KOSMOS
PROBLEMY NAUK BIOLOGICZNYCH

Tom 62 2013
Numer 3 (300)
Strony 283–285

Polskie Towarzystwo Przyrodników im. Kopernika

WOJCIECH MAJEWSKI[1], JACEK SICIŃSKI[2]

[1]Instytut Paleobiologii PAN
Twarda 51/55, 00-818 Warszawa
E-mail: wmaj@twarda.pan.pl[2]
[2]Zakład Biologii Polarnej i Oceanobiologii
Uniwersytet Łódzki
E-mail: sicinski@biol.uni.lodz.pld

POLAR ECOSYSTEMS IN A CHANGING WORLD — INTRODUCTION

Cold, devoid of trees, and largely covered with ice polar areas for ages generated passion for exploration that sometimes turned out to be fatal. The northern polar region — the Arctic is an ocean covered by sea ice and surrounded by three continents, islands, and archipelagoes. It is an area inhabited by the native Eskimo, Lapp, and Chukchi people. The southern polar region — Antarctica is a centrally located Antarctic continent with its gigantic ice-cup surrounded by the Southern Ocean dotted with islands and archipelagos. This desolate, the most severe land on Earth was never inhabited by indigenous people.

Polish scientific presence in polar regions dates back to mid 19th century for the Arctic, with works of Aleksander Czekanowski and Jan Czerski in polar Siberia, and to late 19th century in Antarctica, with the participation of Henryk Arctowski and Antoni Dobrowolski in the *Belgica* expedition.

The keystone for advancing our scientific presence in the polar regions was the establishment of two scientific stations, the Arctic one in the Hornsund fjord on Spitsbergen in July of 1957, and the Antarctic *Henryk Arctowski* Station on King George Island in the South Shetlands in February 1977. Since then, they have became primary logistic support stations for fields studies in natural sciences, including terrestrial and marine research on modern and fossil polar ecosystems.

Marine pelagic bioscience is another area of polish activity in polar regions. The research vessel *r/v Oceania*, constructed in 1985, is used for various projects on yearly basis. During the 1980's Poland with the research vessel of the National Marine Fisheries Research Institute r/v *Profesor Siedlecki* participated in four expeditions of the Polish Academy of Sciences to West Antarctica as a member of large international program BIOMASS (*Biological Investigations of Marine Antarctic Systems and Stocks*).

Numbering hundreds of contributions, achievements of polish polar biologists have been published in numerous top international journals as well as in *Polish Polar Research*, a quarterly published by the Committee on Polar Research since 1980. During the past decade, investigations of polar ecosystems in the dynamically changing world have been intensified. Their major goals were outlined in *Arctic and Antarctic research programme of Poland 2002–2010*. The leading projects for life sciences were *Structure and dynamics of the Antarctic biological systems on the background of global changes of the environment and human pressure* and *Arctic ecosystem biodiversity*. The climax of this activity was the participation of a large number of Polish scientific institutions in the activities of the *International Polar Year 2007–2008*. Polish biologists took part in a variety of international projects: *Evolution and Biodiversity in Antarctica* (EBA), *Census of Antarctic Marine Life* (CAML), *SCAR-Marine Biodiversity Information Network* (SCAR-MarBIN), *Aliens in*

Antarctica (ALIENS), *Antarctic Climate Evolution* (ACE) and following in Antarctica, as well as *Census of Marine Life* (CoML), *Arctic Ocean Diversity* (ArcOD), *Marine Biodiversity and Ecosystem Functioning* (MARBEF), *Ecosystem Studies of Subarctic and Arctic regions* (ESSAR) and following in the Arctic.

So far, biology and ecology of polar regions have been the scope of two volumes of this quarterly: *Kosmos* 32, 2 of 1983 and *Kosmos* 47, 4 of 1998. Now, we are presenting the third volume, describing selected effects of activity of polish biologists in both polar regions, that had been carried on during the past decade or so.

This issue begins with three papers on biological diversity and ecology of selected organisms (Foraminifera, Malacostraca) and macrozoobenthic communities. Some of these contributions present results of studies carried on in Admiralty Bay on King George Island since the beginnings of the *Arctowski* Station, over 35 years ago. Rich information on diversity and origins of Antarctic tanaids (Tanaidacea) described in another work are followed by a review of the results of polish parasitological studies in polar regions, namely on parasitic worms (Monogenea, Trematoda, Cestoda, Acanthocephala, and Nematoda) of Antarctic fishes, birds, and mammals. These works are concluding, in a way, the first phase of studies describing the initial state of ecosystems in the areas of interest of polish polar expeditions.

The major part of this volume constitute papers on biological reactions to dynamically changing environmental conditions due to climate warming in polar regions. Both areas of interest, South Shetlands in Antarctica and Spitsbergen in the Arctic, are among the major areas of Earth experiencing the fastest warming during the last decades. The impact on local ecosystems and their ability to cope with retreating glaciers or decreasing sea-ice caused by climatic changes are of great interest from science and popular audience. Studying such phenomena requires long-term monitoring effort, which was possible only with support of field infrastructure that was continuously financed over decades, sometimes despite political and economical turmoil. Such economic and logistical effort paid off well, however, and now our researchers may have the edge analyzing long-term multi-annual observation series.

The series of papers describing biological reactions on climate warming in polar regions begins with a paper on microbiota of poorly known glacial settings, areas recently freed by retreating glaciers, and rich in organic matter border zone between land and sea. Changes in Arctic and Antarctic tundra, including temporal and permanent invasions of alien plant and animal species, are the scope of three following contributions.

Lichens, next to mosses, constitute the most important component of Antarctic tundra. On the other hand, flowering plans are a great rarity there. They all together inhabit extremely hostile environment. Thus, they are the subject of interest for morphologists and plant physiologists, who try to understand their adaptation strategies and ecologic plasticity in the dynamically changing environment. These investigations are the scope of two next papers.

Similarly as it is on land, also marine ecosystems are under the reorganization during the last decades, due to climate warming triggering various environmental changes. They may induce fundamental changes in trophic structure of the seas. New observations and analyses of such processes are illustrated using example of marine birds and mammals, as well as two species dominating Antarctic pelagic ecosystems — krill and salpa (*Salpa thompsoni*).

The series of papers on biological adaptations is concluded by a review of new investigation techniques for marine research. The various new methods enable not only investigation of formerly inaccessible areas but also gathering data from much greater areas than before. These improvements are of great importance for studying processes taking place in vast inhospitable seas. What is also important, data collecting is possible remotely, with no direct human presence. In polar regions, the so called human factor used to be the limiting issue for more ambitious projects for decades before.

The last part of this volume, dedicated to paleobiology, shows evolution of some organism typical for polar environments over millions of years, a never ending process of coping with changes in the surrounding world. At the beginning, silicoflagellates are reminded. They are a mysterious unicellular algae, which evolutionary history as well as biology of modern representatives is still quite a mystery.

The evolutionary history of penguins, as well as auks, named also “penguins of the North”, is also presented. The two bird fami-

lies have independently developed the skill of so called "underwater flight". They both had long and exciting histories of adaptation to changing environments in the two Earth's polar regions. The last contribution describes a very ancient history of the boarder between the Paleozoic and Mesozoic about 250 million years ago. It reviews events related to the great faunal turnover between Permian and Trias, recorded in sedimentary rocks of south Spitsbergen. In that time, south Spitsbergen was not in a polar zone, but in temperate latitudes, similarly to the latitudinal position of today's sunny Croatia. This provides a valuable perspective to our discussions on recent climatic changes, that shows not only the scale of potential environmental changes, but also unimaginable duration of processes that shaped the Earth of today.

Finally, we would like to express our great gratitude to all authors and the editorial stuff of the *Kosmos* quarterly for their contributions and help in preparing this volume. We are also very grateful to the reviewers: Adam Barcikowski, Marta Bąk, Andrzej Gaździcki, Michał Grabowski, Adam Halamski, Piotr Jadwiszczak, Krzysztof Jażdżewski, Martin Kukwa, Sławomir Kwaśniewski, Ryszard Ligowski, Katarzyna Niewiadomska, Danuta Peryt, Stanisław Pietr, Stanisław Przestalski, Lech Stempniewicz, Jan Taylor, Jan Marcin Węsławski, and Bronisław Wojtuń for their help in improving all the articles presented below.

W. Majewski

J. Siciński