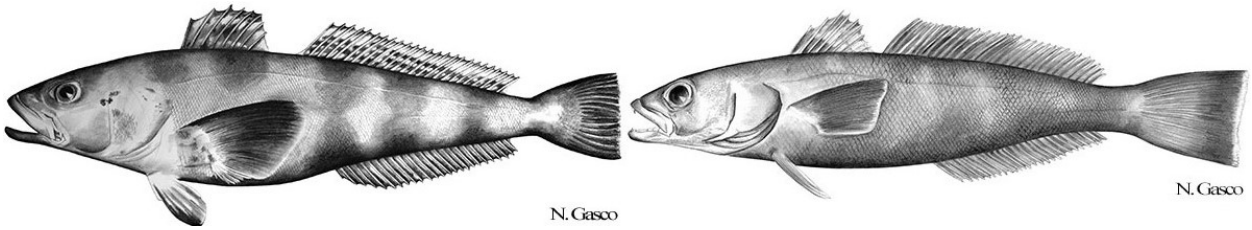
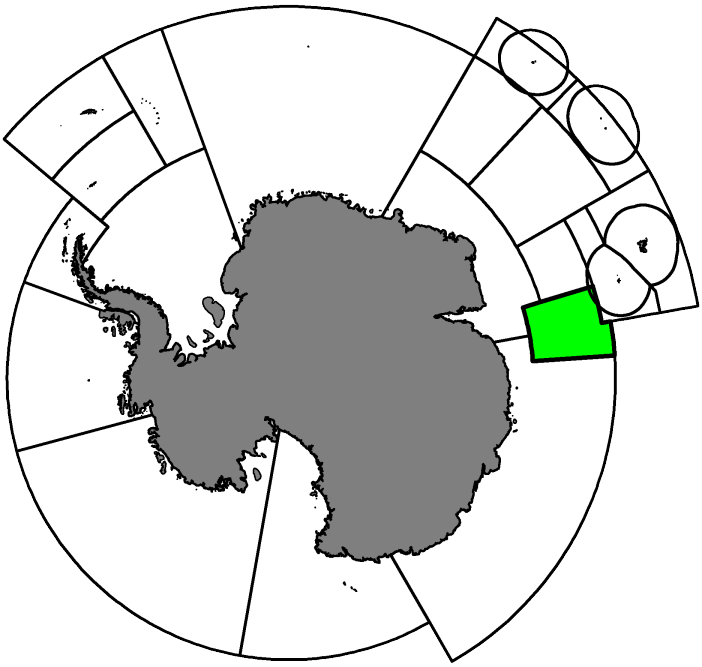
Fishery Report 2021: *Dissostichus eleginoides* and *Dissostichus mawsoni* in Division 58.4.3b

CCAMLR Secretariat

27 May 2022



Antarctic toothfish *Dissostichus mawsoni* Norman, 1937, and, Patagonian toothfish *Dissostichus eleginoides* Smitt, 1898.



Map of the management areas within the CAMLR Convention Area. Division 58.4.3b, 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 Patagonian toothfish (*Dissostichus eleginoides*) and Antarctic toothfish (*Dissostichus mawsoni*) in Division 58.4.3b. 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. That year, the Commission agreed on four exploratory fisheries for *Dissostichus* spp. in this region outside Australia's national jurisdiction: exploratory trawl fisheries on BANZARE Bank (Conservation Measure 203/XIX) and Elan Bank (Conservation Measure 205/XIX); and exploratory longline fisheries on BANZARE Bank (Conservation Measure 204/XIX) and Elan Bank (Conservation Measure 206/XIX).

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). The Commission agreed to exploratory fisheries for *Dissostichus* spp. in each of these new divisions. Since 2004, licensed longline vessels have fished in Division 58.4.3b for *Dissostichus* spp. targeting primarily *D. mawsoni* with smaller catches of Patagonian toothfish (*D. eleginoides*). Prior to 2018, 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. mawsoni*, with any *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 *Dissostichus* spp. in Division 58.4.3b are described in Conservation Measure 41-07.

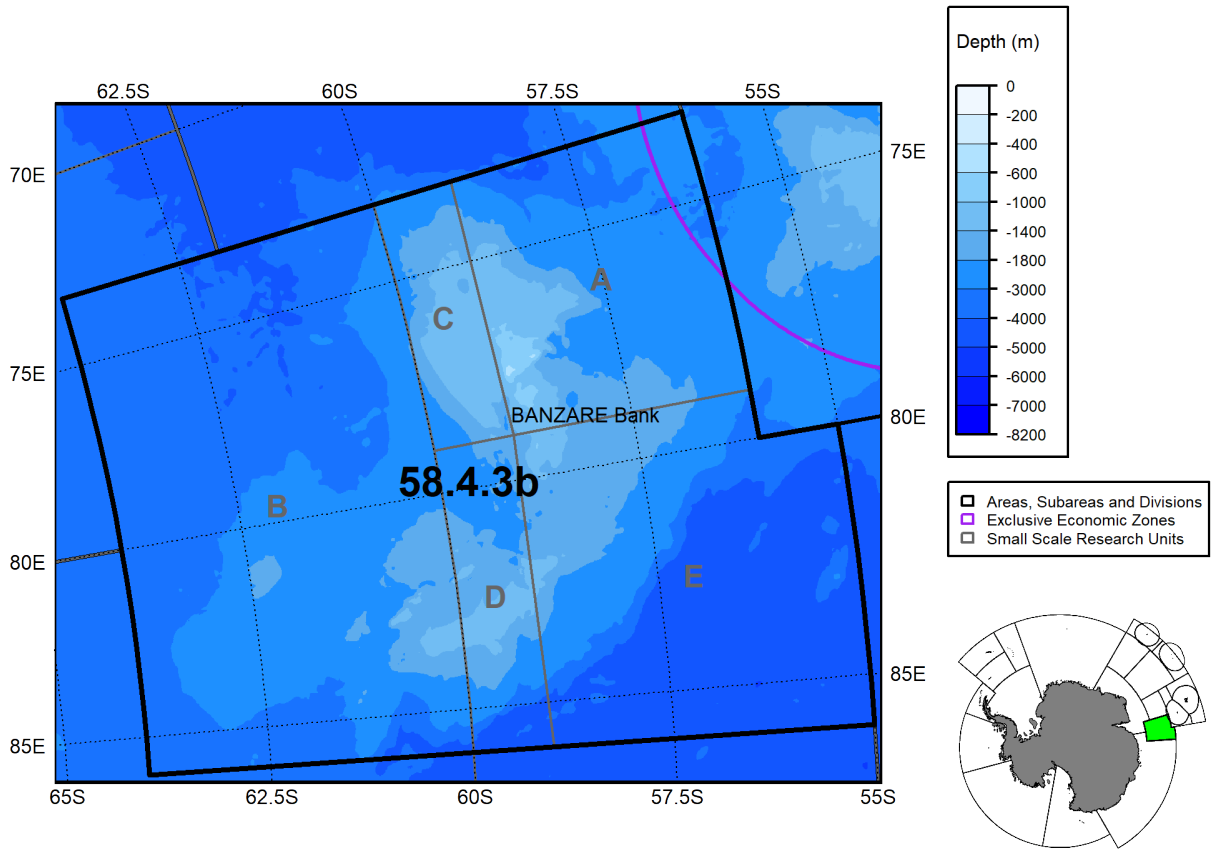


Figure 1: Location of the Small Scale Research Units in Division 58.4.3b.

1.3. Active vessels

In 2012, when fishing last occurred, 1 vessel participated in this fishery. For the 2022 fishing season, no vessels notified their intention to participate in this fishery.

1.4. Timeline of spatial management

In 2007, Division 58.4.3b was subdivided into Small-Scale Research Units (SSRUs; Fig. 1) A (north of 60°S) and B (south of 60°S). In 2008, SSRU A was further subdivided into SSRUs A, C, D and E.

2. Reported catch

2.1. Latest reports and limits

The current limits on the exploratory fishery for *Dissostichus* spp. in Division 58.4.3b are described in Conservation Measure 41-07. Since 2010, fishing in this division has been limited to research only, in accordance with Conservation Measure 24-01, and the commercial catch limit set at 0 tonnes (Table 1). No fishing has taken place since 2012. The catches reported in Division 58.4.3b include catch data from one vessel 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.

In this fishery, the catch of *D. mawsoni* reached a maximum of 360 tonnes in 2006. In 2012, 5 tonnes of *D. eleginoides* and 4 tonnes of *D. mawsoni* were caught.

There has been no directed fishing in Division 58.4.3b since 2012.

Table 1. Catch (tonnes) and effort history *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)
2004	1	300	1	6	-
2005	4	300	0	297	1015
2006	4	300	0	360	1903
2007	4	300	39 (q: 35)	173 (q: 3)	3226
2008	4	200	41	100	360
2009	2	120	15	89	610
2010	1	0	2	12	171
2011	1	0	2	8	-
2012	1	0	5	4	-

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.

Macrourus spp. and *Raja taaf* were very common by-catch species during the survey conducted by Australia in May 2008, summarised in WG-FSA-08/57, indicating that previous by-catch records of rajids from the northern area of the division were likely to be *R. taaf*. The sex specific size at maturity of *R. taaf* was estimated based on individuals caught in the survey, indicating that males and females have a median total length at maturity of 75.5 and 79.5cm respectively. The majority of the catch ranged between 40 and 90cm, indicating that juvenile females may be more vulnerable to longline gear.

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). 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)
1999	0	<1	0	0	0	0	0
2004	159	<1	50	<1	0	20	0
2005	159	7	50	6	0	20	<1
2006	159	8	50	<1	0	20	<1
2007	159	10 q	50	2 q	1267 q	20	<1 q
2008	80	9	50	1	157	20	2
2009	80	4	50	1	97	20	<1
2010	80	2	50	<1	22	20	<1
2011	-	1	-	<1	0	-	<1
2012	-	<1	-	<1	0	-	<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.

There are no VMEs or VME Risk Areas designated in Division 58.4.3b.

2.4. Incidental mortality of seabirds and marine mammals

There has been no observed incidental mortalities of seabirds reported by vessels in Division 58.4.3b in this fishery.

No mammal interactions or mortalities have been observed by vessels in Division 58.4.3b 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 58.4.3b is category 3 (average) (SC-CAMLR-XXX, Annex 8, paragraph 8.1).

3. Illegal, Unreported and Unregulated (IUU) fishing

Illegal, Unreported and Unregulated (IUU) fishing activities were a prevalent issue in Division 58.4.3b (BANZARE Bank) for a significant portion of the last decade, with 13 IUU-listed vessels observed in this division during 2006 and 14 IUU-listed vessels observed during 2007. In 2008, three IUU-listed vessels were observed. Four IUU-listed fishing vessels, one unknown vessel, and IUU fishing gear were observed in the division during 2009, and three IUU-listed vessels were sighted during 2010. IUU fishing activities remained persistent during 2011, 2012 and 2013, with no IUU fishing activities observed during 2014 and 2015. Given the history of high level of IUU fishing activities in this division, it is possible that IUU activities did occur, but

were undetected from 2014 to 2016. However, 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.

Data source	Data class	Variable	2017	2018	2019	2020	2021
Vessel crew	VME	line segments	0	0	0	0	0
		VME indicator units $>$ 5 and $<$ 10	0	0	0	0	0
		VME indicator units $>$ 10	0	0	0	0	0
	by-catch	taxa identified	0	0	0	0	0
		records	0	0	0	0	0
Observer	VME	line segments	0	0	0	0	0
		taxa identified	0	0	0	0	0
		weight or volume measurements	0	0	0	0	0
	toothfish	specimens examined	0	0	0	0	0
		length measurements	0	0	0	0	0
		weigth measurements	0	0	0	0	0
		sex identifications	0	0	0	0	0
		maturity stage identifications	0	0	0	0	0
		gonad weight measurements	0	0	0	0	0
		otolith samples	0	0	0	0	0
	by-catch	specimens examined	0	0	0	0	0
		taxa identified	0	0	0	0	0
		length measurements	0	0	0	0	0
		weigth measurements	0	0	0	0	0
		standard length measurements*	0	0	0	0	0
		wingspan measurements*	0	0	0	0	0
		pelvic length measurements*	0	0	0	0	0
		snout to anus measurements*	0	0	0	0	0
		sex identifications**	0	0	0	0	0
		maturity stage identifications**	0	0	0	0	0
		gonad weight measurements**	0	0	0	0	0
		otolith samples**	0	0	0	0	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.

By-catch group	Variable	2017	2018	2019	2020	2021
Macrourus spp.	specimens examined	0	0	0	0	0
	taxa identified	0	0	0	0	0
	length measurements	0	0	0	0	0
	weigth measurements	0	0	0	0	0
	standard length measurements*	0	0	0	0	0
	snout to anus measurements*	0	0	0	0	0
	sex identifications**	0	0	0	0	0
	maturity stage identifications**	0	0	0	0	0
	gonad weight measurements**	0	0	0	0	0
	otolith samples**	0	0	0	0	0
Skates and rays	specimens examined	0	0	0	0	0
	taxa identified	0	0	0	0	0
	length measurements	0	0	0	0	0
	weigth measurements	0	0	0	0	0
	wingspan measurements*	0	0	0	0	0
	pelvic length measurements*	0	0	0	0	0
	sex identifications**	0	0	0	0	0
	maturity stage identifications**	0	0	0	0	0
	gonad weight measurements**	0	0	0	0	0
Other fish	specimens examined	0	0	0	0	0
	taxa identified	0	0	0	0	0
	length measurements	0	0	0	0	0
	weigth measurements	0	0	0	0	0
	standard length measurements*	0	0	0	0	0
	sex identifications**	0	0	0	0	0
	maturity stage identifications**	0	0	0	0	0
	gonad weight measurements**	0	0	0	0	0
	otolith samples**	0	0	0	0	0

*: Species-dependent records
**: Voluntary records

4.3. Length frequency distributions

The length frequency distributions of *D. eleginoides* and *D. mawsoni* caught in this fishery are presented in Figures 2 and 3. 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 Division 58.4.3b ranged from 100 to 175cm with a single mode, in all seasons, at approximately 140cm. *Dissostichus eleginoides* comprised a much wider length range of 50-175cm with a broad mode at approximately 110cm.

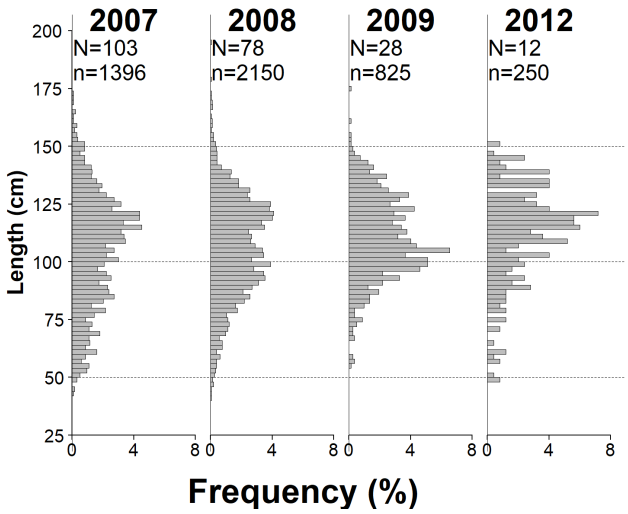


Figure 2. Annual length frequency distributions of *D. eleginoides* caught in Division 58.4.3b. The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were measured.

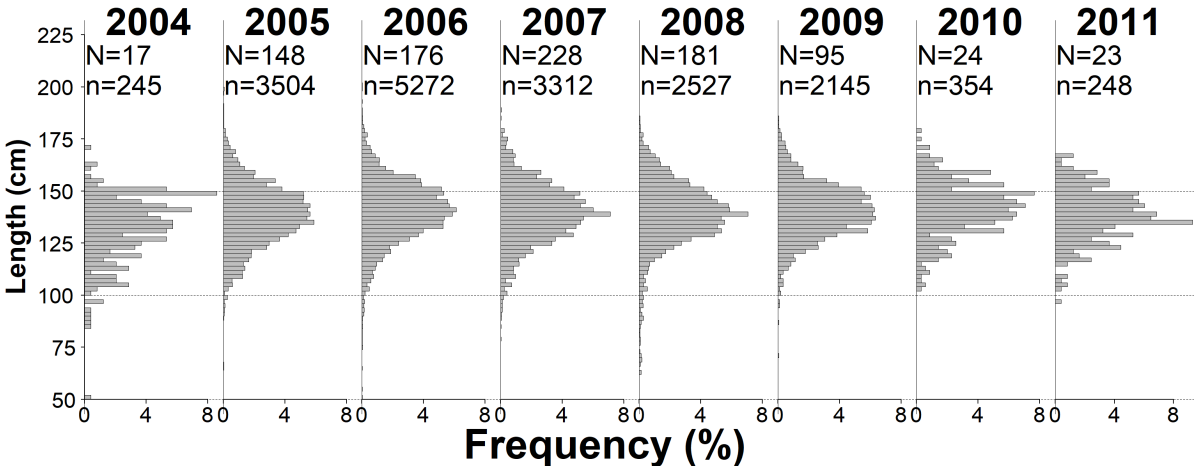


Figure 3. Annual length frequency distributions of *Dissostichus mawsoni* caught in Division 58.4.3b. The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were measured.

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 3). 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).

		Fishing Season		
Flag State	Vessel name	2010	2011	2012
Japan	Shinsei Maru No. 3	4.3 (58,NC)	5.7 (86.6,NC)	5.7 (NC,59.8)

To date in this area, 1198 *D. mawsoni* have been tagged and released (10 have been recaptured; Table 6), and, 401 *D. eleginoides* have been tagged and released (1 have been recaptured; Table 7).

Since 2013, no fishing has occurred in Division 58.4.3b and thus no data on tagging was obtained.

Table 6. Number of *D. mawsoni* 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
Japan	Shinsei Maru No. 3	52 (0)	46 (0)	21 (0)
	Total	**52 (0)**	**46 (0)**	**21 (0)**

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
Japan	Shinsei Maru No. 3	8 (1)	16 (0)	30 (0)
	Total	**8 (1)**	**16 (0)**	**30 (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.

The results of an analysis of fine-scale catch and effort data indicated that intensive legal fishing in small areas, combined with high levels of IUU fishing, have resulted in the localised depletion of *Dissostichus* spp. in Division 58.4.3b and a severe decline in catch-per-unit-effort (CPUE).

A random longline survey was carried out in this division by Australia in May 2008 (WG-FSA-08/57). The results of the survey indicated that catch rates of *Dissostichus* spp. were much lower than what had been reported for commercial fishing, between 17 and 60 kg/thousand hooks (95% confidence limits), and were consistent with toothfish being depleted to low densities across the surveyed area.

The results of the survey concluded that:

(i) based on fishing information until 2007, the fisheries across BANZARE Bank show that the preferred fishing grounds were depleted in the southern area (adopted by the 2007 meeting of the Working Group on Fish Stock Assessment (WG-FSA-07), resulted in the closure of the southern area)

(ii) based on the survey and fisheries across BANZARE Bank, there are very few fish apart from in the preferred fishing grounds

(iii) there are no small fish found in the preferred fishing grounds; all are large, are dominated by males (79%) and are likely spawning

(iv) in the East Antarctic, spawning fish have only been found on BANZARE Bank (WG-FSA-07/44).

Due to their proximity, the fish on BANZARE Bank are likely to recruit from the coastal areas of Antarctica in the Indian Ocean sector. Three scenarios for the stock on BANZARE Bank (SC-CAMLR-XXVIII, Annex 5, paragraph 5.57) are illustrated in Figure 4.

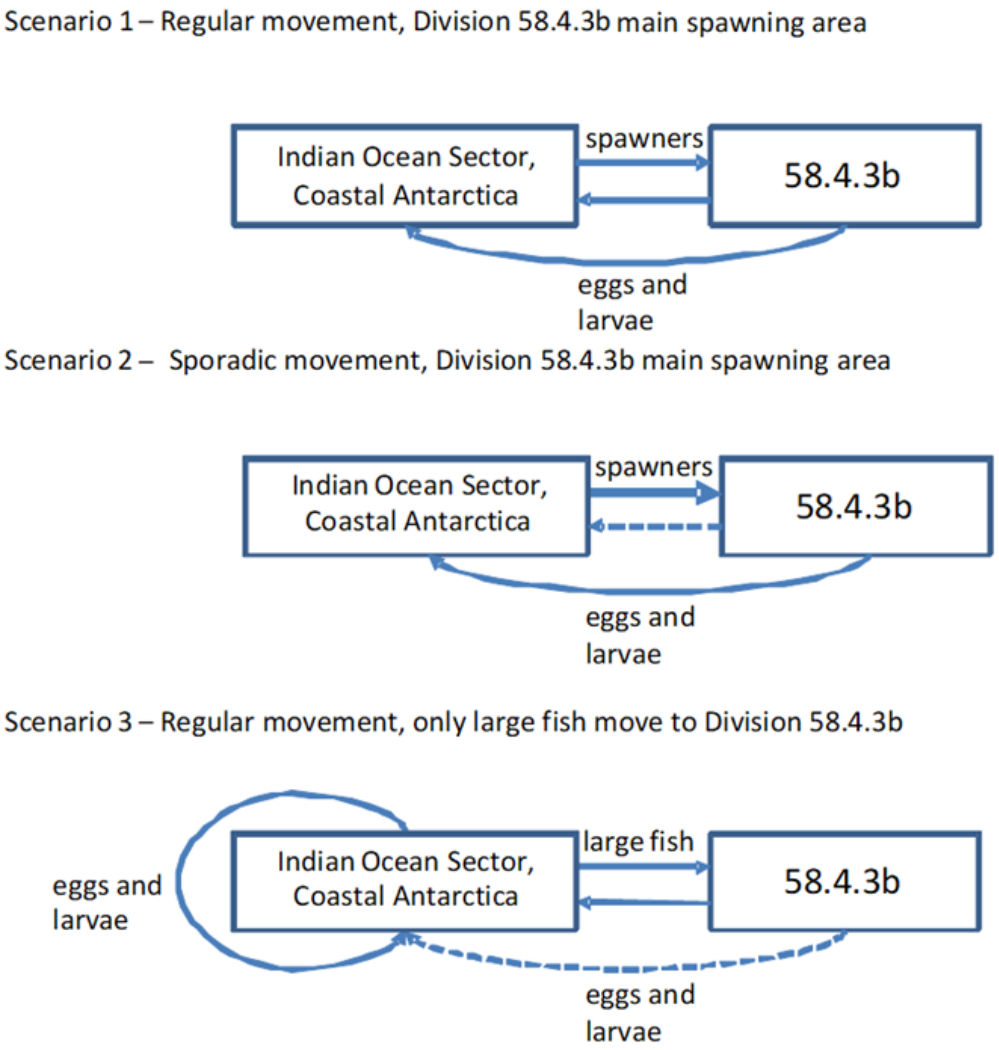


Figure 4. Diagram illustrating possible scenarios for the *Dissostichus mawsoni* stock on BANZARE Bank (Division 58.4.3b). Solid arrows indicate regular movements of fish, dashed arrows indicate sporadic movement of fish.

Exploratory longline fishing during 2007-2009 indicated that *D. eleginoides* was typically found in shallower waters than *D. mawsoni*, and that larger fish (predominantly female) were found deeper (WG-FSA-10/47). Based on the size distribution of catches, the study concluded that recruitment to BANZARE Bank is unlikely and that the population may consist primarily of adults migrating from other areas. The Working Group noted that this study only used data from a single vessel. However, the conclusions of the paper seemed consistent with previous work on the biology and ecology of toothfish in this area, such as that described in WG-FSA-08/57.

5.2. Research plans

There are currently no plans for research in this fishery.

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

Although there has been no integrated stock assessment for this data-poor 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.

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. 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.

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 for Patagonian Toothfish: pdf, html
- Species Description for Antarctic Toothfish: pdf, html
- Fisheries Documents Browser