Nabokin, M., Salganskiy, O., Tkachenko, V., Kovalenko, P., Dzhulai, A., Puhovkin, A., Gogol, S., Protsenko, Yu., Svetlichniy, L., & Kozeretska, I. (2023). Records of *Boeckella poppei* (Mrazek, 1901) (Calanoida: Centropagidae) obtained during Ukrainian Antarctic Expeditions. *Ukrainian Antarctic Journal*, *21*(1), 55–65.
https://doi.org/10.33275/1727-7485.1.2023.706

M. Nabokin [1, 2, *], O. Salganskiy [2, 3], V. Tkachenko [2, 4], P. Kovalenko [2, 5], A. Dzhulai [2, 6], A. Puhovkin [2, 7, 8], S. Gogol [2, 9], Yu. Protsenko [10], L. Svetlichniy [11], I. Kozeretska [2]

[1] Ukrainian Scientific Center of Ecology of the Sea, Ministry of Environmental Protection and Natural Resources of Ukraine, Odesa, 65009, Ukraine
[2] State Institution National Antarctic Scientific Center, Ministry of Education and Science of Ukraine, Kyiv, 01601, Ukraine
[3] National University of Life and Environmental Sciences of Ukraine, Kyiv, 03041, Ukraine
[4] Priazovsky National Nature Park, Ministry of Education and Science of Ukraine, Melitopol, 72319, Ukraine
[5] State Institution Institute for Evolutionary Ecology, National Academy of Sciences of Ukraine, Kyiv, 03143, Ukraine
[6] Dalhousie University, Halifax, B3H3Z1, Canada
[7] Masaryk University, Brno, 62500, Czech Republic
[8] Institute for Problems of Cryobiology and Cryomedicine, National Academy of Sciences of Ukraine, Kharkiv, 61016, Ukraine
[9] R.E. Kavetsky Institute of Experimental Pathology, Oncology and Radiobiology, National Academy of Sciences of Ukraine, Kyiv, 03022, Ukraine
[10] Taras Shevchenko National University of Kyiv, Kyiv, 01601, Ukraine
[11] I.I. Schmalhausen Institute of Zoology, National Academy of Sciences of Ukraine, Kyiv, 01054, Ukraine

*** Corresponding author:** m.nabokin1@gmail.com

Records of *Boeckella poppei* (Mrazek, 1901) (Calanoida: Centropagidae) obtained during Ukrainian Antarctic Expeditions

Abstract. The copepod *Boeckella poppei* (Mrazek, 1901) (Calanoida: Centropagidae) is one of the Maritime Antarctic's most common freshwater zooplankton species. It was first discovered in 1961–1962 on Signy Island (South Orkney Islands). Nowadays, it is found on many other islands in the region. The copepod is also found on Western Subantarctic islands, in the eastern part of the continent, and South America. However, in the Wilhelm Archipelago, there have been only a few disjointed findings of the species so far: it has been noted as numerous both north and south of the Ukrainian Antarctic Akademik Vernadsky station, yet for the archipelago, there are only two brief records which do not describe its distribution in this region. Our data are based on 114 specimens collected in 2005–2023 during Ukrainian Antarctic Expeditions. *Boeckella poppei* was found in 51 samples from 23 lakes on eight islands: Uruguay, Irizar, Berthelot, Galindez, Roca, and Eight (Wilhelm Archipelago), Nelson, King George (South Shetland Islands). Live specimens were recorded during the ice-free period and significantly after the surface was frozen. In many samples, adults and copepodid stages were found, while nauplii were not found.

Keywords: copepoda, distribution, Maritime Antarctic, Wilhelm Archipelago, zooplankton

1 Introduction

The last decades have been characterized by climate warming, which has resulted in alterations in ecosystems, both globally and specifically in Antarctica (Gómez et al., 2016). Studying sensitive ecosystems within relatively simple Antarctic communities, such as those in freshwater reservoirs, can provide valuable information about changes accompanying these processes. Appropriate knowledge also contributes to the biogeography and ecology of specific taxa, wherein databases such as the Global Biodiversity Information Facility play a significant role (GBIF.org, 24 September 2022).

The copepod *Boeckella poppei* (Mrazek, 1901) (Calanoida: Centropagidae) (Figs. 1, 2) is one of the commonest species of freshwater zooplankton in Maritime Antarctica. It used to be called *Pseudoboeckella silvestri* Daday, 1901 (Heywood, 1970), then *P. poppei* Mrázek, 1901 (Heywood, 1977a), and lastly, was moved to the genus *Boeckella* Guerne & Richard, 1889 (Bayly, 1992a).

Boeckella poppei occurs in the Antarctic in freshwater lakes, which can be characterized by significant fluctuations in salinity (Bayly et al., 2003; Pociecha & Dumont, 2008). A rough description of the life cycle of *B. poppei* can be found in Weller (1977). In some cases, a sharp increase in salinity has been recorded, which causes mortality but does not destroy the lake population (Pociecha & Dumont, 2008). In the lakes in which *B. poppei* is identified, the presence of organic-rich material largely derived from microbial mats surrounding these lakes is shown (Bayly et al., 2003). According to Rocco et al. (2002), the copepod's biochemistry changes during the duration of the ozone hole under strong UV irradiation. Antarctic freshwater lakes are mainly not deep, which sometimes leads to the complete freezing of water in the cold period and significant heating during the austral summer (Heywood, 1970; Izaguirre et al., 2003). *Boeckella poppei* males preyed upon the rotifer *Philodina gregaria* Murray, 1910, and their own nauplii, but not on copepodites II (Izaguirre et al., 2003). Generally, the success of *B. poppei* in Antarctica is, therefore, likely a consequence of its capability to live under rapid changes in temperature, salinity, and other parameters (Heywood, 1970; Weller, 1977; Bayly et al., 2003; Izaguirre et al., 2003).

In the Maritime Antarctic, the copepod was first registered in the austral summer of 1961–1962. The samples were collected on Signy Island (South Orkney Islands) (Heywood, 1967); the paper also addresses the population's seasonal dynamics and interaction with the environment's physical, chemical, and biological factors. It was discovered much further to the south later on (in the summer of 1973–1974, on Alexander Island, 70°49′ S, 68°45′ W (Heywood, 1977b) and in January 1976, on Adelaide Island, near the British Rothera Station (Dartnall, 1980)).

As for the South Shetland Islands, the animal was first reported on King George Island by Campos et al. (1978) from samples collected in 1973. The first quantitative results for the island were published by Janiec (1993) (for samples of the 1987–1988 season). The copepod was also recorded on Deception Island in samples collected in 1999 (Downie et al., 2000) and in the lakes of Livingston Island (2001–2002, published by Toro et al. (2007)).

The sporadic data for the Wilhelm Archipelago include the records for the Roca Islands (the season of 2007–2008, published by Polishuk et al. (2009)) and Uruguay Island (2020, Chernov et al. (2020)). These are simple presence data unaccompanied by detailed descriptions. All in all, different authors have noted *B. poppei* throughout the whole of Maritime Antarctica and the Antarctic Peninsula (Dartnall, 2017; Díaz et al., 2019; Maturana et al., 2019; Nabokin, 2022).

The copepod is also known on the Western Subantarctic islands (Pugh et al., 2002; Dartnall, 2017; Díaz et al., 2019) and considered "exceptionally variable" on the Falkland Islands (Dartnall & Hollwedel, 2007). The species was also recorded in continental South America (GBIF, 24 September 2022) and East Antarctica (first identified during the 1934–1937 expedition (Harding, 1941)).

Populations from eastern Antarctica have been studied later. Populations with dwarfism of the species are mentioned in (Bayly & Burton, 1993; Bayly et al., 2003) for the Amery and Bunger Hills oases area. Cited articles review the animal's morphology arguing against the copepod being recently introduced

into these ecosystems and for it being a relic from before the Late Pleistocene glaciation.

Studies of this Antarctic copepod species allow tracing the morphological and genetic changes from population to population (Bayly et al., 2003; Maturana et al., 2021; 2022) and inferring the ways and means of the species' spreading forwards. Since the copepod is common in the freshwater rock pools of Maritime Antarctica, the pools' communities' quantitative parameters might be used for evaluating the state of the Antarctic ecosystems, including the ecological and climatic changes in the region (Jocqué et al., 2007; 2010).

Our paper provides data on the findings of *B. poppei* in the samples collected in the 2005–2006, 2008–2009, 2015–2016, 2018–2019, and 2021–2023 Ukrainian Antarctic Expeditions (UAEs).

2 Materials and methods

The study was done on 114 samples of invertebrates collected in 2005–2006, 2008–2009, 2015–2019, and 2021–2023 UAEs. The findings of the 2005-2006 UAE are taken from Trokhymets et al. (2021).

We collected the material mostly within the Wilhelm Archipelago, with some taken on the South Shetlands, King George Island, Nelson Island, and Deception Island. To do it, we sampled rock pools and large lakes using standard zooplankton research techniques (Jacobs & Grant, 1978; Lebedenko et al., 2021). We condensed a known volume of water through a small Apstein net with a mesh size of 100 μm. If we could not concentrate the sample *in situ*, the water was transported to the laboratory in tanks made of chemically inert plastic and filtered through the gauze with a mesh size of 100 μm. If the lake was covered with ice, a well was cut to sample it. A sample was collected from 5 to 50 liters of water depending on the size of the reservoir and the visible number of copepods inside. The remaining water was removed using a pipette with its tip covered by gauze. The residue was fixed in 96% ethanol, signed, and transported to Ukraine for analysis.

Boeckella poppei was identified according to Bayly (1992a; 1992b), using a stereoscopic microscope MBS-10 (USSR) and a trinocular microscope Euromex (the Netherlands).

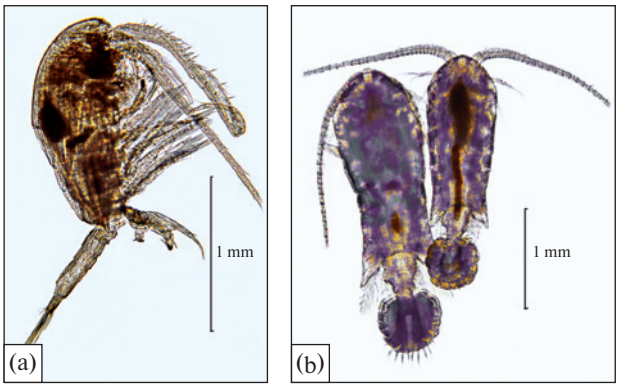

Figure 1. *Boeckella poppei*, (a) – male; (b) – two females of different sizes collected on Nelson Island on 05.02.2023

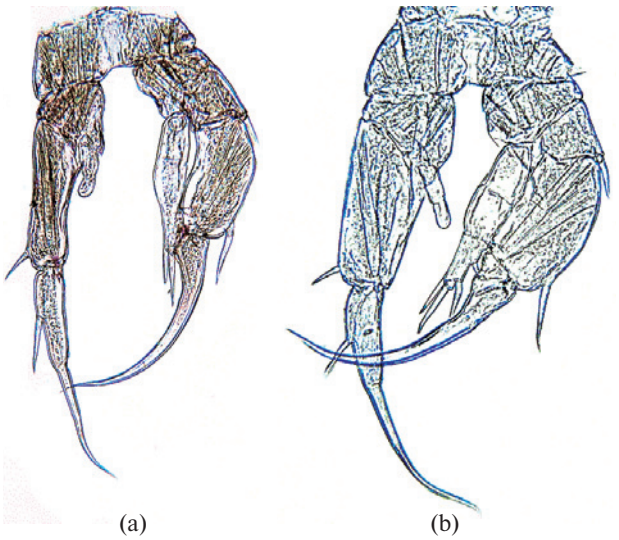

Figure 2. *Boeckella poppei* fifth legs of male: (a) – fifth legs, posterior aspect of specimens collected on Roca Island on 19.02.2018; (b) – fifth legs, posterior aspect of specimens collected on Nelson Island on 05.02.2023

The distribution of the *B. poppei* was mapped using the QIGS 3.28.3 software (https://www.qgis.org/en/site/forusers/download.html). The names of the islands are given in accordance with Secretariat SCAR (https://gcmd.nasa.gov/records/SCAR_Gazetteer.html, 1992, updated 2023) and Yevchun et al. (2021). The animals were microphotographed using a SONY a5000 camera mounted onto the microscope Biolam LOMO (USSR).

3 Results

Boeckella poppei was found in small temporary water bodies up to 1 m deep with an area of up to 1 m^2 and in large lakes with an area of more than 100 m^2. Alive specimens were found even much later after the water became covered with ice. Adults were present in all samples. The copepodid stages were almost never found, and the naupliar were absent. Notably, most of the copepodid stages (including even the early I-III stages) were collected at the end of the austral summer, in March and April. At the start of the sampling in January, all samples contained only adults.

Interestingly, in 2008–2018 the copepod in the Wilhelm Archipelago was recorded only on the Roca Islands. In 2019, it was not found at all. Since 2021, it has been found everywhere in the freshwater lakes of the archipelago. We have never found it in the briny lakes of Deception Island.

By the results of the six UAEs, *B. poppei* was found in 51 samples from 23 lakes from 8 islands (Fig. 3, Appendix).

The copepod was found from 62°09′36.0″ S (King George Island, South Shetlands) to 65°20′09.3″ S (Berthelot Islands, Wilhelm Archipelago) from north to south and from 58°28′12.0″ W (King George Island) to 64°29′31.3″ W (Roca Islands, Wilhelm Archipelago) from east to west.

4 Discussion

Previous works on the distribution of *B. poppei* in Antarctica concerned significant areas both north and south of the Wilhelm Archipelago. As for the archipelago itself and the Argentine Islands in particular, the literature contains only a few short remarks for some islands (Polishuk et al., 2009; Chernov et al., 2020). Our study identified with coordinates the copepod on eight islands. On five islands (Irizar, Berthelot, Galindez, Eight (Wilhelm Archipelago), Nelson Island (South Shetlands)), it had not been recorded before (three of these five islands are mentioned in Trokhymets and Dykyy, (2021), however, without specifying the coordinates).

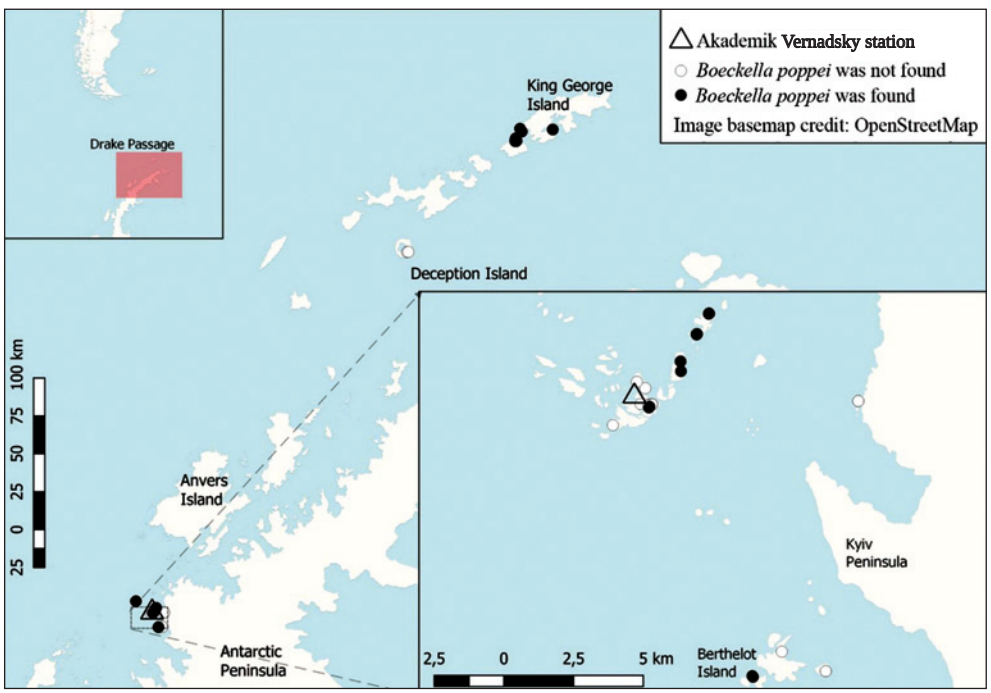

Figure 3. Data on the distribution of *Boeckella poppei* according to the results of the current study

Adult specimens were present practically everywhere. Meanwhile, the copepodid stages were rare; these were numerous and included stages I–III only at the end of the season, in March and April. It could be evidence of the animal's annual development beginning much earlier than the start of sampling and extending past the end; thus, it is important to continue the observations in the cold season. For the Argentine Islands, the information from before the start of the warm season is especially valuable given its scarcity. A more recent paper (Pociecha & Dumont, 2008) mentions the copepod having several annual generations (no less than three) in Lake Wujka of King George Island. However, it does not provide any details on its yearly development.

The fact that in 2022 the copepod was not found in the brackish lakes of Deception Island could mean that it has a low tolerance to salinity. However, according to the GBIF database (GBIF.org, 24 September 2022), nevertheless, *B. poppei* is found in freshwater lakes, which can be characterized by significant fluctuations in the salinity (Bayly et al., 2003; Pociecha & Dumont, 2008). It was also found on Deception Island in 1999 (Downie et al., 2000). Investigating *B. poppei*'s halotolerance could yield insights into its distribution and ecology.

Data from six expeditions confirm the species everywhere on the islands of the Wilhelm Archipelago. In 2008–2018, it was recorded only on the Roca Islands, but in 2021, it appeared on many islands all over the archipelago. While this can indicate an increase in range, it might simply be a result of the earlier sampling design not being synchronized with the animal's developmental rhythm. In the opinion of Bayly and Burton (1993), the species can have persisted in the region since before the Late Pleistocene glaciation. The literature has it both north and south of the study area, and Dartnall and Hollowday (1985) suppose that a sampler's competence and the quality of collected material might greatly impact the number of found and identified organisms. Cukier et al. (2023) discuss the possibility of the freshwater copepods being spread by humans; thus, there is a probability of the animal being dispersed by the samplers. However, the data so far are too scant to be decisively explained.

Further research is needed for a more complete understanding of the genetic diversity and origin of *B. poppei* and to describe in more detail its distribution throughout the Wilhelm Archipelago.

Data availability. All data can be found in the article and the Appendix.

Author contributions. M.N.: concept and design of the study, sample collection and preparation, data analysis and interpretation, initial drafting, and subsequent revision of the manuscript. O.S.: sample collection. V.T.: sample collection and treatment, manuscript revision. P.K.: sample collection, initial drafting, and revision of the manuscript. A.D.: sample collection, manuscript revision. A.P.: sample collection, manuscript revision. S.G.: sample collection, manuscript revision. Yu.P.: data analysis, manuscript revision. L.S.: data analysis and interpretation, manuscript revision. I.K.: sample collection, project administration, study conception and design, interpretation, and revision of the manuscript.

Acknowledgements. The authors express gratitude to V. Gorobchyshyn (Institute for Evolutionary Ecology, National Academy of Sciences of Ukraine, Kyiv, Ukraine) for consultations and comprehensive support. We thank two anonymous reviewers for their constructive comments and suggestions that helped improve the manuscript.

Funding. The current study was performed in the framework of the Ukrainian State Special-Purpose Research Program in Antarctica for 2011–2023 and the Czech Antarctic Research Programme (CARP).

Conflict of Interest. The authors vouch that they have no conflict of interest.

References

Bayly, I. A. E. (1992a). Fusion of the genera *Boeckella* and *Pseudoboeckella* (Copepoda) and revision of their species from South America and sub-Antarctic islands. *Revista Chilena de Historia Natural*, *65*(1), 17–63. https://rchn.biologiachile.cl/pdfs/1992/1/Bayly_1992.pdf

Bayly, I. A. E. (1992b). *The non-marine Centropagidae* (*Copepoda: Calanoida*) *of the world*. SPB Academic Pub., The Hague (Netherlands). SPB Academic Publishing.

Bayly, I. A. E., & Burton, H. R. (1993). Beaver Lake, Greater Antarctica, and its population of *Boeckella poppei* (Mrazek)

(Copepoda: Calanoida). *SIL Proceedings, 1922–2010. Internationale Vereinigung fur Theoretische und Angewandte Limnologie: Verhandlungen*, *25*(2), 975–978. https://doi.org/10.1080/03680770.1992.11900300

Bayly, I. A. E., Gibson, J. A. E., Wagner, B., & Swadling, K. M. (2003). Taxonomy, ecology and zoogeography of two East Antarctic freshwater calanoid copepod species: *Boeckella poppei* and *Gladioferens antarcticus*. *Antarctic Science*, *15*(4), 439–448. https://doi.org/10.1017/S0954102003001548

Campos, H., Arenas, J., & Steffen, W. (1978). Antecedentes y observaciones limnológicas en los principales lagos de la Isla Rey Jorge, Shetland del Sur, Antártica. *Instituto Antártico Chileno, Serie Cientifica*, *24*, 11–19. (In Spanish)

Chernov, A., Pishniak, D., Trokhymets, V., & Bilyi, T. (2020). Structure and inhabitants of the lakes and ponds on Uruguay Island (the Wilhelm Archipelago, Antarctica). In *XIV International Scientific Conference* "*Monitoring of Geological Processes and Ecological Condition of the Environment*" (Vol. 2020, pp. 1–5). European Association of Geoscientists & Engineers. https://doi.org/10.3997/2214-4609.202056052

Cukier, S., Fudala, K., & Bialik, R. J. (2023). Are Antarctic aquatic invertebrates hitchhiking on your footwear? *Journal for Nature Conservation*, *72*, 126354. https://doi.org/10.1016/j.jnc.2023.126354

Dartnall, H. J. G. (1980). Freshwater biology at Rothera Point, Adelaide Island: 1. General description of the pools and the fauna. *British Antarctic Survey Bulletin*, *50*, 51–54. Retrieved February 10, 2022, from https://www.bas.ac.uk/data/our-data/our-publications/bas-bulletins-1963-1988/#50

Dartnall, H. J. G. (2017). The freshwater fauna of the South Polar Region: A 140-year review. *Papers and Proceedings of the Royal Society of Tasmania*, *151*, 19–57. https://doi.org/10.26749/rstpp.151.19

Dartnall, H. J. G., & Hollwedel, W. (2007). A limnological reconnaissance of the Falkland Islands; with particular reference to the waterfleas (Arthropoda: Anomopoda). *Journal of Natural History*, *41*(21–24), 1259–1300. https://doi.org/10.1080/00222930701401010

Dartnall, H. J. G. & Hollowday, E. D. (1985). *Antarctic Rotifers* (British Antarctic Survey Scientific Reports, 100). Cambridge, British Antarctic Survey. Retrieved April 14, 2023, from https://nora.nerc.ac.uk/id/eprint/509185/

Díaz, A., Maturana, C. S., Boyero, L., De Los Ríos Escalante, P., Tonin, A. M., & Correa-Araneda, F. (2019). Spatial distribution of freshwater crustaceans in Antarctic and Subantarctic lakes. *Scientific Reports*, *9*, 7928. https://doi.org/10.1038/s41598-019-44290-4

Downie, R. H., Convey, P., McInnes, S. J., & Pugh, P. J. A. (2000). The non-marine invertebrate fauna of Deception Island (Maritime Antarctic): a baseline for a comprehensive biodiversity database. *Polar Record*, *36*(199), 297–304. https://doi.org/10.1017/s0032247400016788

GBIF.org (24 September 2022). *GBIF Occurrence Download*. https://doi.org/10.15468/dl.8sw4hb. Retrieved May 30, 2023, from https://www.gbif.org/occurrence/download/0022074-220831081235567

Gómez, I., Huovinen, P., & Valdivia, N. (Eds.). (2016). *Impacts of climate change on Antarctic ecosystems*. Revista Chilena de Historia Natural, BMC. Retrieved May 30, 2023, from https://www.biomedcentral.com/collections/antarctic

Harding, J. P. (1941). Lower Crustacea. British Graham Land expedition, 1934–37. *Scientific Reports*, *1*(6), 319–322. Retrieved April 1, 2023, from https://www.biodiversitylibrary.org/item/306267#page/424/mode/1up

Heywood, R. B. (1967). Antarctic Ecosystems. The freshwater lakes of Signy Island and their fauna. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *252*(777), 347–362. https://doi.org/10.1098/rstb.1967.0024

Heywood, R. B. (1970). Ecology of the fresh-water lakes of Signy Island, South Orkney Islands: III. Biology of the copepod *Pseudoboeckella silvestri* Daday (Calanoida, Centropagidae). *British Antarctic Survey Bulletin*, *23*, 1–17.

Heywood, R. B. (1977a). The correct identity of a *Pseudoboeckella* sp. (Copepoda, Calanoida) from Signy Island, South Orkney Islands. *British Antarctic Survey Bulletin*, *45*, 147. Retrieved March 27, 2023, from http://nora.nerc.ac.uk/id/eprint/525556

Heywood, R. B. (1977b). A limnological survey of the Ablation Point area, Alexander Island, Antarctica. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *279*(963), 39–54. https://doi.org/10.1098/rstb.1977.0070

Izaguirre, I., Allende, L., & Marinone, M. C. (2003). Comparative study of the planktonic communities of three lakes of contrasting trophic status at Hope Bay (Antarctic Peninsula). *Journal of Plankton Research*, *25*(9), 1079–1097. https://doi.org/10.1093/plankt/25.9.1079

Jacobs, F., & Grant, G. C. (1978). *Guidelines for zooplankton sampling in quantitative baseline and monitoring programs* (No. 83). Virginia Institute of Marine Science, William & Mary. http://dx.doi.org/doi:10.21220/m2-ccer-mh89

Janiec, K. (1993). The freshwater micro- and meiofauna of Admiralty Bay, King George Island, South Shetland Islands. In *Proceedings of the NIPR Symposium on Polar Biology* (Vol. 6, pp. 133–138). National Institute of Polar Research. https://doi.org/10.15094/00005193

Jocqué, M., Graham, T., & Brendonck, L. (2007). Local structuring factors of invertebrate communities in ephemeral freshwater rock pools and the influence of more permanent water bodies in the region. *Hydrobiologia*, *592*(1), 271–280. https://doi.org/10.1007/s10750-007-0766-7

Jocqué, M., Vanschoenwinkel, B., & Brendonck, L. (2010). Freshwater rock pools: a review of habitat characteristics, faunal diversity and conservation value. *Freshwater Biology*, *55*(8), 1587–1602. https://doi.org/10.1111/j.1365-2427.2010.02402.x

Lebedenko, L., Nabokyn, M., & Kovalyshyna, S. (2021). Monitoring of planktonic invertebrates and recommendations for its identification. In E. Zubcov, & L. Biletchi (Eds.), *Methodological guide for monitoring the hydropower impact on trans-*

boundary river ecosystems (pp. 32–36). Retrieved April 14, 2023, from https://ibn.idsi.md/ro/vizualizare_articol/164397

Maturana, C. S., Rosenfeld, S., Naretto, J., Convey, P., & Poulin, E. (2019). Distribution of the genus *Boeckella* (Crustacea, Copepoda, Calanoida, Centropagidae) at high latitudes in South America and the main Antarctic biogeographic regions. *ZooKeys*, *854*, 1–15. https://doi.org/10.3897/zookeys.854.29614

Maturana, C. S., Rosenfeld, S., Biersma, E. M., Segovia, N. I., González-Wevar, C. A., Díaz, A., Naretto, J., Duggan, I. C., Hogg, I. D., Poulin, E., Convey, P., & Jackson, J. A. (2021). Historical biogeography of the Gondwanan freshwater genus *Boeckella* (Crustacea): Timing and modes of speciation in the Southern Hemisphere. *Diversity and Distributions*, *27*(12), 2330–2343. https://doi.org/10.1111/ddi.13405

Maturana, C. S., Biersma, E. M., Díaz, A., González-Wevar, C., Contador, T., Convey, P., Jackson J. A., & Poulin, E. (2022). Survivors and colonizers: Contrasting biogeographic histories reconciled in the Antarctic freshwater copepod *Boeckella poppei*. *Frontiers in Ecology and Evolution*, *10*, 1012852. https://doi.org/10.3389/fevo.2022.1012852

Nabokin, M. (2022). Faunistic analysis of freshwater zooplankton in small rock pools of Maritime Antarctica. *Ukrainian Antarctic Journal*, *20*(1), 113–124. https://doi.org/10.33275/1727-7485.1.2022.694

Polishuk, V. P., Kostikov, I. Yu., Taran, N. Yu., Voitsitsky, V. M., Budzanivska, I. G., Khyzhnyak, S. V., & Trokhymets, V. M. (2009). The complex studying of Antarctic biota. *Ukrainian Antarctic Journal*, *8*, 284–292. https://doi.org/10.33275/1727-7485.8.2009.455 (In Ukrainian)

Pociecha, A., & Dumont, H. J. (2008). Life cycle of *Boeckella poppei* Mrazek and *Branchinecta gaini* Daday (King George Island, South Shetlands). *Polar Biology*, *31*(2), 245–248. https://doi.org/10.1007/s00300-007-0360-5

Pugh, P. J. A., Dartnall, H. J. G., & McInnes, S. J. (2002). The non-marine Crustacea of Antarctica and the Islands of the Southern Ocean: biodiversity and biogeography. *Journal of Natural History*, *36*(9), 1047–1103. https://doi.org/10.1080/00222930110039602

Rocco, V. E., Oppezzo, O., Pizarro, R., Sommaruga, R., Ferraro, M., & Zagarese, H. E. (2002). Ultraviolet damage and counteracting mechanisms in the freshwater copepod *Boeckella poppei* from the Antarctic Peninsula. *Limnology and Oceanography*, *47*(3), 829–836. https://doi.org/10.4319/lo.2002.47.3.0829

Secretariat SCAR (1992, updated 2023). *Composite Gazetteer of Antarctica, Scientific Committee on Antarctic Research*. GCMD Metadata.

Toro, M., Camacho, A., Rochera, C., Rico, E., Bañón, M., Fernández-Valiente, E., Marco, E., Justel, A., Avendaño, M. C., Ariosa, Y., Vincent, W. F., & Quesada, A. (2007). Limnological characteristics of the freshwater ecosystems of Byers Peninsula, Livingston Island, in maritime Antarctica. *Polar Biology*, *30*(5), 635–649. https://doi.org/10.1007/s00300-006-0223-5

Trokhymets, V., & Dykyy, I. (2021). Prisnovodni rakopodibni u raioni Arhentynskykh ostroviv (Arkhipelah Vilhelma, Zakhidna Antarktyka) [Freshwater crustaceans in the area of the Argentine Islands (Wilhelm Archipelago, West Antarctica)]. In *Materialy druhykh Kharkivskykh zoolohichnykh chytan z zoolohii bezkhrebetnykh, prysviacheni pamiati profesora Ye. I. Lukina. 3–4 lystopada 2021 roku, m. Kharkiv, Ukraina [Materials of the second Kharkiv Zoological Lectures on Invertebrate Zoology, dedicated to the memory of Professor E. I. Lukin. November 3–4, 2021, Kharkiv, Ukraine*]. V. N. Karazin Kharkiv National University.

Trokhymets, V., Gorobchyshyn, V., & Kozeretska, I. (2021). Population features of *Boeckella poppei* in Lake Wujka, King George Island. *Ukrainian Antarctic Journal*, 1, 117–122. https://doi.org/10.33275/1727-7485.1.2021.670

Weller, D. L. M. (1977). Observations on the diet and development of *Pseudoboeckella poppei* (Calanoida, Centropagidae) from an Antarctic lake. *British Antarctic Survey Bulletin*, *45*, 77–92.

Yevchun, H., Fedchuk, A., Drohushevska, I., Pnyovska, O., Chernyshenko, M., & Parnikoza, I. (2021). The Toponymy of the Argentine Islands area, the Kyiv Peninsula (West Antarctica). *Ukrainian Antarctic Journal*, 2, 127–157. https://doi.org/10.33275/1727-7485.2.2021.683

Received: 1 April 2023
Accepted: 22 July 2023

М. Набокін [1, 2, *], О. Салганський [2, 3], В. Ткаченко [2, 4], П. Коваленко [2, 5], А. Джулай [2, 6], А. Пуговкін [2, 7, 8], С. Гоголь [2, 9], Ю. Проценко [10], Л. Свєтлічний [11], І. Козерецька [2]

[1] Український науковий центр екології моря, Міністерство захисту довкілля та природних ресурсів України, м. Одеса, 65009, Україна
[2] Державна установа Національний антарктичний науковий центр, Міністерство освіти і науки України, м. Київ, 01601, Україна
[3] Національний університет біоресурсів і природокористування України, м. Київ, 03041, Україна
[4] Приазовський національний природний парк, Міністерство захисту довкілля та природних ресурсів України, м. Мелітополь, 72319, Україна
[5] Державна установа «Інститут еволюційної екології НАН України», м. Київ, 03143, Україна
[6] Університет Делгаузі, м. Галіфакс, B3H3Z1, Канада
[7] Університет Масарика, м. Брно, 62500, Чеська Республіка
[8] Інститут проблем кріобіології і кріомедицини НАН України, м. Харків, 61016, Україна
[9] Інститут експериментальної патології, онкології і радіобіології ім. Р. Є. Кавецького НАН України, м. Київ, 03022, Україна
[10] Київський національний університет імені Тараса Шевченка, м. Київ, 01601, Україна
[11] Інститут зоології ім. І.І. Шмальгаузена НАН України, м. Київ, 01054, Україна

*** Автор для кореспонденції:** m.nabokin1@gmail.com

Знахідки *Boeckella poppei* (Mrazek, 1901) (Calanoida: Centropagidae), отримані під час Українських антарктичних експедицій

Реферат. Веслоногий рак *Boeckella poppei* (Mrazek, 1901) (Calanoida: Centropagidae) є одним із найбільш поширених видів прісноводного зоопланктону у Морській Антарктиці. Вперше він був виявлений у 1961–1962 роках на острові Сігні (Південні Оркнейські острови). Зараз він зустрічається на багатьох інших островах цього регіону. Також цей веслоногий рак розповсюджений на західних субантарктичних островах, у східній частині континенту та в Південній Америці. Однак на архіпелазі Вільгельма наразі було виявлено лише кілька розрізнених знахідок зазначеного виду: хоча він був відмічений як масовий як північніше, так і південніше Української антарктичної станції «Академік Вернадський», та для самого архіпелагу є лише два короткі записи, які не описують його розповсюдження в цьому регіоні. Наші дані базуються на 114 зразках, зібраних впродовж Українських антарктичних експедицій з 2005 по 2023 роки. *Boeckella poppei* було знайдено в 51 зразках із 23 озер на 8 островах: Уругвай, Ірізар, Берселот, Галіндез, Рока та Вісімка (архіпелаг Вільгельма), Нельсон, Кінг Джордж (Південні Шетландські острови). Живі екземпляри виявляли як в період непокритої льодом води, так і через значний час після замерзання її поверхні. У багатьох зразках ідентифіковані дорослі особини, в той же час науплії не зафіксовані.

Ключові слова: архіпелаг Вільгельма, зоопланктон, копеподи, Морська Антарктика, поширення

APPENDIX

Table 1. Information about sites for which *Boeckella poppei* was recorded during Ukrainian Antarctic Expeditions (2005–2006, 2008–2009, 2015–2016, 2018–2019, and 2021–2023). The rows with sites on which *B. poppei* was recorded for the first time (based on the analysis of literature data) by samples collected during the Ukrainian Antarctic Expeditions are **bolded**

№	Date	Island	Latitude	Longitude	References**
1	23.12.2005	King George	–62.166111	–58.470000	Trokhymets et al., 2021
2	03.01.2006	King George	–62.166111	–58.470000	Trokhymets et al., 2021
3	10.01.2006	King George	–62.166111	–58.470000	Trokhymets et al., 2021
4	02.02.2008	Roca	–65.178983	–64.492017	Polishuk et al., 2009
5	19.02.2015	Roca	–65.178983	–64.492017	Polishuk et al., 2009
6	19.02.2018	Roca	–65.178983	–64.492017	Polishuk et al., 2009
7	05.02.2021	Uruguay	–65.234487	–64.222416	Chernov et al., 2020
8	11.04.2021	Uruguay	–65.234487	–64.222416	Chernov et al., 2020
9	07.03.2021	Uruguay	–65.234487	–64.222416	Chernov et al., 2020
10	02.03.2021	Uruguay	–65.237648	–64.222098	Chernov et al., 2020
11	09.02.2021	Uruguay	–65.234487	–64.222416	Chernov et al., 2020
12	**02.02.2021**	**Irizar**	**–65.219070**	**–64.200420**	**–**
13	17.04.2021	Uruguay	–65.234487	–64.222416	Chernov et al., 2020
14	**09.02.2021**	**Irizar**	**–65.219140**	**–64.200710**	**–**
15	02.03.2021	Uruguay	–65.234487	–64.222416	Chernov et al., 2020
16	**16.02.2021**	**Irizar**	**–65.219070**	**–64.200420**	**–**
17	**21.02.2021**	**Berthelot**	**–65.335596**	**–64.167150**	**–**
18	**21.02.2021**	**Berthelot**	**–65.335923**	**–64.166606**	**–**
19	**15.04.2021**	**Berthelot**	**–65.335923**	**–64.166606**	**–**
20	**06.01.2021**	**Galindez**	**–65.249083**	**–64.246383**	**–**
21	**13.01.2021**	**Galindez**	**–65.249083**	**–64.246383**	**–**
22	**17.01.2021**	**Galindez**	**–65.249083**	**–64.246383**	**–**
23	**06.01.2021**	**Galindez**	**–65.249350**	**–64.246817**	**–**
24	**15.02.2022**	**Eight***	**–65.225694**	**–64.209778**	**–**
25	**15.02.2022**	**Eight***	**–65.225833**	**–64.210028**	**–**
26	**11.02.2022**	**Eight***	**–65.225833**	**–64.210028**	**–**
27	**22.02.2022**	**Irizar**	**–65.219140**	**–64.200710**	**–**
28	**16.02.2022**	**Irizar**	**–65.218978**	**–64.200502**	**–**
29	**22.02.2022**	**Irizar**	**–65.219070**	**–64.200420**	**–**
30	**15.02.2022**	**Eight***	**–65.225778**	**–64.210028**	**–**
31	**04.03.2022**	**Eight***	**–65.225694**	**–64.209778**	**–**
32	**22.03.2022**	**Eight***	**–65.225778**	**–64.210028**	**–**
33	**04.03.2022**	**Irizar**	**–65.219070**	**–64.200420**	**–**
34	**04.03.2022**	**Irizar**	**–65.218978**	**–64.200502**	**–**
35	**28.03.2022**	**Irizar**	**–65.219070**	**–64.200420**	**–**

End of Table 1

№	Date	Island	Latitude	Longitude	References**
36	**22.03.2022**	**Eight***	**–65.225694**	**–64.209778**	**–**
37	**22.03.2022**	**Eight***	**–65.225833**	**–64.210028**	**–**
38	16.04.2022	King George	–62.166111	–58.470000	Trokhymets et al., 2021
39	**05.02.2023**	**Nelson**	**–62.243121**	**–58.997027**	**–**
40	**05.02.2023**	**Nelson**	**–62.241947**	**–58.992166**	**–**
41	**05.02.2023**	**Nelson**	**–62.242149**	**–58.999691**	**–**
42	**05.02.2023**	**Nelson**	**–62.241367**	**–59.005252**	**–**
43	**05.02.2023**	**Nelson**	**–62.245622**	**–59.000592**	**–**
44	**05.02.2023**	**Nelson**	**–62.242605**	**–59.013622**	**–**
45	06.02.2023	King George	–62.224545	–59.005070	Trokhymets et al., 2021
46	**12.02.2023**	**Nelson**	**–62.244903**	**–59.011353**	**–**
47	**12.02.2023**	**Nelson**	**–62.242149**	**–58.999691**	**–**
48	**12.02.2023**	**Nelson**	**–62.241367**	**–59.005252**	**–**
49	**12.02.2023**	**Nelson**	**–62.241367**	**–59.005252**	**–**
50	14.02.2023	King George	–62.159999	–58.943304	Trokhymets et al., 2021
51	16.02.2023	King George	–62.179967	–58.916455	Trokhymets et al., 2021

Notes: * – The name of the island is given in accordance with Yevchun et al. (2021).
** – Sources are given which summarize the past finds of the species in the locality within the framework of the Ukrainian Antarctic Expeditions.

Table 2. Information about the sites for which *Boeckella poppei* was not recorded during Ukrainian Antarctic Expeditions (2005–2006, 2008–2009, 2015–2016, 2018–2019, and 2021–2023)

№	Date	Island	Latitude	Longitude
1	18.02.2008	Galindez	–65.248533	–64.245417
2	18.02.2008	Skua	–65.255017	–64.274567
3	06.12.2009	Berthelot	–65.327800	–64.144400
4	18.02.2015	Galindez	–65.248917	–64.246667
5	03.03.2015	Galindez	–65.248917	–64.246667
6	18.02.2015	Galindez	–65.248483	–64.245983
7	03.03.2015	Galindez	–65.248483	–64.245983
8	11.02.2015	Galindez	–65.248300	–64.244317
9	03.03.2015	Galindez	–65.248300	–64.244317
10	08.02.2015	Galindez	–65.248300	–64.244317
11	23.02.2015	Galindez	–65.248300	–64.244317
12	08.03.2015	Galindez	–65.248300	–64.244317
13	24.12.2015	Rasmussen	–65.247250	–64.085467
14	24.12.2015	Rasmussen	–65.247250	–64.085467
15	26.01.2016	Rasmussen	–65.247250	–64.085467
16	02.01.2018	Berthelot	–65.334080	–64.110520
17	20.01.2018	Berthelot	–65.334080	–64.110520
18	01.03.2018	Galindez	–65.248330	–64.245280
19	28.12.2021	Galindez	–65.248261	–64.246692
20	28.12.2021	Galindez	–65.248261	–64.246692
21	04.03.2022	Eight *	–65.225611	–64.209778
24	04.03.2022	Eight *	–65.225611	–64.210056
25	15.02.2022	Eight *	–65.225611	–64.209778
26	03.01.2022	Galindez	–65.248390	–64.245159
27	16.02.2022	Irizar	–65.219140	–64.200710
28	15.02.2022	Eight *	–65.225611	–64.210056
29	16.02.2022	Irizar	–65.219140	–64.200710
30	16.02.2022	Irizar	–65.219140	–64.200710
31	04.02.2022	Irizar	–65.219140	–64.200710
32	16.02.2022	Irizar	–65.219070	–64.200420
33	16.02.2022	Irizar	–65.219070	–64.200420
34	04.02.2022	Irizar	–65.219140	–64.200710
35	February 2022	Irizar	–65.219070	–64.200420
36	February 2022	Eight *	–65.225611	–64.209778
37	16.02.2022	Irizar	–65.219070	–64.200420
38	04.02.2022	Irizar	–65.219140	–64.200710
39	14.04.2022	Deception	–62.979443	–60.573577
40	14.04.2022	Deception	–62.979443	–60.573577
41	14.04.2022	Deception	–62.979088	–60.556328
42	29.01.2023	Galindez	–65.248917	–64.246667
43	29.01.2023	Galindez	–65.248483	–64.245983
44	29.01.2023	Galindez	–65.248300	–64.244317
45	20.02.2023	Galindez	–65.248917	–64.246667
46	20.02.2023	Galindez	–65.248300	–64.244317
47	20.02.2023	Galindez	–65.248233	–64.253167
48	20.02.2023	Galindez	–65.248717	–64.247567
49	25.02.2023	Uruguay	–65.234487	–64.222416
50	25.02.2023	Irizar	–65.219070	–64.200420
51	25.02.2023	Irizar	–65219140	–64200710
52	25.02.2023	Irizar	–65218978	–64200502
53	25.02.2023	Eight *	–65.225833	–64.210028
54	25.02.2023	Eight *	–65.225778	–64.210028
55	25.02.2023	Eight *	–65.225611	–64.209778
56	25.02.2023	Eight *	–65.225611	–64.210056
57	20.03.2023	Grotto	–65.243104	–64.249628
58	20.03.2023	Grotto	–65.241050	–64.2560667
59	05.02.2023	Nelson	–62.241870	–59.014127
60	08.02.2023	Nelson	–62.244903	–59.011353
61	09.02.2023	Nelson	–62.235783	–59.012095
62	12.02.2023	Nelson	–62.241870	–59.014127
63	12.02.2023	Nelson	–62.241947	–58.992166

End of Table 2

Note: * – The name of the island is given in accordance with Yevchun et al. (2021).