

## COMMENTARY

## ADVANCES IN PENGUIN RESEARCH

The 1st International Conference on Penguins held in Dunedin, New Zealand, August 1988, attracted about 80 penguin investigators. The distribution of penguin researchers from nine countries was more diverse than is the distribution of penguins; fortunately, penguin numbers are far more abundant than investigators and the number of penguin enthusiasts may not be far behind the number of penguins. Public knowledge, and interest in penguins is high and penguins rank not far behind bears in their public appeal. The list of sponsors of the conference which included the Japanese Penguin Fund, a Japanese citizen's group interested in penguins; Masport Industries, a company that uses penguins to advertise wood stoves; and the Royal Society of New Zealand, a scientific society dedicated to the advancement of knowledge, attests to the wide appeal of penguins.

The conference touched on almost all aspects of current penguin research. Organizers, Lloyd Davis and John Darby, divided the more than 50 papers presented into the following areas: breeding biology and demography, timing, behaviour, foraging and energetics, food and brood reduction, metabolism, captivity, monitoring and fossils (Davis & Darby, Eds. 1988).

The keynote address by Bernard Stonehouse traced the history of penguin biology and acknowledged how fitting it was to have the first conference near the site where Lance Richdale did his pioneering study of Yelloweyed Penguins *Megadyptes antipodes*. Like other fields of ornithology, the lay public has made many contributions to penguin biology.

The conference also showed that penguin research has undergone a fundamental change. The technology used to study penguins is now more elaborate than paper, pencil, and scales. Video and tape recorders, microprocessors, microcomputers,

telemetry and radioactive isotopes are often integral tools used in data gathering. These technical advances have given researchers the ability to use free-living penguins to learn more about penguin physiology, foraging behaviour and penguin movements. With diving gauges attached to the birds, the duration and frequency of dives can be determined. Speed meters can measure how fast penguins can travel (7 - 8,5 km/h), and where they go to feed (Little Penguins *Eudyptula minor* feed within 5 km of the colony, Adélie Penguins *Pygoscelis adeliae* 30 to 40 km out to sea with some going more than 150 km). Technology, however, has not solved all problems since penguins sometimes thwart investigators by losing equipment and disappearing. Metabolic rates at sea can now be measured and were found to be twice as high as they are on land. In Adélie Penguins, females may have a higher metabolism and show a greater mass loss than males but metabolic rates of the sexes of other species of penguins are similar (e.g. Little Penguins). Daily moult costs are high and are apparently somewhere between 1,5 and 2 x BMR.

The public appeal of penguins and advances in zoo husbandry were evident at the conference. Studies of captive populations are becoming more common, presumably because penguins are common in captivity and accessible. Until recently most penguin research was done in the wild and researchers were sceptical of captive results because of fears that the animals were not "normal". However, captive populations offer greater opportunities for experimental manipulations and greater control of external conditions than are possible in natural settings. The papers demonstrated that investigators can perform controlled experiments such as showing the importance of light intensity and day-length on breeding biology. Circadian rhythms and changes in physiology can often be more systematically explored using penguins in captive environments,

where light and temperature can be controlled and modified. Behavioural insights can be gained from zoo populations because individuals can be more easily followed under semi-natural conditions. For example, males began braying at a new nest site sometimes a year before they moved. The significance of braying location and its importance to nest site selection would be difficult to discern by watching non-captive penguins.

Researchers showed the ecological and behavioural heterogeneity that exists between species and populations of penguins. Advances in gathering food samples without sacrificing the individuals have made it possible to compare diets between and within species without damage to local populations of penguins. Advances are such that it should be unnecessary for investigators to kill even one penguin to check what it has eaten. Increased fishing in the mostly remote areas where penguins breed requires a greater understanding of the effects of fishing on penguin diet and success. We still understand little about how food affects reproductive parameters, although it is clear that food is important. Even the sex of krill that a penguin eats may affect energy budgets since female krill contain about 30% more energy than the males. How diet and the distribution and abundance of prey affect penguin reproduction is beginning to be explored. Eventually questions of why re-laying varies within a species and between locations by as much as 50% (Gentoo Penguins *P. papua*) will be determined.

Penguins, at least on occasion, appear to defy at least two well held theories. With telemetry devices, researchers are able to test whether the assumption of a positive correlation between nest relief and distance to foraging area was correct. Data given for Gentoo Penguins showed there was no relationship between the size of a food load and the time a penguin was absent from nest. The diving physiology of penguins presented a second violation of theory. Diving records from King and Emperor Penguins *Aptenodytes patagonicus* and *A. forsteri* show they frequently dive to depths of more

than 100 m. These dives present an interesting problem because if the gas exchange at depth is similar for these two species as for other species of penguins, gas bubbles should form in their blood and tissue upon ascent. The surprise is that these penguins don't appear to get the bends and why the don't remains unknown.

Penguins have been around since at least the late Eocene (40 million years ago) and are restricted to the Southern Hemisphere. Despite extensive studies their origin is still unclear but they may be related to the Gaviiformes. A number of species has become extinct and many of these are rather large compared to living species. The relationship and cladistic grouping between extinct species of penguin may provide insights into the ecological ties among groups.

The conference presented data on many aspects of penguin biology that may prove to be useful in the protection and conservation of penguins, although very little was said at the conference about the conservation of penguins. One of the most serious issues is how penguin numbers and diversity can be maintained in the face of increasing human numbers and exploitation of both the marine and coastal environment upon which penguins depend. Whereas the number of people visiting Phillip Island in Australia is increasing, the number of Little Penguins breeding on the island is decreasing because of predators. Similarly, Yelloweyed Penguins have decreased in numbers because of introduced predators. Chick mortality of Yelloweyed Penguins has almost doubled in the last 50 years and in some areas all eggs are eaten. The status of Adélie Penguins differs markedly compared to the previously mentioned species. Their numbers in the Ross sea region decreased in the 1960s, increased in the 1970s and 1980s and have increased still more rapidly recently. Why there has been these changes in the distribution and abundance of species is not clear. We still do not understand why and how penguins colonize one area and not another. A new population of Little Penguins breeds in Melbourne Harbour, Australia

on an artificial breakwater, but why they have colonized this area is unclear. If penguins are to continue to be a dominant species in much of the southern hemisphere, we need greater understanding of their ecology and how adult survival and current levels of reproductive success can be assured.

The 1st International Conference On Penguins showed how much we do understand about penguins, but it also demonstrated how little our scientific knowledge of penguins is coupled with a political agenda to protect them. A second conference on penguins will need to integrate our scientific knowledge of penguins with a conservation focus on species such as the Peruvian *Spheniscus humboldti*, Yelloweyed, Jackass *S.*

*demersus*, Galapagos *S. mendiculus* and Little Penguins that have recently decreased in numbers and in some areas are in serious trouble.

#### REFERENCE

DAVIS, L.S. & DARBY, J.T. (EDS.) 1988. 1st International Conference on Penguins, Dunedin, New Zealand, 16-19 August 1988. Abstracts of presented papers and posters. *Cormorant* 16: 120-137.

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