

Book reviews

Antarctic siphonophores from plankton samples of the United States Antarctic Research Program

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In *Biology of the Antarctic Seas XX*, edited by L.S. Kornicker. Antarctic Research Series 49.

American Geophysical Union, Washington, D.C. 1990

436 pages. \$69.00 ISBN 0 87590 173 5

This volume is a monographic study of the siphonophores in the Antarctic, Subantarctic and adjacent regions of the Atlantic and Pacific Oceans, though not all species known from the literature are included. It treats 80 species of the suborders Physonectidae and Calycophorae, five of which are new to science. In addition, the eudoxid stages of *Lensia lelouveteau* and *L. reticulata* are described for the first time. The material was collected during the USNS *Eltanin* cruises 3–5, 8–23, 25–28, 35 and 38 during all main seasons from 1962 to 1969. Additional data were assembled from the South Atlantic west of 0° and during *Eltanin* cruise 30 into the tropical Pacific but also including some more southerly stations exposed to the austral winter.

In addition to non-closing nets, multiple opening/closing devices were used to sample discrete bathymetric zones: the bathypelagic (2000–1000 m), mesopelagic (1000–200 m), and epipelagic (200 m to the surface). Species were quantitatively sorted using different methods (which, however, have not been described completely) to take into consideration the colonial structure of the organisms and their developmental stages. For example, for the families Diphyidae, Clausophyidae, and Abylidae, both the polygastric and eudoxid stages were counted. This detailed work allows estimates of the numbers of animal stocks belonging to each species per 1000 m³ of water in the three vertical habitat zones and permits the detection of fluctuations in abundance on different scales of space and time.

The species are introduced in taxonomic order. The distributional patterns of each species in the regions of concern are described and supplemented by worldwide records from the literature. Abundance terms are used to characterize regions of varying horizontal concentration according to season and depth as well as to present information on diurnal or ontogenetic/seasonal migrations. The information on each species is completed by at least one illustration of either the entire organism, often of both the polygastric and eudoxid stages, or characteristic parts of it. The descriptive part, totalling 65 pages, ends in a discussion of the seasonal and large-scale spatial patterns. The obvious patchy occurrence of siphonophores is suggested as being a result of the reproduction mode or predator-prey relationships. The

potential role of siphonophores as indicators of hydrographic conditions is also discussed.

The voluminous appendix of more than 360 pages comprises detailed station lists and tables of concentration data which were obtained from non-stratified tows and omitted from the extended compilation of distribution maps. In the latter, four categories of numerical abundance have been established to illustrate the patterns of seasonal abundances for most of the species and their development stages in the three bathymetric habitat zones. The maps from the western South Atlantic indicate the mere presence of species.

Overall, this is a substantial work which provides a long needed review of species of this truly carnivorous zooplankton group in the Southern Ocean and adjacent regions. It provides an up-to-date summary of contemporary knowledge of the zoogeography and abundance of siphonophores in these waters, calling attention to their ecological role, which needs much additional study. For anyone involved with this group, this volume is indispensable. Size scales would have improved the usefulness of the carefully executed illustrations for the non-specialist.

HORST WEIKERT

Atmospheric Sciences in Antarctica

Edited by John W. Meriwether

American Geophysical Union, Washington D.C. 1988

293 pages \$22.00 ISBN 0034 6853 B

The relatively unpolluted Antarctic atmosphere is a unique region on at least ten counts. It has the coldest, driest and windiest troposphere which is believed to be particularly susceptible to the increasing greenhouse effect due to increasing concentrations of infrared-active gases such as carbon dioxide. The unique dynamical, chemical and radiative conditions of the stratosphere cause the springtime Antarctic ozone depletion - the ozone "hole" - to occur there. The large displacement between the geographic and geomagnetic poles leads to extreme ionospheric conditions not encountered elsewhere on the Earth. And, being a pole-centred continent (or almost), it is a splendid platform for mounting networks of ground-based experiments. Free from most electromagnetic interference, it is ideal for investigating the auroral upper atmosphere and the distant magnetospheric boundary regions that are linked to it by geomagnetic field lines. All these subjects are of great topical research interest.

Antarctic atmospheric scientists should therefore be most grateful to John Meriwether of the University of Michigan for so competently organizing, in one valuable volume of

almost 300 pages, this series of seventeen papers. They were first published in 1988 in *Reviews of Geophysics*, an American Geophysical Union journal. These papers summarize, assess and evaluate current knowledge in all these fields, and more, obtained using the latest technology.

Highlights of this volume include investigations of tropospheric aerosols, katabatic winds, column amounts of nitric acid and other infrared-active trace gases, and ozone. Ground-based Dobson spectrophotometers and balloon-borne ozone sondes reveal the spatial and temporal variations of ozone amounts, thereby complementing data from polar orbiting satellites. A new ground-based optical technique detected the amount of OCIO in the lunar absorption spectrum. This unusual molecule is produced during the catalytic destruction of ozone by chlorine derived from chlorofluorocarbons.

The dynamics of the thermosphere are well studied using ground-based and satellite borne optical instruments. Other optical studies have focused on the geomagnetic conjugacy of aurorae and also on dayside aurorae. Hydromagnetic waves observed on the ground in the polar regions and aboard satellites provide evidence of flux transfer events at the magnetopause.

Finally, very low frequency (VLF) radio waves propagating in the whistler mode are used for remote sensing of the magnetospheric plasma density. VLF waves are also involved in wave-particle interactions which result in the precipitation of energetic electrons from the van Allen radiation belt into the upper atmosphere. These waves may be either natural or man-made, particularly from the transmitter at Siple Station where the antenna is some tens of kilometres long. Rockets launched from Siple observed the wave field up into the ionosphere.

All in all, this is an excellent review, mainly of American research work in the atmospheric sciences, that has been carried out in the last decade from Antarctica.

MICHAEL J RYCROFT

Wild Ice — Antarctic Journeys

Ron Naveen, Colin Monteath, Tui de Roy, Mark Jones
Smithsonian Institution Press, Washington DC, 1990.
224 pages, £19.95, ISBN 0 87474 395 8

“Wild Ice” pays homage to the unique beauty of Antarctica. The reader will find more than 150 brilliant colour photographs, several of them covering two pages of the large format book. The four authors, well known for their photography and interest in nature and mountaineering have considerable experience of Antarctica based on a total of 60 field trips to the region.

But this is not only a picture book; the text itself expresses profusely the great concern about the world of the deep south

as the last frontier of pristine wilderness. Personal reflections and experiences, together with quotations from renowned writers, create a lively account of the early whaling epoch and the exploration of the Antarctic region and its wildlife. We find chapters such as “The Boss”, that highlights the dramatic voyages of Sir Ernest Shackleton. Beautiful bird images introduce us to the abundant wildlife of South Georgia that inhabits the most picturesque breeding sites of the avian world. The text by Ron Naveen contains interesting excerpts from Robert Cushman Murphy’s “Oceanic Birds of South America”. Approaching the Peninsula region the striking wonderworld of ice formation is presented by Mark Jones who also talks about Antarctic climatology. Tui de Roy describes the impressive seasonal changes of life on the South Shetland Islands — as a botanist I missed more consideration of the locally abundant and colourful cryptogamic vegetation (only one small picture is given).

In the last main chapter of the book, Colin Monteath presents the majestic scenery of the frozen continent with most exciting records from the investigation of the active volcano Mount Erebus, authentic and thrilling documents of ten Antarctic summers living with sledge dogs, and finally a palaeontological reflection on Gondwana exemplified by the description of a visit to Mount Fleming. I read this chapter with the greatest pleasure.

In a kind of appendix each author allows us to have an inside look into his personal technique of photographing under the adverse conditions of the Antarctic environment. It gives extremely helpful hints for those who want to preserve their Antarctic impressions in photographs.

The book, however, has obviously a greater message than the impressive scenery and praise of the Antarctic beauty. It has to explain why “the serenity and pristine qualities of the great seventh continent and its surrounding ocean ecosystem must continue”. Antarctica ... “is where we must continue evidencing that particular brand of goodwill and caring so typical of us Homo sapiens” (Naveen). Man “is an uninvited guest” of this region (Jones). And Tui de Roy asks “if we cannot maintain an element of respect for wildlife in the wildest region on earth, even in the name of science, how can there be any hope anywhere in the world?” The book culminates in an “Imperative of Protection” looking back over a period of 16 years of Antarctic travelling and commemorating a visit to H.R.H. Prince Edward to Victoria Land. He says in the foreword to this book: “The fragility of Antarctica could be broken if totally unnecessary and potentially damaging commercial exploitation is allowed.”

This is a book not only for those who want to have an insight into the nature of Antarctica, and a reminiscence for those who have experienced Antarctica already, but also for everybody who has a feeling for this enthusiasm and concern about our planet, or who just wants to savour these marvellous pictures.

L. KAPPEN

Physical Principles of Remote Sensing

W.G. Rees

Cambridge University Press, Cambridge 1990

247 pages. £13.95. ISBN 0 521 359945

Remote sensing from satellites and aircraft is an important tool in Antarctic research because of the vast size of the continent and the difficulty in obtaining *in situ* observations. From the earliest days of the space programme Antarctic research teams have utilised imagery from polar orbiting satellites in atmospheric and glaciological studies. Although initially of poor quality by comparison with modern data the imagery nevertheless gave very valuable information on the synoptic-scale weather systems, sea ice extent and iceberg calving and also provided the first mapping information on large areas of the continent.

This is the first book in a new series on Topics in Remote Sensing published by the Cambridge University Press. Unlike many books on remote sensing it can be applauded for trying to establish a clear mathematical and physical basis for the techniques used rather than just presenting a descriptive account of satellite systems and the products that can be generated. Although only just over 200 pages in length it covers most of the currently available and planned observing systems as well as describing many of the processing techniques.

The book begins with a review of the requirement for remote sensing data and an assessment of the areas of science that can obtain the greatest benefit from these techniques. There is a thorough introduction to the basics of electromagnetic radiation and many of the processes of relevance to remote sensing, together with a discussion of the interaction of radiation with the atmosphere and the surface. The atmospheric section considers the attenuation of radiation by gases and aerosol and the impact on measurements made at satellite level, noting that clouds, rain and snow must all be taken into account when trying to interpret satellite microwave data.

Observing systems are then described, beginning with a discussion of photographic characteristics. Modern satellite instrumentation is described including scanning and non-scanning imagers and the detectors for sensing visible and infrared radiation. I found the sections on applications of visible and infrared radiation too short and I would have preferred to see this material expanded at the expense of some of the technical information on instrumentation. For example, the climatologically important question of determination of sea surface temperature from space is given only one page and in an expanded form could have provided a useful case study of the difficulties in applying remote sensing to actual geophysical problems.

Microwave techniques can give data on the surface regardless of the lack of solar illumination and in the presence of clouds, both of which are problems at high latitudes. Passive microwave systems, which are used in monitoring sea ice,

are covered in some detail in this book, with particular emphasis on antenna theory. Active microwave sensors, which illuminate the surface with their own emitted radiation, are likely to be of great importance over the next decade once new satellites, such as the European ERS-1 and the Japanese JERS-1 spacecraft, are launched. Radar altimeters which can provide the topographic height of the ground surface to a few cms will be an important tool in determining the mass balance of the Antarctic. Here the theory of radar altimetry is covered along with some of the applications in mapping and oceanographic studies. This leads into the allied subject of scatterometry, where a two dimensional field of returns is obtained which can then be processed into surface wind vectors over the oceans. The final microwave technique discussed in Synthetic Aperture Radar (SAR) which gives essentially an image of surface roughness at microwave wavelengths. With the extensive cloud cover that often exists over large areas of the Antarctic SAR data will be of tremendous value in mapping and glaciology, although there will have to be further research into the interpretation of these data which certainly cannot be viewed in the same way as high resolution visible imagery.

The final chapters deal with the instrument platforms, including aircraft and satellites, along with the orbital dynamics of spacecraft. Data collection may be the most glamorous part of remote sensing but processing of the raw data is arguably the most important and the book closes with a discussion of basic image processing and analysis techniques.

Aimed firmly at remote sensing of the surface the only gaps are those acknowledged by the author in the area of atmospheric observation, including upper-air wind measurement and boundary layer studies by LIDAR, temperature sounding and rain measurement with passive microwave data.

As an introductory text on remote sensing it succeeds better than most as it clearly stresses the need for a physical understanding of the data being used. Too often remote sensing is portrayed as no more than simply 'looking at pretty pictures'. This book can be recommended as a text to give newcomers to the field a firm foundation in the subject and show them the potential of the latest techniques.

JOHN TURNER

The Exploration of Antarctica, the Last Unspoiled Continent

G.E. Fogg and David Smith

224 pp. Cassel Publishers Limited, London. 1990. £16.95.
ISBN 0 304 31813 2

Prior to my participating on several Antarctic tour cruises this year, I was asked to review this book for Antarctic Science. Weighing a little under two pounds it proved

pleasant reading while en route, but also a valuable reference throughout the cruises.

The first-time visitor to Antarctica will probably be puzzled by David Smith's watercolour and oil illustrations. After all one readily visualizes our seventh continent as a very icy place, all grey and white, shrouded in misty overcast, and inhabited mostly by black and white penguins. This monochromatic concept may, at long last, be dented if not shattered by David Smith's superb illustrations portraying anything but monochromatism. I sensed immediately that a pleasant surprise was in store for me, for the few simple washes across the book's jacket leapt at me in a kaleidoscopic array of colours that could only have originated in Antarctica. I found myself spellbound by David Smith's portrayal of a "Tabular iceberg, Weddell Sea" on pages 42–43, transporting me back to deep within the Weddell Sea where years ago I had spent a considerable time. Nothing on film could possibly surpass this simple oil painting in epitomizing this unique region.

I am particularly impressed by Smith's ability to capture the beauty of Antarctica, especially the brilliant liquid sapphire blues and emerald greens of glacial ice. It takes a master artist to portray their elusive, intrinsic qualities. For this reason among others, Smith's many icy scenes reach out and grab me like no others seen to date. Admittedly a few of his paintings perplex me, especially Sun, storm clouds and icebergs p. 71, The sea freezing p 115, and Sno-cat tracks near Halley Base p. 170. No doubt Smith envisioned polar scenes (37 depicted in colour) beyond my depth, but that is what art is all about.

It cannot be denied that Antarctica at times is very monochromatic, especially when water clouds hang low over the polar sea. I was disappointed not to find a David Smith rendition of such conditions, but black and whites (46 in total) are not lacking, for the book is packed full of photo prints, sketches, engravings, etc. of great historic value, although very few are devoted to penguins and other wildlife. How fortunate for the authors to have the Scott Polar Research Institute with its magnificent photo and other collections close at hand. How lucky for all of us to have this Institute.

Like artist David Smith, Professor G.E. Fogg is a master at what he does well, making history come alive with factual information punctuated throughout by catchy anecdotal accounts and quotations, some taken directly from the diary of David Smith. How so much historic information was fitted into such a small volume was for me at first a bit of an enigma, until I reread several chapters - he simply deleted nonessential material. This talent for separating wheat from the chaff is reason enough to make the small volume a huge success.

So far I have dwelt only on the historical aspects, but Fogg's chapter on the Southern Ocean covers the physical aspects of Antarctica as well. Again his talent surfaces for

keeping a rather complex subject succinctly clear and lively. Strange terms such as the Antarctic Convergence and Divergence, East and West Wind Drifts, Circumpolar Currents, and even the much talked about but little understood Southern Ocean take on meaning. Biological communities from simple one-celled plants and animals to the higher forms are mentioned, but like the historic accounts, we get a solid skeletal framework but not page consuming details on the region's wildlife.

The quotations and anecdotal accounts substantially enhance the historic accounts. One quotation did, however, offend me - the reference to the now defunct American ship, R.V. *Hero*, as that "goddamn green dragon." Having sailed on this highly efficient little ship for nearly a decade with her renowned skipper Master Pieter Lenie, I can find a much better and deserving obituary. As a museum attraction today, R.V. *Hero* floats at rest in Oregon, U.S.A.

The first nine chapters of the text give a comprehensive overview of Antarctica from its discovery down to modern times. The tenth and final chapter, entitled "Hope out of Antarctica," is the culmination of Fogg's finest writing and his assessment of current conditions confronting the continent. Today we hear much about the Antarctic Treaty and its political ramifications that relate not only to territorial claims, but also to the exploitation of natural resources. According to Professor Fogg, the value of science in Antarctica is only doubtfully in food, oil and valuable minerals, but rather more in its scientific philosophy that regards Antarctica (and the world) as a whole or single system or entity - a holistic rather than the prevailing reductionist approach. Although Fogg agrees that reductionism is an essential part of science, he feels that it needs the discipline of holism before it can be used effectively in the real world. He views Antarctica as essential in re-establishing the holistic view, noting that this continent is perhaps the best place for monitoring the health of the planet. On the other hand, he views Antarctica as the ultimate wilderness that goes beyond science in giving humans an awareness of realms not yet fully understood or appreciated. One bridge capable of connecting the human spirit with the natural world is through the eyes and interpretations of artists. Little wonder he gives high praise to the artistic interpretations of David Smith. I wonder if Professor Fogg realizes that he has done much the same through his own philosophies and words. In a strange analogous way, his text is a good example of an holistic approach to writing.

The book comes highly recommended by His Royal Highness The Duke of Edinburgh KG KT, who wrote the Foreword, and by Lord Shackleton who wrote the Introduction. Whoever reads this book will also recommend it highly, as I do.

DAVID F. PARMELEE

A practical guide to the euphausiids of the world.

A. de C. Baker, B.P. Boden and E. Brinton.

Natural History Museum Publications, London (1990).
96pp. £19.95. ISBN 0 565 00985 0

The euphausiids are a particularly conspicuous component of the marine zooplankton, both in term of abundance and their relatively large size. They are important food items for many species of marine mammals, birds and fish and more recently euphausiids have been harvested by man. Euphausiids are found in all oceans and there is considerable overlap in their distributional ranges. For example, at least 20 live in the Southern Ocean, six in Antarctic waters. Thus a reliable set of keys are necessary to aid plankton sorters in the rapid and accurate identification of this important group.

A number of keys already exist. However, these often contain excessive use of complex terminology, designed more to confuse than assist novices, with associated explanatory figures insufficient or absent. Some guides are centred on regional distributions only, eg. Brinton's guide for South-east Asia (Naga Report, 4, 1–287, 1975), Sebastian's euphausiids of Indian Seas (Symposium of Crustacea, 1, 233–254. Marine Biological Association of India 1966) and Kirkwood's key to Southern Ocean species (ANARE Research Notes No. 1, 45pp. 1982). The more comprehensive keys of Mauchline & Fisher (Advances in Marine Biology, 7, 1–454, 1969) and Sheard (BANZARE Reports, Series B, 8 (1), 1–72, 1953), like others, are now dated because they include species no longer recognized, while of course not containing new descriptions. Baker, Boden and Brinton have now produced a much needed, updated, easy to use and well illustrated guide to the adults of the 86 known species of euphausiids.

The guide is primarily aimed at those persons unfamiliar with euphausiids, as well as those engaged in general plankton sorting and experimental work. There is a detailed description of euphausiid morphology and the terminology used in the guide. The authors, however, have kept the terminology as simple as possible in the keys, in the belief that an illustration is more easily understood than a detailed description. The descriptions and figures still need to be used together, so the guide has been organized with descriptions and diagrams on opposing pages, with the figures and associated description bearing the same identifying number. Particular characteristics that may not be obvious at first are clearly identified by an arrow which is repeated in the description.

The arrows clearly identify the features described, alleviating the need to constantly refer to the atlas of krill morphology at the beginning of the guide, but at the same time the arrows assist the novice in learning the terminology. The use of such arrows is to be encouraged in all keys. To facilitate the use of these keys the book is ring-bound so it can be opened flat on the desk at the appropriate descriptions and figures.

The A4 format also permits the use of large illustrations, which have been selected from a number of sources to best show the relevant taxonomic features, as well as the general view of each species.

For novices, there are useful notes on the best method of illumination to observe external features when examining euphausiids under the microscope. Methods are also provided for examining the male and female external reproductive organs, petasma and thelycum respectively, as well as an interesting method for silver staining the thelycum to highlight important structures. The petasma and thelycum have been used previously in euphausiid systematics. However, since these structures need to be fully developed to be of any use taxonomically, and also may require some dissection or staining, the authors have made infrequent use of these organs in the keys. In general, species can be identified without the need to dissect any part of the specimen. In the genus *Nyctiphanes*, where there is sexual dimorphism, keys for both gender are provided. At each specific identification the adult size range is given and a list of useful references including the original description of the species if there is any doubt to the identity of the species. The authors emphasize that the guide is for the identification of adults of near mature specimens, and thus caution the use of the keys for identifying juveniles which may not have developed the important key character found on an adult.

I was fortunate enough to receive this book just prior to sailing on the recent Australian marine science cruise to study krill and fish in Prydz Bay, Antarctica. I therefore had the perfect opportunity to test the "practicality" of the guide in the field, using accompanying non-krill biologists who were unfamiliar with the three species of euphausiid I gave them, ie. *Euphausia crystallorophias*, *E. superba* and *Thysanoessa macrura*. The comments from the novice krill sorters were favourable. They found the keys easy to use, and with the important taxonomic characteristics clearly drawn and highlighted with arrows; they had no trouble identifying the species despite the sorters' minimal knowledge of krill morphology and terminology.

Apart from one or two typographical errors, the only two faults I have with the book are: it could be printed on water-proof paper as a truly "practical guide" for use in laboratories on ship, and I also would like to see the addition of distribution maps for each species. Although the authors provide references for suitable maps, eg. Mauchline & Fisher (1969) and Brinton's (1975) NAGA Report, the incorporation of maps would be useful particularly to confirm that the species identified is known to occur in the area of study. Nonetheless, I believe that this book is the most useful guide to the Euphausiacea, both to novice and expert, and should be found in all plankton sorting laboratories. It is most regrettable that Brian Boden died before he saw the book in print.

GRAHAM HOSIE