

EFFECT OF HABITAT DECIMATION ON RING-BILLED GULL COLONY- AND NEST-SITE TENACITY

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ABSTRACT.—Colony-site tenacity and nest-site tenacity have been documented in several larids, but the proximate factors affecting fidelity remain poorly understood. We examined the effect of severe breeding-habitat alterations (bulldozing) on site tenacity in Ring-billed Gulls (*Larus delawarensis*). Return rates of wing-tagged adults were similar in bulldozed and unchanged parts of the colony site. In bulldozed areas, however, most ring-bills abstained from nesting; those that did breed showed an increased tendency to move to a different nest site. Received 14 April 1981, accepted 31 August 1981.

FIDELITY to a previously used nesting area has been demonstrated or hypothesized for many bird species (see Greenwood 1980 for partial review). In colonially nesting birds, the area to which a bird returns from one breeding season to the next may be as large, and relatively imprecise, as a colony site (colony-site tenacity) or as precise as a specific nest site (nest-site tenacity).

Several larids have been subjects of investigations of colony-site tenacity and/or nest-site tenacity. Austin (1940) documented a well-developed tendency toward colony-site tenacity in Common Terns (*Sterna hirundo*), Arctic Terns (*S. paradisaea*), and Roseate Terns (*S. dougallii*). He subsequently reported (Austin 1949) that 86.2% of 115 Common Terns bred within about 9 m of their former nest site. Coulson and White (1958) noted that breeding Black-legged Kittiwakes (*Rissa tridactyla*) showed strong attachment to the colony site at which they had nested previously, but that 39.5% changed nest sites between years. Vermeer (1963) found that most (81.0%) Glaucous-winged Gulls (*Larus glaucescens*) nested within about 5 m of their previous site. Herring Gulls (*L. argentatus*) reportedly show a strong tendency to return to the vicinity of previously used nest sites (84% to same sub-colony, Charzyk and Coulson 1976). Franklin's Gulls (*L. pipixcan*) were reported to visit the colony site where they had nested in previous years, but after obtaining mates they often moved to a different site (Burger 1974). Nest-site tenacity also was suggested for this species (op. cit.).

For Ring-billed Gulls (*L. delawarensis*) nest-

ing on the Great Lakes, Ludwig (1974) suggested that little, if any, attachment was shown to colony sites of various stabilities. Southern (1977) documented the existence of strong colony-site tenacity in this species at the stable Rogers City Calcite site. Recently, we reported that 96.7% of 152 adult Ring-billed Gulls returning to the Rogers City site were faithful to the same colony subdivision, and most birds bred within 3 m of their previous year's nest site (at least 69.5%, $n = 59$, Southern and Southern 1979). Blokpoel and Courtney (1980) reported similar results at another Great Lakes colony site. Of the 83 banded ring-bills they resighted, 71 (85.5%) nested in the same colony sub-area for 2 yr. In this case, at least some of the birds that changed areas were forced to move, because their previous site had been inundated.

Although the existence of colony- and nest-site tenacity has been demonstrated in several larid species, investigations of the proximate factors influencing tenacity have been limited. Chronological age and breeding experience have been convincingly shown to correlate with increasing degrees of site attachment (Austin 1940, Coulson and White 1958, Blokpoel and Courtney 1980). Other factors, such as predation, low reproductive success, and changes in habitat, have been implicated in causing breakdowns of tenacity (e.g. McNicholl 1975, Erwin 1977, Conover and Miller 1978). In spite of the obvious negative impacts of these factors, however, there are several accounts of continued re-use of adversely affected sites (e.g. Austin 1940, 1949; Southern and

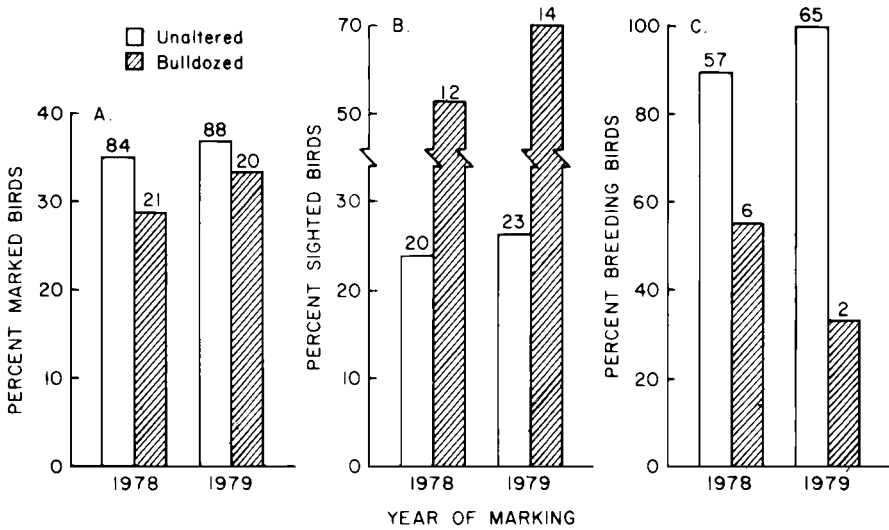


Fig. 1. The numerals above histogram columns indicate the number of birds each represents. A. Proportion of marked birds from bulldozed and unaltered areas that were resighted at the Calcite colony in 1980. B. Proportion of resighted birds, from bulldozed and unaltered areas, that did not nest in 1980. C. Proportion of birds resighted as nesters in 1980, from bulldozed and unaltered areas, that nested in the same subdivision as in previous years.

Southern 1978; Southern et al. 1979; Buckley and Buckley 1980; Petersen 1980).

In 1980, we addressed the question: does decimation of the breeding habitat affect nest-site tenacity in Ring-billed Gulls and, if so, in what way? Our experimental setup was provided for us by the unexpected bulldozing of parts of our study site. By observing the reactions of Ring-billed Gulls encountering these unusual habitat changes, we hoped to gain a better understanding of the influence of such changes on nest-site tenacity in this species. The changes caused by heavy equipment might simulate the type of habitat alterations that ring-bills could experience as a result of ice or waves scouring low-lying colony sites.

STUDY AREA AND METHODS

This study was conducted at the Calcite colony near Rogers City, Michigan (Presque Isle County, 45°N, 83°W). A manmade peninsula that serves as a breakwall for the harbor area of U.S. Steel's calcite plant has also served as a colony site for nesting gulls for several decades.

In 1978–1979 we captured adult Ring-billed Gulls during mid- to late-incubation by means of a cannon-net. Cannon-netting was conducted only in favorable weather and with a minimum of five persons present to expedite the procedure. Each captured

bird was outfitted with a standard U.S. Fish and Wildlife Service band and a patagial tag carrying a unique code (Southern 1971). We tagged 313 birds in 1978 and 395 in 1979.

We designated and marked subdivisions of the colony on the basis of permanent physical structures, e.g. harbor markers. Subdivisions varied widely in shape and size, averaging about 600 m² (mapped in Southern and Southern in press). We observed marked birds from a car, serving as a blind, parked along gravel roads, which run throughout the colony, and noted the subdivisions in which marked birds were sighted and/or nested. Observations were made on a near daily basis during 13 May–13 June 1978, 8–23 May 1979, and 10 May–27 June 1980.

During the fall of 1979, when breeding birds were not present, portions of the colony site were covered with 15–30 cm of fill and graded. These alterations affected some areas that had been used for nesting by birds wing-marked in 1978 and 1979. All vegetation was eliminated in these areas and a hard-packed, bare limestone substrate resulted. In contrast, unaltered areas supported ground cover and weedy vegetation during the summer (e.g. *Capsella*, *Chenopodium*).

RESULTS

Marked birds that had nested previously in bulldozed and unchanged areas were sighted at the Calcite colony with similar frequencies in 1980 (Fig. 1A; marked 1978, $\chi^2 = 0.98$, $\nu =$

TABLE 1. Comparison of 1979 and 1980 nest censuses and mean clutch sizes in bulldozed and unaltered areas.

	Unaltered	Bulldozed
Number of nests		
1979	5,625	1,415
1980	6,495	1,242
Change	+15.5%	-12.2%
Mean clutch size		
1979	2.68	2.64
1980	2.61	2.64
Change	-2.6%	0

1, $P = 0.32$; marked 1979, $\chi^2 = 0.25$, $\nu = 1$, $P = 0.62$). Overall resighting rates were low in 1980 (marked 1978, 31.9%; marked 1979, 33.9%). We suspect human activities, particularly harassment and killing of birds away from the colony site, were partially responsible. A local outbreak of histoplasmosis, associated with the colony site, had evoked sharp public reaction against the gulls. It is unlikely, however, that any one group of birds was affected by these factors to a greater extent than others.

Of those birds we recorded at the colony site in 1980, significantly more from bulldozed areas did not breed in the 1980 season (Fig. 1B; marked 1978, $\chi^2 = 6.93$, $\nu = 1$, $P < 0.01$; marked 1979, $\chi^2 = 13.92$, $\nu = 1$, $P < 0.01$). We designated a bird as a nonbreeder if we never saw it copulating, attending a nest or chicks, or repeatedly defending a territory. Because our sample of tagged birds was distributed throughout the colony, we had ample opportunity to sight birds in all subdivisions.

Nonbreeding birds from bulldozed and unaltered areas seemed to differ in their movements at the colony, although statistically significant differences were not shown ($\chi^2 = 3.19$, $\nu = 1$, $P = 0.07$). Nonbreeders from unchanged areas were sighted frequently (33 times) in the vicinity of their old nest site (i.e. same subdivision), but not uncommonly (14 times) elsewhere in the colony. Birds from bulldozed areas were seen near and away from their old sites equally often (15 times each).

Figure 1C illustrates the tendency of those birds that did breed in 1980 to nest in the same subdivision they had used the preceding year. Lower proportions of breeding birds nested

again in bulldozed areas than did so in unaltered areas (Fig. 1C; marked 1978, $\chi^2 = 8.32$, $\nu = 1$, $P < 0.01$; marked 1979, $\chi^2 = 45.92$, $\nu = 1$, $P < 0.01$).

Nest-census and clutch-size data for 1979 and 1980 are compared between bulldozed and unaltered portions of the colony site in Table 1. Although the total number of nests in bulldozed areas declined between years, more than 1,200 pairs bred in these areas in 1980. Along with the unchanged clutch size between years, this would seem to indicate that the altered habitat was suitable for nesting.

We have very little information on the effect of habitat changes on the pair bond. Of five marked pairs identified in 1979 from unaltered areas, four remained together in 1980. One out of three pairs from changed areas did not reunite in 1980. These samples are not adequate for drawing conclusions.

Male and female Ring-billed Gulls showed similar degrees of site tenacity. Of 24 birds identified as females (Southern 1981), 3 (12.5%) changed subdivisions in 1980; 2 of the 3 were from bulldozed areas. Similarly, 13.3% of 45 males changed subdivisions; 3 of these 6 birds were from disturbed areas. Our sample sizes are not sufficient for determining whether or not one sex more readily deserted bulldozed areas than the other.

DISCUSSION

Severe breeding-habitat alterations (bulldozing) affected Ring-billed Gulls in the following way. Birds that had nested previously in areas bulldozed in fall 1979 were seen at the colony in 1980 as frequently as those from unchanged areas, but their tendency to breed was reduced significantly. Among those birds from disturbed areas that did breed, relocation to a different colony subdivision occurred with greater than expected frequency. Ring-bills that encountered a drastically changed local environment upon arrival at the colony and did not breed in 1980 were equally likely to be sighted near their old site or in other parts of the colony.

It appears that bulldozing somewhat reduced the attractiveness of the habitat to returning gulls. The number of nests in bulldozed areas decreased between 1979 and 1980, while increasing in unaltered areas. Bulldozed areas were more open than unaltered areas,

and this may have contributed to an unfavorable reaction on the part of some birds.

Over 1,200 pairs did nest in bulldozed areas, but most marked birds familiar with those areas moved or did not nest. This implies that many birds breeding in disturbed areas may have been immigrants. Some faithful, but non-breeding, marked birds remained near their prior sites throughout the season, and some occasionally defended territories. By their presence, these tenacious ring-bills might have attracted newcomers that perceived no change in the habitat and proceeded to breed.

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