

Book Reviews

Bulgarian Antarctic Research: Life Sciences

Edited by V. Golemansky and N. Chipev

Pensoft, Sofia (1996).

128 pages. Price not stated. ISBN 954 642 014 X

Bulgaria first become involved in Antarctic activities in 1967 through the 13th Soviet Expedition. In 1987–88 they undertook a summer geological programme on Livingston Island but it was not until 1993 that they developed a continuing annual programme, including biology. They have now applied for the status of Consultative Party to the Antarctic Treaty and this volume comprises some of the necessary evidence of their scientific activities. The 127 pages contain 12 papers on a variety of terrestrial biological topics including humus formation, microbial investigations (*Actinomyces* and *Streptomyces*), diatoms, Rhizopoda, Nematoda, and parasites in birds. The standard of English is excellent throughout and the reference lists comprise both western and Russian literature (up to 1994). There is no indication that any of the papers have been externally reviewed. The studies reported are fragmentary, limited, and all descriptive. They add useful details for such underworked groups as nematodes, protozoa and cestodes but with no new species described nor new theories developed they are unlikely to have been acceptable to any international journal. Given their very limited resources and dependence on the logistics of other nations this volume is evidence of enthusiasm and commitment. Bulgaria needs to go much further to make any substantial addition to Antarctic science and one wonders if they might get better scientific value for their money by taking the Dutch approach - give up the research station and place their scientists in collaborating teams of leading Antarctic countries?

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The Arctic Sea Ice Ecosystem

I.A. Melnikov

Gordon & Breach, Amsterdam (1997).

204 pages. £49 ISBN 2 9198 75043

This small book (5 chapters, fewer than 200 text pages), written by Igor Melnikov, one of the world's leading experts on sea ice ecology, is packed with information and provides a refreshing overview of the Arctic multi-year ice ecosystem. I wish it had been available when I was working actively in the field. It is based on data obtained during more than three years, including two 12-month periods, which the author spent on Russian North Pole stations drifting in the Arctic

Ocean at all seasons and under conditions that most polar scientists today would find daunting at best. The research was carried out between May 1975 and March 1982 and, while much of it has been published elsewhere, most of the information has not been available to western scientists because of the language barrier. This is our loss.

The book begins with a short introduction that includes the research history of the Arctic Ocean ice community, sampling strategy, methods used to analyse the samples, and some terminology. As anyone who has studied sea ice ecosystems knows, methods are extremely important. Consequently, expanded methods and procedures sections would have been useful to facilitate comparisons between the ice in the central Arctic and the better-known marginal seas.

The second chapter reviews the recent and past Arctic sea ice environment, beginning with the geological age of the modern ice cover, to determine the evolutionary history of the ice ecosystem. Additional features here include the climate of ice-covered regions, spatial and temporal characteristics of the ice cover (area, distribution, circulation, age and thickness, ice budget, i.e. formation, growth, and losses) and the structure and dynamics of the water column under the ice. Chapter three discusses the physical (temperature, light, ice structure and dynamics, brine volume and migration) and chemical (salinity, ionic composition, macro- and micro-nutrients, organic matter, and isotope content) characteristics of the sea ice environment that make it a suitable substrate for organisms. The sea ice is a physical layer separating two very different environments: the air above and the seawater below. Consequently, the physical factors that act on the ice set up gradients through the ice thickness that change with the seasons, thus creating a complicated physico-chemical habitat (or biotope as it is called here) for the organisms living in it. Much of the information presented in these two chapters is available in the literature, but Melnikov provides a somewhat different perspective.

The communities (biocenoses) are considered in Chapter 4 where the terminology becomes complex and somewhat confusing because it is not the same as that commonly used by western scientists. The phytocenosis section starts with a literature review of Arctic phytoplankton, being mostly a comparison of the numbers of species found by various authors (but Hsiao 1983, *Nova Hedwigia*, 37, 225-313, the most comprehensive western checklist of species, is not included) and a discussion of the importance of benthic species even in the central Arctic, the dominance of diatoms over dinoflagellates, and seasonal species differences. Within the ice, there are three main habitats, each with a special flora. The cryopelagic flora occurs at the bottom of the ice and consists of 1) cells attached to ice platelets (the platelet ice forms); 2) huge mats or strands attached to the bottom of

the ice (the benthic forms); and 3) mucilaginous aggregates not attached to the bottom of the ice, but drifting freely with the water currents (the plankto-benthic forms). The interstitial flora occurs in the interior of the ice and consists of an upper layer of primarily freshwater green algae, a bottom layer of marine diatoms, and a middle transition layer of mostly dead cells. The cryoepontic flora lives on the upper ice surface and consists primarily of green algae living in the snow.

Thus the phytocenosis consists of both phytoplankton and ice algae and is dominated by diatoms; pennate diatoms are more abundant than centric species in the ice, but centric diatoms are equally important in the water column. Both planktonic and benthic species are present, most are marine in origin, but there are also some freshwater green algae. Some species are called cryophilic because they occur only in the ice where they form mass assemblages. There are a few endemic species and one endemic genus in the water column, but none in the ice. Low endemism is also cited for Arctic fauna, perhaps because of the relatively young age of the ice ecosystem. The origin and actual species composition of the ice flora depends on location: in the marginal seas, the species are planktonic and benthic, while in the central Arctic, they are primarily planktonic.

The zoocenosis section first describes the species composition, vertical distribution and migration, and seasonal dynamics of the zooplankton. It then proceeds to the ice fauna where three ecological groups comprise the cryopelagic fauna: 1) the autochthonous species have both sexes and all life cycle stages living on the bottom of the ice throughout the year, do not occur in the plankton, and maintain a constant relationship with the ice during ice movement; 2) the allochthonous species use the bottom of the ice on a temporary basis during their life cycles and also occur in the water column; and 3) the xenocryobiontic species are sporadic visitors to the ice. The cryointerstitial fauna occur only within the lower 0–1.5 m with nematodes being the most abundant group. An interesting comparison is made between the cryointerstitial fauna and the benthic fauna living in shallow, soft sediments. Species composition differs greatly between the animals living on the bottom of the ice and those living within the ice. Further, just two species are found only in the ice, while the other species are widely distributed in the plankton and benthos.

The final chapter reviews features of the ice ecosystem including its ecological structure, stability on both vertical and horizontal scales, the annual cycle of ice communities, flux of matter, and trophic relationships. The book's conclusions are included here. One thing that is often not considered in studying the ice ecosystem is that the shape and mobility of the organisms reflects the environment in which they live, i.e., the size and shape of the spaces between ice crystals. With regard to the algae, this means there are no colonial species in the cryointerstitial flora, although filamentous forms are common in the cryopelagic system. One of the most important results of this study is that we now know that the contribution of ice algae to primary production is high and thus the ice algae provide much of the energy required for the functioning of the central Arctic ecosystem.

This book should be required reading for everyone studying the sea ice ecosystem in both polar regions. The reference list is extensive with many Russian publications that may not be available in the west. Most of the references are pre-1980 reflecting what was available when this study was performed (only five are from the 1990s and three of those are abstracts of papers presented at meetings and published later). The book is well designed, has an impressive cover, and is not expensive. However, it is also a disappointment - not with the content, but with the lack of competent editing. This makes the book difficult to read and understand, annoyances that I hope will not deter potential users. Many of the problems are relatively minor, e.g., Fram Strait is found as Fram Straits, Fram strait, and Fram Strait; author's names are spelled correctly in the references, but only sometimes in the text, e.g., Kitchell (Kitchel) and Hoham (Hohan); and names of organisms are often incorrectly spelled (see especially Appendix Table 1, but also throughout the text). With regard to Appendix Tables 1 and 2, the formatting is not consistent with some generic names in bold type and others not. Also, m is used in places for μ (p. 110). Some sections are well-edited and a pleasure to read, e.g., Behaviour of the Cryofauna, p. 105. While the publishers should be complimented on publishing this work, they should be chided for not taking a little extra time to provide the readers with a better edited book. One or two people familiar with the ice ecosystem could have done this in less than a week.

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