by compact flocking. The observation that Black-bellied Plovers are somewhat evenly spaced within these foraging flocks is consistent with the idea that such scattered flocking is an attempt to avoid intra-specific interference.

Mitchell A. Byrd, Bruce S. Grant, Stewart A. Ware, Barbara S. Warren, and two anonymous reviewers made very helpful comments on an earlier draft of this note. H. Wade and Barbara R. Stinson provided room and board on Sanibel Island. My sincere thanks to all of the above.—CHRISTOPHER H. STINSON, *Dept. of Biology, College of William and Mary, Williamsburg, VA 23185.* *Accepted 13 Apr. 1976.*

Predation and dispersion of Herring Gull nests.—Tinbergen (1960, The Herring Gull's World, Harper and Row, New York) reported that Herring Gulls (*Larus argentatus*) deserted most nests from which red fox (*Vulpes vulpes*) took eggs. The adults so affected reportedly renested at the borders of the colony, and their deserted territories were incorporated into territories of adjacent pairs. This "spreading out phenomenon," as it was termed, was believed to function as a passive defense by dispersing the nests making their location by predators more difficult.

We noted a different response in the reactions of Herring Gulls to red fox (*Vulpes fulva*) predation on South Manitou Island in northern Lake Michigan (Leelanau Co., Mich.). During studies of productivity at this colony in 1974, Shugart marked and mapped the location of 51 nests in a strip transect (10 m × 215 m) encompassing about 15% of the central nesting area. Eggs in the 51 nests were marked. Hatching began 18 May and newly hatched chicks were banded within 1–2 days of their hatching date. Shugart made the following observations. In 23 of the 51 nests during the first week of hatching, 18 chicks were killed by fox, 16 other chicks disappeared and were probably taken by fox, and 9 small chicks apparently died from exposure during nightly fox visits to the colony. Evidences for the fox predation were the presence of fox tracks on the perimeter of the colony and canine tooth punctures in the chick carcasses following the nights in question. Seven unhatched eggs that remained in the predated nests were found broken and addled outside of nests several days after the chicks were killed, disappeared, or died. The latter indicated that incubation of the original remaining eggs did not continue after the nests were predated.

Within 2–8 days after the death of the first Herring Gull chicks, Shugart observed that grass and twigs were being added to the predated nests or that new nests were being constructed near the original nests. Eight (34%) of the original predated nests had additional eggs laid in the same nest cup. Of the remaining pairs, 14 (61%) apparently laid in newly constructed nests 1 to 9 m ($\bar{x} = 2.05$ m, SD = 1.21 m) from the originally predated nests. The distance between initial nests in the sample area averaged 4.88 m (SD = 2.15 m) which is significantly more ($t = 4.580$, $P < 0.001$) than the distance between the predated nests and the newly constructed nests. Because new clutches of eggs appeared in the original nests or in new nests constructed near the original nests, we consider it likely that the same pairs of adults were renesting on the same territories.

Renesting after hatching and death of chicks from the original clutch has previously been reported for the Herring Gull (Paludan, Vidinsk. Medd. fra Dansk naturh. Foren., 144:1–128, 1951), the Glaucous-winged Gull (*Larus glaucescens*) (Vermeer, Occas. Paper, B. C. Prov. Mus. No. 13, 1963) and the Black-headed Gull (*Larus ridibundus*) (Ytreberg, Nytt. Mag. Zool. 9:5–15, 1960, cited *in* Vermeer, Can. Wildl. Serv. Rep. 12, 1968). These

papers cite only a few instances of renesting after chicks from the original clutch died. To our knowledge extensive renesting after predation has not been previously reported. Renesting in the same place after predation probably indicates a lack of plasticity in breeding responses of Herring Gulls and was maladaptive in the instance reported here since all eggs produced in the renesting were destroyed by foxes.

The response of South Manitou Herring Gulls to fox predation was different from that reported by Tinbergen (op. cit.). Renesting did not occur at the borders of the colony although apparently adequate space was available. Spreading out or even desertion of the original territory may not be assumed to be a singular response to predation because in this instance Herring Gulls renested in the same territory after hatching and predation upon the first clutch. The response of the Herring Gull to predation upon eggs or chicks may be related to the stage of the breeding cycle or the length of time spent on 1 territory, or both.—GARY W. SHUGART, *Dept. of Biological Sciences, Northern Illinois Univ., DeKalb 60115* and WILLIAM C. SCHARF, *Dept. of Biology, Northwestern Michigan College, Traverse City 49684.* *Accepted 5 May 1976.*

Egg quality in relation to nest location in Ring-billed Gulls.—A number of studies of colonial nesting birds have shown that pairs which nest in the center of a colony have a higher reproductive success than pairs nesting near the outside or periphery of the colony. This phenomenon has been recorded for the Black-headed Gull (*Larus ridibundus*) (Patterson, Ibis 107:433–459, 1965), Adelie Penguin (*Pygoscelis adeliae*) (Tenaza, Condor 73:81–91, 1971; Spurr, Ibis 117:324–338, 1975) and Black-legged Kittiwake (*Rissa tridactyla*) (Coulson, Nature 217:478–479, 1968). Coulson et al. (Auk 86:232–245, 1969) found that eggs in centrally located nests of Black-legged Kittiwakes were significantly larger than eggs in nests on the periphery and postulated that part of the early mortality of peripheral Black-legged Kittiwake and Shag (*Phalacrocorax aristotelis*) nestlings may be due to the smaller size and quality of the eggs, particularly the yolk.

From our studies of Ring-billed Gulls (*L. delawarensis*) on Granite Island, northern Lake Superior, Ontario (48°43′N, 88°29′W), we have found proportionately more eggs hatched in the center than in the periphery of the colony (see Ryder, Wilson Bull. 87:534–542, 1975). We define central and peripheral nests respectively as those in the geometric center of the colony and those forming the outside border (see Dexheimer and Southern, Wilson Bull. 86:288–290, 1974). Stimulated by the suggestion of Coulson et al. (Auk 86:232–245, 1969) that egg yolk quality might be related to nestling mortality, we tested eggs from both areas for relative amounts of nutrient and energy content in the yolk assuming that differences in these parameters might provide a clue to help explain the low hatching success of peripherally located eggs. Romanoff (Pathogenesis of the Avian Embryo, Wiley, N.Y., 1972) stated that deficiencies of various compounds in the egg may seriously disturb embryonic development and lead to premature death.

We collected one freshly-laid egg from each of 24 3-egg clutches in the center and 28 3-egg clutches on the periphery of the Granite Island colony on 17 and 21 May 1975. The length and maximum breadth of each egg was measured to 0.001 cm with vernier calipers. Egg volume was calculated using the formula $V = 0.489 \cdot B^2(\max) \cdot L$, where B is the maximum breadth and L the length of each egg (see Ryder, Wilson Bull. 87:534–542, 1975). Eggs were weighed to the closest 0.1 g on a triple beam balance in the field. Within 6 h after collection, whole yolks were separated from the albumen and stored frozen until chemical analyses were made.