



Lead Author e-mail: zawieruchakrzysiu26@gmail.com

Title: Does a seabird guano influence tardigrade body size?

Krzysztof Zawierucha¹, Joanna Cytan¹, Jakub Kosicki², Jerzy Smykla³, Katarzyna Wojczulanis-Jakubas⁴, Łukasz Michalczyk⁵, Łukasz Kaczmarek¹

¹Department of Animal Taxonomy and Ecology, A. Mickiewicz University, Umultowska 89, 61-614 Poznań

²Department of Avian Biology and Ecology, Adam Mickiewicz University, Umultowska 89, 61-614 Poznań

³Department of Biodiversity, Institute of Nature Conservation, Polish Academy of Sciences, Mickiewicza 33, 31-120 Kraków

⁴Department of Vertebrate Ecology and Zoology, University of Gdansk, Wita Stwosza 59, 80-308 Gdańsk

⁵Department of Entomology, Institute of Zoology, Jagiellonian University, Gronostajowa 9, 30-387 Kraków

Polar ecosystems are considered to be fertilised mainly by nutrients of a marine source, i.e nutrients from guano of seabirds. The deposit off the seabirds guano has been demonstrated to affect some plant and invertebrate diversity as well as the morphology of the individuals. Here, we investigated the effect of the zooplanktivorous little auk (*Alle alle*) guano on the morphology of the waters bears (Tardigrada; small cosmopolitan invertebrates 50-1200 µm in size) in the Hornsund (Southern Spitsbergen). We found numerous and large populations of two tardigrade species, *Macrobiotus islandicus islandicus* (Richters, 1904) and *Echiniscus wendti* Richters, 1903. We tested whether there are intra-specific differences in taxonomically important morphometric traits between eight populations of *M. islandicus islandicus* and *Echiniscus wendti* collected both within and outside of bird colonies (GR = “guano rich” and GA = “guano absent”). Specimens were collected in eight localities (five within bird colonies and three controls outside of colonies).

All morphometric traits were highly correlated with each other (all $p < 0.001$). Such co-linearity prevented their joint inclusion in the analysis (violated non-independence). Therefore, we calculated an overall body size index (BSI) using a Principal Component Analysis (PC). The obtained BSI, expressed as a PC1 explained as much as 89% of variance. Next, to test for differences in the BSI between populations (GR/GA), a *t*-test was used. The tardigrade of both species sampled within the little auk colony had significantly higher BSI than those outside the colony ($p < 0.001$). The results suggest that, nutrients present in bird faeces are important for tardigrade development and possibly also for tardigrade population growth. This also suggests that inhabiting bird colonies may be of advantage for the invertebrate communities.