CHAPTER 6.5. SOUTHERN OCEAN SQUID.


THE BIOGEOGRAPHIC ATLAS OF THE SOUTHERN OCEAN


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, Helmutz Centre for Polar and Marine Research, Bremerhaven)
Christoph Held (Alfred Wegener Institute, Helmutz 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 Curien, 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, 1852), 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 novaangliae) (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:

For individual chapter:


This publication is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.
6.5. Southern Ocean Squid

Paul G.K. Rodhouse, Huw J. Griffiths & José C. Xavier

British Antarctic Survey, Cambridge, UK

1. Introduction

Data on Antarctic cephalopods have accumulated since the expeditions of H.M.S Challenger and H.M.S Alert in the 19th century and the heroic era of Antarctic exploration in the early years of the 20th century. After the 1920s there was little activity in the field until the 1960s when several nations started to send research ships to the Southern Ocean for biological research. Antarctic teuthology has since grown and matured and has been the subject of a symposium and four reviews (Clarke & Okutani 1985, Rodhouse et al. 1994, Filippova 2002, Collins & Rodhouse 2006).

Much of our knowledge of squid biogeography in the Antarctic and worldwide derives from the work of the Russian scientist Kir Nesis who died in 2003. His world survey of cephalopods (Abridged key to the cephalopod molluscs of the world) was published in Russian in 1982 and later in English with new material (Nesis 1987). This secondary source of information has been used here where the original papers in Russian, many by Nesis himself, are difficult to access. Xavier et al. (1999) published maps of all known and available records of squid captured in the Southern Ocean and, with subsequent additions, these form the basis of the maps published here.

The most sampled areas in the Southern Ocean are in the region of the larger peri-Antarctic islands, the Antarctic Peninsula and the Prydz Bay area. The least sampled region lies in the Pacific sector, roughly between 180° and 90°W.

The Southern Ocean squids (order Teuthida) are restricted to the suborder Oegopsida. The suborder Myopsida is absent from the Antarctic and Sub-Antarctic regions but one species, Oryctoteuthis gahi, occurs over the southern Patagonian Shelf. Of the octopuses (order Octopoda) both suborders Circara and Incirata are represented. The cuttlefishes (Subclass Nautilioidea), the cuttlefish (Order Sepiida), the sepioioids (Order Sepioida) and the vampire squid (Order Vampyromorpha) are all absent.

The following southern hemisphere species, which have been included in lists of Antarctic cephalopods elsewhere, are not included here as there is little evidence that they are found south of the Sub-Tropical Front: Promachoteuthis sp., Pholiodoteuthis massayae, Octopoteuthis rugosa, Taningia danae, Histiooteuthis macrohista and H. miranda. A single specimen of the cranchid squid Tanionus pavo (Rodhouse, 1990) has also not been included.

2. Biogeography and depth distribution

There are some nineteen species of squid known to inhabit Antarctic and sub-Antarctic waters. Their latitudinal range can be divided into six categories from high Antarctic endemics to cosmopolitan species whose range extends into Antarctic waters. This is a loose categorisation for several reasons: the surface signatures of the fronts are often not well defined, their position vary and they do not reflect the deep structure of the water masses of the Southern Ocean. Furthermore, the interfaces between water masses probably do not form impenetrable barriers to squid dispersal.

2.1. Antarctic endemics extending north to the Antarctic Polar Front (APF)

Moroteuthis knipovitchi Filippova, 1972 (Map 1): one of four members of the family Onychoteuthidae known in the Southern Ocean; maximum ML 450 mm; circumvolar; mesopelagic and near bottom. The species occurs north of the APF at South Georgia, Kerguelen, Crozet and Prince Edward Islands. Literature: Filippova & Yukhov (1979), Rodhouse (1988, 1989), Rodhouse et al. (1996), Piatkowski et al. (1998).


Mastigoteuthis psychrophila Nesis, 1977 (Map 3): single member of the family Mastigoteuthidae known in the Southern Ocean; maximum ML 180 mm; circumvolar; mesopelagic and bathypelagic. Literature: Rodhouse (1990), Lu & Williams (1994a, b), Piatkowski et al. (1994), Rodhouse et al. (1996).

Mesonychoteuthis hamiltoni Robson, 1925 (Map 4): one of two members of the family Cranchiidae known in the Southern Ocean; maximum ML 2500 mm; circumvolar; bathypelagic and near bottom; young specimens have been recorded north of the APF. Large adults have only been caught south of the APF. They are an occasional by-catch in the South Georgia long-line fishery for Patagonian toothfish (Dissostichus eleginoides) and the Ross Sea fishery for Antarctic toothfish (Dissostichus mawsoni). Literature: Filippova & Yukhov (1979), Rodhouse & Clarke (1985), Jackson et al. (2002), Filippova (2002), Collins et al. (2010), Roberts et al. (2011).

2.2. Antarctic endemics extending north to the Sub-Antarctic Front (SAF)

Kondakovia longimana Filippova, 1972 (Map 5): one of four members of the family Onychoteuthidae known in the Southern Ocean; maximum ML 1100 mm; circumvolar; epipelagic, mesopelagic, bathypelagic and near bottom. Literature: Rodhouse (1990), Lu & Williams (1994a, b), Vacchi et al. (1994), Lynnes & Rodhouse (2002).


Sloanevoguia circumpolaris Piatkowski, 2001 (Map 7): the only member of the family Brachioteuthidae found in Antarctic waters apart from Brachioteuthis linkskyi Piatkowski, 2001 which is occasionally found in the Sub-Antarctic; maximum ML 90 mm; circumvolar; epipelagic, mesopelagic and bathypelagic. Literature: Kubodera (1989), Rodhouse (1989, 1990), Piatkowski et al. (1994), Anderson & Rodhouse (2002), Collins et al. (2004) (referred to as notalian-Antarctic B. nissei) by Nesis (1987) and as B. sp. and B. ?picta by other authors prior to Lipinski (2001).

2.3. Antarctic endemics extending north to the Sub-Tropical Front (STF)


2.4. Sub-Antarctic (APF – STF)

Moroteuthis ingens Smith, 1881 (Map 12): one of four members of the family Onychoteuthidae known in the Southern Ocean; maximum ML 940 mm; near seabed from shelf to bathyal. Literature: Masey (1916), Filippova (1972), Filippova & Yukhov (1979), Alexeyev (1994).

Gonatus antarcticus Lønnberg, 1898 (Map 13): single member of the family Gonatidae described from the Southern Ocean; maximum ML 1100 mm; circumvolar (extends south of the APF in the Scotia Sea); mesopelagic, bathypelagic. Literature: Kubodera & Okutani (1986), Rodhouse (1990), Rodhouse et al. (1996), Nesis (1999), Anderson & Rodhouse (2002).
Cephalopoda Decapodiformes Maps 7–12

Map 7
- Slosarczykovi circumantarctica

Map 8
- Batoteuthis skolops

Map 9
- Galiteuthis glacialis

Map 10
- Batoteuthis skolops

Map 11
- Histioteuthis eltaninae

Map 12
- Moroteuthis ingens

Legend:
- ScientificName_accepted

Galiteuthis glacialis

Map 10
- Batoteuthis skolops

Map 11
- Histioteuthis eltaninae

Map 12
- Moroteuthis ingens

5. Fisheries

There are commercial fisheries for squid on the Patagonian Shelf and slope bordering the Falkland Current, in the Humboldt Current and around New Zealand. Over the last 20 years there have been occasional exploratory fishing expeditions to the South Atlantic sector of the Southern Ocean to explore stocks of the ommastrephid squid *Martaila hyadesi* which is taken as a by-catch in the *Illex argentinus* fishery in the South Atlantic (Gonzalez & Roeleveld, 1997). Dickson et al. (2004) noted that this fishery has developed in the Southern Ocean but catch data, combined with data from predators have been used to set precautionary measures in the event that a fishery might develop in the future (Rodhouse 1997).

This is CAML contribution # 134.

References


Mollusca : Cephalopoda

Map 13
- Gonatus antarcticus

Map 14
- Martialia hyadesi

Map 15
- Moroteuthis robsoni

Map 16
- Histiooteuthis atlantica

Map 17
- Todarodes filippovae

Map 18
- Bathyteuthis abyssicola

Chiroteuthis veranyi

Cephalopoda Decapodiformes Map 19  
Chiroteuthis veranyi.


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.obis.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 BROUYER is a marine biologist at the Royal Belgian Institute of Natural Sciences in Brussels. His research interests cover structural and functional 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.

Christoph HELD is a Senior Research Scientist at the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Bremerhaven, and professor at the University of Bremen. He is focused on the design and implementation of marine protected areas, particularly in the Antarctic, and to several sampling campaigns in Norway and Svalbard.

Nicolas LAFFEROTTE is a digital ecologist and exploratory data analyst, working across a variety of Southern Ocean, Antarctic, and wider research projects. His areas of interest include: ecosystem modelling, spatialisation 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 invertebrates, particularly starfish and more specifically on sea urchins. He authored a book and edited an extensive database on Antarctic echinoderms. He is currently President of the scientific council of the Musée 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 a member of the SCAR committees ACCC and Ant-ERA (as chief officer). Main focus of his work are: biodiversity, ecosystem functioning and services, response of marine systems to climate change, non-invasive technologies, and outreach.

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 EVJ, 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, spatialisation and marine protected area selection, risk assessment, animal tracking, seabird ecology, complex systems, and remote sensed data analyses.

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

Bruno DAVID is CNRS director of research at the laboratory BIOGEOSCIENCES, University of Bourgogne. He has contributed to the development of marine protected areas, mostly in the Antarctic and more specifically on sea urchins. He authored a book and edited an extensive database on Antarctic echinoderms. He is currently President of the scientific council of the Musée National d’Histoire Naturelle (Paris), and Deputy Director at the CNRS Institute for Ecology and Environment.

Alexandra POST is a marine geoscientist, with expertise in benthic habitat mapping, sedimentology and geomorphological 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 shelf following the successful CANA, voyages that region.

Yan ROPERT COUDERT spent 10 years at the Japanese National Institute of Polar Research, where he graduated as a Doctor in Polar Science in 2011. Since 2007, he is a permanent researcher at the CNRS in France and the director of a polar research group, which examines the ecological responses 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.

Claude DE BROYER is a marine biologist at the Royal Belgian Institute of Natural Sciences in Brussels. His research interests cover structural and functional 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.

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

Huw GRIFFITHS is a marine biologist 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, Bryozoa, sponges and pycnogonids as model groups to investigate trends at high southern latitudes.

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, spatialisation and marine protected area selection, risk assessment, animal tracking, seabird ecology, complex systems, and remote sensed data analyses.

Huw GRIFFITHS is a marine biologist 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, Bryozoa, sponges and pycnogonids as model groups to investigate trends at high southern latitudes.

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

Bruno DAVID is CNRS director of research at the laboratory BIOGEOSCIENCES, University of Bourgogne. He has contributed to the development of marine protected areas, mostly in the Antarctic and more specifically on sea urchins. He authored a book and edited an extensive database on Antarctic echinoderms. He is currently President of the scientific council of the Musée National d’Histoire Naturelle (Paris), and Deputy Director at the CNRS Institute for Ecology and Environment.

Alexandra POST is a marine geoscientist, with expertise in benthic habitat mapping, sedimentology and geomorphological 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 shelf following the successful CANA, voyages that region.

Yan ROPERT COUDERT spent 10 years at the Japanese National Institute of Polar Research, where he graduated as a Doctor in Polar Science in 2011. Since 2007, he is a permanent researcher at the CNRS in France and the director of a polar research group, which examines the ecological responses 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.