10 Jan 2020

Response to the interactive comments "An integrated data compilation for the development of a marine protected area in the Weddell Sea" by Katharina Teschke et al. (Earth System Science Data)

Anonymous Referee #1 - https://doi.org/105194/essd-2019-86-RC1

Specific comments

1. *"At first reading of title and abstract I was under the impression that a huge data compilation is provided with this paper, while in fact a systematic overview of all the sources to the MPA planning process is given. This should be made more clear right from the begin, so the reader knows what to expect."*

   a. We agree with the referee`s statement that we have to clarify right from the beginning of the paper that a systematic overview of all the data sources - instead of a huge data compilation - used in the MPA planning process is given. We will change the whole text (incl. title) accordingly.

2. *"Usability of data: The authors should elaborate if and how the provided data and information might be used, and/or to which future work they might contribute. Can the provided data layer products directly be used by readers in some way? Is the interested reader invited to build up his own data compilation by using the provided sources?"*
   From general comments: *"How or if the provided data layer products might be used, without access to the underlying data compilation, is not discussed."*

   a. We have mentioned in section "2.2 Data availability" (lines 15-16) that our data layer products can be used for geo-statistical analyses within the framework of MPA planning, among other things. Nevertheless, we will add some more details on data usability in the text in the appropriate sections (e.g., "2.2 Data availability", "3 Outlook").

3. *"Methods: …, but they don't give as much detail on the methods they used to process the data and create the respective data layers. A brief description of the provided data layers is missing in the paper, e.g. in 2.4.1 (Zooplankton) it is not mentioned that via the persistent identifiers the maps with interpolated abundances of the two krill species can be accessed, but also a map with habitat suitability. Another example is chapter 2.4.2 (Zoobenthos), here species level data sources for asteroids, ophiuroids, and holothurians are listed, but the provided map layer shows one polygon only (special echinoderm assemblage). It should be made clear in each section what data products the user can access via the links, and how they are created."*

   a. We will follow the referee's suggestion by indicating in each subsection under "2.3 Environmental data" and "2.4 Ecological data" which data layer products can be accessed via the PANGAEA links and by adding as supplementary material the method by which the data were processed and the respective data layer was developed.

4. *"In my opinion the paragraphs on data sources could be shortened, as every source is listed also in table 1 and 2. Instead I would prefer to read more about the methods (e.g. models used)."*

   a. We agree with this statement, that we could shorten the sections "2.3 Environmental data" and "2.4 Ecological data" by avoiding duplication of information in the text about

e.g., references to publications and cruise reports, explicitly listed in the tables, too. We will change the text accordingly.

b. We have already commented on this remark earlier in this reply (see #3a.). We will provide the information about the analytical methods (e.g. models) in the revised version.

Technical corrections

5. *"Here it is spoken of five persistent identifiers, provided are six (also in 2.2). Suggest to sort the links according to the structure in the paper (from abiotic to seals)."*

   a. We change the text accordingly.

   b. We follow the referee's suggestion by sorting the PANGAEA links according to the structure of section "2.3 Environmental data" and "2.4 Ecological data".

6. *"p 5 line 11 f > a) b) c) in italics"*

   a. We change the writing style to "normal".

7. *"p 5 line 32 Possible to provide more detailed contact than institute webpage?"*

   a. We will add more information about the data warehouse of the Thuenen Institute of Sea Fisheries where data on krill are stored.

8. *"References in text but missing in Reference section: Barthel & Gutt 1992, Timmermann 2013, Seitner et al. 2014 a, b, c (2004?)*

   a. We include Barthel and Gutt (1992) in the "Reference" section because they are missing there. However, we do not include Timmermann (2013) in the "Reference" section, because the correct reference is Haid and Timmermann (2013), referred to in section "2.3.3 FESOM data" and listed in "References". We change "Seiter et al. 2014a, b, c" in the text and Table 1 to "Seiter et al. 2004a, b, c".

Anonymous Referee #2 - https://doi.org/10.5194/essd-2019-86-RC2

Specific comments

1. *"Include further description of Methods used to analyze each data set and to develop each map. This could potentially be done in the paper itself as an Annex or in the Supplement section (including the maps), within the metadata file (adding an easier crosslink to the paper), and/or as a footnote/bigger caption in each available map. CCAMLR Working Groups or Workshops papers such as those submitted to EMM/SAM/WS are not generally available for the general public (login is required) so further information included therein should be available elsewhere for the interested reader."*
   From general comments: *"However, in my view, some information is missing, in particular related to metadata and methods description."*

   a. We agree with the referee`s statement that the methods used to analyse each data set and to develop each map should be available for the interested reader. Therefore, we will describe the methods in the "Supplement" section (including the maps).

2. *"In the description of the Methods, it could be good to include how the methods in each case were chosen (e.g. agreed by international community, based on specific paper, etc.) so it adds to the openness and transparency of the process."*

   a. We agree that a sentence about how the methods were chosen in each case increases the openness and transparency of the MPA planning process. We will add this information to the methods in the "Supplement" section accordingly.

3. *"It is not clear why only maps for 2.3 Environmental data are included at the end of the paper. I would suggest including maps (and methods) for 2.4 Biological data as well, for an easier and more comprehensive visualization."*

   a. We showed all described data for "2.4 Ecological data" (point data) in Figure 1 and mapped in Figure 2 the raster data for "2.3.1 IBCSO data", "2.3.2 AMSR-E sea ice maps" and "2.3.3 FESOM data". We have refrained from presenting the environmental variables, which have only been used as explanatory variables in species distribution models (despite the description of these variables in the text).

   b. Furthermore, we will provide each data layer product as a map in the "Supplement" section in the revised version (see also remark #1a earlier in this reply).

4. *"Avoid duplication of information in the text about data sources, references and cruise reports already included in the tables."*

   a. We will change text sections "2.3 Environmental data" and "2.4 Ecological data" by deleting e.g., references to publications and cruise reports, explicitly listed in the tables, too.

5. *"Most readers would probably be unfamiliar with CCAMLR. I would suggest adding a few general maps, including the CCAMLR Convention Area and the division in MPA Planning Domains (mentioned in the text) for contextualization."*

   a. We will follow the referee's suggestion by adding a map including the CCAMLR Convention Area and the MPA Planning Domains.

6. *"In the 3. Outlook section, there is some mentioning to the development of a storage management system for this data. I would suggest also mentioning the CCAMLR MPA Information Repository (CMIR) that is under development by the CCAMLR Secretariat, as an additional suitable storage space."*

   a. We will add the information in "3 Outlook" that the CCAMLR MPA Information Repository (CMIR), currently being developed by the CCAMLR Secretariat, will also be available in the future as a suitable storage location for metadata.

Technical corrections

i. *"Include CRS and projections information in each metadata file (common and thematic layers) for each shapefile and raster."*

   a. We will add CRS and projections information in the revised version under "2.2 Data availability".

   b. Furthermore, CRS and projections information is supplied for each shape and raster file in "Source" under "Layer Properties" if you upload the file in GIS-software or open the ArcMAP packages.

c. In addition, projections information is named for each map in the legend (see folder "map_png").

ii. "Provide clear cross-reference links between metadata description and available maps (names do not always coincide and it is hard to keep track to which description fits which map)."

a. We follow the referee's suggestion by indicating for each metadata description (under "2.3 Environmental data" and "2.4 Ecological data"), which map was developed and under which file name the respective data layer is stored in PANGAEA.

iii. "If possible, allow for the zip data to keep a clear file name referenced to the data they contain for easier identification when downloaded in folders (in particular for the "Data shapefile raster")."

a. We have had the file names for zip data folders changed accordingly by the great support of the PANGAEA team. Because if a PANGAEA data entry is registered by a DOI, then - strictly speaking - nothing can be changed in the data publication anymore.

iv. "Map legends in Figure 3 are very hard to read – make sure high definition maps are provided in final draft or make maps bigger."

a. We agree that the map legends in Figure 3 are impossible to read. We change the maps accordingly.

v. "In section 2.2 Data availability, paragraph 10, there is the mention to five persistent identifiers. However, six of those are provided. Be aware that the same happens in the Abstract."

a. We change the text accordingly.

19 Feb 2020
Reply to comments from the topical editor

Dear Mr Fleischer,

We thank you for your report on our updated version of the manuscript entitled *"An integrated*
compilation of data sources for the development of a marine protected area in the Weddell Sea".

We have revised our manuscript according to your recommendations, i.e. we have made the following changes to the manuscript:

1) We have changed the PANGAEA internal DOI resolver to the official DOI resolver, i.e. https://doi.org/, in Table 1 and Table 2 (see pp. 14-19).

2) All data sets from our group of authors are now published in the data repository PANGAEA, i.e. (a) the semi-quantitative dataset on zoobenthos (p. 6) and (b) the datasets on fishes (p. 7). Please note that the DOI resolver of the data collection "fishes" is already

officially registered (https://doi.org/10.1594/PANGAEA.911972), but the individual data sets on fish are still "in review" and password protected until the PANGAEA team uploads the data. You can view the data with this temporary access key, which was created especially for us:

https://www.pangaea.de/tok/f07d0042ef0360f809c916870b7371150d03c4ae.

3) We have written an additional paragraph in the Supplementary Material, which focuses on data preparation and cleaning.

Please see the changes - we did as track changes - in the main text and the Supplementary Material.

Kind regards,

Katharina Teschke and co-authors

9 Mar 2020

Reply to comments from editor

Dear Mr Fleischer,

We uploaded the final version of our paper including the extended table with the availability of the raw data and the supplement for data processing instructions.

Kind regards,

Katharina Teschke and co-authors

An integrated ~~data~~ compilation of data sources for the development of a marine protected area in the Weddell Sea

Katharina Teschke[1,2], Hendrik Pehlke[1,2], Volker Siegel[3], Horst Bornemann[1], Rainer Knust[1], Thomas Brey[1,2,4]

[1] Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar und Meeresforschung, Am Handelshafen 12, 27570 Bremerhaven, Germany
[2] Helmholtz Institute for Functional Marine Biodiversity at the University Oldenburg (HIFMB), Ammerländer Heerstraße 231, 26129 Oldenburg, Germany
[3]Thünen Institute of Sea Fisheries, Herwigstraße 31, 27572 Bremerhaven, Germany
[4] University Bremen, Bibliothekstraße 1, 28359 Bremen, Germany

Correspondence to: Katharina Teschke (Katharina.Teschke@awi.de)

Abstract. The Southern Ocean may contribute a considerable part to the proposed global network of Marine Protected Areas (MPAs) that should cover about 10% of the world oceans in 2020. In the Antarctic, the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) is responsible for this task, and currently Germany leads a corresponding scientific evaluation of the wider Weddell Sea region. Compared to other marine regions within the Southern Ocean, the Weddell Sea is exceptionally well investigated. A tremendous amount of data and information has been produced over the last four decades. Here, we give a systematic overview ~~compilation~~ of ~~these~~ all data sources collected ~~that were acquired~~ in the context of the Weddell Sea MPA planning process. The ~~data~~ compilation of data sources comprises data produced by scientists / institutions from more than twenty countries and were either available within our institutes, ~~provided by our collaborators,~~ downloaded via data portals, or transcribed from the literature. It is the first compilation ~~data compilation~~ for this area that includes abiotic data, such as bathymetry and sea ice, and ecological data from zooplankton, zoobenthos, fish, birds and marine mammals. ~~The final~~All data layer products based on this huge ~~data~~ compilation of environmental and ecological data~~, including metadata description,~~ are available from the data publisher PANGAEA via the ~~five~~ six persistent identifiers at https://doi.org/10.1594/PANGAEA.899595 (Pehlke and Teschke, 2019), https://doi.org/10.1594/PANGAEA.899667 (Teschke et al., 2019a), https://doi.org/10.1594/PANGAEA.899645 (Teschke et al., 2019b), https://doi.org/10.1594/PANGAEA.899591 (Teschke et al., 2019c), https://doi.org/10.1594/PANGAEA.899520 (Pehlke et al., 2019a) and ~~, https://doi.org/10.1594/PANGAEA.899591 (Teschke et al., 2019a), https://doi.org/10.1594/PANGAEA.899595 (Pehlke and Teschke, 2019),~~ https://doi.org/10.1594/PANGAEA.899619 (Pehlke et al., 2019b)~~, https://doi.org/10.1594/PANGAEA.899645 (Teschke et al., 2019b) and https://doi.org/10.1594/PANGAEA.899667 (Teschke et al., 2019c)~~. This ~~data~~ compilation of data sources with the final data layer products will serve future research and monitoring well beyond the current MPA development process.

1 Introduction

Marine Protected Areas (MPAs) have experienced a significant increase in number and coverage at a global scale during recent decades (e.g. Mora and Sale, 2011; McDermott et al., 2018; UNEP-WCMC and IUCN,

2019). The number of MPAs has increased almost 1.5 times since the 1990s and the total area protected is currently almost 30 million km². At the United Nations World Summit on Sustainable Development in 2002 the international community of states reached an agreement about the establishment of a representative network of MPAs for the purposes of long-term conservation of marine biodiversity by 2012 (A/CONF.199/20, 2002). The adopted *strategic plan for biodiversity 2011-2020* of the Convention on Biological Diversity aims at the conservation of at least 10 % of the coastal and offshore marine areas by 2020 based on a MPA network (CBD, 2010). The Southern Ocean may contribute a considerable proportion of this MPA network due to its size, and the uniqueness of the Antarctic environment renders its conservation the more urgent.

The Weddell Sea represents the southerly part of the Atlantic Sector of the Southern Ocean. About one quarter of the Weddell Sea's entire marine area covers the continental shelf along the eastern contour of the Antarctic Peninsula and the Antarctic continent up to 20°E as a non topographic delineation. The Weddell Sea is deserving protection in multiple respects. On the one hand, all arguments for the conservation of the Southern Ocean hold true for the Weddell Sea, too: An extreme environment mostly dominated by the seasonal dynamic of the sea ice with an excellent adapted biota. The biodiversity is - particularly in the benthos - very high (e.g. Brey et al., 1994; Brandt et al., 2007), and there is a significant number of endemic species, i.e. unique to the Antarctic or even to the Weddell Sea (e.g. Arntz et al., 1994; Clarke and Johnston, 2003; Linse et al., 2006). Moreover, the Weddell Sea plays an important role for seabirds, penguins and marine mammals. Almost one third of the entire population of emperor penguins (Fretwell et al., 2012) and a major part of the circum-Antarctic population of crabeater seals (*cf.* Bester and Odendaal, 2000; Southwell et al., 2012; Gurarie et al. ~~2016~~2017a, b) apparently occurs in the Weddell Sea. Sponge associations which are comparable to tropical reef systems in terms of their structural and functional complexity occur along the eastern Weddell Sea shelf (Barthel and Gutt, 1992), and on the broad shelf in the southern Weddell Sea a special benthic community - adapted to very cold water temperatures - seems to resident (Teschke et al., 2016).

The Weddell Sea is - despite being one of the most remote and inaccessible places on earth - relatively well investigated compared to other Antarctic regions~~ - exceptionally well investigated~~.

Since approximately 30 years the Weddell Sea is the geographical focus area of the German Antarctic research. In addition, there are manifold research activities of other nations. Consequently, we were able to compile a tremendous amount of environmental and ecological data to support the development of a Weddell Sea MPA (hereafter: WSMPA) under the Commission for the Conservation of Antarctic Marine Living Ressources (CCAMLR). Here we present a systematic overview of ~~the~~ all ~~integrated data compilation of~~ environmental and ecological data sources collected for the development of a WSMPA and provide data layer products that are based on this data compilation.

2 Data description

2.1 Study site

The WSMPA Planning Area in which we acquired the environmental and ecological data is located between the Antarctic Peninsula and 20°E (Fig. 1). The northern border is at 64°S and the continental margin forms the southern border. This area is defined by CCAMLR's MPA Planning Domains in the CCAMLR Convention Area (SC-CAMLR-XXX, 2011) and by aiming at a bio-geographically homogeneous area, particularly on the shelf

(Teschke et al., 2016). In addition to the WSMPA Planning Area (approx. 4.2 million km² in size) we compiled data for a 200 km wide buffer area near the Antarctic Peninsula, which is part of an MPA initiative led by Argentina and Chile (CCAMLR-XXXVII/31, 2018). This buffer zone is adjacent northerly to the northern border of the WSMPA Planning Area and has the eastern and western boundaries at 30°W and 60°W, respectively. Some data (e.g. seal tracking data), extend beyond the WSMPA Planning Area (plus buffer) and originate from adjacent regions of the Weddell Sea, such as the Bellinghausen Sea along the west side of the Antarctic Peninsula.

2.2 Data availability

All raw data sets of environmental and ecological parameters collected by the end of 2016 and further processed as part of the WSMPA planning process are systematically described and the primary reference is mentioned, such as the data portal on which the data are ~~publically~~ freely available or the website of ~~,~~ the institute/organisation on which the data can be requested on demand ~~or the contact to the respective data provider~~ (see Table 1 and 2; see all data records in Fig. 2 and Fig. S1). For each individual raw data set in Tables 1 and 2, the accessibility status is indicated, i.e. it is immediately clear which data set is directly freely available and which data set must first be requested.

In addition, we offer data layer products that we developed on the basis of the raw data sets whose sources are described here. The methods used to process and analyse the data and to develop each data layer are described in detail in the Supplement. All ~~raw data sets presented here were included in the WSMPA spatial planning analysis and the final~~ data layer products with metadata description~~, including i.a. description of analytical data processing,~~ are freely available from the data publisher PANGAEA via the ~~five~~ six persistent identifiers at https://doi.org/10.1594/PANGAEA.899595 (Pehlke and Teschke, 2019), https://doi.org/10.1594/PANGAEA.899667 (Teschke et al., 2019a), https://doi.org/10.1594/PANGAEA.899645 (Teschke et al., 2019b), https://doi.org/10.1594/PANGAEA.899591 (Teschke et al., 2019c), https://doi.org/10.1594/PANGAEA.899520 (Pehlke et al., 2019a) and ~~https://doi.org/10.1594/PANGAEA.899591 (Teschke et al., 2019a), https://doi.org/10.1594/PANGAEA.899595 (Pehlke and Teschke, 2019),~~ https://doi.org/10.1594/PANGAEA.899619 (Pehlke et al., 2019b)~~, https://doi.org/10.1594/PANGAEA.899645 (Teschke et al., 2019b) and https://doi.org/10.1594/PANGAEA.899667 (Teschke et al., 2019c).~~ (see Table 1 and 2). The data layers are available either as ArcMAP packages (as mxd file, containing a map document with all associated files) or as individual GIS files for those who use another GIS-software instead of the ESRI software (ArcMap). The shape and raster files, all with the same spheroid (WGS 1984) and projection (South Pole Lambert Azimuthal Equal Area, EPSG 102020), were processed in such a way that they can be easily used for the analysis of MPA scenarios or other geostatistical analyses in the Weddell Sea without direct access to the underlying raw data. For example, the shape and raster files could be stacked to identify hot- and coldspots of biodiversity, or certain layers could be used as explanatory variables in species distribution models.

2.3 Environmental data

2.3.1 IBCSO data

The bathymetric data used in the context of the WSMPA planning initiative originate from the first regional digital bathymetric model (DBM) established in the International Bathymetric Chart of the Southern Ocean (IBCSO) Version 1.0 programme ~~and published by Arndt et al. (2013a, b)~~ (data request: April 2013) (Table 1; Fig. 3a). This chart model is based upon bathymetric data of different origin, such as multi-beam and single beam data, digitized depths from nautical charts, predicted bathymetry, from many hydrographic offices, scientific institutions and data centres. The IBCSO Version 1.0 DBM has a horizontal resolution of 500 m x 500 m and a vertical resolution of 1 m based on a polar stereographic projection with true scale at 65° referenced to WGS84 ellipsoid (Arndt et al., 2013a, b).

2.3.2 AMSR-E sea ice maps

Daily high resolution sea ice maps of the Antarctic Ocean are provided by the PHAROS group (PHysical Analysis of RemOte Sensing images) at the Institute of Environmental Physics ~~(IUP)~~, University of Bremen, Germany. The sea ice raster maps, which were used in the context of the WSMPA planning initiative, are derived from satellite observations of daily sea ice concentration by the Advanced Microwave Scanning Radiometer - Earth Observing System (AMSR-EOS) instrument on board the Aqua satellite. Daily AMSR-E sea ice concentration data (Jun 2002 - Oct 2011) were downloaded from IUP, University of Bremen (data request: 18-12-2013) (see Table 1; Fig. 3b). The ARTIST Sea Ice (ASI) concentration algorithm was used with a spatial resolution of 6.25 km x 6.25 km (Spreen et al., 2008) and a polar stereographic projection (EPSG: 3976).

2.3.3 FESOM data

Monthly mean values of seawater temperature, salinity and current velocity from 1990 to 2009 were derived from the Finite Element Sea Ice - Ocean Model (FESOM) (Table 1; Fig. 3c, d). The model run was initialised on January, 1st 1980 with hydrographic data from the Polar Science Center Hydrographic Climatology (Steele et al., 2001), and forced with NCEP daily atmospheric re-analysis data (Kalnay et al., 1996) for 1980 to 2009. For more information on FESOM and the atmospheric forcing data sets see e.g. Timmermann et al. (2009) and Haid and Timmermann (2013), respectively. The FESOM raster has a resolution of 0.18° (x) x 0.05° (y); in the vertical, two z-levels (i.e. sea surface and sea bottom) are used. The raster bases on WGS84 geographic coordinate system (EPSG: 4326).

IBCSO data, AMSR-E sea ice maps and FESOM data were used in a pelagic regionalisation analysis for the Weddell Sea. The respective data layer products are available at https://doi.org/10.1594/PANGAEA.899595 ("Pelagic regionalisation - clustering approach"). The clustering approch to classify different pelagic provinces is described in the Supplement. In addition, the data sets were used as environmental variables in various geostatistical approaches to develop spatial distribution maps for (i) adult Antarctic krill (AMSR-E), (ii) ice krill (IBCSO, FESOM), (iii) echinoderms (FESOM), (iv) demersal fish (IBCSO, FESOM), (v) Antarctic toothfish (IBCSO), (vi) Antarctic petrel (IBCSO, AMSR-E, FESOM) and (vii) emperor penguins (AMSR-E). The

methods used to develop the different spatial distribution maps are described in the Supplement and the PANGAEA link to the respective data layer products (incl. file names) is given in the corresponding subsection under "2.4 Ecological data".

2.3.4 SeaWiFS data

Near-surface chlorophyll a concentration values stem from the Sea-Viewing Wide Field-of-View Sensor (SeaWiFS) measurements on board of the OrbView-2 (formerly SeaStar) spacecraft (Table 1). The monthly aggregated data (1997 to 2010) were downloaded ~~via the NASA's OceanColor website~~ as level 3 standard mapped images (SMI) with a spatial resolution of 9 km x 9 km (data request: 09-09-2014).

2.3.5 WOA13 data

Data on dissolved oxygen, phosphate and nitrate were obtained from the World Ocean Atlas 2013 version 2 (WOA13 V2) (Garcia et al., 2014a, b) (Table 1). The data (1955 to 2012) were downloaded as monthly statistical means with a horizontal resolution of 1° (x) x 1° (y) and 57 and 37 vertical (z) levels between 0 to 1500 m and 0 to 500 m for dissolved oxygen and phosphate/nitrate, respectively. The data request was on 11-07-2013 (dissolved oxygen), 17-07-2013 (nitrate) and 18-07-2013 (phosphate), respectively.

2.3.6 Data on chemical sediment components

A data compilation on total organic carbon content and calcium carbonate and silicia in surface sediments were downloaded from the data archive PANGAEA (Seiter et al., 200~~1~~4a, b, c, and references therein) (see Table 1). Data on biogenic silica of the sediment surface were obtained from PANGAEA, too (~~see~~ Geibert et al., 2005~~a,~~ b).

The data described under 2.3.4 to 2.3.6 were used as explanatory variables in the Antarctic krill species distribution model (SDM) (SeaWiFS, WOA13, chemical sediment components) and in the demersal fish SDM (WOA13, chemical sediment components). The SDMs are described in detail in the Supplement and the PANGAEA link to the respective data layer products (incl. file names) is given in the corresponding subsection under "2.4 Ecological data".

2.4 Ecological data

In the following, we describe the sources of raw data sets used in the WSMPA planning process and indicate which data layer product was developed on the basis of which raw data sets per higher taxonomic group. In addition, the methods for processing and analysing the data and for developing each data layer are described in detail in the Supplement.

2.4.1 Zooplankton

Antarctic krill (adults)

The WSMPA data collection on adult Antarctic krill (*Euphausia superba*) originates from (i) historical UK data from "Discovery Expeditions" (1928-1939) and data collected during the SIBEX cruise by British Antarctic Survey, (ii) five South African data sets from the 1990s, (iii) four Soviet data sets from 1998 and 1990, (iv) Polish data (Witek et al., 1985) and (v) German data from location discovery cruises with MV "Polarsirkel" in 1979/80 and 1980/81 (Siegel, 1982), RV "Walther Herwig" cruises (1975/76, 1977/78) and the 2004 Lazarev Sea Krill Survey (LAKRIS) (RV "Polarstern" cruise ANT-XXI/4) (Siegel, 2012). All the data are publicly available via the database KRILLBASE (doi.org/brg8) (Atkinson et al., 2017) (see Table S2 in the Supplement that provides a detailed list of data used from KRILLBASE). The data from KRILLLBASE were complemented by abundance data on *E. superba*, which were collected (a) during the Norwegian Antarctic research expedition 1976/77 (MV "Polarsirkel") ~~(Fevolden, 1979)~~, (b) during two Soviet research cruises in 1977 ~~(RV "Gizhiga")~~ and 1983 ~~(RV "Volny Vetter")~~, (c) in the context of the Lazarev Sea Krill Survey ~~(RV "Polarstern" cruises ANT-XXIII/2, ANT-XXIII/6, ANT-XXIV/2) (e.g. Siegel, 2012)~~ as well as (d) during RV "Polarstern" cruises ANT-V/1-3, ANT-VII/4, ANT-XVIII/4 and ANT-XXIX/3 ~~(Siegel et al., 2013)~~ (Table 2). Furthermore, ~~Japanese, Norwegian and Soviet fisheries~~ Fisheries data ~~(catch and effort)~~ on *E. superba* for the WSMPA Planning Area (i.e. Statistical Subarea 48.5 and southern part of Subarea 48.6) stem from the CCAMLR database (https://www.ccamlr.org; data request ~~through CCAMLR Secretariat~~: 03-10-2013) (Table 2).

All these data were used in a species distribution model (SDM) of adult Antarctic krill and ultimately led to a data layer product showing habitat suitability for adult Antarctic krill in the WSMPA Planning Area (see doi 10.1594/PANGAEA.899667; file name: "Adult Antarctic krill, *Euphausia superba* - habitat suitability prediction").

Antarctic krill (larvae)

Abundance data on Antarctic krill larvae stem from (a) the Antarctic research expeditions 1976/77 ~~(Fevolden, 1979)~~ and 1979/80 with MV "Polarsirkel" ~~(Siegel, 1982)~~, (b) the First International BIOMASS Experiment survey (FIBEX), (c) ~~(RV "Walther Herwig" cruise 1981) (e.g. Trathan and Everson, 1994) and~~ the Lazarev Sea Krill Survey (LAKRIS) ~~(RV "Polarstern" cruises ANT-XXI/4, ANT-XXIII/6) (Siegel, 2012)~~ as well as (~~c~~d) RV "Polarstern" cruise ANT-VII/4 and the combined RV "Polarstern" (ANT-VIII/2) and RV "Akademik Fedorov" cruises ~~(Menshenina, 1992)~~ (see Table 2).

All data on Antarctic krill larvae were used for an interpolation approach and led to a map of the interpolated abundances of krill larvae in the WSMPA Planning Area (see doi 10.1594/PANGAEA.899667; "Antarctic krill larvae, *Euphausia superba* - interpolated abundance").

Ice krill

Abundance data on adult ice krill (*Euphausia crystallorophias*) originate from pelagic trawl surveys during (a) the German Antarctic research cruise 1975/76 with "Walther Herwig", (b) the "Pre-Site Survey" 1979/80 with MV "Polarsirkel" ~~(Siegel, 1982)~~, (c) the Lazarev Sea Krill Survey ~~(RV "Polarstern" cruises ANT-XXI/4, ANT-XXIII/2, ANT-XXIII/6, ANT-XXIV/2) (e.g. Siegel, 2012)~~ as well as (d) RV "Polarstern" cruises ANT-V/1-3, ANT-VII/4 and ANT-XXIX/3 ~~(Siegel et al., 2013)~~ (Table 2).

The abundance data on *E. crystallorophias* were used for an interpolation approach and led to a map showing the interpolated abundances of ice krill (see doi 10.1594/PANGAEA.899667; "Ice krill, *Euphausia crystallorophias* - interpolated denisty"). In addition, the abundance data on *E. crystallorophias* were used for "ground truthing" of the potential ice krill habitat (doi 10.1594/PANGAEA.899667; "Ice krill, *Euphausia crystallorophias* – pot habitat").

All data about *E. superba* and *E. crystallorophias*, which were used additionally to KRILLBASE and the CCAMLR database, are stored in the data warehouse of the Thuenen Institute of Sea Fisheries (https://www.thuenen.de) and can be requested on demand.

2.4.2 Zoobenthos

Sponges

Abundance data and semi-quantitative data on sponges (higher taxonomic groups), which were compiled in the context of the WSMPA planning initiative, originate from zoobenthos data sets. The abundance data (Gerdes, 2014 a-o) and the semi-quantitative data (Teschke and Brey, 2020) are publically available via PANGAEA ~~(see Gerdes, 2014 a-o). The semi-quantitative data set can be requested from us if required (contact: Katharina Teschke, AWI) and is available as presence-absence data set in PANGAEA (see Teschke and Brey, 2019a)~~ (see Table 2).

Based on these data, we developed a map of the occurrence of sponges in the WSMPA Planning Area (doi 10.1594/PANGAEA.899645; "Sponges, Porifera - interpolated presence").

Echinoderms

The data set on echinoderms consists of presence-absence data on species level for asteroids, abundance data on ophiuroid taxa as well as holothurian taxa. The first two data sets are available in PANGAEA (Teschke and Brey, 2019a, b~~2019b, c~~), the latter in the information system biodiversity.aq (Gutt et al., 2014). ~~Publications, which have used those primary data sets, are e.g. Dahm (1996), Gutt (1988) and Gerdes et al. (1992).~~

These data were used in a clustering approach to ultimately identify the potential habitat for echinoderms in the WSMPA Planning Area by environmental proxies (doi 10.1594/PANGAEA.899645; "Special echinoderm assemblage - pot habitat").

2.4.3 Fish

Antarctic silverfish (larvae and adults)

The WSMPA data collection on Antarctic silverfish larvae (*Pleuragramma antarctica*) originates from quantitative zooplankton data sets obtained during the RV "Polarstern" cruises ANT-I/2 ~~(Boysen-Ennen and Piatkowski, 1988)~~ and ANT-III/3 ~~(Hubold et al., 1988)~~ and during the Lazarev Sea Krill Survey (LAKRIS) ~~("Polarstern" cruises: ANT XXI/4, ANT XXIII/6, ANT XXIV/2) (Flores et al., 2014)~~ (Table 2). The first mentioned data are stored in the data warehouse of the Thuenen Institute of Sea Fisheries and can be requested on demand (https://www.thuenen.de/de/sf). Fish larvae data from ANT-III/3 are available from Hubold et al.

(1988) and t~~T~~he LAKRIS data can be requested from https://www.awi.de/forschung/biowissenschaften/polare-biologische-ozeanographie.

~~are available in PANGAEA (*PANGAEA reference will be added during review process*).~~

All abundance data on Antarctic silverfish (adults and larvae) were used for an interpolation approach and led to a map of the interpolated abundances of *P. antarctica* in the WSMPA Planning Area (doi 10.1594/PANGAEA.899591; "Antarctic silverfish, *Pleuragramma antarctica* - interpolated abundance").

Demersal fish

Abundance data on demersal fish and adult *P. antarctica* stem from benthic and pelagic trawl surveys during seven "Polarstern" cruises between 1996 and 2011 ~~(ANT-XIII/3, ANT-XV/3, ANT-XVII/3, ANT-XIX/5, ANT-XXI/2, ANT-XXIII/8, ANT-XXVII/3)~~ (Table 2), and ~~. Publications, which have used these data, are e.g. Caccavo et al. (2018) and Mintenbeck et al. (2012). The primary data sets~~ are published in PANGAEA (Knust 2020 or references therein, i.e. Balguerías and Knust, 2020; Knust et al., 2020a-d; Schröder and Knust, 2020). ~~can be requested from us if required (contact: Rainer Knust, AWI).~~ This data compilation was complemented by data on demersal fish and *P. antarctica* derived from trawl and dredge surveys published in PANGAEA (Drescher et., 2012; Ekau et al., 2012a, b; Hureau et al., 2012; Kock et al., 2012; Wöhrmann et al., 2012).

All data on demersal fish were used in a SDM and led to a data layer product showing the habitat suitability for demersal fish in the WSMPA Planning Area (see doi 10.1594/PANGAEA.899591; "Demersal fish - habitat suitability prediction").

Antarctic toothfish (adults)

Fishery data ~~(catch per unit effort)~~ on the Antarctic toothfish (*Dissostichus mawsoni*) for the WSMPA Planning Area (i.e. Statistical Subarea 48.5 and southern part of Subarea 48.6) were taken from the CCAMLR database ~~and requested through the CCAMLR Secretariat~~ (https://www.ccamlr.org; data request: 03-08-2016) (Table 2).

The data were used to determine the potential habitat of *D. mawsoni* in the WSMPA Planning Area (see doi 10.1594/PANGAEA.899591; "Adult toothfish, *Dissostichus mawsoni* - pot habitat").

Demersal fish nesting sites

Information about nesting sites of demersal fish was collected during the RV "Polarstern" cruises PS82 (Knust and Schröder, 2014) ~~(ANT-XXIX/9)~~ and PS96 (Piepenburg, 2016) ~~(ANT-XXXI/2)~~. ~~The data are available from Knust and Schröder (2014) (PS82) and Piepenburg (2016) (PS96).~~ The data collected during RV "Polarstern" cruises were supplemented by data from the literature (Daniels 1978, 1979; Jones & Near 2012). The map with the locations of the nesting sites of demersal fish is available at PANGAEA (doi 10.1594/PANGAEA.899591; "Demersal fish - observation of nesting sites") and is also shown in the Supplement (see Fig. S12).

2.4.4 Flying and non-flying seabirds

Breeding and non-breeding Adélie penguins

Tracking data on breeding and non-breeding Adélie penguins *(Pygoscelis adeliae)* originate from (i) British Antarctic Survey (BAS) inventory data ~~from Phil Trathan~~ (ID 754, ~~) and Mike Dunn and P. Trathan (ID~~ 764, ID 773, 779), (ii) a data set from BAS ~~(P. Trathan)~~ and Instituto Antártico Argentino ~~(Mercedes Santos)~~ (ID 753)

~~(Warwick et al., 2019)~~ and (iii) a data set from the US AMLR Program ~~from Jefferson Hinke and Wayne Trivelpiece~~ (NOAA) (ID 910) ~~(see e.g. Hinke et al. 2015)~~ (see also Table 2). All the data are stored in the Birdlife International`s Seabird Tracking Database (http://www.seabirdtracking.org/; data request: 20-10-2015). Adélie penguins breeding locations and estimated abundances of breeding pairs were derived from Lynch and LaRue (2014).

The tracking data on *P. adeliae* were used to model the probability of breeding and non-breeding *P. adeliae* occurrence during foraging (doi 10.1594/PANGAEA.899520; "Breeding Adélie penguin, *Pygoscelis adeliae* - modelled foraging trips" and "Non-breeding Adélie penguin, *Pygoscelis adeliae* - modelled foraging trips"). The final data layer product for breeding *P. adeliae* also depict breeding locations and estimated abundances of breeding pairs as well as buffer areas around each colony.

~~Tracking data on non breeding *P. adeliae* were acquired from Birdlife International`s Seabird Tracking Database, too (data request: 20-10-2015) (Table 2). Downloaded data include (i) BAS inventory data from Phil Trathan (ID 754) and Mike Dunn and P. Trathan (ID 773, 779), (ii) a data set from BAS (P. Trathan) and Instituto Antártico Argentino (Mercedes Santos) (ID 753) and (iii) a data set from the US AMLR Program from Jefferson Hinke and Wayne Trivelpiece (NOAA) (ID 910).~~

Breeding Emperor penguins

Data on Emperor penguin *(Aptenodytes forsteri)* colony locations and breeding population estimates were derived from Fretwell et al. (2012, 2014) (Table 2).

These data were used to develop a probability map of foraging areas for *A. forsteri* (doi 10.1594/PANGAEA.899520; "Breeding emperor penguin, *Aptenodytes forsteri* - modelled foraging areas").

Antarctic petrels

Information on breeding locations and estimated number of breeding pairs of the Antarctic petrel *(Thalassoica antarctica)* ~~were kindly provided by Jan van Franeker (Wageningen University & Research) and~~ are published in van Franeker et al. (1999) (Table 2).

The information on breeding pairs and their colony locations is shown in the final data layer product next to modelled foraging habitats of *T. antarctica* (doi 10.1594/PANGAEA.899520; "Antarctic petrel, *Thalassoica antarctica* - modelled foraging areas").

2.4.5 Pinnipeds

Tracking data from pinnipeds were obtained from the MEOP data portal "Marine Mammals Exploring the Oceans Pole to Pole" available via http://www.meop.net/ (data request: 14-11-2016) (see Table 2 for a detailed list of data used). ~~In addition, we have used MEOP data (UK data: ct27, ct70; German data: ct113, wd06, wd07) for which unconditional sharing were not yet accepted at the time of data retrieval and were provided by Lars Boehme (University of St. Andrews) and us (H. Bornemann), respectively. The UK and German data sets are now also freely accessible from the MEOP data portal.~~ Furthermore, the data from the MEOP data portal were complemented by tracking data sets on southern elephant seals (Tosh et al., 2009a, b; James et al., 2012a, b), Weddell seals (McIntyre et al., 2013a, b) and crabeater seals (Nachtsheim et al., 2016a, b) stored in PANGAEA.

All these tracking data were used to model the probability of seal occurrence during foraging (doi 10.1594/PANGAEA.899619; "Seal abundance - modelled prediction values").

Point data from pack-ice seals (unspecified taxa) based on aerial surveys are from Plötz et al. (2011a-e) and were downloaded from PANGAEA (Table 2). These data were sampled during five flight campaigns from 1996 to 2001 within the Antarctic Pack Ice Seals (APIS) programme. In addition, information on crabeater seal densities (predicted or observed) was derived from Bester et al. (1995 and 2002), Flores et al. (2008) and Forcada et al. (2012; Table 2). ~~German and South African APIS data and UK census data were published in e.g. Gurarie et al. (2016) and Forcada et al. (2012), respectively.~~

All the APIS point data and information on seal densities were used to develop a map showing the distribution patterns of seals in the WSMPA Planning Area (10.1594/PANGAEA.899619; "Seal abundance - modelled and interpolated prediction values").

3 Outlook

This is the first ~~data~~ compilation of data sources for the Antarctic Weddell Sea and adjacent seas, which considers data across the entire ecosystem: i.e., from abiotic data, such as bathymetry and sea ice, to ecological data ranging from zooplankton and zoobenthos to fish, birds and marine mammals. The effort to create such a ~~data~~ compilation of data sources was directly coupled with the initiative to develop a WSMPA. However, our compilation of data sources will facilitate the future research on fauna, ecology and nature conservation in the Weddell Sea. Using our systematic overview of available data for the development of a specific data collection, future projects save the time-consuming multi-parameter data search from the scratch. In addition, our work serves to guide future studies aimed at closing data gaps in the wider Weddell Sea region and/or simply pointing to specific data sets that may be of particular interest to future generations (baseline is a particular issue). For example, ~~However, the data compilation is also suitable for further scientific questions in the wide field of faunistic, ecological and nature conservation studies to investigate the effect of climate change and possible fishing activities in this area. S~~some of the ecological data sets were collected in the 1980s and earlier, when the Weddell Sea was still almost pristine and hardly affected by any anthropogenic activities, so that these data sets are optimally suited to describe a reference state for assessing the effect of pressures on the Weddell Sea ecosystem. In addition, the ecological data - with a few exceptions - provide information on abundances of the respective taxa and are therefore better suited as an indicator for environmental changes than presence-absence data or presence data only.

Ultimately, the ~~data~~ compilation of data sources serves to ~~protect our data heritage for use by future generations (baseline is a particular issue), to enable work with readily available multi parameter data sets, and to~~ motivate ~~researches~~ researchers to ~~add~~ incorporate further data, both from existing "paper sources" and from future measurements, into existing data repositories and archives.

Subsequent work will focus on the development of an efficient and tailor-made management system for the storage of these complex and heterogeneous data and information of WSMPA data compilation and automated data mining, handling and analysis. This system will serve three purposes: (i) to better enable a more holistic and integrative approach towards ecosystem research in the Weddell Sea in general, (ii) to enable the management of the WSMPA to carry out the tasks of the Research and Monitoring Programme as a mandatory part of an MPA

under CCAMLR when adopting the MPA, and (iii) to provide key stakeholders and the public with access to data, information and management measures related to the ecosystem of the Weddell Sea region in general and the WSMPA in particular. The CCAMLR MPA Information Repository (CMIR) currently being developed by the CCAMLR Secretariat will also be available in the future as a suitable storage location for metadata on CCAMLR MPAs in Antarctica.

Author contribution. KT collected all data together, described the metadata and led the writing of the paper. HP took over the technical part of the data acquisition (retrieval, storage, processing). VS collected and prepared the data on zooplankton for further analyses within the WSMPA planning. HB and RK were significantly involved in the collection of the data on pinnipeds and fishes, respectively. TB collaborated in the paper writing.

Competing interests. The authors declare that they have no conflict of interests.

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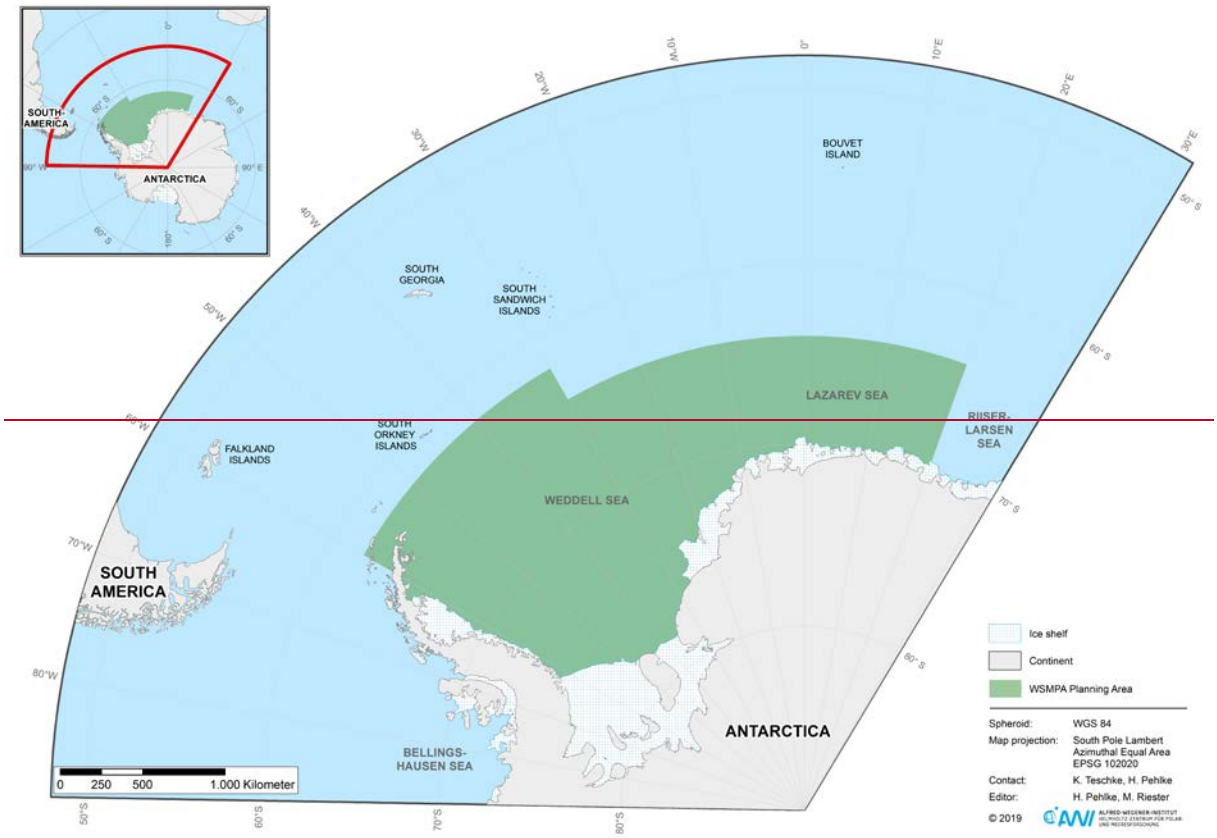
Figure 1.


SOUTH-
AMERICA
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Continent
WSMPA Planning Area
Spheroid: WGS 84
Map projection: South Pole Lambert Azimuthal Equal Area EPSG 102020
Contact: K. Teschke, H. Pehlke
Editor: H. Pehlke, M. Riester
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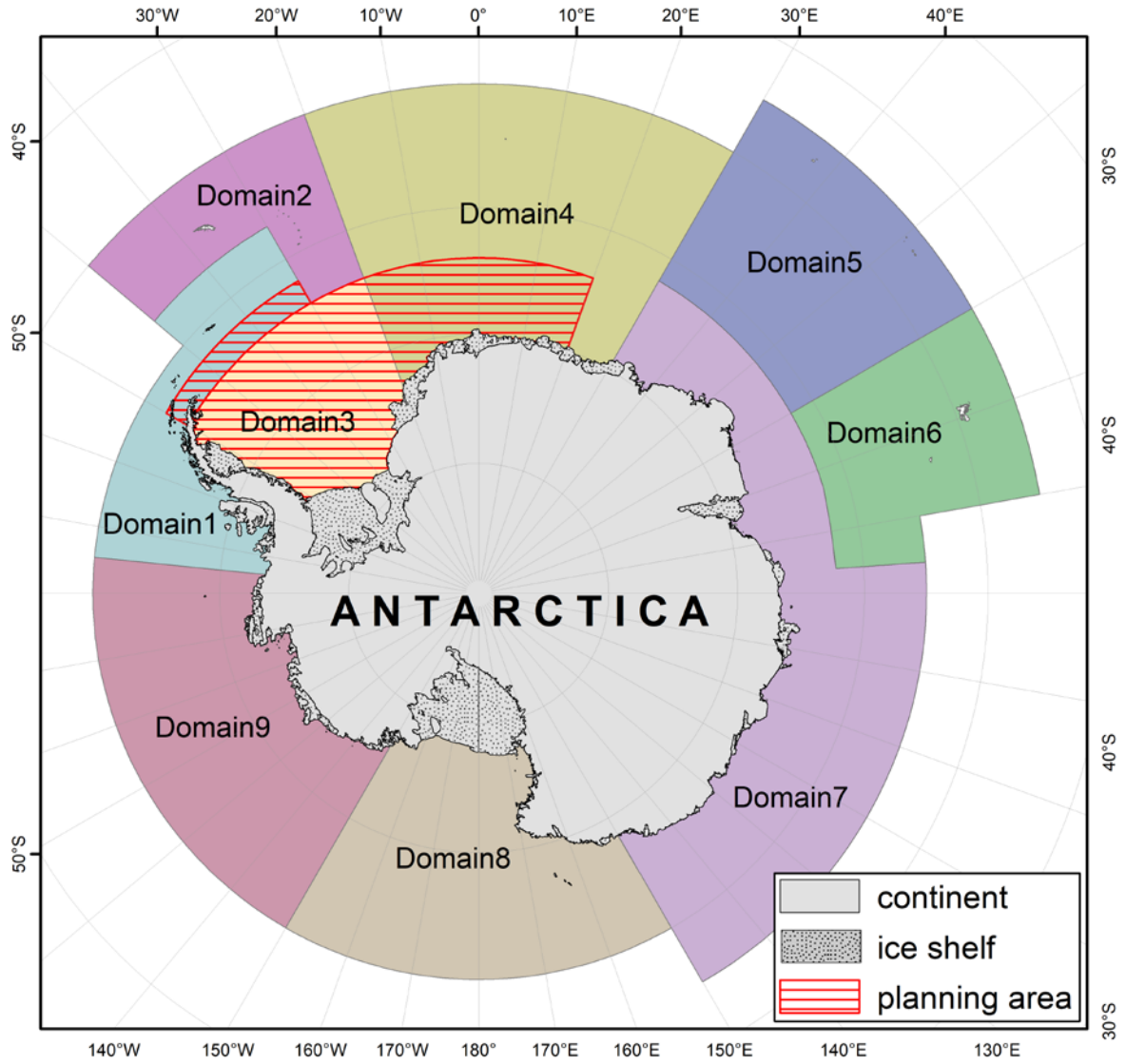

Figure 1. CCAMLR Convention Area with its Marine Protected Area (MPA) Planning Domains and the planning area (incl. 200 km wide buffer area near the Antarctic Peninsula) for the development of a MPA in the wider Weddell Sea (red shaded area). Domain 1: Western Peninsula - South Scotia Arc, Domain 2: North Scotia Arc, Domain 3: Weddell Sea, Domain 4: Bouvet Maud, Domain 5: Crozet - del Cano, Domain 6: Kerguelen Plateau, Domain 7: Eastern Antarctica, Domain 8: Ross Sea, Domain 9: Amundsen - Bellingshausen.

~~Study site in the Antarctic Weddell Sea and adjacent marine regions. Black dashed line indicates the boundaries of Weddell Sea MPA Planning Area including the 200 km wide buffer area near the Antarctic Peninsula. Overview map of the study site in the wider Weddell Sea and its location in the Southern Ocean (top left corner).~~

Figure 2.

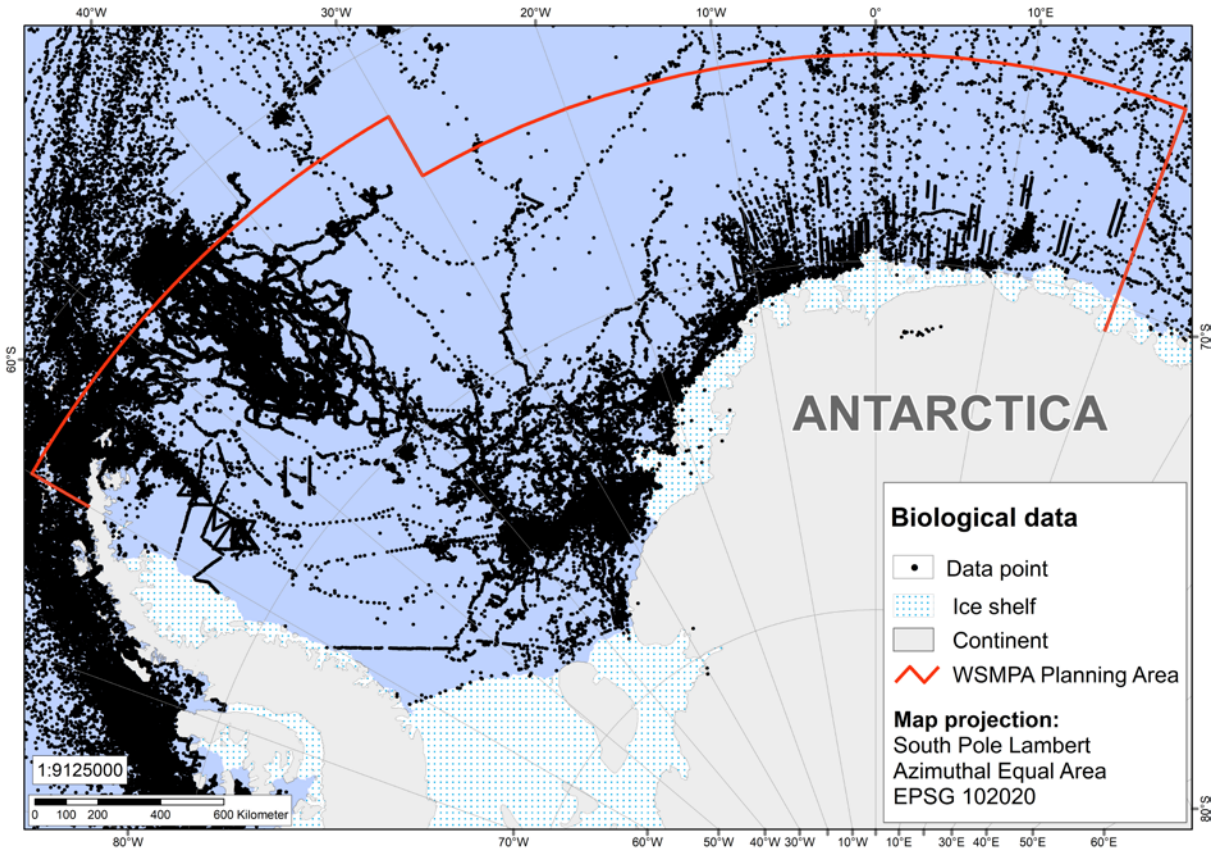

Figure 2. Distribution of all data recordings across the wider Weddell Sea region, which were compiled in the context of the WSMPA planning initiative. Figure S1 in the Supplement provides the distribution of data recordings per higher taxonomic group, i.e. zooplankton, zoobenthos, fishes, birds and pinnipeds.

Figure 3.

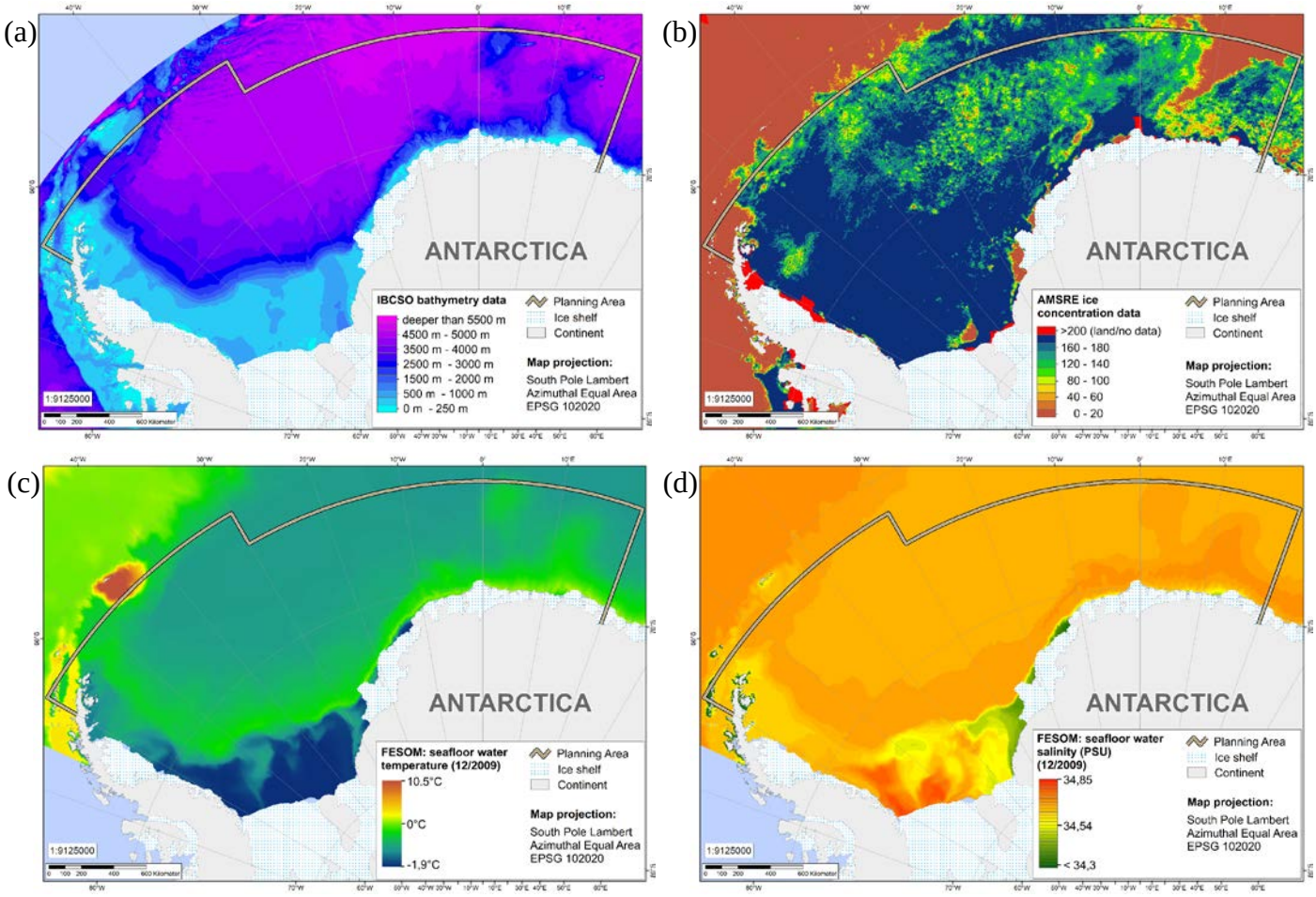

Figure 3. Raster data sets of environmental parameters, which have been used as basic data in a regionalisation analysis of environmental provinces in the context of the WSMPA planning. IBCSO bathymetry (a), AMSR-E sea ice maps (exemplarily for 15 December 2009) (b), FESOM sea bottom temperature and salinity data (exemplarily for December 2009) (c, d).

Tables

Table 1. Data collection of environmental parameters compiled for the development of a marine protected area (MPA) in the wider Weddell Sea (Antarctica). For each raw data set, the name of the data source, the primary reference, such as the data portal or website on which the data are available~~is publicly accessible or the contact to the respective data provider~~, as well as examples of publications that have used the respective primary data set are listed. In addition, DOI links to the final WSMPA data layer products is provided, which includes the respective raw data set.

Content	Name	Reference to raw data	Availability of raw data	Reference to publications, which have used raw data (exemplarily)	DOI link to ArcMap packages
Depth	International Bathymetric Chart of the Southern Ocean (IBCSO) Version 1.0	Arndt et al. (2013b) doi:10.1594/PANGAEA.805736 [data request: April 2013]	freely available	Arndt et al. (2013a) Jerosch et al. (2016)	doi:10.1594/PANGAEA.899595 doi:10.1594/PANGAEA.899667 doi:10.1594/PANGAEA.899591
Sea ice concentration	Daily AMSR-E Sea Ice Maps	https://seaice.uni-bremen.de/data/ ~~Contact: Gunnar Spreen, Christian Melsheimer or Georg Heygster (Institute of Environmental Physics, University of Bremen)~~ [data request: 18-12-2013]	freely available	Spreen et al. (2008)	doi:10.1594/PANGAEA.899595 doi:10.1594/PANGAEA.899667
Temperature, salinity, current velocity	Finite Element Sea Ice - Ocean Model (FESOM)	https://www.awi.de/forschung/klimawissenschaften/klimadynamik ~~https://www.awi.de~~ [data delivery: 20-11-2013]	request necessary	Danilov et al. (2004) Timmermann et al. (2009) Haid & Timmerman (2013)	doi:10.1594/PANGAEA.899595 doi:10.1594/PANGAEA.899645 doi:10.1594/PANGAEA.899667 doi:10.1594/PANGAEA.899591
Dissolved oxygen, phosphate, nitrate	World Ocean Atlas 2013 version 2 (WOA13 V2)	https://www.nodc.noaa.gov/OC5/woa13/woa13data.html [data request: 11 to 18 July 2013]	freely available	Garcia et al. (2014a, b)	doi:10.1594/PANGAEA.899667 doi:10.1594/PANGAEA.899591
Total organic carbon content		Seiter et al. (2004b) doi:10.1594/PANGAEA.199835	freely available	Seiter et al. (2004a)	doi:10.1594/PANGAEA.899591
Calcium carbonate, silicia		Seiter et al. (2004c) doi:10.1594/PANGAEA.186024	freely available	Seiter et al. (2004a)	doi:10.1594/PANGAEA.899591
Biogenic silica		Geibert et al. (2005b) doi:10.1594/PANGAEA.230042	freely available	Geibert et al. (2005a)	doi:10.1594/PANGAEA.899591
Chlorophyll a concentration	Sea-Viewing Wide Field-of-View Sensor (SeaWiFS) measurements	https://oceandata.sci.gsfc.nasa.gov/SeaWiFS/ [data request: 09-09-2014]	registration necessary	Moore & Abbott (2000) Gregg & Casey (2004)	doi:10.1594/PANGAEA.899667

Content of Data	Name of data source	Reference to primary data set or data provider	Reference to publications, which have used primary data set (exemplarily)	DOI link to ArcMap packages
Depth	International Bathymetric Chart of the Southern Ocean (IBCSO) Version 1.0	Arndt et al. (2013a) [data request: April 2013]	Arndt et al. (2013b) Jerosch et al. (2016)	https://doi.pangaea.de/10.1594/PANGAEA.899595 https://doi.pangaea.de/10.1594/PANGAEA.899667 https://doi.pangaea.de/10.1594/PANGAEA.899591
Temperature, salinity, current velocity	Finite Element Sea Ice – Ocean Model (FESOM)	Contact: Ralph Timmermann(AWI) ralph.timmermann@awi.de [data delivery: 20-11-2013]	Danilov et al. (2004) Timmermann et al. (2009) Haid and Timmerman (2013)	https://doi.pangaea.de/10.1594/PANGAEA.899595 https://doi.pangaea.de/10.1594/PANGAEA.899645 https://doi.pangaea.de/10.1594/PANGAEA.899667 https://doi.pangaea.de/10.1594/PANGAEA.899591
Sea ice concentration	Daily AMSR-E Sea Ice Maps	https://seaice.uni-bremen.de/data/ Contact: Gunnar Spreen, Christian Melsheimer or Georg Heygster (Institute of Environmental Physics, University of Bremen) [data request: 18-12-2013]	Spreen et al. (2008)	https://doi.pangaea.de/10.1594/PANGAEA.899595 https://doi.pangaea.de/10.1594/PANGAEA.899667
Chlorophyll a concentration	Sea-Viewing Wide Field-of-View Sensor (SeaWiFS) measurements	NASA's OceanColor website [data request: 09-09-2014]	Moore and Abbott (2000) Gregg and Casey (2004)	https://doi.pangaea.de/10.1594/PANGAEA.899667
Dissolved oxygen, phosphate, nitrate	World Ocean Atlas 2013 version 2 (WOA13 V2)	https://www.nodc.noaa.gov/OC5/woa13/woa13data.html [data request: 11 to 18 July 2013]	Garcia et al. (2014a, b)	https://doi.pangaea.de/10.1594/PANGAEA.899667 https://doi.pangaea.de/10.1594/PANGAEA.899591
Total organic carbon content		Seiter et al. (2014b)	Seiter et al. (2014a)	https://doi.pangaea.de/10.1594/PANGAEA.899591
Calcium carbonate, silicia		Seiter et al. (2014c)	Seiter et al. (2014a)	https://doi.pangaea.de/10.1594/PANGAEA.899591
Biogenic silica		Geibert et al. (2005b)	Geibert et al. (2005a)	https://doi.pangaea.de/10.1594/PANGAEA.899591

Table 2. Data collection of ecological parameters compiled for the development of a marine protected area (MPA) in the wider Weddell Sea (Antarctica). For each raw data set, the name of the data source, the primary reference, such as the data portal or website on which the data are ~~is publicly~~ available ~~accessible or the contact to the respective data provider~~, as well as the respective cruise reports and/or examples of publications that have used the respective primary data set are listed. In addition, DOI links to the final WSMPA data layer products is provided, which includes the respective raw data set. The raw data sets are structured according to higher taxonomic groups, i.e. zooplankton, zoobenthos, fishes, birds and pinnipeds. Within each higher taxonomic group, the individual raw data sets are sorted by taxa and the oldest data set is listed first each time.

Content	Name	Reference to raw data	Availability of raw data	Cruise report	Reference to publications, which have used raw data (exemplarily)	DOI link to ArcMap packages
Zooplankton						
Adult Antarctic krill (abundances)	KRILLBASE (doi:brg8) See detailed list of data in Table S2 in Supplement	Atkinson et al. (2017)	request necessary		Atkinson et al. (2004) Atkinson et al. (2008) Piñones & Fedorov (2016) Atkinson et al. (2019)	doi:10.1594/PANGAEA.899667
Adult Antarctic krill (catch and effort)	Japanese, Norwegian and Soviet fisheries data	https://www.ccamlr.org/ ~~CCAMLR database:~~ ~~Contact: CCAMLR Secretariat~~ [data request: 03-10-2013]	request necessary			doi:10.1594/PANGAEA.899667
Adult Antarctic krill (abundances)	Soviet cruises: RV Gizhiga 1977 and RV Volny Vetter 1983	https://www.thuenen.de/de/sf/ ~~Database of Thuenen Institute of Sea Fisheries~~ ~~Contact: Lara Kim Hühnerlage kim.huenerlage@thuenen.de~~	request necessary			doi:10.1594/PANGAEA.899667
Adult Antarctic krill (abundances)	ANT-XVIII/4	https://www.thuenen.de/de/sf/ ~~Database of Thuenen Institute of Sea Fisheries~~	request necessary	Fahrbach et al. (2003)		doi:10.1594/PANGAEA.899667
Adult Antarctic krill & ice krill (abundances)	MV Polarsirkel 1976/77	Fevolden (1979) doi:10.1080/00364827.1979	freely available			doi:10.1594/PANGAEA.899667
Adult Antarctic krill & ice krill (abundances)	Lazarev Sea Krill Survey (LAKRIS) data (ANT-XXI/4, ANT-XXIII/2, ANT-XXIII/6, ANT-XXIV/2)	https://www.thuenen.de/de/sf/ ~~Database of Thuenen Institute of Sea Fisheries~~	request necessary	Smetacek et al. (2005) Strass (2007) Bathmann (2008, 2010)	Siegel (2012)	doi:10.1594/PANGAEA.899667

Adult Antarctic krill & ice krill (abundances)	ANT-XXIX/3	https://www.thuenen.de/de/sf/ ~~Database of Thuenen Institute of Sea Fisheries~~	request necessary	Gutt (2013)	Siegel et al. (2013)	doi:10.1594/PANGAEA.899667
Adult Antarctic krill & ice krill (abundances)	ANT-V/3	https://www.thuenen.de/de/sf/ ~~Database of Thuenen Institute of Sea Fisheries~~	request necessary	Schnack-Schiel (1987)		doi:10.1594/PANGAEA.899667
Adult Antarctic krill & ice krill (abundances)	ANT-VII/4	https://www.thuenen.de/de/sf/ ~~Database of Thuenen Institute of Sea Fisheries~~	request necessary	Arntz et al. (1990)		doi:10.1594/PANGAEA.899667
Adult ice krill (abundances)	RV Walther Herwig 1975/76	https://www.thuenen.de/de/sf/ ~~Database of Thuenen Institute of Sea Fisheries~~	request necessary			doi:10.1594/PANGAEA.899667
Adult ice krill (abundances)	MV Polarsirkel 1979/80	https://www.thuenen.de/de/sf/ ~~Database of Thuenen Institute of Sea Fisheries~~	request necessary		Siegel (1982) Hempel et al. (1983)	doi:10.1594/PANGAEA.899667
Larval Antarctic krill (abundances)	MV Polarsirkel 1976/77	Fevolden (1979) doi:10.1080/00364827.1979	freely available			doi:10.1594/PANGAEA.899667
Larval Antarctic krill (abundances)	MV Polarsirkel 1979/80	https://www.thuenen.de/de/sf/ ~~Database of Thuenen Institute of Sea Fisheries of Sea Fisheries~~			Siegel (1982)	doi:10.1594/PANGAEA.899667
Larval Antarctic krill (abundances)	First International BIOMASS Experiment survey (FIBEX), RV “Walther Herwig” 1981	https://www.thuenen.de/de/sf/ ~~Database of Thuenen Institute of Sea Fisheries~~	request necessary		Trathan & Everson (1994) Siegel (2005)	doi:10.1594/PANGAEA.899667
Larval Antarctic krill (abundances)	ANT-VII/4	https://www.thuenen.de/de/sf/ ~~Database of Thuenen Institute of Sea Fisheries~~	request necessary	Arntz et al. (1990)		doi:10.1594/PANGAEA.899667
Larval Antarctic krill (abundances)	ANT-VIII/2 and RV Akademik Fedorov, 1989	https://www.thuenen.de/de/sf/ ~~Database of Thuenen Institute of Sea Fisheries~~	request necessary	Augstein et al. (1991)	Menshenina (1992)	doi:10.1594/PANGAEA.899667
Larval Antarctic krill (abundances)	Lazarev Sea Krill Survey (LAKRIS) data (ANT-XXI/4, ANT-XXIII/6)	https://www.thuenen.de/de/sf/ ~~Database of Thuenen Institute of Sea Fisheries~~	request necessary	Smetacek et al. (2005) Bathmann (2008)	Siegel (2012)	doi:10.1594/PANGAEA.899667
Zoobenthos						

Sponges (abundances)	WH068/1 WH068/2 ANT-III/2 ANT-V/1 ANT-VI/3 ANT-VII/4 ANT-IX/3 ANT-X/3 ANT-XIII/3 ANT-XIII/4 ANT-XV/3 ANT-XVII/3 ANT-XIX/5 ANT-XXI/2 ANT-XXIII ANT-XXVII	Gerdes (2014a-p) doi:10.1594/PANGAEA.834061 doi:10.1594/PANGAEA.834065 doi:10.1594/PANGAEA.834009 doi:10.1594/PANGAEA.717708 doi:10.1594/PANGAEA.834017 doi:10.1594/PANGAEA.834021 doi:10.1594/PANGAEA.834013 doi:10.1594/PANGAEA.834025 doi:10.1594/PANGAEA.834029 doi:10.1594/PANGAEA.834033 doi:10.1594/PANGAEA.834041 doi:10.1594/PANGAEA.834074 doi:10.1594/PANGAEA.834069 doi:10.1594/PANGAEA.834049 doi:10.1594/PANGAEA.834053 doi:10.1594/PANGAEA.834057	freely available	- - Hempel (1985) Schnack-Schiel (1987) Fütterer (1988) Arntz et al. (1990) Bathmann et al. (1992) Spindler et al. (1993) Arntz & Gutt (1997) Fahrbach & Gerdes (1997) Arntz & Gutt (1999) Arntz & Brey (2001) Arntz & Brey (2003) Arntz & Brey (2005) Gutt (2008) Knust et al. (2012)	Gerdes et al. (1992) Gerdes et al. (2003)	doi:10.1594/PANGAEA.899645
Sponges (semi-quantitative data)	ANT-VII/4 ANT-IX/3 ANT-XIII/3 ANT-XV/3 ANT-XXI/2	Teschke & Brey (2020) doi:10.1594/PANGAEA.911801	freely available	Arntz et al. (1990) Bathmann et al. (1992) Arntz & Gutt (1997) Arntz & Gutt (1999) Arntz & Brey (2005)	Galéron et al. (1992)	doi:10.1594/PANGAEA.899645
Echinoderms - Asteroids (presence-absence)	ANT-I/2 ANT-II/4 ANT-V/3 ANT-VI/3 ANT-XV/3 ANT-XVII/3	Teschke & Brey (2019a) doi:10.1594/PANGAEA.898629	freely available	Drescher et al. (1983) Kohnen (1984) Schnack-Schiel (1987) Fütterer (1988) Arntz & Gutt (1999) Arntz & Brey (2001)	Voß (1988)	doi:10.1594/PANGAEA.899645
Echinoderms - Ophiuroids (abundances)	ANT-I/2 ANT-II/4 ANT-V/3 ANT-V/4 ANT-VI/3 ANT-VII/4 ANT-IX/3 ANT-X/3	Teschke & Brey (2019b) doi:10.1594/PANGAEA.898773	freely available	Drescher et al. (1983) Kohnen (1984) Schnack-Schiel (1987) Miller & Oerter (1990) Fütterer (1988) Arntz et al. (1990) Bathmann et al. (1992) Spindler et al. (1993)	Brey et al. (1994) Dahm (1996)	doi:10.1594/PANGAEA.899645

Echinoderms - Holothurians (abundances)	ANT-I/2 ANT-II/4 ANT-III/3	Gutt et al. (2014) doi:10.3897/zookeys.434.7622	freely available	Drescher et al. (1983) Kohnen (1984) Hempel (1985)	Gutt (1988) Piepenburg et al. (1997)	doi:10.1594/PANGAEA.899645
Fishes						
Pleuragramma antarctica & demersal fishes (abundances)	ANT-XIII/3	Balguerías & Knust (2020) doi:10.1594/PANGAEA.911965	freely available	Arntz & Gutt (1997)	Mintenbeck et al. (2012)	doi:10.1594/PANGAEA.899591
	ANT-XV/3	Schröder & Knust (2020) doi:10.1594/PANGAEA.911966	freely available	Arntz & Gutt (1999)	Caccavo et al. (2018)	
	ANT-XVII/3	Knust et al. (2020a) doi:10.1594/PANGAEA.911967	freely available	Arntz & Brey (2001)		
	ANT-XIX/5	Knust et al. (2020b) doi:10.1594/PANGAEA.911968	freely available	Arntz & Brey (2003)		
	ANT-XXI/2	Knust et al. (2020c) doi:10.1594/PANGAEA.911969	freely available	Arntz & Brey (2005)		
	ANT-XXVII/3	Knust et al. (2020d) doi:10.1594/PANGAEA.911970	freely available	Knust et al. (2012)		
Pleuragramma antarctica & demersal fishes (abundances)	ANT-I/2	Drescher et al. (2012) doi:10.1594/PANGAEA.786877	freely available	Drescher et al (1983)	Ekau (1988) Caccavo et al. (2018)	doi:10.1594/PANGAEA.899591
	ANT-III/3	Ekau et al. (2012a) doi:10.1594/PANGAEA.786883	freely available	Hempel (1985)		
	ANT-V/3	Ekau et al. (2012b) doi:10.1594/PANGAEA.786884	freely available	Schnack-Schiel (1987)		
	ANT-VII/4	Hureau et al. (2012) doi:10.1594/PANGAEA.786886	freely available	Arntz et al. (1990)		
	ANT-IX/3	Wöhrmann et al. (2012) doi:10.1594/PANGAEA.786887	freely available	Bathmann et al. (1992)		
	ANT-XXIII/8	Kock et al. (2012) doi:10.1594/PANGAEA.786888	freely available	Gutt (2008)		
Fish larvae - *Pleuragramma antarctica* (abundances)	ANT-I/2	https://www.thuenen.de/de/sf/ ~~Database of Thuenen Institute of Sea Fisheries~~	request necessary	Drescher et al (1983)	Boysen-Ennen & Piatkowski (1988)	doi:10.1594/PANGAEA.899591
Fish larvae - *Pleuragramma antarctica* (abundances)	ANT-III/3	Hubold et al. (1988) doi:10.1007/BF00443454	freely available	Hempel (1985)		doi:10.1594/PANGAEA.899591

Fish larvae - *Pleuragramma antarctica* (abundances)	Lazarev Sea Krill Survey (LAKRIS) data: ANT-XXI/4, ANT-XXIII/6, ANT-XXIV/2	https://www.awi.de/forschung/biowissenschaften/polare-biologische-ozeanographie ~~Contact: Hauke Flores (AWI) Hauke.Flores@awi.de~~	request necessary	Smetacek et al. (2005) Bathmann (2008, 2010)	Flores et al. (2014)	doi:10.1594/PANGAEA.899591
Antarctic toothfish (catch per unit effort)	Japanese, Korean, Norwegian and South African fishing data	https://www.ccamlr.org/ ~~CCAMLR database: Contact: CCAMLR Secretariat~~ [data request: 03-08-2016]	request necessary			doi:10.1594/PANGAEA.899591
Demersal fish nesting sites	PS82 (ANT-XXIX/9) PS96 (ANT-XXXI/2)	Knust & Schröder (2014) doi:10.2312/BzPM_0680_2014 Piepenburg (2016) doi:10.1594/PANGAEA.862097	freely available freely available	Schröder (2016)	La Mesa et al. (2019)	doi:10.1594/PANGAEA.899591
Demersal fish nesting sites		Daniels (1978, 1979) doi:10.1111/j.1095-8649.1978.tb04190.x doi:10.1126/science.205.4408.831 Jones & Near (2012) doi:10.1111/j.1095-8649.2012.03282.x	freely available freely available			doi:10.1594/PANGAEA.899591
Birds						
Adélie penguin colonies (estimated abundances of breeding pairs)		Lynch & LaRue (2014) doi:10.1642/AUK-14-31.1	freely available			doi:10.1594/PANGAEA.899520
Breeding and non-breeding Adélie penguins (tracking data)	US AMLR Program (ID 910)	http://www.seabirdtracking.org/ ~~Birdlife International`s Seabird Tracking Database~~ [data request: 20-10-2015]	request necessary		Hinke et al. (2015)	doi:10.1594/PANGAEA.899520
Breeding and non-breeding Adélie penguins (tracking data)	BAS / Instituto Antártico Argentino data (ID 753)	http://www.seabirdtracking.org/ ~~Birdlife International`s Seabird Tracking Database~~ [data request: 20-10-2015]	request necessary		Warwick-Evans et al. (2019)	doi:10.1594/PANGAEA.899520
Breeding and non-breeding Adélie penguins (tracking data)	BAS Inventory (754, 773, 779)	http://www.seabirdtracking.org/ ~~Birdlife International`s Seabird Tracking Database~~ [data request: 20-10-2015]	request necessary		Dunn et al. (2011)	doi:10.1594/PANGAEA.899520

Breeding Adélie penguins (tracking data)	BAS Inventory (ID 764)	http://www.seabirdtracking.org/ ~~Birdlife International`s Seabird Tracking Database~~ [data request: 20-10-2015]	request necessary	Lynnes et al. (2002)	doi:10.1594/PANGAEA.899520
Emperor penguin colonies (populations estimates)		Fretwell et al. (2012) doi:10.1371/journal.pone.0033751 Fretwell et al. (2014) doi:10.1371/journal.pone.0085285	freely available freely available		doi:10.1594/PANGAEA.899520
Antarctic petrel Colonies (estimated number of breeding pairs)		Van Franeker et al. (1999) doi:10.2307/1521989	freely available		doi:10.1594/PANGAEA.899520
Pinnipeds					
Seal taxa (tracking data)	Data from: Australia (ct109, ct96), Brazil (ct56, ct46, ct39, ct22), China (ct105), UK (ct1, ct8, ct27, ct27x, ct40, ct43, ct45, ct49, ct58, ct70), France (ct16, ct62, ft01, ft02, ft11, ft12), Germany (ct21, ct35, ct35b, ct44, ct54, ct68, ct87, ct99, ct102, ct113, wd06, wd07), Norway (ct34), South Africa (ct33, ct50, ct73), USA (ct9, ct14, ct25, ct29, ct37, ct48)	http://www.meop.net/ ~~Marine Mammals Exploring the Oceans Pole to Pole (MEOP) data portal~~ [data request: 14-11-2016]	registration necessary	Treasure et al. (2017) Nachtsheim et al. (2019) Boehme et al. (2016)	doi:10.1594/PANGAEA.899619
Southern elephant seals (tracking data)		Tosh et al. (2009a) doi:10.1594/PANGAEA.692856 James et al. (2012a) doi:10.1594/PANGAEA.785852	freely available freely available	Tosh et al. (2009b) James et al. (2012b)	doi:10.1594/PANGAEA.899619
Weddell seals (tracking data)		McIntyre et al. (2013a) doi:10.1594/PANGAEA.818467	freely available	McIntyre et al. (2013b)	doi:10.1594/PANGAEA.899619
Crabeater seals (tracking data)		Nachtsheim et al. (2016a) doi:10.1594/PANGAEA.854842	freely available	Nachtsheim et al. (2016b)	doi:10.1594/PANGAEA.899619

Pack-ice seals (aerial surveys)	Antarctic Pack Ice Seals (APIS) programme EMAGE-I to -V	Plötz et al. (2011a-e) doi:10.1594/PANGAEA.760097 doi:10.1594/PANGAEA.760098 doi:10.1594/PANGAEA.760099 doi:10.1594/PANGAEA.760100 doi:10.1594/PANGAEA.760101	freely available	Southwell et al. (2012) Gurarie et al. (2017a, b)	doi:10.1594/PANGAEA.899619
Crabeater seal densities (predicted or observed)		Bester et al. (1995, 2002) doi:10.1017/S0954102095000502 doi:10.1017/S0954102002000676 Flores et al. (2008) doi:10.1016/j.dsr2.2007.12.024 Forcada et al. (2012) doi:10.1016/j.biocon.2012.02.002	freely available freely available freely available		doi:10.1594/PANGAEA.899619

~~Data content~~	~~Name of data source~~	~~Reference to primary data set or data provider~~	~~Cruise reports~~	~~Reference to publications, which have used primary data set (exemplarily)~~	~~DOI link to ArcMap packages~~
~~**Zooplankton**~~					
~~Adult Antarctic krill (abundances)~~	~~KRILLBASE (doi.org/brg8) See detailed list of data in Table S2 in Supplement~~	~~Atkinson et al. (2017)~~		~~Atkinson et al. (2004) Atkinson et al. (2008) Piñones and Fedorov (2016) Atkinson et al. (2019)~~	~~https://doi.pangaea.de/10.1594/PANGAEA.899667~~
~~Adult Antarctic krill (catch and effort)~~	~~Japanese, Norwegian and Soviet fisheries data~~	~~CCAMLR database; Contact: CCAMLR Secretariat [data request: 03-10-2013]~~			~~https://doi.pangaea.de/10.1594/PANGAEA.899667~~
~~Adult Antarctic krill (abundances)~~	~~MV Polarsirkel 1976/77~~	~~Database of Thuenen Institute of Sea Fisheries~~		~~Fevolden (1979)~~	~~https://doi.pangaea.de/10.1594/PANGAEA.899667~~
~~Adult Antarctic krill (abundances)~~	~~Soviet cruises: RV Gizhiga 1977 and RV Volny Vetter 1983~~	~~Database of Thuenen Institute of Sea Fisheries~~			~~https://doi.pangaea.de/10.1594/PANGAEA.899667~~
~~Adult Antarctic krill (abundances)~~	~~ANT-XVIII/4~~	~~Database of Thuenen Institute of Sea Fisheries~~	~~Fahrbach et al. (2003)~~		~~https://doi.pangaea.de/10.1594/PANGAEA.899667~~

Adult Antarctic krill & ice krill (abundances)	Lazarev Sea Krill Survey (LAKRIS) data (ANT-XXI/4, ANT-XXIII/2, ANT-XXIII/6, ANT-XXIV/2)	Database of Thuenen Institute of Sea Fisheries	Smetacek et al. (2005) Strass (2007) Bathmann (2008, 2010)	Siegel (2012)	https://doi.pangaea.de/10.1594/PANGAEA.899667
Adult Antarctic krill & ice krill (abundances)	ANT-XXIX/3	Database of Thuenen Institute of Sea Fisheries	Gutt (2013)	Siegel et al. (2013)	https://doi.pangaea.de/10.1594/PANGAEA.899667
Adult Antarctic krill & ice krill (abundances)	ANT-V/3	Database of Thuenen Institute of Sea Fisheries	Schnack-Schiel (1987)		https://doi.pangaea.de/10.1594/PANGAEA.899667
Adult Antarctic krill & ice krill (abundances)	ANT-VII/4	Database of Thuenen Institute of Sea Fisheries	Arntz et al. (1990)		https://doi.pangaea.de/10.1594/PANGAEA.899667
Adult ice krill (abundances)	RV Walther Herwig 1975/76	Database of Thuenen Institute of Sea Fisheries			https://doi.pangaea.de/10.1594/PANGAEA.899667
Adult ice krill (abundances)	MV Polarsirkel 1979/80	Database of Thuenen Institute of Sea Fisheries		Siegel (1982) Hempel et al. (1983)	https://doi.pangaea.de/10.1594/PANGAEA.899667
Larval Antarctic krill (abundances)	MV Polarsirkel 1976/77 MV Polarsirkel 1979/80	Database of Thuenen Institute of Sea Fisheries		Fevolden (1979) Siegel (1982)	https://doi.pangaea.de/10.1594/PANGAEA.899667
Larval Antarctic krill (abundances)	First International BIOMASS Experiment survey (FIBEX), RV "Walther Herwig" 1981	Database of Thuenen Institute of Sea Fisheries		Trathan and Everson (1994) Siegel (2005)	https://doi.pangaea.de/10.1594/PANGAEA.899667
Larval Antarctic krill (abundances)	ANT-VII/4	Database of Thuenen Institute of Sea Fisheries	Arntz et al. (1990)		https://doi.pangaea.de/10.1594/PANGAEA.899667
Larval Antarctic krill (abundances)	ANT-VIII/2 and RV Akademik Fedorov, 1989	Database of Thuenen Institute of Sea Fisheries	Augstein et al. (1991)	Menshenina (1992)	https://doi.pangaea.de/10.1594/PANGAEA.899667
Larval Antarctic krill (abundances)	Lazarev Sea Krill Survey (LAKRIS) data (ANT-XXI/4, ANT-XXIII/6)	Database of Thuenen Institute of Sea Fisheries	Smetacek et al. (2005) Bathmann (2008)	Siegel (2012)	https://doi.pangaea.de/10.1594/PANGAEA.899667
Zoobenthos					

Sponges (abundances)	ANT-III/2, WH85 ANT-V/1 ANT-VI/3 ANT-VII/4 ANT-IX/3 ANT-X/3 ANT-XIII/3 ANT-XIII/4 ANT-XV/3 ANT-XVII/3 ANT-XIX/5 ANT-XXI/2 ANT-XXIII ANT-XXVII	Gerdes (2014a-o)	Hempel (1985) Schnack-Schiel (1987) Fütterer (1988) Arntz et al. (1990) Bathmann et al. (1992) Spindler et al. (1993) Arntz and Gutt (1997) Fahrbach and Gerdes (1997) Arntz and Gutt (1999) Arntz and Brey (2001) Arntz and Brey (2003) Arntz and Brey (2005) Gutt (2008) Knust et al. (2012)	Gerdes et al. (1992) Gerdes et al. (2003)	https://doi.pangaea.de/10.1594/PANGAEA.899645
Sponges (presence-absence)	ANT-VII/4 ANT-IX/3 ANT-XIII/3 ANT-XV/3 ANT-XVII/3 ANT-XXI/2	Teschke and Brey (2019a)	Arntz et al. (1990) Bathmann et al. (1992) Arntz and Gutt (1997) Arntz and Gutt (1999) Arntz and Brey (2001) Arntz and Brey (2005)	Galéron et al. (1992)	https://doi.pangaea.de/10.1594/PANGAEA.899645
Echinoderms – Asteroids (presence-absence)	ANT-I/2 ANT-II/4 ANT-V/3 ANT-VI/3 ANT-XV/3 ANT-XVII/3	Teschke and Brey (2019b)	Drescher et al. (1983) Kohnen (1984) Schnack-Schiel (1987) Fütterer (1988) Arntz and Gutt (1999) Arntz and Brey (2001)	Voß (1988)	https://doi.pangaea.de/10.1594/PANGAEA.899645
Echinoderms – Ophiuroids (abundances)	ANT-I/2 ANT-II/4 ANT-V/3 ANT-V/4 ANT-VI/3 ANT-VII/4 ANT-IX/3 ANT-X/3	Teschke and Brey (2019c)	Drescher et al. (1983) Kohnen (1984) Schnack-Schiel (1987) Miller and Oerter (1990) Fütterer (1988) Arntz et al. (1990) Bathmann et al. (1992) Spindler et al. (1993)	Brey et al. (1994) Dahm (1996)	https://doi.pangaea.de/10.1594/PANGAEA.899645
Echinoderms – Holothurians (abundances)	ANT-I/2 ANT-II/4 ANT-III/3	Gutt, Piepenburg and Voß (2014)	Drescher et al. (1983) Kohnen (1984) Hempel (1985)	Gutt (1988) Piepenburg et al. (1997)	https://doi.pangaea.de/10.1594/PANGAEA.899645
Fishes					

Fish larvae – *Pleuragramma antarctica* (abundances)	ANT-I/2	Database of Thuenen Institute of Sea Fisheries	Drescher et al (1983)	Boysen-Ennen and Piatkowski (1988)	https://doi.pangaea.de/10.1594/PANGAEA.899591
Fish larvae – *Pleuragramma antarctica* (abundances)	ANT-III/3	Hubold et al. (1988)	Hempel (1985)		https://doi.pangaea.de/10.1594/PANGAEA.899591
Fish larvae – *Pleuragramma antarctica* (abundances)	Lazarev Sea Krill Survey (LAKRIS) data: ANT-XXI/4, ANT-XXIII/6, ANT-XXIV/2	Contact: Hauke Flores (AWI) Hauke.Flores@awi.de	Smetacek et al. (2005) Bathmann (2008, 2010)	Flores et al. (2014)	https://doi.pangaea.de/10.1594/PANGAEA.899591
Pleuragramma antarctica & demersal fishes (abundances)	ANT-XIII/3 ANT-XV/3 ANT-XVII/3 ANT-XIX/5 ANT-XXI/2 ANT-XXVII/3	Contact: Rainer Knust (AWI) Rainer.Knust@awi.de	Arntz and Gutt (1997) Arntz and Gutt (1999) Arntz and Brey (2001) Arntz and Brey (2003) Arntz and Brey (2005) Knust et al. (2012)	Mintenbeck et al. (2012) Caccavo et al. (2018)	https://doi.pangaea.de/10.1594/PANGAEA.899591
Pleuragramma antarctica & demersal fishes (abundances)	ANT-I/2 ANT-III/3 ANT-V/3 ANT-VII/4 ANT-IX/3 ANT-XXIII/8	Drescher et al. (2012) Ekau et al. (2012a) Ekau et al. (2012b) Hureau et al. (2012) Wöhrmann et al. (2012) Kock et al. (2012)	Drescher et al (1983) Hempel (1985) Schnack-Schiel (1987) Arntz et al. (1990) Bathmann et al. (1992) Gutt (2008)	Ekau (1988) Caccavo et al. (2018)	https://doi.pangaea.de/10.1594/PANGAEA.899591
Antarctic toothfish (catch per unit effort)	Japanese, Korean, Norwegian and South African fishing data	CCAMLR database; Contact: CCAMLR Secretariat [data request: 03-08-2016]			https://doi.pangaea.de/10.1594/PANGAEA.899591
Demersal fish nesting sites	PS82 (ANT-XXIX/9) PS96 (ANT-XXXI/2)	Knust and Schröder (2014) Piepenburg (2016)	Schröder (2016)	La Mesa et al. (2019)	https://doi.pangaea.de/10.1594/PANGAEA.899591
Demersal fish nesting sites		Daniels (1978, 1979) Jones and Near (2012)			https://doi.pangaea.de/10.1594/PANGAEA.899591
Birds					
Adélie penguin colonies (estimated abundances of breeding pairs)		Lynch and LaRue (2014)			https://doi.pangaea.de/10.1594/PANGAEA.899520
Breeding and non-breeding Adélie penguins (tracking data)	US AMLR Program (ID 910)	Birdlife International`s Seabird Tracking Database [data request: 20-10-2015]		Hinke et al. (2015)	https://doi.pangaea.de/10.1594/PANGAEA.899520

Breeding and non-breeding Adélie penguins (tracking data)	BAS / Instituto Antártico Argentino data (ID 753)	Birdlife International`s Seabird Tracking Database [data request: 20-10-2015]	Warwick-Evans et al. (2019)	https://doi.pangaea.de/10.1594/PANGAEA.899520
Breeding and non-breeding Adélie penguins (tracking data)	BAS Inventory (754, 773, 779)	Birdlife International`s Seabird Tracking Database [data request: 20-10-2015]	Dunn et al. (2011)	https://doi.pangaea.de/10.1594/PANGAEA.899520
Breeding Adélie penguins (tracking data)	BAS Inventory (ID 764)	Birdlife International`s Seabird Tracking Database [data request: 20-10-2015]	Lynnes et al. (2002)	https://doi.pangaea.de/10.1594/PANGAEA.899520
Emperor penguin colonies (populations estimates)		Fretwell et al. (2012) Fretwell et al. (2014)		https://doi.pangaea.de/10.1594/PANGAEA.899520
Antarctic petrel Colonies (estimated number of breeding pairs)		Van Franeker et al. (1999)		https://doi.pangaea.de/10.1594/PANGAEA.899520
Pinnipeds				
Seal taxa (tracking data)	Data from: Australia (ct109, ct96), Brazil (ct56, ct46, ct39, ct22), China (ct105), UK (ct1, ct8, ct27, ct27x, ct40, ct43, ct45, ct49, ct58, ct70), France (ct16, ct62, ft01, ft02, ft11, ft12), Germany (ct21, ct35, ct35b, ct44, ct54, ct68, ct87, ct99, ct102, ct113, wd06, wd07), Norway (ct34), South Africa (ct33, ct50, ct73), USA (ct9, ct14, ct25, ct29, ct37, ct48)	Marine Mammals Exploring the Oceans Pole to Pole (MEOP) data portal [data request: 14-11-2016]	Treasure et al. (2017) Nachtsheim et al. (2019) Boehme et al. (2016)	https://doi.pangaea.de/10.1594/PANGAEA.899619
Southern elephant seals (tracking data)		Tosh et al. (2009a) James et al. (2012a)	Tosh et al. (2009b) James et al. (2012b)	https://doi.pangaea.de/10.1594/PANGAEA.899619
Weddell seals (tracking data)		McIntyre et al. (2013a)	McIntyre et al. (2013b)	https://doi.pangaea.de/10.1594/PANGAEA.899619
Crabeater seals (tracking data)		Nachtsheim et al. (2016a)	Nachtsheim et al. (2016b)	https://doi.pangaea.de/10.1594/PANGAEA.899619

~~Pack-ice seals (aerial surveys)~~	~~Antarctic Pack-Ice Seals (APIS) programme EMAGE I to V~~	~~Plötz et al. (2011a-e)~~	~~Southwell et al. (2012) Gurarie et al. (2016)~~	~~https://doi.pangaea.de/10.1594/PANGAEA.899619~~
~~Crabeater seal densities (predicted or observed)~~		~~Bester et al. (1995, 2002) Flores et al. (2008) Forcada et al. (2012)~~		~~https://doi.pangaea.de/10.1594/PANGAEA.899619~~

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