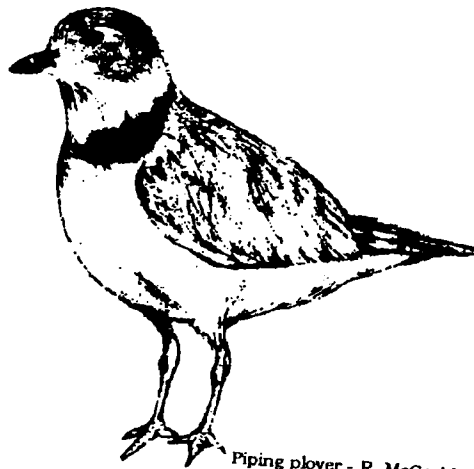


**U. S. FISH AND WILDLIFE SERVICE
CHINCOTEAGUE NATIONAL WILDLIFE REFUGE**

PIPING PLOVER MONITORING AND MANAGEMENT

SUMMER 1997



Piping plover - R. McCorkle

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

TABLE OF CONTENTS

I. INTRODUCTION	1
II. MANAGEMENT AREAS	1
III. METHODS	4
A. <u>POPULATION MONITORING</u>	4
1. PRE-NESTING	4
2. NEST SEARCHES AND MONITORING	5
B. <u>MANAGEMENT TECHNIQUES</u>	5
1. PREDATOR MANAGEMENT	6
2. PREDATOR EXCLOSURES	6
IV. MANAGEMENT RESULTS	7
A. <u>POPULATION MONITORING</u>	7
1. EGG AND CHICK LOSS	8
2. HATCHING AND FLEDGLING SUCCESS	9
B. <u>MANAGEMENT TECHNIQUES</u>	10
1. PREDATOR EXCLOSURES	12
2. PREDATOR MANAGEMENT	12
V. DISCUSSION	13
VI. RECOMMENDATIONS	15
VII. REFERENCES	18

LIST OF FIGURES AND TABLES

FIGURES

FIGURE 1	Base map of Chincoteague National Wildlife Refuge (Assateague Island) southern portion.	2
FIGURE 2	Base map of Chincoteague National Wildlife Refuge (Assateague Island) northern portion.	3

TABLES

TABLE 1	Causes of Piping Plover Egg Loss On Assateague Island, 1997	9
TABLE 2	Piping Plover Hatching and Fledgling Success 1991-1997	11
TABLE 3	Piping Plover Productivity on Islands Owned/Managed by the Chincoteague National Wildlife Refuge, Summer 1997	12

PIPING PLOVER MONITORING AND MANAGEMENT SUMMER 1997

I. INTRODUCTION

The piping plover monitoring and management program for the 1997 breeding season followed the recommendations developed as a result of a three year study that concluded in 1991 and experiences gained during the 1992 through 1996 field seasons. This report represents data collected in the 1997 season (February through August) and presents the results of this year's nesting success and offers recommendations that will promote nesting success and increased productivity in the 1998 nesting season.

II. MANAGEMENT AREAS

Chincoteague National Wildlife Refuge (CNWR) is a 5,691 ha (14,014 acres) 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 principle monitoring areas within the Assateague Island portion of the refuge include 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 Dikey north to the North Wash Flats crossover for approximately 5.9 km (3.7 miles). The Maryland/Virginia state line is located approximately 4.8 km (3 miles) north of North Wash Flats crossover. 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)

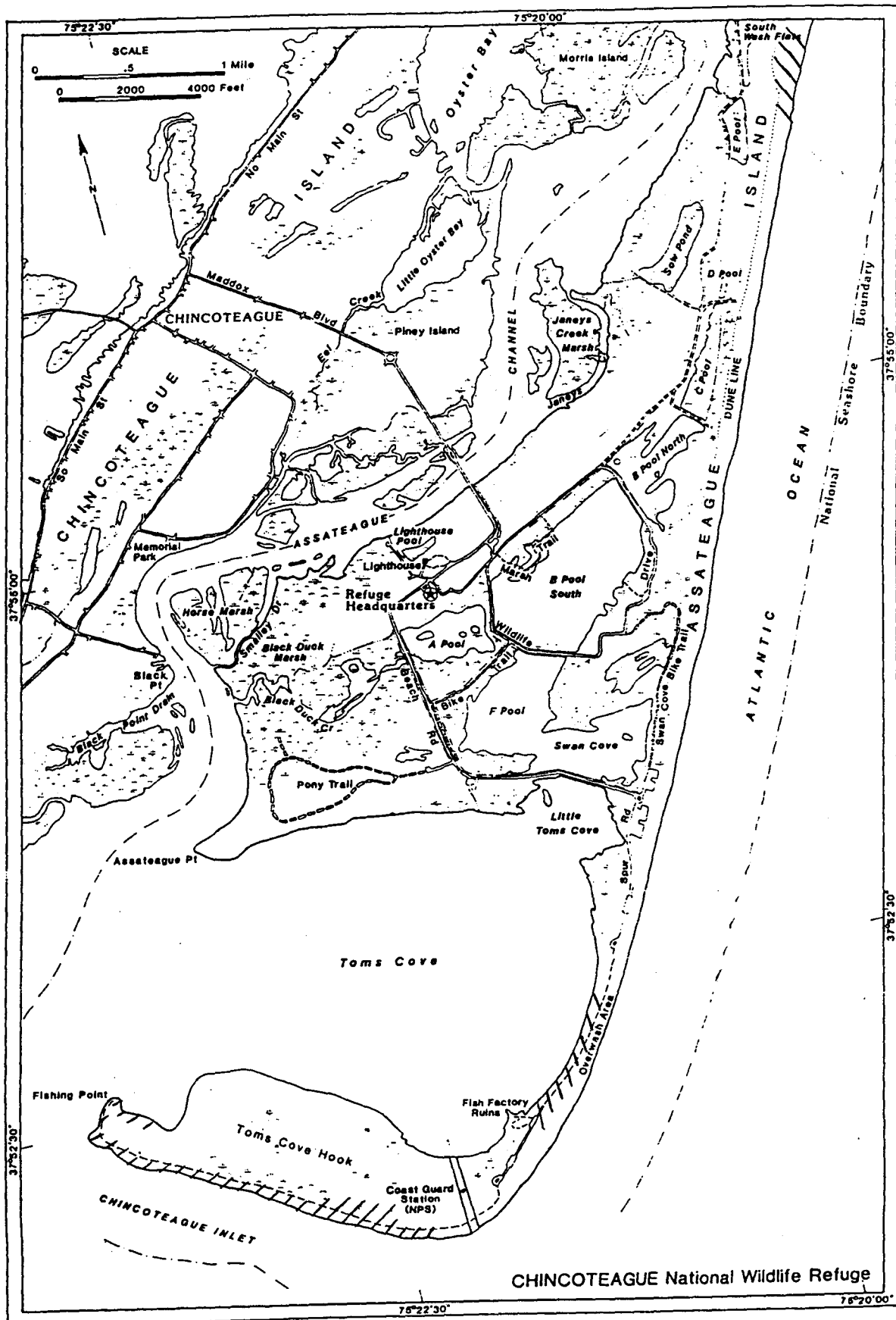
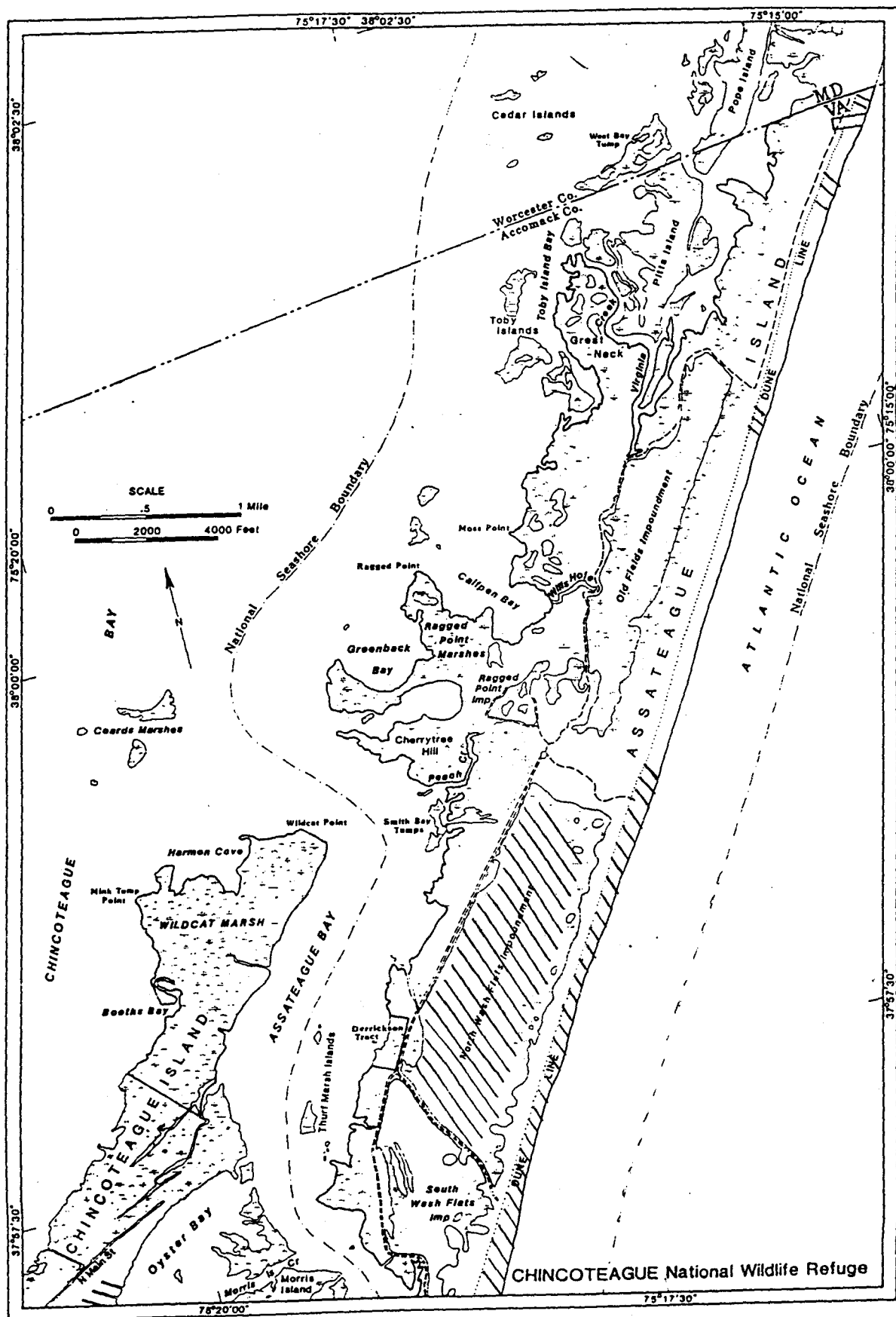


Figure 2 Base map of the Chincoteague National Wildlife Refuge.
(northern portion)



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 a 324 ha (800 acres) 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 ten 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 and the refuge's annual Predator Control Program. 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, shooting, leg hold and live trapping. 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 the Wild Beach in previous years, some members of 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, and shooting of some particularly troublesome avian species, which included grackles 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 ft) piece of 122 cm (48 in) 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 ft) diameter circle surrounding the nest. Five-1.8 m (6 ft) 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-ft) 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 in) 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 and Wash Flats were protected by predator-proof nest exclosures. In addition, all nests found outside the traditional nesting area on the Wild Beach (north of the North Wash Flats crossover) were also exclosed this year.

IV. MANAGEMENT RESULTS

Results presented in this report were compiled from data collected throughout the 1997 nesting season. These data are from 27 weeks of monitoring: February 24 through August 29. 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, 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 24, but no birds were sighted until March 5. A group of 12 plovers was observed on the Hook on that date. The first plover on the Wild Beach was also sighted on March 5. Plovers were first observed on the Wash Flats on March 12. Surveys continued throughout the summer, with the last nest of the season found on July 3 on the Hook. Three nests occurred in the overwash area adjacent to the ORV zone this year.

Plovers nested in all three of the major nesting areas, with the most nests (25) being located on the Hook. The Wild Beach had 11 nests, an increase from over last years total of nine nests. The first nest initiation date for 1997 was approximately May 1 on the Wild Beach and Hook, which was similar to nest initiation in 1996.

Nesting plovers increased by one pair (25) on Assateague Island this year. Assawoman Island had an increase of one pair, for a total of twelve pairs. No plovers nested on Wallops Island this year, while Metompkin Island gained six pairs, for a total of nine nesting pairs.

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 several portions of the island. A total of 16 nesting pairs were recorded this year.

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 three nests between North Wash Flats crossover and 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 146 eggs were produced in 41 nests on the refuge portion of Assateague Island this year. That was an increase of 54 eggs and twelve nests. The eggs lost (60) were due mostly to predation and weather (Table 1). The seven weather related nest losses were due to the high tides and strong winds which accompanied a late northeaster on June 5. Only two eggs were documented as infertile. Four nests containing 13 eggs were lost due to predation. Three sets of plover wings were found just outside of two separate exclosures. Tracks were found encircling two exclosures and inside another one, indicating that predation by a raccoon was the cause of adult and egg mortality. One nest with one egg was lost to avian predation before it was exclosed.

b. EXCLOSED NEST/EGG LOSSES

A total of 29 nests were exclosed this year compared to 12 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 with the exception of three nests found north of the North Wash Flats crossover towards the

TABLE 1
Causes of Piping Plover Egg Loss on Assateague Island, 1997

AREA	Number of Eggs (Nests) Lost To:					Total
	Predation	Weather	Infertile	Abandon	Unk	
Hook Beach	13(4)	23(6)	1(0)	4(1)	5(1)	46(12)
Wild Beach	0	2(1)	1(0)	0	10(3)	13(4)
Wash Flats	0	0	0	1(1)	0	1(1)
Total	13(4)	25(7)	2(0)	5(2)	15(4)	60(17)

Virginia/Maryland line. These nests were exclosed in an attempt to determine if nesting might be more successful in this area. Based on hatching and fledgling success, there did not appear to be a difference between the northern location and the area on the Wild Beach. Sixty-two percent of the exclosed nests were successful, hatching at least one chick, and 62% of the unexclosed nests were successful. Ten percent of the unexclosed nests that were lost were attributed to predation, with the other 21% due to weather.

c. ASSATEAGUE ISLAND CHICK LOSSES

Chick losses increased significantly this year, from 34 chicks lost in the 1996 nesting season to 58 chicks lost in 1997. The Wild Beach accounted for 41% of all losses with 24 chicks lost. The Hook accounted for 47% (27 chicks) of the chick losses and the Wild Beach 12% (7 chicks). Although chick losses were not directly observed, avian predation is suspected in most cases. Likely avian predators include crows, grackles, and gulls. On the Hook nesting area raccoon predation became a problem for the first time in many years, however, this was only temporary as the offending animal was removed within a few days of the losses.

2. HATCHING AND FLEDGLING SUCCESS

Even without the benefit of predator exclosures, the Wild Beach had a high hatching success. Of the 39 eggs from eleven nests, 26 hatched for an average of 2.36 chicks hatched/nest. That was down from 2.89 chicks hatched/nest in 1996. Hatching success also decreased on the Hook from 2.15 chicks hatched/nest in 1996 to 1.8 in the 1997 nesting season.

Fledgling success on Assateague Island was less than the 1996 season, with 1.12 chicks fledged/pair for a total of 28 chicks fledged (Table 2). The fledgling

success for 1996 was 1.46 chicks fledged/pair for a total of 35 chicks fledged. The Hook was the most productive area in 1997 with 60% of all the plovers nesting on the island found in this area. A total of 15 pairs of piping plovers nested on the Hook and produced 23 fledglings for an average of 1.5 fledglings/nesting pair. The success rate on the Wild Beach was 0.28 (2 chicks) fledglings/nesting pair. That was a decrease over the 1996 nesting season when seven chicks fledged from this area. Only 7% of the chicks hatched on the Wild Beach survived to fledging age. The number of plover pairs on the Wild Beach remained about the same as in 1996 with eight pairs in 1996 and seven pairs in 1997. In 1996 there were no nesting plovers on the Wash Flats, compared to two pairs this year with three nest attempts. The two pairs on the Wash Flats produced three fledglings for an average of 1.5 fledglings/nesting pair.

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, Cedar, and Wallops. Table 3 provides a summary of this year's data. The fledgling success on these islands combined with the Assateague Island portion of the refuge resulted in an overall total of 43 chicks fledged, or 0.69 chicks fledged/nesting pair, one of the lowest in many years.

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 and North Wash Flats after the third or final egg was laid. Exclosures were also placed around all nest north of the North Wash Flats crossover nesting area of the Wild Beach in an attempt to increase fledgling success.

TABLE 2
Piping Plover Hatching and Fledgling Success, 1991 - 1997

AREA	YEAR	NESTS	NESTING PAIRS	TOTAL ¹ EGGS	HATCHED/ NEST	CHICKS FLEDGED	FLEDGLINGS/ NESTING PAIR
Hook	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
	1997	26	15	96	1.80	23	1.50
Wild Beach	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
	1997	11	7	39	2.36	2	0.28
Wash Flats	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
	1997	4	2	11	2.50	3	1.50
T O T A L	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
	1997	41	25	145	3.52	28	1.12

1. Includes chicks from broods found after hatching.

TABLE 3
Piping Plover Productivity on Islands Owned/Managed by the
Chincoteague National Wildlife Refuge, Summer 1997¹.

ISLAND	NO PAIRS	% OF ISLAND POPULATION ²	CHICKS FLEDGED	CHICKS FLEDGED/ NESTING PAIR
Assateague	25	29	28	1.12
Wallops	0	100	0	0.00
Assawoman	12	100	5	0.42
Metompkin	9	10	10	1.11
Cedar	16	100	0	0.00 ³
TOTAL	62	--	43	0.69

1. PREDATOR EXCLOSURES

Of the 40 nests found prior to hatching, 29 received predator exclosures. Eight unexclosed nests were located on the Wild Beach, an area where exclosures are not used. Three nests on the Wild Beach were predated before the clutch contained three or four eggs. Of the 29 exclosed nests, 62% (18 nests) successfully hatched at least one egg. Of the eleven exclosed nests that were unsuccessful, six losses were attributed to weather, three losses to predation, one was abandoned, and one was lost to an unknown cause. All exclosures were accepted under 60 minutes 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 continues to be the least desirable control method with more emphasis placed on early detection and gassing of fox dens.

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.

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 1997 was only one fox captured using leg-hold traps during the trapping period.

Raccoon control was emphasized on the Hook this year. During mid-nesting season, a raccoon climbed into one exclosure and killed both adults and took all eggs. Night shooting was conducted for three nights with the taking of three raccoons in the vicinity of the lost nest. No raccoon predation occurred after these animals were removed from the area.

V. DISCUSSION

Plover productivity on Assateague Island decreased slightly in the 1997 season after a fair season in 1996. The number of chicks fledged declined from 35 in 1996 to 28 this year, despite an increase of one more nesting pair. The decrease is due in part to the low fledgling success on the Wild Beach and Hook. Lower production was attributed to severe weather events in early June which contributed to increased predation on broods later in the summer.

Nests on the overwash area adjacent to the ORV zone of the Hook continued to be monitored intensively after hatching. High public use in the area, both on the ocean and bay, continued to warrant close monitoring to prevent disturbance to feeding chicks. With the increased protection afforded the nesting plovers, least terns moved into the area with an increase in nesting activity.

An unusually late 'Northeast' storm occurred during the first week of June. This storm, which began during an oil spill on Assateague and adjacent islands, created very high tides throughout the plover areas. This storm also resulted in significant losses of nests on all islands along the Virginia coast, particularly on the islands of Assawoman, Metompkin, and Cedar. Because of this storm and continued disturbances, Cedar Island did not produce any chicks this year.

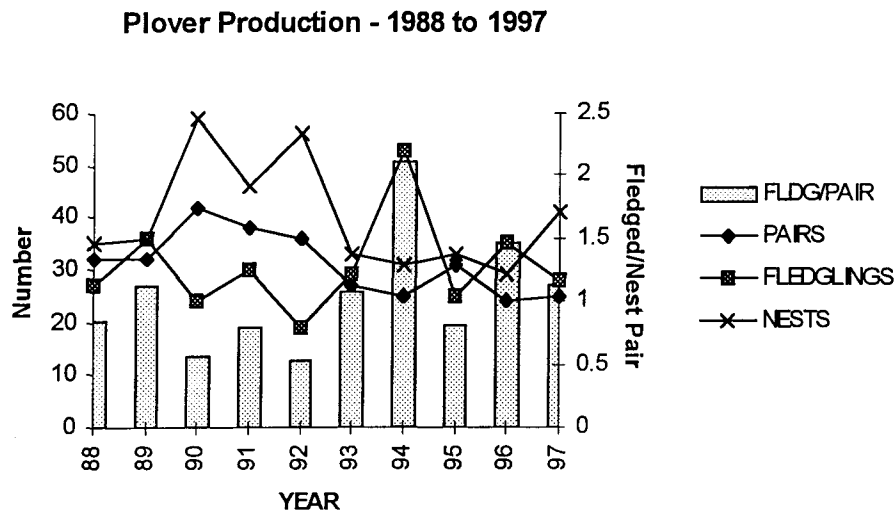
The oil spill mentioned above, although very severe in places, did not appear to impact adult plover survivability or production. Only a few birds were documented as being oiled, and those were mostly on Assawoman Island.

Raccoons became a problem for the first time in many years. During mid-nesting season, evidence of raccoons climbing into

exclosures and killing adults was documented. The initiation of night shooting within these areas adjacent to the lost nest resulted in the taking of three raccoons. No raccoon predation occurred after these animals were removed from the area.

This season marked the 10th year of intense monitoring and management to protect this threatened species on Assateague Island. During this 10 year period, the adult breeding population has fluctuated from year to year as has the number of young produced to fledgling stage. During the early 90's, the population was at its highest with 42 nesting pairs during the 1990 season. During the last four years, the refuge population has been at its lowest with a low of 24 pairs recorded during the 1996 season. The best production year was 1994 when 25 pairs produced a record 53 fledglings (2.12/nesting pair). The worst year was 1992, when 36 pairs produced only 19 fledglings (0.53/nesting pair).

In all, the refuge population (\bar{x} = 31.2 pairs per year) has produced 306 fledglings from 1988 through 1997 for an average of 30.6 fledged per year or just 0.98 fledged per nesting pair over the ten year period.



One interesting note relating to the overall Assateague Island plover population is that as the refuge's population continues to decline, the Assateague Island National Seashore's (north end of island) population

continues to grow. In 1988 when the refuge maintained 32 nesting pairs on Assateague, the seashore had about 16 nesting pairs. This year the refuge population on Assateague Island was 25 pairs where as the Seashore's population was 60 pairs.

VI. RECOMMENDATIONS

The 1998 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 and raccoon live trapping. Red fox and raccoon will continue to be the target species. Initiate the raccoon trapping and fox den gassing program in early February to reduce the potential of predation on nest during the early nesting period. 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 known piping plover nesting areas.

Initiate fish crow and boat-tailed grackle control by establishing lethal bait or aversion conditioning stations within the Hook and Wild Beach nesting areas. Obtain assistance from APHIS's Wildlife Management Division to implement the most effective program.

2. Continue plover population monitoring using the same procedures employed during the 1993 through 1997 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 nesting area adjacent to the North and South Wash Flats impoundments (Fig 2). Carry exclosures at all times and exclose a new nest immediately if found with 2, 3 or 4 eggs. Test placement of exclosures around nests after the second egg has been laid (Sec. 7 to be completed). Nests on the Wild Beach will remain unexclosed 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 (located further east) to encourage more birds to move from the Wild Beach to the Flats.
10. Initiate a more extensive study of the Wild Beach plover population to determine the reason(s) for low survival rates (possibly night observations). Emphasis of study should be on plover and ghost crab interactions and plover chick food availability. Explore funding options available through Challenge Grants or Fish and Wildlife Coop Units of nearby Universities.

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. 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.
13. Continue to prohibit kite flying on the Overwash area during the plover nesting season due to the disturbance to nesting birds.
14. Restrict the removal of shells and driftwood from plover nesting areas at the end of the nesting season. They provide shelter from blowing wind and sand and provide visual cover for the plovers.
15. Monitor nests on the Wild Beach 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.
16. Initiate an experimental nest protection procedure by placing a protective boom or sand bags around nests that are in danger of being washed out during a high tide event. Booms or bags will be covered with sand to prevent birds from abandoning nest. Protection device will be removed once danger has passed (Sec. 7 to be completed).
17. Continue to remove or reduce, by disking, vegetative areas to enhance and increase plover nesting habitat on the southern tip of the Hook (Sec. 7 Approved).
18. Complete experimental scrub vegetation removal between the Wild Beach dunes and North wash flats nesting area to allow movement of plover adults and young to the less ghost crab populated areas of the flats (Sec. 7 Approved).

VII. REFERENCES

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