Book Reviews

Sphenesciformes

The Biology of Penguins. BERNARD STONEHOUSE, Ed. University Park Press, Baltimore, 1975. x, 556 pp., illus. $29.50.

The 19th-century expeditions to the southern oceans brought to western Europe specimens and accounts of penguins that kindled an enduring interest in this distinct group of birds. Despite the range in size from the small species of *Eudyptula* (about 1 kilogram), to the large emperor penguin, *Aptenodytes forsteri* (19 to 46) kilograms), and to the fossil *Pachydyptes ponderus* (estimated by G. G. Simpson to have weighed about 100 kilograms), the penguins are morphologically among the most uniform orders of birds. *The Biology of Penguins* is a collection of 21 essays. Some of the essays contain novel information, others are synthetic reviews, and some are critical compilations.

The newer fossil records, reviewed by G. G. Simpson, do not contribute to a further understanding of the origin of the penguins but continue to support Simpson's earlier conclusion that they descended from flying ancestors. Information on proteins (C. M. A. Baker and C. Manwell) supports this conclusion that the penguins are the most closely related to the "tube-nosed swimmers" (Procellariiformes). However, since this oldest procellariiform fossil is from the mid-Eocene and it seems probable that penguins originated in the Cretaceous, a direct procellariiform ancestry is precluded.

There is still a paucity of knowledge on feeding behavior and food items of penguins, an especially critical lack for consideration of partition of food resources among the two or more species that breed on individual Antarctic islands. Indeed, it seems that each species is able to feed on most of the kinds of items eaten by all species. Temporal relationships of annual cycles are doubtless very important. For example, J. Warham notes that when two species of *Eudyptes* occupy the same island the larger arrives first and lays first. I. F. Spellerberg draws attention to a staggering of the breeding of the populations of the Gentoo (*Pygoscelis papua*), macaroni (*Eudyptes chrysolophus*), and rock hopper (*Eudyptes crestatus*) penguins on Heard Island. Nevertheless, R. L. Zusie is able to recognize three groups of adaptations, associated with plankton feeders, plankton and large-prey feeders, and fish feeders. It is, of course, possible that the abundance of food in cold southern waters has not forced an extensive partition of food resources.

By the mid-Eocene penguins were probably successful "underwater fliers" and are now highly effective divers. The assessment of the all too fragmentary knowledge on the physiology of diving by G. L. Kooyman leads to the conclusion that that of penguins is generally similar to that of diving mammals. In both there is a marked reduction of blood flow through skeletal muscles and a postdive increase in lactic acid in the blood. It is interesting, however, that penguins apparently inhale before a dive whereas seals exhale, this difference perhaps to be attributed to their very different respiratory systems.

The breeding areas of penguins extend from the Antarctic continent to the equator. In a sense, it is for the more northern species that there has been the greater dearth of knowledge. Some alleviation of this is provided by the studies of P. N. Reilly and P. Balmford on the breeding biology of the little penguin, *Eudyptula minor*, in Australia. This burrow-nesting species in New Zealand apparently lays a second clutch in a season only on loss of the first, whereas in Australia double clutches are common and even successful triple clutches occur. A further contribution to our knowledge of temperate-zone species is the first good account (J. Boswall and D. MacIver) of the annual cycle and life history of the very widespread, abundant, partially migratory Magellanic penguin, *Spheniscus magellanicus*, in Argentina.

The northernmost species, the Galápagos penguin, *Spheniscus mendiculus*, occurs on the equator, where air temperatures may exceed 40°C and water temperatures range from 15° to 28°C. Dee Boersma reports a lability in body temperature of 38° to 42°C on land, substantially greater than I observed in the yellow-eyed penguin, *Megadyptes antipodes*, in New Zealand, and a lower lability and level (37° to 39°C) in water. She justifiably regards this lability as an energy-conserving adaptation to a harsh environment. She suggests that the unusual biannual molt of this species is an adaptation that maintains a better insulating layer against temperature stresses from insolation ashore in the Galápagos.

Behavioral displays of penguins are extensive, conspicuous, and easily observable (except in the little penguin, in which they occur at night). Since the classic treatise of Richdale (1951) on the behavior of the yellow-eyed penguin the ethology of penguins has progressed extensively, although no communication has surpassed his in richness of detail. *The Biology of Penguins* contains ethological contributions on no less than eight species.

Much of the volume is devoted to the truly Antarctic species and largely to the widespread Adélie penguin, *Pygoscelis adeliae*. For the Antarctic species, in general, there is encouraging evidence of increases in the sizes of many colonies during recent decades. These changes have probably occurred for different reasons among different colonies and species (J. W. H. Conroy); cessation of commercial exploitation, amelioration of climate, and increased availability of krill (especially important for the pygoscelid species) with the decline of whale population are suggested causes. Of interest is the recolonization by the king penguin, *Aptenodytes patagonica*, of Heard Island about two decades ago (G. M. Budd).

I. F. Spellerberg analyzes the fragmentary information on predation on Antarctic species. Many marine mammals prey on penguins, but no species appears to specialize on this source of food. Although the trophically versatile skuas and sheathbills are major predators, they appear not to have evolved specifically in this direction. Perhaps the most significant contribution is that of P. Jouventin on the emperor penguin, *Aptenodytes forsteri*, based on a 12-year study at Pointe Géologie on the Antarctic continent, perhaps the most hazardous of all avian habitats. Remarkably low fecundity and late attainment of reproductive function (4 to 6 years) are balanced by longevity.

Among the relatively few typographic errors only one can cause confusion: in table 1.1 (because of a misplaced +) the royal penguin, *Eudyptes schlegeli*, appears not to occur on Macquarie Island, where it is abundant, but rather on the Falkland Islands, where it has not been recorded. Generally the reproduction of the photographs is disappointing. Although it is in no sense a complete biology of penguins, and was not so intended, this volume is a very important contribution to our knowledge of these fascinating birds.

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