that Snow Buntings migrating through coastal areas in the subarctic where spring melt has occurred are not only granivores, but also herbivores.

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THE POSSIBLE SIGNIFICANCE OF LARGE EYES IN THE RED-LEGGED KITTIWAKE[1]

ROBERT W. STORER
Museum of Zoology and Department of Biology, The University of Michigan, Ann Arbor, MI 48109

Key words: Arctic gulls; kittiwakes; vision; eye size; adaptation; sclerotic rings.

The Red-legged Kittiwake (*Rissa brevirostris*) differs conspicuously in leg color and bill length from its congener, the Black-legged Kittiwake (*R. tridactyla*). These well known characters serve as the bases for the species' English and scientific names, respectively. In contrast, a third difference, the much larger eye and opening in the sclerotic ring of the former species has not, to my knowledge, been reported in the literature.

This difference can be seen by comparing skulls of the two species (Fig. 1), but is more conspicuous when comparing the sclerotic rings (Fig. 2). The mean diameters of the openings within the sclerotic rings are 11.8 mm and 10.0 mm in the Red-legged and Black-legged kittiwakes, respectively. (For distribution of measurements, see Fig. 3.) This difference is even greater proportionally because the former species is smaller than the latter. (Mean humerus length of 6 Red-legged Kittiwakes is 81.3 mm as opposed to 88.6 for 10 Black-legged Kittiwakes—sexes equally represented.)

Large eyes are considered an adaptation for noctur-

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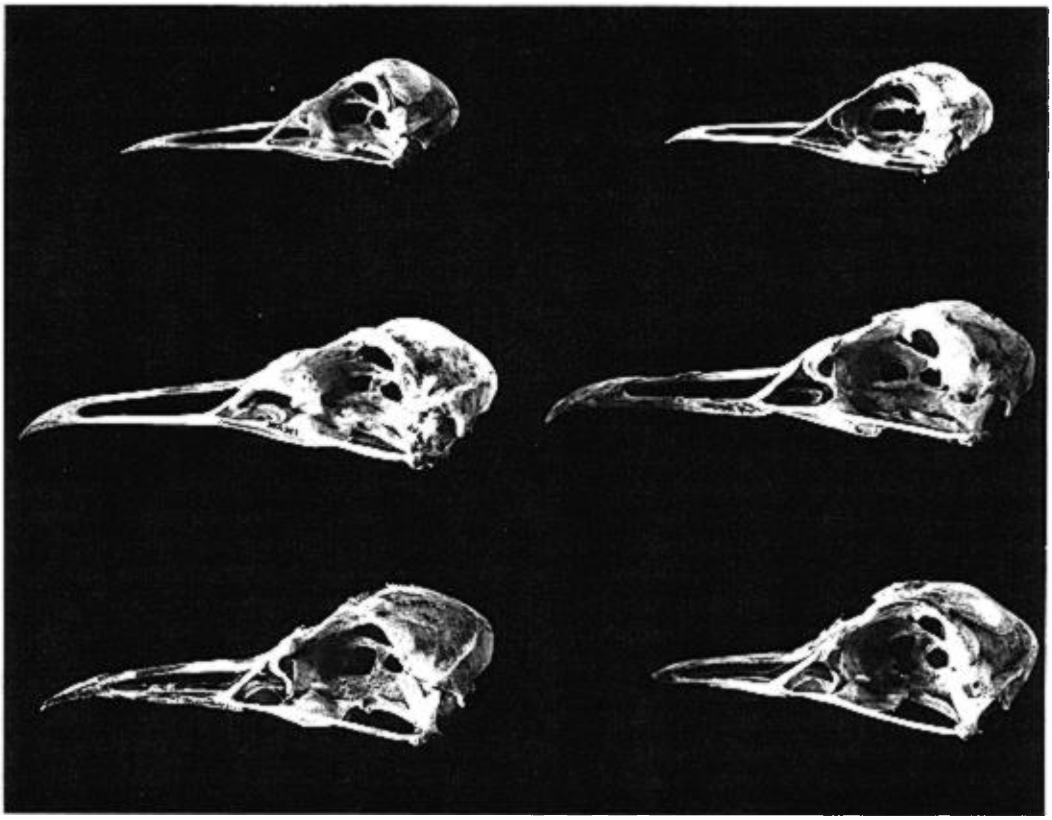

FIGURE 1. Skulls of migratory gulls (left column, top to bottom: Bonaparte's Gull, Ring-billed Gull, Black-legged Kittiwake) and of gulls wintering in the Arctic (right column, top to bottom: Ross' Gull, Ivory Gull, Red-legged Kittiwake).

nal or crepuscular vision (Walls 1942); yet I can find no evidence that the Red-legged Kittiwake is crepuscular or nocturnal like the Swallow-tailed Gull (*Creagrus furcatus*) of the Galapagos (Snow and Snow 1968). Furthermore, Gabrielson and Lincoln (1959) remark that "it is a common sight to see mixed companies of the two species [of kittiwakes] working on schools of small fish or on concentrations of other marine life." The two species are broadly sympatric only during the breeding season when days are long and extending the feeding period may not be important. On the other hand, the major wintering ground of the Red-legged Kittiwake is within the Bering Sea (Gabrielson and Lincoln 1959). Here, nights and twilight periods are long, and I suggest that extending the foraging period through greater visual sensitivity during these periods could bestow a strong selective advantage on birds with larger eyes.

To test this hypothesis, skulls and sclerotic rings of two other gulls that winter in the Arctic, Ross' Gull (*Rhodostethia rosea*) and the Ivory Gull (*Pagophila eburnea*) were compared with those of migratory gulls of similar size, Bonaparte's Gull (*Larus philadelphia*) and the Ring-billed Gull (*L. delawarensis*), respectively. Skulls of these are shown in Figure 1, in which the relatively large orbits of the two Arctic gulls can be seen. This is corroborated by the larger size of the openings in the sclerotic rings of these species (Fig. 3). As in the case of the kittiwakes, this difference is proportionally greater because the Arctic-wintering species are smaller than the migratory ones with which they are compared. (Mean humerus lengths: Ross' Gull, 59.8

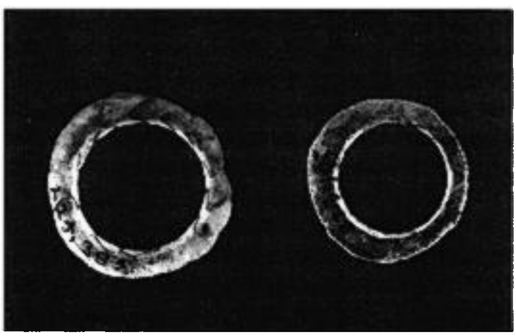

FIGURE 2. Sclerotic rings of the Red-legged Kittiwake (left) and the Black-legged Kittiwake.

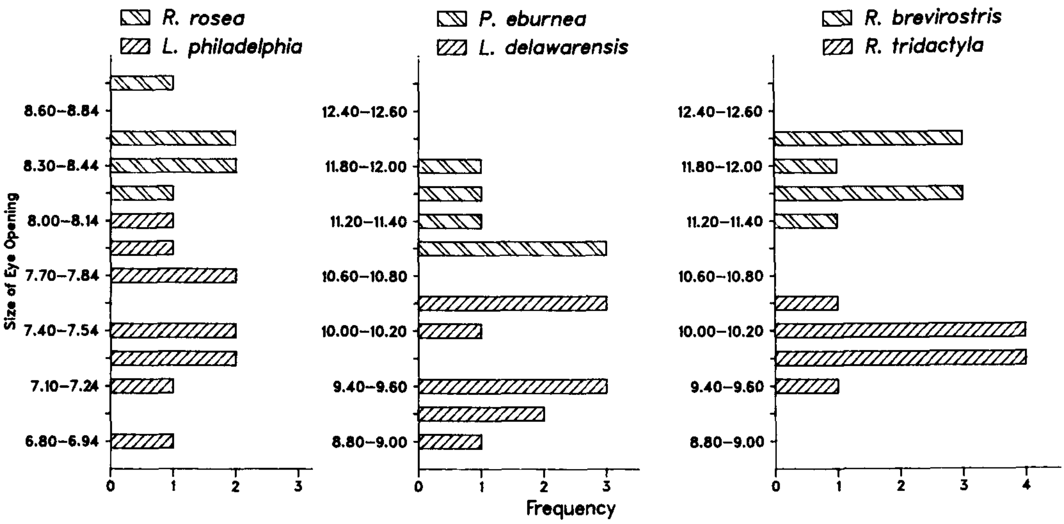

FIGURE 3. Distribution of measurements (in mm) of diameters of the opening in the sclerotic ring of six species of gulls. In each graph, the measurements for the Arctic-wintering species are greater than those of the somewhat larger species wintering to the south. ("Frequency" is the number of specimens.)

[n = 8]; Bonaparte's Gull, 66.4 [n = 10]; Ivory Gull, 91.2 [n = 6]; and Ring-billed Gull, 99.1 mm [n = 10].)

From these data, it is evident that the three gulls wintering in the Arctic have relatively larger eyes than those wintering farther south. A detailed study of the morphology of the eyes of these species and comparisons with the eyes of gulls wintering at lower latitudes should prove interesting.

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