N.Z. ECOLOGICAL SOCIETY

Report of Fifth Annual Meeting

The fifth Annual Meeting of the New Zealand Ecological Society was held in Wellington in the Biology Department of Victoria University College on Thursday and Friday, May 10*th and* 11*th,* 1956. *The programme followed the same pattern as those of most previous meetings of the Society. The whole of the first day was devoted to a symposium, the subject being "The Delineation of Natural Areas in New Zealand." On the second day a shorter symposium on "Cook Strait as a Field for Ecological Study" was held in the morning, and in the afternoon there was a programme of contributed papers on a variety of topics. The Annual General Meeting was held on the Thursday evening and was followed by the Presidential Address. During the meeting photographs and specimens of ecological interest were exhibited in an adjacent room and attracted much interest. On the Saturday following the meeting a number of members took part in an excursion to Lake Wairarapa and the surrounding district. Owing to an unfortunate clash of dates the number of members attending the meeting was smaller than in some previous years, but the attendance was up to* 80 *at some sessions.*

PRESIDENTIAL ADDRESS

Ecological Aspects of Antarctic Biology

Dr. R. A. Falla

A revival of interest in the Antarctic regions occasioned by plans for expeditions sponsored by more than a dozen countries makes it appropriate to reconsider some aspects of biological work in the Antarctic. It is true that most of the planning for scientific work centres on the vast programme of the International Geophysical Year, a project in which the polar regions are only a part of the total coverage, and it should also be noted that practically none of the expeditions now being planned has any adequate provision for sustained biological work except where transport vessels have the necessary equipment and allowance of time to include biological work in a programme of oceanographical stations.

Biologists need not, I think, be unduly disappointed at this picture. There have been more ample opportunities in the past and earlier expeditions have included a larger proportion of biologists and naturalists than is the case today. Good work has been done in collecting and observing, but there has been too little attention given to co-ordinated thinking and action for planned research in fields in which useful results might be expected. It is due to the great advances in technique and methods in geophysics and related sciences as well as a high degree of organisation at the international level that the present boom, as it may be called, has been brought about in the application of physical science research in the polar regions. Biologists may indeed welcome the prospect of the more precise knowledge of physical factors of environment which will undoubtedly result from the intensive attack which is to be made on them between 1956 and 1958. Another indirect result of increased Governmental interest in the I.G.Y. programme in almost every country is that the establishment of transport services and fairly permanent bases seems to be assured on a greater scale than ever before, and there is little doubt that any of the sciences

that may temporarily be in the role of Cinderella may yet be able to establish themselves in a modest corner of the comfortable quarters now being planned for physicists and adventurer explorers.

None of the features characterizing biological work as carried out in the Antarctic can be regarded as unique. Accepted concepts and standard techniques are valid here as elsewhere. My reason for singling out Antarctic biology for special treatment is rather directed to drawing attention to certain conditions that tend to simplify problems which are obscured by a greater complexity of factors in other parts of the world. It has, for example, for a long time been recognised that both flora and fauna of polar regions are characterized by comparative paucity of forms and a great multiplication of individuals. This is true of the plankton of polar seas, and attention has been drawn to it by many writers. It must be recognized that the biology of the Antarctic is basically the biology of the Antarctic seas, and this address might well have been restricted to a summary of the work that has been done on the physical environment and the marine plants and animals of the region. I feel, however, that there is sufficient general literature available on this subject, and that we might gain something from approaching it from the standpoint of an investigator stationed on the edge of the land mass or the continental ice. It will be recognized, of course, that in the absence of any plant life higher than mosses and lichens, which support a very restricted and minute fauna, all animal activity on exposed rock or ice is peripheral to a mainly pelagic existence for all the animals concerned. Thus rock and fast ice are of interest to penguins only insofar as they meet the needs of reproduction and annual moult. Seals have much the same kind of association with bay-ice and shore-lines, and there are a few predators associated with the seasonal activities. Below the level of mammals and birds there are no groups, with the exception of parasitic invertebrates, with which the ecologist need be concerned, or rather that he could not study equally well elsewhere. It is true that there is a limited freshwater fauna, mainly protozoan, and a limited moss fauna, but its character is much the same in all essentials as that of freshwater and of moss in frigid areas anywhere. More than half the number of Rotifiers described from Antarctica, and nearly all the Tardigrada occur widely elsewhere. For these reasons, and because of my own more direct professional interests in the groups, I shall confine the development of my theme mainly to the field of vertebrate zoology.

The area itself has long been recognized as a conveniently definable biogeographic region, and of the various concepts of community classification proposed by ecologists its life conforms most closely with what has been called a biotic province, defined in part as "a considerable geographic area over which the climate is relatively uniform, though often locally modified by physiographic features." (Dice.) Whatever may be the merit in regions of greater complexity elsewhere of such alternative concepts as life zones, biomes and others, Antarctic animals fit into the biotic province concept neatly and to a degree that calls for very little subdivision. It is of course a vast one. The continent itself, ice-cap and rock framework, covers an area of the earth estimated at more than 500,000 square miles. Even if we regard only a coastal strip as of direct biological significance there are still some 10,000 miles of coast-line to be considered. That conditions over the whole of this vast distance are practically uniform is sometimes regarded as obvious on geographical grounds but does require some explanation. The topography, dominated by a high central ice-cap, determines almost all the atmospheric circulation at the coast, and air masses from the north seldom touch it. The same is true of water masses and very little current of northern origin reaches Antarctic shores because of a buffer of west-moving drift generated by the prevailing local winds at the coast. Thus is isolation and uniformity preserved except in the Scotia Arc and Grahamland area alone where intrusive elements may be traced to South American relationship. The intrusion of a little more variety of life at this point includes the only two flowering plants known in Antarctica, a grass and a *Colobanthus*, a few associated insects and an addition to the usual basic list of breeding birds of a cormorant, two extra penguins and a sheathbill.

Geographically then we can orient ourselves on a polar projection and envisage a biogeographic region which is merely a liv-

ing fringe flanking a dome of ice where no life exists. Its surface offers the limited variety of polished rock, and morainic debris interspersed with ice and snow and supporting no flowering or woody plants, with the addition of almost featureless fast bay-ice, and a varying extent of unstable floating pack-ice. In other words, the features of the physical environment can be listed and assessed with a fair degree of completeness and simplicity. The list of organisms with which we are concerned is also reasonably complete and is not unwieldy. The known terrestrial invertebrates are usefully summarized by Lindsey (1940) in one sentence: "Several protozoans, sixteen species of rotifers and the same number of tardigrades, two fresh-water crustaceans, mites, and at least eighteen species of insects comprise the known fauna." There are strictly no terrestrial vertebrates if we understand as such any animal that is supported by the land on which it lives. But the land does supply essential elements in the life of birds and seals which depend on the sea for food, and as they also are few in number of kinds there is material for a reasonably complete picture.

This is an appropriate point for a digression on implications for scientific programmes. We owe this reasonably complete list to skilful and laborious collecting under difficulties, but it is not yet time to regard that phase as ended. There is probably not one fully adequate series of specimens of any of the known animals yet assembled; and in addition there is the stimulus that a "reasonably complete" list must heighten the challenge to find the more elusive forms yet unknown. This is true of the lichen flora. One sledging party of the second Byrd Antarctic Expedition obtained no fewer than 77 new species of lichens to add to the 216 previously known. They have been found within 237 miles of the Pole in the Queen Maud Range, and Lindsay, pointing out that many masquerade as minute crumbs of dirt on rock, predicts that "lichen-conscious sledgers" will undoubtedly find many more.

The phrase "lichen-conscious sledgers" may suggest that collecting must be done largely by non-scientific personnel. In the present state of planning and organisation for expeditions this is almost inevitable, but it can be accepted as making an important contribution. Even when there happens to be a botanist or a biologist of any kind included in the main party, he is not likely to be a participant in all sledging trips to localities of interest. Time spent in encouragement and instruction to fellow-members of the party in such matters is time well spent, and a specialist who is neither too patronising nor too uncommunicative will find ready and intelligent assistance among the trained personnel who may be schooled in other disciplines. Any expedition that fails to make adequate provision for the needs of basic collecting of plants and animals of all groups is failing in a fundamental responsibility. A further problem to be considered is that when biologists are included in Antarctic expeditions, the number possible is seldom more than one. The choice must be made whether to select a man for a specialized research project or one prepared to deal with a wider general field. Rather than express a preference between these two alternatives I would suggest that a useful compromise is the selection of a biologist with a wide range of aptitude but with willingness and ability to undertake at least one specialized line of investigation. Equipment, laboratory facilities and library resources can seldom be adequate for sustained research, which requires them as immediate tools, and in general field techniques for dealing with fresh material or planned observations of the habits and behaviour of organisms are more practicable. It should be noted also that there is an attractive field open to physiologists who will find abundant material in the mechanisms of adjustment and reaction of the established plants and animals as well as of adventitious man.

I propose now to outline from the two groups, mammals and birds, something of the picture built up by past and current researchers, with forecast and suggestion of the trends for future research that may most readily fill the existing gaps in knowledge. The Antarctic seals, for example, are all eared seals, and the four species regularly occurring within the Antarctic circle show an interesting diversity of habit and striking differences of degree of adaptation to the environment.

The Ross seal is regarded as rare, and nothing significant is known of its habits. An inhabitant of the pack-ice, solitary, known to feed on cephalopods, crustacea, and fish—that sums up the present state of

our knowledge of the life of *Ommatophoca rossi*. The long-term study that will be necessary to elucidate its life-history has not even been begun, but a start may be made this year in which so many simultaneous expeditions should at least be able to ascertain whether its supposed rarity is actual or just a matter of local and restricted concentration.

The Leopard seal is more widespread, but also apparently solitary. It has a diversified diet of the flesh of birds and mammals as well as of fish and cephalopods, and it ranges widely and regularly into the subantarctic to prey on penguins. Information on its bionomics is still sketchy, but it appears to be dependent on pack-ice for nursery requirements of short duration, and for an important constituent of its diet—young seals of other species. It has a significant role as a predator on seals and penguins equalled only by that of the killer whale (*Orca*).

The Crabeater seal is more highly specialized in structure and habits, but is numerous in its restricted range. It frequents offshore pack-ice almost exclusively and feeds on crustaceans of the genus *Euphausia*. Its multicusped cheek teeth enable it to strain out a mouthful just as successfully as does the mouth structure of whalebone whales. Its dependence on Euphausiids keeps it associated with the pack probably throughout the year though its winter movements are not well known. The lactation period is short and growth rate rapid compared with other southern seals; indeed, it is thought that pups may be in the water within a fortnight of birth.

Good preliminary work has been done, notably by Lindsey (U.S.A.) and Bertram (British Grahamland Expedition) and more recently a detailed study of the Elephant seal (*Mirounga leonina*) has been undertaken by Laws of the Falkland Islands Dependencies Survey. The Elephant seal is more strictly subantarctic, but its adaptation to Antarctic conditions in some parts of its range indicates the trends of adaptation in the truly Polar seals.

The birds of Antarctica have always attracted much attention, and important investigations are being pursued in several parts of the region. It will suffice here to mention the almost romantic course of study of the Emperor penguin, the most completely specialized and adapted of Antarctic birds.

*The recorded life-history of Emperor penguins will always be associated with the name of Edward Wilson. Before he commenced his field work with the British National Antarctic Expedition in 1901, little was known, but when the spring sledging parties discovered at Cape Crozier a rookery in which the main nesting season already was over, Wilson described the frozen eggs and chicks in great detail and pieced together the evidence; breeding cycle, commencing with eggs laid about mid-winter day; incubated by birds standing on fast sea-ice and holding the egg on their feet; helpless chicks held similarly by one parent while the other gathered food; and then the extraordinary period when the guarding of growing chicks is shared by all the adults present, including birds otherwise unemployed. The young, although they grow faster than King penguins, are nevertheless not fledged and able to take to the water until February. They spend the next winter and perhaps more than one of free adolescent life on the heavy pack-ice, feeding on squid, small fish, and crustaceans.

Wilson posed for himself and other zoologists a number of problems arising from this life-history. To solve some of them he planned a winter journey to Cape Crozier during Scott's next expedition in 1910, and how he, Bowers and Cherry Garrard carried it out is told in the book by the last-mentioned, "The Worst Journey in the World." Wilson did not live to follow up the research, but later work is gradually supplying some of the answers. The hard-won specimens of the embryo within the egg give no clue to ancestry, as the rather over-simplified theory of recapitulation current in Wilson's day had given rise to a hope that they might. Another feature that has remained more puzzling is that the onset of the breeding season occurs without the external stimulus of increasing daylight which has now been shown to be a factor influencing so many other birds. In this matter, however, recent work tends to show that the nature of the external stimulus is secondary in importance to the establishment of an internal rhythm (Marshall and Coombs, "Nature," vol. 169, p. 261, 1952). The Emperor penguin seems

to be remarkably adapted in structure, internal rhythm, life-history, and habits to environmental conditions which are rigorous by any standard. Its home terrain is so difficult of access and its habits outside the breeding season so undemonstrative that we have as yet no detailed account of its behaviour. Cape Crozier as nesting centre has apparently a small population and high mortality compared with other nesting places subsequently discovered at Queen Mary Land, Gaussberg, and an area off the Caird Coast.† Still another area, recently discovered (1950) at Point Géologie in French Adélie Land, is estimated to have a population of 5,000 birds, and may prove more accessible to the scientists of the French Expedition working there. A sixth breeding station, on the Dion Islets near Marguerite Bay, has been under observation by biologists of the Falkland Islands Dependencies Survey since 1949.*

† Young birds were recorded from here by Shackleton's 1914-16 Expendition.

- quoted from "Antarctic Birds" (R. A. FALLA) in"The Antarctic Today."