Creatures from the cold and deep: methods for assessing zooplankton along the Antarctic peninsula

Plasman Charlie[1], Lainas Araujo Edwin[2], Vega Ludmila[3], Huyghe Filip[4], Kochzius Marc[4] and Van de Putte Anton[5]

[1] Operational Directorate Natural Environment, Institute of natural Sciences
E-mail: cplasman@naturalsciences.be
[2] Universidad Scientifica del Sur, Panamericana Sur 19, Lima, Peru
[3] Universidad de Buenos Aires, Departamento de Biodiversidad Experimental, Faculdad de Sciencias Exactas y Naturales, Intendente Güiraldes 2160, Ciudad Unversitaria, C1428EG, Argentina.
[4] Marine Biology, Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussels
[5] Operational Directorate Natural Environment, Institute of Natural Sciences, Vautierstraat 29, 1000 Brussels, Belgium

Zooplankton plays a central role in the trophic web of most marine ecosystems, the full extent of which is not yet completely understood in most regions. This is especially the case for the waters surrounding the Antarctic continent, an area still only benefiting from limited access and therefore limited scientific output. At the same time, the seas surrounding Antarctica support a complex ecosystem full of abundant and impressive wildlife. To improve our understanding of this ecosystem, it is imperative to gain a better knowledge of zooplankton diversity as well as the factors likely to influence this diversity. Since sampling in a remote area like Antarctica remains costly and time-consuming, our aim is also to improve sampling and evaluation methods, thereby rendering access to Antarctic zooplankton diversity data more widely accessible.

Here, we deploy several methods to assess and evaluate zooplankton with a focus on automation and improving speed and cost-efficiency of the data collection process. Sampling was done at 24 locations during an expedition in December 2024 along the Western Antarctic Peninsula and the Bransfield Strait. Bongo-nets with mesh sizes of 100 and 200 µm were lowered at 200 m depth or down till 20 m above the seabed in more shallow areas and towed vertically at a speed of 30 m/s, collecting zooplankton. Samples were preserved in 96 % ethanol on board the ship. Organisms will be identified to the lowest possible taxonomic level and developmental stage visually, using microscopes and identification manuals.

Additionally, key organisms will be photographed and used to train a zooscan for automated species recognition using machine learning. Environmental data were collected at each station using a CTD and will be implied along with online data to assess possible environmental drivers of zooplankton diversity and community structure.

Finally, Niskin bottles were deployed at each station, collecting water at 100 m depth at half of the maximum sampling depth. At each station, five litres of water were filtered for eDNA with a 0.22 µm and a 0.45 µm mesh size filter using the Sylphium syringe filtering system and preserved in Longmire buffer. Collected eDNA will be extracted from the filters using Qiagen Blood & Tissue extraction kits, quantified and quality controlled, amplified in a PCR reaction using universal COI primers and sequenced using Oxford Technologies Nanopore. Results of this analysis will be compared with the morphological identification in order to assess the potential of eDNA to describe zooplankton diversity.

The overall outcome of this project will be a description of zooplankton diversity from the Antarctic peninsula as well as the development of a method to easily sample and monitor zooplankton diversity in the future.

Keywords
Species Identification; Salps; Antarctic Expedition; Southern Ocean; Genetic Diversity.