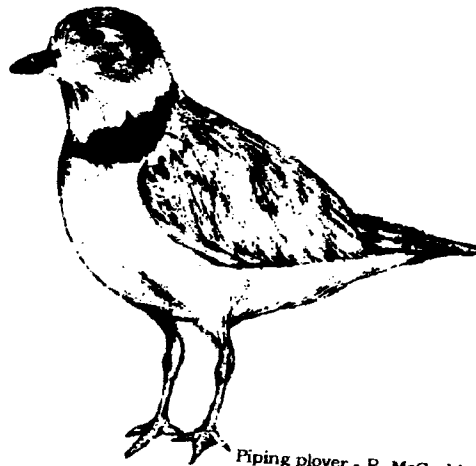


**U. S. FISH AND WILDLIFE SERVICE
CHINCOTEAGUE NATIONAL WILDLIFE REFUGE**

PIPING PLOVER MONITORING AND MANAGEMENT

SUMMER 1996



Piping plover - R. McCorkle

U.S. FISH AND WILDLIFE SERVICE
CHINCOTEAGUE NATIONAL WILDLIFE REFUGE
ASSATEAGUE ISLAND, VIRGINIA

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PIPING PLOVER MONITORING AND MANAGEMENT SUMMER 1996

I. INTRODUCTION

The piping plover monitoring and management program for the 1996 breeding season followed the recommendations developed as a result of a three year study that concluded in 1991 and experiences gained during the 1988, 1992, 1993, 1994 and 1995 field seasons. This report represents data collected in the 1996 season (February through August) and presents the results of this year's nesting success and offers recommendations that will promote increased productivity in the 1997 nesting season.

II. MANAGEMENT AREAS

Chincoteague National Wildlife Refuge (CNWR) is a 5,691 ha (14,014 acre) wildlife refuge located almost entirely on Assateague Island in Accomack County, Virginia. Assateague Island is a barrier island that extends approximately 59 km (37 miles) along the Maryland/Virginia Coast. Assateague Island portion of the refuge includes beach, dune, saltmarshes, freshwater impoundments, and maritime forest/shrub habitats. Adjacent islands that are a part of the refuge complex and support piping plovers include Assawoman, the northern end of Metompkin, and parts of Cedar Islands. Wallops Island, just south of Assateague, is administered by the National Aeronautics and Space Administration (NASA) and is included as part of the Wallops Island NWR under a Use Agreement (UA) with NASA.

The three principal monitoring areas within the Assateague Island portion of the refuge included the Hook Beach, Wild Beach, and North Wash Flats (Figures 1 and 2). The Hook is the southernmost portion of Assateague Island and extends for approximately 4.5 km (2.8 miles). The Hook is approximately 316 ha (780 acres) of multiple tidal flats and pools, small vegetated dunes, blowouts, and relatively wide beach areas. Since 1988, the Hook has been closed to all public use from March 15 to August 31, the piping plover's breeding season.

The Wild Beach nesting area extends from D Dike north to the North Wash Flats cross over for approximately 5.9 km (3.7 miles). The Maryland/Virginia state line is located approximately 4.8 km (3 miles) north of this nesting area. The Wild Beach is also typified by small vegetated dunes, occasional tidal pools, and varying widths of beach. This area tends to be highly vulnerable to adverse weather

Figure 1 Base map of the Chincoteague National Wildlife Refuge.
(southern portion)

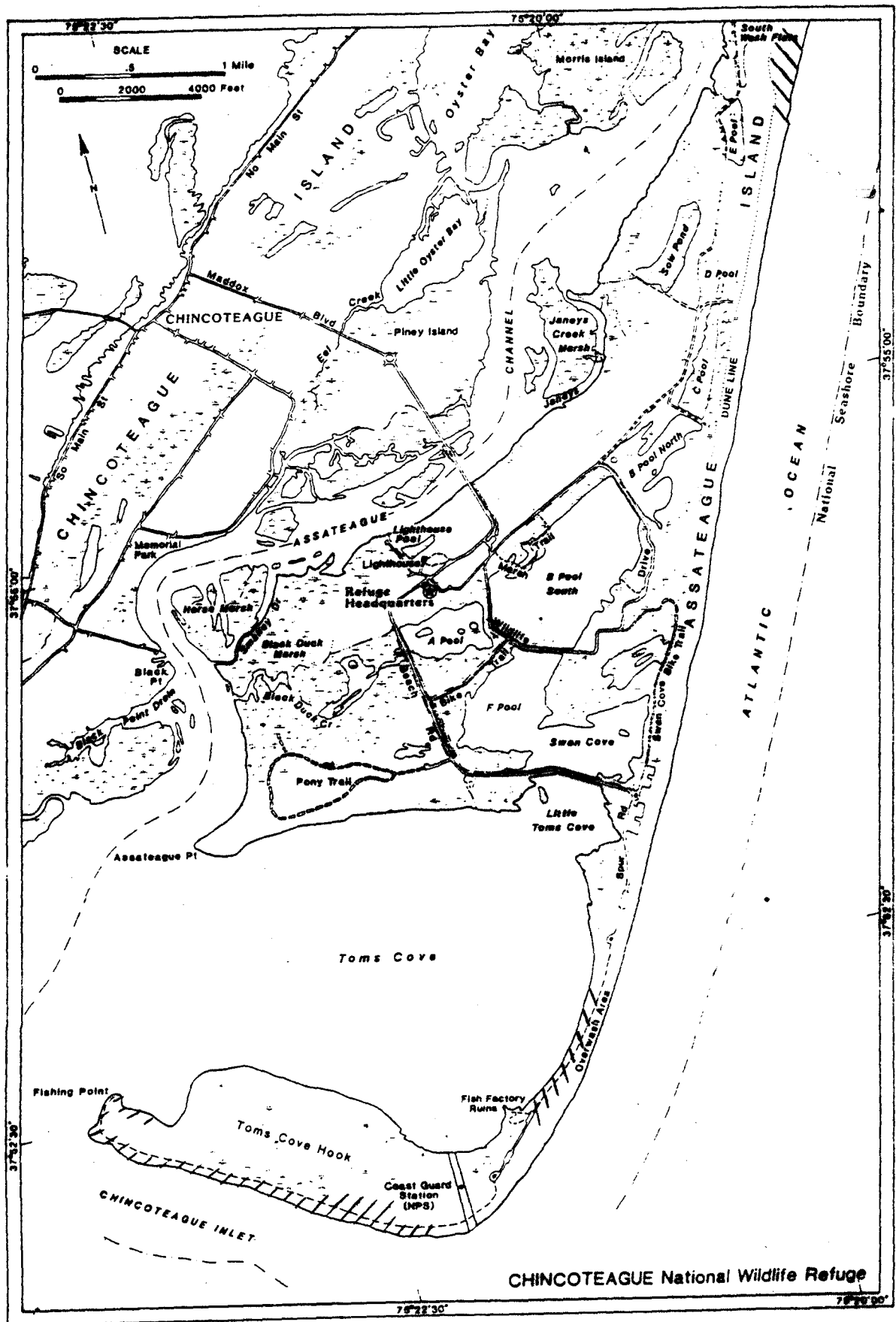
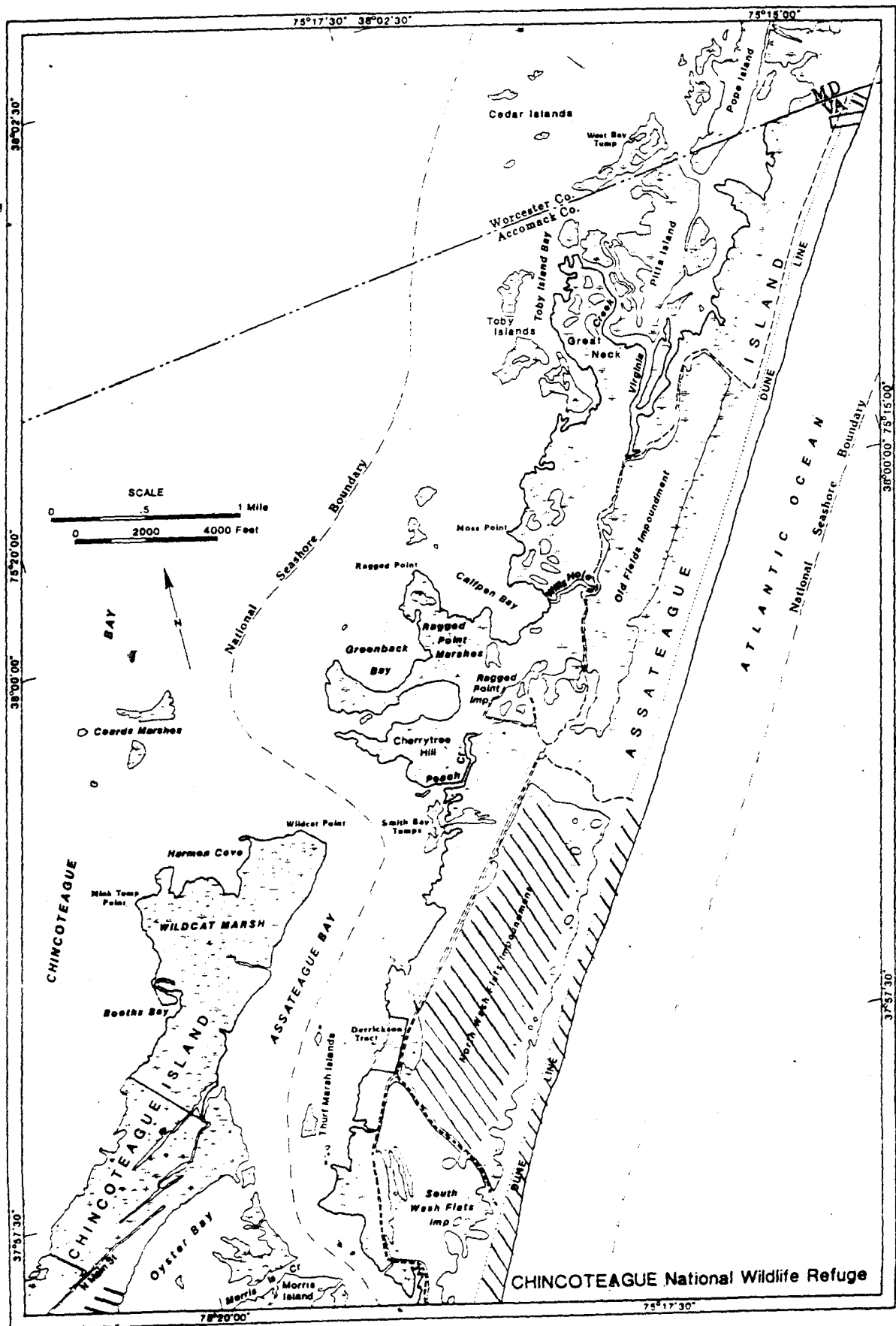


Figure 2 Base map of the Chincoteague National Wildlife Refuge.
(northern portion)



conditions, i.e. flooding, wind gusts, and blowing sand. Areas behind the high tide line are posted and closed to public access during the nesting season. However, the intertidal zone is accessible to pedestrian traffic throughout the year.

The North Wash Flats is an 324 ha (800 acre) impoundment between the bay and the ocean. It is a brackish water impoundment that is managed according to the refuge's Marsh and Water Management Plan to allow nesting and feeding by piping plovers and other migrant shorebirds. Waterfowl use the impoundment extensively during the fall and winter months. In past years, the low elevation of this area has rendered it highly subject to flooding. All public access is prohibited year round.

The barrier islands of Assawoman, Cedar, Metompkin, and Wallops are composed of narrow sandy beaches with intermittent dunes and extensive saltmarshes. Public access is restricted during the breeding period (March through August) on most of the islands.

III. METHODS

The techniques employed to monitor plovers have evolved over the past nine years as more information became available and monitoring techniques improved. The procedures used are those that have proven to be the most cost-effective to date and yet provide the types of data needed to determine the effectiveness of the refuge's piping plover management program.

A. POPULATION MONITORING

Population monitoring included both the pre-nesting and nesting periods throughout the spring and summer months. Monitoring activities were confined to specific periods to lessen disturbance to territorial pairs, incubating adults, and adults with young.

1. PRE-NESTING

Prior to the nesting season, refuge staff and volunteers began surveys to document the arrival of migrant and resident plovers. Beginning in late February all beach areas were periodically surveyed for plover arrival, establishment of territories, courtship display, and preliminary nest scrapes. One to two surveys were conducted each week to obtain an idea of population density and dispersal. More intense monitoring began in mid-April when territorial pairs were firmly documented.

2. NEST SEARCHES AND MONITORING

Locating nests was accomplished by observing territorial individuals or pairs from a distance until their behavior revealed the nest or approximate location. In vegetative concealed areas, tracks were followed to locate the nest once the general area was known. The time frame for searches was established between late April and the second week of July, with the second week of May set aside for intense nest searches. Search time was limited to less than 10 minutes when nest searches were held after 1000 hours or in extreme weather conditions such as mid-day heat, rain, wind, etc. The time restraint was adhered to even at the expense of not finding a new nest. During the rest of the season, nests were found only by observing territorial adults. Intense nest searches were defined as walking through potential nesting areas at a slow pace, looking for nests, scrapes, or plover tracks. Once a nest was located, the observer flagged the nest approximately 10 meters north and south of the nest and recorded it in the nest records so any observer could locate the nest. Throughout the season, visits to the areas were limited to once a day to minimize disturbance. Disturbance to incubating or territorial adult(s) was limited to a maximum of 20 minutes on any given day with most nests monitored with a spotting scope at a distance that did not disturb the incubating bird.

B. MANAGEMENT TECHNIQUES

Predator management for increased Piping Plover productivity has been performed on the refuge since 1988 and follows protocol as directed by the Piping Plover Recovery Plan. The refuge incorporates refuge specific techniques fashioned by the piping plover recovery team for the refuge's individual predator problems. Several direct and indirect management techniques are currently in use to increase plover productivity. Direct predator management techniques include den gassing. Leg hold trapping and live trapping were limited this year due to the effectiveness of den gassing and lower mammalian predator levels in response to the recent viral epidemics. Indirect techniques used to control predation levels of plovers and nests has been the use of predator-proof exclosures and predator proof fencing around North Wash Flats nesting area. Predator exclosures are utilized within the Hook and North Wash Flats nesting areas which excludes the Wild Beach nesting area. In response to high predation rates on Wild Beach in previous years, the recovery team felt that leaving the Wild Beach nests un-

exclosed would encourage renesting in the adjacent North Wash Flats nesting area.

1. PREDATOR MANAGEMENT

Predator management techniques utilized this year included den gassing, leg-hold trapping, and shooting of some particularly troublesome avian species, which included grackles, crows, and gulls. Fox den searches were performed several times throughout the spring and summer within plover nesting areas. Dens were gassed using carbon monoxide cartridges early in the season and whenever an active den was discovered within the plover nesting areas. Although the number of animals taken by den gassing cannot be accurately determined, this method has proven to be a quick and humane way to control the fox population. Because den gassing requires much less time and produces effective results, leg-hold trapping for foxes was very limited this year.

2. NEST EXCLOSURES

Nest exclosures are comprised of a 10.9 m (36 foot) piece of 122 cm (48 inch) wide 5.1 cm by 10.2 cm (2 X 4 in) welded wire mesh. The wire mesh is placed around the nest forming a 3.7 m (12 foot) diameter circle surrounding the nest. Five 1.8 m (6 foot) pieces of 15.9 mm (five-eighths inch) rebar are evenly spaced around the perimeter and are driven into the ground to secure the wire mesh in place. The nest exclosure is then covered by 3.8 cm (1.5 in) mesh nylon netting to deter avian predation. Each exclosure requires approximately ten to fifteen minutes to construct and set up time is recorded for each nest to determine if abandonment could be caused due to excessive set up time.

A predator-proof exclosure is placed around each nest after the third egg is laid, or on smaller clutches, if no additional eggs are laid after three days. After exclosure placement, the nest is observed at a distance to allow the adult to return to the nest. The exclosure is removed if the adults fail to resume incubation within 60 minutes.

The 3.7 m (12-foot) diameter predator-proof exclosure used in past seasons was continued this year to provide a greater distance between the nest and the exclosure. In addition, the single piece of 3.8 X 3.8 cm (1.5 X 1.5 inch) mesh bird netting was also continued this season. The netting has proven to be

effective in keeping out avian predators and facilitated a quicker and easier placement and handling during exclosure construction.

All nests found on the Hook were protected by predator-proof nest exclosures except those nests occurring within or behind the primary dunes and in dense vegetation with approximately 75% or more coverage. This was done to allow the natural topography and vegetation to protect the nest without interference from the predator exclosures or the possibility of increasing depredation rates.

IV. MANAGEMENT RESULTS

Results presented in this report were compiled from data collected throughout the 1996 nesting season. These data come from approximately 24 weeks of monitoring: February 26 through August 9. Tables are presented that depict data for the past seven years of plover monitoring to better facilitate comparisons between years.

In an effort to provide a more comprehensive report of piping plover productivity within the refuge complex, data from the refuge's Lower Island units of Assawoman, Cedar, Metompkin, and NASA's Wallops Island are also presented. Although the monitoring of these units was not as intense as the refuge portion of Assateague Island, accurate data on nesting pairs and productivity were obtained through the Virginia Department of Game and Inland Fisheries Division of Non-game.

A. POPULATION MONITORING

Plover surveys on Assateague Island began on February 26, but no birds were sighted until March 11. A group of 18 plovers was observed on the Hook on that date. The first plover on the Wild Beach was sighted on April 5. No plovers were observed on the Wash Flats until April 22. Surveys continued throughout the summer, with the last nest found July 3 on the Hook. Three nests occurred in the overwash area adjacent to the ORV zone this year.

Plovers nested in only two of the three major nesting areas, with the most nests (20) being located on the Hook. The Wild Beach had nine nests, an increase over last years total of six nests. The increase on the Wild Beach was probably due to the wet conditions on the Wash Flats, which resulted in no nest being initiated in this area. The first nest initiation date was estimated to be approximately April 30 on the Wild Beach, 11 days later than in 1995. Nests were initiated at about the same time

on the Hook, with May 1 being the approximate initiation date.

Nesting plovers decreased by seven pair on Assateague Island this year. Overall pairs decreased by seven pair also. Assawoman Island had an increase of one pair, for a total of eleven pair. The Wallops population was static at three pair, while Metompkin lost a pair, for a total of three nesting pair.

Data for Cedar Island are for the entire island which has many privately owned areas. However, the Service has several beach easements scattered throughout the island and fee title to sever portions of the island. Plover nesting success this year was by far the best in many years. A total of 13 pairs produced 28 fledged young for a total of 2.15 young/nesting pair.

Surveys and monitoring activities were conducted throughout the spring and summer in all potential plover nesting areas with emphasis on the three known nesting sites. Most nesting activity occurred in traditional breeding areas with the exception of the three nests found adjacent to the off-road vehicle zone on the Hook (overwash on bay side) and a brood found about a mile south of the MD/VA line.

1. EGG AND CHICK LOSS

Egg and chick losses were attributed to a variety of factors with many unknowns associated with chick losses. In all instances, direct and indirect evidence were used to attribute loss to a particular cause.

a. ASSATEAGUE ISLAND EGG LOSSES

A total of 92 eggs were produced in 29 nests on Assateague this year. That was a decrease of 17 eggs and four nests. The most eggs lost (8) were due to predation (Table 1). All of the egg predation was attributed to avian species. Six of the seven weather related losses were due to the high tides and strong winds which accompanied tropical storm Bertha on July 13. The other egg was lost due to an earlier high tide. Because all nests on the Wild Beach had hatched by July 9, all weather related egg losses occurred on the Hook. Only three eggs were infertile. One nest containing four eggs was lost due to abandonment. Tracks were found encircling the exclosure, indicating that harassment by a fox may have led

to nest abandonment. The cause for the loss of one egg was unknown. The egg was in a clutch of 4 eggs, two of which hatched. After the two chicks hatched, both adults left the nest, which still contained two eggs. One of the remaining eggs was infertile, the other contained an embryo that was within a few days of complete development.

TABLE 1
Causes of Piping Plover Egg Loss on Assateague Island, 1996

AREA	Number of Eggs (Nests) Lost To:					
	Predation	Weather	Infertile	Abandon	Unk	Total
Hook Beach	6 (5)	7 (4)	0	4 (1)	0	17 (10)
Wild Beach	2 (1)	0	3 (3)	0	1 (1)	6 (5)
Wash Flats	0	0	0	0	0	0
Total	8 (6)	7 (4)	3 (3)	4 (1)	1 (1)	23 (15)

b. EXCLOSED NEST/EGG LOSSES

A total of 12 nests were exclosed this year compared to 20 last season. All nests that were found on the Hook were exclosed after the third egg was laid or the clutch was completed. Nests on the Wild Beach were not exclosed. Seventy-five percent of the exclosed nests were successful, hatching at least one chick. Only 65% of unexclosed nests were successful. Sixty-seven percent of the unexclosed nests that were lost were attributed to predation, with the other 33% due to weather. The major cause of egg loss in exclosed nests was weather, with 45% (5 eggs/2 nests) lost due to flooding from tropical storm Bertha. Abandonment accounted for 36% (4 eggs/1 nest) of the loss in exclosed nests. Avian predation occurred at one nest before the clutch was completed. Two eggs were predated from this nest. The one egg remaining in the nest was then exclosed.

c. ASSATEAGUE ISLAND CHICK LOSSES

Chick losses decreased significantly this year, from 63 chicks lost in 1995 to 34 chicks lost in the 1996 nesting season. The Wild Beach accounted for the 56% of losses with 19 chicks lost. The Hook accounted for 44% (15 chicks) of the chick

losses. Although chick losses were not directly observed, avian predation is suspected in most cases. Likely avian predators include crows, grackles, and gulls.

2. HATCHING AND FLEDGLING SUCCESS

Even without the benefit of predator exclosures, the Wild Beach had the highest hatching success on the refuge. Of the 32 eggs from nine nests, 26 hatched for an average of 2.89 chicks hatched/nest. That was down from 3.80 chicks hatched/nest in 1995. Hatching success also decreased on the Hook from 2.45 chicks hatched/nest in 1995 to 2.15 the 1996 nesting season.

Fledgling success on Assateague Island improved over the 1995 season, with 1.46 chicks fledged/pair for a total of 35 chicks fledged (Table 2). The fledgling success for 1995 was only 0.81 chicks fledged/pair for a total of 25 chicks fledged. The Hook was the most productive area in 1996 with 67% of all the plovers nesting on the island found in this area. A total of 16 pair of piping plovers nested on the Hook and produced 28 fledglings for an average of 1.75 fledglings/nesting pair, the highest average of the two nesting areas that were utilized this year. The success rate on the Wild Beach was 0.88 fledglings/nesting pair, the highest ever. That was a vast improvement over the 1995 nesting season when no chicks fledged from this area. The number of chicks fledged was seven, the second highest ever recorded. Even though only 27% of the chicks hatched on the Wild Beach survived to fledging age, this represents the highest chick survival rate ever on the Wild Beach. The number of plovers on the Wild Beach increased by 3 pair to 8 pair. The increase in pairs on the Wild Beach may be attributed to the absence of nesting plovers on the Wash Flats. In 1995 there were five pairs of piping plovers on the Wash Flats, compared to none this year.

Monitoring of the Lower Island units continued this year with a cooperative agreement between the Virginia Department of Game and Inland Fisheries and the U.S. Fish and Wildlife Service. During the summer months, Commonwealth and refuge biologists conducted periodic surveys on breeding success of plovers on the barrier islands of Assawoman, the northern end of Metompkin, and Wallops. Table 3 provides a summary of this year's data. The fledgling success on these islands combined with the Assateague Island portion

TABLE 2
Piping Plover Hatching and Fledgling Success, 1990 - 1996

AREA	YEAR	NESTS	NESTING PAIRS	TOTAL ¹ EGGS	HATCHED/ NEST	CHICKS FLEDGED	FLEDGLINGS/ NESTING PAIR
Hook	1990	33	23	91	1.09	16	0.70
	1991	25	20	83	2.32	19	0.95
	1992	25	17	87	1.44	19	1.12
	1993	21	17	60	2.33	21	1.24
	1994	17	15	64	2.65	41	2.73
	1995	22	21	73	2.45	21	1.00
	1996	20	16	60	2.15	28	1.75
Wild Beach	1990	16	13	54	2.50	2	0.15
	1991	9	9	33	2.89	3	0.33
	1992	16	12	55	2.55	0	0.00
	1993	12	10	44	3.71	8	0.80
	1994	10	7	35	2.20	2	0.29
	1995	5	5	19	3.80	0	0.00
	1996	9	8	32	2.89	7	0.88
Wash Flats	1990	10	6	34	2.10	6	1.00
	1991	12	9	43	0.91	8	0.89
	1992	15	7	57	0.00	0	0.00
	1993	0	0	0	0.00	0	0.00
	1994	4	3	15	2.75	10	3.33
	1995	6	5	17	2.50	4	0.80
	1996	0	0	0	0.00	0	0.00
T O T A L	1990	59	42	179	1.64	24	0.57
	1991	46	38	159	2.07	30	0.79
	1992	56	36	199	1.36	19	0.53
	1993	33	27	104	3.08	29	1.07
	1994	31	25	114	2.52	53	2.12
	1995	33	31	109	2.67	25	0.81
	1996	29	24	92	2.38	35	1.46

1. Includes chicks from broods found after hatching.

of the refuge resulted in an overall total of 85 chicks fledged, or 1.57 chicks fledged/nesting pair.

B. MANAGEMENT TECHNIQUES

Management techniques employed to enhance the success of nesting plovers included the continued placement of predator-proof exclosures and predator trapping within and adjacent to known plover nesting areas. The use of CO₂ cartridges to gas fox dens was continued for the third year. Plover exclosures were placed around all nests found on the Hook after the third or final egg was laid.

TABLE 3
Piping Plover Productivity on Islands Owned/Managed by the
Chincoteague National Wildlife Refuge, Summer 1996¹.

ISLAND	NO PAIRS	% OF ISLAND POPULATION ²	CHICKS FLEDGED	CHICKS FLEDGED/ NESTING PAIR
Assateague	24	29	35	1.46
Wallops	3	100	2	0.67
Assawoman	11	100	16	1.45
Metompkin	3	10	4	1.33
Cedar	13	100	28	2.15 ³
TOTAL	54	--	85	1.57

1. PREDATOR EXCLOSURES

Of the 26 nests found prior to hatching, 12 received predator exclosures. Eight of these nests were located on the Wild Beach, an area where exclosures are not used. Three nests were predated before the clutch contained three or four eggs, two were flooded and one nest of two eggs hatched three days after it was found, therefore the exclosures had not yet been erected around the nests. Of the 12 exclosed nests, 75% (9 nests) successfully hatched at least one egg. Of the three exclosed nests that were unsuccessful, two losses were attributed to weather and

¹ Data provided by Robert C. Cross, Biologist with the VDGIF, Onancock, VA for the islands of Metompkin, Wallops, Assawoman, and Cedar.

² These percentages represent the portion of the island's population on Service owned or managed lands. On Assateague Island, the Assateague Island National Seashore accounted for 71% (60 pair) of Assateague's total population, and on Metompkin Island, The Nature Conservancy portion represented 90% of the island's population.

³ Data for Cedar represents the entire island. The Refuge retains fee title and easements scattered throughout the island.

one was abandoned, possibly due to fox harassment. All exclosures were accepted within one hour of placement.

2. PREDATOR MANAGEMENT

The predator program this year continued to emphasize red fox and raccoon control within and adjacent to plover nesting areas. Trapping effort decreased this season with more emphasis placed on early detection and gassing of fox dens. ~~No fox were~~^{was} captured during the trapping period. ~~not~~

Fox control was performed by den gassing, therefore the total number of animals taken is unknown. A total of six dens were treated with CO₂ on the refuge. All of the dens treated were new dens, with no dens from the previous year being reopened.

With the emphasis on den gassing and having only a brief trapping period, trapping results for 1996 were non-existent.

V. DISCUSSION

Plover productivity on Assateague Island increased in the 1996 season after a very poor 1995 nesting season. The number of chicks fledged rose from 25 in 1995 to 35 this year, despite a decrease of seven nesting pairs. The increase is due in part to the improved success on the Wild Beach. One possible reason for the increase is the cool, wet spring this nesting season. These cool conditions effectively slowed down the rate of ghost crab production, keeping numbers lower than normal until mid-season. The ghost crab population on the Wild Beach has been targeted as the cause, both directly and indirectly, for a very poor fledgling success rate. While some chicks may be taken by the ghost crabs themselves, the behavior of the adults toward the crabs may be an even bigger factor. While the adults are defending against the ghost crabs, their alarm calls are alerting other predators to the presence of their chicks. An adult chasing after a ghost crab may leave chicks unattended long enough for an avian predator to grab a chick.

Nests on the overwash area of the Hook were monitored intensively for two or more weeks after hatching. This was in response to the flock of gulls observed using the area. When gulls also began congregating in the prime nesting area of the Hook, shooting of selected problem birds helped to remedy the situation. Some of the later nests on the Wild Beach were monitored for the first few days after hatching, the time period in which a majority of chicks are lost.

Tropical storm Bertha resulted in losses of nests and chicks. Although nesting was completed on the Wild Beach at the time of the storm, three chicks from two different broods were lost in that area. A brood of three chicks was lost from the Hook, along with three nests containing a total of six eggs.

Losses from avian predators accounted for much of the egg loss on the Hook. The area targeted by predators is the wide sandy area preferred by nesting plovers. This area provides almost no vegetative cover to conceal the eggs. Several nests were predated while containing only one egg. Removal of a few selected gulls in the area helped to reduce the use of this section of beach by other resting gulls. This in turn reduced the egg predation problem.

VI. RECOMMENDATIONS

The 1997 field season recommendations are presented below. When implemented, these recommendations will provide protection to nesting birds and their habitat, minimize disturbance to plovers during the early spring migration, nest site selection, incubation, and chick rearing stages, and to secure additional potential nesting areas. Deviations from any established procedure or protocol will be implemented only to provide more protection or less disturbance to nesting birds.

1. Continue the predator control program through use of soft catch leg-hold, live traps, and den gassing, with emphasis on fox den gassing. Red fox and raccoon will continue to be the target species. Only experienced trappers familiar with island trapping techniques will be used. All trappers will be required to have pre-exposure rabies inoculation prior to any trapping activity. Trapping and fox den gassing will be confined to areas adjacent to piping plover nesting areas.
2. Continue plover population monitoring using the same procedures employed during the 1993 through 1996 seasons. No more than two surveys per week will be conducted beginning no later than the last week of February.
3. Maintain closures and area posting consistent with previous years (March 15 through August 31). Delay reopening of the Hook at the end of the nesting season if conditions warrant. Continue the closed area on the Hook to include the overwash area adjacent to the ORV zone, north of the old Coast Guard station, on the bay side north to the entrance to the ORV zone. Sign and rope off the north, south, and east sides of the closed area to keep pedestrians from entering the area. This would

provide protected nesting habitat for both plovers and least terns.

4. Confine intense nest searches to the second week of May; the established peak nesting period. During this time conduct walk-throughs in all three refuge nesting areas. During the rest of the season, nests should be found only by observing territorial adults. Limit disturbance to incubating or territorial adult(s) to a maximum of 20 minutes on any given day. Search time will be limited to less than ten minutes when nest searches are held after 1000 hours or in extreme weather conditions such as mid-day heat, rain, wind, etc. This time limit should be adhered to even at the expense of not finding any new nests.
5. Nest monitoring will be limited to direct observations at a distance that does not disturb the incubating bird. The incubating adult will not be flushed from the nest until approximately two to three days prior to the estimated hatching date. At nests that contained complete clutches when found, nest checks will be made six to seven days prior to the estimated hatch date.
6. Limit vehicle activity (nest monitoring, trapping, etc.) within nesting areas to survey routes established at the beginning of the nesting season and to no more than one trip each day.
7. Continue predator-proof exclosures on plover nests, with the exception of the Wild Beach, and only on nests with at least three eggs or completed clutches. Nests on the Wild Beach will remain un-exclosed with the presumption that heavy predation will encourage renesting on the Wash Flats or Hook. Continue procedure to not place predator-exclosures around nests on the Hook which occur behind primary dunes in dense vegetation, areas naturally protected by at least 75% vegetation. Exclosures around hatched or lost nests will remain within the nesting area and removed at the end of the field season.
8. Trap and remove all predators detected within the enclosed section of the North Wash Flats nesting area. Protect area with placement of snares in strategic locations along the fence line when conditions dictate.
9. Expand the nesting areas of the North Wash Flats area by placement of additional mounds of shells to encourage more birds to move from the Wild Beach to the Flats.
10. Expand or conduct a more extensive study of the Wild Beach plover population to determine the reason(s) for

low survival rates. Emphasis of study should be on plover and ghost crab interactions and plover chick food availability.

11. Create (bulldoze) shallow depressions behind foredunes on the Wild Beach to create ephemeral interdune pools to provide feeding habitat for plover chicks as recommended by Melvin 1993. These pools would provide high quality feeding habitat that would serve to keep chicks off the beach and away from potential ghost crab predation.
12. Experimentally remove a scrub vegetation section between the Wild Beach dunes and North Wash Flats nesting area to allow movement of plover adult and young to the less ghost crab populated areas of the flats. Remove or reduce, by disking, vegetation encroachment in plover nesting areas on the south end of the Hook (Section 7 completed).
13. Limit visits to the Hook by law enforcement personnel to only those requiring direct contact. Patrols for trespassing violations should be conducted by boat whenever possible. Any person who may be required to enter the nesting area during the season should accompany a plover monitor to determine the route to be followed.
14. Control avian predators where necessary. Carry exclosures at all times and exclose a new nest immediately if found with 3 or 4 eggs. In areas where egg predation has become a problem, exclose nests containing less than three eggs.
15. Continue to prohibit kite flying on the Overwash area during the plover nesting season due to the disturbance to nesting birds.
16. Prohibit the removal of shells and driftwood from plover nesting areas at any time. They provide shelter from blowing wind and sand and provide visual cover for the plovers.
17. Nests on the Wild Beach should be monitored intensively for at least three days immediately after the first chick hatches, as this appears to be the most critical time period in determining whether or not a chick will survive to fledge.

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