

PIPING PLOVER (*CHARADRIUS MELODUS*) MONITORING AT
CAPE HATTERAS NATIONAL SEASHORE

2006 ANNUAL REPORT



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Introduction

Piping plover (PIPL) monitoring at Cape Hatteras National Seashore (CAHA) began in 1985. Monitoring focuses on identifying nesting habitat, locating breeding plovers and nests, protecting territories and nests, and determining nest and brood success. This report contains a summary of monitoring results for 2006, comparisons to results from previous years and management activities for 2006.

Methods

Location of Nesting Habitat

Bodie Island Spit, Cape Point, South Beach, Hatteras Inlet Spit, Ocracoke (North), and Ocracoke Inlet Spit (South Point) are potential nesting habitat. NPS staff began monitoring these sites in late March and early April. More staff was brought on in April and May for more regular and intensive monitoring. Monitoring of recent breeding sites was conducted two to three times per week for territorial pairs and nests.

Territory and Nest Protection

Pre-nesting closures were posted at Bodie Island Spit, Cape Point, South Beach, Hatteras Inlet Spit, and Ocracoke Inlet Spit by April 1. The pre-nesting closures included the upper beach, dunes, sand/mud flats, and sound side shoreline at Ocracoke and Bodie Island Spits. These sites have had breeding activity within the last three years. A shoreline closure (~0.2 miles) on the west side of the Cape Point closure was added on May 1, for protection of a foraging site. At the Hatteras Inlet overwash fans, a closure was posted on April 27, after four nest scrapes were found on April 26.

Nest and Brood Monitoring

Nests were viewed from a distance deemed sufficient to avoid disturbing the nesting plovers based on professional experience of field staff. Observations were conducted from dawn to dusk during incubation or at least twice daily if the closure was of adequate size to reasonably exclude chances of human disturbance. Observers documented the behavior of adults, presence of predators, human disturbance and the condition of the predator enclosure. Nests were briefly approached once a week to closely inspect the enclosure, count eggs and search for predator tracks. Nest visits increased when nests were expected to hatch or when hatch date was unknown. All known nests were protected by predator enclosures. The enclosures have been used at CAHA since 1994. Enclosures are circular in shape (~10 feet in diameter), made of 4" X 2" mesh wire fence anchored with steel rebar and topped with ¾" mesh bird netting. Because of high rates of predation, predator enclosures were sometimes constructed before clutch completion. After hatching, the broods were monitored from dawn to dusk until the chicks fledged or were lost. Monitoring was subject to occasional brief interruptions from unplanned demands on the monitor. Observers documented in their notes brood status, behavior, bird and/or brood movements, human disturbance, predator interactions, or other significant environmental events.

Monitoring of Migrating and Wintering Piping Plovers

Park staff conducted wintering and migrating PIPL surveys on a 10 day rotation (time permitting) from July 17, 2006-December 28, 2006. Pilot implementation of the NPS's Southeast Coast Inventory and Monitoring Network (SECN) Migratory, Wintering, and Beached

Shorebird Monitoring Protocol Study began in mid-July 2006 at CAHA. Monitoring occurred 5 days per week except when the monitor had holidays or annual/sick leave. The primary objective of the study is to determine areas of consistent use by target species, including PIPL, American Oystercatcher (AMOY), and Wilson’s Plover (WIPL). The pilot protocol is designed to systematically collect information pertaining to target species in beach areas at the Park and provide up-to-date information to Park managers to aid in management decisions.

Results and Discussion

Productivity

Six breeding pairs of PIPL were found at CAHA during the 2006, breeding season (Table 1). This represents three more pairs than were found in 2005, and the most known pairs since 1999. In 1996, six different breeding areas supported nesting. This season, known pairs occupied five sites although nesting was documented at only three of these sites. In 2006 nesting occurred at Cape Point, South Beach and Ocracoke Inlet Spit. A pair actively maintained a territory in the early part of the season at Hatteras Inlet Spit where territorial and breeding behavior was observed in April and May, but no eggs were found. At Bodie Island Spit territorial defense was observed in May. From June 15-June 21, aerial displays, scraping, high step tattoo, rump pecks, and attempted copulation was observed. No nest was ever located and no breeding behavior was observed after the June 21.

Table 1. Number of PIPL breeding pairs by site at CAHA (1987-2006)

Year	Total Pairs	Sites within Cape Hatteras National Seashore					
		Bodie Island Spit	Cape Point	South Beach	Hatteras Island Spit	Ocracoke (North)	Ocracoke Inlet Spit
1987	10	0	4	0	4	1	1
1989	15						
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	12	0	5	1	3	3	0
1994	11	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

The six PIPL pairs produced four known nests this season (Table 2). Three nests successfully hatched. Two were located at Cape Point and one at Ocracoke Inlet. Average clutch size was 3.75 eggs with a four egg and a three egg nest laid at Cape Point, a four egg nest at South Beach, and a four egg nest at Ocracoke Inlet spit. Nine eggs (60%) hatched (Table 3, 3a). Three chicks survived to fledgling age. Fledgling rate was 0.50 chicks/ breeding pair (Table 4). Since 1989, productivity rates have ranged from 0.0 to 2.0 chicks/pair. The average rate over the past 15 years is 0.672 chicks/pair (Table 4a). A rate of 1.2 fledglings/ breeding pair annually would be needed to sustain a population and higher to increase a population (US Fish and Wildlife Service 1996).

A summary of 2006 PIPL breeding pair observations (Appendix A) provides details of seasonal biological technician staff field observations of breeding pairs and nests at the five sites where breeding pairs were observed.

Table 2. 2006 PIPL nesting season at CAHA

LOCATION	# Breeding Pairs	# Nests	# Nests Hatched	# Nests Lost	# Chicks Fledged	# Chicks Lost
Bodie Island Spit	1	0	0	0	0	0
Cape Point	2	2	2	0	3	3
South Beach	1	1	0	1	0	0
Hatteras Inlet Spit	1	0	0	0	0	0
Ocracoke (North)	0	0	0	0	0	0
Ocracoke Inlet Spit	1	1	1	0	0	3
TOTAL	6	4	3	1	3	6

Table 3. PIPL hatching success at CAHA in 2006

LOCATION	# NESTS	# EGGS	NESTS LOST/ ABANDONED		NESTS HATCHED		EGGS HATCHED		NESTS W/ FLEDGED CHICKS	
			#	%	#	%	#	%	#	%
Bodie Island Spit	0	0	0	0%	0	0%	0	0%	0	0%
Cape Point	2	7	0	0%	2	100%	6	85%	1	50%
South Beach	1	4	1	100%	0	0%	0	0%	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	1	4	0	0%	1	100%	3	75%	0	0%
TOTAL	4	15	1	25%	3	75%	9	60%	1	25%

Table 3a. PIPL hatching success at CAHA from 1992-2006

YEAR	# NESTS	# EGGS	NESTS LOST/ ABANDONED		NESTS HATCHED		EGGS HATCHED		NESTS W/ FLEDGED CHICKS	
			#	%	#	%	#	% (a)	#	%
2006	4	15	1	25%	3	75%	9	60%	1	25%
2005	2	8	0	0%	2	100%	8	100%	2	100%
2004	2	6	1	50%	1	50%	4	66%	0	0%
2003	2	5(b)	0	0%	2	100%	4(b)	100%	1	50%
2002	3	8	2	67%	1	33%	1	13%	0	0%
2001	3	10	2	67%	1	33%	3	30%	1	33%
2000	6	23	3	50%	3	50%	10	44%	2	33%
1999	6	23	3	50%	3	50%	11	48%	3	50%
1998	8	31	2	25%	6	75%	20	65%	5	63%
1997	16	47(b)	6	38%	10	63%	32	68%	2	13%
1996	16	56(b)	6	38%	10	63%	30	53%	2	13%
1995	19	63	6	32%	13	68%	30	48%	6	32%
1994	18	65(c)	8	44%	10	56%	32(d)	49%	6	33%
1993	21	69	12	57%	9	43%	27	39%	5	24%
1992	14	49(e)	6	43%	8	57%	17	35%	6	43%

(a) - of all known eggs

(b) - assumes 1 egg from a brood whose nest was not found (see 2003 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 3 eggs from a brood whose nest was not found (see 1992 report)

Table 4. Fledging success of PIPL at CAHA in 2006

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%	0.00
Cape Point	2	2	6	3.0	3	50%	1	50%	1.50
South Beach	1	0	0	0.0	0	0%	0	0%	0.00
Hatteras Inlet Spit	1	0	0	0.0	0	0%	0	0%	0.00
Ocracoke (North)	0	0	0	0.0	0	0%	0	0%	0.00
Ocracoke Inlet Spit	1	1	3	3.0	0	0%	0	0%	0.00
Total	6	3	9	3.0	3	33%	1	33%	0.50

Table 4a. Fledging Success of PIPL at CAHA from 1992-2006

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

(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)

Nest Loss/Abandonment

Nest #2 on South Beach failed during or near hatching. Initially it was assumed the nest had hatched and the chicks were lost immediately after hatching based on the adult's behavior and nest site observations. However, upon further review of the data collected, it was characterized as a nest loss because no chicks were ever observed. On June 12 the adult was seen incubating the nest. On June 13 the nest was empty, there were no signs of predation, and the predator exclosure was in good order. The adults were still defensive of the nesting site. The male PIPL was attempting to brood a least tern chick and defending the chick against an adult least tern. The male PIPL stayed with the least tern chick all day. The female PIPL was present intermittently. The vicinity of the nest site was searched from 8 a.m. - 4 p.m., by foot, for signs of the chicks. The area from Cape Point flats to the drain on South Beach was searched for several days, but no chicks were ever located. A thunderstorm on the night of June 12 may have contributed to the loss of the nest and/or chicks. Because no chicks were ever observed, the nest was considered unsuccessful and the loss was characterized as due to unknown factors.

Chick Mortality

Of the six chicks at Cape Point, three were lost prior to fledging. The three chicks lost were from the same brood and were lost on day 4, 7, and 8. At Ocracoke the three chicks that were lost were also from the same brood and were lost on day 1, 9, and 12. In both instances chick loss was due to unknown causes. (Note: 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 even though the mortality is characterized as “unknown”.) As in past years, the majority of chick mortality occurred within ten days of hatching (Table 5).

Table 5. Age distribution of PIPL chick mortality at CAHA (1990-2006)

Year	Age (days)																									Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
1990	3	3	1	2	4	1	1	2	1			2	2		1											20
1991				1	2	1	1	3	5	2	1							3								19
1992			2	1	2	2	2			1				1					1							12
1994		2		6					1	1	2					1	1		1							15
1995	2		7	2	2	3	1	2	1		1	1	1													21
1996	1	4	8	2	4	1			3			2	1												1	26
1997		2	3	5	5	1	1	4				1	1	1	2	1			2							29
1998		2	1				2	1		1													1			8
1999	1	2			1																					3
2000	2	1		2	1							1														5
2001			1																							1
2002							1																			1
2003					3												1									4
2004		1			1			1												1						4
2005				1			1																			2
2006	1			1			1	1	1			1														6*
1990-2006	10	17	23	23	25	9	11	14	12	5	4	8	5	2	3	2	2	3	4	1	0	0	1	0	1	

*-egg hatched, day 1, chick not seen

Chick Movement

The brood from Nest 1 established itself on the west side of Cape Point. They stayed near the nest site throughout chick rearing. They foraged at two ephemeral pools west/southwest of the nest and at the surf (within the established shoreline closure). They also foraged and sheltered in the low dunes north of the nest site. The brood from Nest #3 (3 chicks) moved east on day three (July 15) to the salt pond flats and were within 500’ of the ORV corridor on the east side of Cape Point. This prompted the bypass road to be closed and a night time closure of the Point for the duration of chick rearing. The east side of the ORV corridor was opened in the morning when the chicks were located and the chicks were monitored from dawn to dusk. The Point was closed at night since chick movements could not be monitored at night. On July 16, two chicks moved back to the west side of the point near their nest site to forage at the ephemeral pools and at the surf until they were both lost to unknown causes by July 20. The brood from Nest #4 on Ocracoke Spit moved 0.4 linear miles from their nest to a sound side foraging area by day 4. They remained at this foraging site until they were lost to unknown causes.

Predator Exclosures

In 2006 predator exclosures were used to protect all four nests. All four predator exclosures were constructed and accepted by pairs within 30 minutes. An incubating adult from Nest #2 on South Beach was observed on one occasion bouncing off of the bird netting on May 30 and on June 1 the incubating adult flew up into the bird netting and became entangled. The bird had to be removed from the netting and flew off without any apparent injuries. Approximately one hour after the incident an individual had returned to the nest to incubate. Both adults were seen incubating the

next day. Typically, the PIPLs enter and exit predator exclosures by walking through the 4" X 2" mesh.

Predation

No documented egg depredation occurred while eggs were being incubated. Although likely, staff is unable to document or provide evidence of the loss of Nest #2 on South Beach to predators. The eggs disappeared overnight however staff was unable to document signs of predation or predator tracks and the predator exclosure was in good condition.

There was no documented chick predation; however some of the chicks lost to unknown causes may be attributed to predators. The presence or tracks of crows, grackles, gulls, ghost crabs, Virginia opossum, mink, raccoon, red fox, grey fox, domestic cats, and domestic dogs were documented within many of the PIPL breeding territories. A fox den was discovered within the Bodie Island spit bird closure in June. PIPL breeding activity occurred at Bodie Island spit, but no nest was found. An AMOY nest and least tern nests suffered raccoon predation at the Cape Point and South Beach sites. Mink were primarily seen on Ocracoke spit.

Predator Removal

For the fifth consecutive year, USDA trappers removed fox from CAHA. Trapping efforts occurred during June 19-30 on Bodie and Hatteras Islands. This year's project resulted in the removal of four red fox and three grey fox from Bodie Island. No fox were trapped on Hatteras Island. Although no fox were trapped on Hatteras Island and USDA trappers saw no indications of fox activity, fox signs were observed by park personnel. Tracks were noted on South Beach and in the Cape Point area. Also, a fox was sighted on the salt pond shoreline. No signs of fox were observed on Ocracoke Island in 2006. In addition to fox, 21 raccoons, eight Virginia opossums, and two free ranging cats, were removed by USDA trappers in 2006. Since trapping was initiated in 2002, 58 red fox, 27 grey fox, 99 raccoon, 21 Virginia opossum, seven feral cats, and one feral dog have been removed.

A volunteer for the park removed 10 raccoons, 12 Virginia opossum, and seven feral cats from Hatteras Inlet in January 2006. Additionally park staff removed four cats from bird nesting habitat on Hatteras Island during the summer.

Weather

No significant weather events, i.e. hurricanes or tropical storms, occurred during the breeding season. However, smaller localized events may have affected nesting. Nest #4 on Ocracoke Inlet spit was partially buried by high wind and blowing sand. One egg was buried by sand and the nest was a deep cup rather than a scrape (June 29). One adult remained hunkered down on the nest during the strong winds. By July 4 the buried egg was visible again during the nest check. We assumed this was the unhatched egg in the four egg clutch. A strong thunderstorm was noted on the night before Nest #2 on South Beach was discovered lost; however, the loss is characterized as "unknown" because it cannot be shown conclusively that weather was the cause.

Human Disturbance

Human disturbance, direct or indirect, can lead to the failure of PIPL breeding success. From April 1-August 31, 2006, resource staff recorded 255 pedestrian, 47 ORV, 22 dog, and five horse violations of bird closures. Numbers are conservative since sites are not monitored continuously, weather erases tracks, and staff did not disturb an incubating pair or young just to document disturbance. Most illegal entries were not witnessed but documented based on vehicle, pedestrian, or dog tracks left behind. Law enforcement documented most illegal ORV entries, but not all, and therefore their violation numbers may be different than what was recorded by resource staff. Pedestrian entry required visitors to lift and stoop under the string that connected all posted signs. 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. Of the 22 dog entries into closures, most dog tracks were not accompanied by human footprints, indicating that the dogs were unleashed in the closures. Some of the specific observations related to human disturbance are provided in the breeding pair summary information contained in Appendix A.

Non-breeding Surveys

Park staff documented PIPL use of the seashore throughout the year (Appendix B). Migratory birds appeared to peak in August and September with a high count of 93 birds at Ocracoke Inlet spit on August 10 (Table 6). Ocracoke Inlet spit revealed the highest counts during fall migration. Three surveys at Ocracoke Inlet spit were coordinated with Cape Lookout National Seashore surveys on North Core Banks to investigate bird abundance around Ocracoke Inlet (Table 6).

Table 6. Counts of PIPL on both sides of Ocracoke Inlet during fall migration.

Date	Ocracoke Inlet Spit	North Core Banks	Total	Tide
10-Aug-06	93	7	100	mid
14-Aug-06	69	16	85	low
2-Oct-06	15	16	31	low

Individual banded birds from the Great Lake's population and Atlantic Canada were sighted at Ocracoke Inlet spit (Table 7). CAHA continues to be an important migration stopover location and wintering site for PIPLs.

Table 7. Ocracoke Inlet spit banded PIPL sightings.

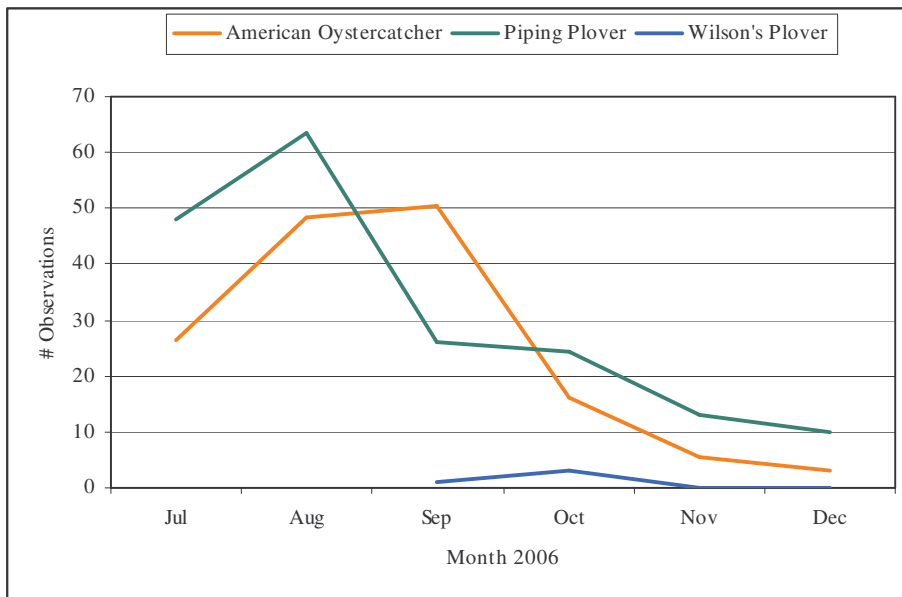
Date	Left Leg-Top	Left Leg-Bottom	Rt. Leg-Top	Rt. Leg-Bottom	Location
6-Jul-06		red/light blue		metal/light blue	Ocracoke spit
17-Jul-06		metal sleeve		metal	Ocracoke spit
25-Jul-06		orange/light green split		light green	Ocracoke spit
19-Aug-06		orange/white split		white	Ocracoke spit

Southeast Coast Inventory and Monitoring Network (SECN) Winter Monitoring

In addition to the monitoring being conducted by park staff, SECN is conducting a more comprehensive study on wintering shorebirds. Following is a summary of SECN results which includes species other than just the PIPL. Pilot implementation of the SECN Migratory, Wintering, and Beached Shorebird Monitoring Protocol at CAHA began in mid-July 2006. The primary objective was to determine areas of consistent use by target species, such as PIPL, AMOY, and WIPL.

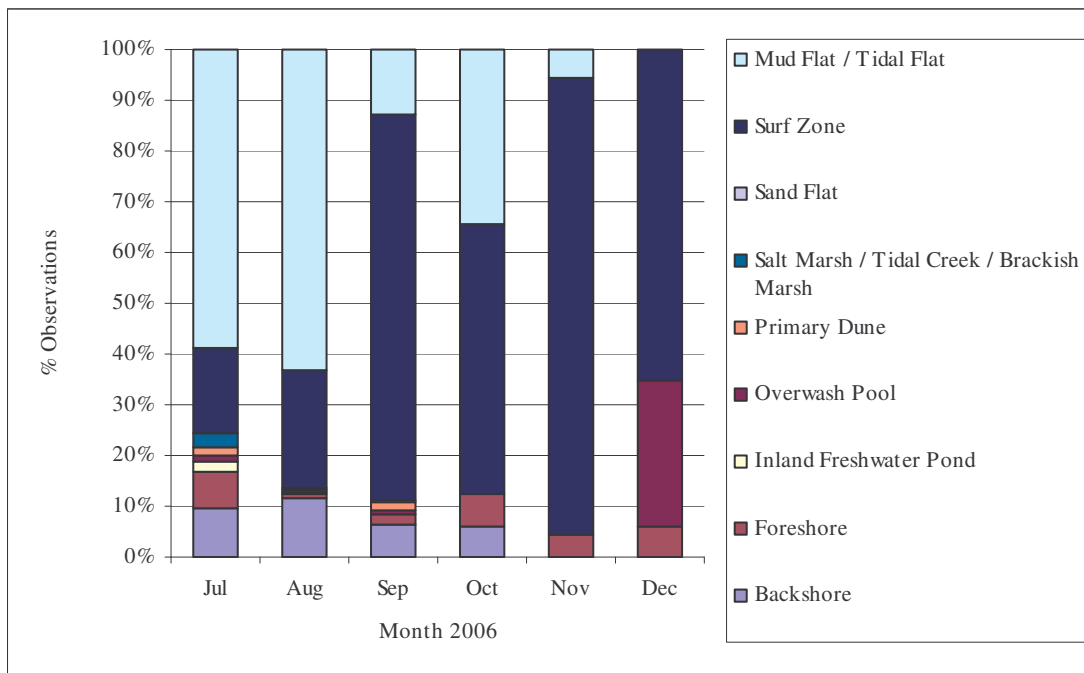
The number of AMOY and PIPL observed decreased from 62 and 50, respectively, during August / September to approximately ten and five in late November (Figure 1). Few WIPL were observed at CAHA from July to early December.

Figure 1. Number of AMOY, PIPL, and WIPL observations at CAHA, 23 July 2006-6 December 2006.



Approximately 60% of the shorebird observations occurred in mud flats / tidal flats during late summer (Figure 2). From September to early December, most observations occurred in the surf zone.

Figure 2. Percentage of focal shorebird observations in select habitats at CAHA 23 July 2006- 6 December 2006.



No target shorebirds were detected as part of the beached shorebird component of this protocol. Monitoring and protocol refinement will continue through the remainder of the 2006/2007 wintering period and spring 2007 migratory period.

Winter Closures

Winter closures were established upon removal of the nesting closures during the first week of September (Maps 1-4). These maps also contain all the known PIPL nesting locations for the past 10 years. The aerial photographs used as basemaps are from 1998 and have been modified to show current shorelines.