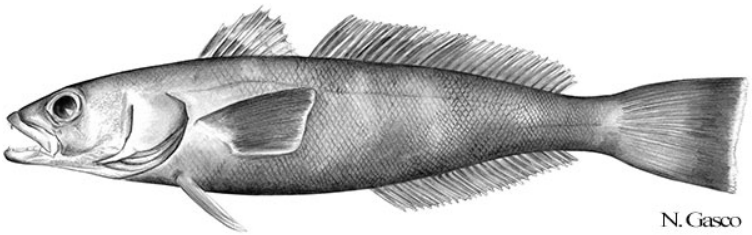
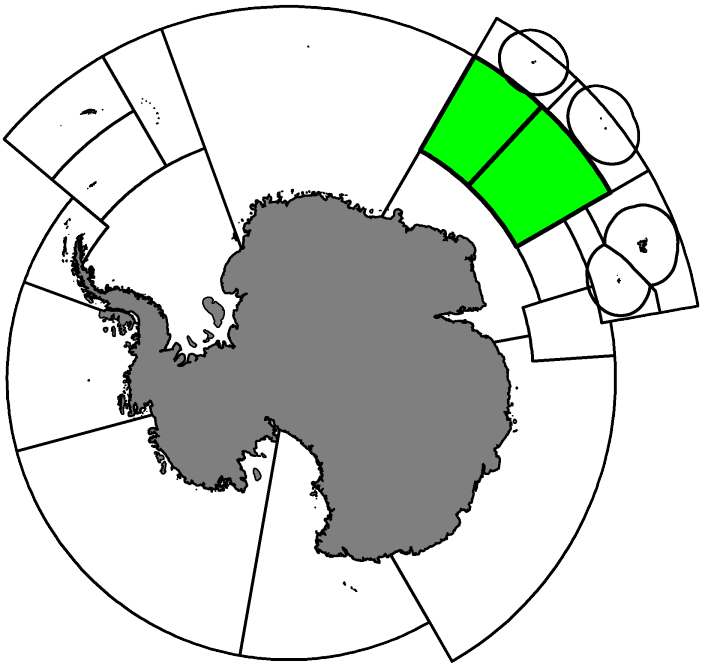
Fishery Report 2022: *Dissostichus eleginoides* in Divisions 58.4.4a and 58.4.4b

CCAMLR Secretariat

17 March 2023



Patagonian Toothfish, *Dissostichus eleginoides* Smitt, 1898.



Map of the management areas within the CAMLR Convention Area. Divisions 58.4.4a and 58.4.4b, the regions discussed in this report are shaded in green. Throughout this report, "2022" refers to the 2021/22 CCAMLR fishing season (from 1 December 2021 to 30 November 2022).

Contents

1. Introduction to the fishery

1.1. History

This report describes the closed fishery for toothfish (*Dissostichus* spp.) in Division 58.4.4. In 1995, Division 58.4.4 was subdivided into Division 58.4.4a (Ob Bank) and Division 58.4.4b (Lena Bank) (SC-CAMLR-XIV, Annex 5, paragraph 5.175). These divisions were managed as a single area and a catch limit for *Dissostichus* spp. applied to fishing north of 60°S, and in waters outside areas of national jurisdiction (The South African EEZ at Prince Edward and Marion Islands extends into the northern part of Division 58.4.4a, see Fig. 1). The longline fishery for *Dissostichus* spp. in Division 58.4.4 began as a new fishery in 1998 (Conservation Measure 138/XVI). Following the Commission's recognition that high levels of illegal, unreported and unregulated (IUU) fishing for *Dissostichus* spp. in the Convention Area had rendered it unrealistic to consider this fishery as 'new' (CCAMLR-XVIII, paragraph 10.14), the fishery was reclassified as exploratory in 1999.

Expressing concern regarding the low levels of stocks of *Dissostichus* spp. in Divisions 58.4.4a and 58.4.4b and the high levels of IUU fishing in that region (CCAMLR-XXI, paragraph 11.36), the Commission prohibited directed fishing for *Dissostichus* spp. in these Divisions and closed the fishery in 2002 (Conservation Measure 32-02). The Commission agreed that such prohibition shall apply at least until further scientific information is gathered and reviewed.

1.2. Conservation Measures currently in force

Directed fishing for *Dissostichus* spp. in Divisions 58.4.4a and 58.4.4b is prohibited under Conservation Measure 32-02 at least until further scientific information is gathered and reviewed by the Scientific Committee and the Working Group on Fish Stock Assessment (WG-FSA).

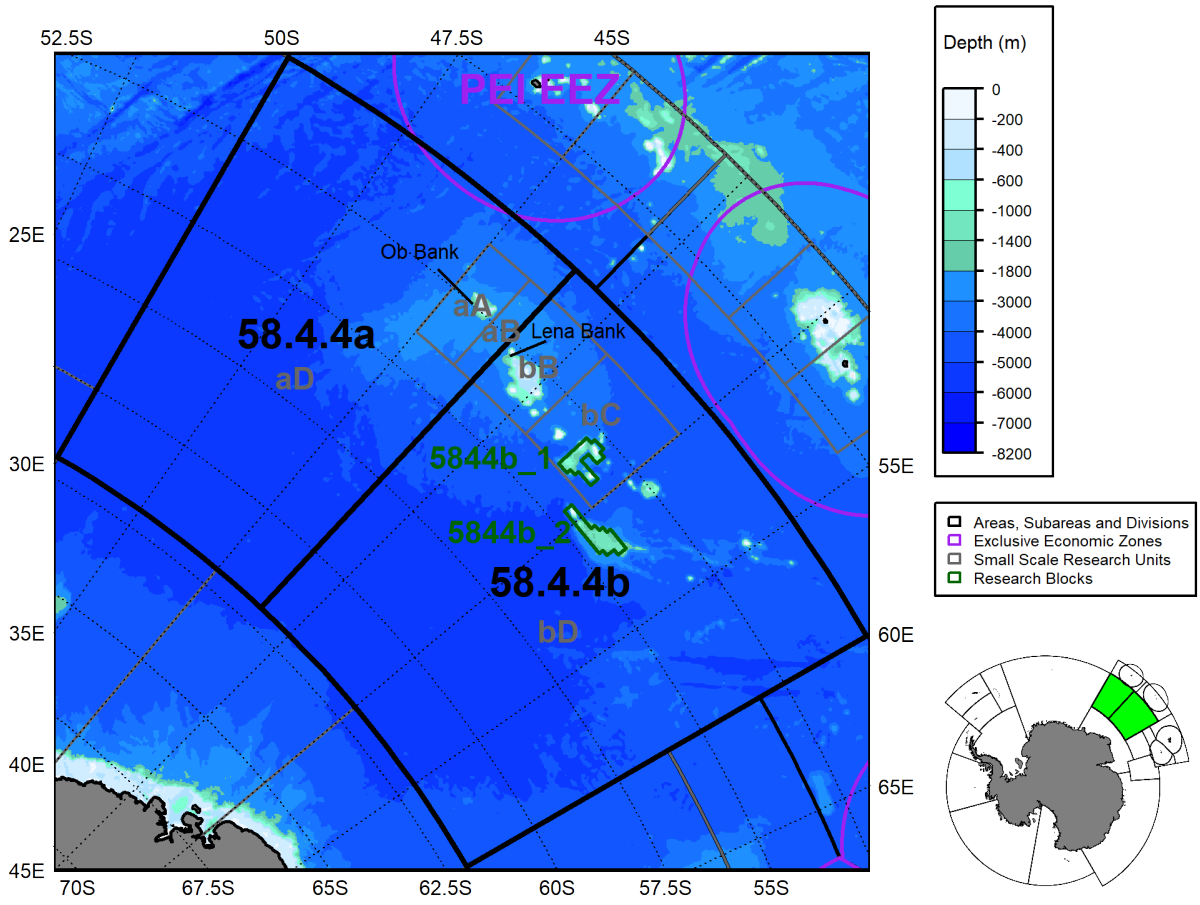


Figure 1: Location of the Research Blocks and Small Scale Research Units in Divisions 58.4.4a and 58.4.4b. The fishable depth range (600m-1800m) is highlighted in shades of green.

1.3. Active vessels

To this day, 3 vessels have conducted research fishing in accordance with a research plan submitted under Conservation Measure 24-01 in this area. Research fishing was conducted by a Japanese-flagged longliner from 2008 to 2017, and in 2019. The vessel was joined by 2 French-flagged vessels, one in 2015, 2017 and 2019, and another in 2018.

For the 2020 fishing season, when fishing last occurred, 1 Japanese-flagged vessel and 3 French-flagged vessels were included in the research plan in this fishery.

1.4. Timeline of spatial management

In 1999, the whole of Division 58.4.4 was subdivided into Small-Scale Research Units (SSRUs) A, B, C and D (Fig. 1).

Research fishing in 2008 occurred in all SSRUs in Divisions 58.4.4a and 58.4.4b. Subsequently it was considered that this spatial extent was too large to have adequate probability of recapturing tagged fish and that research effort should be concentrated on a subset of the area and focus on SSRUs 58.4.4bB and 58.4.4bC. However, due to high levels of depredation by killer whales *Orcinus orca* in block B in 2012, the area for research moved to SSRUs 58.4.4bC and 58.4.4bD. In 2014 research blocks 58.4.4b_1 and 58.4.4b_2 were defined and have subsequently been used in this research fishery.

2. Reported catch

2.1. Latest reports and limits

In 2008 and from 2010 onward, a catch limit has been allocated to research fishing only.

Reported catches of *Dissostichus eleginoides* are shown in Table 1. In this fishery, the catch of *D. eleginoides* reached a maximum of 141 tonnes in 2000. In 2020, when fishing last occurred, 0 tonnes of *D. eleginoides* were caught.

For the 2021 fishing season, both Japanese and French vessels did not undertake any research fishing due to operational restrictions caused by COVID-19.

Table 1. Catch (tonnes) and effort history for *Dissostichus eleginoides* in this fishery. Source: Fine scale data and past estimates for IUU catch (-: no fishing, or no IUU estimate available).

Season	Number of vessels	Catch limit (tonnes)	Catch	Estimated IUU catch (tonnes)
2000	2		141	-
2001	1		9	-
2002	-		-	-
2003	-		-	-
2004	-	0	-	0
2005	-	0	-	220
2006	-	0	-	104
2007	-	0	-	109
2008	1	80	77	-
2009	-	0	-	-
2010	1	60	59	80
2011	1	53	35	-
2012	1	70	28	-
2013	1	50	31	-
2014	1	60	27	-
2015	2	35	35	-
2016	1	42	42	-
2017	2	42	31	-
2018	1	42	2	-
2019	2	41	11	-
2020	1	41	0	-
2021	-	32	-	-
2022	-		-	-

Table 2: Catch and catch limits by Research Block in 2020 for *Dissostichus eleginoides* in Division 58.4.4b. Source: Fine scale data.

Research Block	Catch limit	Catch (% of catch limit)
5844b_1	23	0 (0%)

2.2. By-catch

Catch limits for by-catch species groups (*Macrourus* spp., skates and rays, and other species) are defined in Conservation Measure 33-03 and provided in Table 3.

If the by-catch of any one species is equal to, or greater than, 1 tonne in any one haul or set, then the fishing vessel must move at least 5 nautical miles away for a period of at least five days.

If the catch of *Macrourus* spp. taken by a single vessel in any two 10-day periods in a single SSRU exceeds 1,500 kg in a 10-day period and exceeds 16% of the catch of *Dissostichus* spp. in that period, the vessel shall cease fishing in that SSRU for the remainder of the season.

The by-catch in Divisions 58.4.4a and 58.4.4b consisted predominantly of *Macrourus* spp. (Table 3).

Table 3. Reported catch and catch limits for by-catch species (*Macrourus* spp., skates and rays, and others) in this fishery (see Conservation Measure 33-03 for details). -: no fishing. Source: fine-scale data.

Season	*Macrourus* spp.		Skates and rays			Other catch	
	Catch Limit (tonnes)	Reported Catch (tonnes)	Catch Limit (tonnes)	Reported Catch (tonnes)	Number Released	Catch Limit (tonnes)	Reported Catch (tonnes)
2000		14		<1	0		<1
2001		<1		<1	0		<1
2002		-		-	-		-
2003		-		-	-		-
2004		-		-	-		-
2005		-		-	-		-
2006		-		-	-		-
2007		-		-	-		-
2008		4		<1	13		2
2009		-		-	-		-
2010	9.6	1	3	<1	55	9.6	<1
2011	8.48	2	2.65	<1	73	8.48	<1
2012	11.2	2	3.5	<1	0	11.2	<1
2013	8	1	2.5	<1	1	8	<1
2014	9.6	1	3	<1	7	9.6	<1
2015	5.6	4	1.75	<1	189	5.6	2
2016	6.72	1	2.1	<1	84	6.72	<1
2017	6.72	7	2.1	<1	1426	6.72	4
2018	6.72	<1	2.1	<1	842	6.72	<1
2019	6.56	2	2.05	<1	39	6.56	<1
2020	7	<1	2	<1	32	7	<1
2021	5.12	-	1.6	-	-	5.12	-
2022		-		-	-		-

In 2019, an analysis of by-catch data in Division 58.4.4b indicated strong effects of gear, bathymetry and locations on by-catch composition and biomass (WG-FSA-2019/53). A high proportion of Rajids were caught and released in cut-off, particularly in Research Block 5844b_2.

2.3. Vulnerable marine ecosystems (VMEs)

All Members are required to submit, within their general new (Conservation Measure 21-01) and exploratory (Conservation Measure 21-02) fisheries notifications requirements, information on the known and anticipated impacts of their gear on vulnerable marine ecosystems (VMEs), including benthic communities and benthos such as seamounts, hydrothermal vents and cold-water corals. All of the VMEs in CCAMLR's VME Registry are currently afforded protection through specific area closures.

There are no VMEs or VME Risk Areas designated in Divisions 58.4.4a and 58.4.4b.

However, in 2019, the research plan was modified to avoid areas with high densities of sea pens (WG-FSA-18/23) and skates in the eastern region of research block 5844b_2 (WG-FSA-2019/53).

2.4. Incidental mortality of seabirds and marine mammals

The requirements of Conservation Measure 25-02, including the 'Minimisation of the incidental mortality of seabirds in the course of longline fishing or longline fishing research in the Convention Area' apply to this fishery. There is an exemption to the requirement for night setting by achieving the sink rates described in Conservation Measure 24-02 and subject to a bird by-catch limit.

There have been no observed bird or mammal mortalities reported by vessels from Divisions 58.4.4a and 58.4.4b in this fishery.

3. Illegal, Unreported and Unregulated (IUU) fishing

An estimated total of 7,196 tonnes of *Dissostichus* spp. has been removed by Illegal, Unreported and Unregulated (IUU) fishing since the fishery began with >500 tonnes being removed since 2004. In 2010, the last year in which IUU catch was recorded, an estimated 80 tonnes was taken from Division 58.4.4a.

IUU fishing activities were observed in Division 58.4.4a (Ob Bank) during 2008, 2009, 2010 and 2011. French surveillance information suggested that IUU activities have been persistent until 2014. IUU fishing activities were observed in Division 58.4.4b (Lena Bank) during each year from 2006 to 2011, however, given the history of IUU fishing activities in this Division, it is possible that IUU activities do still occur, but were undetected from 2011 to 2016. Information from satellite surveillance trials indicated the presence of unidentified vessels in this division in 2016. Since 2011, following the recognition of methodological issues in its assessment, no estimates of the IUU catch of *Dissostichus* spp. have been provided for this Division (SC-CAMLR-XXIX, paragraph 6.5).

4. Data collection

4.1. Data collection requirements

The collection of biological data under Conservation Measure 23-05 as part of the CCAMLR Scheme of International Scientific Observation (SISO) includes representative samples of length, weight, sex and maturity stage, as well as collection of otoliths for age determination of the target and most frequently taken by-catch species.

4.2. Summary of available data

Both the vessel's crew and observers collect fishing effort, catch, and by-catch information.

Following Conservation Measure 22-07, vessels participating in this fishery must report the occurrence of VME indicator organisms on hauled lines. To do so, the vessel's crew observe lines in segments (1000-hook sections or 1200m sections, whichever is the shorter) and report the number of VME indicator units (either one litre of those VME indicator organisms that can be placed in a 10-litre container, or one kilogram of those VME indicator organisms that do not fit into a 10-litre container). Depending on the number of VME indicator units landed, vessels must immediately report and potentially cease fishing in the area (termed a Risk Area) until further review of the data is completed (see Conservation Measure 22-07). Based on the portion of the line monitored, observers further identify VME indicator organisms to the lowest taxonomic level possible.

The vessel's crew report total catch of non-VME by-catch (mostly fishes) by coarse taxonomic groups given the taxonomic expertise required to discriminate similar species. Observers collect biological information on toothfish and by-catch specimens at a finer taxonomic resolution, as well as data on individual specimens such as size and maturity.

Summaries of data reported to CCAMLR for the past five years are given in Tables 4 and 5.

Table 4. Summary of VME indicator taxa by-catch, by-catch of other species and biological data reported by vessels crew and observers in each of the last five seasons. By-catch records correspond to the number of observations of total weight and count of individuals for each taxon identified. Observers may take further biological measurements on toothfish and by-catch taxa. Taxonomic identification may occur at different levels. -: no fishing.

Data source	Data class	Variable	2018	2019	2020	2021	2022
Vessel crew	VME	line segments	107	220	20	-	-
		VME indicator units >5 and <10	0	0	0	-	-
		VME indicator units >10	0	0	0	-	-
	by-catch	taxa identified	5	10	3	-	-
		records	61	76	11	-	-
Observer	VME	line segments	107	90	8	-	-
		taxa identified	5	4	1	-	-
		weight or volume measurements	42	4	0	-	-
	toothfish	specimens examined	265	768	91	-	-
		length measurements	265	768	91	-	-
		weight measurements	264	768	91	-	-
		sex identifications	265	768	91	-	-
		maturity stage identifications	265	768	91	-	-
		gonad weight measurements	3	677	0	-	-
		otolith samples	150	649	39	-	-
	by-catch	specimens examined	322	483	47	-	-
		taxa identified	6	6	2	-	-
		length measurements	322	112	47	-	-
		weight measurements**	322	483	47	-	-
		standard length measurements*	0	0	0	-	-
		wingspan measurements*	4	2	0	-	-
		pelvic length measurements*	4	2	0	-	-
		snout to anus measurements*	152	369	0	-	-
		sex identifications**	4	463	47	-	-
		maturity stage identifications**	0	463	47	-	-
		gonad weight measurements**	0	461	0	-	-
		otolith samples**	0	0	0	-	-

*: Species-dependent records
**: Voluntary records

Table 5. Summary of biological data for predominant by-catch groups reported by observers (from random subsets of lines) in each of the last five seasons. Taxonomic identification may occur at different levels. -: no fishing.

By-catch group	Variable	2018	2019	2020	2021	2022
Macrourus spp.	specimens examined	152	369	27	-	-
	taxa identified	4	3	1	-	-
	length measurements	152	0	27	-	-
	weight measurements**	152	369	27	-	-
	snout to anus measurements*	152	369	0	-	-
	sex identifications**	0	359	27	-	-
	maturity stage identifications**	0	359	27	-	-
	gonad weight measurements**	0	359	0	-	-
	otolith samples**	0	0	0	-	-
Skates and rays	specimens examined	4	2	0	-	-
	taxa identified	1	2	0	-	-
	length measurements	4	0	0	-	-
	weight measurements**	4	2	0	-	-
	wingspan measurements*	4	2	0	-	-
	pelvic length measurements*	4	2	0	-	-
	sex identifications**	4	2	0	-	-
	maturity stage identifications**	0	2	0	-	-
	gonad weight measurements**	0	0	0	-	-
Other fish	specimens examined	166	112	20	-	-
	taxa identified	1	1	1	-	-
	length measurements	166	112	20	-	-
	weight measurements**	166	112	20	-	-
	standard length measurements*	0	0	0	-	-
	sex identifications**	0	102	20	-	-
	maturity stage identifications**	0	102	20	-	-
	gonad weight measurements**	0	102	0	-	-
	otolith samples**	0	0	0	-	-

*: Species-dependent records
**: Voluntary records

The counts of by-catch taxa reported above (Table 5) correspond to specimens that have been individually sampled by observers. These are a subset of all the specimens counted by observers and are generally identified at a more precise taxonomic level. The figures below (Figs. 2 and 3) display the distribution of the most frequently examined by-catch taxa in time and space. It is important to note that observers sample a random subset of lines and do not individually examine all taxa; as such these figures are more representative of the distribution of biological observations than the catch of these taxa or their spatial distribution. At a coarse taxonomic level, the total catch of by-catch species groups is provided in section 2.2 above.

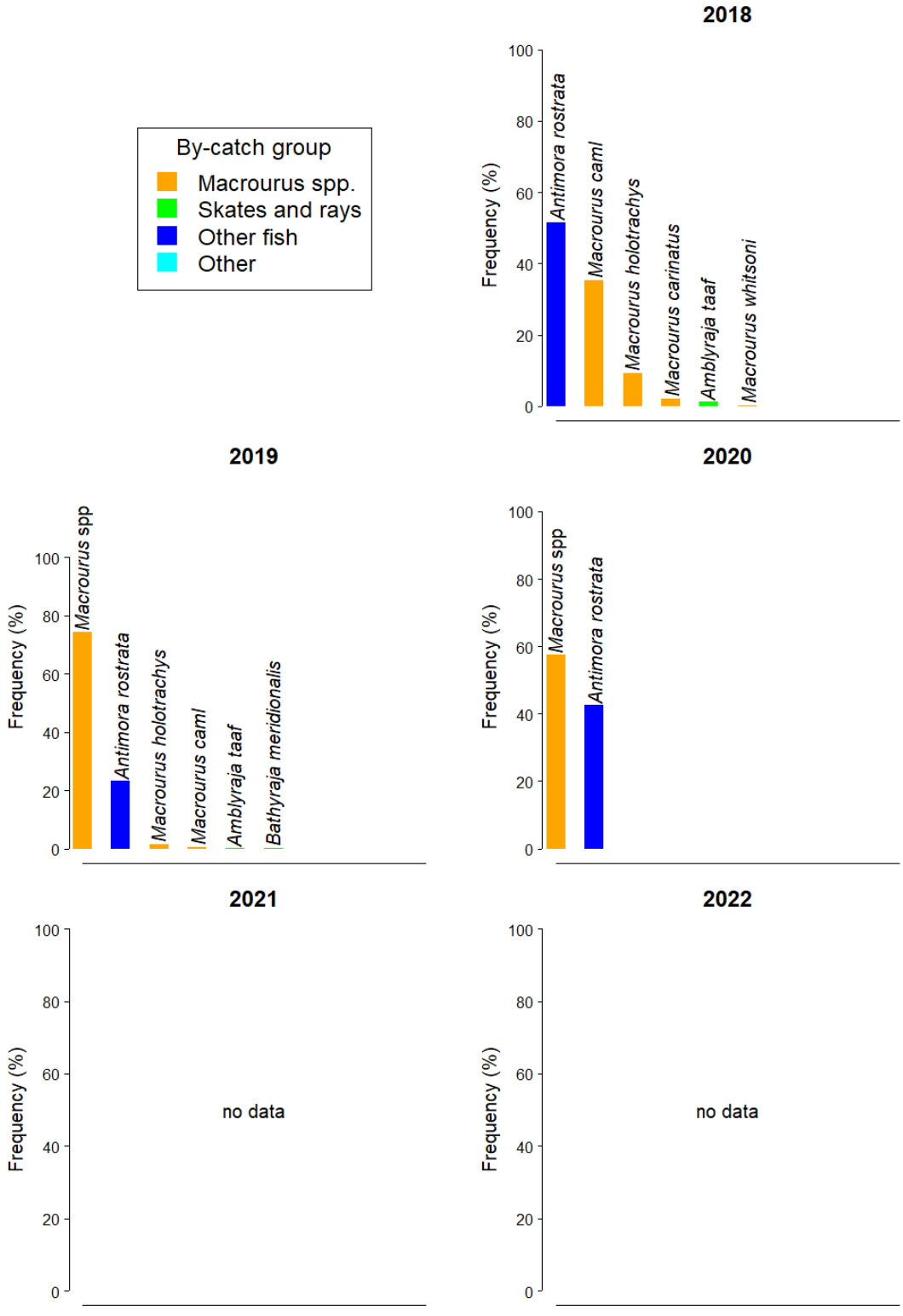


Figure 2. Relative frequencies of the most commonly examined by-catch taxa in each of the last five seasons, from the observer data (unweighted raw counts of individually examined specimens). Taxonomic identification may occur at different levels.

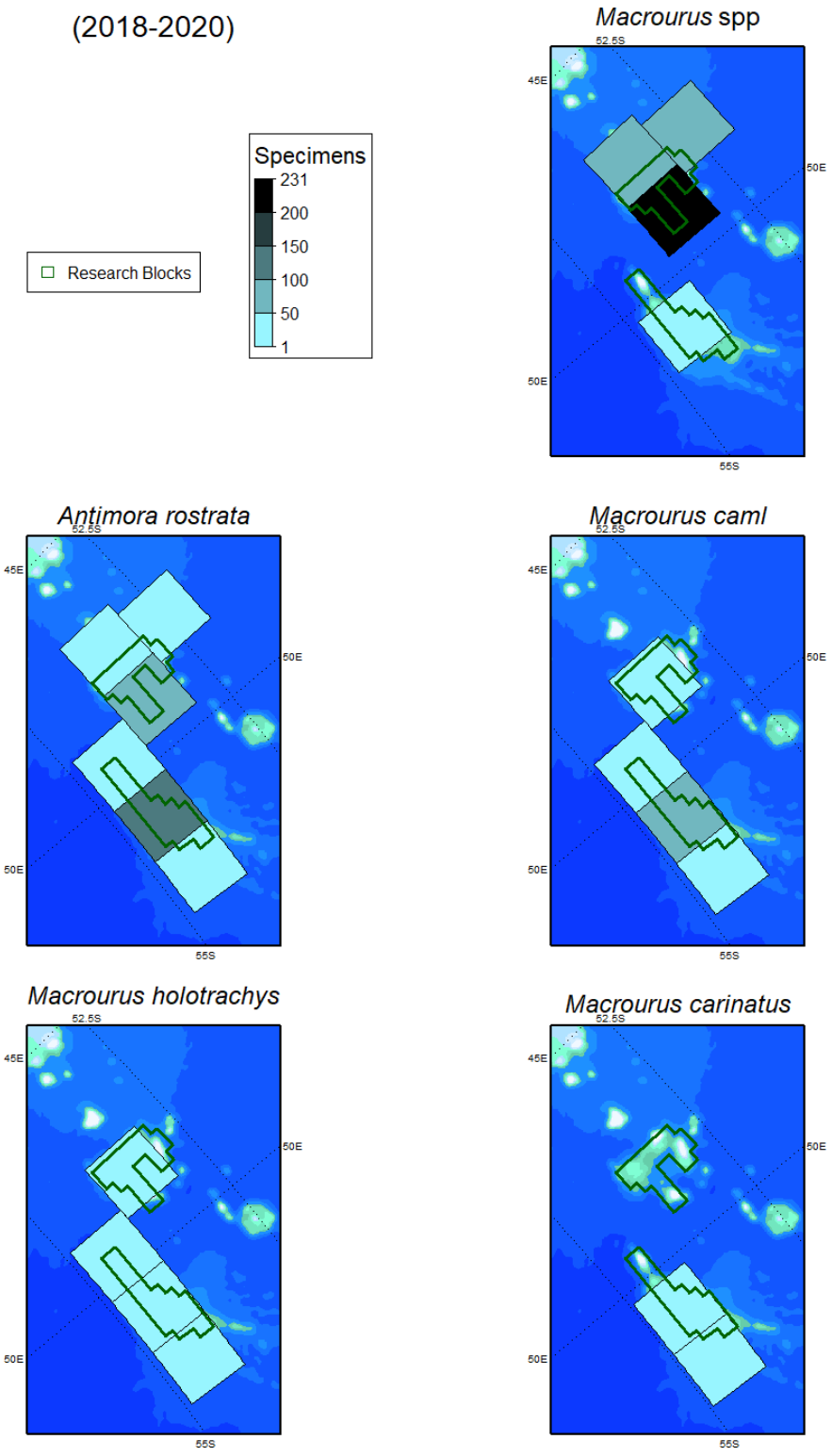


Figure 3. Spatial distribution of the most commonly examined by-catch taxa across the last five seasons, from the observer data (unweighted raw counts of individually examined specimens in each cell). The data were aggregated using equal area (100 km x 100 km) cells. Taxonomic identification may occur at different levels. Refer to Figure 1 for more details on the boundaries shown.

4.3. Length frequency distributions

The length frequency distributions of *D. eleginoides* caught in this fishery are shown in Figure 4. These length frequency distributions are unweighted; they have not been adjusted for factors such as the size of the catches from which they were collected. The interannual variability exhibited in the figure may reflect changes in the fished population but is also likely to reflect changes in the gear used, the number of vessels in the fishery and the spatial and temporal distributions of fishing.

The majority of *D. eleginoides* caught in the fishery during research fishing ranged from 50 to 150cm with a broad mode shifting from approximately 75cm to 110cm (Fig. 4).

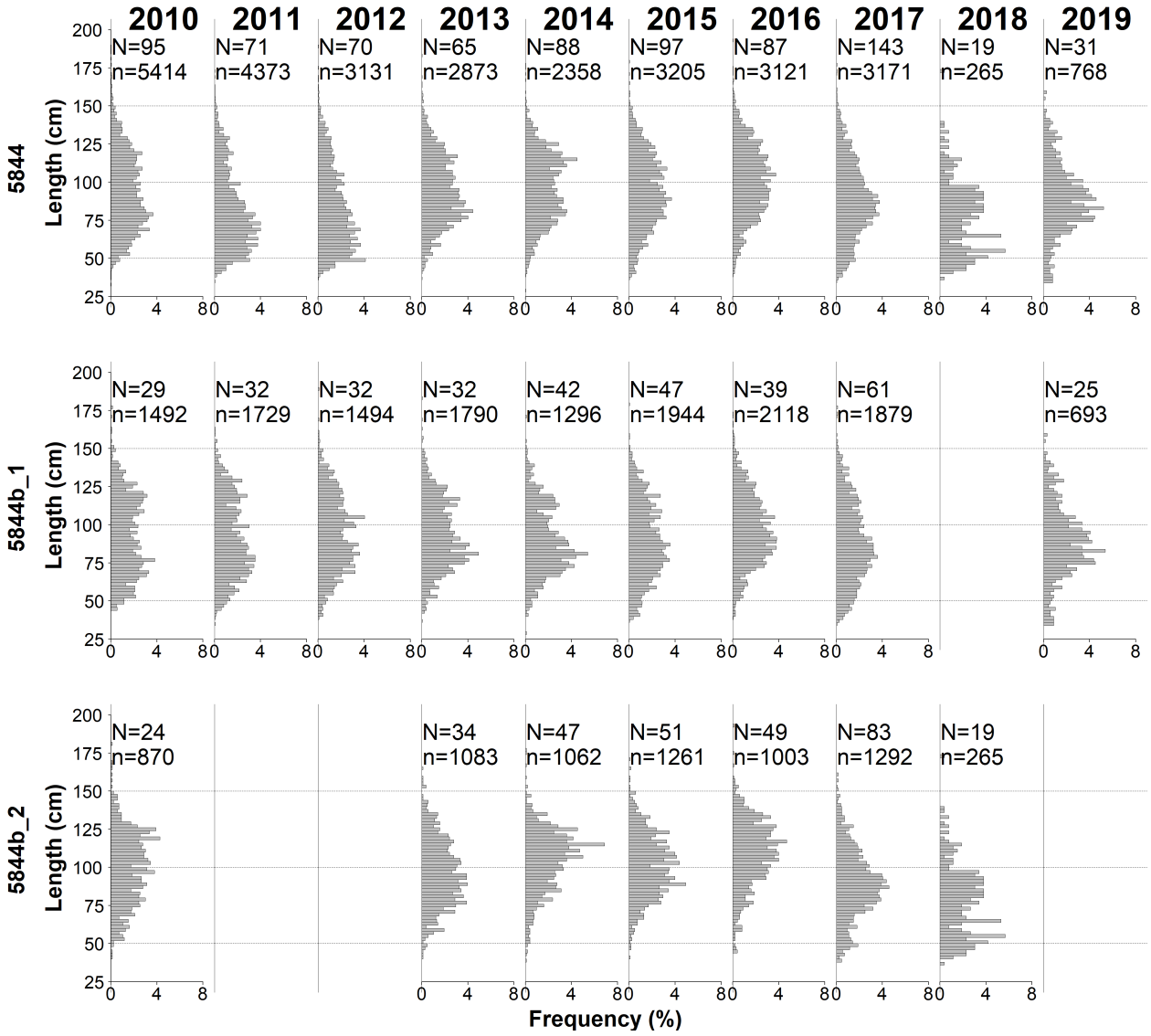


Figure 4. Annual length frequency distributions of *D. eleginoides* caught in Division 58.4.4 and Research Blocks. The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were measured in a given season/area.

4.4. Tagging

Since 2012, vessels have been required to tag and release *Dissostichus* spp. at a rate of 5 fish per tonne of green weight caught. The tag-overlap statistic estimates the representative similarity between the size distributions of those fish that are tagged by a vessel and of all the fish that are caught by that vessel (Table 6). Each vessel catching more than 10 tonnes of each species of *Dissostichus* is required to achieve a minimum tag-overlap statistic of 60% (Annex 41-01/C).

Table 6. Annual tagging rate (number of fish tagged per tonne of total catch), reported by vessels operating in this exploratory fishery. The tag-overlap statistics (CM 41-01) for *D. eleginoides* is provided in brackets (NC: Tag-overlap statistic is Not Calculated for less than 30 fish tagged; -: no fish were tagged). In the last row, the tagging rate and tag-overlap statistic were computed using all fish tagged and all fish caught in the area.

		Fishing Season										
Flag State	Vessel name	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
France	Ile Bourbon									6.2 (NC)		
France	Le Saint Andre						6.2 (79.1)		10 (82)		25 (NC)	10 (NC)
Japan	Shinsei Maru No. 3	5.1 (82.8)	5.3 (85.1)	6.1 (75.3)	7.5 (73.1)	5.9 (74.2)	6.4 (73.2)	5.3 (79.5)	6.3 (73.6)		11.3 (88.6)	
Total		**5.1 (82.8)**	**5.3 (85.1)**	**6.1 (75.3)**	**7.5 (73.1)**	**5.9 (74.2)**	**6.3 (75.2)**	**5.3 (79.5)**	**8.2 (79.1)**	**6.2 (NC)**	**11.8 (87.6)**	**10 (NC)**

To date, 2164 *D. eleginoides* have been tagged and released (59 have been recaptured) in this fishery (Table 7).

Table 7. Number of *D. eleginoides* tagged in recent fishing Seasons. The number of fish recaptured by each vessel in each Season is provided in brackets.

		Fishing Season										
Flag State	Vessel name	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
France	Ile Bourbon									10 (3)		
France	Le Saint Andre						36 (3)		156 (8)		10 (0)	4 (0)
Japan	Shinsei Maru No. 3	300 (1)	189 (4)	172 (3)	233 (3)	159 (9)	183 (10)	218 (5)	99 (4)		115 (6)	
Total		**300 (1)**	**189 (4)**	**172 (3)**	**233 (3)**	**159 (9)**	**219 (13)**	**218 (5)**	**255 (12)**	**10 (3)**	**125 (6)**	**4 (0)**

5. Research

5.1. Status of the science

Catch limits for CCAMLR's fisheries for *D. mawsoni* and *D. eleginoides* for the 'assessed' fisheries are set using fully integrated assessments; more basic approaches are used for the 'data-poor' fisheries (in Subarea 48.6 and in Area 58 outside the exclusive economic zones (EEZs)). The management of these data-poor fisheries has been a major focus of attention in CCAMLR in recent years after the acknowledgement that commercial fishing by itself had resulted in too few data to develop a full assessment of the targeted stocks in these areas. CCAMLR has developed a framework for designing and undertaking research fishing designed to lead to an assessment of these toothfish stocks in the short to medium term, established under the provisions of Conservation Measure 41-01. This research planning framework has three phases: prospecting phase, biomass estimation phase and assessment development phase, with a set of decisions and review for the progression between stages.

In order to obtain the data necessary for a stock assessment, catch limits for research fishing by commercial vessels are set at a level intended to provide sufficient information (including sufficient recaptures of tagged fish) to achieve a stock assessment within a time period of 3 to 5 years. These catch limits are also set so that they provide reasonable certainty that exploitation rates at the scale of the stock or research unit will not negatively impact the stock. Appropriate exploitation rates are based on estimates from areas with assessed fisheries and are not more than 3-4% of the estimated stock size.

In 2012 and 2013, CCAMLR put in place a more structured approach to setting catch limits, and spatially constraining research, in data-poor fisheries. This process attempts to use all available information combined with a regular review process to make progress, while recognising the inherent uncertainties and data limitations in data-poor fisheries.

In 2019, A sample of 2407 otolith had been read over the 2008-2017 fishing seasons (WG-SAM-2019/30). The growth curve and age-length keys have been updated based on these aging data. Furthermore, Japanese scientists read 200 otoliths collected in previous fishing season (2010, 2016, and 2017). Japan and France presented a CASAL model evaluation incorporating the calculation of harvest rate for *D. eleginoides* in Division 58.4.4b (WG-FSA-2019/62).

In 2021, a final report on research fishing operations summarized fishing activities and collected data (WG-FSA-2021/51). Although progress and achievements of each objective were reported, it was noted that there were ongoing studies that will be presented later in separate documents at future working group meetings.

5.2. Research plans

5.2.1. Background WG-FSA noted that this is a closed area and requested that the Scientific Committee consider the viability of this research plan and the sustainability of this stock given: (i) that proposed research designs have not been implemented, (ii) low and declining catch rates, (iii) low numbers of historical tag

recaptures, (iv) low expected numbers of future recaptures due to low catches, and (v) limited milestone achievement (SC-CAMLR-XXXVII, Annex 9, paragraph 4.137).

In 2019, a revised research plan for Division 58.4.4b was submitted by Japan an France (WG-SAM-2019/08), and a CASAL model evaluation incorporating the calculation of harvest rate for *D. eleginoides* at Division 58.4.4b was presented by those Members (WG-FSA-2019/62).

In 2021, a final report on research fishing operations (WG-FSA-2021/51) and an update to the CASAL model (WG-FSA-2021/52) were presented.

5.2.2. Objectives The 2019 revised research plan for Division 58.4.4b aimed at achieving five objectives (WG-SAM-2019/08):

1. Investigate the population structure of Patagonian toothfish (*D. eleginoides*),
2. Provide an assessment of the status and productivity of the Patagonian toothfish stock,
3. Investigate the population structure of by-catch species and inform by-catch mitigation measures,
4. Improve knowledge on benthic invertebrates and VME in data a poor area,
5. Contribute to scientific research programs on killer whales (*O. orca*) ecology and depredation,

This research plan is now concluded and its final report was presented (WG-FSA-2021/51).

5.3. Advice by the Scientific Committee

In 2016, the Scientific Committee supported the continuation of this research program and recommended that the catch limit for Division 58.4.4b remained unchanged (from the previous season) at 25 tonnes in Research Block 5844b_1 and 35 tonnes in Research Block 5844b_2 for the 2017 season (SC-CAMLR-XXXV, paragraph 3.254).

The Scientific Committee noted in 2017 that WG-FSA-17 had reviewed the joint proposal by France and Japan to continue research in Division 58.4.4b and agreed that it was appropriate to achieve its research objectives (SC-CAMLR-XXXVI, paragraph 3.123).

In 2018, in response to concerns about the progress of research in this Division, the Scientific Committee agreed a revised research plan for this division.

In 2019, the Scientific Committee noted the progress made with a stock assessment model in this Division, and that the level of the estimated yields was consistent with the CCAMLR decision rules and would allow a yield substantially higher than the catch limit set using the Chapman estimate of biomass (WG-FSA-2019 report, Table 7). The Scientific Committee agreed that a 20% increase from the existing catch limit in research block 5844b_1 to 23 tonnes would be consistent with the trend analysis procedure. It also agreed on catch limits to be calculated for research block 5844b_2 using the trend analysis rules.

In 2021, the Scientific Committee noted the research results of the multi-Member longline survey conducted between the 2017 and 2021 fishing seasons by Japan and France. It noted that these results were a testament to the commitment for valuable desk-based analyses to be progressed after the end of fishing operations (SC-CAMLR-40, paragraph 3.105).

6. Stock status

6.1. Summary of current status

As a data-limited fishery, this fishery does not have such estimates. However recent stock evaluations have been carried out using CASAL (WG-FSA-2021/52). Estimated maximum constant yields (MCYs) for *D.*

eleginoides were higher than the current catch limit of 18 tonnes in research block 1. Harvest rates to achieve the CCAMLR management target (50% B0), FCAY, were estimated to be close to 7%, which is higher than the current precautionary harvest rate for explanatory fisheries where there is no estimate of B0.

6.2. Assessment method

Although there has been no integrated stock assessment for this data-limited exploratory fishery, initial biomass estimates were undertaken using the catch rate and seabed area analogy method, as recommended by SC-CAMLR-XXX (Annex 5, paragraph 2.40(ii)). Since this estimate was highly uncertain due to the inherent difficulty of CPUE standardisation and the assumption of a comparable reference area, a precautionary discount factor of 0.3 was applied, similar to that used for *D. mawsoni* in the Ross Sea. Using this approach, the precautionary biomass was estimated at 4,078 tonnes. Applying a precautionary exploitation rate of 0.01 (consistent with assuming that the current status of this potentially depleted stock is 30% B0 under the generalised yield model application described in WG-FSA-10/42 Rev. 1), resulted in a precautionary research catch limit of 41 tonnes.

In 2019, catch limits for Research Block 58.4.4b_1 were set according to the conclusions of a new CASAL assessment that has been presented during WG-FSA 2019 (WG-FSA-2019/62).

In 2021, the single-sex age structured CASAL model using 5cm bins for length distribution was updated to assess the stock of *D. eleginoides* in research block 1 (WG-FSA-2021/52).

Stock biomass and catch limits in data-limited fisheries are estimated using the trend analysis.

6.3. Year of last assessment, year of next assessment

Research plans for data-limited fisheries are reviewed annually.

7. Climate Change and environmental variability

In 2018, a summary of the potential impacts of climate change on Southern Ocean fisheries (FAO 2018) highlighted the following key points:

The Antarctic region is characterized by complex interaction of natural climate variability and anthropogenic climate change that produce high levels of variability in both physical and biological systems, including impacts on key fishery taxa such as Antarctic krill. The impact of anthropogenic climate change in the short-term could be expected to be related to changes in sea ice and physical access to fishing grounds, whereas longer-term implications are likely to include changes in ecosystem productivity affecting target stocks. There are no resident human populations or fishery-dependent livelihoods in the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) Area, therefore climate change will have limited direct implications for regional food security. However, as an "under-exploited" fishery, there is potential for krill to play a role in global food security in the longer term. The institutional and management approach taken by CCAMLR, including the ecosystem-based approach, the establishment of large marine protected areas, and scientific monitoring programmes, provides measures of resilience to climate change.

In 2022, the Commission recognised that climate change is already having effects in the Convention Area (CCAMLR-41, paragraph 6.3) and agreed that it needed to act urgently to prepare for, and adapt to, the effects of climate change on the marine ecosystems within the Convention Area (CCAMLR-41, paragraph 6.5). The Commission noted (CCAMLR-41, paragraph 6.4) that the Scientific Committee had incorporated climate change into its advice (SC-CAMLR-41, paragraph 7.8) and through discussions at the SC-Symposium (SC-CAMLR-41, Annex 11) had also added climate change to the work plans and terms of reference of its Working Groups (SC-CAMLR-41, paragraph 7.14). The Commission also welcomed (CCAMLR-41, paragraph 6.8) the Scientific Committee's agreement to hold a workshop on climate change in the first half of 2023 (SC-CAMLR-41, paragraph 7.10) and encouraged the inclusion of a range of scientific experts as well

as policy makers to foster integration of the best available science into management actions. The Commission adopted (CCAMLR-41, paragraph 6.28) Resolution 36/41.

Additional Resources

- Fishery Summary: pdf, html
- Species Description: pdf, html
- Trend Analysis: pdf, html
- Fisheries Documents Browser