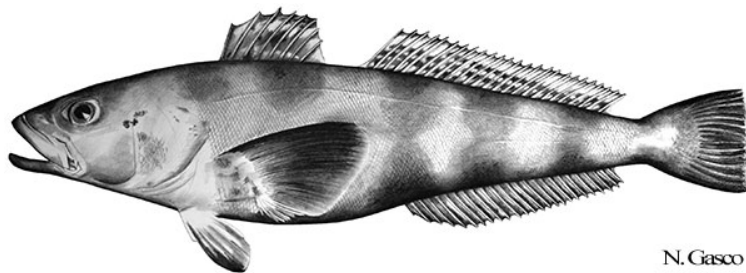# Fishery Report 2021: *Dissostichus mawsoni* in Division 58.4.2
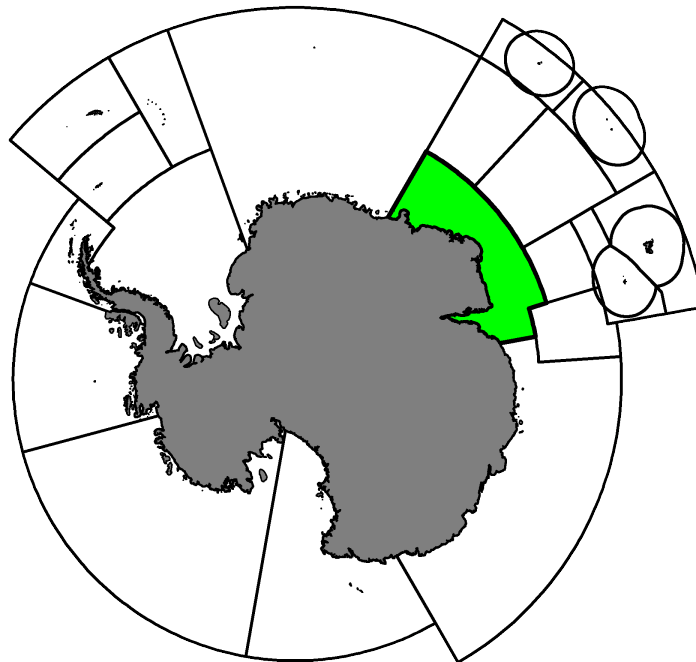
CCAMLR Secretariat

27 May 2022

Antarctic Toothfish, *Dissostichus mawsoni* Norman, 1937.

Map of the management areas within the CAMLR Convention Area. Division 58.4.2, the region discussed in this report is shaded in green. Throughout this report, "2021" refers to the 2020/21 CCAMLR fishing season (from 1 December 2020 to 30 November 2021).

Contents

1. Introduction to the fishery

1.1. History

This report describes the exploratory longline fishery for Antarctic toothfish (*Dissostichus mawsoni*) in Division 58.4.2. This fishery was first agreed by the Commission in 2000 and started as a trawl fishery for spiny icefish (*Chaenodraco wilsoni*), striped-eye rockcod (*Lepidonotothen kempi*), Antarctic rockcod (*Trematomus eulepidotus*) and Antarctic silverfish (*Pleuragramma antarctica*) and an exploratory trawl fishery for toothfish (*Dissostichus* spp.) (Conservation Measure 186/XVIII). In 2001 and 2002, the exploratory trawl fishery was also permitted in association with a new fishery for grenadier (*Macrourus* spp.). In 2003, the fishery for *Dissostichus* spp. in Division 58.4.2 changed to an exploratory longline fishery and since 2004 has targeted primarily *D. mawsoni*. Prior to 2017, this fishery was classified as 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. mawsoni*, with any Patagonian toothfish (*D. eleginoides*) caught counting towards the catch limit for *D. mawsoni*.

1.2. Conservation Measures currently in force

The current limits on the exploratory fishery for *D. mawsoni* in Division 58.4.2 are described in Conservation Measure 41-05.
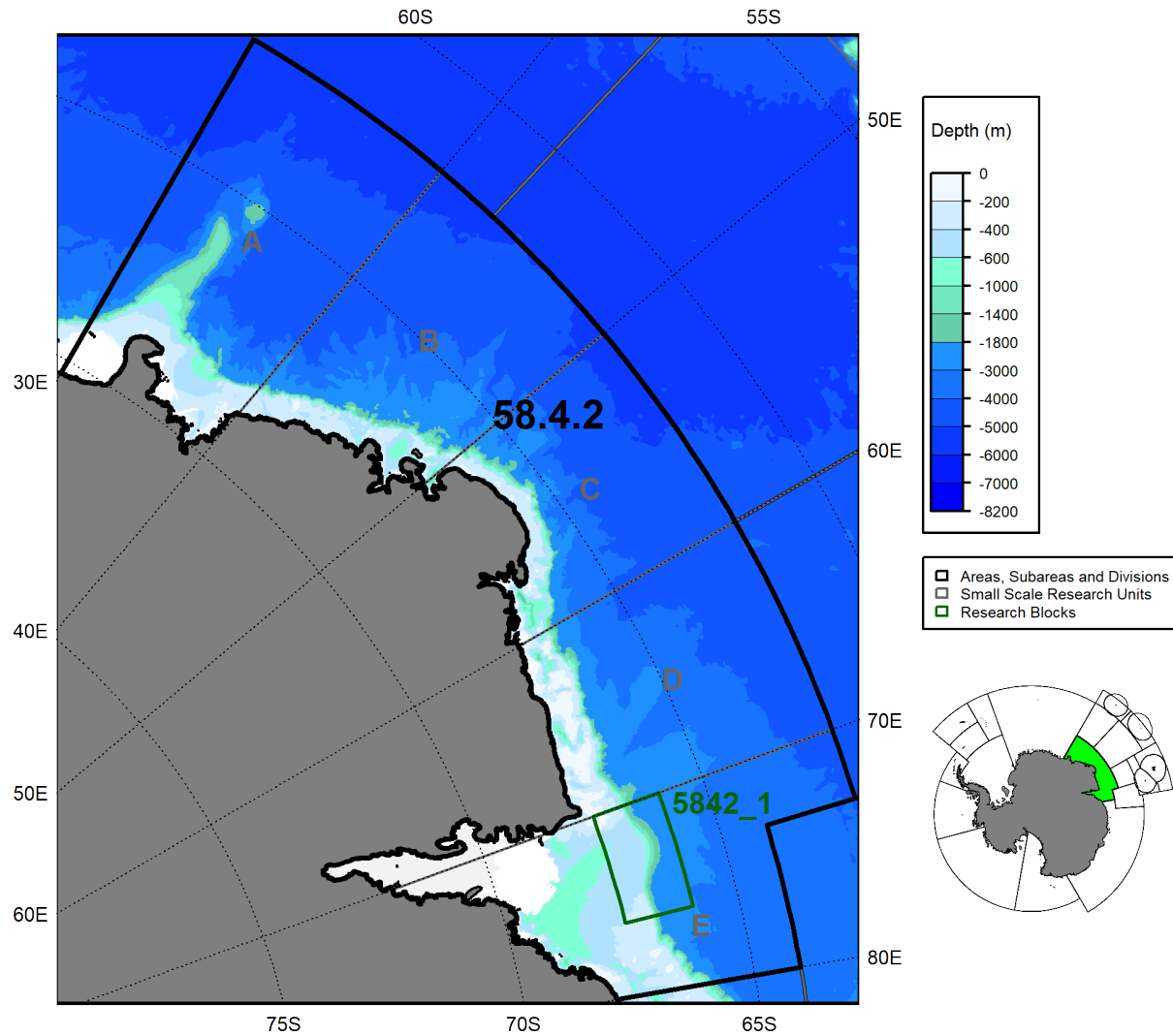
Figure 1: Location of Small Scale Research Units and Research Block in Division 58.4.2. The fishable depth range (600m-1800m) is highlighted in shades of green.

1.3. Active vessels

In 2021, 1 vessel participated in this fishery. For the 2022 fishing season, a total of 3 vessels notified their intention to participate in this fishery (2 from Australia; 1 from France).

1.4. Timeline of spatial management

In 2014, a Research Block (Fig. 1) was designated in Division 58.4.2 and catch limits applied. This Research Block was designed to ensure that research fishing occurred in those areas with a high probability of

recapturing tagged fish; fishing in this division is restricted to the Research Block only. Further details on research in this division are given in section 5.

2. Reported catch

2.1. Latest reports and limits

Reported catches of *Dissostichus* spp. are shown in Table 1. In this fishery, the catch of *D. mawsoni* reached a maximum of 216 tonnes in 2008. In 2021, 0 tonnes of *D. eleginoides* and 60 tonnes of *D. mawsoni* were caught.

The catches reported in Division 58.4.2 include catch data from particular vessels that CCAMLR has agreed should be quarantined as there is no confidence in the amount and/or the location of those catches (SC-CAMLR-XXXIII, paragraph 3.68). All ancillary data associated with these vessels (*e.g.* by catch, tagging, observer data) is also quarantined and is not included in the data presented in this report.

Table 1. Catch (tonnes) and effort history for *Dissostichus* spp. in this fishery. Source: Fine scale data and past estimates for IUU catch (-: no IUU estimate available; q: catch data currently quarantined).

Season	Number of vessels	Catch limit (tonnes)	*D. eleginoides*	*D. mawsoni*	Estimated IUU catch (tonnes)
2003	1		0	112	-
2004	1	500	0	20	197
2005	4	780	1	125	86
2006	3	780	0	164	192
2007	3	780	0	124	288
2008	3	780	0	216	0
2009	2	70	0	19 (q: 47)	176
2010	1	70		0 (q: 93)	432
2011	1	70		0 (q: 136)	-
2012	2	70	0	53	-
2013	1	70	0	4	-
2015	1	35		10	-
2017	2	35		35	-
2018	2	42	0	42	-
2019	2	50	0	50	-
2020	2	60	0	58	-
2021	1	60	0	60	-

Table 2: Catch and catch limits by Research Block in 2021 for *Dissostichus mawsoni* in Division 58.4.2. Source: Fine scale data.

Research Block	Catch limit	Catch (% of catch limit)
5842_1	60	60 (100%)

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.

The by-catch in Division 58.4.2 consists 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). 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	0	<1	0	0	0	0	0
2003	0	12	0	<1	0	0	<1
2004	80	<1	50	<1	0	100	<1
2005	124	19	50	3	3	60	2
2006	124	4	50	<1	0	60	<1
2007	124	7	50	<1	0	60	<1
2008	124	12	50	<1	0	60	1
2009	20	<1 q	50	0	0	40	<1 q
2010	20	<1 q	50	<1	7	40	<1 q
2011	20	<1 q	50	0	0	40	<1 q
2012	20	<1	50	0	0	40	<1
2013	20	<1	50	0	0	20	<1
2015	20	<1	50	0	0	20	<1
2017	6	1	2	0	0	6	<1
2018	7	5	2	<1	1	7	<1
2019	8	2	3	<1	2	8	<1
2020	10	2	3	<1	3	10	<1
2021	10	5	3	<1	0	10	<1

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.

By the end of this fishing season, there were no VMEs or VME Risk Areas designated in Division 58.4.2.

2.4. Incidental mortality of seabirds and marine mammals

There has been no observed incidental mortality of birds reported by vessels in Division 58.4.2 in this fishery.

There has been no observed incidental mortality of mammals reported by vessels in Division 58.4.2 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.

The risk level for birds in the fishery in Division 58.4.1 is category 2 (average to low) (SC-CAMLR-XXX, Annex 8, paragraph 8.1).

3. Illegal, Unreported and Unregulated (IUU) fishing

Two illegal, unreported and unregulated (IUU)-listed vessels were detected in Division 58.4.2 in 2006 and 2007. One IUU-listed fishing vessel was sighted in 2009 and two IUU-listed vessels were sighted in 2010. IUU fishing activities were not detected again until 2015. However, IUU fishing activities may still have occurred in the region between 2010 and 2014, but may not have been detected. However, since 2011, following the recognition of methodological issues in its assessment, no estimates of the IUU catch of *Dissostichus* spp. have been provided (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.

Data source	Data class	Variable	2017	2018	2019	2020	2021
Vessel crew	VME	line segments	170	165	241	259	239
		VME indicator units > 5 and < 10	0	0	0	0	0
		VME indicator units > 10	0	0	0	0	0
	by-catch	taxa identified	5	23	18	21	7
		records	62	221	145	185	147
Observer	VME	line segments	194	213	150	100	239
		taxa identified	9	11	11	5	5
		weight or volume measurements	25	70	44	9	7
	toothfish	specimens examined	555	1297	1622	1611	2044
		length measurements	554	1297	1620	1611	2016
		weigth measurements	507	1297	1478	1384	1718
		sex identifications	544	1297	1622	1611	2044
		maturity stage identifications	542	276	1431	1388	1735
		gonad weight measurements	202	1007	0	0	0
		otolith samples	246	1053	428	600	473
	by-catch	specimens examined	160	1944	1645	1519	2116
		taxa identified	10	12	15	8	8
		length measurements	143	1921	1565	1512	2112
		weigth measurements**	147	1944	1636	1511	2103
		standard length measurements*	0	0	278	568	445
		wingspan measurements*	0	1	4	3	4
		pelvic length measurements*	0	0	0	0	0
		snout to anus measurements*	78	1240	1319	861	1661
		sex identifications**	143	1865	1536	1519	2116
		maturity stage identifications**	26	0	1484	946	2116
		gonad weight measurements**	0	0	0	0	0
		otolith samples**	0	169	120	102	85

*: 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.

By-catch group	Variable	2017	2018	2019	2020	2021
Macrourus spp.	specimens examined	82	1250	1323	902	1666
	taxa identified	3	3	5	3	2
	length measurements	82	1229	1244	897	1663
	weigth measurements**	82	1250	1316	901	1659
	snout to anus measurements*	76	1240	1319	861	1661
	sex identifications**	82	1220	1253	902	1666
	maturity stage identifications**	17	0	1226	902	1666
	gonad weight measurements**	0	0	0	0	0
	otolith samples**	0	167	120	102	85
Skates and rays	specimens examined	0	1	4	3	4
	taxa identified	0	1	1	1	1
	length measurements	0	1	4	3	4
	weigth measurements**	0	1	4	3	4
	wingspan measurements*	0	1	4	3	4
	pelvic length measurements*	0	0	0	0	0
	sex identifications**	0	1	4	3	4
	maturity stage identifications**	0	0	2	2	4
	gonad weight measurements**	0	0	0	0	0
Other fish	specimens examined	61	691	318	614	446
	taxa identified	5	7	9	4	5
	length measurements	61	691	317	612	445
	weigth measurements**	61	691	316	607	440
	standard length measurements*	0	0	278	568	445
	sex identifications**	61	644	279	614	446
	maturity stage identifications**	9	0	256	42	446
	gonad weight measurements**	0	0	0	0	0
	otolith samples**	0	2	0	0	0

*: Species-dependent records
**: Voluntary records

4.3. Length frequency distributions

The length frequency distributions of *D. mawsoni* caught in this fishery are shown in Figure 2. 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 in the Division 58.4.2 fishery ranged from 50 to 175cm in length, with a relatively consistent broad mode at approximately 140cm (Fig. 2). In some years, a distinct bimodal distribution is observed and is likely to be as a result of vessels fishing in shallower water on the shelf.
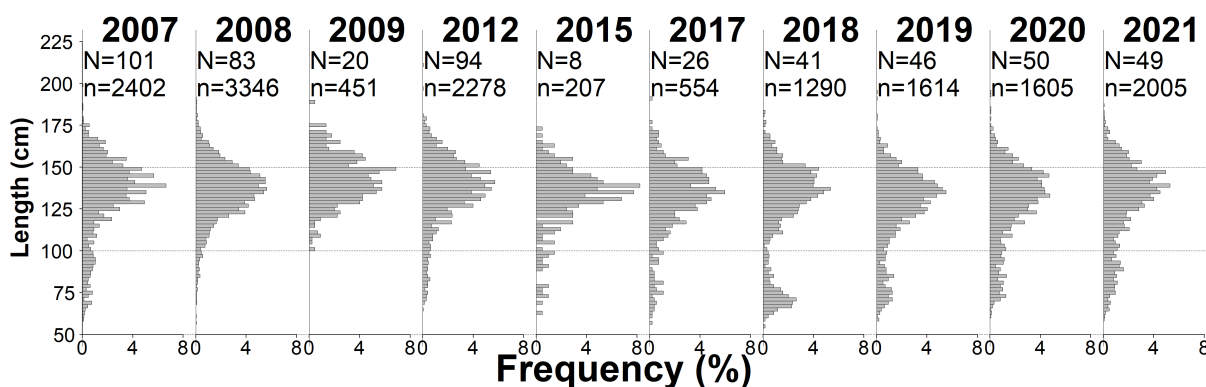
Figure 2. Annual length frequency distributions of *Dissostichus mawsoni* caught in Division 58.4.2. The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were measured in a given season.

4.3. 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. 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. 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).

Flag State	Vessel name	Fishing Season							
		2012	2013	2015	2017	2018	2019	2020	2021
Australia	Antarctic Aurora								5.2 (83.6,NC)
Australia	Antarctic Chieftain					5.1 (77.2,NC)	5.1 (93.1,NC)	5.6 (83.3,NC)	
France	Le Saint Andre				5.2 (88.4,-)	6 (83.2,-)	5.3 (72.9,-)	5.6 (87.4,-)	
Japan	Shinsei Maru No. 3		5.7 (NC,NC)						
Republic of Korea	Hong Jin No. 701	5 (77.4,-)							
Republic of Korea	Kingstar			8.5 (86.3,-)	5.5 (81.8,-)				
South Africa	Koryo Maru No. 11	5.2 (52.9,NC)							

To date in this area, 4010 *D. mawsoni* have been tagged and released (22 have been recaptured; Table 7), and, 39 *D. eleginoides* have been tagged and released (0 have been recaptured; Table 8).

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

Flag State	Vessel name	Fishing Season							
		2012	2013	2015	2017	2018	2019	2020	2021
Australia	Antarctic Aurora								309 (10)
Australia	Antarctic Chieftain					140 (0)	170 (0)	222 (3)	
France	Le Saint Andre				76 (0)	85 (0)	88 (5)	100 (2)	
Japan	Shinsei Maru No. 3		20 (0)						
Republic of Korea	Hong Jin No. 701	203 (0)							
Republic of Korea	Kingstar			82 (0)	110 (0)				
South Africa	Koryo Maru No. 11	63 (0)							
	Total	**266 (0)**	**20 (0)**	**82 (0)**	**186 (0)**	**225 (0)**	**258 (5)**	**322 (5)**	**309 (10)**

Table 8. Number of *D. eleginoides* tagged in recent fishing Seasons. The number of fish recaptured by each vessel in each Season is provided in brackets.

Flag State	Vessel name	Fishing Season							
		2012	2013	2015	2017	2018	2019	2020	2021
Australia	Antarctic Aurora								0 (0)
Australia	Antarctic Chieftain					1 (0)	0 (0)	1 (0)	
France	Le Saint Andre				0 (0)	0 (0)	0 (0)	0 (0)	
Japan	Shinsei Maru No. 3		1 (0)						
Republic of Korea	Hong Jin No. 701	0 (0)							
Republic of Korea	Kingstar			0 (0)	0 (0)				
South Africa	Koryo Maru No. 11	3 (0)							
	Total	**3 (0)**	**1 (0)**	**0 (0)**	**0 (0)**	**1 (0)**	**0 (0)**	**1 (0)**	**0 (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)). 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.

Spanish and Australian scientists are working on the age and growth estimates of Antarctic toothfish within divisions 58.4.1 and 58.4.2 from 2015 and 2017 respectively.

In 2018, an initial stock assessment model was developed for Antarctic toothfish in Divisions 58.4.1 and 58.4.2 (WG-FSA-18/58 rev1) but deemed to be unsuitable to provide management advice on catch limits.

In 2019, Korean scientists joined this collaborative work (WG-FSA-2019/47).

In 2021, WG-FSA-2021/18 presented a report of research activities conducted in this Division since 2012.

5.2. Research plans

5.2.1. Background Exploratory fishing for toothfish (*Dissostichus* spp.) in Division 58.4.2 began in 2003. However, a robust stock assessment and catch limits according to CCAMLR decision rules remain to be determined for this Division. Accordingly, the current exploratory Antarctic toothfish (*Dissostichus mawsoni*) fishery in this Division has been identified as 'data-poor'. In 2014, a Research Block was designated in this Division. Research plans are generally focused in Research Block, to facilitate the development of local biomass estimates. All Members notifying to fish in Division 58.4.2 submitted a research plan, based on Conservation Measure 24-01, Annex 24-01/A, format 2.

In 2019, Australia, France, Japan, the Republic of Korea and Spain collaborated on a multi-member research plan on the *Dissostichus mawsoni* exploratory fishery in East Antarctica (Divisions 58.4.1 and 58.4.2) (WG-FSA-2019/44).

In 2021, that research plan was updated with 2022 operating details, a change to the sampling design within existing research blocks, and a proposed new research block WG-SAM-2021/03.

5.2.2. Objectives Standard catch, fishing effort, tagging and biological data will be collected under Conservation Measures 41-05 and 41-11 to inform an assessment of the status and productivity of toothfish stocks in this Division. Annual milestones include updated reports on research activity and collected data, ageing of collected toothfish otoliths, and updated estimation of biological parameters. Environmental data collection will entail the attachment of conductivity, temperature and depth loggers (CTD loggers) and Benthic Video Cameras (BVCs) to fishing gear. Bycatch data will be collected in accordance with the relevant conservation measures. These data will help to inform estimations of the distribution, relative abundance, and life history of the main bycatch species. Samples of fish muscle tissue, stomach contents, plankton and zooplankton will be used for the investigation of trophic relationships and ecosystem function using stable isotope.

The 2021 multi-member research plan (WG-SAM-2021/03) aims to achieve four objectives:

Objective 1: Provide an assessment of the status and productivity of toothfish stocks in Divisions 58.4.1 and 58.4.2.

Objective 2: Identify the spatial distributions of toothfish, important habitats and vulnerable marine ecosystems (VME) in order to inform spatial management approaches.

Objective 3: Identify the spatial and depth distributions of bycatch species, and inform bycatch mitigation measures.

Objective 4: Improve the understanding of trophic relationships and ecosystem function to assist the development of ecosystem-based fisheries management approaches.

5.3. Advice by the Scientific Committee

In 2016, the Scientific Committee considered the advice of WG-FSA on research in Divisions 58.4.1 and 58.4.2 and agreed that the research plan in WG-FSA-16/29 was appropriate to achieve the research objectives.

In 2017, the Scientific Committee recommended that the catch limits for these divisions remain unchanged for 2018 and supported the catch allocation scheme developed by the research proponents in 2016.

In 2019, the Commission agreed that the research plan was appropriate to achieve the research objectives in 58.4.2, with a catch limit of 50 tonnes in Research Block 5842_1.

In 2021, following the Scientific Committee's advice (SC-CCAMLR-40, paragraph 3.104), the Commission agreed that this research should proceed in 2022 (CCAMLR-40, paragraph 6.40).

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

A recent summary of the potential impacts of climate change on Southern Ocean fisheries (FAO 2018) highlights 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.

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.

There is no formal evaluation of the impacts of climate change and environmental variability available for this particular fishery.

Additional Resources

- Fishery Summary: pdf, html

- Species Description: pdf, html

- Trend Analysis: pdf, html

- Fisheries Documents Browser