys & Winter Monitoring

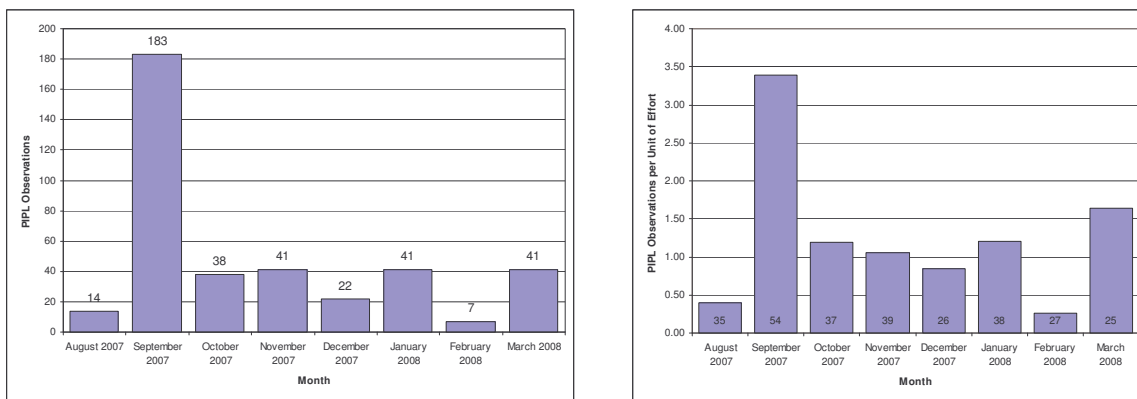
CAHA staff continues to consult with the Southeast Coast Inventory and Monitoring Network and the USFWS regarding changes to the winter monitoring protocol. Instead of splitting the winter season in half and just reporting on data collected in 2008 (e.g. January–March and August–December 2008), the results will cover an entire winter season (August 2007-March 2008). This will allow for a more relevant analysis of the data.

The non-breeding PIPL monitoring protocol was developed to document trends over time and to document the habitat type in which PIPLs are most frequently found. Documenting the habitat type assists CAHA staff in determining which areas need to be protected to minimize disturbance to wintering PIPLs. From August 2007-March 2008, a total of 387 PIPL observations were documented. Of the 387 PIPLs documented, 188 occurred inside a nonbreeding/migratory closure, 74 occurred outside a closure, and 125 did not document whether the PIPL was inside or outside of the closure. The observations that did not document if they were inside or outside were collected prior to the change in the protocol. These observations allowed CAHA to make adjustments to the winter closures to include habitat types where PIPLs had been observed outside of the closures. For example, the winter closure on South Ocracoke was expanded in 2008-2009 to include more of the sand flat habitat type. As more data is accumulated we will be able to make better management decisions as to where the winter closures need to be placed.

The ability of CAHA to reference the previous years' data resulted in there being no winter closure at Cape Point or Hatteras Inlet because wintering PIPLs were not observed in the area in 2006-2007. Although there is no "official" winter closure at Cape Point or Hatteras Inlet, interior habitat remains closed to ORVs but is now open to pedestrians.

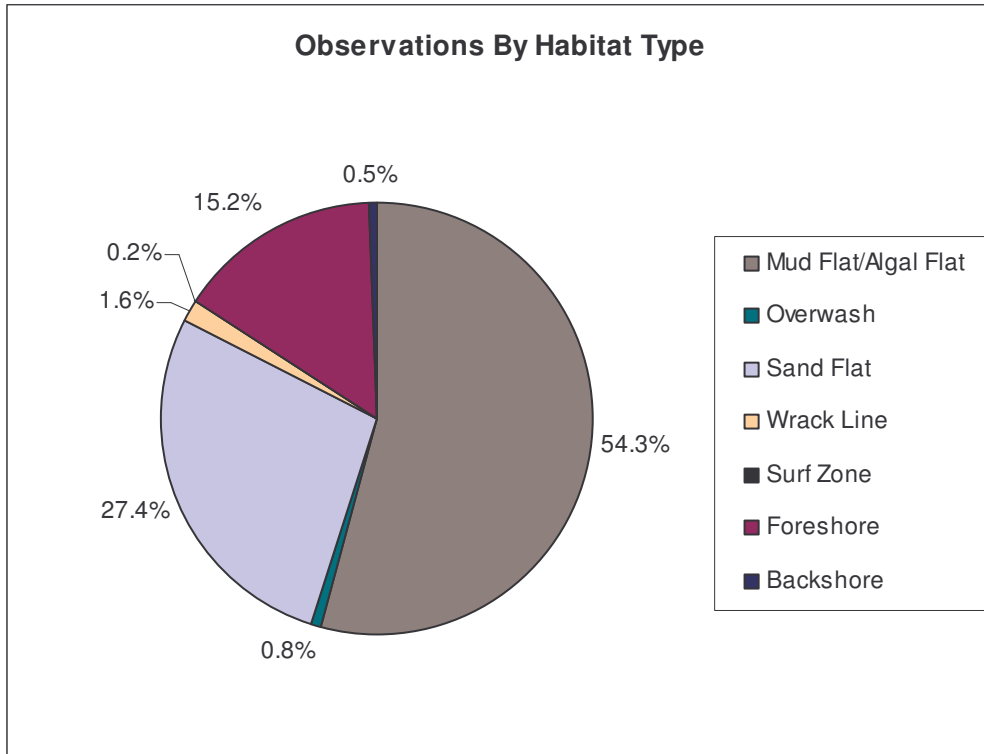
Park staff documented non-breeding PIPL use of the seashore beginning at the end of the PIPL breeding season in August 2007 through March 2008 (Figure 2). Migratory birds peaked in September with a high count of 33 PIPLs counted on September 7, 2007 on Ocracoke Island Spit. After the migrants passed through the area in September, PIPL numbers appeared to stabilize over the winter months except for in February 2008 when there was an unexplained drop in numbers.

Figure 2. Actual Observation Numbers vs. Normalized Data (with Sample Size).



Park staff documented the habitat type in which migratory and wintering PIPL were observed from August 2007 to March 2008 (Figure 3). Of the 387 observations, 210 were in mud flat/algal flat, 106 were in sand flat, 59 were in foreshore, 6 were in wrack line, 3 were in overwash, 2 were in backshore, and 1 was flying over the surf zone.

Figure 3: Wintering Observations of PIPL by Habitat Type



In time, the accumulated data will hopefully shed some light on the non-breeding PIPL population at the seashore. At present, the park continues to work on establishing semi-permanent transects in a constantly changing environment.