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AN ALTERNATIVE ORIGIN OF SUPERNORMAL CLUTCHES IN CASPIAN TERNS

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Abnormally large clutch sizes among larids have been attributed to accidental retrieval of eggs displaced from other nests (Shugart 1980, Conover 1983), accidental laying by a second female (Behle and Goates 1957, Vermeer 1970, Shugart 1980), brood parasitism (Conover et al. 1979), and polygyny (Conover et al. 1979, Kovacs and Ryder 1983, Lagrenade and Mousseau 1983). Recently, supernormal clutches among five species of larids have been associated with female-female pairs (Hunt and Hunt 1977, Conover et al. 1979, Fitch 1979, Ryder and Somppi 1979, Shugart 1980, Conover 1983, Kovacs and Ryder 1983, Lagrenade and Mousseau 1983), adding the possibility that promiscuous matings and pairing of females may also explain the origins of supernormal clutches. Except for accidental retrieval of displaced eggs, all of these hypotheses assume that the eggs found in a supernormal clutch were deposited there directly by one or more females. My work with Caspian Terns (*Sterna caspia*) suggests an alternative origin of supernormal clutches.

I studied the natural history of Caspian Terns in Grays Harbor, on the coast of Washington, during 1975. I have described the colony elsewhere (Penland 1981). Part of my work involved identifying the eggs in the sequence in which they were laid in a clutch. I did this by placing a 0.5-cm^2 spot of color on the large end of each egg. Single eggs found in a nest were marked with red, and during subsequent visits the second and third eggs were similarly marked with green and blue, respectively. Approximately 250 eggs among the 1,075 clutches were color-marked.

I found unexpected combinations of marked eggs in seven clutches, including three supernormal clutches, beginning 12 days after the eggs were initially marked. The unusual color combinations included: three clutches with two red-marked eggs; one clutch with a red-marked and two green-marked eggs; one supernormal clutch with a red-marked and two green-marked eggs plus one unmarked egg; one supernormal clutch with two red-marked and two green-marked eggs; and one supernormal clutch with three red-marked and two unmarked eggs. These clutches, which I call "aggregated clutches," included eggs that were initially laid in separate nests and subsequently moved to be included together in a new nest. In the last case, the clutch consisted of an aggregation of eggs from at least three different clutches. Nest densities in the vicinity of these aggregated clutches averaged 1.3 ± 0.4 nests per m^2; the aggregated clutches were in the interior of the colony.

The combining of eggs appeared to be associated with supernormal clutches in this colony. The three supernormal clutches with marked eggs represented 12.5% of the total number of supernormal clutches; the other three- and two-egg aggregated clutches represented 0.4% of the total clutches of this size. It would be interesting to learn the sexes of attending adults at aggregated clutches because all of the supernormal clutches of Caspian Terns examined by Conover (1983) and most of those examined in other larids (Hunt and Hunt 1977, Conover et al. 1979, Fitch 1979, Ryder and Somppi 1979, Shugart 1980, Kovacs and Ryder 1983, Lagrenade and Mousseau 1983) were attended by female-female pairs. The adults at two- and three-egg clutches that include aggregated eggs should also be investigated, since female-female pairing has been associated with some normal-sized clutches in Ring-billed Gulls (*Larus delawarensis*; Conover et al. 1979, Kovacs and Ryder 1983) and Western Gulls (*L. occidentalis*; Hunt and Hunt 1977).

The aggregation of eggs that I found does not appear to have been the result of accidental retrieval of displaced eggs, since these clutches often contained several aggregated eggs. In addition, I observed no instances of nests being washed out that have led to accidental egg retrieval, as cited by Conover (1983). However, my presence periodically disturbed the entire colony and was the probable cause of nest abandonment on the periphery of the colony. The combining of eggs seemed to occur during the first half of the incubation period for the colony, because all aggregated clutches were seen before the first chicks hatched and no instances of movement of the blue-marked eggs were observed. An incident of egg aggregation may have occurred in 1976 when I found a supernormal clutch containing one red-marked and three unmarked eggs together with three exposed eggs and one partly buried egg within 0.5 m of the nest. The numbering of eggs and nests in order to determine the origin of transferred eggs and the status of attending adults at each nest would provide insight into this phenomenon.

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LITERATURE CITED

BEHLE, W., AND W. GOATES. 1957. Breeding biology of the California Gull. Condor 59:235–246.

CONOVER, M. 1983. Female-female pairings in Caspian Terns. Condor 85:346–349.

CONOVER, M., D. MILLER, AND G. HUNT, JR. 1979. Female-female pairs and other reproductive associations in Ring-billed and California gulls. Auk 96:6–9.

FITCH, M. 1979. Monogamy, polygamy, and female-female pairs in Herring Gulls. Proc. Colonial Waterbird Group 3:44–48.

HUNT, G., JR., AND M. HUNT. 1977. Female-female pairing in Western Gulls in southern California. Science 196:1466–1467.

KOVACS, K., AND J. RYDER. 1983. Reproductive performance of female-female pairs and polygynous trios of Ring-billed Gulls. Auk 100:658–669.

LAGRENADE, M.-C., AND P. MOUSSEAU. 1983. Female-female pairs and polygynous associations in a Quebec Ring-billed Gull colony. Auk 100:210–212.

PENLAND, S. 1981. Natural history of the Caspian Tern in Grays Harbor, Washington. Murrelet 62:66–72.

RYDER, J., AND P. SOMPPI. 1979. Female-female pairing in Ring-billed Gulls. Auk 96:1–5.

SHUGART, G. 1980. Frequency and distribution of polygyny in Great Lakes Herring Gulls in 1978. Condor 82:426–429.

VERMEER, K. 1970. Breeding biology of California and Ring-billed gulls. Can. Wildl. Serv. Rep. 12:1–52.

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