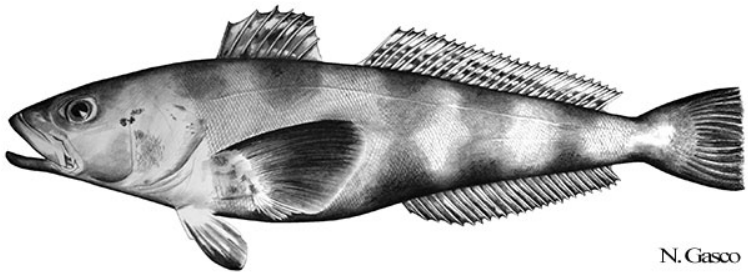
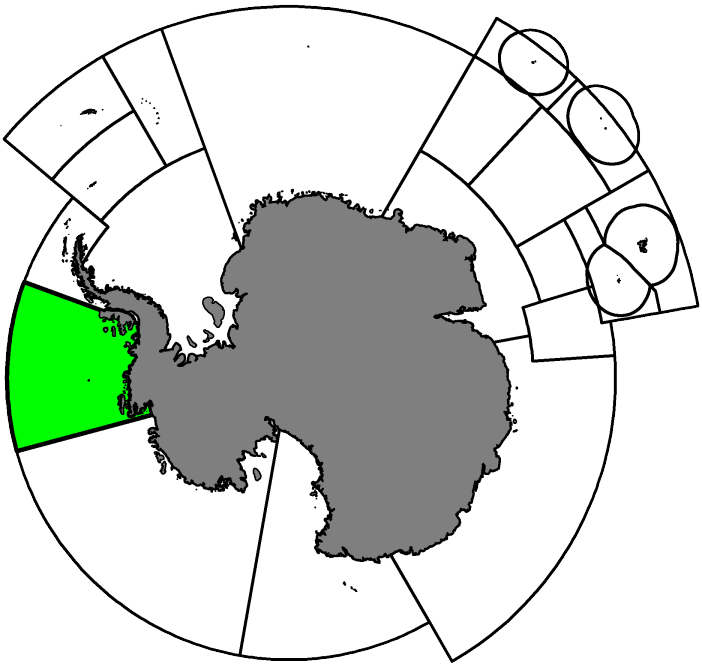
Fishery Report 2022: *Dissostichus mawsoni* in Subarea 88.3

CCAMLR Secretariat

17 March 2023



Antarctic Toothfish, *Dissostichus mawsoni* Norman, 1937.



Map of the management areas within the CAMLR Convention Area. Subarea 88.3, 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

Research fishing for Antarctic toothfish (*Dissostichus mawsoni*) in Subarea 88.3 has been occasionally conducted by Chilean, New Zealand and Russian flagged vessels between 1998 and 2012. Since 2016 research fishing has been led by the Republic of Korea in Research Blocks (Fig. 1) in this Subarea, joined by New Zealand from 2017 to 2019 and by Ukraine since 2018.

1.2. Conservation Measures currently in force

Directed fishing for *Dissostichus* spp. in Subarea 88.3 is prohibited under Conservation Measure 32-02 until further scientific information is gathered and reviewed by the Scientific Committee and the Working Group on Fish Stock Assessment (WG-FSA).

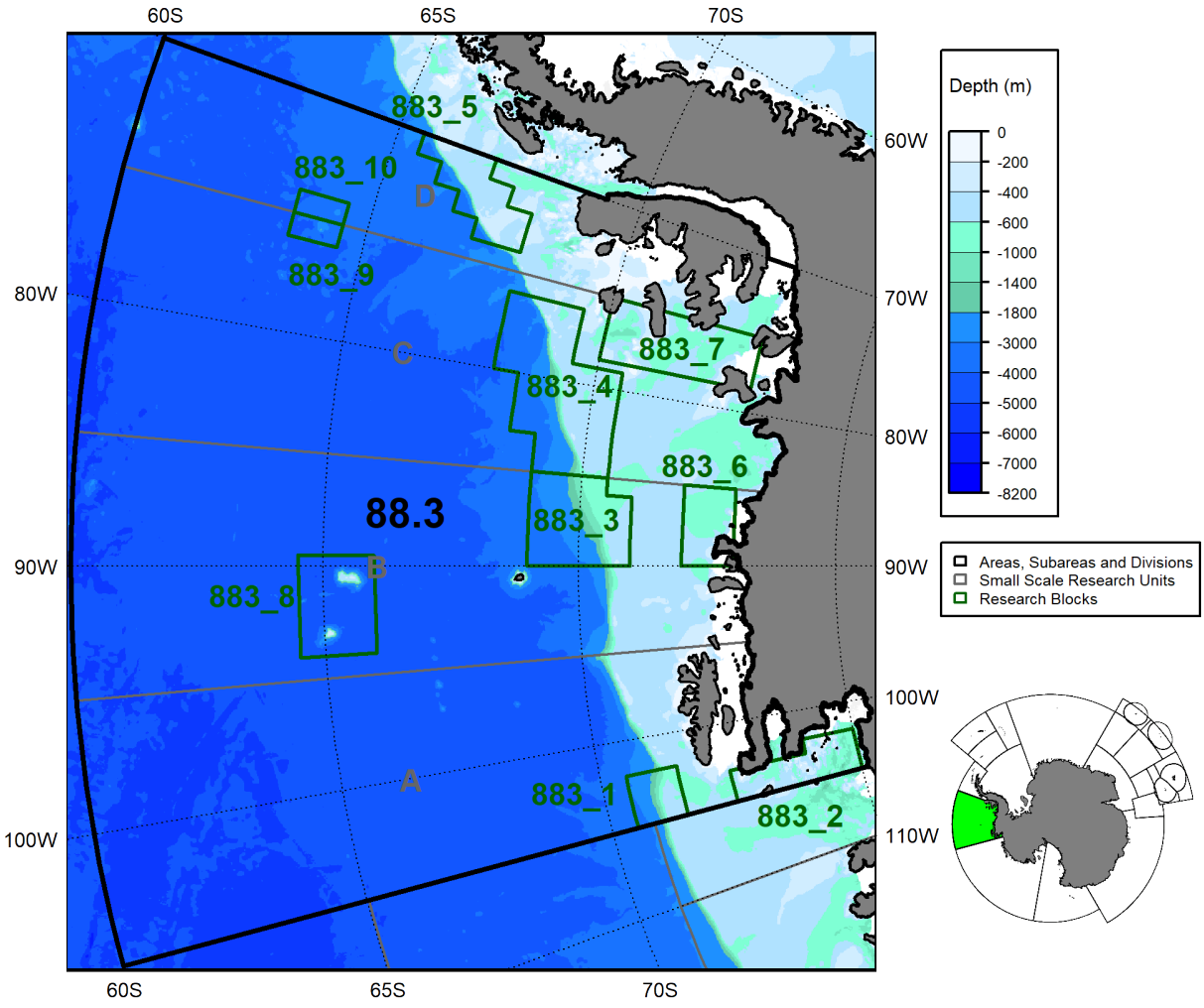


Figure 1: Location of the Research Blocks in Subarea 88.3. The fishable depth range (600m-1800m) is highlighted in shades of green.

1.3. Active vessels

In 2022, 2 vessels participated in this fishery.

1.4. Timeline of spatial management

Following a proposal from Korea to begin research fishing under Conservation Measure 24-01 in 2016 (WG-SAM-16/11), Research Blocks 1 to 5 were defined (Fig. 1). Additional Research Blocks (6-10) were proposed by New Zealand in 2017 (WG-FSA-17/40).

2. Reported catch

2.1. Latest reports and limits

The total catch reported from the research surveys that have been conducted in Subarea 88.3 is shown in Table 1. In this fishery, the catch of *D. mawsoni* reached a maximum of 129 tonnes in 2022. In 2022, 0 tonnes of *D. eleginoides* and 129 tonnes of *D. mawsoni* 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)
2011	1	65	0	5	-
2012	1	65	0	4	-
2013	-	0	-	-	-
2014	-	0	-	-	-
2015	-	0	-	-	-
2016	1	171	0	106	-
2017	1	171	0	119	-
2018	1	245	0	39	-
2019	1	245	1	63	-
2020	2	254	0	96	-
2021	-		-	-	-
2022	2	254	0	129	-

Table 2: Catch and catch limits by Research Block in 2022 for *Dissostichus mawsoni* in Subarea 88.3. Source: Fine scale data.

Research Block	Catch limit	Catch (% of catch limit)
883_3	60	60 (100%)
883_4	60	60 (100%)
883_6	30	6 (20%)
883_7	30	4 (13.3%)

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 500kg in a 10-day period and exceeds 16% of the catch of *D. mawsoni* in that period, the vessel shall cease fishing in that SSRU for the remainder of the season.

Skates thought to have a reasonable chance of survival are released at the surface in accordance with Conservation Measure 33-03.

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)
2016	39.2	3	12.25	<1	0	39.2	1
2017	39.2	7	12.25	<1	0	39.2	<1
2018	39.2	7	12.25	<1	0	39.2	<1
2019	39.2	5	12.25	<1	197	39.2	2
2020	43	11	16	<1	69	43	<1
2021		-		-	-		-
2022	40	4	11	<1	494	40	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. For research fisheries notified under Conservation Measure 24-01, exemptions from specific Conservation Measures can be made, as recorded each year under Conservation Measure [24-05]. All of the VMEs in CCAMLR's VME Registry are currently afforded protection through specific area closures.

The proponents of this research indicated that CCAMLR standard methods for the identification of VMEs will be applied on board during the survey (WG-FSA-2021/34).

There are no VMEs or VME Risk Areas designated in Subarea 88.3.

2.4. Incidental mortality of seabirds and marine mammals

There have been no reported bird or mammal mortalities reported by vessels from Subarea 88.3 in this fishery.

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.

3. Illegal, Unreported and Unregulated (IUU) fishing

There are no records of illegal, unreported and unregulated (IUU) fishing activities in Subarea 88.3.

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	713	1303	935	-	1395
		VME indicator units >5 and <10	0	0	0	-	0
		VME indicator units >10	0	0	0	-	0
	by-catch	taxa identified	8	11	14	-	12
		records	128	313	253	-	369
Observer	VME	line segments	713	1392	276	-	817
		taxa identified	2	8	6	-	3
		weight or volume measurements	10	47	19	-	3
	toothfish	specimens examined	936	2031	2186	-	3700
		length measurements	936	2031	2186	-	3700
		weight measurements	936	2031	2165	-	3700
		sex identifications	914	2031	2156	-	3700
		maturity stage identifications	914	1999	2144	-	3678
		gonad weight measurements	901	1975	2141	-	3678
		otolith samples	720	897	1158	-	1153
	by-catch	specimens examined	1030	1798	951	-	1494
		taxa identified	10	12	16	-	15
		length measurements	981	1797	455	-	800
		weight measurements**	1024	1797	951	-	1494
		standard length measurements*	0	1	0	-	360
		wingspan measurements*	49	75	2	-	16
		pelvic length measurements*	49	75	2	-	16
		snout to anus measurements*	614	981	686	-	1047
		sex identifications**	989	1760	909	-	1115
		maturity stage identifications**	987	1531	905	-	1107
		gonad weight measurements**	0	0	14	-	207
		otolith samples**	0	0	321	-	400

*: 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	616	977	686	-	1046
	taxa identified	1	1	3	-	4
	length measurements	616	977	191	-	356
	weight measurements**	610	977	686	-	1046
	snout to anus measurements*	612	977	686	-	1046
	sex identifications**	582	956	676	-	946
	maturity stage identifications**	582	863	675	-	945
	gonad weight measurements**	0	0	14	-	119
	otolith samples**	0	0	321	-	400
Skates and rays	specimens examined	42	75	2	-	15
	taxa identified	1	1	1	-	1
	length measurements	0	75	2	-	15
	weight measurements**	42	75	2	-	15
	wingspan measurements*	42	75	2	-	15
	pelvic length measurements*	42	75	2	-	15
	sex identifications**	42	75	2	-	15
	maturity stage identifications**	42	37	2	-	10
	gonad weight measurements**	0	0	0	-	0
Other fish	specimens examined	364	716	261	-	429
	taxa identified	6	8	11	-	8
	length measurements	364	716	260	-	429
	weight measurements**	364	716	261	-	429
	standard length measurements*	0	1	0	-	360
	sex identifications**	358	715	229	-	154
	maturity stage identifications**	358	631	227	-	152
	gonad weight measurements**	0	0	0	-	88
	otolith samples**	0	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.

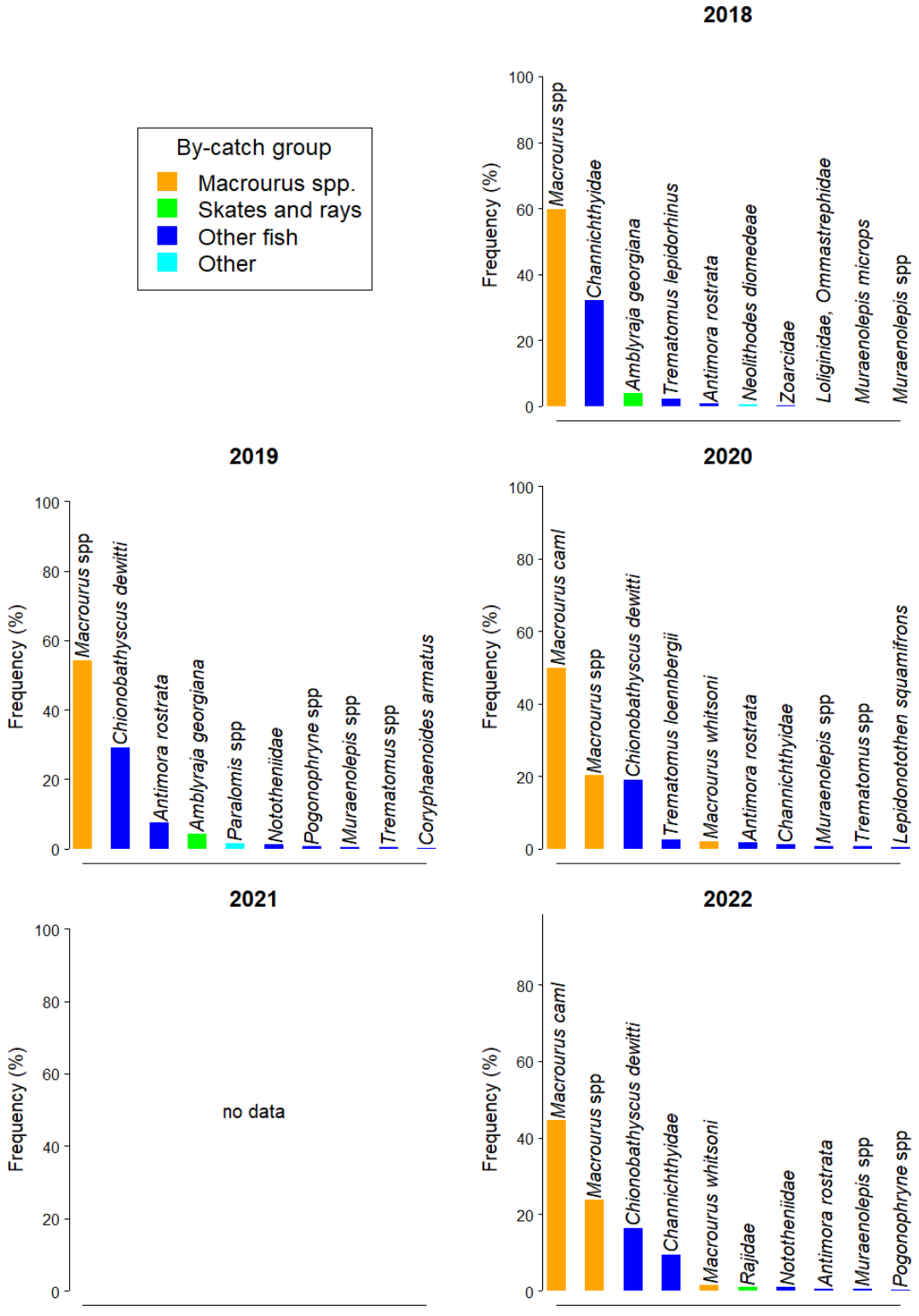


Figure 2. Relative frequencies of the most commonly examined by-catch taxa in each of the last five seasons, from the observer data (unweighted raw counts of individually examined specimens). Taxonomic identification may occur at different levels.

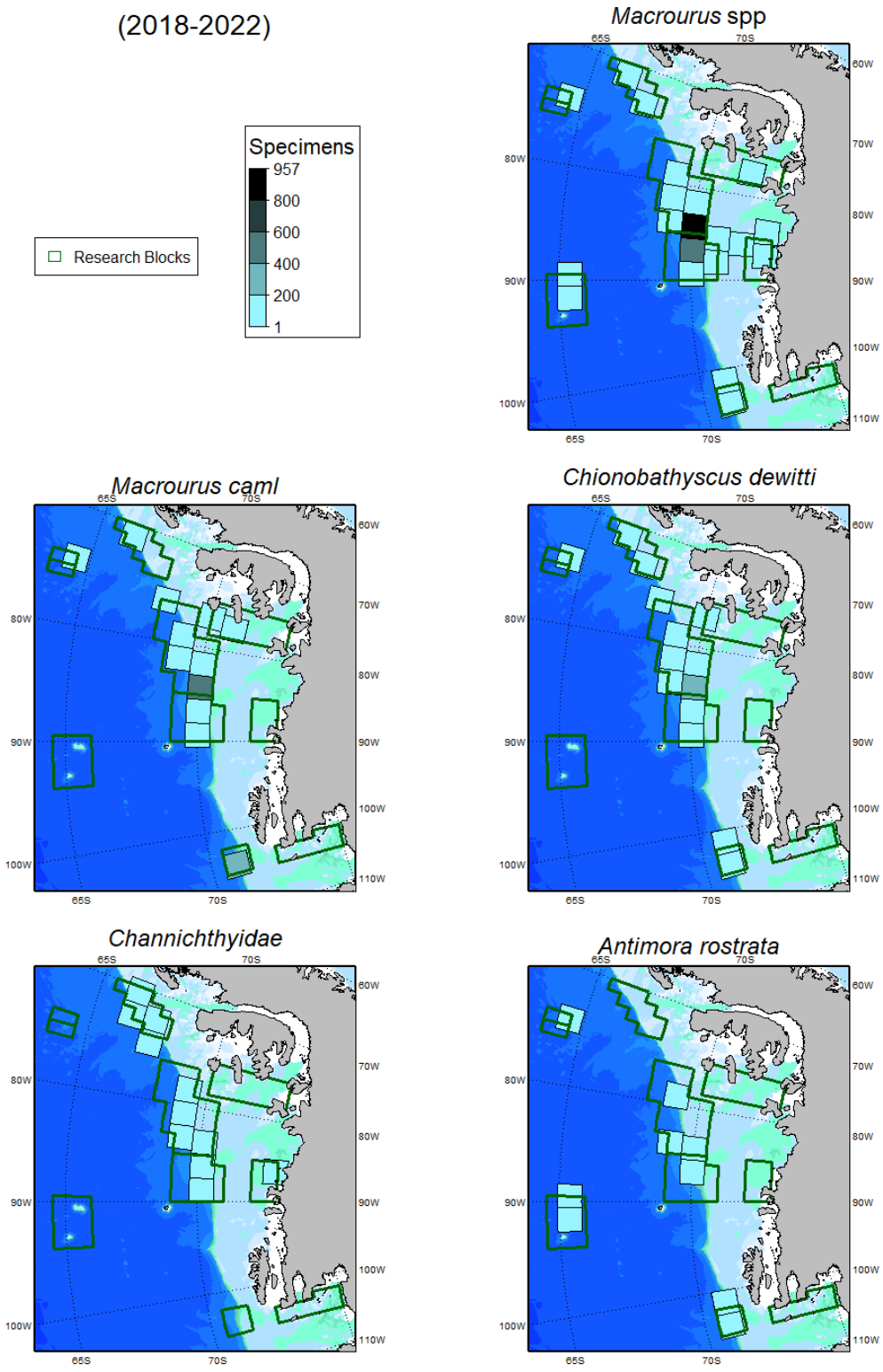


Figure 3. Spatial distribution of the most commonly examined by-catch taxa across the last five seasons, from the observer data (unweighted raw counts of individually examined specimens in each cell). The data were aggregated using equal area (100 km x 100 km) cells. Taxonomic identification may occur 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. mawsoni* caught during research activities 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. mawsoni* caught during research fishing ranged from 50 to 175cm with two broad modes at approximately 60cm and 150cm.

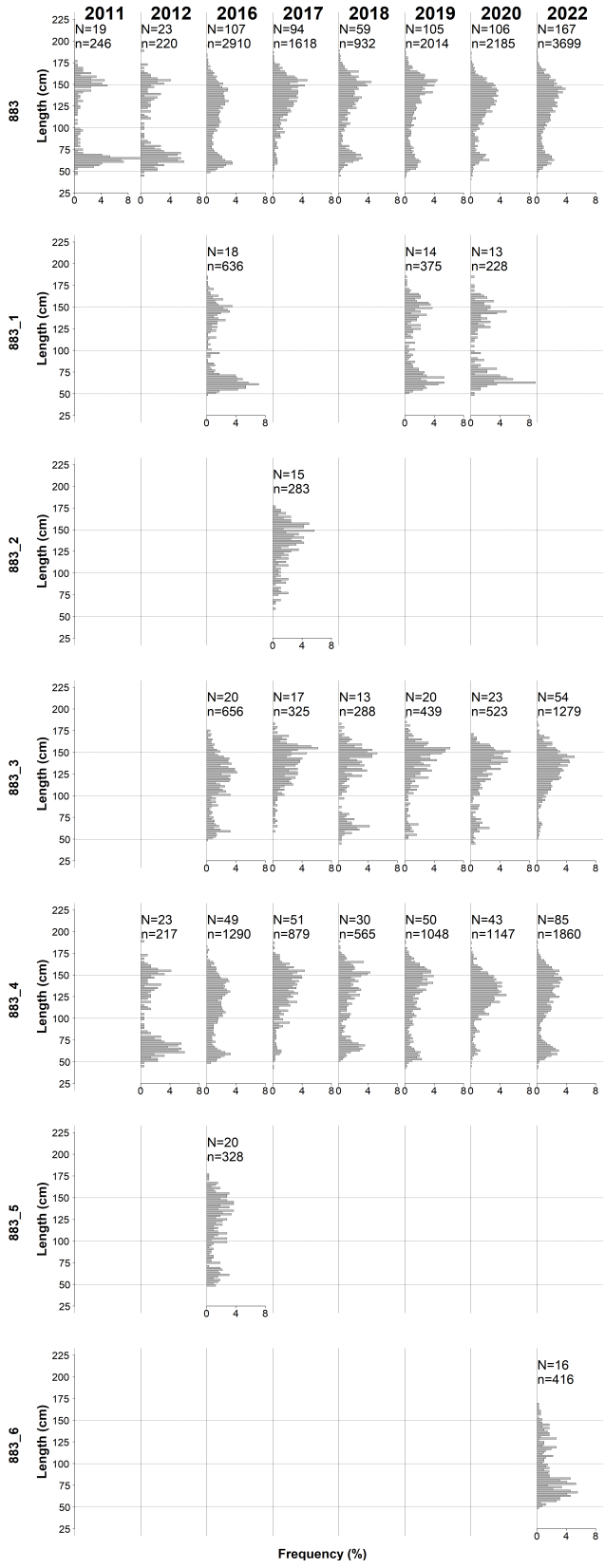


Figure 4. Annual length frequency distributions of *D. mawsoni* caught in Subarea 88.3 and its Research Blocks. The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were measured in a given season/area.

4.3. 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.

To date in this area, 2972 *D. mawsoni* have been tagged and released (20 have been recaptured, 18 of which were released in this area; Table 6), and, 6 *D. eleginoides* have been tagged and released (0 have been recaptured).

Table 6. Number of *Dissostichus mawsoni* tagged and recaptured in the area for each fishing Season.

		Recaptured			
Season	Tagged	2019	2020	2022	Total
2005	8				
2011	30				
2012	63				
2016	566	1			**1**
2017	597	1	1		**2**
2018	203	2	2	1	**5**
2019	342		4	1	**5**
2020	495			4	**4**
2022	668			1	**1**
Total	**2972**				**18**

5. Research

5.1. Status of the science

There were a total of 95 research hauls and 131 tagged fish as part of surveys conducted by Chilean, New Zealand and Russian flagged vessels up to 2012. This level of research activities meant that there was insufficient data to assess the toothfish stock in this Subarea. The previous surveys were restricted by sea-ice. However, as the ice concentration in the west of the Antarctic is reducing, this led the Republic of Korea to propose a multi-year research plan for Subarea 88.3 starting in 2016.

New Zealand (in 2017) and Ukraine (in 2018) joined the Republic of Korea in these research efforts.

In 2019, an integrated research proposal for *Dissostichus* spp. in Subarea 88.3 was submitted by the Republic of Korea, New Zealand and Ukraine (WG-SAM-2019/02).

In 2021, an updated research proposal was submitted by the Republic of Korea and Ukraine (WG-FSA-2021/34).

In 2022, the Republic of Korea and Ukraine reported on the progress and continuation of their research proposal (WG-FSA-2022/26). WG-FSA-2022/27 and WG-FSA-2022/28 presented analyses of diet composition, feeding strategy and spatial diet variations of Antarctic toothfish. *Chionobathyscus dewitti*, Macrouridae and Mollusks were found to be dominant prey items, and diet was found to differ between slope and shelf areas, reflecting the different prey assemblages between these areas. Also, a genetic study using microsatellite markers (WG-FSA-2022/29 Rev. 1) reported a higher genetic diversity in the Ross Sea region than other areas within Area 88.

5.2. Research plans

5.2.1. Background The main objective of the proposal is to determine the abundance and distribution of Antarctic toothfish in Subarea 88.3. Secondary objectives are to improve understanding of stock and

population structures of toothfish in Area 88, to carry out calibration trials among the vessels, to collect data on the spatial and depth distributions of by-catch species, and to trial scientific electronic monitoring technologies.

5.2.2. Objectives The research proposal (WG-FSA-2022/26) aims at achieving five objectives:

- Determine the abundance and distribution of Antarctic toothfish in Subarea 88.3,
- Improve understanding of stock structure of toothfish in Area 88,
- Carry out calibration trials among vessels,
- Collect data on the spatial and depth distributions of by-catch species,
- Trial scientific electronic monitoring technologies.

5.3. Advice by the Scientific Committee

The advice from the Scientific Committee in 2016 on this research proposal is presented in SC-CAMLR-XXXV, paragraphs 3.255 and 3.256. The Scientific Committee recommended that the catch limits and priority for each Research Block should be as in 2016 should ice conditions allow.

In 2017, the Scientific Committee recommended that the catch limits for the Korean and New Zealand joint research plan in Subarea 88.3 be endorsed for 2018 (Table 5 and SC-CAMLR-XXXVI, paragraph 3.142).

In 2019, the Scientific Committee endorsed the Research proposal as described in [WG-SAM-19/02] (SC-CAMLR-38 paragraphs 4.59 to 4.61).

In 2020, the Scientific Committee and the Commission did not reach consensus on this research proposal (CCAMLR-39 paragraphs 5.32 and 5.33).

In 2021, the Scientific Committee endorsed the Research proposal as described in WG-FSA-2021/34, with an updated sampling rate requirement for by-catch species of 30 specimens per species per line, or the entire catch for a line if this was less than 30 specimens (SC-CAMLR-40 paragraphs 3.107).

In 2022, the Scientific Committee endorsed (SC-CAMLR-41, paragraph 4.8) the Research proposal as described in WG-FSA-2022/26.

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

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