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COMPETITION AND PREDATION: HERRING GULLS VERSUS LAUGHING GULLS

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Gulls of the genus *Larus* generally nest colonially, often in mixed-species assemblages. For example, Herring Gulls (*L. argentatus*) in Europe nest with Lesser Black-backed Gulls (*L. fuscus*; Brown 1967, MacRoberts and MacRoberts 1972) and Black-headed Gulls (*L. ridibundus*; Greenhalgh 1974); and in North America Ring-billed Gulls (*L. delawarensis*) nest with California Gulls (*L. californicus*; Vermeer 1970) and Herring Gulls (Southern 1970). It is often difficult to determine whether such assemblages are actually mixed, or if monospecific colonies simply exist side by side. When assemblages are mixed it is often impossible to ascertain whether they are so by choice or because of a lack of suitable nest sites. The rate of competition and predation by one or both species has not been investigated. In this paper I examine competitive interactions and predation between Laughing Gulls (*L. atricilla*) and Herring Gulls on Clam Island, New Jersey, from 1976 through 1978.

Laughing Gulls on the east coast of the United States traditionally nest in *Spartina* salt marshes (Bent 1921), although at the limits of their range they frequently nest on dry land (Nisbet 1971, Dinsmore and Schreiber 1974). Thus, when Herring Gulls expanded southward in the early 1900's into Maine and Massachusetts, they came into direct conflict with Laughing Gulls (Nisbet 1971, Drury and Kadlec 1974). As early as 1943, Herring Gulls nested with Laughing Gulls in a sand dune colony at Muskeget Island, Massachusetts (Noble and Wurm 1943). Despite initial differences in habitat, the Laughing Gulls disappeared (Nisbet, pers. comm.). Increases in Herring Gulls in the northeast also have been associated with decreases in Common Terns (*Sterna hirundo*; Nisbet 1973).

In the 1950's and 1960's Herring Gulls again expanded their breeding range, nesting as far south as North Carolina with Laughing Gulls (Hailman 1963, Parnell and Soots 1975). They nested on the upper parts of domes on man-made islands while Laughing Gulls occupied low swales between the domes. Where Herring Gulls were absent, Laughing Gulls nested farther up the domes (Parnell and Soots 1975). When Herring Gulls began breeding in more southern areas, they chose to nest in salt marshes, the customary nesting areas of the large and stable Laughing Gull colonies (Burger 1977). Although differences in nest site selection were noted initially, these differences decreased as Herring Gull colonies expanded. Overlap in colony and nest site characteristics is obvious in several New Jersey colonies (Burger and Shisler 1978). Since the first report of Herring Gulls on Clam Island (Rogers 1965), the colony has increased from 50 to 1,200 pairs whereas the Laughing Gull colony of 4,000 to 6,000 pairs remained about the same size through 1976.

My primary objectives in this paper are to examine how these species interact temporally and behaviorally, and to determine the result of these interactions in terms of nesting space allocation and reproductive success.

STUDY AREA AND METHODS

Clam Island is a 54 ha salt marsh island in Barnegat Bay, Ocean County, New Jersey (39°45'N, 74°08'E). Several channels cut the island into four major islets. Slight differences in elevation result in differences in tidal inundation and vegetation. Predominant vegetation is *Spartina alterniflora* (51%), *S. patens* (20%) and bushes (*Iva* and *Baccharis*, 4%) having a maximum height of 1.5 m. Ponds normally cover 25% of Clam Island, although this varies depending on rains and storm tides.

I gathered all data from 15 March to 30 July 1976, 1977 and 1978. Aerial surveys by helicopter aided in establishing study sites, ascertaining nesting boundaries of both species, and censusing total numbers of nesting pairs. From early March until mid-May I observed interactions between the two species. From mid-April until the end of June all of the Herring Gull nesting areas, and all (1977 and 1978) or 25% (1976) of the Laughing Gull nesting areas were checked two to four times a week to determine breeding chronology and hatching success. The percentage of Laughing Gulls nesting in each vegetation type was determined by helicopter and ground surveys.

I determined relative marsh elevations by designating a fixed point on the marsh as zero, and measuring all elevations with respect to this point by using a Leitz self-leveling level accurate to 0.01 cm. Elevations of all nests in a 20-m wide transect served as a basis of comparison from 1976 to 1978.

Since predation might occur between species, I set up 12 dummy nests of eel grass (*Zostera*) in each of the major habitat types (dense bushes, sparse bushes,

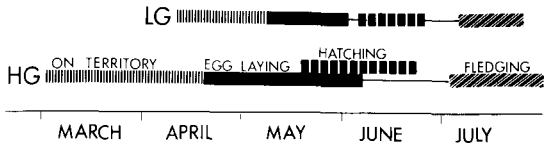

FIGURE 1. Breeding chronology of Herring Gulls (HG) and Laughing Gulls (LG) in New Jersey.

grass) in a transect from the center of the Herring Gull colony to the center of the Laughing Gull colony. Each nest, separated from other dummy nests by at least 15 m, contained two Herring Gull eggs obtained from a nearby colony. These nests were checked hourly for the first six hours, and every two hours thereafter until all eggs disappeared. Since my behavior might influence predatory behavior, I set up a series of dummy nests with eggs in another part of the colony where I could observe both series from a hide, while my assistants checked the original experimental nests.

RESULTS

BREEDING SYNCHRONY

Herring Gulls winter in New Jersey away from the colony. They arrive on the colony area in early March, and begin defending territories in mid-March (see Fig. 1). Normally they build nests a few days after selecting sites. However, 1978 was exceedingly wet and Herring Gulls built nests only a day or two prior to egg-laying. The first eggs are laid in mid-April, although the peak of egg-laying is not until early May. Due to the extended egg-laying period, hatching of early eggs begins before late nesters have laid. Fledging begins in early July, and peaks in mid-July when the young form groups in the bay.

Laughing Gulls arrive in early to mid-April and immediately select territories. They spend more time standing about their territory than Herring Gulls, and do not construct nests until a day or so before egg-laying (see Fig. 1). The brief laying period does not overlap the hatching period. They fledge at the same time as Herring Gulls.

POPULATION TRENDS

The Laughing Gull population on Clam Island remained relatively stable (about 5,000 pairs) until the mid-seventies (Rogers 1965, F. Lesser and E. O'Malley, pers. comm.). In 1976, 2,000 pairs bred on one of the four main islets, and 3,000 pairs bred on the north islet. By 1977, only 500 pairs bred on Clam Island proper, and 3,500 pairs bred on the north islet (Fig. 2). In 1978, only 500 pairs nested on the whole Clam Island complex, while 3,500 pairs nested nearby on High Bar Island.

In 1964 only 50 pairs of Herring Gulls bred on Clam Island (Rogers 1965). From 1976 to 1978 the Herring Gulls increased from 800 to 1,200 pairs, and expanded over most of the islets. In 1976 the Herring Gulls predominantly nested on the largest islet in high areas with bushes. In subsequent years they expanded into the grass, choosing the highest areas scattered about the marsh.

COLONY AND NEST SITE SELECTION

Herring Gulls in New Jersey tended to form new colonies in the high areas of marshes containing bushes (Burger 1977). At Clam

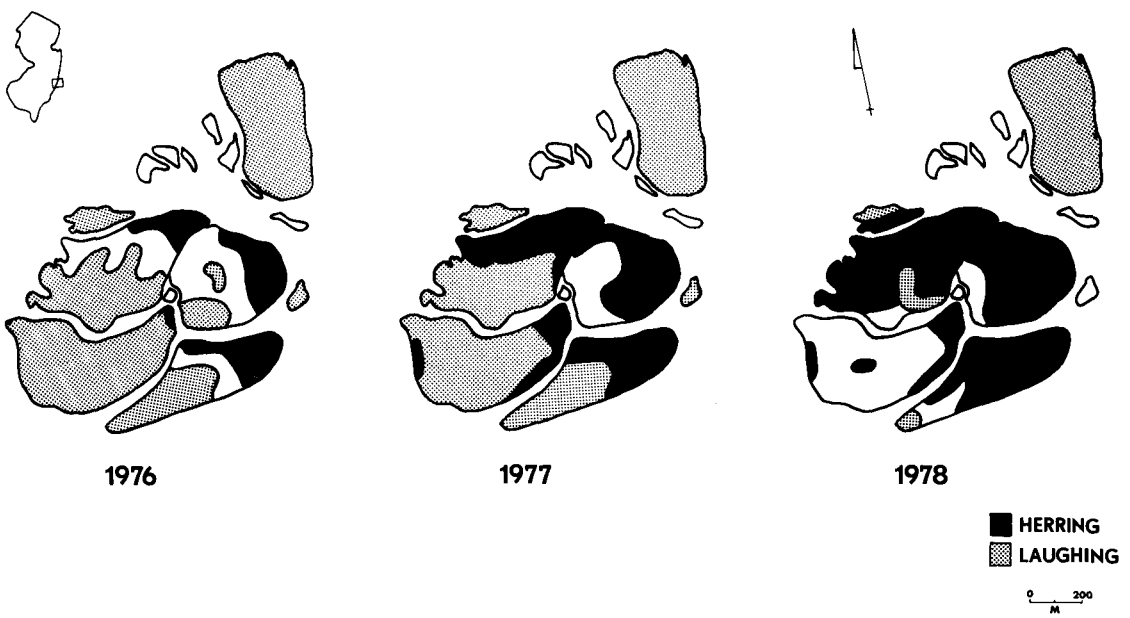

FIGURE 2. Area occupied on Clam Island by Herring Gulls (black) and Laughing Gulls (grey).

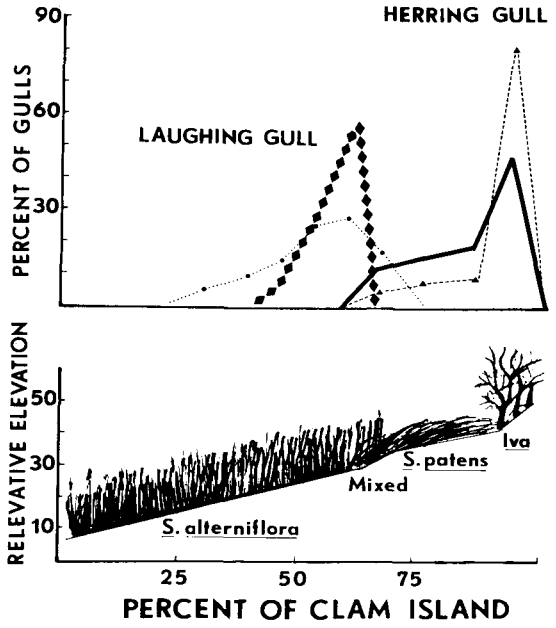

FIGURE 3. Vegetation, elevation and location of Herring Gull nests in 1976 (dashed line) and 1978 (solid line), and of Laughing Gull nests for 1976 (dotted line) and 1978 (diamonds).

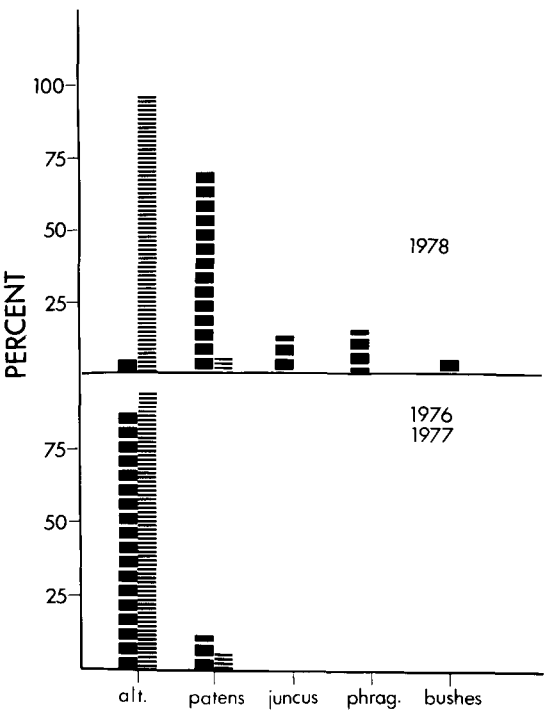

FIGURE 4. Location of Laughing Gull nests on Clam Island (lines) and in the rest of Ocean County, N.J. (rectangles) as a function of vegetation (and thus elevation) arranged in order of height with *S. alterniflora* being the lowest.

Island they also nested in the bushes, and were restricted to that habitat until the early 1970's. In 1976 a few pairs nested in the *Spartina patens* areas adjacent to the main colony (Fig. 2). By 1978 almost 40% of all nests were in *Spartina* grass (Fig. 3). For a complete discussion of nest site overlap between species see Burger and Shisler (1978).

In general, Laughing Gulls selected *S. alterniflora* marshes for nesting (Bongiorno 1970, Montevecchi 1975, Burger and Shisler 1978). On Clam Island, Laughing Gulls nested predominantly in *S. alterniflora*, although pairs initially attempted to establish territories in the higher *S. patens* areas. In 1976 and 1977 the Laughing Gulls nested in the highest grass areas available that were devoid of Herring Gulls. In 1976 I counted all of the Laughing Gull nests in Ocean County (Fig. 4). The percentage of gulls nesting in *S. alterniflora* (90%) was the same on Clam Island as on the other colonies. In another large colony farther south at Brigantine National Wildlife Refuge they also have nested predominantly in *S. alterniflora* grass for fifteen years (C. Beer and M. Impekoven, pers. comm.). In 1978, however, the pattern differed. Laughing Gulls elsewhere nested predominantly in *S. patens* (67%), and most others (27%) nested in still higher areas of *Juncus*, *Phragmites* and bushes. In some cases this involved shifting colony locations away from low *S. alterniflora* islands. This shift was necessitated by several weeks of high tides in late April which inundated the areas normally used. The Laughing Gulls that remained and nested on Clam Island, however, did not shift into the higher and drier *S. patens* and bushes, but remained in *S. alterniflora*. The birds attempted to nest in the highest *S. alterniflora* areas near the Herring Gull nesting areas (refer to Fig. 3), but were forced to move due to behavioral interactions with Herring Gulls (see below). The percentage of Laughing Gulls nesting in *S. alterniflora* on Clam Island did not differ from 1976 to 1978, although the percentage nesting in these low areas on other colonies did shift dramatically. Few Herring Gulls nested in the other Laughing Gull colonies, and those were limited primarily to *Phragmites* and bushes. Thus, in a year of normal tides, Laughing Gulls nest in *S. alterniflora* regardless of the presence of Herring Gulls (which so far have not nested in *S. alterniflora*). In years of high floodtide Laughing Gulls shift to higher locations where Herring Gulls are *not* present, but do not do so when Herring Gulls occupy these areas.

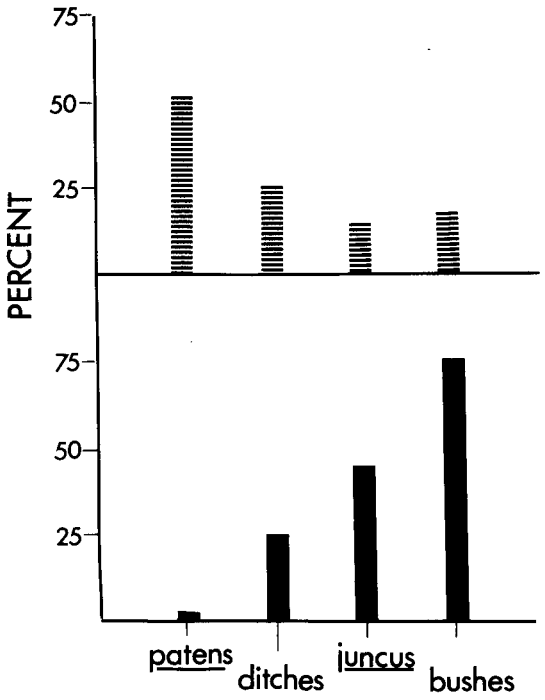

FIGURE 5. Percent of Laughing Gull nests in various habitats (top) compared to percent survival (bottom) after a heavy rain on High Bar Island.

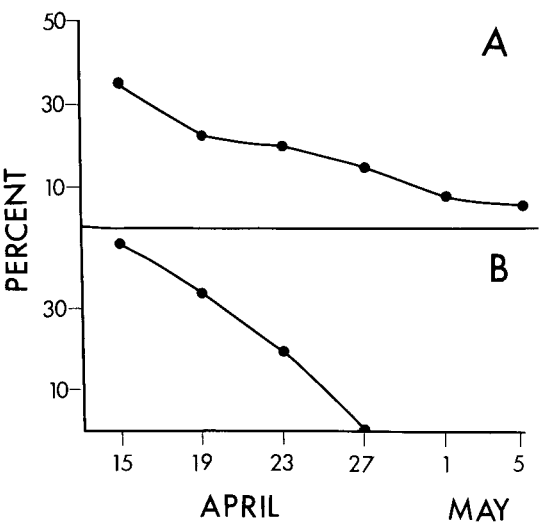

FIGURE 6. Total aggression observed in areas of Herring and Laughing gull overlap (A), and percent of aggression due to interspecific interactions (B). See text for further explanation.

The importance of Laughing Gulls shifting to higher nesting areas was dramatically shown in early July of 1978. A two-day heavy rain (as much as 15 cm of rain in five hours) drenched Clam and High Bar islands. The rain was accompanied by very high tides which again inundated vast areas of *S. alterniflora*. After the storm I surveyed High Bar (Fig. 5). The upper graph shows the percentage of pairs (N = 3,500) nesting in each habitat type, arranged in order of elevation, with bushes being the highest. When ditches are dug for mosquito control, soil is removed and placed on the marsh. These spoil areas contained *S. patens*, but they were higher in elevation than normal *S. patens* areas. Most birds nested in *S. patens* although 14% did nest in bushes. Had this colony been able to nest on Clam Island the percentage of Laughing Gulls nesting in bushes would have been substantially higher as the bush area is three or four times greater on Clam Island. The percentage of young surviving the storm and high tides is indicated in the bottom graph. Over 70% of those young from nests in the bushes survived, whereas only 5% survived from nests in *S. patens*. A higher percentage survived on the higher *S. patens* spoil areas, attesting to the importance of these areas under adverse weather conditions. Ditches created for mosquito control have been criticized (Bourn and Cottam 1939), yet they yield benefits for Laughing Gulls.

BEHAVIORAL INTERACTIONS

Competition. In the previous sections I have shown that 1) Herring Gulls arrive earlier than Laughing Gulls, 2) the characteristics of nest sites overlap, 3) nesting Herring Gulls have increased whereas nesting Laughing Gulls have decreased on Clam Island and 4) Herring Gulls have expanded the area they occupy on Clam Island whereas Laughing Gulls have contracted their breeding space. These factors suggest direct competition for nest space on Clam Island.

In order to determine the extent of interspecific interactions, I selected areas containing equal numbers of Herring and Laughing gulls in the *S. patens* contact area, and recorded all aggressive interactions, the species involved, the particular displays, and the outcome. Figure 6A shows the percent of total aggression (N = 560) that occurred each day and Figure 6B shows the percent of all aggression that was interspecific. Although interspecific aggression accounted for over 45% of the interactions when Laughing Gulls first arrived, the percentage dropped to zero within two weeks. The Laughing Gulls simply ceased interacting and left. The Herring Gulls remained to defend territories, and subsequently laid eggs.

I made observations only in areas where some Laughing Gulls and some Herring Gulls were on territory. Since these birds

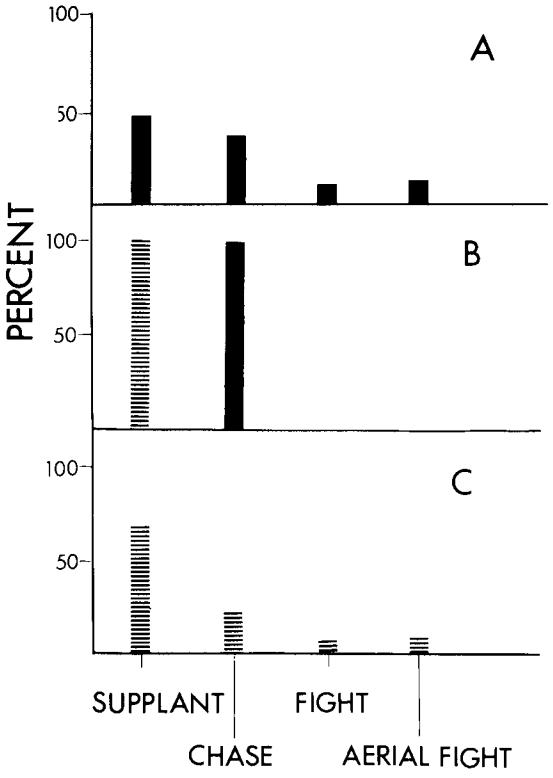

FIGURE 7. Aggressive behavior of Laughing Gulls (A) and Herring Gulls (C) against conspecifics, and of Herring Gulls (dashed line) and Laughing Gulls (solid line) against each other (B).

could not be marked, I defined a territorial bird as one that chased intruders from the area over a two-hour period. A win occurred when one bird displaced another. When a Laughing Gull was on territory it ignored 48% of the Herring Gull intruders, and only 20% of the Laughing Gull intruders. Herring Gulls, however, ignored 37% of the Herring Gull intruders, and only 18% of the Laughing Gull intruders. A Laughing Gull on territory won against Herring Gull intruders only 38% of the time whereas it won 78% of the conspecific encounters. Herring Gulls, on the contrary, won 96% of the encounters with Laughing Gulls and 79% of those with conspecifics. Thus, Laughing Gulls ignored more intruding Herring Gulls, and lost when they attempted to defend their areas. Herring Gulls, however, ignored few intruders and won most of their encounters. When Laughing Gulls defended territories against other species, they supplanted or chased the intruder 88% of the time (Fig. 7). A supplant involves flying toward the intruder and displacing it; whereas a chase involves flying or walking after the intruder. Likewise, when Herring Gulls defended their territories against conspecifics they supplanted and chased in 85% of the encounters. Thus, with respect to conspecifics, their defense behavior during the pre-egg laying stage was similar. However, their behavior differed towards the other species (Fig. 7B). When Laughing Gulls won (only 4%), they chased the Herring Gulls. Herring Gulls won their interspecific interactions simply by supplanting the Laughing Gull intruders.

TABLE 1. Percent predation by Herring Gulls on Laughing Gull eggs as a function of distance from the Herring Gull colony.

Distance from Herring Gull colony	Number of nests	Number of eggs	Percent at end of first week after laying	Percent just before hatching
10 m	40	96	70	98
100 m	40	104	52	74
1,000 m	80	219	10	19
2,000 m	80	224	2	6

In summary, Laughing Gulls attempted to defend nest sites in high *S. patens* areas early in the season. However, they lost most encounters, and were required to expend more time and energy in defense in the few instances when they did win.

Predation. It is possible that both species might engage in interspecific predation of eggs or young. I observed that Laughing Gulls did not prey on the eggs or young of Herring Gulls whereas Herring Gulls ate Laughing Gull eggs and chicks. Often I found Laughing Gull egg shells, and legs of Laughing Gull chicks with U.S. Fish and Wildlife bands in Herring Gull nests. In 1976 when substantial numbers of both species nested on Clam Island, I examined hatching rates. That year, 72% of the Herring Gull eggs (N = 650) hatched and 86% of the Laughing Gull eggs (N = 1,800) hatched in widely separated sample areas. However, in an area of close contact only 60% of the Laughing Gull eggs (N = 200) hatched whereas 85% of the Herring Gull eggs (N = 180) hatched ($\chi^2 = 17.7$, df = 2, $P < 0.001$). To examine the predatory behavior of Herring Gulls, I put out dummy nests and eggs on several areas. Significant differences occurred in the time before eggs were eaten ($F = 18.0$, df = 4,71, $P < 0.01$, least significant interval = 0.46 h). Eggs in all habitats in the Herring Gull colony remained intact for significantly longer than those in non-colony grass and in Laughing Gull colonies. Eggs in Laughing Gull colonies were all eaten by Herring Gulls within 1.5 h whereas those in the Herring Gull colony were eaten only after 2 h ($\bar{x} = 7.8 \pm$

2.1). The mean times (±SD) before eggs were eaten within the Herring Gull colony were: dense bushes = 10.7 ± 2.2 h, edge of dense bushes = 8.7 ± 4.5 h, sparse bushes = 6.7 ± 2.3 h, grass = 3.5 ± 1.1 h. In grassy areas between the two colonies the mean time before eggs disappeared was 2.1 ± 0.09 h, and within the Laughing Gull colony the mean time was 1.3 ± 0.49 h. Laughing Gulls only nested in open grass. Observations from a blind in other experiments indicated that 15 out of 16 eggs were eaten by Herring Gulls. A Fish Crow (*Corvus ossifragus*) ate the other egg.

In 1978 I sampled Laughing Gull areas 10 m, 100 m and 1,000 m from Herring Gull nesting areas (Table 1). Predation rates decreased as a function of distance from the main Herring Gull nesting area. Unfortunately, Herring Gulls are now nesting over most of Clam Island and are within easy strike distance of any Laughing Gull nests. Further, Herring Gulls have begun to nest in the bush areas on High Bar Island, where their numbers are likely to increase.

DISCUSSION

The competitive and predatory interactions between Laughing Gulls and Herring Gulls should be placed in historical context.

Direct competition seems to play the most important role in the colony and nest site selection problems of Laughing Gulls. In direct encounters with Herring Gulls, Laughing Gulls were unable to successfully defend nest sites. That Laughing Gulls compete for sites is demonstrated by their occurrence in the same areas of the marsh when they first arrive. That they lose those encounters was demonstrated by direct observations of interacting pairs, and the rapid encroachment of nesting Herring Gulls into areas previously occupied by Laughing Gulls. Their inability to successfully defend nest sites is a function of temporal (see below) and size factors. Laughing Gulls are only one-third the size of Herring Gulls. The importance of size in competitive interactions has been noted by Morse (1974) who examined competition in 20 avian studies and found that the larger species usually wins. Most studies, however, have not directly examined aggressive interactions, but inferred their occurrence and outcome from the degree of overlap in food resources (see Schoener 1974, Burger et al. 1979). Competition for food between Laughing Gulls and Herring Gulls is minor (Hunt and Hunt 1973). Burger et al. (1977) examined aggressive interactions in a mixed species roost of herons and egrets in Mexico and found that the largest species does not always win. However, for nesting assemblages of these same species (Burger 1978), the larger species usually does win. The Cattle Egret (*Bubulcus ibis*), a recent invader of North America, is an exception as it tends to win more of its encounters than predicted by its small size. Cattle Egrets and Herring Gulls are strikingly similar in that both have recently undergone a range expansion, are increasing rapidly in numbers, win aggressive encounters against local species, and threaten to displace some species (see Burger 1978).

Predation also plays a critical role in the relationship between Herring and Laughing gulls. Herring Gulls are notable cannibals (see Parsons 1971) as well as predators on other species (Patterson 1965, Tinbergen et al. 1967, Bourget 1973, Montevecchi 1977). Andersson (1970), however, found no measurable effects of Herring Gull predation on other nesting species, and Lemmetyinen (1973) reported insignificant losses of Common Tern eggs to Herring Gulls.

Statements in the literature, however, are usually vague with respect to the nature and amount of predation in natural situations. Lemmetyinen (1971, 1972) has examined, for Common Terns and Arctic Terns (*Sterna paradisaea*), the effect of predation and the defense behavior of the terns. Burger and Lesser (1978) gave figures on predation rates in twelve Common Tern colonies in New Jersey. Herring Gulls were the primary predators, and predation rates on eggs ranged from 10 to 80%. Montevecchi (1977) has provided the only quantitative data on seasonal predation rates in a Laughing Gull colony. Egg predation in 150 nests ranged from 20 eggs per day in mid-May to two or three a day in mid-July. He observed Herring Gulls preying on Laughing Gull eggs and chicks. The occurrence of maximum predation at different times in the breeding season was discussed by Nisbet (1975).

In Montevecchi's study, and in this study in 1976, the colony of Laughing Gulls was productive and territorial birds exhibited adequate mobbing defense. However, in 1978 the number of breeding Laughing Gulls was severely reduced, resulting in their inability to adequately mob and defend their nests. Often only four or five Laughing Gulls mobbed a Herring Gull, and they were usually unable to deter it. A similar effect due to low breeding numbers was noted for the Brown-hooded Gull (*L. maculipennis*) in Argentina marshes (Burg-

er 1974). When gulls flew up to mob an aerial predator, a second predator would eat their uncovered eggs. Thus, a colony disturbed by other factors (such as low density due to suboptimal habitat or competition) seems particularly prone to predation pressure.

It is impossible, of course, to be sure that these two species were not in contact at some time in the past. However, I cannot evaluate this. Historically, they did not meet until the turn of the century (Nisbet 1971). The causes for the rapid expansion are not clearly understood, but many researchers believe that the abundance of food on garbage dumps has decreased winter mortality and increased reproductive success (see Drury and Kadlec 1974, Burger 1977). The rapidity of the increase in Herring Gulls did not allow for suitable accommodations between the species, and Laughing Gulls were adversely affected (Nisbet 1971). The process seems to be continuing into New Jersey, with the same result. The new presence of Herring Gulls also affects Common Terns in the northeast and New Jersey (Burger and Lesser 1978). Similarly, in Europe the recent increase in numbers of Herring Gulls is adversely affecting Black-headed Gulls (Kruuk 1964, Patterson 1965) and Common Terns (Andersson 1970, Greenhalgh 1974). With rapid population increases, Herring Gulls require considerable nesting space—that presently used by several other gull and tern species.

Temporal factors are also crucial in the interactions between Laughing Gulls and Herring Gulls. Herring Gulls arrive on the nesting colony on Clam Island at least a month, and sometimes two months before the Laughing Gulls. In late February 1978, a few Herring Gulls landed on Clam Island and stood about in the snow, defending areas from conspecifics. They remained on the island only a few hours each day, but nonetheless they began the process of possession. By mid-March, individual gulls had well-defined territories. When Laughing Gulls arrived in early April, most Herring Gulls were firmly established on territory, and many had well-constructed nests. As Tinbergen (1953, 1956, 1959) and others have noted, a territory owner has a greater probability of winning an encounter than does an intruder. Thus, even discounting their size advantage, Herring Gulls would probably win their encounters with the newly arrived Laughing Gulls. I believe the persistence of the Laughing Gulls in attempting to defend areas from Herring Gulls relates to their nest/colony site fidelity.

Gulls strongly tend to return to the same colony and nest site year after year (Bongiorno 1970, McNicholl 1975). Philopatry has been reported for several species of gulls: Black-headed Gull (Patterson 1965), Black-tailed Gull (*L. crassirostris*; Austin and Kuroda 1953), Common Gull (*L. canus*; Onno 1967), Lesser Black-backed Gull (Brown 1967), Herring Gull (Tinbergen 1956) and Glaucous-winged Gull (*L. glaucescens*; Vermeer 1963). Although philopatry has not been demonstrated in Laughing Gulls, it is reasonable to assume that this tendency exists in instances where a nest was successful one year, and the site is dry in the next year. Thus, individual Laughing Gulls might return to discover that Herring Gulls now occupy their previous nest site. Having formerly "owned" that territory, they might attempt to defend it before giving up and moving elsewhere.

In conclusion, Laughing Gulls seem unable to adequately defend their colony and nest sites from Herring Gulls. They are thus forced into suboptimal, lower areas of the marsh. The birds that remain on their traditional sites, now near Herring Gulls, suffer high rates of predation and harassment. Those that move into lower areas are subjected to tidal floods. Additionally, moving into suboptimal habitats does not insure less predation when these areas are close to Herring Gull nesting areas. Unless long-used Laughing Gull nesting areas are protected from Herring Gulls in New Jersey, their numbers may decline dramatically as they have done farther north.

SUMMARY

Interactions between Herring and Laughing gulls were examined on Clam Island, New Jersey. In the last three years, the number of breeding Herring Gulls has increased from 800 to 1,200 pairs, while Laughing Gulls have decreased from 5,000 to 500 pairs. Herring Gulls arrive on the nesting areas in late February or early March and begin egg-laying in mid-April. Laughing Gulls arrive in early or mid-April and begin egg-laying in early May.

Direct aggressive encounters between the two species occur in areas of overlap. Herring Gulls win most of these encounters, and thus displace Laughing Gulls from these areas. Over a two-week period Laughing Gulls gradually abandon areas of overlap.

Herring Gulls prey on the eggs of Laugh-

ing Gulls in proportion to the distances these nests are from the Herring Gull nesting area. Adjacent areas suffered 100% predation whereas areas 1,000 m from Herring Gulls suffered only 19% predation. Areas farther from nesting Herring Gulls suffered still lower predation rates (6%) but were vulnerable to flood and storm tides.

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RECENT PUBLICATIONS

The Warblers of America.—Ludlow Griscom, Alexander Sprunt, Jr., et al. Revised and updated by Edgar M. Reilly, Jr. Illustrated by John Henry Dick. 1979. Doubleday & Co., Garden City, N.Y. 302 p. $19.95. The first edition of this book, issued in 1957, has long been out of print. (For reviews of it, see *Auk* 75:226–228, 1958 and *Wilson Bull.* 70:99–101, 1958.) The major changes in the new edition involve recognition of revisions in the classification of warblers and the addition of a recently discovered species. The chapters on warblers in the West Indies, by James Bond, and in Central America, by Alexander Skutch, have been rewritten. Other than this, the contents have not been much updated. The book nevertheless remains a nontechnical source of basic information on all the species in the family.

Bird Families of the World.—Illustrations by Ad Cameron; Consultant Editor, C. J. O. Harrison. 1978. Harry N. Abrams, Inc., New York. 264 p. $25.00. The class of birds passes here in review, in a book of similar scope to those by Gilliard (1958) and Austin and Singer (1961). All living families and several extinct ones are taken up in turn. In clearly organized accounts, each family is characterized in terms of its appearance, distribution, habits, behavior, economic importance, and systematics. The authors are some 40 ornithologists, but since half of them are British many families have been written up by people who have had little field experience with them. Consequently, while the accounts are informative and mostly accurate, they contain needless errors and are sometimes less solid than they could have been. The volume is oversize, nicely designed, and abundantly illustrated in color. Cameron's drawings have been planned carefully; they do not merely depict the birds but show them in characteristic postures and illustrate points mentioned in the text. This book is a good basic reference of its kind for serious students of birds.

Waterfowl/Ducks, Geese & Swans of the World.—Frank S. Todd. 1979. Sea World Press. 399 p. $44.95. Available: Sea World Press, 1250 Sixth Ave., San Diego, CA 92101. The large format, handsome layout, and wealth of superb color photographs in this book may suggest that it is simply another pictorial extravaganza. Do not be fooled; it is a work of solid value. In words and pictures, it presents virtually all the living forms of the Anseriformes, including screamers. The Order as a whole is introduced, after which each of the subgroups is treated. Closing chapters discuss waterfowl in relation to mankind—in captivity and in the wild. In his Foreword, Jean Delacour says of the text, "It is . . . of high quality, accurate and to the point, and it contains much new information about the behavior of a number of species." One appendix tabulates basic data on all the species and subspecies of waterfowl. Another gives well-founded advice about photographing these birds. Glossary, selected bibliography, and index. This book is less useful than Johnsgard's (noticed in *Condor* 81:27, 1979) as a technical reference but it is unequalled for showing the birds *and* telling their natural history.