CHAPTER 6.5. SOUTHERN OCEAN SQUID.

THE BIOGEOGRAPHIC ATLAS OF THE SOUTHERN OCEAN


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6.5. Southern Ocean Squid

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1. Introduction

Data on Antarctic cephalopods have accumulated since the expeditions of HMS Challenger and HMS 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, Doryteuthis gahi, occurs over the southern Patagonian Shelf. Of the octopuses (order Octopoda) both suborders Cirrata and Incirrata are represented. The nautiluses (Subclass Nautiloidea), the cuttlefish (Order Sepiida), the sepiolids (order Sepiolidae) 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., Phololoteuthis massayae, Octopoteuthis rugosa, Taniaing danae, Histolotheuthis macrohista and H. miranda. A single specimen of the cranchid squid Taonius pavo (Rodhouse, 1990) has also not been included.

Photo 1 "Martiaria hyadesi" Rochebrune & Mabile, 1889. Image: © CP. Rodhouse.

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 south of the Antarctic Polar Front (APF): 2.1. Antarctic endemics extending north to the Antarctic Polar Front (APF); 2.2. Antarctic endemics extending north to the Sub-Antarctic Front (SAF); 2.3. Antarctic endemics extending north to the Sub-Tropical Front (STF); 2.4. Sub-Antarctic (APF – STF).

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

Morchoteuthis knipovitchi Filippova, 1972 (Map 1): one of four members of the family Onychoteuthidae known in the Southern Ocean; maximum ML 500 mm; circumvapor; 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), Lipinski et al. (1996), Piatkowski et al. (1994), Jackson et al. (2002).

Mastigoteuthis psychrophila Nesis, 1977 (Map 3): single member of the family Mastigoteuthidae known in the Southern Ocean; maximum ML 180 mm; circumvapor; mesopelagic and bathypelagic. Literature: Rodhouse (1990), Lu & Williams (1994a), 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; circumvapor; 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 mawsonii). 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 Onchyoteuthidae known in the Southern Ocean; maximum ML 1100 mm; circumvapor; epipelagic, mesopelagic, bathypelagic and near bottom. Literature: Rodhouse (1990), Lu & Williams (1994a, b), Vacchi et al. (1994), Lynnes & Rodhouse (2002).


Slosarczykia circumantarctica Lipinski, 2001 (Map 7): the only member of the family Brachioteuthidae found in Antarctic waters apart from Brachioteuthis linkingayi Lipinski, 2001 which is occasionally found in the Sub-Antarctic; maximum ML 90 mm; circumvapor; epipelagic, mesopelagic and bathypelagic. Literature: Kubodera (1989), Rodhouse (1990), Piatkowski et al. (1996), Piatkowski et al. (1994, 1998), Anderson & Rodhouse (2002), Collins et al. (2004) (referred to as notalan-Antarctic B. nissei by Nesis (1987) and as B. sp. and B. ?ctica 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; circumvapor; maximum ML 940 mm; near seabed from shelf to bathyal. Literature: Masye (1916), Filippova (1972), Filippova & Yukhov (1979), Alexeyev (1994).

Gonatus antarcticus Lönneberg, 1898 (Map 13): single member of the family Gonatidae described from the Southern Ocean; maximum ML 350 mm; circumvapor (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 1–6

Map 1. Moroteuthis knipovitchi

Map 2. Alluroteuthis antarcticus

Map 3. Mastigoteuthis psychrophila

Map 4. Mesonychoteuthis hamiltoni

Map 5. Kondakovia longimana

Map 6. Psychroteuthis glacialis

On all maps fronts shown from south to north are: Antarctic Polar Front, Sub-Antarctic Front and Sub-Tropical Front.
Cephalopoda: Decapodiformes

Map 7: *Slosarczykovia circumantarctica*

Map 8: *Batoteuthis skolops*

Map 9: *Galiteuthis glacialis*

Map 10: *Batoteuthis skolops*

Map 11: *Histioteuthis eltaninae*

Map 12: *Moroteuthis ingens*
2.5. Southern hemisphere extending south to the APF

Mortoreuthis robsoni Adam, 1962 (Map 15): one of four members of the family Ommastrephidae from the Southern Ocean; maximum ML to 750 mm; circum-polar; extends South of APF in Scotia Sea - South Georgia); pelagic and near bottom. Literature: Nesis (1987).

Histiotethus atlantica Hoyle, 1885 (Map 16): one of two members of the family Histiotethidae known in the Southern Ocean; maximum ML 258 mm; circum-polar; mesopelagic, bathypelagic. Literature: Kubodera (1989), Alexeyev (1994), Voss et al. (1998), Jackson et al. (2002).


2.6. Cosmopolitan extending south to the APF

Bathyteuthis abyssicola Hoyle. 1885 (Map 18): single member of the family Bathyteuthidae known to extend into the Southern Ocean; maximum ML 700 mm; mesopelagic, epipelagic, juveniles lower epipelagic. Literature: Hoyle (1912), Odhner (1923), Roper (1969), Lu & Mangoi (1987), Lu & Williams (1994a), Piatkowski et al. (1994), Rodhouse et al. (1996).

Chiroteuthis yanagi Furussac, 1825 (Map 19): single member of the family Chiroteuthidae known to extend into the Southern Ocean; maximum ML 107 mm; circum-polar; bathyal, bathypelagic and mesopelagic. Literature: Alexeyev (1994), Rodhouse & Lu (1998).

3. Squid from higher predator gut contents

Squid remain difficult to catch with scientific sampling gear and biogeographic knowledge of most species is patchy so conclusions about distribution are tentative. Gaps in data from nets are to some extent filled by information from studies on gut contents of higher predators. The beaks of squid are indigestible so they accumulate in predator stomachs and can be identified and used to estimate the biomass they represent (Clarke 1962). This approach has been particularly valuable in the Antarctic where an estimate has been made of total cephalopod biomass consumed by predators, especially squid (Clarke 1980, 1983). Subsequent research has provided detailed information about the prey of all the major Antarctic cephalopod predators, including fish (Collins & Rodhouse 2006). The research field remains active and a project within the Census of Antarctic Marine Life Programme has resulted in the publication of an identification guide: the beaks of Southern Ocean cephalopods (Xavier & Cherel 2009). Although in this CAML atlas predator data have been used to infer distribution of squid species in the text the distribution maps are solely based on specimens caught with scientific sampling gear or commercial fishing gear.

4. Inferring distribution

All the species listed here are probably circum-polar. Nevertheless, for most species there are large gaps in known distribution — there are areas that have not been sampled by nets and where predator data are scarce or absent. Productivity is low in large regions in the Antarctic Polar Current system where iron, a micronutrient, is at low concentrations despite fertile levels of nutrients off the land and the surrounding shelf or upwellled from the depths (Wadley 1983, Rogers 1994, Rodhouse et al. 1996). Analysis of remotely sensed sea surface temperature and ocean currents should provide a reliable indication of the distribution of squid in the Southern Ocean.

Litudinal distributions of all the squid species included here seem to be limited by the frontal systems of the Southern Ocean to the extent that it has been possible to classify them in terms of the frontal limits of their distribution. Nevertheless the conclusions drawn here are tentative. Sampling has been very unevenly spread and some species such as Galiteuthis glacialis have been observed to cross apparent frontal boundaries with incursions of large volumes of water (Nesis 1987). Other deep living species may extend northwards beyond and beneath the frontal boundaries given here. The so-called colossal squid Mesonychoteuthis hamiltoni, a deep living species, has been found in the gut contents of sperm whales as far north as southern Africa and Galiteuthis glacialis (Clarke 1980). Filippova, bathypelagic, abyssopelagic. Literature: Kubodera (1989), Alexeyev (1994), Voss et al. (1998), Jackson et al. (2002).

References


Mollusca : Cephalopoda

Map 13
- Gonatus antarcticus

Map 14
- Martialia hyadesi

Map 15
- Moroteuthis robsoni

Map 16
- Histiotethis atlantica

Map 17
- Todarodes filippovae

Map 18
- Bathyteuthis abyssicola

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 intensive compilation and validation efforts of Southern Ocean biogeographic data by the SCAR Marine Biodiversity Information Network (SCAR-MarBIN) 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 biogeographical 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 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 key regional platform 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.

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Claude DE BROYER is a marine biologist at the Royal Belgian Institute of Natural Sciences in Brussels. His research interests cover structural and ecolocial biodiversity and biogeography of crustaceans, and polar and deep sea benthiic ecosystem. 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.

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Alexandra POST is a marine geoscientist, with expertise in benthic habitat mapping, sedimentology and geographic characterisation of the seafloor. She has worked at Geoscience Australia since 2002, with a primary focus on understanding seabed 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 adjoining the successful CANA 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 that examines the ecological responses of Adélie penguins to environmental changes. He is also the secretary of the Expert Group on Birds and Marine Mammals of the IUCN Species Survival Commission on Antarctic Research.

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