THE BREEDING SUCCESS OF TWO SYMPATRIC GULLS, THE HERRING GULL AND THE GREAT BLACK-BACKED GULL

R. MICHAEL ERWIN

VARIOUS aspects of the breeding biology of the Herring Gull (*Larus argentatus*) and the Great Black-backed Gull (*Larus marinus*) were examined on Sandy Point, a small coastal island near Westerly, Rhode Island. Since no extensive studies have been made on interactions between gull species, the project provided an ideal opportunity to examine several parameters of breeding in the two species.

The major emphasis was placed upon comparing egg-laying patterns and hatching success between the species. For this study, three groups of gulls were designated: (1) All nesting Great Black-Backs, (2) "Experimental" Herring Gulls—those nesting in proximity to Black-Backs, and (3) "Control" Herring Gulls—those nesting at a considerable distance from the Black-Backs.

METHODS

The field work was conducted from early April until early June of 1969. Visits were made to the study area every three days, when nest checks were made. The laying date of each egg and its fate were recorded. Statistical tests used were the Newman-Keuls Multiple Range test, Student's *t*-test, and Chi-Square analysis (Steel and Torrie, 1960). Arcsine transformations were performed on the individual hatching percentages (Mosteller and Youtz, 1961).

RESULTS

Analysis of the hatching success was made for each of the three groups studied (Table 1). Using the Newman-Keuls Multiple Range test, highly significant differences were found between the hatching percentages of the three groups. Control Herring Gulls had significantly greater success than either Experimental Herring Gulls ($q = 7.19$, $P < 0.01$) or Great Black-backed Gulls ($q = 13.96$, $P < 0.01$). In turn, Experimental Herring Gulls had greater success than did Black-Backs ($q = 6.77$, $P < 0.01$). Since hatching percentages are significantly different, the number of young produced per pair will also be significantly different.

Egg-laying patterns for each group based on the date of laying of the first egg in the clutch are given in Figure 1. The Black-Backs (mean laying date = 22–25 April) lay eggs about two weeks earlier than either group of Herring Gull (mean laying date = 7–10 May). The Black-Backs exhibited a more protracted laying period than either Herring Gull group.

Since nests were visited every three days, the breeding season was sub-

TABLE 1

HATCHING SUCCESS FOR HERRING GULLS AND GREAT BLACK-BACKED GULLS

Group	Number of Nests	Total Number of Eggs Laid	Number of Young Produced	Per cent Hatched	Number of Eggs Per Pair	Number of Young Produced Per Pair
Black-Backs	48	136	60	44 **	2.83	1.25
Herring (Control)	48	142	117	82 **	2.90	2.39
Herring (Exp)	48	129	86	67 **	2.69	1.76

** All are significantly different at .01 level.

divided into 3-day intervals. To test the significance of laying date on hatching success, the 3-day intervals were blocked into three categories; "Early," "Peak," and "Late" layers (Table 2). The "Peak" layers category consisted of the mean interval plus the interval immediately before and after the mean. "Early" layers were all those laying eggs before these three intervals, while "Late" nesters included all those after. According to Newman-Keuls analysis, "Late" laying Black-Backs had significantly greater success than "Peak" layers ($q = 3.92$, $P < 0.05$) but not "Early" layers ($q = 2.92$, $P > 0.05$), even though "Early" eggs were 15 per cent less successful. There was no difference between "Early" and "Peak" layers ($q = 1.00$, $P > 0.05$). In the Control Herring Gull group, "Late" nesters were significantly lower in success than "Peak" ($q = 3.52$, $P < 0.05$), but not "Early" layers ($q = 2.72$, $P > 0.05$), although "Late" eggs were 9 per cent less successful than "Early." Again, there was no difference between "Early" and "Late" success. Experimental "Late" nesters were significantly less successful than were "Early" layers ($q = 3.87$, $P < 0.05$) but not "Peak" ($q = 3.05$, $P > 0.05$). "Early" and "Peak" layers showed no differential success ($q = .83$, $P > 0.05$). Even though "Late" and "Peak" layers were not significantly different, the "Late" had a 5 per cent lower hatching success, the q value (3.05) being close to significant (3.44) at the 0.05 level. The correlation between laying date and hatching success is shown in Table 2.

DISCUSSION

The hatching success of the three groups was vastly different. The Great Black-Backs were significantly lower in success than the other two groups. The 44 per cent hatching success was much lower than the 76 per cent success reported for Black-Backs in 1963 (Harris, 1964). Harris interpreted his high success as being a result of lack of predation. Whether the reduced success of the Black-Back on Sandy Point can be attributed solely to the

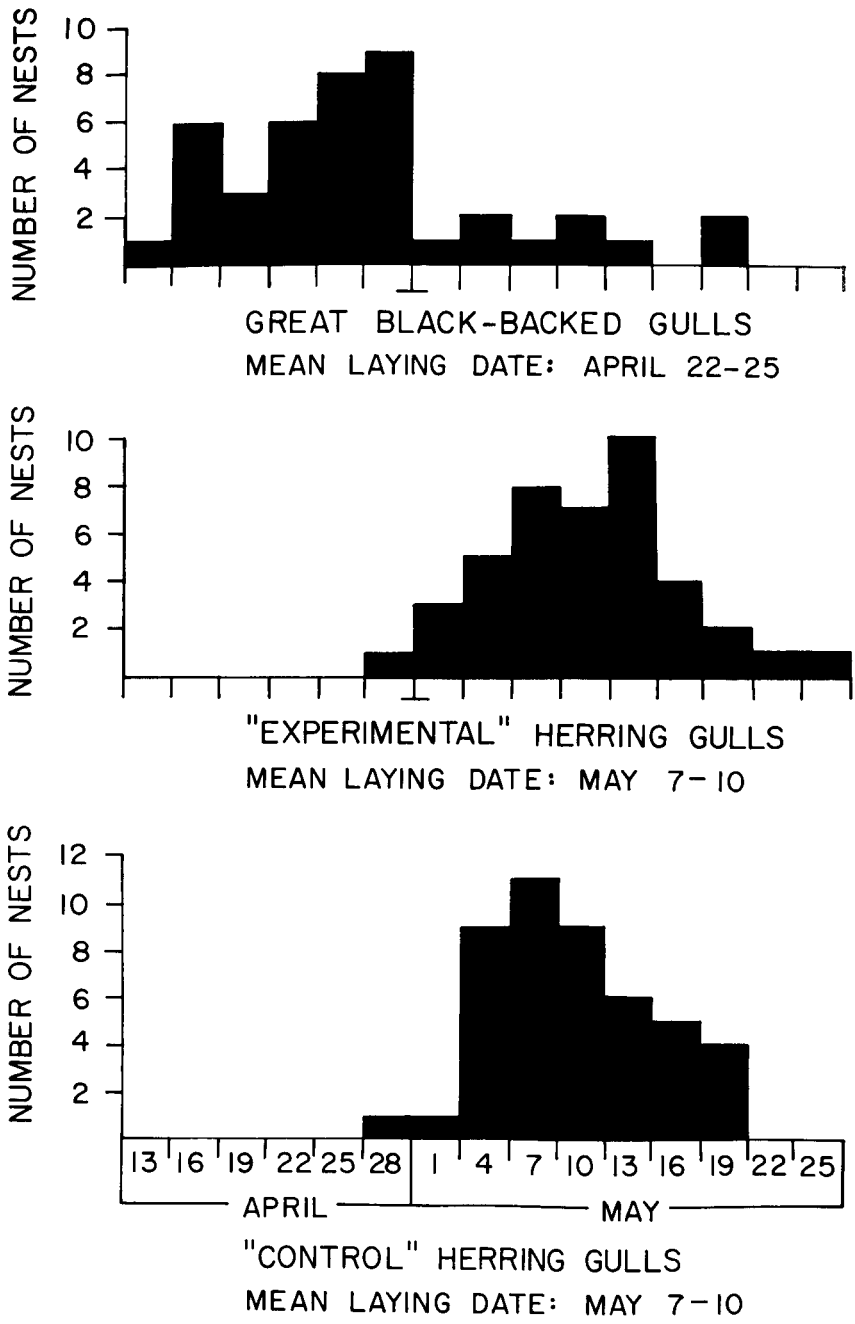
NUMBER OF NESTS
10
8
6
4
2
GREAT BLACK-BACKED GULLS
MEAN LAYING DATE: APRIL 22-25
NUMBER OF NESTS
10
8
6
4
2
"EXPERIMENTAL" HERRING GULLS
MEAN LAYING DATE: MAY 7-10
NUMBER OF NESTS
12
10
8
6
4
2
13 16 19 22 25 28 1 4 7 10 13 16 19 22 25
APRIL
MAY
"CONTROL" HERRING GULLS
MEAN LAYING DATE: MAY 7-10

TABLE 2

THE EFFECT OF LAYING PERIOD ON HATCHING SUCCESS OF HERRING AND GREAT BLACK-BACKED GULLS

Group	Laying Period	Number of Nests	Number of Eggs Laid	Number of Young Produced	Per cent Hatched
Black-Backs	"Early" (10–19 April)	10	30	15	50
	"Peak" (19–28 April)	23	62	28	45
	"Late" (28 April–19 May)	9	26	17	65
Herring (Control)	"Early" (25 April–4 May)	9	31	27	87
	"Peak" (4–13 May)	25	74	66	89
	"Late" (13–19 May)	8	27	21	78
Herring (Exp)	"Early" (25 April–4 May)	11	26	20	77
	"Peak" (4–13 May)	26	67	47	70
	"Late" (13–25 May)	9	20	13	65

predatory effects of the Herring Gulls nesting in proximity to them is questionable. Human disturbance was undoubtedly a significant factor.

One hypothetical explanation for the low hatching success might involve nest neglect. Since Black-Backs lay eggs about two weeks earlier than Herring Gulls, there is some degree of asynchrony in the breeding cycles. While Black-Backs are completing nest-building and beginning to lay eggs, the majority of Herring Gulls are establishing territories. With the establishment of territories and subsequent nest-building, fights and aggressive displays are at a peak (Tinbergen, 1956). This widespread fighting and aggressive activity of the Herring Gulls may incite excessive aggression in the Black-Backs (Ripley and Hagen cited by Udvardy, 1951). Nest neglect may result with the eggs becoming increasingly vulnerable to predation. Similarly, human presence on the island causes nests to be neglected and occasionally abandoned with continuous disturbance.

The 82 per cent success found in the Control Herring Gull group was compared to the result of 75 per cent on Sandy Point (North Control) in 1963 (Kadlec and Drury, 1968). No statistical difference was found ($\chi^2 = 2.78$, $P > 0.05$). It may be concluded that the Sandy Point Herring Gull Colony generally has a very high hatching success relative to other reported colonies (Brown, 1967; Harris, 1964; Paynter, 1949; and Kadlec and Drury,

←

FIG. 1. Egg-laying patterns of Herring and Great Black-backed Gulls in three-day intervals.

1968). The reduced success of the Experimental Herring Gull group (67 per cent) relative to the Control group (82 per cent) suggests that Black-Back predation may be significant in reducing the success of gulls nesting in proximity to them. However, whether this predatory effect would severely limit the population size of Herring Gulls, as suggested by Pough (1951) is doubtful since Brown (1967) found that the rapidly increasing population on Walney Island had only a 66 per cent success.

Darling (cited by Hailman, 1964) suggested that in colonial nesters, social stimulation caused large-scale synchrony of the breeding cycle. Hailman (1964) disputed this, finding only local synchrony in Swallow-tailed Gulls (*Creagrus furcatus*). The patterns of Control and Experimental Herring Gulls in this study would lend support to Darling's hypothesis. The study areas were considerably distant, yet the mean laying dates were identical, as was the onset of egg laying. This could possibly be due to social stimulation as suggested by Darling, as well as similar seasonal hormonal responses.

Fisher and Lockley (cited by Orians, 1961) suggested that this "Darling Effect" was important in interspecific stimulation in mixed breeding colonies. If this were the case on Sandy Point, the Experimental Herring Gulls, nesting close to the earlier-nesting Black-Backs, would be expected to nest and lay eggs somewhat earlier than Control Herring Gulls. Since this was not the case, one cannot assume that Black-Backs are socially stimulating the Herring Gulls to nest earlier.

Patterson (1965) and Brown (1967) found differential hatching success in gulls depending on when the eggs were laid. Patterson found in Black-headed Gulls (*Larus ridibundus*) that birds laying at the peak of the season were more successful than early or late breeders. Brown noted that late layers were significantly less successful than peak layers, and that early nesters tended to be less successful (but not significantly so) than those laying at the peak of the season. The results from the two Herring Gull groups tend to support Brown's findings. In both groups, "Late" layers were significantly ($P < 0.05$) less successful than either "Early" layers (Experimental group) or "Peak" layers (Controls). In the Experimental group, the "Late" layers were close enough to being significantly lower in success than "Peak" layers that notice should be taken. In the Control group, although "Late" and "Early" were not significantly different, the "Late" birds did have 9 per cent less success. Brown (1967) attributes the low success of late egg-laying Herring Gulls to increased predation and parental neglect during the waning period of the breeding season.

As suggested earlier, these same factors could act in reverse on Great Black-Backs. The asynchrony of the breeding seasons of the two species,

coupled with human disturbance, could have a relatively greater detrimental effect on the success of Black-Backs laying early in the season. Both "Early" and "Peak" layers had less success than did "Late" layers ("Late" vs. "Peak" difference was significant at the 0.05 level). Although not statistically significant, "Early" layers had 15 per cent less hatching success than did "Late" egg-layers.

SUMMARY

The hatching success of the Great Black-backed Gull and two Herring Gull groups was significantly different. The "Control" Herring Gull group had the greatest success (82 per cent) while the Black-Backs (44 per cent) were least successful. "Experimental" Herring Gulls were intermediate having a 67 per cent success.

The Great Black-Backs laid eggs about two weeks earlier than either Herring Gull group. The mean laying interval was 22–25 April for Black-Backs and 7–10 May for both groups of Herring Gulls.

Hatching success was somewhat dependent on the laying date of the eggs. In Black-Backs, "Late" layers had a higher hatching percentage than either "Early" or "Peak" egg layers. Conversely, "Late" laying Herring Gulls were less successful than "Early" layers (Experimental group) or "Peak" layers (Control group).

ACKNOWLEDGMENTS

I wish to express my thanks to my major professor, Dr. Garrett Clough, who introduced me to the project and made several visits with me to the colony. Dr. William Krueger, who served as acting major professor in Dr. Clough's absence was of invaluable assistance in the preparation of the manuscript. I also wish to thank Drs. Howard Winn, John Crenshaw, and John Kupa for their advice and consultation. Lastly, my roommate, Dr. Frank Saitta, contributed a considerable amount of time and help in the final preparation.

LITERATURE CITED

Brown, R. G. B. 1967. Breeding success and population growth in a colony of Herring and Lesser Black-backed Gulls, *Larus argentatus* and *L. fuscus*. Ibis, 109:502–515.

Hailman, J. P. 1964. Breeding synchrony in the equatorial Swallow-tailed Gull. Amer. Naturalist, 98:79–83.

Harris, M. P. 1964. Aspects of the breeding biology of the gulls, *Larus argentatus*, *L. fuscus*, and *L. marinus*. Ibis, 106:432–455.

Kadlec, J. A. and W. H. Drury. 1968. Structure of the New England Herring Gull population. Ecology, 49:645–676.

Mosteller, F. and C. Youtz. 1961. Tables of the Freeman-Tukey transformations for the binomial and Poisson distributions. Biometrika, 48:433–440.

Orians, G. H. 1961. Social stimulation within blackbird colonies. Condor, 63:330–337.

Patterson, I. J. 1965. Timing and spacing of broods in the Black-headed Gull, *Larus ridibundus*. Ibis, 107:433–459.

Paynter, R. A. 1949. Clutch size and the egg and chick mortality on Kent Island Herring Gulls. Ecology, 30:146–166.

POUGH, R. H. 1951. Audubon water bird guide. Doubleday and Co., Inc., New York.
STEEL, R. G. AND J. H. TORRIE. 1960. Principles and procedures of statistics. McGraw-Hill Co., New York.
TINBERGEN, N. 1956. The Herring Gull's world. Doubleday and Co., New York.
UDVARDY, M. D. F. 1951. The significance of interspecific competition in bird life. Oikos, 3:98–123.

DEPARTMENT OF ZOOLOGY, UNIVERSITY OF RHODE ISLAND, KINGSTON, RHODE ISLAND 02881, 9 MAY 1970.

NEW LIFE MEMBER

Among the new Life Members of The Wilson Ornithological Society is John P. O'Neill, one of the country's most talented young bird painters. A graduate of the University of Oklahoma, Mr. O'Neill is currently working on his doctorate at Louisiana State University. His ornithological interests center in Neotropical birds and he is a co-describer of four new species of South American birds. In addition to illustrating his own papers with paintings of these new species he has supplied the plates for two published books and for two more in preparation. He is an Elective Member of the AOU, a member of the Cooper Society, the American Society of Mammalogists, the Texas Ornithological Society, and the Avicultural Society. When not engaged in his ornithological work in South America he has made studies of the local Indians as a hobby. The picture shows him working on a painting of antbirds for a forthcoming book on the birds of Trinidad and Tobago.