EVOLUTION OF SOME ARCTIC GULLS (*LARUS*): AN EXPERIMENTAL STUDY OF ISOLATING MECHANISMS. By NEAL GRIFFITH SMITH. *Ornithological Monographs No. 4: American Ornithologists' Union, 1966. 6¾ x 10 inches. 99 pages, 62 text figures. $2.50 U.S. ($2.00 to AOU members).*

This monograph is an important and impressive contribution to our knowledge of the northern *Larus* gulls, whose complicated patterns of variation and overlap delight and occupy discerning ornithologists throughout the northern hemisphere. It is important in that original techniques were applied with imagination in a highly successful assault on a difficult and rewarding problem. It is impressive in the sheer volume of demanding work that Smith has accomplished, with untrained assistants, under difficult field conditions.

The monograph is exceptionally well produced. The printing is excellent and the illustrations beautifully prepared. Unhappily 'Coats Island' is mis-spelled throughout.

The ingenious experiments described bear on several related problems of species recognition, maintenance of the pair bond and habitat selection. Basically, the experiments were designed to test a hypothesis of mine[1], based on a suggestion of Salomonsen[2], that orbital ring colour functioned as a recognition mark in discouraging miscegenation between, on the one hand, Glaucous and Herring gulls, and on the other Kumlien's, Thayer's, and Iceland gulls, in mixed rookeries. The technique employed was to drug the birds at an early stage in the mating period, and change the colour of their orbital rings before they recovered. Their behaviour toward their mates was recorded before and after the alteration. Many of the experiments were undertaken with large numbers of birds and with careful controls. For example, Smith managed to induce 55 Thayer's x Glaucous gull matings, by changing the eye contrast of both male and female.

The techniques used, though obviously highly successful, are not fully explained. A large amount of collecting was evidently done, among other things for the weighing of testes throughout the breeding season. How did the removal of birds in such quantities affect the behaviour and physiology of birds collected later from the same colonies? Smith found that males collected (with drugs) by formal random sampling averaged smaller and were less variable in size than ones obtained by shooting. His explanation of this phenomenon would have been interesting. The size difference might have been caused by the bias of the shooter: by selecting for males he selected for large size. However, the difference in variance, which Smith considered more important, is not significant. But how were the drugged males distinguished from females? A few sexing errors would cause an underestimate of the mean size of males, and an overestimate of variance. Again, how were birds pre-selected for collecting by random number sampling kept in sight in the milling, disturbed flocks from the time they were selected until picked up comatose? How were whole colonies induced to take the drug? For the curves of breeding activity, what data were used, and how were they combined? These points, among others, seem to me to require more explanation.

Smith's experiments suggest that it is eye contrast as a whole, and not orbital ring colour only, that plays the important part in species discrimination. The evidence is, however, equivocal, for iris contrast is not always demonstrable where gulls of contrasting orbital ring colours cohabit; for example, in West Greenland[2]. The observation of speckled irides in some Southampton Island Herring Gulls, made by T. W. Barry in 1956 (quoted in Macpherson[1], page 25), indicates a need for further study. If iris contrast does have the importance attributed to it, the Glaucous Gull rather than the Herring Gull is surely the species which it helps to isolate from the smaller forms. The irides of Thayer's Gulls from Pelly Bay, for example, are heavily speckled, and the only other large gull of the area is the Glaucous Gull.

Smith's discovery of a small area of overlap between the breeding ranges of Kumlien's Gull and Thayer's Gull on the east Baffin Island coast has important taxonomic implications. The two forms were formerly believed allopatric and hence not specifically distinct[2,1]. Considering the difficulty of distinguishing individual Thayer's and Kumlien's gulls from elsewhere in their breeding ranges, the extent to which the two diverge

in pigmentation in the area of overlap is nothing short of remarkable. The paler, Kumlien's Gulls, are probably not distinguishable (at least in this respect) from the Iceland Gulls of Greenland, with their clear irides and white wings, while the sympatric Thayer's Gulls are as dark as they come.

I think Smith may be mistaken in his conclusion on nest-site competition. In the absence of the Herring Gull from the western, central, and northern parts of the Canadian Arctic, the Glaucous Gull commonly breeds on islets and skerries. It is only in the East, where its range overlaps that of the Herring Gull, that it largely forsakes such nest sites[3,1]. The Glaucous Gull is similarly excluded from lowland and island nest sites in Iceland, this time by the Great Black-backed Gull[4]. Here again, the Glaucous Gull retreats to the cliffs in the presence of the competitor.

What zoogeographical evidence we have suggests that the Herring Gull is a newcomer to the Canadian Arctic. Furthermore, it nests with the small marine forms only on rare, atypical rookeries, of which Smith found four in Frozen Strait and I found two off southwest Baffin Island. The Glaucous Gull, on the other hand, is a regular congener of the smaller forms. Thus orbital ring colour has diverged, in my opinion, between Iceland, Kumlien's, and Thayer's gulls on the one side, and the Glaucous Gull on the other, and not between the former group and the Herring Gull. The pale orbital ring of the Herring Gull is perhaps the product of its association with another species (*L. fuscus*).

The controversial nature of some of the points which Smith discusses only lends spice to his unusually interesting study, which I recommend to the attention of every biologist interested in adaptation and the species concept. We can look forward to further rewarding investigation of the northern *Larus* associations, in which no doubt Smith's ingenious experimental methods will play an important part.

A. H. Macpherson

1 Macpherson, A. H. 1961. Observations on Canadian arctic *Larus* gulls, and on the taxonomy of *L. thayeri* Brooks. Arctic Inst. of N.A. Tech. Paper No. 7. 40 pp.

2 Salomonsen, Finn. 1950. Grønlands Fugle: The birds of Greenland. Copenhagen. Munksgaard. 608 pp. (Danish and English).

3 Manning, T. H., E. O. Höhn and A. H. Macpherson, 1956. The birds of Banks Island. National Museum of Canada Bulletin. No. 143, iv + 144 pp.

4 Gudmundsson, Finnur. 1955. "[Icelandic birds. XI. The Glaucous Gull (*Larus hyperboreus*)]. Natúrúfraedingurinn 25: 24-35.

INTRODUCTION TO ENVIRONMENTAL PHYSIOLOGY: ENVIRONMENTAL EXTREMES AND MAMMALIAN SURVIVAL. By G. Edgar Folk, Jr. *Philadelphia: Lea and Fibiger, 1966. 308 pages, 110 illustrations, appendices, bibliography, index. $12.00 U.S.*

Physiological reactions evoked by environmental conditions are as visible as their conditions and consequent reactions are measurable. In addition to curiosity for that which is new, economy of effort and thought have prescribed to environmental physiologists the selection of animals living in circumstances different from those of the moderate climates occupied by well-sheltered people and their domestic mammals. Folk does not hesitate to show that in addition to his interest in animal physiology he has enjoyed his own experience in the Arctic in deserts and on mountains. Without appreciation for geographical variation of animals and their circumstances, physiologists cannot recognize examples of adaptation to the environment. Fortunately, in recent years, many physiologists have recognized animals representing high degrees of adaptation with resulting enlargements of our knowledge and understanding. These findings are the subjects of Folk's book.

In an extensive chapter on biological rhythms I was less confused than by many reviews of this complex subject. Solar cycles appear to provide less noisy environmental signals than other daily and seasonal changes, and Folk has presented some of his own studies showing intrinsic circadian mammalian physiological rhythms in arctic winter and summer. Like most writers he oversimplifies arctic conditions in speaking of continuous daylight and darkness, for winter nights are not uniformly dark and summer days are not without a marked solar period-