Census of Antarctic Marine Life
SCAR-Marine Biodiversity Information Network

BIOGEOGRAPHIC ATLAS OF THE SOUTHERN OCEAN

CHAPTER 2.1 Data and Mapping.

Van de Putte A.P., Griffiths H.J., Raymond B., Danis B., 2014.

In: De Broyer C., Koubbi P., Griffiths H.J., Raymond B., Udekem d'Acoz C. d', et al. (eds.). Biogeographic Atlas of the Southern Ocean. Scientific Committee on Antarctic Research, Cambridge, pp. 14-15.

EDITED BY:
Claude DE BROYER & Philippe KOUBBI (chief editors)

with Huw GRIFFITHS, Ben RAYMOND, Cédric d'UDEKEM d'ACOZ, Anton VAN DE PUTTE, Bruno DANIS, Bruno DAVID, Susie GRANT, Julian GUTT, Christoph HELD, Graham HOSIE, Falk HUETTMANN, Alexandra POST & Yan ROPERT-COUDERT

SCIENTIFIC COMMITTEE ON ANTARCTIC RESEARCH

THE BIOGEOGRAPHIC ATLAS OF THE SOUTHERN OCEAN

The “Biogeographic Atlas of the Southern Ocean” is a legacy of the International Polar Year 2007-2009 (www.ipy.org) and of the Census of Marine Life 2000-2010 (www.coml.org), contributed by the Census of Antarctic Marine Life (www.caml.aq) and the SCAR Marine Biodiversity Information Network (www.scarmarbin.be; www.biodiversity.aq).

The “Biogeographic Atlas” is a contribution to the SCAR programmes Ant-ECO (State of the Antarctic Ecosystem) and AnT-ERA (Antarctic Thresholds- Ecosystem Resilience and Adaptation) (www.scar.org/science-themes/ecosystems).

Edited by:

Claude De Broyer (Royal Belgian Institute of Natural Sciences, Brussels)
Philippe Koubbi (Université Pierre et Marie Curie, Paris)
Huw Griffiths (British Antarctic Survey, Cambridge)
Ben Raymond (Australian Antarctic Division, Hobart)
Cédric d’Udekem d’Acoz (Royal Belgian Institute of Natural Sciences, Brussels)
Anton Van de Putte (Royal Belgian Institute of Natural Sciences, Brussels)
Bruno Danis (Université Libre de Bruxelles, Brussels)
Bruno David (Université de Bourgogne, Dijon)
Susie Grant (British Antarctic Survey, Cambridge)
Julian Gutt (Alfred Wegener Institute, Helmoltz Centre for Polar and Marine Research, Bremerhaven)
Christoph Held (Alfred Wegener Institute, Helmoltz Centre for Polar and Marine Research, Bremerhaven)
Graham Hosie (Australian Antarctic Division, Hobart)
Falk Huettmann (University of Alaska, Fairbanks)
Alix Post (Geoscience Australia, Canberra)
Yan Ropert-Coudert (Institut Pluridisciplinaire Hubert Currien, Strasbourg)

Published by:

The Scientific Committee on Antarctic Research, Scott Polar Research Institute, Lensfield Road, Cambridge, CB2 1ER, United Kingdom (www.scar.org).

Publication funded by:

- The Census of Antarctic Marine Life (Albert P. Sloan Foundation, New York)
- The TOTAL Foundation, Paris.

The “Biogeographic Atlas of the Southern Ocean” shared the *Cosmos Prize* awarded to the Census of Marine Life by the International Osaka Expo’90 Commemorative Foundation, Tokyo, Japan.

Publication supported by:

- The Belgian Science Policy (Belspo), through the Belgian Scientific Research Programme on the Antarctic and the “biodiversity.aq” network (SCAR-MarBIN/ANTABIF)
- The Royal Belgian Institute of Natural Sciences (RBINS), Brussels, Belgium
- The British Antarctic Survey (BAS), Cambridge, United Kingdom
- The Université Pierre et Marie Curie (UPMC), Paris, France
- The Australian Antarctic Division, Hobart, Australia
- The Scientific Steering Committee of CAML, Michael Stoddart (CAML Administrator) and Victoria Wadley (CAML Project Manager)

Mapping coordination and design: Huw Griffiths (BAS, Cambridge) & Anton Van de Putte (RBINS, Brussels)

Editorial assistance: Henri Robert, Xavier Loréa, Charlotte Havermans, Nicole Moortgat (RBINS, Brussels)

Printed by: Altitude Design, Rue Saint Josse, 15, B-1210, Belgium (www.altitude-design.be)

Lay out: Sigrid Camus & Amélie Blaton (Altitude Design, Brussels).

Cover design: Amélie Blaton (Altitude Design, Brussels) and the Editorial Team.

Cover pictures: amphipod crustacean (*Epimeria rubrieques* De Broyer & Klages, 1991), image © T. Riehl, University of Hamburg; krill (*Euphausia superba* Dana, 1850), image © V. Siegel, Institute of Sea Fisheries, Hamburg; fish (*Chaenocephalus* sp.), image © C. d’Udekem d’Acoz, RBINS; emperor penguin (*Aptenodytes forsteri* G.R. Gray, 1844), image © C. d’Udekem d’Acoz, RBINS; Humpback whale (*Megaptera novaeangliae* (Borowski, 1781)), image © L. Kindermann, AWI.

Online dynamic version :

A dynamic online version of the Biogeographic Atlas is available on the SCAR-MarBIN / AntaBIF portal : atlas.biodiversity.aq.

Recommended citation:

For the volume:

De Broyer C., Koubbi P., Griffiths H.J., Raymond B., Udekem d’Acoz C. d’, Van de Putte A.P., Danis B., David B., Grant S., Gutt J., Held C., Hosie G., Huettmann F., Post A., Ropert-Coudert Y. (eds.), 2014. Biogeographic Atlas of the Southern Ocean. Scientific Committee on Antarctic Research, Cambridge, XII + 498 pp.

For individual chapter:

(e.g.) Crame A., 2014. Chapter 3.1. Evolutionary Setting. In: De Broyer C., Koubbi P., Griffiths H.J., Raymond B., Udekem d’Acoz C. d’, *et al*. (eds.). Biogeographic Atlas of the Southern Ocean. Scientific Committee on Antarctic Research, Cambridge, pp. xx-yy.

ISBN: 978-0-948277-28-3.

PART 2. METHODS

Use of place-names in the “Biogeographic Atlas of the Southern Ocean”

- For Antarctic place-names south of 60°S, the SCAR composite gazetteer was consulted (http://www.scarmarbin.be/ gazetteer.php?p=search).
- For localities north of 60°S, only place-names officially approved by national bodies were used wherever possible. Where unofficial names were used, they were labeled as such in the first instance and subsequently cited in quotation marks.
- Falkland Islands should read, if not fully cited: Falkland Islands (Islas Malvinas),
- South Georgia should read, if not fully cited: South Georgia (Islas Georgias del Sur),
- South Sandwich Islands should read, if not fully cited: South Sandwich Islands (Islas Sandwich del Sur).

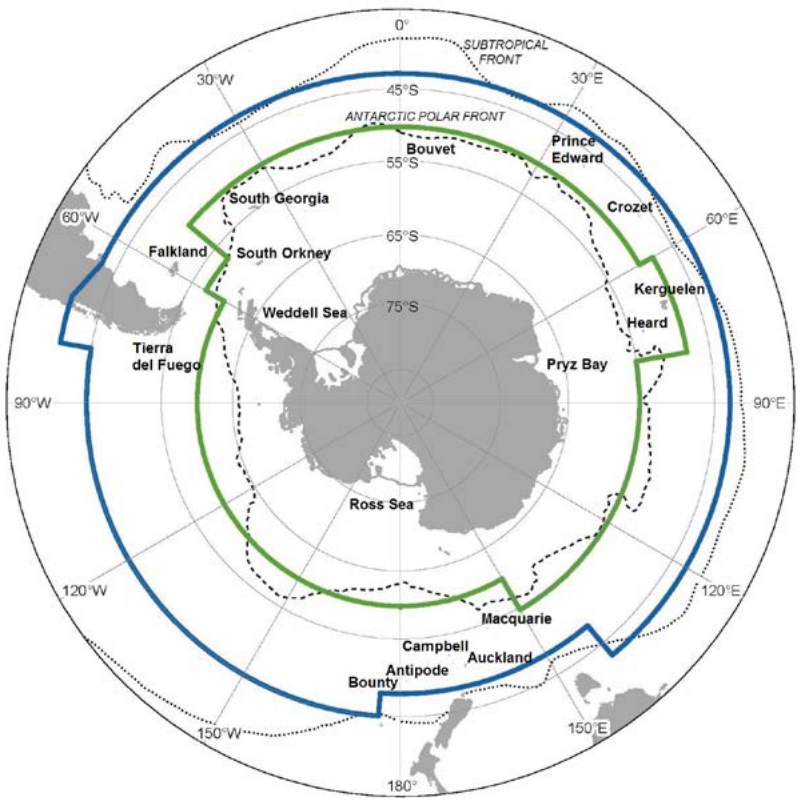
2.1. Data and mapping

Anton P. Van de Putte[1], Huw J. Griffiths[2], Ben Raymond[3 4 5] & Bruno Danis[6]

[1] *Royal Belgian Institute of Natural Sciences, Operational Directorate Natural Environment, Brussels, Belgium*
[2] *British Antarctic Survey, Cambridge, United Kingdom*
[3] *Australian Antarctic Division, Department of the Environment, Kingston, Australia*
[4] *Antarctic Climate & Ecosystems Cooperative Research Centre, University of Tasmania, Hobart, Australia*
[5] *Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, Australia*
[6] *Marine Biology Laboratory, Université Libre de Bruxelles, Brussels, Belgium*

1. Introduction

The data used in this Atlas were primarily drawn from SCAR-MarBIN (Scientific Committee on Antarctic Research—Marine Biodiversity Information Network, www.scarmarbin.be) and its successor project ANTABIF (the Antarctic Biodiversity Information Facility, www.biodiversity.aq). These two initiatives, both official SCAR products, are responsible for managing Antarctic biodiversity data, including that from the ambitious Census of Antarctic Marine Life programme (CAML; Danis *et al.* 2013), linked to the International Polar Year 2007-09. The complete expert-validated database, including records from beyond the SCAR-MarBIN primary area of interest up to 40°S (Map 1), represents 1.07 million occurrence records for 9064 validated species from ~434,000 distinct sampling stations. For more information on the data coverage see Chapter 2.2.



Data and mapping Map 1 SCAR-MarBIN / RAMS area of interest. The most inner line close to the Antarctic Polar Front indicates the operational (average) northern limit of the Antarctic primary area of interest. The outer line close to the sub-Tropical Front indicates the operational (average) northern limit of the sub-Antarctic area of interst (see De Broyer & Danis 2011: Table 1 for details).

2. History

The origins of biodiversity.aq can be traced back to the CAML, a 5-year project which aimed at assessing the nature, distribution and abundance of the Southern Ocean biodiversity (see Chapter 1.3). During the International Polar Year (IPY) in 2007/09 CAML focused the attention of the public on the ice-bound oceans of Antarctica. SCAR-MarBIN was created as a companion-project of CAML, in order to manage its biodiversity data and make this openly accessible to all (Danis *et al.* 2013). During the course of IPY and CAML, international expeditions collected an unprecedented mass of information on the biogeography of Antarctic marine species, including numerous species new to science (e.g. Brandt *et al.* 2007).

SCAR-MarBIN was funded by the Belgian Science Policy office (BELSPO) until September 2009. It was succeeded by another BELSPO-funded project, the Antarctic Biodiversity Information Facility (ANTABIF, www.biodiversity.aq). Whereas SCAR-MarBIN focused on marine life in Antarctica, the new biodiversity.aq portal builds on the success of SCAR-MarBIN and ensures its continuation by creating an overarching network that provides access to data from both the marine and the terrestrial realms. Data made available through SCAR-MarBIN or biodiversity.aq are freely and openly available, complying with SCAR data policies. This honors the idea within the Antarctic scientific community that primary biodiversity data should be made publicly available as soon as possible after it has been collected, in the spirit of article III. 1c of the Antarctic Treaty (which states that *"Scientific observations and results from Antarctica shall be exchanged and made freely available."*). Following the model of SCAR-MarBIN, biodiversity.aq aggregates Antarctic biodiversity data from various providers, such as the German PANGAEA and the Australian Antarctic Data Centre, and redistributes these data to larger projects such as the Ocean Biogeographic Information System (OBIS) and the Global Biodiversity Information Facility (GBIF). Biodiversity.aq also offers a data hosting and publishing service to nations or research institutes that lack such facilities (ipt.biodiversity.aq). All publicly available biodiversity data can be searched and retrieved through this data platform.

3. The biodiversity.aq ecosystem

Biodiversity.aq is a modular data ecosystem that integrates different biodiversity tools including the Biogeographic Atlas of the Southern Ocean. The main gateway is www.biodiversity.aq, and more specialised functions are hosted under various subdomains: IPT, Data, Atlas, AFG and mARS (Fig. 1).

The first subdomain ipt.biodiversity.aq is dedicated to the integrated publishing toolbox (IPT) developed by GBIF for publication of primary biodiversity data and metadata. This important new feature allows users to standardise, document and share their primary biodiversity data using a simple web interface. It is a one-stop shop for opening up data, which can be crucial in the face of the extremely rapid environmental change that is currently challenging Antarctic ecosystems.

Data that is published through the IPT can be discovered through global biodiversity portals such as GBIF or OBIS, enhancing the visibility of the research. However there is also a dedicated Antarctic biodiversity data portal: data.biodiversity.aq. This portal builds onto SCAR-MarBIN, which offers access to marine biodiversity data for the Southern Ocean, by extending the data access to include terrestrial biodiversity information as well.

Data.biodiversity.aq offers an intuitive search engine that allows users to explore Antarctic occurrence data, taxonomic data and metadata. Occurrence data can be explored through the online mapping system, which in the future will also include various environmental layers. Data can be downloaded free of charge in common data formats such as .xls and .txt and also as data layers for Geographical Information Systems (GIS).

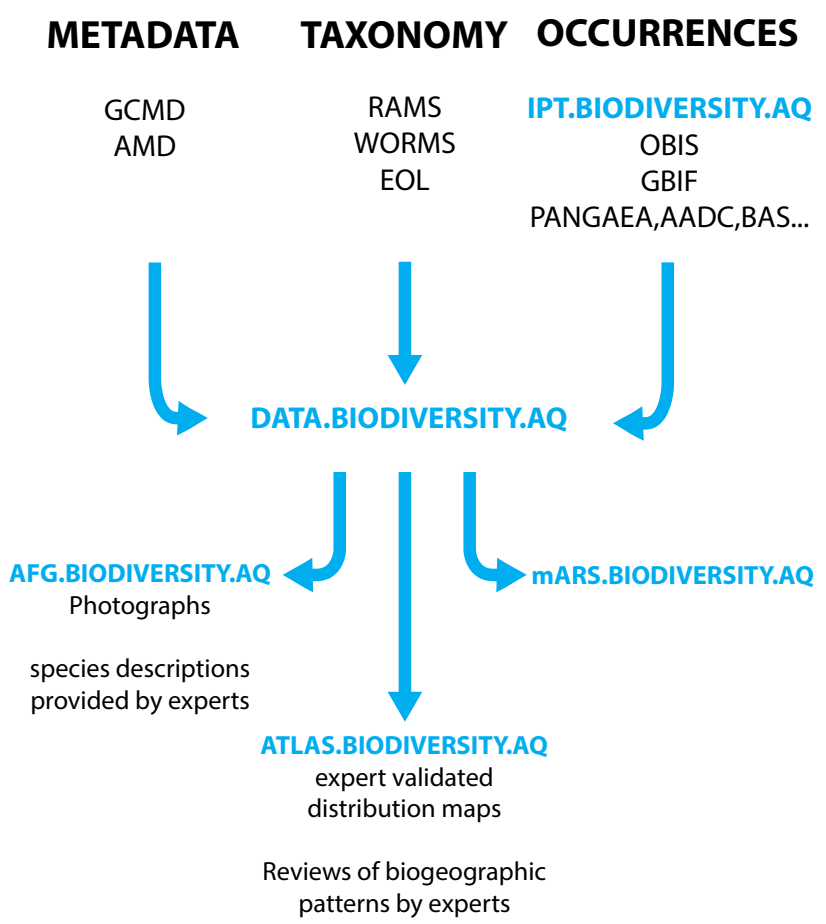


Figure 1 The Biodiversity.aq data ecosystem

Other tools for the exploration of Antarctic biodiversity information are the Antarctic Field Guides, afg.biodiversity.aq. This portal aggregates information from various resources in order to provide a digital tool for the identification of Antarctic species. The field guides present information on taxonomy and distribution in combination with high quality photographs and descriptions of (morphological) features that will aid in the identification of specimens in the field. Users can compile their own personal field guide based on taxonomic or geographic areas of interest. Personalised field guides can be downloaded as PDF files or shared online with other users.

The Microbial Antarctic Resources System (mARS) is a project under development that is envisioned as an information system dedicated to facilitate the discovery, access and analysis of geo-referenced molecular Antarctic microbial diversity data. The scope of diversity will encompass all free-living and host-associated viruses, bacteria, archaea, and singled-celled eukaryotes. mARS focuses on past, present and future works. It is an open, community-driven platform that will allow scientists to publish, document, analyse and share their data and metadata with the broad community for science, conservation and management purposes, in the spirit of the Antarctic Treaty.

4. Datatypes

The main focus of SCAR-MarBIN and biodiversity.aq is primary biodiversity data, which constitutes "digital text or multimedia data records detailing facts about the occurrence of an organism." Secondary data constitutes a wide range of ecological information on sampling sites and organisms found there (GBIF 2009).

Broadly there are three types of primary biodiversity data: occurrence data, taxonomic data, and metadata (Fig. 1). Occurrence data provide information on the times and locations at which an organism has been observed. Taxonomic data offer information on the identity of organisms. Metadata is descriptive information that provides the data user with additional details about the data such as collection procedures, and thus a means of verifying the appropriateness of the dataset for the desired usage. These three main data types were the focus for the Atlas.

The metadata of datasets published through biodiversity.aq are made available through the IPT, but also the Antarctic Master Directory (AMD), which is a component of NASA's Global Change Master Directory metadata system (GCMD). The AMD provides metadata on Earth science data sets pertaining to Antarctica and the Southern Ocean. It was crested through a collaboration between the Standing Committee on Antarctic Data Management (SCADM), and NASA's GCMD staff and acts as a resource for discovering and describing internationally held Antarctic data.

The Register of Antarctic Marine Species (RAMS; De Broyer & Danis 2011) covers the taxonomic component of the Atlas. RAMS was compiled and published thanks to a collective effort of a board of 64 taxonomic editors. It built on earlier work by Clarke & Johnston (2003), and provides an accurate list of more 8300 valid species with an up-to-date systematic classification comprising more than 18,250 taxon names (Fig. 2). RAMS is the taxonomic backbone of biodiversity.aq and also feeds in to global biodiversity initiatives such as the World Register of Marine Species (WORMS), OBIS and GBIF.

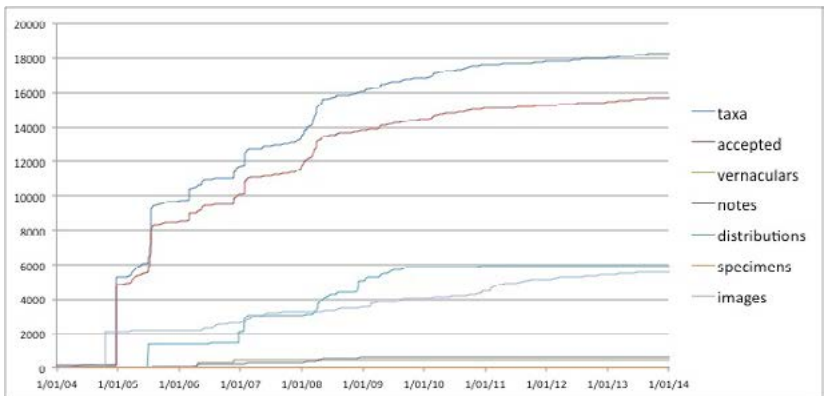


Figure 2. Number of records available through the Register of Antarctic Marine Species.

The occurrence data used in the Atlas generally fall into one of three categories: (i) validated occurrence records of Antarctic marine species that were previously available via SCAR-MarBIN, (ii) newly-provided records that were obtained for the Atlas project from other sources, and which have been made publicly available through biodiversity.aq, or (iii) data from other sources which have not been incorporated into biodiversity.aq. Data in the latter category include records provided by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), the International Whaling Commission (IWC), and PANGAEA (pangaea.de).

Newly provided metadata and data was submitted by the expert contributors to biodiversity.aq using a template that followed the Darwin Core 2.0 data standards, and also incorporated additional fields from the OBIS data system. This approach ensures long-term interoperability with global information systems, including OBIS, GBIF and the AMD.

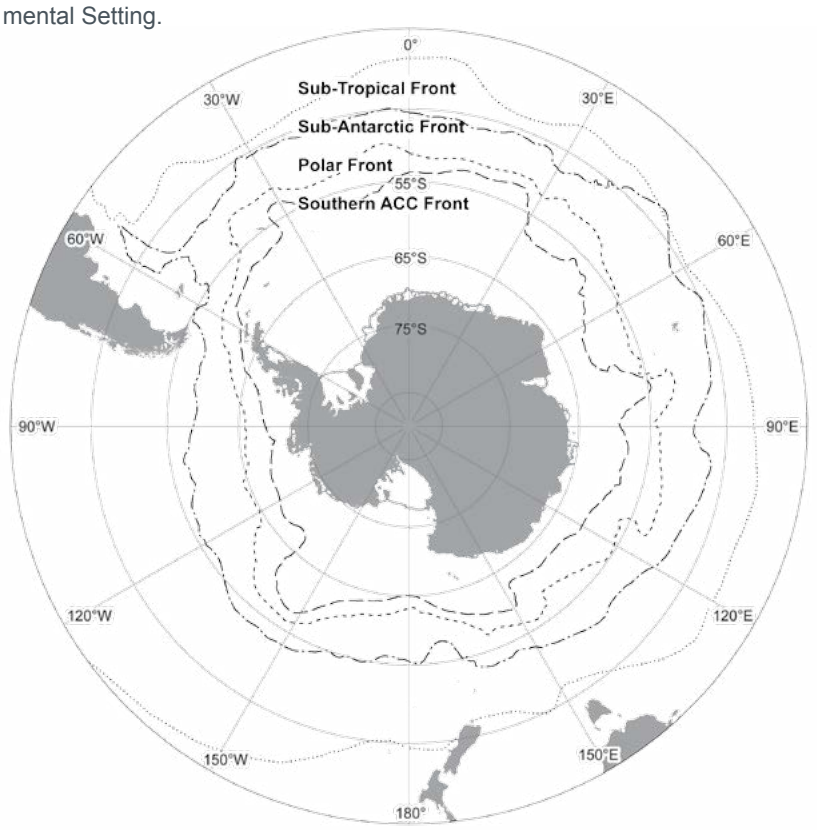
5. Data cleaning

The data cleaning process relied on input of the experts of each chapter. All changes that were made by the data managers during the data cleaning process were confirmed by the principal authors of the respective chapters.

A common first step in data cleaning was to check the data-type constraints for all variables. In the provided template, each variable was associated with a particular data type (e.g. text for species names, or numeric values for latitudes and longitudes). Where possible, incorrect data types were transformed to the correct ones. The taxonomic information of the records was validated using RAMS through the taxon match tool on the WoRMS website. For samples lacking geographic coordinates but possessing verbatim localities, approximate localities were determined using SCAR's and other gazetteers. In cases where records were georeferenced using degrees minutes seconds or degrees decimal seconds, these values were converted to decimal degrees. Plots of the data points were used to identify obvious outliers (e.g. points over land, or in the wrong hemisphere) and errors due to swapping of latitude and longitude values, or in the sign of decimal degrees.

6. Mapping

Maps were produced in ArcGIS or Matlab using a standardised template. The maps have a south pole centred stereographic projection with a central meridian of 0° of longitude. The most northerly extent of the maps is generally 35° south and includes the southern parts of South America, Australia and New Zealand. The Antarctic coastline data used in the maps was sourced from the SCAR Antarctic Digital Database. Average frontal positions were taken from Sokolov & Rintoul (2009a, b), for more information see Chapter 4: Environmental Setting.



Data Map 2 Fronts in the Southern Ocean. The long-term sea surface temperatures between the fronts are as follows, from south to north (approximate ranges, see details in Chapter 4): Between the continent and the Southern ACC Front (SACCF): -1.6 to +3°C; Between the SACCF and the Polar Front: - 0.3 to +6°C; Between the Polar Front and the Sub-Antarctic Front: + 1.2° to 12°C; Between the Sub-Antarctic Front and the (extreme northern limit) of the Sub-Tropical Front: 5.7 to 24°C

Acknowledgements

This is CAML contribution #.89

References

Brandt A., Gooday A.J., Brandão S.N., Brix S., Brökeland W., Cedhagen T., Choudhury M. *et al.*, 2007. First insights into the biodiversity and biogeography of the Southern Ocean deep sea. *Nature*, **447**, 307–311. doi:10.1038/nature05827

Clarke A., Johnston N.M., 2003. . Antarctic Marine Benthic Diversity. *Oceanography and Marine Biology Annual Review* **41**, 47–114.

Danis B., Van de Putte A.P., Renaudier S., Griffiths H.J., 2013. Connecting biodiversity data during the IPY: the path towards e-polar science. In: Verde C., di Prisco G. (eds.). *Adaptation and Evolution in Marine Environments*, **2**, 21-32.

De Broyer C., Danis B., 2011. How many species in the Southern Ocean? Towards a dynamic inventory of the Antarctic marine species. *Deep-Sea Research II*: *Topical Studies in Oceanography* **58,** 5-17. doi:10.1016/j.dsr2.2010.10.007 http://dx.doi.org/10.1016/

GBIF, 2009. GBIF Work Programme 2009-2010. Copenhagen: Global Biodiversity Information Facility, 59pp. Accessible at http://imsgbif.gbif.org/CMS_NEW/get_file.php?FILE=976c6c3015d7d2505d5ac1d45357c8

Sokolov, S., Rintoul S.R., 2009. The circumpolar structure and distribution of the Antarctic Circumpolar fronts: 1. Mean circumpolar Paths. *Journal of Geophysical Research*, **114**, C11018, doi:10.1029/2008JC005108.

Sokolov, S., S. R. Rintoul. 2009b. The Circumpolar structure and distribution of the Antarctic Circumpolar Fronts: 2. Variability and Relationship to Sea Surface Height. *Journal of Geophysical Research*, **114**:C11019, doi:10.1029/2008JC005248.

THE BIOGEOGRAPHIC ATLAS OF THE SOUTHERN OCEAN

Scope

Biogeographic information is of fundamental importance for discovering marine biodiversity hotspots, detecting and understanding impacts of environmental changes, predicting future distributions, monitoring biodiversity, or supporting conservation and sustainable management strategies.

The recent extensive exploration and assessment of biodiversity by the Census of Antarctic Marine Life (CAML), and the intense compilation and validation efforts of Southern Ocean biogeographic data by the SCAR Marine Biodiversity Information Network (SCAR-MarBIN / OBIS) provided a unique opportunity to assess and synthesise the current knowledge on Southern Ocean biogeography.

The scope of the Biogeographic Atlas of the Southern Ocean is to present a concise synopsis of the present state of knowledge of the distributional patterns of the major benthic and pelagic taxa and of the key communities, in the light of biotic and abiotic factors operating within an evolutionary framework. Each chapter has been written by the most pertinent experts in their field, relying on vastly improved occurrence datasets from recent decades, as well as on new insights provided by molecular and phylogeographic approaches, and new methods of analysis, visualisation, modelling and prediction of biogeographic distributions.

A dynamic online version of the Biogeographic Atlas will be hosted on www.biodiversity.aq.

The Census of Antarctic Marine Life (CAML)

CAML (www.caml.aq) was a 5-year project that aimed at assessing the nature, distribution and abundance of all living organisms of the Southern Ocean. In this time of environmental change, CAML provided a comprehensive baseline information on the Antarctic marine biodiversity as a sound benchmark against which future change can reliably be assessed. CAML was initiated in 2005 as the regional Antarctic project of the worldwide programme Census of Marine Life (2000-2010) and was the most important biology project of the International Polar Year 2007-2009.

The SCAR Marine Biodiversity Information Network (SCAR-MarBIN)

In close connection with CAML, SCAR-MarBIN (www.scarmarbin.be, integrated into www.biodiversity.aq) compiled and managed the historic, current and new information (i.a. generated by CAML) on Antarctic marine biodiversity by establishing and supporting a distributed system of interoperable databases, forming the Antarctic regional node of the Ocean Biogeographic Information System (OBIS, www.iobis.org), under the aegis of SCAR (Scientific Committee on Antarctic Research, www.scar.org). SCAR-MarBIN established a comprehensive register of Antarctic marine species and, with biodiversity.aq provided free access to more than 2.9 million Antarctic georeferenced biodiversity data, which allowed more than 60 million downloads.

The Editorial Team

Claude DE BROYER is a marine biologist at the Royal Belgian Institute of Natural Sciences in Brussels. His research interests cover structural and ecofunctional biodiversity and biogeography of crustaceans, and polar and deep sea benthic ecology. Active promoter of CAML and ANDEEP, he is the initiator of the SCAR Marine Biodiversity Information Network (SCAR-MarBIN). He took part to 19 polar expeditions.

Huw GRIFFITHS is a marine Biogeographer at the British Antarctic Survey. He created and manages SOMBASE, the Southern Ocean Mollusc Database. His interests include large-scale biogeographic and ecological patterns in space and time. His focus has been on molluscs, bryozoans, sponges and pycnogonids as model groups to investigate trends at high southern latitudes.

Cédric d'UDEKEM d'ACOZ is a research scientist at the Royal Belgian Institute of Natural Sciences, Brussels. His main research interests are systematics of amphipod crustaceans, especially of polar species and taxonomy of decapod crustaceans. He took part to 2 scientific expeditions to Antarctica on board of the *Polarstern* and to several sampling campaigns in Norway and Svalbard.

Bruno DANIS is an Associate Professor at the Université Libre de Bruxelles, where his research focuses on polar biodiversity. Former coordinator of the scarmarbin.be and antabif.be projects, he is a leading member of several international committees, such as OBIS or the SCAR Expert Group on Antarctic Biodiversity Informatics. He has published papers in various fields, including ecotoxicology, physiology, biodiversity informatics, polar biodiversity or information science.

Susie GRANT is a marine biogeographer at the British Antarctic Survey. Her work is focused on the design and implementation of marine protected areas, particularly through the use of biogeographic information in systematic conservation planning.

Christoph HELD is a Senior Research Scientist at the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Bremerhaven. He is a specialist in molecular systematics and phylogeography of Antarctic crustaceans, especially isopods.

Falk HUETTMANN is a 'digital naturalist' he works on three poles (Arctic, Antarctic and Hindu-Kush Himalaya) and elsewhere (marine, terrestrial and atmosphere). He is based with the university of Alaska-Fairbank (UAF) and focuses primarily on effective conservation questions engaging predictions and open access data.

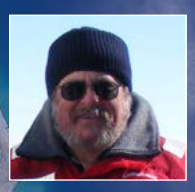
Philippe KOUBBI is professor at the University Pierre et Marie Curie (Paris, France) and a specialist in Antarctic fish ecology and biogeography. He is the Principal Investigator of projects supported by IPEV, the French Polar Institute. As a French representative to the CCAMLR Scientific Committee, his main input is on the proposal of Marine Protected Areas. His other field of research is on the ecoregionalisation of the high seas.

Ben RAYMOND is a computational ecologist and exploratory data analyst, working across a variety of Southern Ocean, Antarctic, and wider research projects. His areas of interest include ecosystem modelling, regionalisation and marine protected area selection, risk assessment, animal tracking, seabird ecology, complex systems, and remote sensed data analyses.

Anton VAN DE PUTTE works at the Royal Belgian Institute for Natural Sciences (Brussels, Belgium). He is an expert in the ecology and evolution of Antarctic fish and is currently the Science Officer for the Antarctic Biodiveristy Portal www.biodiversity.aq. This portal provides free and open access to Antarctic Marine and terrestrial biodiversity of the Antarctic and the Southern Ocean.

Bruno DAVID is CNRS director of research at the laboratory BIOGÉOSCIENCES, University of Burgundy. His works focus on evolution of living forms, with and more specifically on sea urchins. He authored a book and edited an extensive database on Antarctic echinoids. He is currently President of the scientific council of the Muséum National d'Histoire Naturelle (Paris), and Deputy Director at the CNRS Institute for Ecology and Environment.

Julian GUTT is a marine ecologist at the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Bremerhaven, and professor at the Oldenburg University, Germany. He participated in 13 scientific expeditions to the Antarctic and was twice chief scientist on board Polarstern. He is member of the SCAR committees ACCE and AnT-ERA (as chief officer). Main focii of his work are: biodiversity, ecosystem functioning and services, response of marine systems to climate change, non-invasive technologies, and outreach.



Graham HOSIE is Principal Research Scientist in zooplankton ecology at the Australian Antarctic Division. He founded the SCAR Southern Ocean Continuous Plankton Recorder Survey and is the Chief Officer of the SCAR Life Sciences Standing Scientific Group. His research interests include the ecology and biogeography of plankton species and communities, notably their response to environmental changes. He has participated in 17 marine science voyages to Antarctica.

Alexandra POST is a marine geoscientist, with expertise in benthic habitat mapping, sedimentology and geomorphic characterisation of the seafloor. She has worked at Geoscience Australia since 2002, with a primary focus on understanding seafloor processes and habitats on the East Antarctic margin. Most recently she has led work to understand the biophysical environment beneath the Amery Ice Shelf, and to characterise the habitats on the George V Shelf and slope following the successful CAML voyages in that region.

Yan ROPERT COUDERT spent 10 years at the Japanese National Institute of Polar Research, where he graduated as a Doctor in Polar Sciences in 2001. Since 2007, he is a permanent researcher at the CNRS in France and the director of a polar research programme (since 2011) that examines the ecological response of Adélie penguins to environmental changes. He is also the secretary of the Expert Group on Birds and Marine Mammals and of the Life Science Group of the Scientific Committee on Antarctic Research.