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Nest habitat and nesting success of Lesser Golden-Plovers.—Many birds, especially ground-nesters with no aggressive nest defense, use camouflage for nest protection (e.g., Lack, Ecological adaptations for breeding in birds. Methuen, London, 1968). At Churchill, Manitoba, I found Lesser Golden-Plovers (*Pluvialis dominica*) frequently nesting on lichen heath. Their nests appeared far more difficult to see on the variegated lichen substrate than on nesting habitat covered by other vegetation (Fig. 1). At Churchill, scattered trees on the tundra may be used as lookout posts by avian predators and provide cover for surprise-attacking ground predators (Stroud et al., Wader Study Group Bull. 46:25–28, 1986). I examined whether habitat and distance to nearest tree affected nest survival and nest-site selection.

I studied plovers in a 3.75 km^2 area about 24 km east of Churchill town. I found 23 golden-plover nests. Two nests were excluded from calculations, one because it contained 8 eggs (probably laid by two females) and thus was highly conspicuous even with an incubating bird (the eggs in this nest were eventually depredated, one by one), and another that was deserted for an unknown reason. Twenty of the nests were found during the three first days of the field work (starting 24 June). Four of the nests were found during egg laying, the other ones immediately after laying of the last egg as judged from water flotation.

Nests were visited at 1–4 day intervals during incubation, some of them more than once daily during hatching. On average, hatching took 77 h from pipping until the chick was dry ($\pm$30 h [SD]; N = 32 eggs, 10 nests). Eggs that disappeared between two nest visits were therefore counted as robbed. After predation, one (female) or both birds disappeared from their territory (10 of the birds were individually color banded).

At each nest the 3–4 most dominant plants (from % coverage) within a radius of 1 m were recorded and habitat was classified according to the most dominant component (usually covering >60%). The distance from each nest to the nearest tree (>1 m tall; most trees were 2–4 m tall) was measured. Occurrence of the various habitats in the study area was established from parallel transects across the area, 150 m apart. At each 150th pace I classified vegetation by the same procedure as I used at nest sites and measured distance to the nearest tree. Habitat availability is based on 96 point samples throughout the study area. Distances

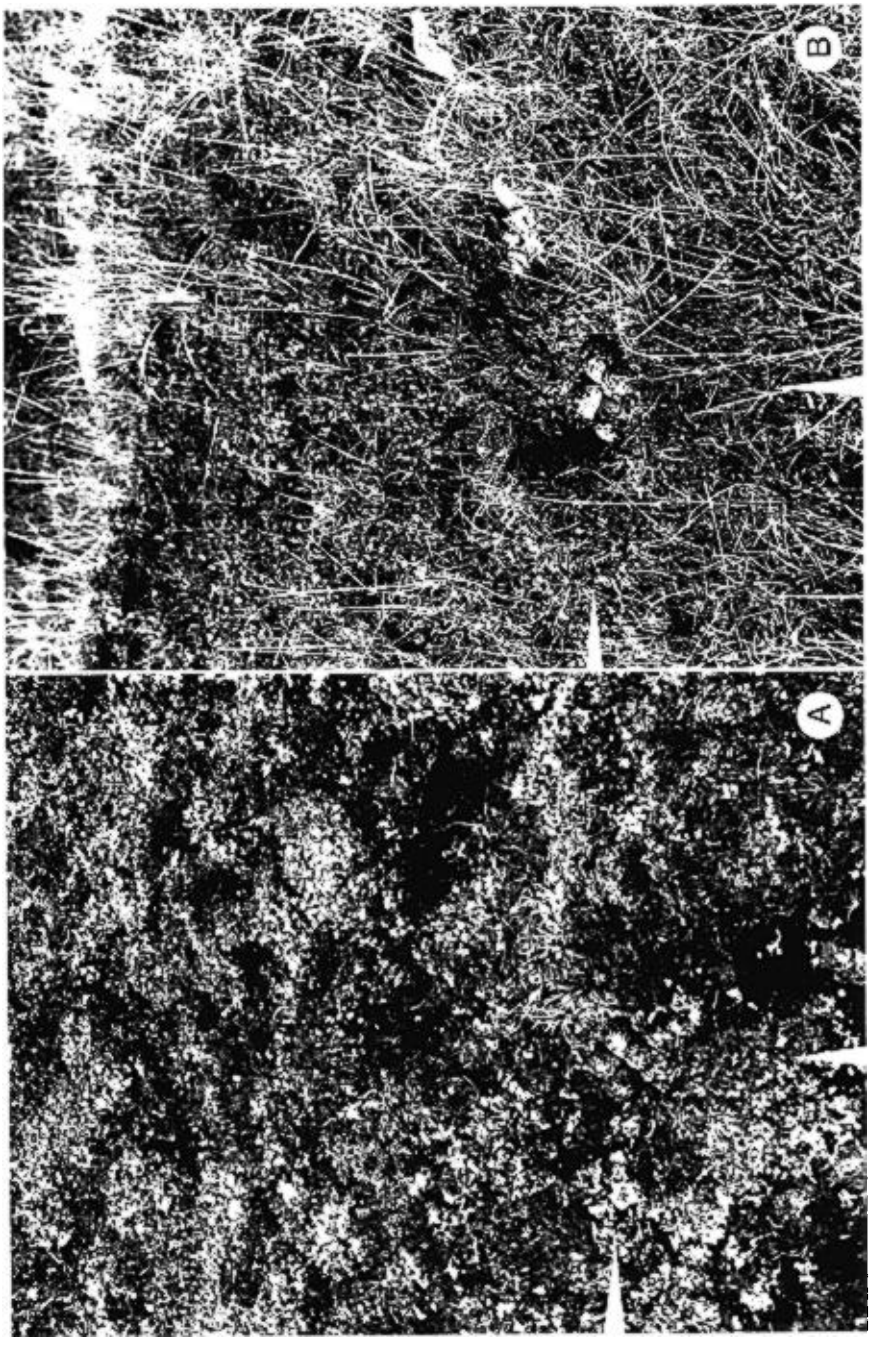

FIG. 1. Lesser Golden-Plover nests at Churchill, Manitoba, on (A) lichen heath and (B) a non-lichen habitat (dominated by *Dryas*).

TABLE 1
HABITAT USE AND NEST PREDATION OF LESSER GOLDEN-PLOVERS AT CHURCHILL, MANITOBA, 1986

Habitat[a]	Percent occurrence[b]	Percent use as nest habitat	Depredated nests	Surviving nests
Lichens	33.3	71.4	2	13
Sedges	27.1	9.5	1	1
Moss	10.4			
Dryas integrifolia	9.4	9.5	2	
Tall shrub[c]	13.5			
Dwarf shrub[d]	3.1	9.5	1	1
Gravel pit; <10% vegetative cover	3.1			
N	96	21	6	15

[a] Dominating vegetation (from percent coverage within a radius of 1 m).
[b] On 96 points 150 m apart on parallel transects across the study area.
[c] *Salix* spp. (8.3% of the points) or *Betula glandulosa* (5.2%), about 0.2–1 m tall.
[d] *Rhododendron lapponicum* (2.1% of the points), and *Empetrum nigrum* (1.0%), usually <0.2 m tall.

between nests and trees were compared with 21 points selected randomly from the 96 point samples.

Six of 21 nests (28.6%) were depredated. The predation was total in 5 of the nests, whereas one nest was deserted after 3 of the 4 eggs had been robbed. The predators were never identified, but eggshell remains near one nest had holes indicating avian predation. Nest predation was significantly lower in lichen habitat than in non-lichen habitat (Fisher's Test, $P = 0.0307$, one-tailed), and lichen habitat was clearly preferred for nesting ($\chi^2 = 5.60$, $P < 0.02$; Table 1).

The six depredated nests were a median distance of 18.5 m from trees and surviving nests a median distance of 19.5 m. The distribution was not statistically significant between depredated and surviving nests (Wilcoxon's Sum of Ranks test, $R = 62$, $z = 0.31$, $P > 0.1$). The 21 random points from the habitat transects were situated a median distance of 26.5 m from trees, whereas golden-plover nests were a median distance of 19.5 m from trees. These distributions were not significantly different from each other (Wilcoxon's Sum of Ranks test, $R = 431.5$, $z = 0.50$, $P > 0.1$).

The study shows that the golden-plover nests survived better on the variegated lichen substrate than on a more uniform background of more or less green plants, and that the plovers preferred lichen habitat for nest substrate. Thus, nest predation is a likely factor influencing habitat choice in this species. However, lichen habitats could have been chosen by the plovers for a number of reasons: (1) they are the first to become snowfree and available to the plovers, (2) they are better drained than most of the other habitats, notably the boggy sedge and willow shrub habitats (Skeel, Can. J. Zool. 61:218–225, 1983), and (3) the "porous" lichens may provide better insulating substrate for the eggs. However, *Dryas, Empetrum,* and *Rhododendron* vegetations occur on the more elevated ground, and should be equally attractive as lichen heath as far as (1) and (2) are concerned. With regard to (3) above in all habitats some lichen would be readily available to line and insulate nests. Camouflage remains the most likely factor making golden-plovers prefer lichen heath as nest substrate.

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Piracy by Ring-billed Gulls on Dunlin.—On 16 December 1987, I observed Ring-billed Gulls (*Larus delawarensis*) and Black-bellied Plovers (*Pluvialis squatarola*) pirating Dunlin (*Calidris alpina*) during a heavy rain at Bolinas Lagoon, California. Dunlin normally feed at the water's edge preying on polychaetes, amphipods, insects, and small bivalves (Page, pers. obs.); they rarely eat fish. However, during my observations, the Dunlin appeared to be searching specifically for arrow gobies (*Clevelandia los*). Fish being captured and eaten were generally equal to or less than the length of the Dunlin's culmen (mean culmen = 37.9 ± 2.7 mm [SD], N = 35; Warnock, unpubl. data). Often Dunlin had difficulty swallowing the fish, and this facilitated kleptoparasitism. Dunlin lost 16 (44%) of the 36 fish they captured during 26 attempts by the kleptoparasites. Twenty-three kleptoparasitic attempts were made by Ring-billed Gulls with a success rate of 65%. Black-bellied Plovers were successful once during two attempts, and once a Dunlin stole a fish from another. Kleptoparasitic attempts were initiated by Ring-billed Gulls standing within 5 m of the feeding Dunlin. Gulls did not chase Dunlin for more than 50 m, and if unsuccessful, the gull landed immediately and resumed watching the feeding Dunlin. Black-bellied Plovers used different attack methods. Both times the plovers were feeding within 1 m of the Dunlin at the moment the latter caught a fish. The plover then ran toward the Dunlin and attempted to snatch the fish from its bill. The unsuccessful plover immediately resumed feeding after the attempt at kleptoparasitism.

The rash of piracy directed toward the Dunlin represents instances of opportunistic kleptoparasitism by visually oriented feeders. During normal feeding, Dunlin prey items are usually not visible when being consumed. This may make them less susceptible to piracy by gulls (Payne and Howe 1976) and plovers. The heavy rainfall may have resulted in a decrease in invertebrate activity (Pienkowski 1981) causing Dunlin to exploit food sources not normally used. In a review of Dunlin stomach contents, Burton (1974) mentioned only one instance of a fish being consumed. On the Bolinas Lagoon in northern California, fish were not found in 30 samples of stomach-pumped Dunlin (Page and Stenzel, unpubl. data), although I have occasionally (<10 times in over three years of extensive observations) seen Dunlin take small fish at this location.

Gulls frequently steal food from shorebirds at Bolinas Lagoon (pers. obs.) and other locations (Brockmann and Barnard 1979, Barnard and Thompson 1985). Interspecific kleptoparasitism in shorebirds is rarer. When it does occur, the aggressor tends to be a visual feeder rather than a tactual one and the contested prey tends to be large rather than small. Many species of shorebirds are tactile feeders. One would predict that shorebirds, when tactile feeding on larger, more visible prey items, will more likely be kleptoparasitized by birds which are visual feeders. Observations of kleptoparasitic behavior by gulls and shorebirds on the Bolinas Lagoon support the above prediction. Shorebirds which switch from small, easily swallowed prey items to larger, more visible, harder to handle prey items must balance the benefits of an energy rich meal to the costs of increased kleptoparasitism.

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