

NEW WORLD SECTION

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NEST SITES AND AGGRESSIVE BEHAVIOUR OF PIPING AND WILSON'S PLOVERS IN VIRGINIA: SOME PRELIMINARY RESULTS

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INTRODUCTION

Piping Plovers *Charadrius melodus* and Wilson's Plovers *C. wilsonia* have a limited area of breeding sympatry on the coasts of Virginia and North Carolina, where they use similar beach nesting habitats (A.O.U. 1983). Both species breed on the same beach on the northern end of Metompkin Island, one of Virginia's barrier islands on the Atlantic coast. There are no published reports of nest sites or behavioral interactions between these two species in their area of sympatry. In Holland, three other plovers were sympatric during breeding, and had persistent aggressive behavior and nest spacing there that suggested interspecific territoriality (Simmons 1956). We report here on preliminary observations of nest sites, nest spacing and aggressive behavior of Piping and Wilson's Plovers that nested on the same beach in Virginia.

STUDY SITE AND METHODS

All observations were made at the northern end of Metompkin Island, Accomack County, Virginia USA (see Figure 1), on a beach that was formerly the southern tip of Assawoman Island. One of us (PWB) made observations there between 11 and 18 June 1984, using a 55x spotting scope from a canvas blind; observations during that period were made by him. The other (KT) made observations there during weekly visits to the island between 1 May - 30 July 1983, 1 May - 15 July 1984, and 20 May - 30 July 1985, using 10x binoculars and a 20x spotting scope in the first two years, and a canvas blind and a 45x spotting scope in 1985. We sampled behavior using focal animal sampling on the attentive parent (by PWB) or *ad lib.* sampling (Altmann 1974). Displays were defined according to descriptions by Cairns (1982) and Bergstrom (1982). The attentive parent was the one closer to the chicks, if both parents were visible. The sexes of Wilson's Plovers were distinguished by the darker breast band of the male, and those of Piping Plovers by the same method, plus the brighter orange bill and feet of the male. The map was drawn (by PWB) from an aerial photograph taken 1 May 1982, and the area of nesting habitat was estimated by cutting out and weighing sections of the map.

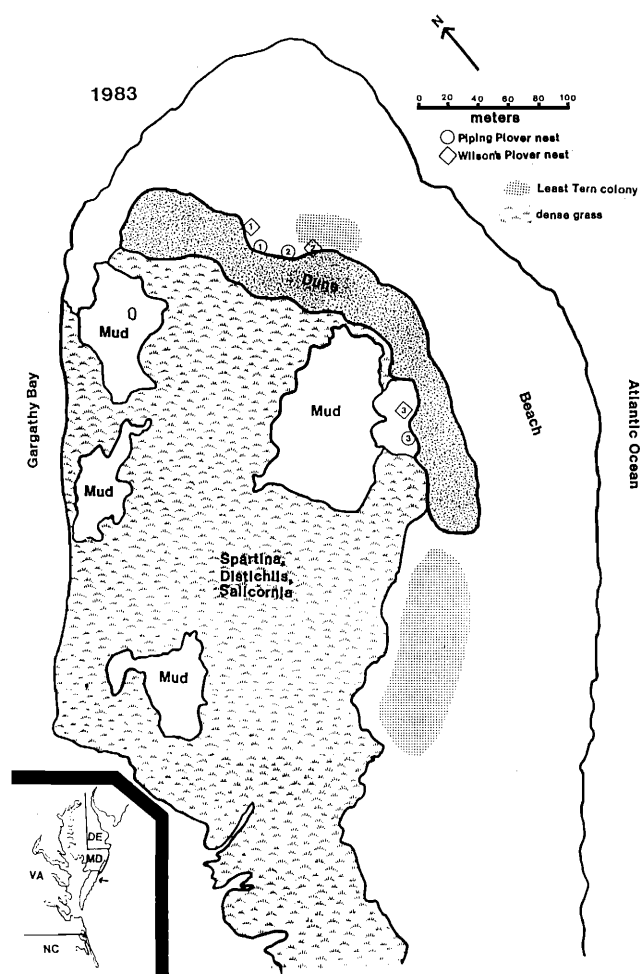


Figure 1. Nest sites of Piping and Wilson's Plovers at the north end of Metompkin Island, Accomack County, Virginia USA, in 1983. Symbols with numbers are listed in Table 1.

NEST SITES

Nest locations on the north end of Metompkin Island are shown for 1983, 1984 and 1985 in Figures 1, 2, and 3 respectively. Measured distances and dates of discovery for some of

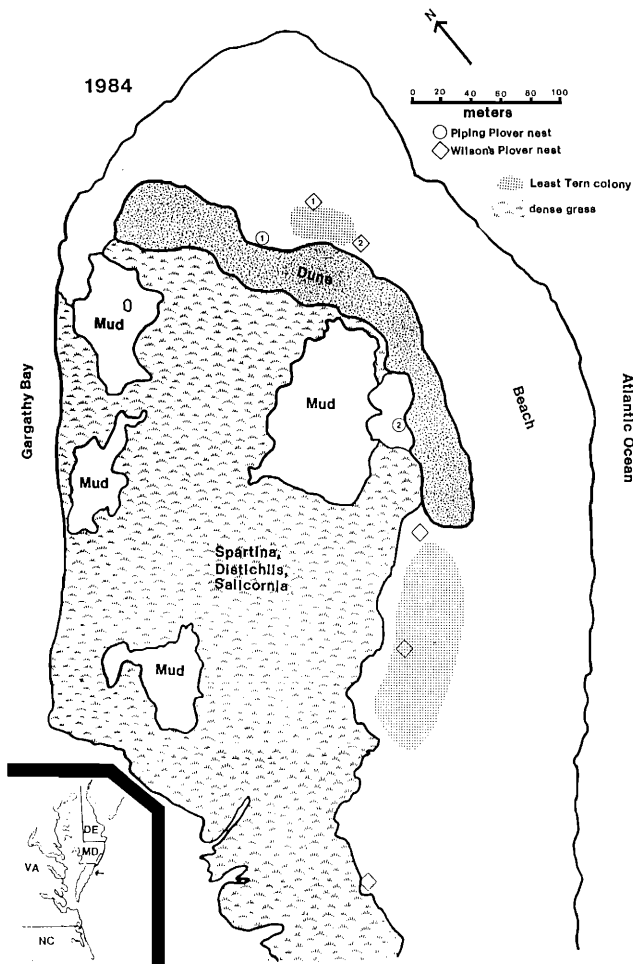


Figure 2. Plover nest sites at Metompkin Island, Virginia in 1984.

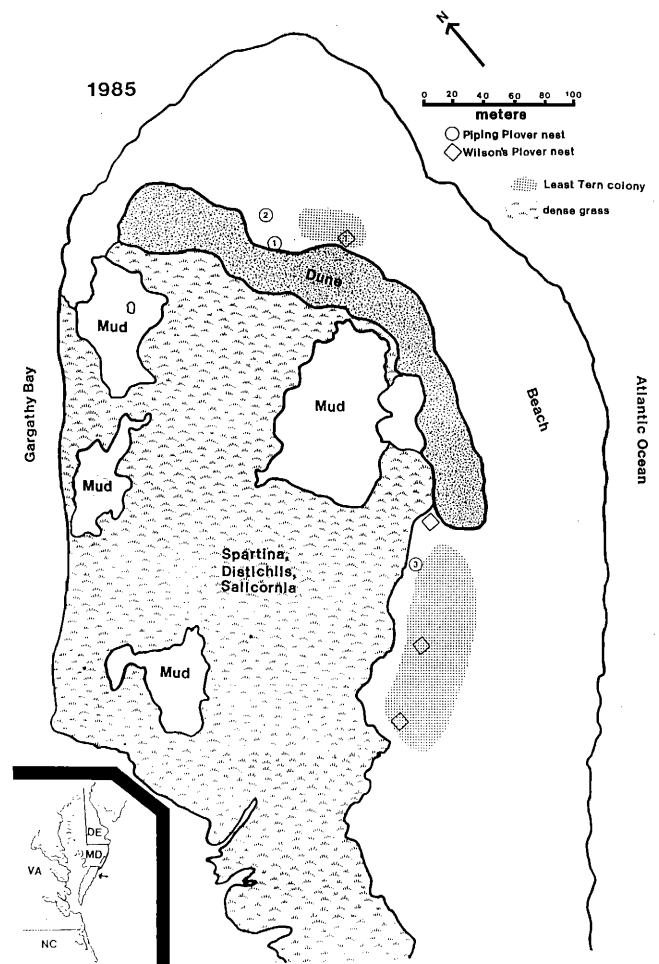


Figure 3. Plover nest sites at Metompkin Island, Virginia in 1985.

Table 1. Data on plover nests on Metompkin Island, Virginia, in 1983-85

Year	Species	No.	Location	Date Found	Fate
1983	P	1	3 m N of dune	12 May	F
1983	P	2	2 m N of dune, 46 m ESE of P1, 15 m from LT colony	12 May	F
1983	P	3	3 m W of back of dune	12 May	F
1983	W	1	16 m NNW of P1	12 May	F
1983	W	2	18 m E of P2	12 May	F
1983	W	3	18 m NNE of P3	12 May	F
1984	P	1	2 m N of dune, 6 m from 83 nest	27 May	?
1984	P	2	3 m W of dune, in blowout	27 May	?
1984	W	1	35 m NNE of dune, 61 m from high tide line, hatch 15-16 June	27 May	H
1984	W	2	Near LT colony, eggs gone 13 June	11 June	?
1985	P	1	6 m from 84 nest, 1.5 m from dune, eggs gone by 2 June	27 May	H
1985	P	2	Renest of P1 pair, 21 m NNE of P1, female on nest 24 June	18 June	?
1985	P	3	30 m from dune, 15 m from veget., one chick with female on 20 June	27 May	H
1985	W	1	15 m from dune, 9 m from veget.	28 May	?

Species: P=Piping Plover, W=Wilson's Plover, LT=Least Tern; numbers refer to the nest locations in Figures 1 - 3. P1 each year was by the same pair. Fates: H=hatch, F=fail, ?=unknown.

the nests are listed in Table 1. All but three of the 20 plover nests found were on the raised portion of the beach littered with oyster shells ("high shelly beach"), within 30 m of the sparse dune vegetation. The three other nests (two Piping and one Wilson's Plover nests, See Figures 1 and 2) were in a strip of sparsely vegetated sand between the dune and a mud flat. Distances to objects were not measured, but all nests of both species that were on the beach were 1 m or less from oyster shells. There was no vegetation on the beach, so the only nests on the beach that were close to vegetation were the ones near the dune (see Table 1).

All nests of both species were within 25 m of a Least Tern *Sterna antillarum* nest, except for two Piping and two Wilson's Plover nests (including the three nests located behind the dune, plus the southernmost Wilson's Plover nest in 1984). Nest site preferences appear to be similar in these three species: they also associated in nesting elsewhere on the 8 km long island, but nesting density was nowhere as high as in the area shown here.

Nest site fidelity (between years) was documented for one pair of banded Piping Plovers. One pair (P1 on each map and in Table 1) nested in almost exactly the same spot in all three years. The P1 pair also had a second nest in 1985, which was near its first nest (see Table 1).

NEST SPACING

Nearest neighbor distances were measured from the maps for all plover nests present at the same time. This included all but one nest (P2, 1985) of the 20 located. Distances were calculated for three cases: Piping Plovers only, Wilson's Plovers only, and the nearest neighbor of either species. The three years were combined for each of these calculations.

For seven Piping Plover nests, mean distance to the nearest conspecific nest was 138 m (SD 89, median 157, range 19 - 234). For 12 Wilson's Plover nests, the mean distance was 85 m (SD 52, median 67, range 44 - 203). For all 19 plover nests, mean distance to the nearest neighbor was 47 m (SD 35, median 43, range 16 - 160). At 13 out of 19 nests (including all Piping Plover nests), the nearest neighbor was of the other species, while 6 of the 12 Wilson's Plover nests had a conspecific as their nearest neighbor.

We tested the dispersion of nests, expecting that any deviation from random dispersion would be in the direction of regular dispersion, resulting from territoriality. We estimated that there were 1.6 ha of suitable plover nesting habitat on the portion of Metompkin shown in Figure 1. The ratios of observed to expected neighbor distances showed that, as we expected, the dispersion pattern was regular in all 3 cases ($R = 3.3, 2.7, \text{ and } 1.9$ respectively), and the deviations from random dispersion were highly significant ($z = 11.7, 11.3, \text{ and } 7.1$ respectively, all $P < 0.0001$; Clark and Evans 1954).

We also compared the distance from each nest to its nearest neighbor in 1) its own species, and 2) the other species. We found that Piping Plover nests were significantly closer (by a mean of 84 m) to a Wilson's Plover nest than they were to a conspecific nest (paired $t = 2.55, df = 6, P < 0.05$). There was no significant difference in distances for all

Wilson's Plover nests (paired $t = 0.23, df = 11$). However, half of these had conspecifics as nearest neighbors, probably because there were more Wilson's Plover nests in the area in 1984 and 1985. The six Wilson's Plover nests that had heterospecifics as nearest neighbors were significantly closer (by a mean of 64 m) to a Piping Plover nest than to a conspecific nest (paired $t = 2.7, df = 5, P < 0.05$).

INTERSPECIFIC AGGRESSION

Aggressive behavior between members of the two plover species during incubation was frequent enough to suggest that those interactions affected the spacing of their nests. During the incubation period, chases of nesting Wilson's Plovers by nesting Piping Plovers were seen on the beach by KT in all three years between 15 and 30 May. Usually the male, but sometimes the female, Piping Plover lowered its head and ran toward the intruding Wilson's Plover, and the intruder eventually flew away. Several times during incubation in 1983, both members of a nesting Piping Plover pair chased both members of a Wilson's Plover pair that were nesting nearby. One parallel run was seen between a male Piping and a male Wilson's Plover: both stood erect and ran parallel for about 18 m, then the Wilson's Plover flew away. This was observed by KT from behind the dunes while another person walked at the edge of the water. This is not the usual posture for Wilson's Plovers in this display (see below).

A human's presence near the nests often started aggressive behavior between the species. As the observer (KT) approached the nests on the beach, one member each of a nesting Piping and Wilson's Plover pair (usually the males) would move down from the nest site on the high shelly beach, toward the water. The other member of the pair vacated the nest, either moving toward the dune or remaining on the high shelly beach. As the observer moved past the nest area, a territorial chase between the two defending birds often took place, always with the Piping Plover chasing the Wilson's Plover. Eventually both birds flew back to their nests. In the meantime, the other member of each pair (usually the females) began to return to the nest unobtrusively. In contrast, when KT was watching the nests from behind the dunes, interspecific aggression was usually started by the presence of other humans or other shorebird species on the beach (see below).

Both Piping and Wilson's Plovers moved their chicks from the nest site on the shelly beach through the dunes to the mud flats (see Figure 1), where they were seen standing or feeding with their chicks through July. Adults of both species were seen frequently on the beach by KT in May, but in June and July families of plovers were rarely seen there. Single adults were seen foraging on the beach during June and July, and they would usually give alarm calls while running ahead of the observer, then fly to the mud flats when the observer had passed. Sometimes during the chick period a Piping or Wilson's Plover on the beach gave distraction displays (Mock-brooding or Broken Wing) before flying back over the dunes to the mud flats.

During the chick period, Piping Plovers also chased Wilson's Plovers. The chases usually started when a Wilson's Plover tending chicks approached a Piping Plover tending chicks. One such chase was seen by KT on 8 June 1985, when one family of each species were feeding on the same mud flat. When one of the Wilson's Plover parents moved closer to the Piping Plovers, one

of the Piping Plovers flew at it and the Wilson's Plover flew back to near its chicks. A series of similar chases was seen on 14 June 1984 by PWB. One pair of Piping Plovers tended four chicks in the northwest mud flat shown in Figure 2, with a small puddle in the middle (shown on the map). A pair of Wilson's Plovers tended their chicks in vegetation at the edge of the mud flat. During 10 hr of continuous behavioral observations between 07:45 and 17:45, the female Piping Plover (while she was tending chicks) chased the male Wilson's Plover away from the puddle four times. She ran at him as seen as he came near the puddle, chased him on the ground for about a minute, then chased him in the air until he left the mud flat. Both species used a horizontal posture without any ruffled feathers during the ground chases. The male Wilson's Plover was always chased as soon as he entered the mud flat; the female Wilson's Plover stayed at the edge of the mud flat, probably with the chicks.

The two species did a parallel run display together at the same mud flat on 18 June 1984, while PWB and another person were standing about 50 m away. The male Piping Plover was tending his chicks near the puddle, and a pair of Wilson's Plovers was nearby. The Piping Plover used its typical erect posture in the display (Cairns 1982), and the male Wilson's Plover used its typical horizontal posture (Bergstrom 1982). The display continued for 3-4 min before the Wilson's Plovers moved away.

AGGRESSION TOWARD OTHER SHOREBIRDS

Piping Plovers were also aggressive toward other shorebirds, both during incubation and chick tending, but these species were not displaced as quickly as Wilson's Plovers. During incubation, this aggression was usually seen (by KT) while she was watching the beach from behind the dune. When an intruding shorebird (an American Oystercatcher *Haematopus palliatus*, Willet *Catoptrophorus semipalmatus*, Semipalmated Sandpiper *Calidris pusilla*, or Dunlin *C. alpina*) flew or walked into the plovers' nest area, Piping Plovers would immediately appear and run and then fly at the intruder. Wilson's Plovers, also alarmed, would call and move toward the intruder, only to be chased by the Piping Plover as well. Many such chases by Piping Plovers occurred, usually of Oystercatchers, but the Wilson's Plover was not always chased by the Piping Plover. Neither plover chased Least Terns during nesting, even though the nests of all three species were close together (see above). The Least Terns were very aggressive towards any birds, including those flying over, other than plovers as well as toward human intruders near their nests.

During the chick period, Piping Plovers encountered and chased other shorebirds that also had chicks. On 14 June 1984 the female Piping Plover chased a Willet family 14 times in 10 h observations and an American Oystercatcher family once when each came within about 10 m of the chicks she was tending. She did not chase them as soon as they were visible to her. If the chased Willet or Oystercatchers did not leave the area right away (usually they did not), she squatted on the ground near them until they did so, up to 9 min later (for a Willet family). This looked like the "squatting" distraction display of Snowy Plovers *Charadrius alexandrinus* (Cramp and Simmons 1983: 161). Once she led her chicks away from a Willet after failing to chase it away. Both adult Piping Plovers ignored two

Least Tern adults that sat near the puddle for several hours.

The male Piping Plover chased a Willet family five times while he was tending the chicks, using behaviors similar to those used by the female. The female may have done more chases because she spent more time attending the chicks than the male (72% vs. 20% of the day on 14 June); one parent alone attended for 92% of the time, and chases were always done by the attending parent. The rates of chases per attentive hour were almost the same for the two sexes: 2.8 attacks/h by the female, and 2.5 attacks/h by the male. In the last chase seen on 14 June, both parents chased a Willet family. During 2 hr of observation on the afternoon of 13 June at the same puddle, the Piping Plover parents chased a Willet family once. No chases by Wilson's Plovers were seen during these observations, but their chicks were not on the mud flat.

DISCUSSION

Nest sites of both plovers on Metompkin were generally similar to those of the same species elsewhere. Piping Plovers in Nova Scotia nested on level raised sand spits or on lower slopes of the dunes, and not near objects or vegetation (Cairns 1982). Mean inter-nest distance was 52 m but the closest pair of nests was 3 m apart (Cairns 1982), both of which were less than what we found on Metompkin. Four Piping Plover nests in North Carolina were on "wide, open sandy flats", apparently not near a dune, and all were near Least Tern colonies (Golder 1985). The plovers probably benefit from the nest defense behavior of the terns. Piping Plovers on Long Island usually nested behind the dunes, unlike most of the nests on Metompkin, but nests there were also fairly far apart (30 m or more) and not near vegetation (Wilcox 1959).

Nests of Wilson's Plovers in Georgia were on "open areas of the sandy islands and on the edges of the dunes", near objects but not vegetation (Tomkins 1944). Most of the Wilson's Plover nests in Texas on natural substrates were in sparse vegetation at the edges of salt flats (Bergstrom 1982), similar to the location of the nest on Metompkin (W3 in 1983) that was behind the dune (see Figure 1). Most were near vegetation but not objects. Wilson's Plovers nested on the beach on Matagorda Island in Texas, but no nests were found there (Bergstrom 1982).

The regularity of nest spacing for each of the two plover species on Metompkin shows that both species were intraspecifically territorial. Distances to nests of either species were considerably less, but still showed regular dispersion. This suggests that interspecific aggression is probably also spacing out nests, but to a lesser degree than intraspecific aggression. Also, Piping Plovers tolerated Wilson's Plovers nesting significantly closer to them than they tolerated conspecifics, so the results (in nest spacing) of intraspecific and interspecific aggression were not the same.

Why Piping Plovers consistently displaced Wilson's Plovers in aggressive encounters is not clear, since Piping Plovers are lighter (mean adult weight 55.2 g, Wilcox 1959, compared to 64.1 g for Wilson's Plover, unpublished data). Piping Plovers usually started the aggressive encounters with Wilson's Plovers, and they were usually the first

species to respond to other intruders. Piping Plovers may compensate for their lighter weight with higher frequency and/or intensity of aggressive behavior.

The aggressive displays between Piping and Wilson's Plovers resembled those used in intraspecific territoriality in each species. Within each species the parallel run displays occur only in the maintenance of territorial boundaries and never in other contexts (Cairns 1982, Bergstrom 1982). Similarity of behavior could mean similar function (territoriality). However, based on the nest spacing data, Piping Plovers did not defend the same area against Wilson's Plovers as they did against conspecifics, so this is probably a case of partial exclusion and not interspecific territoriality (*sensu* Walters 1979). The interactions of Piping Plovers with other species also appear to be partial exclusion, except for tolerance of Least Terns (Walters 1979).

It is not known whether territoriality limits the local breeding population of the species, which is an additional requirement for interspecific territoriality according to Murray (1981). The limited area of suitable habitat and the nest spacing suggest that it does limit the breeding population, but more data on the use of space by both species are needed to determine the exact nature of any territoriality between them.

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