PRESS RELEASE

@mncn_csic, @mncn-csic.bsky.social

www.mncn.csic.es

We are far from knowing the actual number of Antarctic species

The biased understanding of the biodiversity and functioning of Antarctica's ecosystems hinders their conservation

- A lot is known about penguins or seals, but there is a generalized lack of information on microinvertebrates, microorganisms, or plants.
- Published in *Science*, the article proposes standardizing study methods and integrating and improving accessibility to available data
- The article sets the guidelines for obtaining a comprehensive view of what is known and unknown about this continent.

Madrid, 6th february 2025 Today, an international study led by the Spanish National Museum of Natural Sciences (*Museo Nacional de Ciencias Naturales*, MNCN-CSIC) and the Instituto de Investigación en Cambio Global from *Rey Juan Carlos* University (URJC) is published in *Science*. The study analyzes our current level of knowledge about Antarctic biodiversity, characterizing both advances in research and the gaps that still exist, thereby identifying the major unanswered questions about its ecology and evolution. The results show that, although much is known about the biology of marine vertebrates that breed along the coast, such as penguins and seals, there is still a significant lack of knowledge about much of the diversity and functioning of the terrestrial ecosystems of the icy continent. The researchers emphasize the need to invest more in taxonomic studies on cryptic groups, monitoring populations, regional surveys in less explored areas, and the characterization of functional traits and physiological responses. Equally necessary is the standardization of methods and the integration and accessibility of data.

“This study has allowed us, for the first time, to gain a comprehensive view of the level of ecological knowledge for an entire continent, setting the standard for exporting this type of research to Europe and other territories with far greater complexity,” says Luis R. Pertierra, the leader of this study. “That is, knowing what we know, and what we don’t, as a basis for identifying what still remains to be understood.”

Comunicación MNCN
Tel.: 914 111 328 / Ext. 443450/3536
Móvil: +34 699 047 365
c-e: comunicacion@mncn.csic.es
c/ José Gutiérrez Abascal, 2.
28006, Madrid

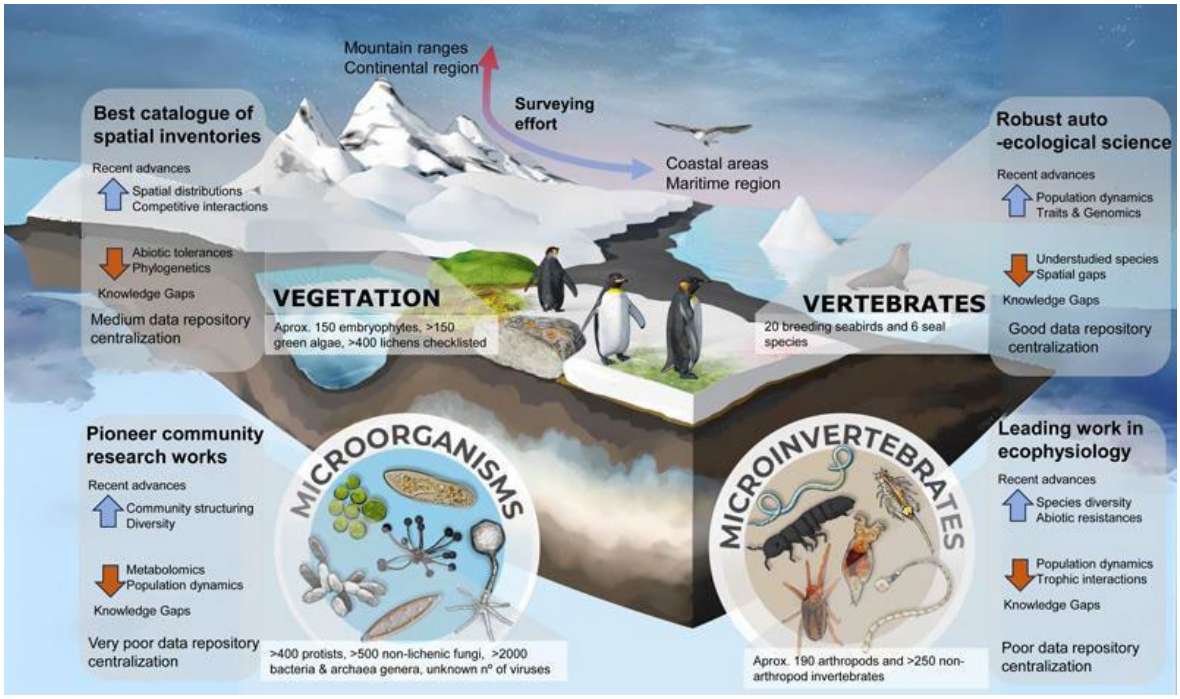


Diagram summarizing the results of this study.

“Antarctica is one of the few nearly pristine territories left on the planet, with environmental characteristics that support a unique biodiversity,” explains Asunción de los Ríos, a researcher at MNCN. “Research on the icy continent began just two centuries ago, and its study has revealed important discoveries about the evolution and functioning of life in such isolated places with such extreme climatic conditions,” the researcher notes. “Moreover, these ecosystems perform crucial functions, such as climate regulation, so it is crucial to understand how they are being affected by the impacts of global change,” adds Leopoldo García Sancho, a researcher at the Complutense University of Madrid. This study confirms that over 2,000 species of fauna, microbiota, and terrestrial flora have already been described for a system that is apparently inert and surrounded by ice, but many more remain to be discovered. Added to this is the difficulty of accessing the tens of thousands of microorganisms (such as bacteria and viruses) that are presumably beneath the ice. As a result, what we know about the properties of these organisms is even more limited and highly variable across different groups.

“We are at a critical point where it is necessary to pause and analyze what we know and what remains to be discovered about this fascinating continent in order to guide future research efforts,” says Pertierra. This is why scientists from different parts of the world have come together in this study to analyze the gaps in our knowledge of Antarctic biodiversity. Among its authors is Andrés Barbosa, a prominent member of the Scientific Committee for Antarctic Research (SCAR) and who also coordinated Spanish research on this continent. Sadly, he passed away two years ago, and this study is dedicated to him.

This international group of researchers has compiled and analyzed information from the major global biodiversity databases. “Large repositories like GBIF, which compiles spatial occurrence data, or GenBank, which gathers genetic information, allow us to both examine the distribution of biodiversity, and identify gaps in our

Comunicación MNCN
Tel.: 914 111 328 / Ext. 443450/3536
Móvil: 699 047 365
c-e: comunicacion@mncn.csic.es
c/ José Gutiérrez Abascal, 2.
28006, Madrid

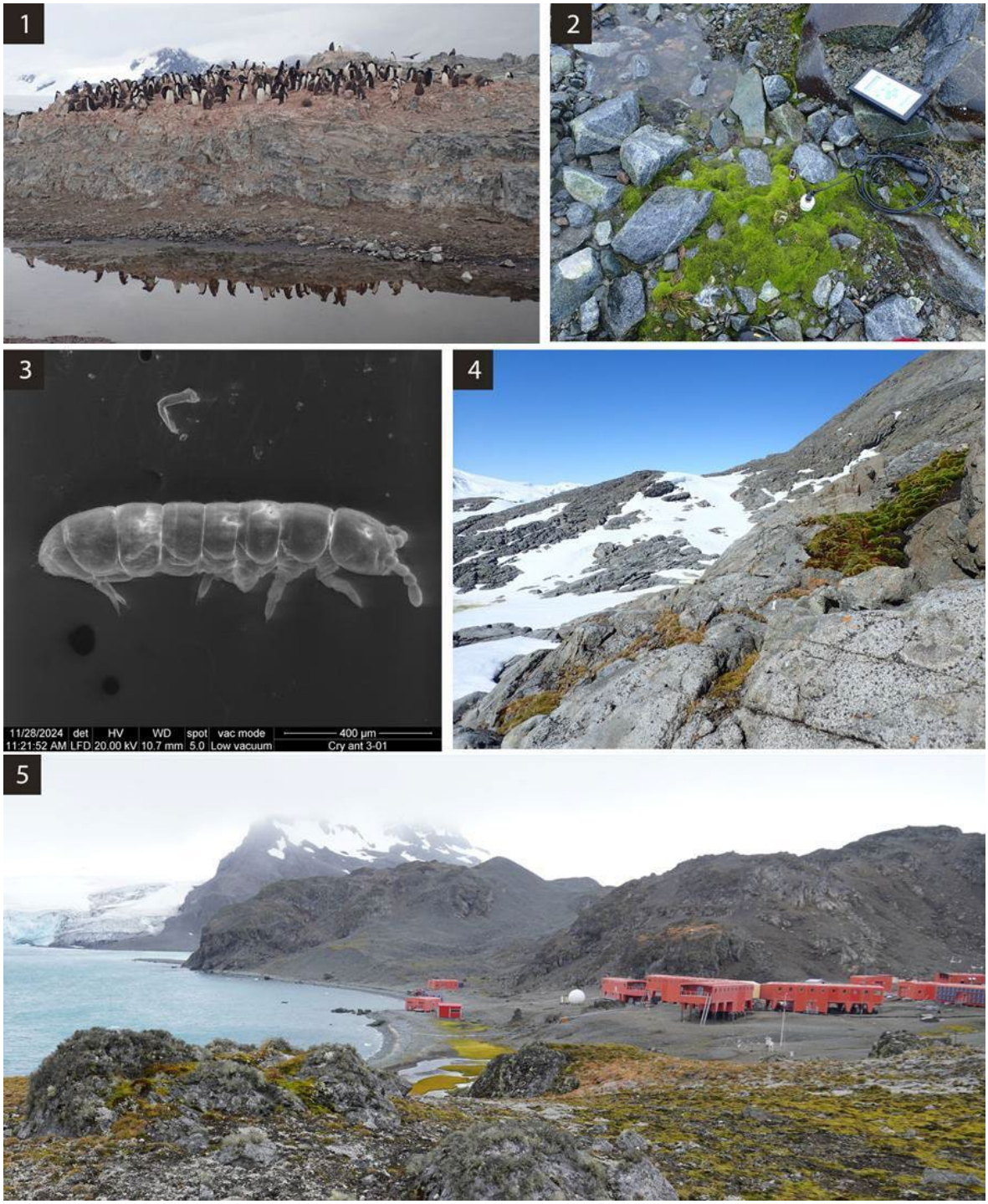
knowledge about it," says Cristina Ronquillo, a co-author of the study who works at the MNCN. The analysis of these massive data shows that about twenty vertebrates largely take the spotlight within the nearly 400 animal species, with a minority but growing knowledge about invertebrates. "It is worth noting that this systematized knowledge is mainly focused on describing the climatic tolerances of species," emphasizes Miguel Ángel Olalla Tárraga, a researcher at IICG-URJC. This is probably because "we have an urgent demand for information on these tolerances to understand species' responses to rising temperatures" as Pablo Escribano, also from URJC, notes. In contrast, we know very little about the structure of food webs in Antarctic ecosystems. "Basically, our knowledge is limited to a rough idea of who eats whom," Pertierra points out.

There is also a significant lack of information regarding the functional traits of most species, making it difficult to identify the mechanisms that allow them to adapt their physiology to extreme conditions. For example, we have a broad understanding of the distribution of the Antarctic flora, which continues to improve thanks to satellite measurements that detect patches of vegetation in high-resolution images. However, once again this knowledge is not supported by advances in other disciplines. "For example, we know very little about their evolutionary relationships or the nature of their interactions," says Pertierra. The lack of knowledge about microorganisms is even greater, although "recent studies on nutrient cycling and the functioning of microbial communities, as well as their movement from one area to another, provide clues about how microscopic life develops in such an extreme climate," adds Antonio Quesada, a researcher at the Autonomous University of Madrid.

The study emphasizes that this imbalance in knowledge about the biology of so many groups of organisms prevents us from understanding how ecological processes develop in Antarctica—an essential factor in guiding conservation measures in the face of global change. "Analyzing knowledge gaps in biodiversity allows us to identify key research priorities for the coming years. In the case of Antarctica, it is crucial to invest in taxonomic research, monitor populations, identify model species, standardize the study methods we use, and integrate the data we collect. These are some of the measures we propose to address the uncertainties we have about this important and fascinating territory," concludes Joaquín Hortal, also a researcher at MNCN.

Pertierra LR, Convey P, Barbosa A, Biersma EM, Cowan D, *et al*. (2025) Advances and shortfalls in the knowledge of Antarctic terrestrial biodiversity. *Science*. DOI:

Comunicación MNCN
Tel.: 914 111 328 / Ext. 443450/3536
Móvil: 699 047 365
c-e: comunicacion@mncn.csic.es
c/ José Gutiérrez Abascal, 2.
28006, Madrid



1) Adélie penguin colony on Adelaide Island. In the few ice-free areas of Antarctica, a remarkable diversity of microfauna and microorganisms remains almost imperceptible. Photo: Luis R. Pertierra (January 2019). 2) Soil sample collection and characterization near the Adelaide Island colony for the extraction of microinvertebrates. Note the presence of a moss carpet, barely recognizable in the previous image. Photo: Luis R. Pertierra (January 2019). 3) Scanning electron microscope (SEM) view of the Antarctic springtail Cryptopygus antarcticus, collected from Deception Island, analyzed at the MNCN laboratories. 4) Mosses and vascular plants thrive in ice-free areas of the Antarctic Peninsula, here illustrated by Horseshoe Island. Image: Luis R. Pertierra (2019). 5) Panoramic view showing extensive lichen and moss colonization in the vicinity of the Spanish Antarctic Base Juan Carlos I (Livingston Island). Image: A. de los Ríos (2023).

Comunicación MNCN
Tel.: 914 111 328 / Ext. 443450/3536
Móvil: 699 047 365
c-e: comunicacion@mncn.csic.es
c/ José Gutiérrez Abascal, 2.
28006, Madrid