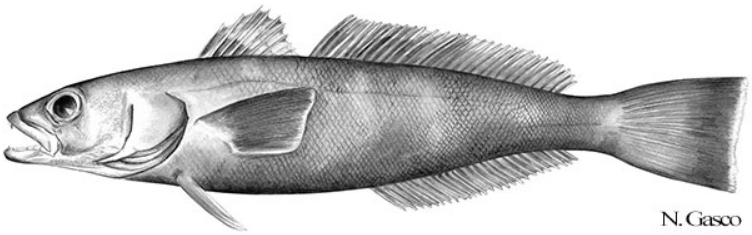
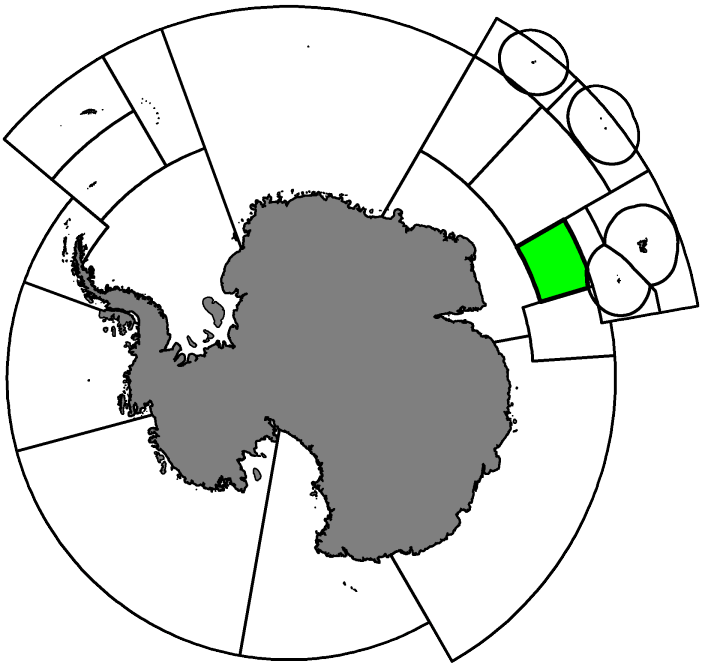
Fishery Report 2022: *Dissostichus eleginoides* in Division 58.4.3a

CCAMLR Secretariat

17 March 2023



Patagonian Toothfish, *Dissostichus eleginoides* Smitt, 1898.



Map of the management areas within the CAMLR Convention Area. Division 58.4.3a, the region discussed in this report is 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 exploratory longline fishery for Patagonian toothfish (*Dissostichus eleginoides*) in Division 58.4.3a. The fishery in Division 58.4.3 began as a new fishery in 1997 (Conservation Measure 113/XV). Following the Commission's decision 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), along with a renewed interest in this fishery, the fishery was reclassified as exploratory in 2000. Prior to 2017, this fishery was an exploratory fishery for *Dissostichus* spp., however, in order to better align the target species with the assessment process, the target species was specified as *D. eleginoides*, with any Antarctic toothfish (*D. mawsoni*) caught counting towards the catch limit for *D. eleginoides*.

1.2. Conservation Measures currently in force

The current limits on the exploratory fishery for *D. eleginoides* in Division 58.4.3a are described in Conservation Measure 41-06.

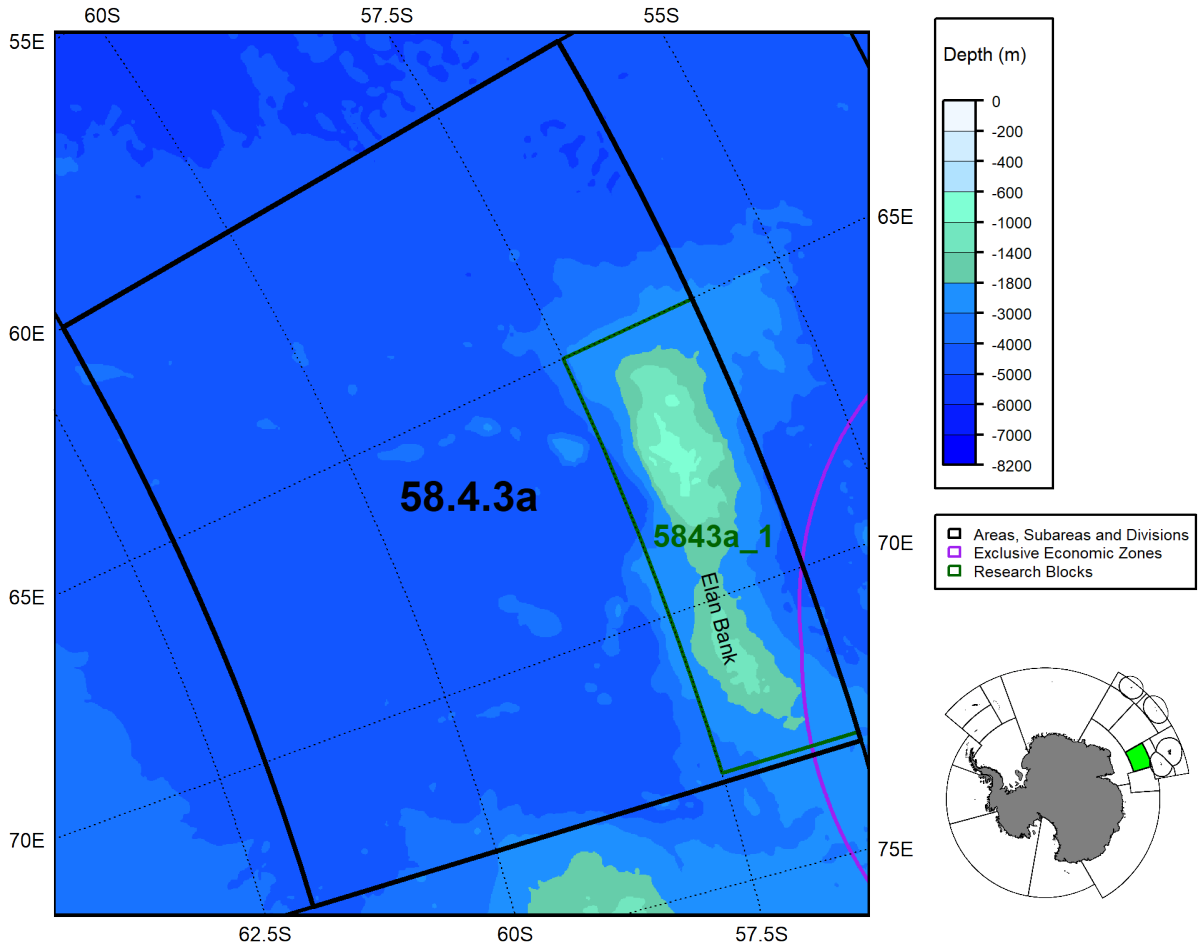


Figure 1: Location of the Research Block in Division 58.4.3a. The fishable depth range (600m-1800m) is highlighted in shades of green.

1.3. Active vessels

In 2018, when fishing last occurred, 1 vessel participated in this fishery. For the 2023 fishing season, no vessels notified their intention to participate in this fishery.

1.4. Timeline of spatial management

In 2001, the boundaries of Division 58.4.3 were reassigned based on ecological considerations, and two new divisions were formed: Division 58.4.3a (Elan Bank) and Division 58.4.3b (BANZARE Bank). Since 2005, licensed longline vessels have fished in Division 58.4.3a targeting primarily *D. eleginoides* (Table 1).

2. Reported catch

2.1. Latest reports and limits

Reported catches of *Dissostichus* spp. are presented in Table 1. In this fishery, the catch of *D. eleginoides* reached a maximum of 97 tonnes in 2005. In 2018, when fishing last occurred, 3 tonnes of *D. eleginoides* were caught.

Table 1. Catch (tonnes) and effort history for *Dissostichus* spp. 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)	*D. eleginoides*	*D. mawsoni*	Estimated IUU catch (tonnes)
1997	1		0	0	-
2005	4	250	97	9	98
2006	1	250	88	1	0
2007	2	250	3	1	0
2008	1	250	9	0	0
2009	1	86	31	0	0
2010	-	86	-	-	0
2011	1	86	4	0	-
2012	1	86	37	0	-
2013	2	32	16	0	-
2014	2	32	32	0	-
2015	2	32	15	0	-
2016	-	32	-	-	-
2017	2	32	11	0	-
2018	1	38	3	0	-
2019	-	30	-	-	-
2020	-	24	-	-	-
2021	-	19	-	-	-
2022	-	19	-	-	-

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 2.

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.

Those skates and rays which are caught alive and which have not been tagged (Conservation Measure 41-01, Annex 41-01/C, paragraphs 2v and vii), should be released by cutting the snood and, when practical, removing the hooks, and the number recorded and reported.

The by-catch in Division 58.4.3a consists predominantly of skates and rays (Table 2).

Table 2. 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)
1997		0		<1	0		1
2005	26	2	50	17	985	20	2
2006	26	<1	50	7	0	20	1
2007	26	<1	50	<1	0	20	<1
2008	26	<1	50	2	0	20	<1
2009	26	2	50	2	57	20	2
2010	26	-	50	-	-	20	-
2011	26	<1	50	<1	0	20	<1
2012	26	4	50	32	0	20	3
2013	26	2	50	<1	3666	20	1
2014	26	2	50	2	6148	20	1
2015	26	<1	50	<1	683	20	<1
2016	26	-	50	-	-	20	-
2017	5	<1	2	<1	717	5	<1
2018	6	<1	2	<1	1054	6	<1
2019	5	-	2	-	-	5	-
2020	4	-	1	-	-	4	-
2021	3	-	1	-	-	3	-
2022	3	-	1	-	-	3	-

In 2019, an analysis of by-catch data from this fishery indicated strong effects of gear and bathymetry on by-catch composition and biomass (WG-FSA-2019/56).

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 Division 58.4.3a.

2.4. Incidental mortality of seabirds and marine mammals

In 2012, a single mortality of a white-chinned petrel (*Procellaria aequinoctialis*) was reported. There have been no observed bird mortalities reported by vessels since 2012.

In 2005, two incidental mortalities of Southern elephant seal (*Mirounga leonina*) were observed in Division 58.4.3a. There have been no observed mammal mortalities reported by vessels since 2005.

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.

The risk level for birds in the fishery in Division 58.4.3a is category 3 (average) (SC-CAMLR-XXX, Annex 8, paragraph 8.1).

3. Illegal, Unreported and Unregulated (IUU) fishing

According to French surveillance data, there was little evidence of IUU fishing in Division 58.4.3a between 2006 and 2008, however, IUU fishing activities were observed during the 2009 and remained prevalent until 2013. IUU fishing activities have not been observed in this division since 2013, however, considering the previous interest in this region, IUU activity may still be occurring but remaining undetected. Furthermore, 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 3 and 4.

Table 3. 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	84	-	-	-	-
		VME indicator units $>$ 5 and $<$ 10	0	-	-	-	-
		VME indicator units $>$ 10	0	-	-	-	-
	by-catch	taxa identified	4	-	-	-	-
		records	46	-	-	-	-
Observer	VME	line segments	96	-	-	-	-
		taxa identified	6	-	-	-	-
		weight or volume measurements	63	-	-	-	-
	toothfish	specimens examined	321	-	-	-	-
		length measurements	321	-	-	-	-
		weight measurements	321	-	-	-	-
		sex identifications	321	-	-	-	-
		maturity stage identifications	321	-	-	-	-
		gonad weight measurements	0	-	-	-	-
		otolith samples	103	-	-	-	-
	by-catch	specimens examined	174	-	-	-	-
		taxa identified	5	-	-	-	-
		length measurements	173	-	-	-	-
		weight measurements**	173	-	-	-	-
		standard length measurements*	0	-	-	-	-
		wingspan measurements*	47	-	-	-	-
		pelvic length measurements*	47	-	-	-	-
		snout to anus measurements*	86	-	-	-	-
		sex identifications**	47	-	-	-	-
		maturity stage identifications**	0	-	-	-	-
		gonad weight measurements**	0	-	-	-	-
		otolith samples**	0	-	-	-	-

*: Species-dependent records
**: Voluntary records

Table 4. 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	86	-	-	-	-
	taxa identified	1	-	-	-	-
	length measurements	86	-	-	-	-
	weight measurements**	86	-	-	-	-
	snout to anus measurements*	86	-	-	-	-
	sex identifications**	0	-	-	-	-
	maturity stage identifications**	0	-	-	-	-
	gonad weight measurements**	0	-	-	-	-
	otolith samples**	0	-	-	-	-
Skates and rays	specimens examined	47	-	-	-	-
	taxa identified	1	-	-	-	-
	length measurements	47	-	-	-	-
	weight measurements**	47	-	-	-	-
	wingspan measurements*	47	-	-	-	-
	pelvic length measurements*	47	-	-	-	-
	sex identifications**	47	-	-	-	-
	maturity stage identifications**	0	-	-	-	-
	gonad weight measurements**	0	-	-	-	-
Other fish	specimens examined	40	-	-	-	-
	taxa identified	2	-	-	-	-
	length measurements	40	-	-	-	-
	weight measurements**	40	-	-	-	-
	standard length measurements*	0	-	-	-	-
	sex identifications**	0	-	-	-	-
	maturity stage identifications**	0	-	-	-	-
	gonad weight measurements**	0	-	-	-	-
	otolith samples**	0	-	-	-	-

*: Species-dependent records
**: Voluntary records

The counts of by-catch taxa reported above (Table 4) 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.

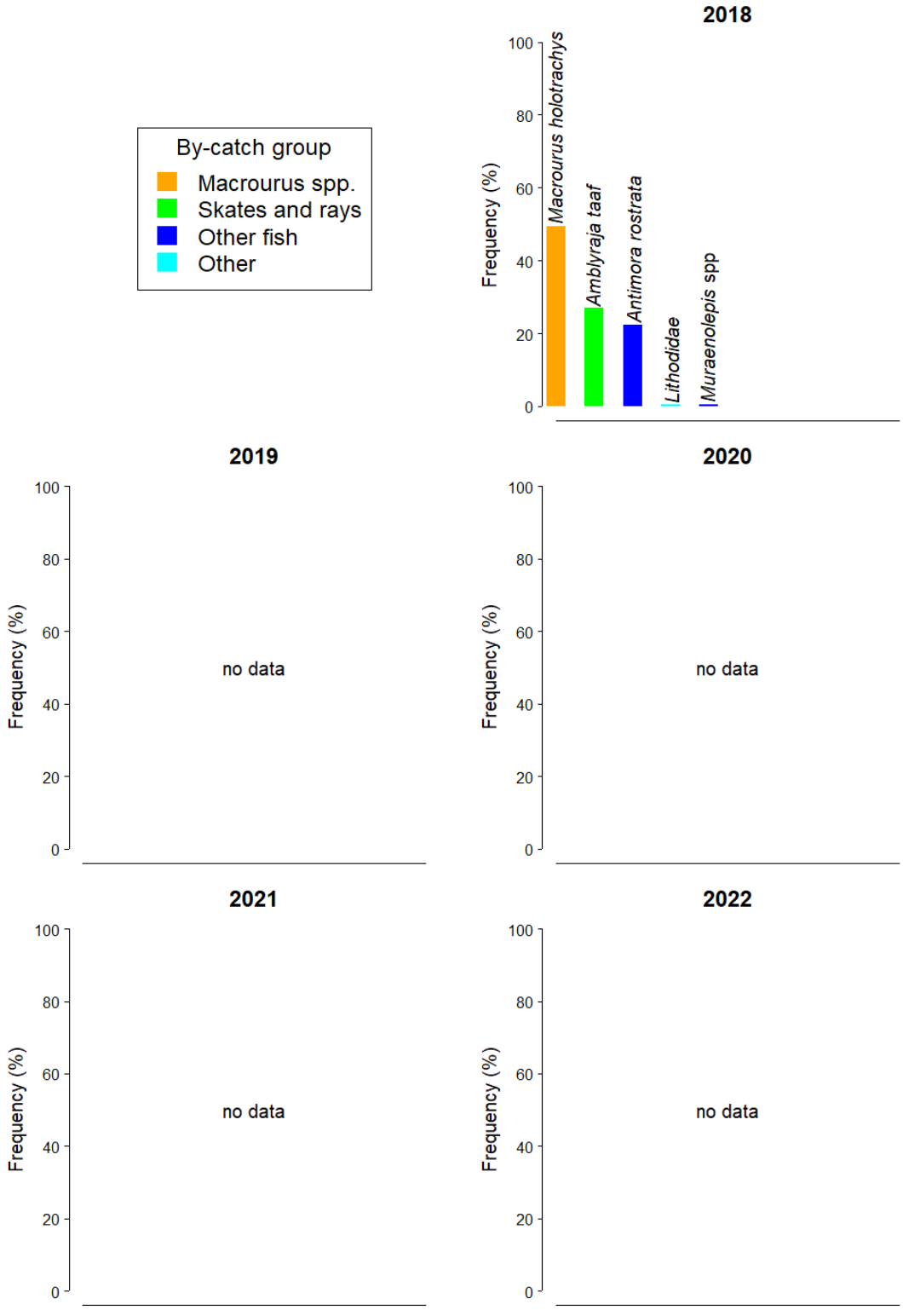


Figure 2. Relative frequencies of the most commonly examined by-catch taxa in each of the last five seasons, from the observer data (unweighted raw counts of individually examined specimens). Taxonomic identification may occur at different levels.

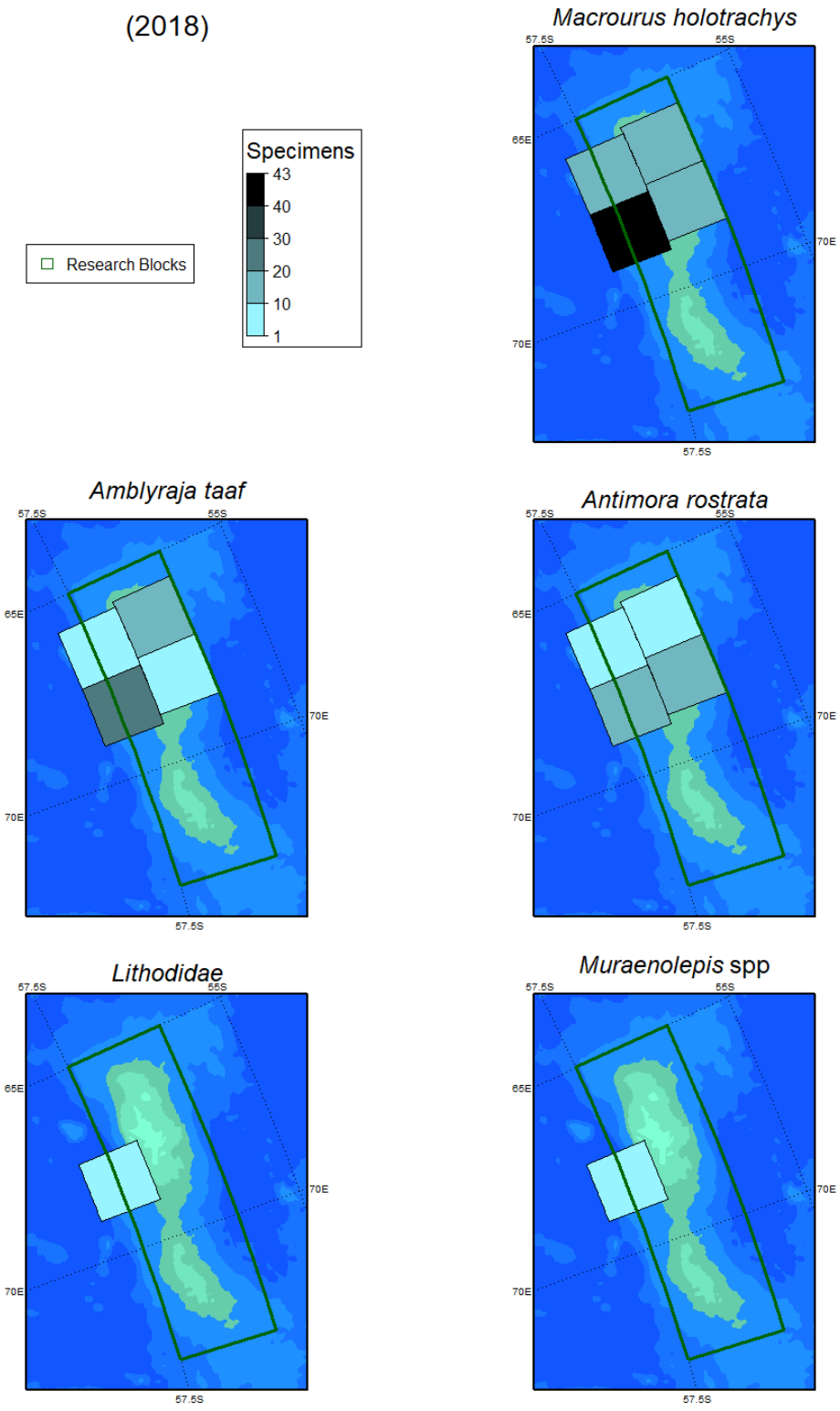


Figure 3. Spatial distribution of the most commonly examined by-catch taxa across the last five seasons, from the observer data (unweighted raw counts of individually examined specimens in each cell). The data were aggregated using equal area (100 km x 100 km) cells. Taxonomic identification may occur 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 Division 58.4.3a fishery ranged from 30 to 175cm in length (Fig. 4). The variability in size distributions in this fishery may reflect changes in fishing operations.

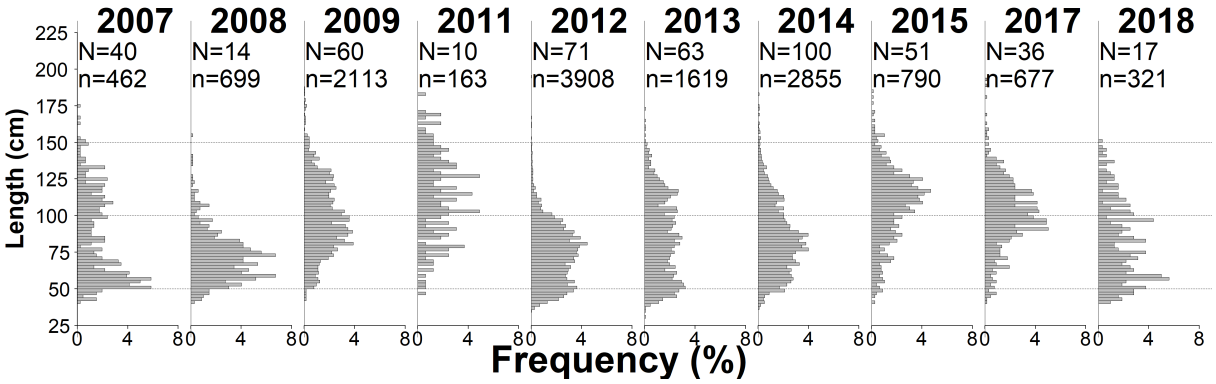


Figure 4. Annual length frequency distributions of *Dissostichus eleginoides* caught in Division 58.4.3a. The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were measured in a given season.

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 5). 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 5. 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. mawsoni* and *D. eleginoides* respectively are 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	2011	2012	2013	2014	2015	2017	2018
France	Le Saint Andre		6.4 (NC,77.1)	9.2 (-,73.9)	5.6 (-,84.8)	10 (-,NC)	6.8 (NC,NC)	
France	Mascareignes III							6 (-,NC)
Japan	Shinsei Maru No. 3	3.9 (-,NC)		6 (-,64.8)	6.9 (NC,84.6)	5.8 (-,61.8)	7.6 (NC,81.7)	
Total		**3.9 (-,NC)**	**6.4 (NC,77.1)**	**7.3 (-,70.5)**	**6.2 (NC,89.5)**	**5.9 (-,61.8)**	**7.5 (NC,81.3)**	**6 (-,NC)**

To date in this area, 1221 *D. eleginoides* have been tagged and released (68 have been recaptured; Table 6).

Table 6. 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	2011	2012	2013	2014	2015	2017	2018
France	Le Saint Andre		235 (9)	60 (11)	90 (22)	6 (3)	13 (3)	
France	Mascareignes III							15 (3)
Japan	Shinsei Maru No. 3	14 (0)		56 (1)	110 (3)	84 (3)	72 (0)	
Total		**14 (0)**	**235 (9)**	**116 (12)**	**200 (25)**	**90 (6)**	**85 (3)**	**15 (3)**

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.

5.2. Research plans

5.2.1. Background A robust stock assessment that provides advice on catch limits according to the CCAMLR decision rules has not been developed due to lack of information in some areas (namely, Subarea 48.6 and Divisions 58.4.1, 58.4.2 and 58.4.3a). Thus, this subarea and these divisions have been designated as 'data-poor fisheries' (SC-CAMLR-XXX, paragraph 3.122). The Scientific Committee noted that the number of research hauls and tagging rate should be increased in fine-scale rectangles in which tags had been released in the past few years to increase the likelihood of tagged fish being recaptured (SC-CAMLR-XXX, paragraphs 3.126 and 3.128). The Scientific Committee agreed that the Research Blocks with the high numbers of tags available for recapture identified in WG-FSA-12/60 Rev. 1 could be used as a basis for research fishing in the data-poor fisheries, and agreed that research in 2013 should be concentrated within these blocks to maximise the likelihood of recapturing tags that had been released in the previous season (SC-CAMLR-XXXI, paragraph 3.171).

France and Japan had proposed research in Division 58.4.3a under Conservation Measure 21-02 (SC-CAMLR-XXXI, paragraph 3.146). The Scientific Committee welcomed the development of an assessment framework

using CASAL during the meeting of the Working Group on Fish Stock Assessment (WG-FSA) and agreed that this work should be progressed to develop an assessment that is suitable to provide management advice.

The Scientific Committee endorsed the continuation of this research with a catch limit of 32 tonnes over three years (SC-CAMLR-XXXI, paragraph 3.147; SC-CAMLR-XXXII, paragraph 3.208; SC-CAMLR-XXXIII, paragraph 3.192).

The Scientific Committee noted that a substantial number of tags were being recaptured in this fishery and there was an expectation that a robust assessment was likely for this division in the near future (SC-CAMLR-XXXIII, paragraph 3.194).

In 2018, a revised research plan was submitted by France and Japan (WG-FSA-18/61).

5.2.2. Objectives The research plan submitted by France and Japan aimed at achieving five objectives (WG-FSA-18/61).

Objective 1: Collect data required for an assessment of the status and productivity of toothfish stocks in Division 58.4.3a. Standard catch, fishing effort, tagging and biological data will be collected under Conservation Measures 41-01 and 41-06.

Objective 2: Collect data on the spatial and depth distributions of by-catch species, and inform by-catch mitigation measures.

Objective 3: Record marine mammal sightings to study potential depredation.

Objective 4: Improve benthic invertebrate populations' knowledge and their related conservation issues.

Objective 5: Collect and use environmental data to improve understanding of ecosystem function. It is a first step to spatial management and ecosystem-based fisheries management approaches. Collection of environmental data will start during the 2018/19 CCAMLR season.

5.3. Advice by the Scientific Committee

A multi-year tag-recapture experiment undertaken jointly by France and Japan was initiated and continued under the following advice by the Scientific Committee: SC-CAMLR-XXXI, paragraph 3.147; SC-CAMLR-XXXII, paragraphs 3.205 to 3.207; and SC-CAMLR-XXXIII, paragraphs 3.191 and 3.192.

In 2015, the Scientific Committee noted that integrated stock assessment models for this division were not yet sufficiently robust to provide management advice using the CCAMLR decision rules and also that methods for the provision of management advice in data-poor fisheries affected by illegal, unreported and unregulated (IUU) fishing were applicable to this Division. It further recommended that growth and maturity parameters be further developed for this area.

In 2018 research was carried out by the and the French vessel Mascareignes III. At SC-CAMLR-XXXVII France and Japan had agreed to a pause in fishing activities in this Division while undertaking analysis of previous research for consideration by the Scientific Committee and its working groups.

6. Stock status

6.1. Summary of current status

As a data-limited fishery, this fishery does not have such estimates.

6.2. Assessment method

A preliminary stock assessment for Division 58.4.3a was detailed in WG-SAM-08/05 and employed a biomass dynamic surplus production model to assess the status of the stock using the tag/release of 199 individuals and recapture of six individuals from 2005 and 2006 data respectively, as well as legal and estimated illegal catches. Resultant stock size estimates were then used to estimate long-term yields (using the CCAMLR decision rules) under four different assumptions about the additional uncertainty in future stock dynamics, beyond that already accounted for in the stock assessment. This gave a range of potential long-term yields of 113, 105, 103 and 86 tonnes, which encompassed a wide range of future stock dynamic uncertainty assumptions.

Stock biomass and catch limits in data-limited fisheries are now 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