

1. **Research Unit:** Department of Antarctic Biology
2. **Supervisor:** Dr hab. Robert Bialik, prof. IBB PAS
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4. **Project title (English):** Phylogeography and genetic diversity of the Antarctic species *Branchinecta gaini* (*Branchiopoda: Anostraca*)
5. **Project title (Polish):** Filogeografia i różnorodność genetyczna antarktycznego gatunku *Branchinecta gaini* (*Branchiopoda: Anostraca*)
6. **Description of the project (up to 500 words):**

Anostracans have the greatest diversity among large branchiopods (*Spinicaudata*, *Laevicaudata*, *Cyclestherida*, *Anostraca*, *Notostraca*) and more than 350 species can be distinguished in 10 families worldwide. These organisms have archaic morphology similar to their Palaeozoic relatives and have specific survival strategy consisting in rapid maturation and production of dormant cysts, which allows them to exist in seasonal habitats such as vernal pools. They participate in trophic chains at different levels. Some species like *Artemia spp.* and *Streptocephalus sirindhornae* have economic significance for human. They are used as a food in aquaculture, serve as a model species in toxicological studies.

Large branchiopods are considered one of the most endangered freshwater invertebrates. Populations of large branchiopods are significantly affected by human activities, in particular environmental transformations causing the disappearance of ephemeral water bodies. Climate change that modifies hydrological cycles could be another threat to large branchiopods populations. However, there are still gaps in knowledge that impede the effective protection of large branchiopods.

Branchinecta gaini is the only representative of large branchiopods found in Antarctica. The Antarctica offers an important field of research for understanding dispersal, allopatric speciation, and recent responses to climate change. The range covers the Southern Part of South America, Sub-Antarctic Islands and Antarctic Peninsula. According to they only tolerate fresh water. However, this species has been found on King George's Island in The Antarctic Lake Wujka which is regularly fed by seawater. One can hypothesize that this local population has adapted to the specific conditions there. It also begs the question of how isolated subpopulations of this species are? We do not know what gene flow is, and what role the wind or birds can play when they take cysts to other sites? Phylogeographic aspects have yet not been studied. There is also a lack of knowledge about ecology and actual threats.

To assess morphological variability, morphometric measurements of antennae, copulating organs, cerci, and cyst diameter and ornamentation will be made. Genetic variability will be determined on the basis of molecular analyses of mitochondrial genes such as COI, 12S and nuclear gene 16S ribosomal RNA will be analyzed. In order to learn about the diet of this species, the contents of the digestive tract will be examined. Sediments from place of occurrence, current and historical, of this species in terms of the presence of cysts. Analyses of bird's manure and elements raised by the wind in the air will allow to assess the possibility of anemochory or zoochory and their impact on gene flow. In addition, the following habitat analysis will be performed: water temperature, pH, conductivity, nutrient concentration, dissolved organic carbon, chlorophyll A fluorescence, plankton species composition along with on-site weather condition parameters.

Analysis of genetic diversity, and genetic distance between *Branchinecta gaini* subpopulations can provide answers to issues related to phylogeography and evolutionary biology. Better understanding of its genetics and biology can contribute to the more effective protection of biodiversity in Antarctica and probably it can provide better understanding of large branchiopods evolutionary mechanisms.

The 50 mature individuals of *Branchinecta gaini*, which will be used for the first morphological analysis, were collected in the immediate vicinity of the Arctowski Polish Antarctic Station in the 2020/2021 season. Moreover, during the first year of the project, the airborne images collected during 2019-2021, will be analyzed in order to identify potential locations of the occurrence of *Branchinecta gaini* at King George and Admiralty bays.

7. References related to conducted /planned research (maximum 3):

MARRONE, F., D. C. ROGERS, P. ZARATTINI, and L. NASELLI-FLORES. 2017. New challenges in anostracan research: old issues, new perspectives and hot topics. *Hydrobiologia*. 801: 179–185, DOI: 10.1007/s10750-017-3345-6.

GUERIAU, P., N. RABET, G. CLÉMENT, L. LAGEBRO, J. VANNIER, D. E. G. BRIGGS, S. CHARBONNIER, S. OLIVE, and O. BÉTHOUX. 2016. A 365-Million-Year-Old Freshwater Community Reveals Morphological and Ecological Stasis in Branchiopod Crustaceans. *Current Biology*. 26: 383–390, DOI: 10.1016/j.cub.2015.12.039.

POCIECHA, A., and H. J. DUMONT. 2007. Life cycle of *Boeckella poppei* Mrazek and *Branchinecta gaini* Daday (King George Island, South Shetlands). *Polar Biology*. 31: 245–248. DOI: 10.1007/s00300-007-0360-5.

8. Scholarship amount (net): 3000 PLN for mid-term evaluation, after mid-term evaluation, change to 57% professor's remuneration (currently it would be 3242 PLN net).