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Data Article

A time series of benthic invertebrate bycatch data from demersal longline fisheries targeting *Dissostichus eleginoides* near the Prince Edward and Marion Islands (2009–2023)

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ABSTRACT

This dataset presents a time series of benthic invertebrate bycatch records collected during demersal longline fishing operations targeting Patagonian toothfish (*Dissostichus eleginoides*) in the sub-Antarctic Southern Ocean region from 2009 to 2023. The data were obtained from independent scientific observers aboard commercial vessels in accordance with Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) Conservation Measure, which mandates the reporting of taxa associated with Vulnerable Marine Ecosystems (VMEs). Each record includes haul-level bycatch weight, taxonomic identification, VME classification status (indication of whether species are VMEs, Not VMEs, or Unclear), and associated fishing effort, measured in terms of hooks. The groomed and validated dataset comprises 1788 records spanning 32 benthic morphotypes. This time series has been curated for reusability and is intended to support ecosystem-based fisheries management as reflected in CCAMLR Conservation Measure notwithstanding the exemptions given to the area by CCAMLR. In addition, the dataset may contribute towards trait-based vulnerability

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assessments, along with the refinement of benthic threshold detection protocols under CCAMLR frameworks. All data, metadata, and analysis scripts are being made openly available to enable reproducibility and secondary analyses.

Specifications Table

Subject	Biology
Specific subject area	Benthic bycatch data from longline fisheries near the sub-Antarctic islands.
Type of data	Figures and graphs, with supporting documents – raw data in csv, R-code, validated data in excel. **NB**: coordinate information is confidential and thus excluded
Data collection	Benthic bycatch data were collected by fisheries observers aboard longline vessels targeting Patagonian toothfish near the Prince Edward and Marion Islands (2009–2023). Following CCAMLR CM 22–07 [1], 50 % of longline segments (1200 m or 1000 hooks) were randomly selected prior to hauling. Observers identified and weighed the taxa in these segments.
Data source location	The Prince Edward and Marion Islands, located in the sub-Antarctic Southern Ocean, between 43 and 51 degrees south and 30 to 45 degrees east.
Data accessibility	A draft version of dataset is currently unpublished and has an embargo of three-months, which will be lifted prior to manuscript publication Repository name: Mendeley data Data identification number: doi: 10.17632/pftstv8ztn.1 Direct URL to data: https://data.mendeley.com/preview/pftstv8ztn?a=2919488d-da00-48a4-9233-17dbb8bd3820
Related research article	None

1. Value of the Data

- These data are the first publicly available account of benthic invertebrate bycatch records from the South African sub-Antarctic Exclusive Economic Zone (EEZ), providing unique biodiversity information from the remote Prince Edward and Marion Islands region.
- By covering a 14-year standardized time series (2009–2023), the dataset enables the long-term monitoring assessment of benthic communities and fills a major geographic gap in Southern Ocean biodiversity knowledge.
- The inclusion of gear-specific records (spanish, trotline, autoline) is useful in allowing researchers to evaluate how different longline configurations interact with benthic habitats, informing gear selectivity studies and bycatch mitigation strategies.
- Verification of VME classification of each taxon supports direct application in CCAMLR conservation frameworks and can be used to assist in further refinement of move-on rules or other mitigation measures.
- Standardising the taxonomic classification allows for future use of these data in global biodiversity databases, including mapping occurrence and distribution.
- The temporal and operational detail provided enables analysis of changes in bycatch composition and monitoring practices over time, supporting ecosystem-based fisheries management in high-latitude fisheries.

2. Background

The Prince Edward and Marion Islands, located in the sub-Antarctic Southern Ocean (43°–51°S, 30°–45°E), became South African territory in 1947 under the Prince Edward Islands Act (No. 43 of 1948) [2]. South Africa is the only African country with sovereign territory in the sub-Antarctic region [3]. These waters have supported a licensed longline fishery targeting Patagonian toothfish (*Dissostichus eleginoides*) [4], managed in line with conservation frameworks of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). As a demersal fishery, gear deployment interacts with the seafloor and results in incidental benthic bycatch [5]. Three longline systems—spanish, trotline, and autoline—have been used [6–8] over the years. To mitigate fishing impacts, South Africa voluntarily adopted CCAMLR Conservation Measures 22–06 and 22–07 [1,9–11]- requiring scientific observers to report taxa associated with Vulnerable Marine Ecosystems (VMEs). Although the primary function of the benthic observer program is to flag instances where VME benthic taxa bycatch trigger different spatial and management responses, a substantial amount of observer data has been collected on benthic invertebrates (including non-VME taxa) since 2009. Thus, providing a foundation for detecting and protecting benthic ecosystems in the region.

3. Data Description

The dataset is organized into five supplementary files (Table 1) and includes both the raw and groomed data collected during demersal longline fishing operations in the Prince Edward/Marion Islands region between 2009 and 2023. The original observer dataset comprised 1817 records (**Supplementary File 1_Raw_data.csv**). After quality control and filtering to remove incomplete or anomalous entries, the groomed dataset includes 1788 records (**Supplementary File 3: Sheet 2, main dataset**) representing standardized observations of benthic bycatch suitable for analysis. Files are provided in CSV, R Source code (.R), and Excel (.xlsx) to support data reuse and reproducibility.

Table 1
Summary of supplementary files, include format and short account of contents.

File name	Format	Contents
Supplementary File 1	.csv	Raw observer benthic invertebrate data (2009–2023), including taxa names as recorded by the observer, recorded weight (kg) per randomly selected segment, hook count, year, and gear type.
Supplementary File 2	.R source file	R script used for data pre-processing, including filtering/grooming of data, and figure generation.
Supplementary File 3	.xlsx	Contains three sheets: • Sheet 1: Metadata for all variables • Sheet 2: Main dataset representing the groomed and filtered data. • Sheet 3: Taxon label classification with taxonomic information and validated nomenclature.
Supplementary File 4	.png	Supplementary Figure 1: An image showing the observer annual bycatch weight (kg) recorded for each benthic taxa recorded from 2009 to 2023.
Supplementary File 5	.png	Supplementary Figure 2: An image showing the temporal proportion of vessel operations in the region (2009-2023 fishing seasons), based on hook deployments by gear type.

The groomed and validated main dataset (**Supplementary File 3: Sheet 2, main dataset**) consists of the below variables, which are complimented by the taxonomic standardized information in sheet three (taxon label classification) of the same file.

3.1. Variable descriptions

Supplementary File 3 provides the key fields below and these are also highlighted in the metadata Supplementary File 3: Sheet 1, metadata.

- Taxon name: Observer-identified benthic invertebrate name.
- Year: Year of record collection (2009–2023).
- Weight_kg: Bycatch weight per sampled segment ($\leq$15 kg after filtering).
- Gear type: Type of longline gear (spanish, trotline, or autoline).
- Hooks: Number of hooks deployed for the sampled segment.
- VME status: Classification as "VME," "Not VME," or "Unclear". The benthos classification followed the CCAMLR VME guide produced in 2009 [11]. Although an updated version of guide exists [12], the observer's during the 2009–2023 fishing seasons consistently used version 1 [11].

These observer records include benthic invertebrate taxa identified at various taxonomic levels, ranging from broad phyla to more resolved family- or order-level classifications. Taxonomic information was captured by the at-sea observers across the following levels:

- Kingdom: All records fall under Animalia
- Phylum: e.g., Cnidaria, Porifera, Echinodermata, Chordata
- Class: e.g., Hexacorallia, Octocorallia, Demospongiae, Holothuroidea
- Order: e.g., Scleractinia, Actiniaria, Antipatharia
- Family: e.g., Gorgoniidae, Stylasteridae
- Genus/Subgenus/Species: Rarely available in observer records; not a focus in this dataset.

The curated list includes both accepted taxonomic names as captured by observers at sea and taxon nomenclature was confirmed through the World Register of Marine Species (WoRMS) batch-match function [13] (see **Supplementary File 3: Excel, Sheet 3, taxon label classification**). This hierarchical structure supports flexible data use, allowing researchers to aggregate by broader morphotypes for ecological summaries or drill down to taxonomic groups relevant to VME assessments under CCAMLR protocols. These records span across 32 benthic morphotypes, with each record assigned to a classification category based on CCAMLR guidelines [10; 11] - VME, Not VME, or Unclear (see **Supplementary File 3: Excel, Sheet 3**, **taxon label classification**). The most comprehensive total annual weight (kg) of benthic bycatch, grouped by VME classification, was observed during the 2011–2016 period, with peak total bycatch weights recorded in 2011 and 2015 (Fig. 1). After 2016, both the total bycatch declined markedly, likely reflecting changes in fishing effort [4], and a cumulative fishing interaction with the benthos. Nonetheless, VME-classified taxa consistently represent the majority of observed weight, with continued—albeit reduced—occurrence in more recent years (2017– 2023).

Temporal trends in total bycatch weight, disaggregated by taxon and year, illustrate persistent but variable occurrences of benthic invertebrate groups across VME, Not VME, and Unclear classifications (**Supplementary File 4: Supplementary Figure 1**). This figure highlights several key patterns:

- High historical weights for confirmed VME taxa such as Gorgoniidae, Stylasteridae, and *Scleractinia* during the 2011–2016 period, 2010, and 2014-2016; respectively.
- A diversity and volume decline beginning in 2017, reflecting reductions in observer effort or gear interactions.
- Sporadic detection of VME taxa in recent years, including Xenophyophoroidea in 2023, emphasizing the ongoing ecological relevance of observer monitoring, even under limited effort.

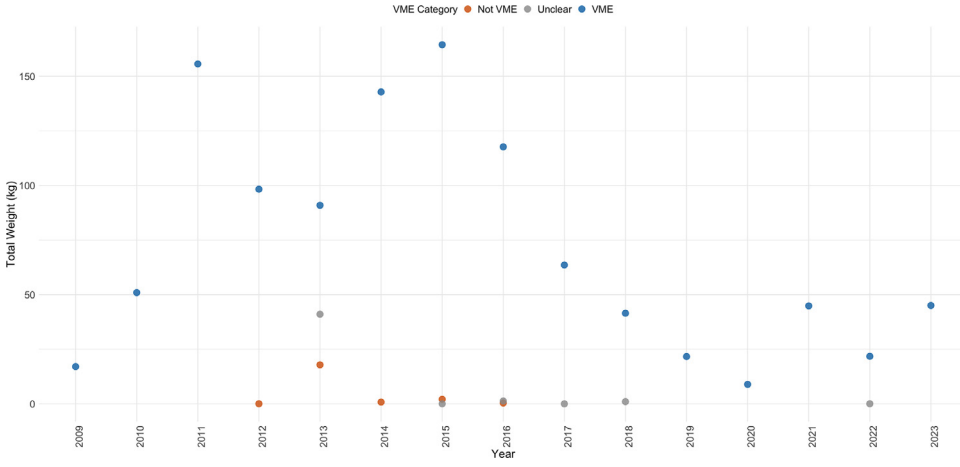

Fig. 1. Annual total bycatch weight (kg) of benthic taxa collected during pelagic longline fishing operations around the Prince Edward/Marion Islands from 2009 to 2023, categorized by the established VME classification status.

Annual distributions of benthic bycatch segment weights varied by gear type over the study period (Fig. 2A). During the initial years (2009–2013), both spanish and trotline systems were deployed, with spanish gear typically producing lower and less variable bycatch weights. Following 2013, the fishery transitioned almost exclusively to trotline gear, which yielded slightly higher median bycatch weights and greater interannual variability. In 2022 and 2023, a shift to autoline gear was observed. Autoline bycatch weights are consistently low, and generally lower than those recorded for trotline gear in prior years (Fig. 2A). Across all gear types and years, the majority of bycatch segment weights remained below 1 kg, though occasional high-weight outliers were evident, particularly for trotline gear (Fig. 2A). These patterns suggests that changes in fishing gear over time might influenced both the central tendency and variability of benthic

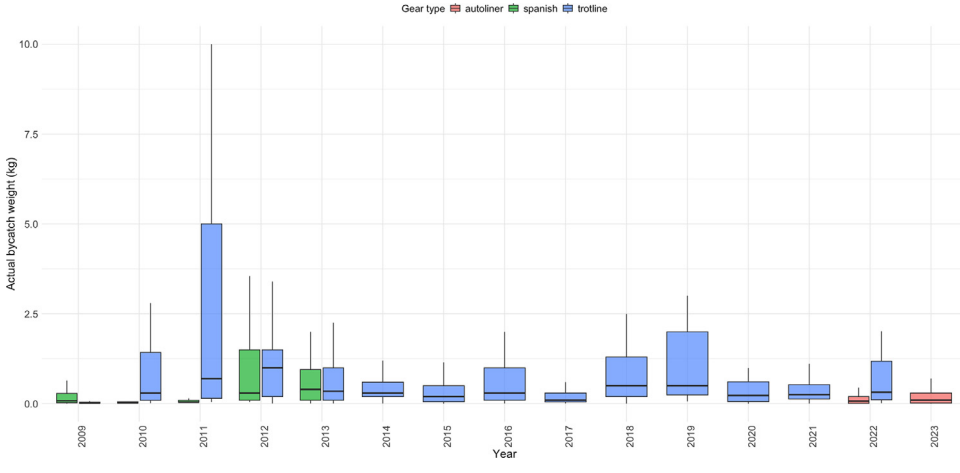

Fig. 2A. Distribution of the actual benthic bycatch segment weights (kg) by year and gear type in the longline fishery from Prince Edward/Marion Islands 2009–2023. Each box shows the interquartile range (IQR), median (horizontal line), and whiskers extending to 1.5 × IQR, with outliers excluded for clarity.

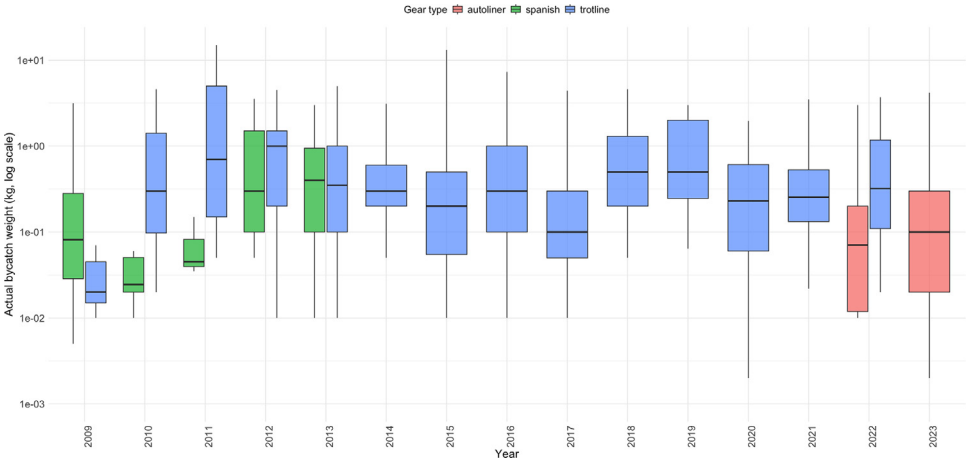

Fig. 2B. Distribution of log-transformed benthic bycatch segment weights (kg) by year and gear type in the longline fishery from Prince Edward/Marion Islands 2009–2023. Each box shows the interquartile range (IQR), median (horizontal line), and whiskers extending to 1.5 × IQR, with outliers excluded for clarity.

bycatch weights in the fishery, with most segment weights remaining below 1 kg and increased variation observed in years dominated by trotline gear. Although three vessels were licensed to operate in the fishery overall, only one or two were active in any given year, contributing to annual variation in fishing effort (**Supplementary File 5: Supplementary Figure 2**).

Given the novel geographic range and potential application of these data, we present a quality-controlled subset of observer-collected bycatch records from the Prince Edward Islands fishery, spanning the years 2009 to 2023. This represents the first publicly available dataset of benthic bycatch from the South African sub-Antarctic EEZ, covering a high-latitude ecosystem that has historically been underrepresented in open-access biodiversity records. The dataset includes both VME and non-VME taxa, with validated taxonomic information. In addition to the taxa weights, each record is classified following CCAMLR identification guide [11]; providing a valuable foundation to support the refinement of VME detection thresholds and inform broader ecosystem-based fisheries management.

4. Experimental Design, Materials and Methods

The sampling approach used by observers involves monitoring a designated section of each longline, which is required to be divided into segments of either 1200 m or 1000 hooks, as outlined in Conservation Measure 22–07 [1]. Prior to hauling, the observer randomly selects 50 % these segments for identification, weighing and counting the taxa. Thus, approximately 50 % of the benthic bycatch from these random segments forms the basis of each observer's report. The data presented in this study are derived from such treated observational records (**Supplementary File 1_Raw_data.csv**), which were collected by fisheries observers between 2009 and 2023 aboard longline vessels targeting Patagonian toothfish in the waters surrounding the Prince Edward and Marion Islands.

These data were (**Supplementary File 1_Raw_data.csv**) imported into R (v4.5.0) (**Supplementary File 2: R source code**), where records were filtered to retain only those with bycatch weights $\leq$15 kg per segment to minimize the influence of outliers, potential gear saturation from unusually high biomass hauls or any erroneous records. Fields with missing or null values, particularly those lacking taxa identification, year, or weight data, were excluded from down-

stream data evaluation steps. The resulting dataset (**Supplementary File 3: Excel, Sheet 2, main dataset**) was then validated against observer guide [11] to confirm if taxa records aligned with the CCAMLR VME classification. This validation process allowed for the identification and distinction of non-VME taxa from the analysis (**Supplementary File 3: Excel, Sheet 3, taxon label classification**).

Taxonomic names, as originally recorded by at-sea observers in the "Taxon name" field, were standardized through a batch match against WoRMS to enhance data reliability and ensure consistency. Accepted names, authorities, and the unique ID code for taxa (i.e., AphiaIDs) were retrieved (**Supplementary File 3: Excel, Sheet 3, taxon label classification**). To ensure consistent time series comparisons, a complete grid of all taxon-year combinations (2009–2023) was created and merged with the observed data. This allowed visualization of temporal gaps in bycatch occurrence. VME status was assigned to each taxon based on CCAMLR 2009 criteria, with each entry categorized as "VME", "Not VME", or "Unclear" depending on the classification information captured. This curated dataset (**Supplementary File 3: Excel, Sheet 2–3, main dataset and taxon label classification**) forms the basis for all subsequent frequency and faceted visual analyses.

To investigate temporal patterns, the assigned VME status category ("VME," "Not VME," "Unclear") in accordance with indicator taxa was plotted. Data were thereafter grouped by year and gear type, and the distribution of total bycatch weights was visualized using box plots. Owing to the uneven nature of the bycatch weight data and occurrence of small weights typically <1 kg, a constant of 10 was added to each observation and each observation was log transformed, thereby facilitating comparison of central tendency and dispersion across years and gear types (Fig. 2B). To complement these summaries, we further explored fishing effort by calculating the total number of hooks deployed per year, stratified by gear type and anonymized vessel identity (**Supplementary File 5_Supplementary Figure 2**).

Limitations

The dataset does not include latitude and longitude coordinates due to confidentiality restrictions associated with commercial fishing operations in South Africa's sub-Antarctic EEZ. The removal of precise spatial data was necessary to comply with national fisheries policies and data-sharing agreements that protect the locations of licensed longline fishing activity. As a result, the dataset cannot be used for fine-scale spatial analysis or mapping of benthic bycatch distributions. However, temporal resolution is preserved at the annual level, and fishing effort is stratified by gear type and anonymized vessel identifiers. Another limitation is the reduction in observer coverage after 2016, which may affect the consistency of sampling effort and detection of less common taxa in more recent years. Despite these constraints, the dataset maintains high utility for evaluating temporal trends, gear-benthic interactions, and trait-based assessments relevant to monitoring.

Ethics Statement

The authors have read and follow the ethical requirements for publication in Data Brief. We thereby confirm that the current work does not involve subjects, experiments, or any data collected from social media platforms.

CRediT Author Statement

Zoleka Filander: Conceptualization, methodology, validation, formal analysis, data curation, visualization, writing- original draft. **Sobahle Somhlaba:** Methodology, validation, formal analy-

sis, data curation, visualization, writing – review and editing. **Azwianewi Makhado:** Conceptualization, formal analysis, visualization, writing – review and editing.

Data Availability

Benthic–bycatch dataset from Prince Edward and Marion Islands longline fisheries (2009–2023) (Original data) (MIMMS).

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Declaration of Competing Interest

The authors declare that they have no competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary Materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.dib.2025.112056.

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