

STATUS AND BREEDING BIOLOGY
OF THE PIPING PLOVER
IN LAKE OF THE WOODS COUNTY, MINNESOTA

A SECOND PROGRESS REPORT SUBMITTED TO:
NONGAME PROGRAM
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INTRODUCTION

The Piping Plover (Charadrius melodus) has been designated an "Endangered Species" in the State of Minnesota. Two breeding localities are known: Lake of the Woods and the Duluth Harbor. Recognizing the need to monitor this species closely, the Nongame Program of the Minnesota Department of Natural Resources contracted with F. Cuthbert to study the status and breeding biology of the Piping Plover on Pine and Curry Island in Lake of the Woods County during the 1982 breeding season. Although the initial study provided a general understanding of the breeding biology of this population, several important questions remained, and many new ones were generated. As a result, the project was renewed for a second year, 1983. The primary focus of the second field season was to: 1) obtain data on population size, nest location, and reproductive success so that comparisons between seasons could be made, and 2) identify plovers color banded in 1982 and begin to develop an understanding of patterns of mate retention, age at first breeding, and return rate of adults to the Lake of the Woods area. This report summarizes the results of the 1983 study.

METHODS

The project goals were realized through performance of the following tasks. From late April through mid-August 1983, T. Wiens established a base camp on Pine and Curry Island and collected data on the following aspects of the biology of plovers: 1) breeding chronology, 2) total number of plovers present throughout the season (non-breeding individuals and breeding pairs), 3) philopatry, nest-site tenacity, and mate retention of birds color banded in 1982, 4) nesting success, 5) factors causing reproductive failure, 6) nest

density and distribution of nests, 7) feeding habitat, and 8) major characteristics of the nest habitat.

To determine breeding chronology, factors causing reproductive failure, size of territories, and feeding habitat, plovers were observed daily (weather permitting) from 21 April to 7 August 1983. Additional checks were made on 17 April and 17 August. Most observations were made from a boat anchored near the shoreline.

Population size, distribution of nests, and nesting success were monitored throughout the season by direct observation of adults, nests, and nest contents. Juveniles were considered to have fledged once they were capable of flight.

To facilitate recognition of individual plovers, 51 individuals (8 adults, 43 juveniles) were captured and banded with U.S. Fish and Wildlife Service aluminum leg bands and unique combinations of colored leg bands. An additional 14 juveniles received only aluminum leg bands. Adults were captured with mist nets or wire mesh drop traps; juveniles were captured by hand.

Characteristics of the nesting habitat were determined from measurements taken on major habitat features (e.g. distance from nearest shoreline, beach pool, piece of vegetation, object, vegetation line.) In addition, open beach width and slope of ground at the nest site were recorded.

Finally, the occurrence and distribution of additional nesting pairs in the vicinity of Pine and Curry Island and Morris Point was determined during reconnaissance trips by boat to Zippel Bay (weekly), Rocky Point and Stony Point (mid-May, mid-June, mid-July), and the Northwest Angle (mid-June).

RESULTS AND DISCUSSION

BREEDING CHRONOLOGY

The chronology for Piping Plovers on Pine and Curry Island in 1983 is summarized in Figure 1. The chronology for 1983 was very similar to that of 1982. Individual nest histories from egg laying through hatching are presented in Table 1.

Arrival.--the first plover appeared on 24 April; most individuals arrived by mid-May. There was no obvious difference in arrival time for either sex.

Courtship and territory establishment.-- plovers began courtship (indicated by "butterfly flight" and vocalizations) and territorial defense (indicated by aggressive chases and "parallel runs") several days after arriving on Pine and Curry Island. This activity continued into early May, with pair bonds forming during the first week of May. The first copulation was observed on 7 May. Courtship activities continued until eggs were laid and then decreased considerably; several pairs were observed "courting" as late as mid-June. Territorial defense continued throughout the breeding season. Defense was intense during the establishment of territories and during courtship, primarily late April to mid-May. The intensity of defense decreased considerably during egg-laying, then became moderate for the incubation period. After hatching, defense again became intense. As the chicks matured, the extent of defense declined steadily and by the time the juveniles fledged territorial behavior was rarely observed.

Nest construction.--the first scrape was constructed on 5 May. Many scrapes were made by all breeding males as part of courtship and pair-bonding. Scrape construction continued until clutch initiation, then ended unless renesting occurred.

FIGURE 1

CHRONOLOGY OF THE BREEDING CYCLE OF PIPING PLOVERS ON PINE AND CURRY ISLAND IN 1983

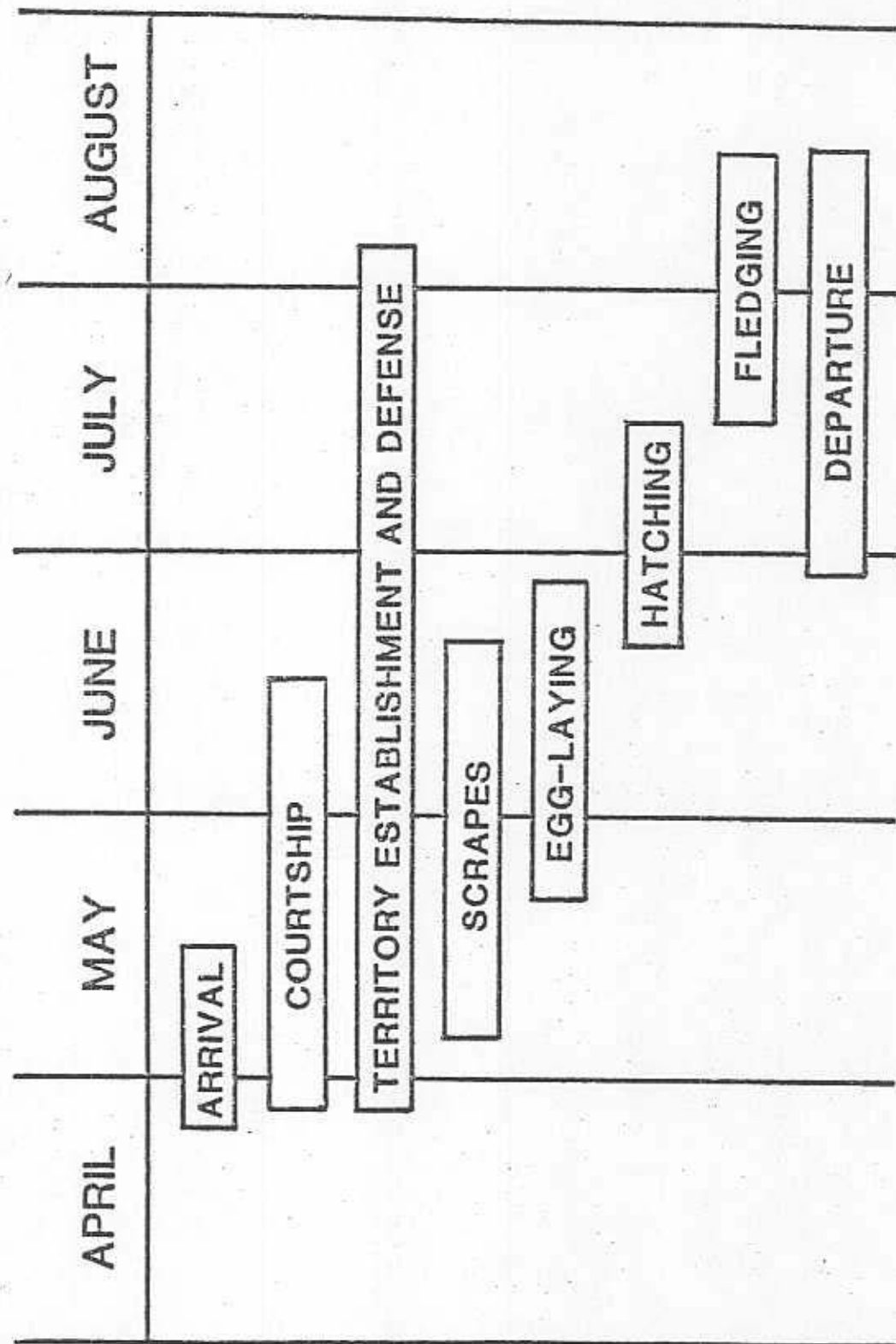


Table 1. Individual Nest Histories

<u>NEST</u> ¹	<u>DATE FIRST</u> ² <u>EGG LAYED</u>	<u>NUMBER OF</u> ³ <u>EGGS LAYED</u>	<u>DATE OF</u> ³ <u>HATCHING</u>	<u>EGGS</u> <u>HATCHED</u>	<u>CHICKS</u> <u>FLEDGED</u>
1	22-23 May	4	23 June	4	3
2	22-23 May	4	23 June	4	4
3	21-22 May	3*	*	0	0
4	21-22 May	4	21 June	4	4
5	22-24 May	4	25 June	4	3
6	27-28 May	4	27 June	4	4
7	27-28 May	4	27 June- 1 July	2	2
8	-	4	23 June	3	1
9 (Morris Point)	30 May	4	26 June- 1 July	3	3
10 (Zippel Bay)	-	4	23 June	3	0
11	-	4	25 June	4	2
12	-	4	2-3 July	4	3
13 (Morris Point)	-	4	26 June	1	1
14 (Rocky Point)	-	4	18-28 June	3	3
15	-	4	5 July	3	0
16	-	3	19-20 July	0	0
17 (Morris Point)	-	4	26 June	4	3
18	21-22 June	3	22-24 July	3	3
19	21-22 June	4	*	0	0
20	-	4	3 July	3	3
21	-	4	8 July	4	1
22	-	4	1-3 July	4	1
TOTAL		85		64	44

¹ Nest located on Pine and Curry Island unless otherwise indicated.

² -Indicates lack of information.

³ *Indicates that the nest either failed before the clutch was completed, or before the nest hatched.

Egg laying.--the first eggs were laid on 21-22 May. The majority of eggs was laid in late May and early June. Two late nests were initiated on 21-22 June. Eggs were laid every other day; a clutch of four was completed six days after initiation.

Renesting.--one pair lost a nest in late May and subsequently renested. No other pair lost a nest until 23 June and none of these birds attempted to build a second nest.

Hatching.--the first nest hatched on 21 June, the latest on 22-24 July. The peak of hatching occurred in late June and early July. Incubation time ranged from 25 to 28 days.

Fledging.--juveniles were considered to have fledged when they were capable of flight; as early as 22 days of age for two juveniles and 23 days of age for another. Most juveniles could fly well by 25 days of age. The first juveniles fledged on 14-15 July, the last on 17 August.

Departure from Pine and Curry Island.--most adults were gone by the end of July. One adult was observed on 17 August (a very late nester). Juveniles began to leave in mid to late July; most were gone by mid-August. Nine juveniles were still present on 17 August.

POPULATION SIZE

We estimated the 1983 Piping Plover population in Lake of the Woods to be 49 adult birds. This number is very close to the estimate of 44 individuals reported in 1982. Forty two were breeding individuals (21 pairs, each known to have produced at least one egg) and seven were non-breeders. This figure is higher than the 15 breeding pairs present in 1982. All birds had the complete breast band characteristic of the subspecies C. m. circumcinctus.

Two adult plovers died in 1983. Both became entangled in portions of thin survey string, used by DNR personnel when they were posting signs. No other adults are known to have died.

PHILOPATRY, NEST-SITE TENACITY, AND MATE RETENTION

Philopatry.--we define philopatry as the return of birds banded in Lake of the Woods in 1982 to this same area in 1983. Of the 37 adults banded in 1982, 26 (70%) returned to Lake of the Woods in 1983. Twenty three (77%) of the 30 individuals that attempted to breed in 1982 returned in 1983. Of these 23, 18 (78%) attempted to breed again in 1983.

Of the 26 juveniles fledged in 1982, nine ((35%)) returned to the site in 1983. Eight of these second-year birds attempted to breed.

Nest-site tenacity.--eighteen individuals nested in both 1982 and 1983. These birds, especially the males, showed a tendency to return to the immediate vicinity of their 1982 nest site. However one female moved from Rocky Point to Zippel Bay (16 km). For the plovers that nested in both years, the mean distance between the 1982 and 1983 nests was 81.8 m; the range was 9-711 m. There was a significant difference between male and female nest site tenacity; the males tended to nest closer to the location of their previous nest. Nine males nested in both years, and all established their 1983 nest within 80 m of their 1982 nest location. Each of the nine males also returned to his respective nesting locale (i.e. Pine and Curry Island, Morris Point, or Rocky Point).

Mate retention.--of the plovers color-banded in 1982, 15 were breeding pairs. In 1983, only three of these pairs (20%) were still together. All members of an additional 3 pairs (20%) were present in the Lake of the Woods area but bred with different mates. Seven pairs (47%) were no longer together

and only one member of each pair was observed during the 1983 season. Finally, both members of 2 pairs (13%) were present early in the season but 1 member of each pair died before the 1983 mate combinations were determined. Based on this sample, 80% of the plover pairs did not remain intact for consecutive breeding seasons. A primary cause of mate change may be disappearance of the previous mate.

NESTING SUCCESS

The 21 breeding pairs present in 1983 produced 22 nests with eggs (Table 1); one pair renested. Nineteen of the nests had four eggs, two had three eggs, and one was destroyed before the clutch was completed. Both of the three egg clutches were late season nesting attempts. The mean number of eggs/clutch (3.9) was the same as in 1982.

A total of 85 eggs was laid in 1983, and 64 (75%) hatched ($\bar{x} = 2.9/\text{nest}$). Nineteen of the 21 pairs hatched at least one egg. Hatching success in 1983 was considerably higher than the 44% rate in 1982.

Forty four (69%) of the 64 chicks fledged ($\bar{x} = 2.1/\text{breeding pair}$). Seventeen of the 21 pairs raised at least 1 juvenile to fledging. Total number of chicks fledged in 1983 (44) was almost double the number (26) that fledged in 1982.

Overall reproductive success (measured as percent of chicks fledged from eggs laid) was 52%. Again, this was considerably higher than the 30% reported in 1982.

FACTORS CAUSING REPRODUCTIVE FAILURE

Egg mortality.--a total of 21/85 eggs (25%) failed to hatch. This was considerably lower than the 56% egg mortality rate reported in 1982. However,

half of the nests lost from one to all of the eggs. Total nest failure occurred in only 3 (14%) of the 22 nests. We attribute egg mortality to the following causes: predation (48%), storm damage (19%), unknown (19%) and human disturbance (14%).

Chick Mortality.--of the 64 chicks that hatched, 20 (31%) did not survive to fledge. The 1983 chick mortality estimate is similar to the 34% rate reported in 1982. Most disappeared within a few days of hatching. Although predation is suspected, it was never observed and no dead chicks were found. Therefore, cause of chick mortality is unknown.

As in 1982, cause of mortality was difficult to determine. Potential predators included Herring Gulls (Larus argentatus), Ring-billed gulls (L. delawarensis), Common Ravens (Corvus corax), and American Crows (C. brachyrhynchos). All were seen in and around Piping Plover nesting areas. The number of gulls appeared to be less than the number present in 1982, especially early in the season. This is a possible explanation for the decrease in predation of nests from 1982 to 1983. The number of crows in the area was similar to that of 1982. One pair of ravens nested on Morris Point. They fledged 2 juveniles, and the family group was often observed in the Common Tern colony (near Piping Plover families) late in the summer.

One mink (Mustela vison) was seen on a marshy portion of Pine and Curry Island on 28 April. Otters (Lutra canadensis) were seen near or on the island three times during the summer, and their tracks were seen occasionally, but never in plover nesting areas. A variety of raptors were common migrants in the spring, but were rarely seen in the summer. Predation by this avian group does not seem likely.

Nesting areas on Pine and Curry Island and Morris Point were posted as Wildlife Sanctuaries before any human activity occurred in 1983. Between 14 May (first day of fishing season) and 7 August, 36 cases of human trespass on the Wildlife Sanctuaries were observed. The average time of each intrusion was 11 minutes. In most cases the people landed to urinate or stretch. It appeared that human disturbance was much lower than in 1982, especially the number of people camping or stopping for shore lunches.

DENSITY AND DISTRIBUTION OF NESTS

Of the 22 nests found in 1983, 17 were located on Pine and Curry Island, three on Morris Point, one at Zippel Bay, and one on Rocky Point (Fig. 2). Nest locations for Pine and Curry Island and Morris Point are shown in Figures 3, 4, and 5. The mean distance from each nest at time of initiation to the nearest active nest was 62 m, (range = 19 - 233 m). This is similar to the mean distance of 58 m reported in 1982. Distribution of nests among the four locations was similar to that reported in 1982.

FEEDING HABITAT

Plovers foraged exclusively by pecking at the ground. They eat what appear to be tiny invertebrates that are present on the surface of the ground. Attempts to sample these organisms were unsuccessful. Plovers fed on open beach, along the shoreline, along the edge of beach pools, and in clumps of vegetation. Plovers appeared to prefer feeding on the shoreline or beach pool edges (wet sand) as opposed to open beach (dry sand). While tending their young, adult plovers routinely led the chicks to the shoreline edge to feed.

Adults normally foraged within their respective territories or at neutral feeding areas. An example of a neutral feeding area is the low mud flat located

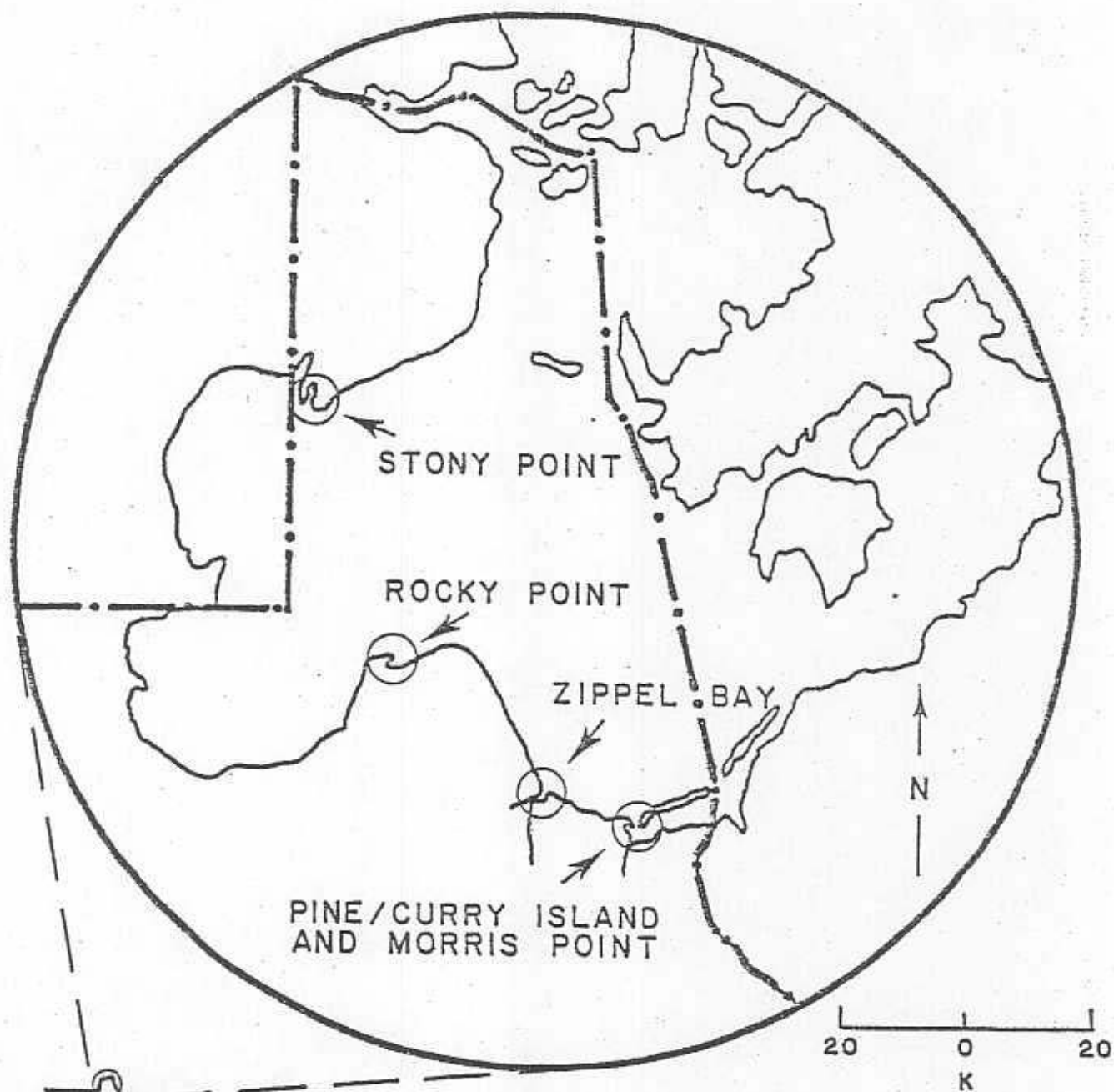
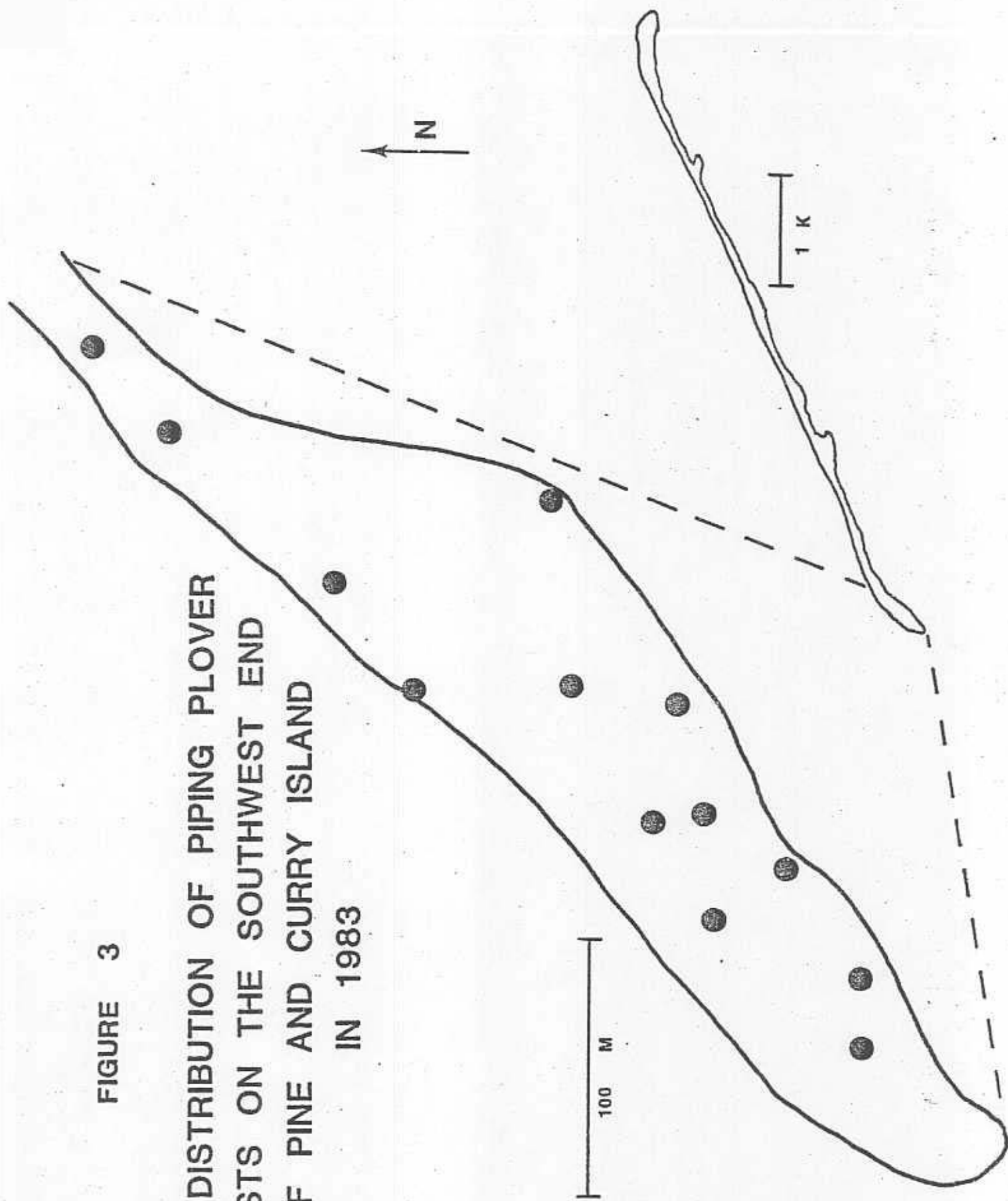


FIGURE 2. PIPING PLOVER
BREEDING SITES IN LAKE OF
THE WOODS COUNTY, MINNESOTA

FIGURE 3

THE DISTRIBUTION OF PIPING PLOVER
NESTS ON THE SOUTHWEST END
OF PINE AND CURRY ISLAND
IN 1983



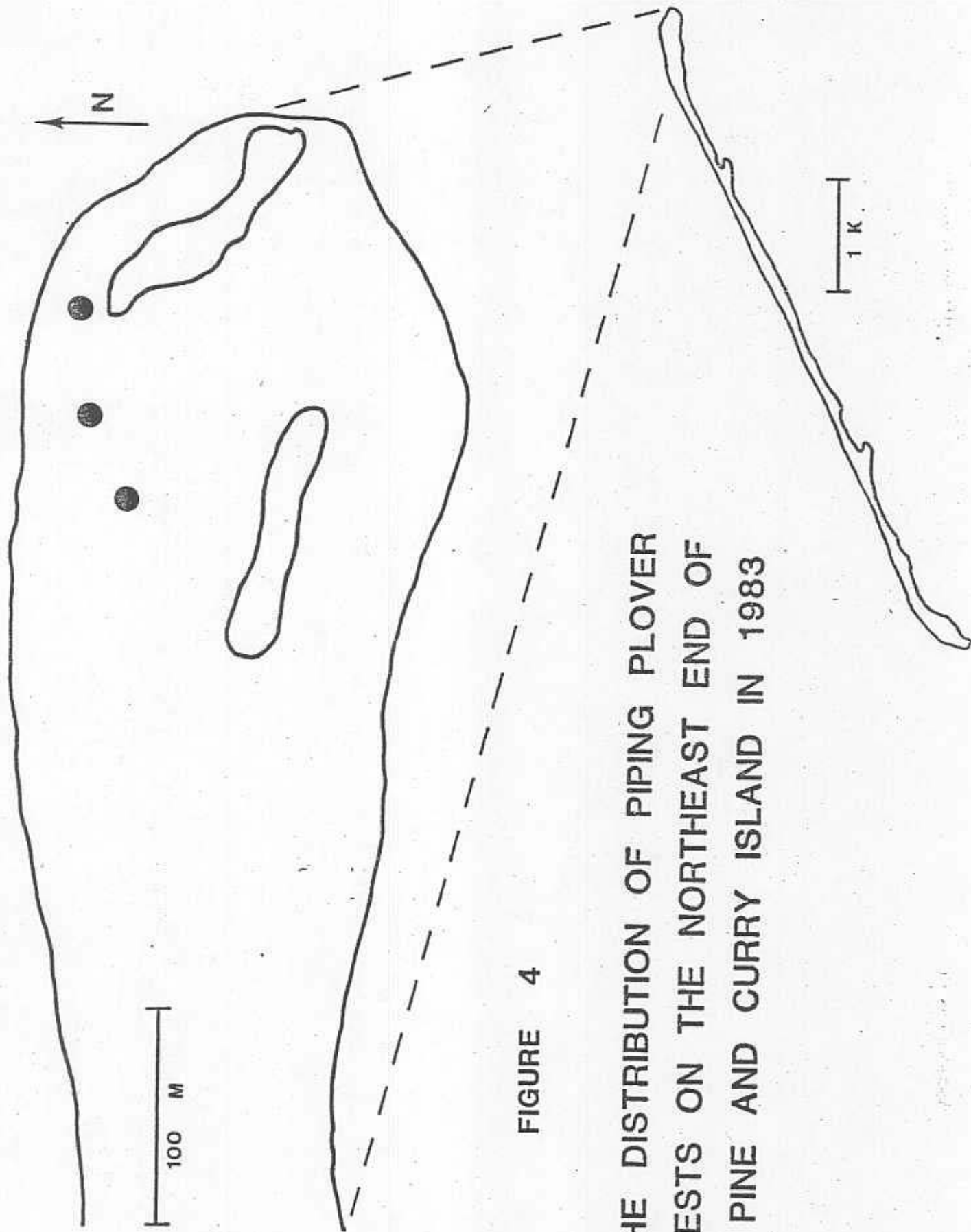
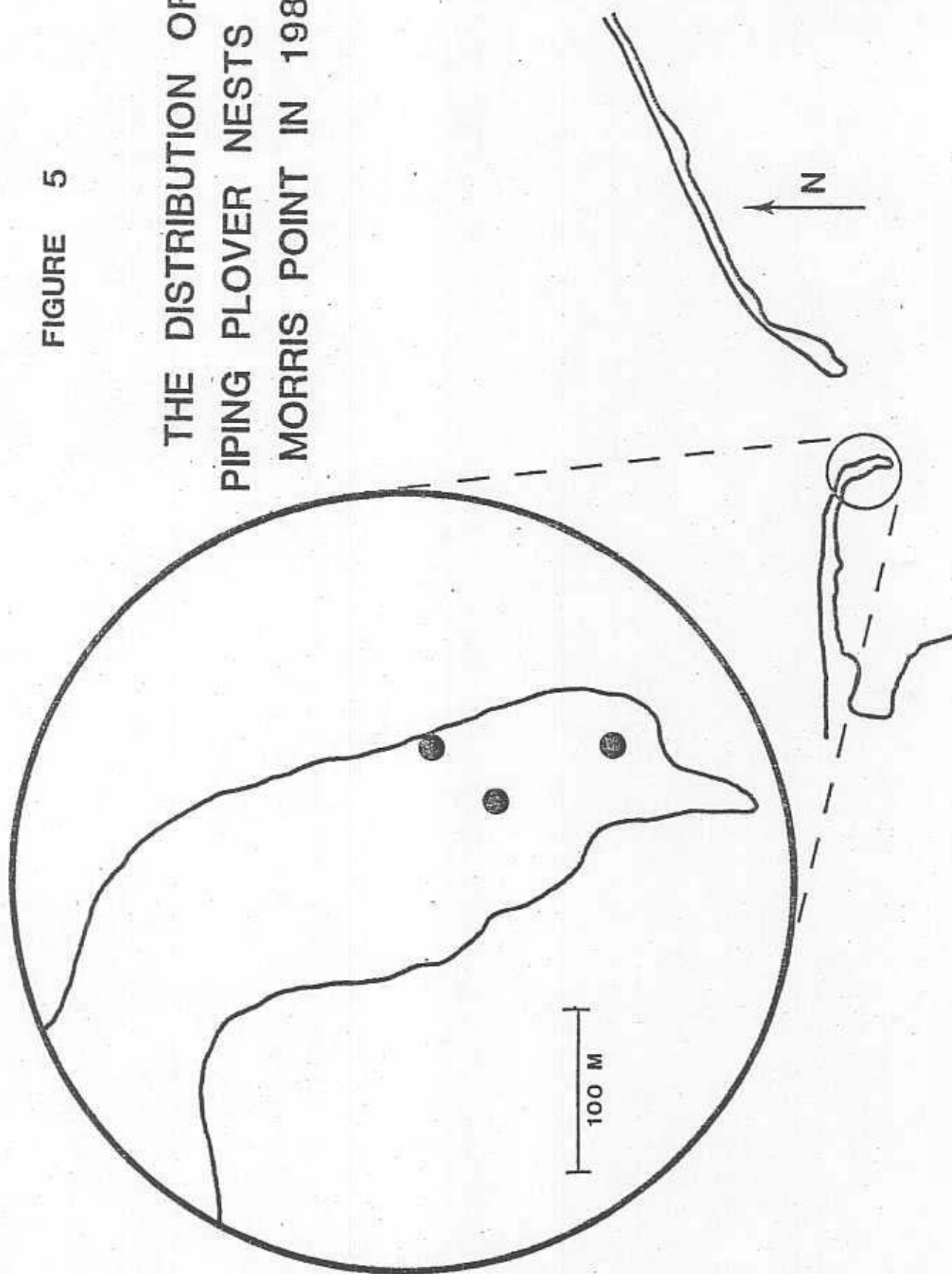


FIGURE 4

THE DISTRIBUTION OF PIPING PLOVER
NESTS ON THE NORTHEAST END OF
PINE AND CURRY ISLAND IN 1983

FIGURE 5

THE DISTRIBUTION OF
PIPING PLOVER NESTS ON
MORRIS POINT IN 1983



near Morris Point. This mud flat, unsuitable for nesting, was not defended as a territory by any of the plovers. Many birds from both Morris Point and Pine and Curry Island frequently visited this flat to feed. As many as nine plovers were seen there at one time. Plovers fed within their territorial boundaries as long as adjacent territories were actively defended but foraging plovers also encroached upon undefended terrain. Young chicks fed exclusively within their parent's territory; their independence and feeding range gradually expanded until they fledged. After fledging, they foraged on any undefended portion of beach.

MAJOR HABITAT CHARACTERISTICS

To avoid disturbance of nesting birds, measurements of habitat characteristics were taken late in the season (1 to 6 August). Data were collected on seven variables associated with 21 active plover nests (Table 2). The results are summarized below.

Distance from nest to shoreline.--mean distance from nest to shoreline was 22.9 m. The shoreline selected for measurement was that used most often by foraging juveniles. These distances were somewhat variable, depending on wave height and water level.

Distance from nest to nearest beach pool.--no beach pool was present within 100 m of seven nests. The mean distance from 14 nests to the closest beach pool was 39.9 m. These distances varied depending on rainfall; in some cases the beach pools were only temporary.

Distance from nest to nearest piece of vegetation--mean distance was 0.9 m. Closest species were Artemisia caudata (14 nests), Salix interior (4), Poaceae (1), Fragaria sp. (1), and unidentified (1). Because the amount of vegetation

Table 2. Characteristics of Piping Plover Nest Habitat

Variable	\bar{x}	S.D	Range
Nest to shoreline distance	22.9 m	12.4 m	3 - 50 m
Nest to beach pool distance	39.9 m	23.7 m	13 - over 100 m
Nest to nearest vegetation distance	0.9 m	1.5 m	0.05 - 6.4 m
Nest to nearest object distance	1.8 m	1.6 m	0.05 - 5.6 m
Nest to vegetation line distance	15.8 m	10.0 m	1 - 38 m
Beach width	12.6 m	11.2 m	4 - 44 m
Slope at nest site	1.6°	1.5°	0 - 5.0°

increased rapidly as the season progressed, many nests were much further from vegetation at the time they were initiated.

Distance from nest to nearest object.--for 19 nests the nearest object was driftwood, and for two nests it was a tin can. The mean distance to the nearest object was 1.8 m.

Distance from nest to vegetation line.--the vegetation line was the point where open beach ended and vegetation began. A total of 16 nests was located within the vegetated zone; mean distance to the vegetation line was 16.3 m. Five nests were located on open beach; mean distance to the vegetation line was 14.0 m.

Open beach width.--the mean distance from the shoreline to the vegetation line was 12.6 m. These measurements were taken in August; earlier in the season the open beach was much more extensive.

Slope of ground at nest site.--mean slope at the nest site was 1.6° .

POTENTIAL NESTING SITES ON OTHER ISLANDS OR SURROUNDING SHORELINE OF LAKE OF THE WOODS

In addition to Pine and Curry Island and Morris Point, nesting occurred at Zippel Bay and Rocky Point (Fig. 2). Only one pair was seen at Zippel Bay. This pair established their nest on open flat sand spoil created by dredging operations of the previous fall. Although the eggs hatched, the chicks disappeared within a few days. Six plovers were seen at Rocky Point on 18 May; only one pair nested and fledged three young.

No plovers were seen on Stony Point on 18 May. Three plovers were seen there on 17 June. One of these birds performed territorial and courtship behavior; there was no evidence of pair formation or nesting. No plovers were observed there on 16 July.

Potential Piping Plover nesting sites within the Northwest Angle are very limited (Fig. 6). To some extent open beach exists from Stony Point to Driftwood Point, but nowhere does it appear adequate for nesting. A small portion of open beach is present at Sugar Point. The most likely spot for plover nesting is Garden Island, where a sand spit of about 100 m exists on the east end. A smaller spit is present on the west end. All of the remaining shoreline of the northwest angle, both island and mainland, lacks open beach and appears unsuitable as plover habitat. With the exception of Stony Point, no plovers were recorded within the northwest angle.

RECOMMENDATIONS FOR MANAGEMENT

In our 1982 progress report we presented 3 management strategies for consideration. These were: 1) minimization of human disturbance, 2) predator control on Pine and Curry Island and 3) habitat manipulation. We recommended that an effort be made to minimize human use of Pine and Curry Island in 1983 but that the other two strategies be reconsidered after the 1983 season. Our 1983 evaluations and recommendations are as follows:

- 1) T. Wiens believes the efforts by the Minnesota DNR were responsible for decreasing the number of people who used Pine and Curry Island in 1983. We recommend that DNR personnel continue to inform resort owners and users of State and Federal concern for this species. In addition, posting of plover breeding sites should be continued.
- 2) Egg and chick mortality was very high in 1982 which led us to propose that predator control might be desirable. However, the mortality rate was considerably lower in 1983. At this point we recommend that reproductive success be monitored for at least one additional breeding

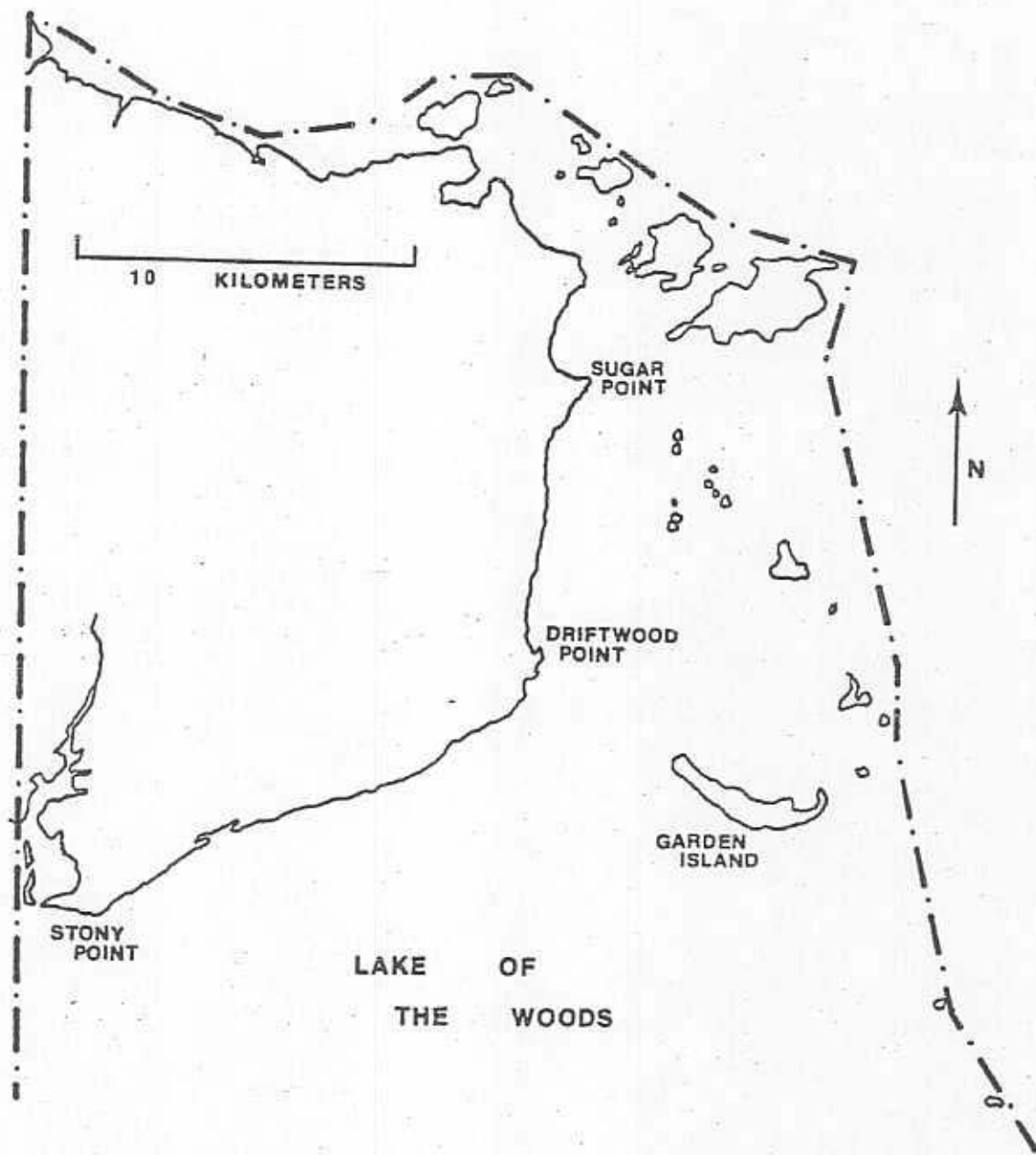


FIGURE 6. THE NORTHWEST ANGLE, LAKE OF THE WOODS
COUNTY, MINNESOTA.

season and that no attempt be made to increase reproductive success through predator management.

- 3) After two seasons of good chick productivity we believe there is no reason to consider habitat manipulation to increase potential nest sites.

RECOMMENDATIONS FOR ADDITIONAL RESEARCH AND MONITORING

Although we now have a good understanding of Piping Plover breeding biology in Lake of the Woods, we recommend that this population be monitored at the following levels in future years. Our rationale is as follows:

- 1) Egg mortality was 56% in 1982 but only 25% in 1983. Data from an additional year are needed before we can determine if egg loss (primarily through predation) is a potential or actual threat to plover reproductive success in Lake of the Woods.
- 2) Currently, this is the only Piping Plover population in North America localized to such an extent that a large percent of the population can be monitored for consecutive breeding seasons. This is especially exciting because most young and adults were banded in both years. We believe that an additional season (1984) will add important information on philopatry (adults and 1 year olds), nest-site tenacity, mate retention, and other categories of social interaction. In 1984 banded adults should be recaptured to replace both types of bands because these will otherwise be lost (due to sand abrasion) by 1985.
- 3) Although overall reproductive success appears good (30-52%), and the number of breeding adults increased from 30 in 1982 to 42

in 1983, this population is so small that it could be eliminated or seriously reduced by chance environmental events or genetic problems (e.g. inbreeding depression, genetic load) of serious concern in populations of less than 50 breeding individuals.

We recommend an annual census and periodic checks of reproductive success so that population declines can be detected and evaluated as soon as possible.

1984 Census number of adults present at Pine and Curry Island and Morris Point.

Band young with USFWS and color bands.

Recapture and band selected adults.

Monitor reproductive success.

1985 Census number of adults present at Pine and Curry Island and Morris Point.

Record color banded individuals present and their mates.

Record number of 1 year olds present.

Return prior to first fledging to estimate young produced.

1986 Same as 1985

1987+ Continue to visit Pine and Curry Island and Morris Point on an annual basis (early May (10th) or mid-June) to census number of adults present. If number of adult birds decreases significantly between seasons, an immediate effort should be made to evaluate if decrease is the beginning of a population decline. Otherwise, measure reproductive success periodically (every 4-5 years).