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A BRIEF SUMMARY OF SCIENTIFIC HIGHLIGHTS:						
<i>See the following pages</i>						

Revitalization of the A. B. Dobrowolski Polish Antarctic Station, Bunger Hills, East Antarctica

Members of the 4th Polish Antarctic Research Expedition to Bunger Hills, including Marek Lewandowski (leader), Monika A. Kusiak, Adam Nawrot and Wojciech Miloch, joined the 67th Russian Antarctic Expedition for the 2021/2022 summer season to the Bunger Hills in East Antarctica. The Polish group visited Dobrowolski Station, that was not operational since 1979, to conduct a reconnaissance geoscience program, including environmental studies, geological field surveys at multiple locations, and seismological, magnetic, meteorological and ionospheric measurements at the Station. The huts were repaired and new equipment was installed inside. The Station remained clean and in good condition, ready to serve as a summer base for future expeditions. Future plans include the installation of an automatic and autonomous magnetometer, seismometer and weather station, and the continuation of research programs in geomorphology, geology and environmental studies. Details of the Polish expedition's activities at Dobrowolski Station were presented at the SCAR conference in India (2022). See <https://dobrowolski.igf.edu.pl/> for more details.



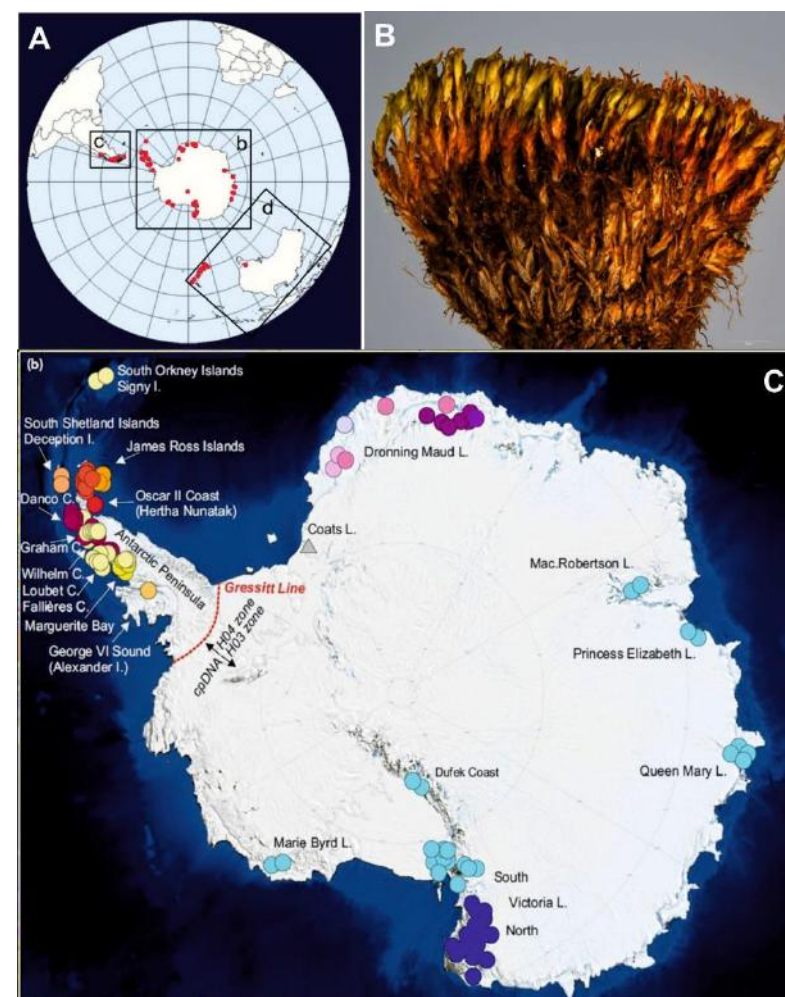
A. B. Dobrowolski Polish Antarctic Station in Bunger Hills, East Antarctica on January 2022. Photo by Adam Nawrot.

Saluga M., Ochyra R. & Ronikier M. 2022. Phylogeographical breaks and limited connectivity among multiple refugia in a pan-Antarctic moss species. *Journal of Biogeography* 49: 1991-2004.

The historical biogeography of the Antarctic terrestrial flora remains poorly explored and understood. Long-term *in situ* persistence of mosses was demonstrated but the phylogeographic patterns and processes that shaped their present-day distribution are still largely unknown.

We addressed, using phylogenetic and phylogeographic tools, the biogeography, origin and approximate age of *Syntrichia sarconeurum*, one of the most widespread but scattered Antarctic endemic moss species. Its phylogeographical structure revealed a long-term survival and limited connectivity of different regions within the Antarctic. The species has survived several Quaternary glacial periods in multiple refugia (since about 1.36 Ma), not only in the peripheral areas of the maritime Antarctic but also within the Antarctic continent. The phylogeographic structure shows notably a major genetic discontinuity coinciding with the Gressitt Line – a biogeographical barrier observed between the biota of the Antarctic Peninsula and main continental Antarctica.

Our phylogeographic study has serious taxonomic implications, *i.e.*, *Syntrichia sarconeurum* is a heterogeneous taxon that actually consists of two distinct species. Populations from the sub-Antarctic islands, the Antarctic Peninsula region as well as Coats Land and Dronning Maud Land in the continental Antarctic are conspecific with the Fuegian *S. lithophila*. The populations from East Antarctica, in turn, constitute the second species called *S. frigidideserticola*.

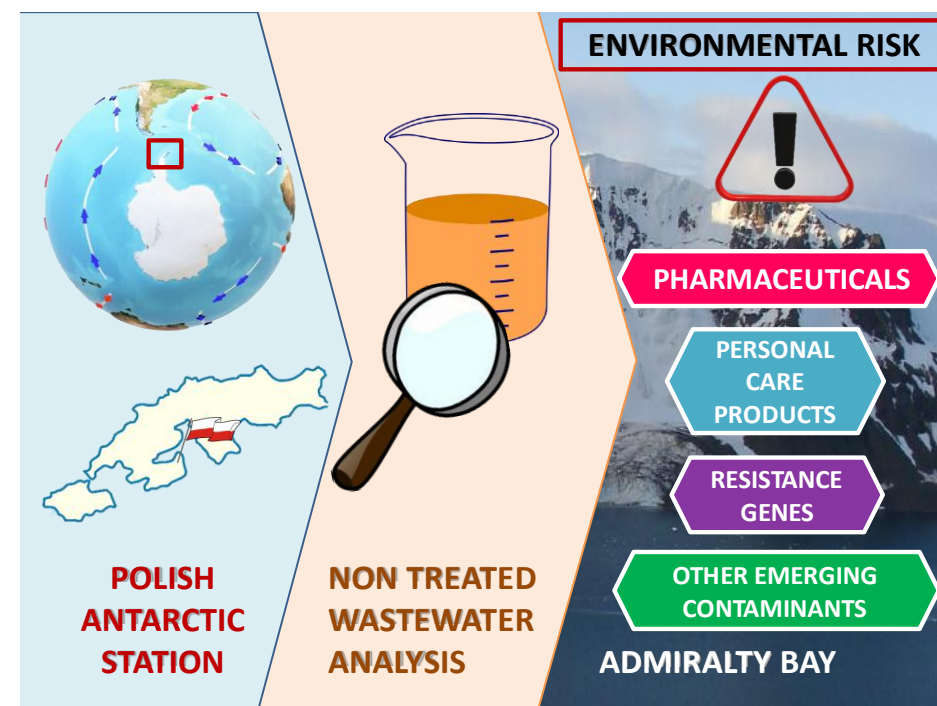


(A) Geographical range of the studied groups; (B) dried specimens of *Syntrichia sarconeurum* (phot. H. Bednarek-Ochyra); and (C) map of Antarctica showing the genetic characteristic of *S. sarconeurum*. The dashed line outlines the boundary between the distribution of the two main cpDNA haplotypes (H03 and H04) that coincides with the Gressitt Line.

Szopińska M., Potapowicz J., Jankowska K., Luczkiewicz A., Svahn O., Björklund E., Nannou C., Lambropoulou D. & Polkowska Ż. 2022. Pharmaceuticals and other contaminants of emerging concern in Admiralty Bay as a result of untreated wastewater discharge: Status and possible environmental consequences. *Science of the Total Environment* 835: 155400.

Today, human activity is having an ever-growing impact on the environment, while there is also increasing interest in nature preservation. Consequently, a detailed characterization of emerging contaminants (ECs) in the aquatic environment is of primary importance. One of the potential point source of EC can be improper wastewater disposal. Overall, there is a risk of pharmaceutical and personal care products emission to the Antarctic environment through the discharge of both treated and untreated wastewater. Moreover, antibiotics disseminated with wastewater may also favor the selection of resistant populations naturally occurring in the microbiota of the receiving waters. This is of serious concern in the pristine Antarctic environment, as it leads to changes in the original resistome and to genetic homogenization of the bacterial community. Additionally, the discharge of wastewater may enrich the environment with mobile genetic elements, such as conjugative plasmids, transposons and integrons, which act as effective carriers of antibiotic resistance genes. Research shows that pharmaceuticals like ketoconazole, diclofenac, ibuprofen pose the greatest risk for the aquatic environment. Moreover, antibiotic resistance genes and integrons were present in the studied samples. To overcome this problem the following

mitigation strategies are suggested: (1) to create a centralized record of the medications prescribed and consumed *in situ*, to improve knowledge of potential contaminants without analysis; (2) to use more environmentally friendly substitutes for pharmaceuticals and personal care products when possible to limit consumption at the source; and (3) to apply advanced systems for wastewater treatment before discharge to the recipient, i.e., use end-of-pipe technologies as a final barrier.



Non-treated wastewater discharge as a point source for pharmaceutical and personal care products emission to the Antarctic environment.

Chelchowski M., Balazy P. & Kuklinski P. 2022. Seasonal variability in macrobenthos assemblage parameters in the highly disturbed Antarctic intertidal zone – Relatively rich biodiversity year around. *Estuarine, Coastal and Shelf Science* 278: 108114.

To understand the impact of anthropogenically induced transformations of biological communities, their naturally occurring fluctuation must be recognized first. Therefore, the aim of our study was to investigate the variability in Antarctic intertidal benthic assemblage faunal composition during an annual cycle on King George Island, South Shetland Islands. Once a month, from December 2016 to November 2017, we collected samples at low-, mid- and high-tidal levels. Polychaetae were the most diverse group, including 15 species, followed by amphipods (12 species). Throughout the year, the most abundant taxa were gastropods (38% of the total number), followed by amphipods (23%) and bivalves (22%). The general pattern of the number of species and their abundance and biomass depended on the season and exhibited the highest values in austral autumn (April–June). Both species richness and abundance were highest in June and lowest in August. Our study discovered that Antarctic intertidal macrofauna assemblages quickly respond to changes in environmental conditions and thus reflect seasonal climate fluctuations. The rapid development of these assemblages when the conditions are favorable proves their opportunistic and highly adaptable nature, which is potentially a good prognosis for survival in this ever-changing ecosystem.



Snow covered and impacted by ice intertidal zone in November 2017. The study site was selected in Admiralty Bay in the direct vicinity of the Polish Antarctic Station (62° 09.41' S; 58° 28.10' W).

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Life sciences**Marine ecosystems**

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9. Fudala K., Bialik R.J. 2022. Seals from outer space - Population census of southern elephant seals using VHR satellite imagery. *Remote Sensing Applications-Society and Environment* 28: 100836.
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12. Oosthuizen W.Ch., Pistorius P.A., Korczak-Abhire M., Hinke J.T., Santos M., Lowther A.D. 2022. The foraging behavior of nonbreeding Adélie penguins in the western Antarctic Peninsula during the breeding season. *Ecosphere* 13: e4090.

Terrestrial plants, bacteria and fungi

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14. Abu Bakar N., Lau B.Y.C., Smykla J., Karsani S.A., Alias S.A. 2022. Protein homeostasis, regulation of energy production and activation of DNA damage-repair pathways are involved in the heat stress response of *Pseudogymnoascus* spp. *Environmental Microbiology* 24: 1849–1864.
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18. Ochyra R., Saługa M., Ronikier M., 2022. Taxonomic and nomenclatural novelties in *Syntrichia* (Bryophyta: Pottiaceae), with reinstatement of an endemic continental Antarctic species. *Plant and Fungal Systematics* 67: 40–44.
19. Saługa M., Ochyra R., Ronikier M., 2022. Phylogeographical breaks and limited connectivity among multiple refugia in a pan-Antarctic moss species. *Journal of Biogeography* 49: 1991–2004.
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22. Znój A., Gawor J., Gromadka R., Chwedorzewska K.J., Grzesiak J. 2022. Root-associated bacteria community characteristics of Antarctic plants: *Deschampsia antarctica* and *Colobanthus quitensis* - a comparison. *Microbial Ecology* 84: 808–820.
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Physical Sciences

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2022. Global patterns and controls of nutrient immobilization on decomposing cellulose in riverine ecosystems. *Global Biogeochemical Cycles* 36: e2021GB007163.
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Anthropogenic pollutants

27. Potapowicz J., Szopińska M., Szumińska D., Bialik R.J., Polkowska Ż. 2022. Sources and composition of chemical pollution in Maritime Antarctica (King George Island), part 1: Sediment and water analysis for PAH sources evaluation in the vicinity of Arctowski station. *Chemosphere* 288: 132637.
28. Szopińska M., Potapowicz J., Jankowska K., Luczkiewicz A., Svahn O., Björklund E., Nannou C., Lambropoulou D., Polkowska Ż. 2022. Pharmaceuticals and other contaminants of emerging concern in Admiralty Bay as a result of untreated wastewater discharge: Status and possible environmental consequences. *Science of the Total Environment* 835: 155400.