

**PIPING PLOVER (*CHARADRIUS MELODUS*) MONITORING  
CAPE HATTERAS NATIONAL SEASHORE  
2009 ANNUAL REPORT**



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## ABSTRACT

Piping Plover [*Charadrius melodus* (PIPL)] monitoring at Cape Hatteras National Seashore (CAHA) began in 1985. Monitoring efforts have focused on identifying nesting habitat, locating and protecting breeding plover territories and nests, and determining nest and brood success. The level of effort and man hours involved with that monitoring has also steadily increased since 2004. In 2009, nine PIPL pairs and nine nests were identified. Four unpaired males were also identified – one on Cape Point, two on South Beach and one on South Point, Ocracoke. Six PIPL chicks successfully fledged from five broods for a fledge rate of 0.67 chicks per breeding pair. The 2009 breeding season was the first complete year that CAHA was managing under the requirements of the Consent Decree (CD).

## INTRODUCTION

CAHA is located along the northern Outer Banks region of North Carolina. Consisting of more than 30,000 acres distributed along approximately 66.8 miles of shoreline, it is part of a dynamic barrier island system. 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. Federal ownership in CAHA extends from ocean to sound across three barrier islands-Ocracoke, Hatteras and Bodie- spanning Dare and Hyde counties. The eight village enclaves are excluded from CAHA boundaries. The villages include Rodanthe, Waves, Salvo, Avon, Buxton, Frisco, and Hatteras on Hatteras Island and Ocracoke Village on Ocracoke Island.

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 the Wilson's plover, also use CAHA as a breeding area. Because PIPL eggs are cryptic and the nesting PIPL population at CAHA 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 on CAHA.

The PIPL is a small sandy-colored shorebird with a black band across the forehead and a black collar 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. PIPLs 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. Both the eggs and chicks are cryptic in coloration, which makes it difficult to see them. Chicks are precocial and follow the adults to locations where they forage for invertebrates found in and on the sand. The chicks usually fledge between 25–35 days after hatching.

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 disturbance 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 2009 breeding season, comparisons to results from previous years, and the resource management activities undertaken for PIPLS in 2009.

## **METHODS**

### **Consent Decree**

In October 2007, a lawsuit was brought by the Defenders of Wildlife and the National Audubon Society against the National Park Service (NPS) for failure to provide adequate protection of threatened and endangered species from the impacts of off-road vehicle (ORV) use at CAHA. On April 30, 2008, a settlement agreement that had been reached between all parties to the lawsuit was approved by the U.S. District Court as a CD. The purpose of the CD 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 CD include earlier dates for the establishment of pre-nesting closures and larger buffer requirements for nesting birds and chicks. The CD 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 CAHA's shoreline is dynamic in nature, a habitat evaluation was conducted in February and early March of 2009, 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 A, Maps 1-6). These sites were then posted with symbolic fencing consisting of wooden posts, bird usage signs prohibiting entry, string, and flagging tape by March 15th, as required by the CD, which is 16 days earlier than the April 1 date 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 South Point Ocracoke (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 be used as nesting habitat.

Pre-nesting closures were established by March 15, 2009 at Bodie Island Spit, Cape Point, South Beach, Hatteras Overwash Fans, Hatteras Inlet Spit, North Ocracoke Spit, and South Point (Appendix A, Maps 1-6). All pre-nesting closures were the same, to the extent possible, as the 2008 season as is required by the CD. The pre-nesting closure at Bodie Spit began at the north end of the Bait Pond overwash area (~0.6 mi south of Ramp 4) and included the mud flat area to the south of the small dune area and last year's PIPL nest site location. A 100-foot ORV

corridor extended for approximately 0.8 miles of shoreline. The pre-nesting closure at Cape Point 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 Cape Point full beach closure terminated in the area between Salt Pond Road and Ramp 45 (approximately 350 meters east of Ramp 45). From this area to approximately 1.5 miles west of Ramp 45, the upper section of South Beach was protected by the pre-nesting closure. 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. ORV traffic was routed from the Pole Road via the spur roads onto the ocean-side shoreline. At Hatteras Inlet Spit, the ocean-side shoreline was closed to pedestrians and ORVs from 170 meters west of the Pole Road exit onto the beach to the inlet (approximately 0.6 miles). Hatteras Inlet could only be accessed via the sound side and the inlet shoreline itself was only open to pedestrians. This was the second year that a pre-nesting closure was established on North Ocracoke Spit because of the accretion that has been occurring at this site and because of the loss of habitat at Hatteras Inlet Spit. The closure began 0.2 miles north of Ramp 59. A 100 foot ORV corridor extended for approximately 0.6 miles of shoreline. 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 South Point was again similar to the closure installed in 2008 with a 100 foot ORV corridor starting approximately 0.3 mi southeast of Ramp 72 extending for approximately 2.3 miles.

The pre-nesting closures were modified throughout the season based on observed bird activity, in order to meet the buffer requirements of the CD and to provide adequate protection for nesting birds and broods. A closure was modified when 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 would also be modified if breeding adult plovers were documented foraging outside of established closures. Buffer requirements of the CD 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. Nest and Chick Buffers Required by the CD.

<b>Species</b>	<b>Breeding Behavior/ Nest Buffer (m)</b>	<b>Unfledged Chick Buffer (m)</b>
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 early March. At the spits, South Beach and Cape Point, monitoring was conducted daily. Observations were made up until July 15<sup>th</sup>, as required by the CD. 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. Monitors took waypoints for scrapes and ensured all breeding behaviors were properly buffered and modified the closures if the buffer was too small. After a nest was located, a predator enclosure was installed, generally after at least three eggs were laid. Thereafter the nest was briefly approached once weekly, to inspect the enclosure, verify the number of eggs, and check for predator tracks. The nests were also monitored, from a distance, daily for incubation in an effort to detect nest abandonment or other potential problems. Morning and evening monitoring began five to seven days 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 Enclosures**

Predator enclosures have been used at CAHA since 1994 to reduce impacts from predators on nesting plovers. Enclosures 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. Enclosures were installed following the guidelines established in the USFWS' Piping Plover Recovery Plan (USFWS 1996, Appendix F). If a nest was discovered prior to clutch completion (i.e. less than four eggs), predator enclosures were, in general, installed when there were three eggs present because of the high rates of predation.

## **Winter Closures**

Winter closures were established upon removal of the pre-nesting closures during the end of August or first week of September (Appendix A, Maps 1-6). Although they were established to provide an undisturbed area for over-wintering PIPL populations, migratory PIPLs also used these closures. In the fall and to a lesser degree in the spring large numbers of PIPLs migrate through CAHA. The winter closures were installed in preferred foraging and resting locations, which include Bodie Island Spit, Cape Point, Hatteras Overwash Fans, Hatteras Inlet Spit, North Ocracoke, and South Point. Because PIPLs have not been documented utilizing the interior of the Cape Point area during the winter months, the interior of Cape Point was open to pedestrians but remained closed to ORVs.

## **Migrating and Wintering Piping Plovers**

Surveys for the Southeast Coast Inventory Monitoring Network Migratory and Wintering Shorebird Monitoring Study were conducted on the 5<sup>th</sup>, 15<sup>th</sup>, and 25<sup>th</sup> day of each month from August 2008 through March 2009. Semi-permanent transect locations were established along the spits and Cape Point (Appendix A, Maps 12-16). Varying length transects were walked at two mph and all target species were documented. Species, number observed, and habitat type were documented. 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) was also documented. Pedestrians, ORVs and dogs observed outside on the survey area were documented as well.

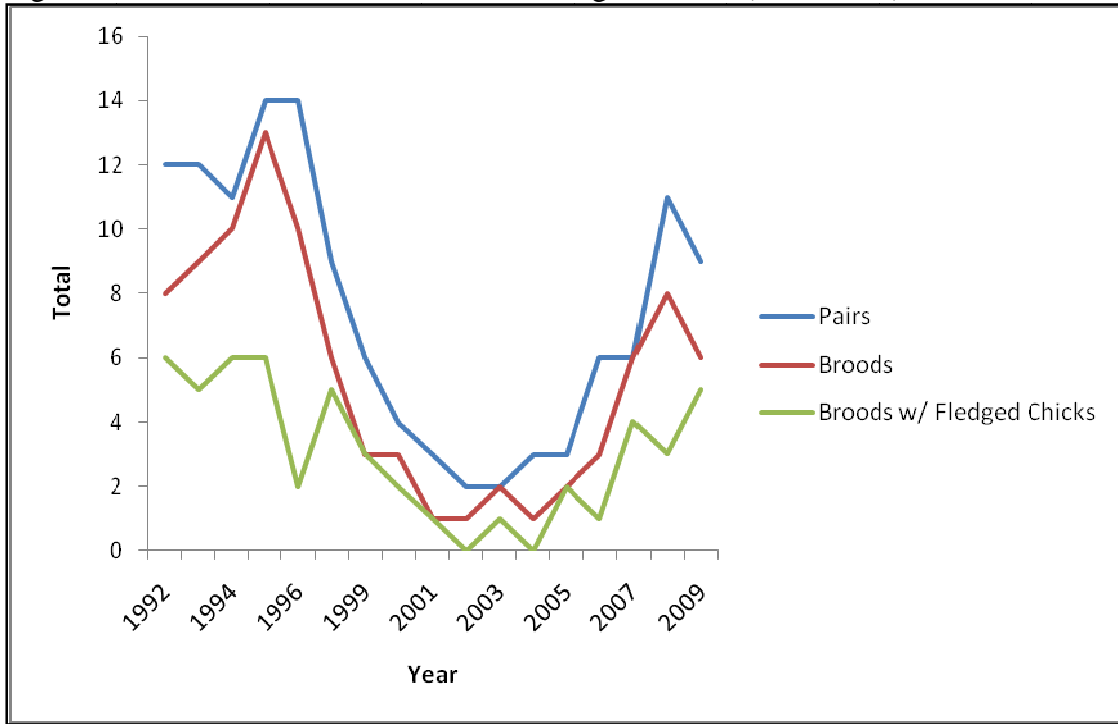
The primary objective of the original study was to determine areas of consistent use by the target species, which are PIPL, American oystercatcher (AMOY), Wilson's Plover (WIPL) and red knot (REKN). The pilot protocol was designed to systematically collect information pertaining to the target species and provide up-to-date information to park managers to aid in management decisions. Because of insufficient staff in the winter, these protocols were modified to only include Cape Point and the spits making the surveys meaningful only for documenting winter use at CAHA by PIPLs since WIPL have not been documented at CAHA in the winter and AMOYs and REKN utilize the entire shoreline. Rather than survey every mile of beach at CAHA every five days per the protocol, the protocol was modified to survey the points and spits every 5<sup>th</sup>, 15<sup>th</sup> and 25<sup>th</sup> of the month so as to coincide with the days of the International Shorebird Survey protocols the other coastal areas use.

## **RESULTS AND DISCUSSION**

### **Productivity**

Nine breeding pairs of PIPLs were identified through field observations (Table 2). This represents three more pairs than were observed in 2007, but two fewer than were observed in 2008. In 2009, nesting occurred at only two sites: Cape Point and South Point (Appendix A, Maps 8, 9). The four pairs identified on South Point ties 2008 as the most ever recorded for that area. The five pairs at Cape Point ties 2008 as the most recorded since 1995. Bodie Island Spit had one pair from 2006-2008, however, a pair was not observed in 2009. Not since 1998 have five separate broods produced fledglings at CAHA (Figure 1). In 2009 one of six broods failed to produce a fledgling in 2009, whereas in 2008 only three of eight broods produced fledglings. Four of six broods produced fledglings in 2007.

Figure 1. Pairs, Broods and Broods with Fledged Chicks (1992-2009).



The nine PIPL pairs produced nine known nests this season (Table 2). Six nests successfully hatched; five at Cape Point and one at South Point. Average clutch size of all nests was 3.7 eggs, with five four-egg nests laid at Cape Point and three four-egg and one two-egg nest laid at South Point. Of the 34 eggs laid, 23 hatched, including 19 eggs from Cape Point and four eggs from South Point for a hatch rate of 67% (Table 3, 3a). Six chicks fledged and the fledge rate was 0.67 chicks/ breeding pair (Table 4). Although not statistically significant, the fledge rate for 2009 is slightly higher than that documented during the 2008 breeding season and the same as the 2007 season. Since 1989, productivity rates have ranged from 0.0 to 2.0 chicks/pair. The average rate during the past 18 years is 0.64 chicks/pair (Table 4a). The monitoring efforts and management strategy formally changed in 2006 with the implementation of the Interim Strategy and then again in 2008 with the CD. In the last five years, CAHA has had an average fledge rate of 0.74 chicks/ breeding pair versus the previous 13-year-average of 0.58 chicks/ breeding pair (Table 4a).

Table 2. 2009 PIPL Nesting Season.

Location	# Breeding Pairs	# Nests	# Nests Hatched	# Nests Lost	# Chicks Fledged	# Chicks Lost
Bodie Island Spit	0	0	0	0	0	0
Cape Point	5	5	5	0	4	15
South Beach	0	0	0	0	0	0
Hatteras Inlet Spit	0	0	0	0	0	0
Ocracoke (North)	0	0	0	0	0	0
South Point	4	4	1	3	2	1
Total:	9	9	6	3	6	16

Table 3. PIPL Hatching Success in 2009.

Location	# Nests	# Eggs	Nests Lost/Abandoned		Nests Hatched		Eggs Hatched		Nests w/ Fledged Chicks	
			#	%	#	%	#	%	#	%
Bodie Island Spit	0	0	0	NA	0	NA	0	NA	0	NA
Cape Point	5	20	0	NA	5	100%	19	95%	4	80%
South Beach	0	0	0	NA	0	NA	0	NA	0	NA
Hatteras Inlet Spit	0	0	0	NA	0	NA	0	NA	0	NA
Ocracoke (North)	0	0	0	NA	0	NA	0	NA	0	NA
South Point	4	14	3	75%	1	25%	3	21%	1	25%
TOTAL:	9	34	3	33%	6	60%	22	65%	5	55%

Table 3a. PIPL Hatching Success from 1992-2009.

Year	# Nests	# Eggs	Nests Lost/Abandoned		Nests Hatched		Eggs Hatched		Nests w/ Fledged Chicks	
			#	%	#	%	#	% (a)	#	%
1992	14	49	6	43%	8	57%	21	43%	6	43%
1993	21	69	12	57%	9	43%	27	39%	5	24%
1994	18	65	8	44%	10	56%	32	49%	6	33%
1995	19	63	6	32%	13	68%	30	48%	6	32%
1996	16	56	6	38%	10	63%	30	53%	2	13%
1997	16	47	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	43%	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(b)	0	0%	2	100%	5	100%	1	50%
2004	2	6	1	50%	1	50%	4	67%	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(c)	29	4	40%	6	60%	17	59%	4	40%
2008	13	43	5	38%	8	62%	22	51%	3	23%
2009	9	34	3	33%	6	67%	22	65%	5	55%
Average (1992-2009)	9.5	32.4	3.9	41%	5.7	60%	16.9	52%	3	31%

(a) – of all known eggs

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

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



Table 4. Fledging Success of PIPL in 2009.

Location	# Pairs	# Broods	# Chicks	Avg Brood (chicks/brood)	Chicks Fledged		Broods w/ Fledged Chicks		Fledge Rate (chicks/pair)
					#	%	#	%	
Bodie Island Spit	0	0	0	NA	0	NA	0	NA	NA
Cape Point	5	5	19	3.8	4	21%	4	80%	0.8
South Beach	0	0	0	NA	0	NA	0	NA	NA
Hatteras Inlet Spit	0	0	0	NA	0	NA	0	NA	NA
Ocracoke (North)	0	0	0	NA	0	NA	0	NA	NA
South Point	4	1	3	3	2	67%	1	100%	0.5
Total:	9	6	22	3.4	6	27%	5	83%	0.67

Table 4a. Fledging Success of PIPL 1992 - 2009.

Year	# Pairs	# Broods	# Chicks	Avg 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	8	30%	5	56%	0.67
1994	11	10	32	3.2	9	30%	6	60%	0.82
1995	14	13	30	2.3	7	23%	6	46%	0.5
1996	14	10	30	3	3	10%	2	20%	0.21
1997	11	10	32	3.2	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%	1.17
2000	4	3	10	3.3	3	30%	2	67%	0.75
2001	3	1	3	3	2	67%	1	100%	0.67
2002	2	1	1	1	0	0%	0	0%	0
2003	2	2	5	2.5	1	20%	1	50%	0.5
2004	3	1	4	4	0	0%	0	0%	0
2005	3	2	8	4	6	75%	2	100%	2
2006	6	3	9	3	3	33%	1	33%	0.5
2007	6	6	17	2.8	4	24%	4	67%	0.67
2008	11	8	22	2.7	7	32%	3	38%	0.64
2009	9	6	22	3.8	6	27%	5	83%	0.67
Average (1992-2009)	7.7	5.7	16.7	3	4.9	30%	3	53%	0.64

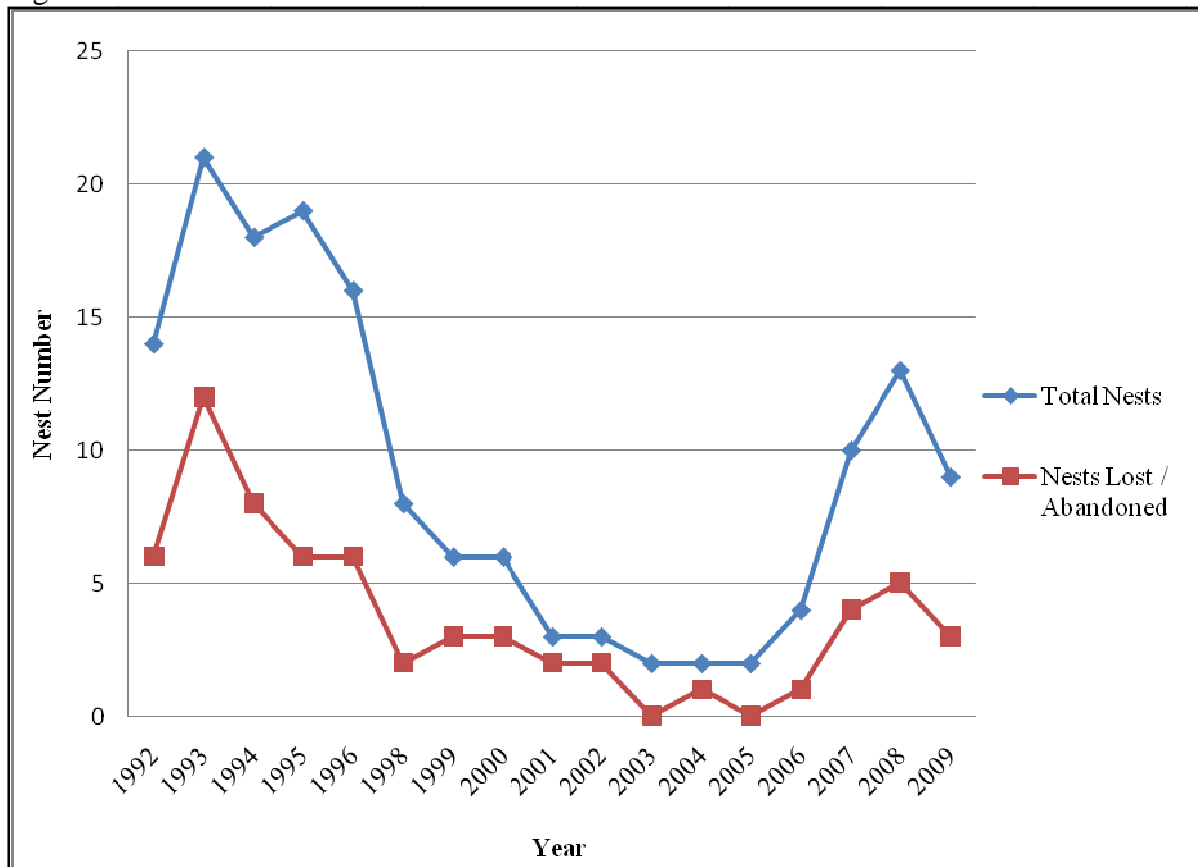
### Nest Loss/Abandonment

Three nests were lost to various factors during the 2009 breeding seasons. Weather, infertility and predation, and abandonment were factors contributing to their loss.

- Nest 4, a four-egg nest discovered on South Point on May 4th, was determined to be abandoned on May 21<sup>st</sup> after no PIPL activity had been seen around the nest. The male associated with that nest disappeared. The female was observed defending the nest territory against another male, but her mate was absent.
- Nest 8, a two-egg nest discovered on May 22<sup>nd</sup> on South Point was incubated well past its expected hatch date and was eventually predated by ghost crabs. The eggs were most likely infertile.
- Nest 9 was discovered on June 8<sup>th</sup> on South Point and was over-washed by spring tides on June 23<sup>rd</sup>.

Another nest also suffered a clutch reduction. Nest 3 lost a single egg during egg laying but the pair continued laying about 15 meters south of the original Nest 3. There were high winds and rain the day prior to the egg disappearing. Because it is not known if predation may have also been involved, no definite cause can be attributed to its loss. It was determined, based on hatch date and pair activities, that the nest was indeed a continuation of Nest 3, and it was designated as Nest 6 (Pair 3) to avoid potential confusion that could be caused by re-numbering the other nests/broods (Figure 2).

Figure 2. Total PIPL Nests and Lost / Abandoned for CAHA 1992-2009.



### Chick Mortality

Of the 22 chicks that hatched at CAHA, 16 were lost prior to fledging. At Cape Point, 19 chicks hatched and 15 of those were lost. Brood 2, which was the first to hatch at Cape Point, began with four chicks and lost two chicks to an opossum on day three and then another chick disappeared on day 13. Brood 1 began with four chicks and lost chicks on days three, seven and 13. Brood 5 began with four chicks and lost chicks on days five, six and 10. Brood 6 (Pair 3) began with three chicks and lost chicks on day three, 15 and 16. Brood 8 began with four chicks and lost two chicks on day four and another on day five. At South Point, Brood 7 began with three chicks and lost a chick on day four.

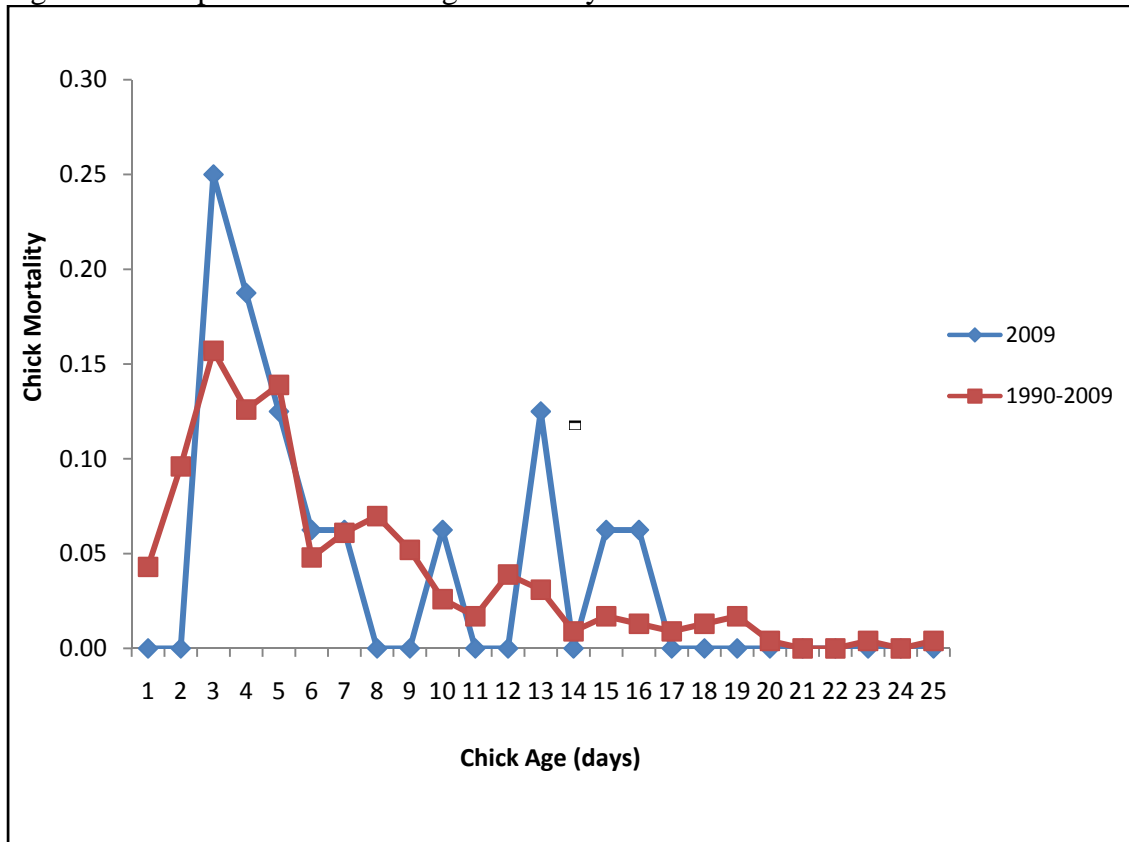
In 2009, 16 chicks (73 %) were lost prior to fledging, up from 15 chicks (68 %) that were lost in 2008, but three percentage points lower than the 13 chicks (76 %) that were lost in 2007 (Table 5). Evidence strongly suggests two chicks from Brood 2 were lost to an opossum.

Table 5. PIPL Chick Mortality for CAHA from 1992-2009.

Year	# of Eggs Hatched	Chicks Lost		Chicks Fledged	
		#	%	#	%
1992	17	9	53%	8	47%
1993	27	19	70%	8	30%
1994	32	23	72%	9	28%
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	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%
2009	22	16	73%	6	27%
Average (1992-2009)	16.7	11.7	68%	4.9	32%

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 3).

Figure 3. Comparison of Chick Age Mortality at CAHA from 1990-2009.



### 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 A, Maps 10, 11). Way points of the observed foraging habitats were taken after all the chicks had fledged and the chicks were not disturbed to collect the points.

The chicks from Brood 1 at Cape Point moved just south of the nest location into the ephemeral mud flats. The brood remained in this general area, never moving more than 155 meters from the nest enclosure until they fledged (Appendix A, Map 10).

The chicks from Brood 2 at Cape Point moved 320 meters from the nest enclosure southwest along the dunes to the mud flats near the mouth of the Small Salt Pond. The brood continued to utilize the mud flats to the south of the mouth of the Small Salt Pond and into the mouth of the Small Salt Pond, and on one occasion were observed in the mud flats inside the southeast side of the Small Salt Pond. (Appendix A, Map 10).

The chicks from Brood 5 at Cape Point moved south from their nest location into the ephemeral mud flats. The brood foraged in the mud flats around the nest enclosure and generally never traveled more than 147 meters from it until the time they fledged (Appendix A, Map 10).

The chicks from Brood 3a at Cape Point moved south from their nest location into the ephemeral mud flats. The brood foraged in the mud flats around the nest enclosure and generally never traveled more than 405 meters from it until the time they fledged (Appendix A, Map 10).

The chicks from Brood 6 at South Point on Ocracoke, moved 1200 meters west to the sound-side algal/mud flats from their nest location. The brood ranged 208 meters along the sound until they fledged (Appendix A, Map 11).

The chicks from Brood 7 at Cape Point moved about 480 meters east from their nest location into the ephemeral mud flats. The brood foraged in the mud flats and generally never traveled more than 30 meters in any direction until the time they fledged (Appendix A, Map 10).

### **Predator Enclosures**

In 2009, predator enclosures were used to protect all nine nests. All of the predator enclosures were installed and accepted by pairs within 30 minutes. Six nests were enclosed as three-egg nests, two were enclosed after being discovered as four-egg nests and one which was discovered as a two-egg nest, never became a four-egg clutch and was being incubated three days after it was discovered. This nest was enclosed as a two-egg nest.

### **Predation**

This year, staff observed strong evidence suggesting the loss of two chicks from Cape Point to opossum predation. On June 1<sup>st</sup> two chicks from Brood 2 went missing soon after hatching. An examination of the area around the nest enclosure revealed a high density of opossum tracks and signs in the sand where it appeared the opossum had captured and eaten the chicks. While the evidence supports a determination that these two chicks were lost to predation, the loss of the other 14 chicks - 64 percent of the eggs hatched - is considered as "unknown".

The presence or tracks of crows, ghost crabs, grackles, gulls, opossum, mink, raccoon, red fox, grey fox, coyote and feral cats were documented within many of the PIPL breeding territories. Ghost crab predation was suspected in the loss of one nest at South Point but that nest was 17 days past its expected hatch date and was most likely infertile.

### **Predator Removal**

Trapping of mammalian predators was conducted for protected species on Cape Hatteras National Seashore from January 2009 to December 17, 2009. A total of 464 animals including: 25 red fox (*Vulpes vulpes*), 1 gray fox (*Urocyon cinereoargenteus*), 152 raccoon (*Procyon lotor*), 102 opossum and 105 opossum kits (*Didelphis virginiana*), 10 nutria (*Myocastor coypus*), 3 coyote (*Canis latrans*), 1 mink (*Mustela vison*), and 64 feral cats were captured. The feral cats were removed and taken to the local animal shelter. Additionally 6 rabbits and 6 crows were captured using live cages and released.

The Piping Plover Monitoring 2008 Annual Report provided estimates of predators removed from PIPL nesting areas during the period September 2007-July 2008. Since predator removal often is targeted in areas where multiple protected species are present and threatened by many of the same predators, it was determined that rather than trying to assign predator removal efforts to just PIPL protection, this year's report would provide total predator removal numbers for protected species efforts at CAHA. Consequently, the numbers provided in this report should not be directly compared to the numbers provided in last year's report since the basis for the numbers are somewhat different.

### **Weather**

No hurricanes or tropical storms occurred during the breeding season. However, smaller localized events may have affected nesting. A very high new moon spring tide overwashed one nest on South Point and may have contributed to the loss of Brood 3a on Hatteras. The brood was foraging in the Small Salt Pond when the event occurred and was never observed afterwards.

## **Human Disturbance**

Human disturbance, direct or indirect, can lead to the abandonment of nests or loss of chicks. Throughout the season, resource staff documented 192 pedestrian, eight ORV, 19 dog, three horse and three boat violations in the pre-nesting closures. 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 or habitat protected for 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 in the sand. Pedestrian entry most often 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 cannot 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 CD 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 three such violations occurred associated with pre-nesting closures established for PIPLs.

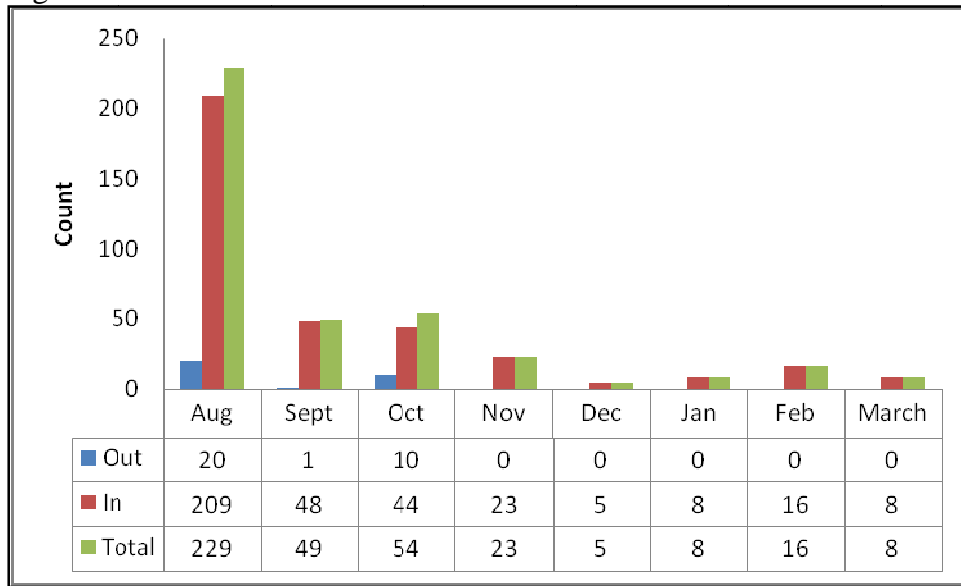
## **Non-breeding Surveys & Winter Monitoring**

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 2008-March 2009, a total of 392 PIPL observations were documented. Of the 392 PIPLs documented, 361 occurred inside a non-breeding/migratory closure and 31 occurred outside a closure (Figure 4). 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 and replicated in 2009 to include more of the sand flat habitat type. As more data is accumulated CAHA 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 and Hatteras Inlet because wintering PIPLs were not observed in the area from 2006-2008. Although there are no “official” winter closures at Cape Point and Hatteras Inlet, interior habitat remained closed to ORVs but was now open to pedestrians.

Figure 4. Total Numbers Observed vs. Inside or Outside Closure.



Staff documented non-breeding PIPL use at CAHA beginning at the end of the PIPL breeding season in August 2008 through March 2009 (Figure 5 and 6). Migratory birds peaked in August followed by a high count of 30 PIPLs observed on September 15, 2008 on South Point. After the migrants passed through the area in August, September and October, PIPL numbers appeared to stabilize over the winter months except for in February 2009 when there was an unexplained increase in numbers observed.

Figure 5. Actual Observation Numbers by Month

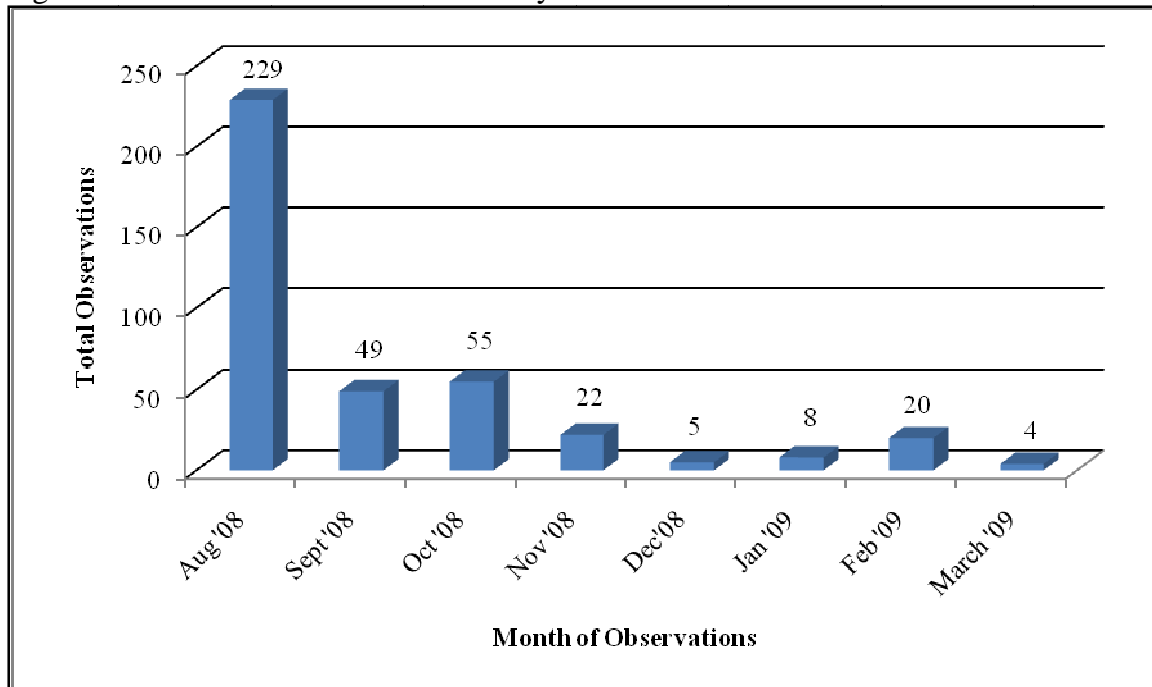
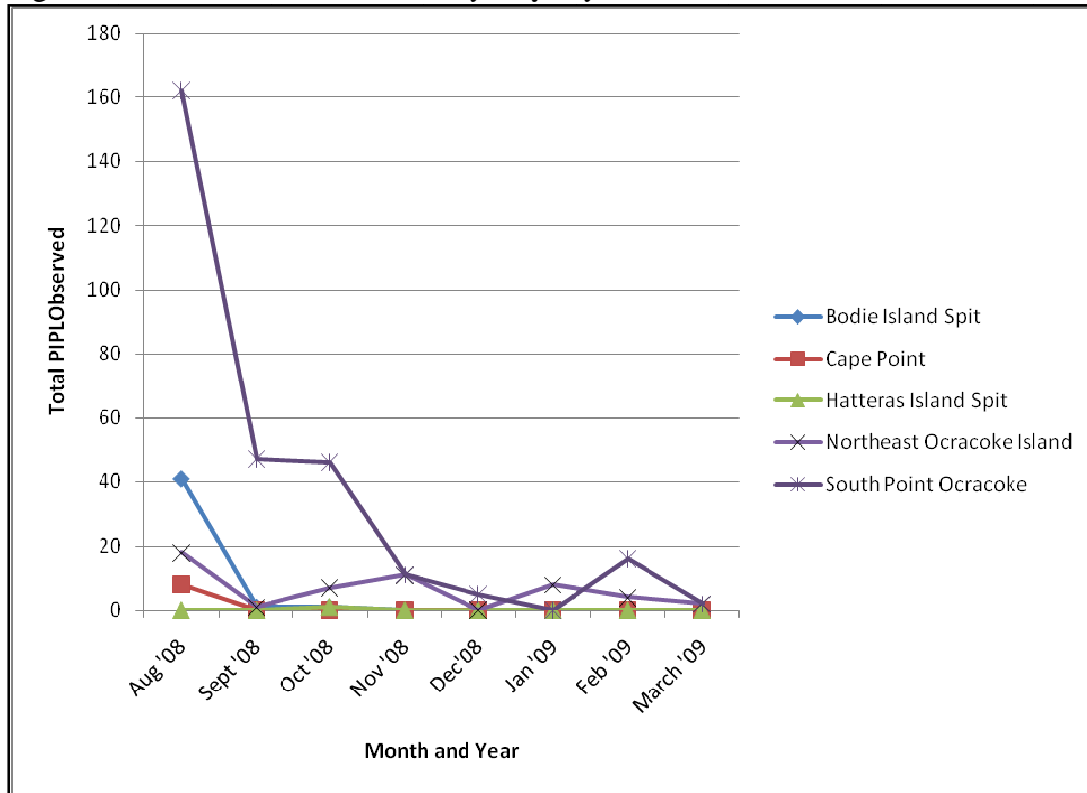




Figure 6: PIPLs Observed on Survey Days by Island and Month.



CAHA staff documented the habitat type in which migratory and wintering PIPL were observed from August 2008 to March 2009 (Figure 7). Of the 392 observations, 300 were in mud flat/algal flat, 59 were in sand flat, 9 were in foreshore, 21 were in wrack line and 3 were in freshwater pond habitat. Peak ORV usage during migration occurred in October and there were no more than 50 ORVs observed in the five survey locations from December 2008 to March 2009 (Figure 8).

Figure 7: Wintering Observations of PIPL by Habitat Type.

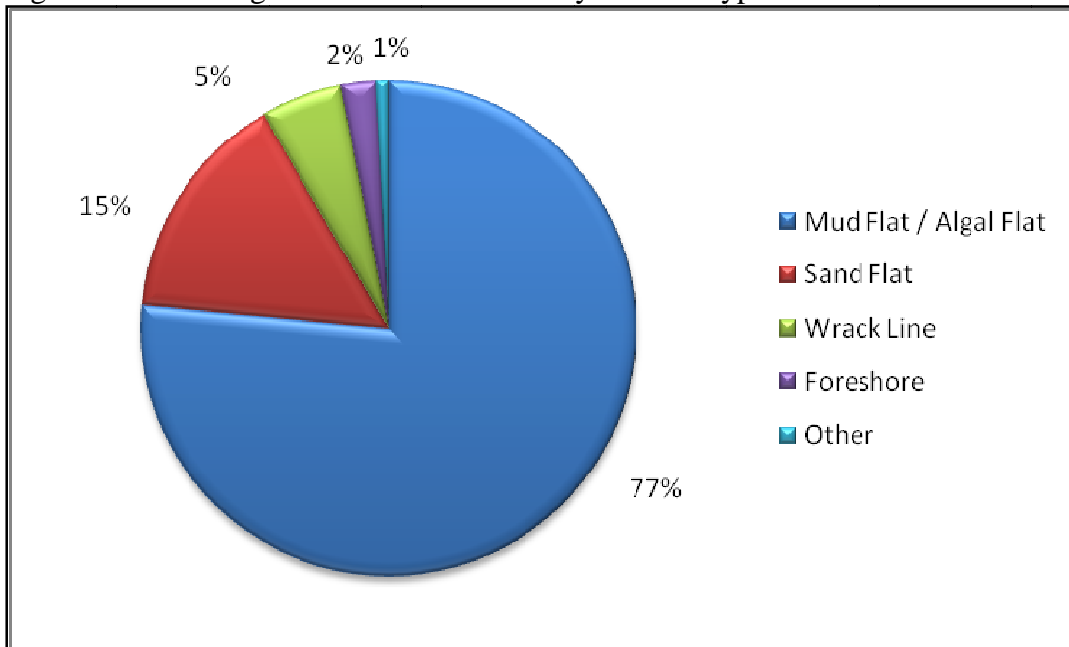
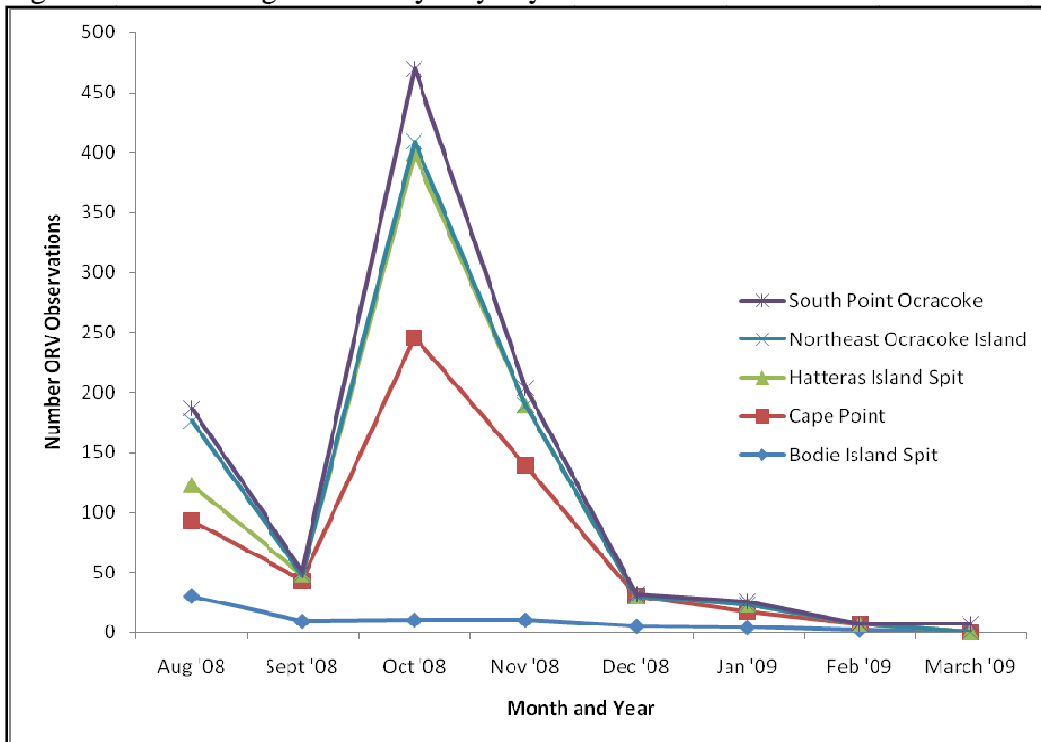


Figure 8: ORV Usage on Survey Days by Location and Month.



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

## **APPENDICES**

### **APPENDIX A: MAPS**

- Map 1: Bodie Island PIPL Nesting Activity 2000-2009
- Map 2: Cape Point PIPL Nesting Activity 2000-2009
- Map 3: Hatteras Overwash Fans PIPL Nesting Activity 2000-2009
- Map 4: Hatteras Inlet Spit PIPL Nesting Activity 2000-2009
- Map 5: North Ocracoke PIPL Nesting Activity 2000-2009
- Map 6: South Ocracoke PIPL Nesting Activity 2000-2009
- Map 7: Bodie Island PIPL Nesting Activity 2009
- Map 8: Cape Point and South Beach PIPL Nesting Activity 2009
- Map 9: South Ocracoke PIPL Nesting Activity 2009
- Map 10: Cape Point PIPL Chick Foraging Areas 2009
- Map 11: Ocracoke PIPL Chick Foraging Areas 2009
- Map 12: Bodie Island Wintering and Migratory PIPL Monitoring 2008-09
- Map 13: Cape Point Wintering and Migratory PIPL Monitoring 2008-09
- Map 14: Hatteras Inlet Wintering and Migratory PIPL Monitoring 2008-09
- Map 15: North Ocracoke Wintering and Migratory PIPL Monitoring 2008-09
- Map 16: South Ocracoke Wintering and Migratory PIPL Monitoring 2008-09
- Map 17: Piping Plover Wintering and Migratory Closures 2009-2010