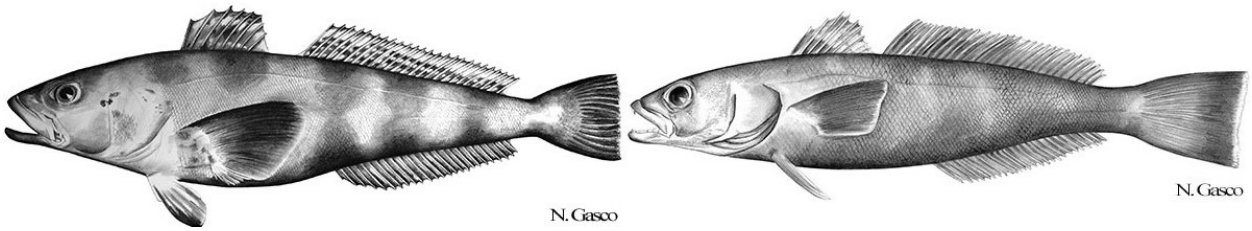
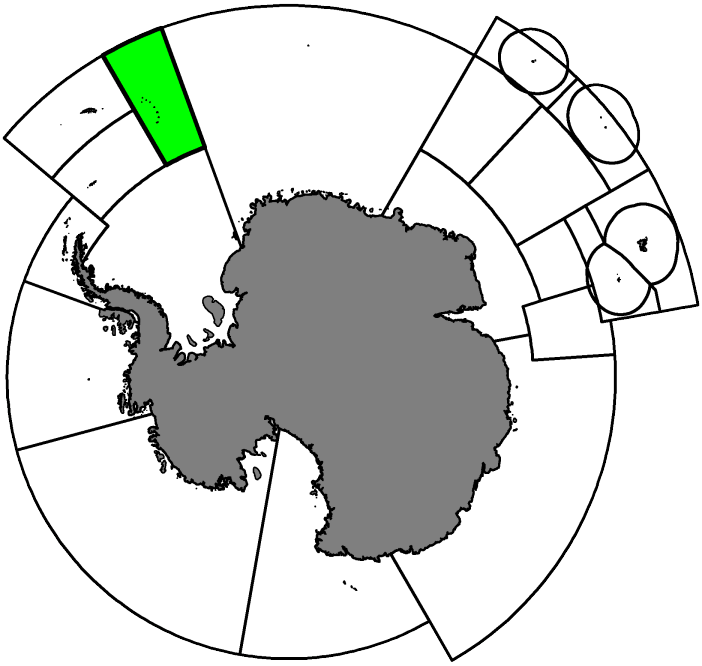
Fishery Report 2020: *Dissostichus eleginoides* and *Dissostichus mawsoni* in Subarea 48.4

CCAMLR Secretariat

16 March 2021



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



Map of the management areas within the CAMLR Convention Area. Subarea 48.4, the region discussed in this report is shaded in green. Throughout this report, "2020" refers to the 2019/20 CCAMLR fishing season (from 1 December 2019 to 30 November 2020).

Contents

1. Introduction to the fishery

1.1. History

This report describes the longline fishery for Patagonian (*Dissostichus eleginoides*) and Antarctic (*D. mawsoni*) toothfish in Subarea 48.4.

The fishery for *D. eleginoides* in Subarea 48.4 was initiated as a new fishery in 1993 following notifications from Chile and the USA (SC-CAMLR-XI, Annex 5, paragraph 6.22), and the adoption of Conservation Measure 44/XI, which set a precautionary catch limit for *D. eleginoides* of 240 tonnes for that season. Subsequently, the USA withdrew from the fishery and the Chilean longline vessel abandoned fishing after one week of poor catches (SC-CAMLR-XII, Annex 5, paragraph 6.2). In addition, a Bulgarian-flagged longliner fished in November and December 1992 and reported a catch of 39 tonnes of *D. eleginoides* (SC-CAMLR-XII, Annex 5, paragraph 6.1).

There was no further fishing activity in Subarea 48.4 until 2005 when a mark-recapture experiment was initiated.

The UK conducted a multi-year (2017-2019) effort-limited research program to the south of the directed fishery area in Subarea 48.4 examining the linkages between *D. mawsoni* in Subarea 48.2 and the adjacent area of Subarea 48.4.

According to the Stock Assessment of this fishery, observed recruitment is characterised by a larger pulse from the early 2000s, followed by low background levels of recruitment. The stock hypothesis currently used in the assessment assumes a single stock unit for this subarea. The characteristics of the growth and maturity do not provide evidence for localised spawning activity.

1.2. Conservation Measures currently in force

The limits on the established fishery for *Dissostichus* spp. in Subarea 48.4 are defined in Conservation Measure 41-03.

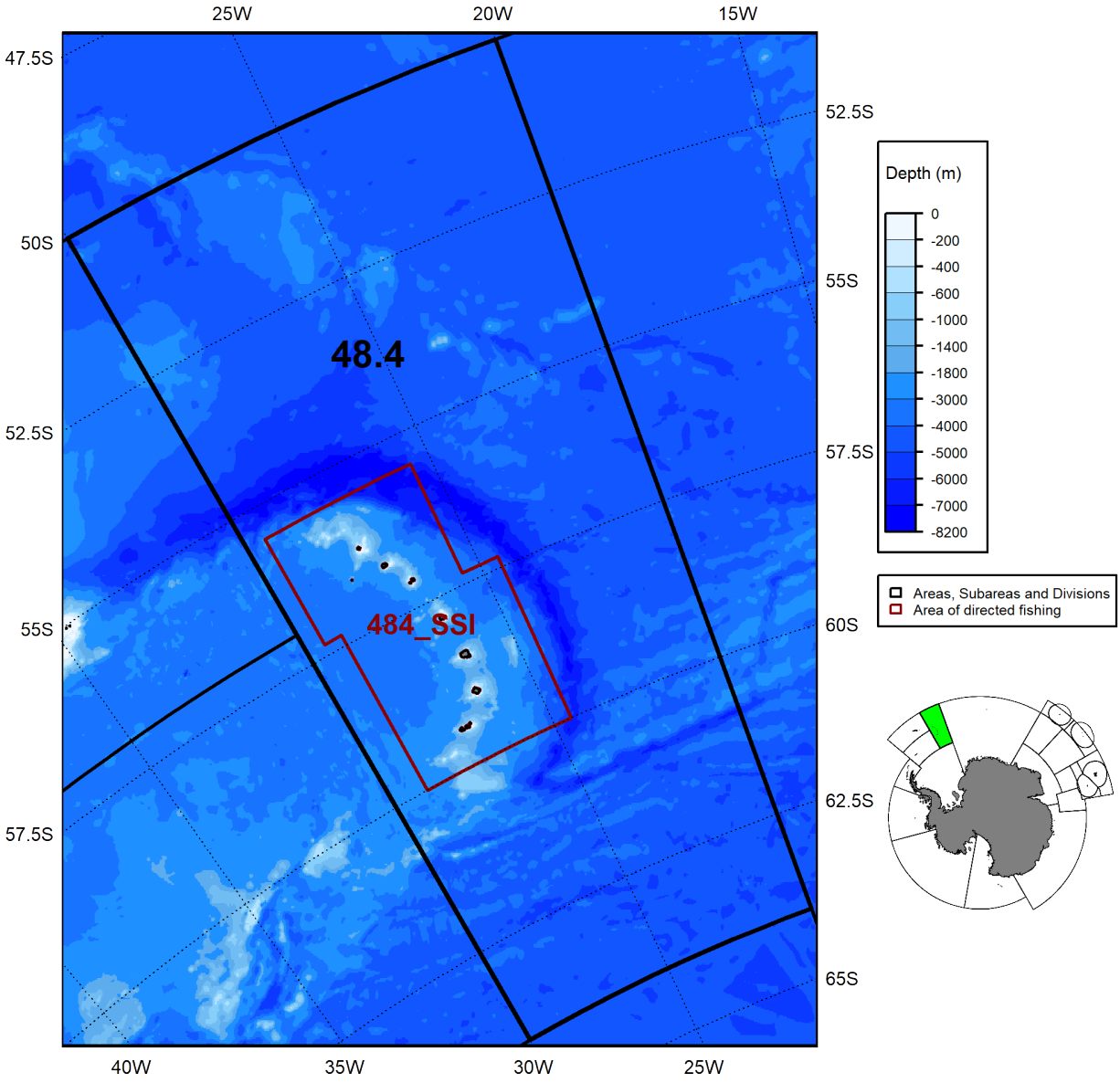


Figure 1: Location of the area of directed fishing in Subarea 48.4.

1.3. Active vessels

In 2020, 2 vessels participated in this fishery.

1.4. Timeline of spatial management

In 2008, the Commission agreed to divide Subarea 48.4 into a northern area (Subarea 48.4N) and a southern area (Subarea 48.4S) with directed longline fisheries of *D. eleginoides* in Subarea 48.4N and Dissostichus spp. in Subarea 48.4S with a single catch limit applied to both species.

In 2014, the management approach in this subarea was changed and rather than using the northern and

southern areas, separate catch limits were set for both species within the directed fishing area specified in Conservation Measure 41-03.

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 98 tonnes in 2008. In 2020, 19 tonnes of *D. eleginoides* and 44 tonnes of *D. mawsoni* were caught.

Table 1. Catch (tonnes) and effort history for *Dissostichus* spp. in this fishery. The separate catch limits for *D. eleginoides* and *D. mawsoni* from 2014 onwards are shown here separated by a semicolon. Source: Fine scale data.

Season	Number of vessels	Catch limit (tonnes)	*D. eleginoides*	*D. mawsoni*	Estimated IUU catch (tonnes)
1990	1		0		-
1992	1		30		-
1993	1		10		-
2005	1	100	27		-
2006	2	100	19	0	-
2007	2	100	54	0	-
2008	2	100	98	0	-
2009	2	150	74	59	-
2010	2	116	57	56	-
2011	2	70	39	15	-
2012	2	81	55	22	-
2013	2	115	72	40	-
2014	2	44 ; 24	44	24	-
2015	2	42 ; 28	42	28	-
2016	2	47 ; 39	42	28	-
2017	2	47 ; 38	28	19	-
2018	2	26 ; 37	17	32	-
2019	2	26 ; 37	17	33	-
2020	2	27 ; 45	19	44	-

2.2. By-catch

Catch limits for by-catch species groups (macrourids, skates (Rajids) and other species) are defined in Conservation Measure 41-03.

As defined in Conservation Measure 41-03, if the by-catch of skates exceeded 5% of the catch of *Dissostichus* spp. in any one haul or set, or if the catch of *Macrourus* spp. reached 150kg and exceeds 16% of the catch of *Dissostichus* spp. 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.

In addition to the mitigation measures described in Conservation Measure 41-03, skates are handled and released following 'Year-of-the-Skate' protocols to maximise their survival.

Catches of by-catch species groups (macrourids, skates (Rajids) and other species) and number of skates released alive, are summarised in Table 2. The by-catch limits in Subarea 48.4 (as set out in Conservation Measure 41-03) have changed with the development of the Fishery Research: from 2005 to 2008 there were no specified limits, from 2009 to 2013 there was an overall by-catch limit for macrourids and skates in Subarea 48.4N and a move-on rule provision in Subarea 48.4S, and in 2014, with the introduction of species-specific catch limits for the two target species, whole-fishery catch limits for macrourids and skates were introduced.

Table 2. Reported catch and catch limits for by-catch species (*Macrourus* spp., Rajids and others) in this fishery (see Conservation Measure 41-03 for details). Source: fine-scale data.

Season	*Macrourus* spp.		Rajids			Other catch	
	Catch Limit (tonnes)	Reported Catch (tonnes)	Catch Limit (tonnes)	Reported Catch (tonnes)	Number Released	Catch Limit (tonnes)	Reported Catch (tonnes)
1990	0	<1	0	<1	0	0	<1
2005	-	3	-	0	0	-	<1
2006	-	5	-	1	4359	-	<1
2007	-	14	-	2	6515	-	<1
2008	-	16	-	4	8276	-	<1
2009	-	26	-	2	9767	-	1
2010	-	16	-	2	6183	-	1
2011	-	5	-	<1	4680	-	<1
2012	-	7	-	<1	5582	-	<1
2013	-	6	-	<1	3115	-	<1
2014	11	3	3.5	<1	1124	-	<1
2015	11.2	4	3.5	<1	624	-	<1
2016	13.8	3	4.3	<1	1203	-	<1
2017	13.6	4	4.3	<1	1549	-	<1
2018	10.1	5	3.2	2	1768	-	<1
2019	10.1	4	3.2	<1	1750	-	<1
2020	11.5	3	3.6	<1	2322	-	<1

The distribution of skates and macrourids in Subarea 48.4 has been investigated and their distributions described in WG-FSA-09/17 and 09/18.

Catch rates for macrourids in the north of Subarea 48.4 were high at the start of the fishery. Vessels subsequently altered their fishing techniques and areas to avoid macrourid by-catch and rates dropped (Table 2).

Macrourid catches were previously thought to almost entirely comprise Whitson's grenadier (*Macrourus whitsoni*). Subsequent taxonomic studies (including genetic analyses) now indicate that the Macrourus population comprises two species, including *M. whitsoni* and the recently described species Caml grenadier (*M. caml*) (WG-FSA-10/33; McMillan et al., 2012).

2.3. Vulnerable marine ecosystems (VMEs)

As Conservation Measure 22-06 does not apply to this subarea there are no CCAMLR VMEs or VME Risk Areas designated in Subarea 48.4. There are fishery-specific restrictions in place to mitigate the impact of the fishery on vulnerable marine ecosystems (VMEs), including benthic communities and benthos such as seamounts, hydrothermal vents and cold-water corals.

2.4. Incidental mortality of seabirds and marine mammals

In 2017, one Southern giant petrel (*Macronectes giganteus*) was killed in the fishery in Subarea 48.4. There have been no reported mammal mortalities reported by vessels in this fishery.

The level of risk of incidental mortality of birds in Subarea 48.4 is category 3 (medium) (SC-CAMLR-XXX, Annex 8, paragraph 8.1).

Conservation Measure 25-02 on minimisation of the incidental mortality of birds in longline fishing applies to this subarea. Conservation Measure 41-03 also stipulates that if any vessel catches three seabirds in a season then that vessel must only set longlines at night.

3. Illegal, Unreported and Unregulated (IUU) fishing

Data on potential illegal, unreported and unregulated (IUU) fishing in this Subarea is limited to sightings from licenced vessels (including fishing vessels, expedition yachts and research ships). There has been no recorded evidence of IUU fishing activities in Subarea 48.4 since 2006.

4. Data collection

4.1. Data collection requirements

The collection of biological data 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. Length frequency distributions

The recent 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 length frequency distribution of *D. eleginoides* caught in Subarea 48.4 shows a shifting mode from around 120 cm at the beginning of the time series to 140 cm in recent years (Figure 2). A second mode of smaller fish (75cm) is evident in 2010 and develops throughout the remainder of the time series, indicating a recruitment pulse.

The length frequency distribution of *D. mawsoni* (Figure 3) is dominated by a single strong mode around 150cm and does not show any cohort progression between years as observed in the length frequency distributions of *D. eleginoides*.

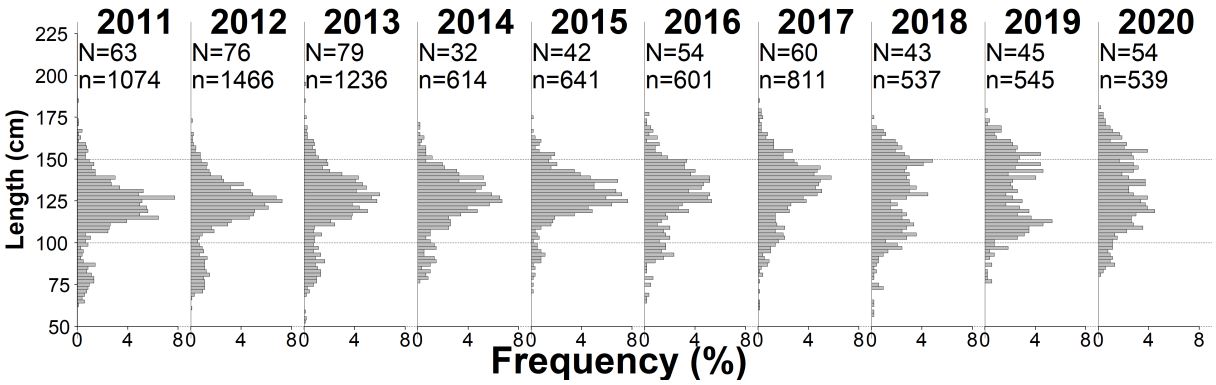


Figure 2. Annual length frequency distributions of *D. eleginoides* caught in Subarea 48.4. The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were measured.

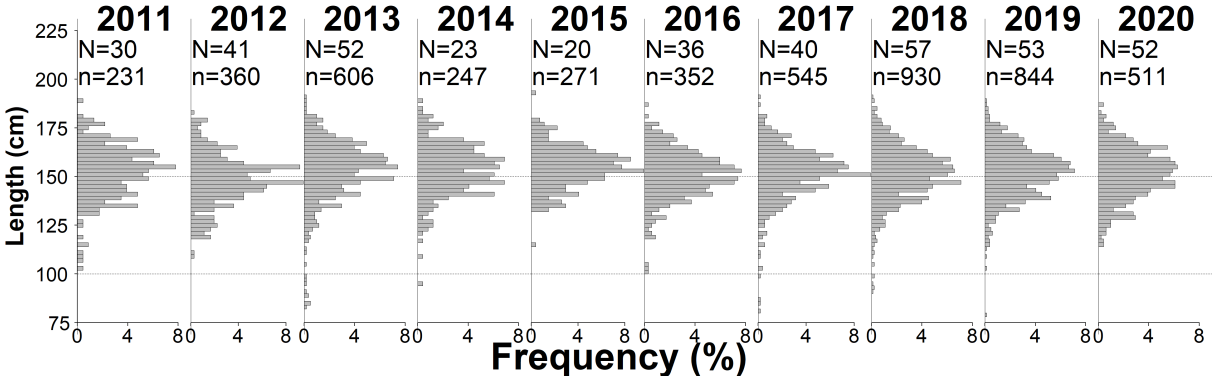


Figure 3. Annual length frequency distributions of *Dissostichus mawsoni* caught in Subarea 48.4. The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were measured.

4.3. Tagging

In 2005, the UK conducted a pilot tagging program using a longline fishing vessel. Following the pilot study, the Commission agreed to continue the tagging experiment in Subarea 48.4.

Since 2012, vessels have been required to tag and release *Dissostichus* spp. at a minimum rate of 5 fish per tonne of green weight caught. All vessels which have fished in Subarea 48.4 have exceeded the minimum required tagging rate. Tagging data now underpin stock assessments for Subarea 48.4.

The tag-overlap statistic estimates the 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. In exploratory fisheries since 2015, each vessel releasing more than 30 tagged fish of each species of *Dissostichus* is required to achieve a minimum tag-overlap statistic of 60% (Annex 41-01/C). Vessels fishing in Subarea 48.4 have also followed this requirement, and both vessels fishing in 2015 achieved tag-overlap statistics of 83-90%.

To date in this area, 2401 *D. mawsoni* have been tagged and released (125 have been recaptured, 111 of which were released in this area; Table 3), and, 4036 *D. eleginoides* have been tagged and released (511 have been recaptured, 480 of which were released in this area; Table 4).

One tagged *D. eleginoides* has also moved into Subarea 48.4 from Subarea 48.3 (WG-FSA-14/29 Rev. 1; 17/06). One *D. mawsoni* tagged in Subarea 48.4 was reported recaptured in Subarea 88.2 after three years at liberty. During the survey in the south of Subarea 48.4, 85 *D. mawsoni* were tagged and none recaptured.

WG-FSA-09/17, 09/18 and 16/40 Rev. 1 provided a comprehensive analysis of the catch distribution of the two *Dissostichus* species in Subarea 48.4.

Table 3. Number of *Dissostichus mawsoni* tagged and recaptured in the area for each fishing Season.

		Recaptured											
Season	Tagged	2009	2010	2011	2012	2014	2015	2016	2017	2018	2019	2020	Total
2006	10												
2007	1												
2009	193	2	15	3	2								**22**
2010	202		6	4		1							**11**
2011	83				1		1						**2**
2012	147												
2013	179					1		1	1	2			**5**
2014	191						13	1	1	1			**16**
2015	584							12	5	1	1		**19**
2016	149							8	5	2	1	1	**17**
2017	104									3	3		**6**
2018	161									3	1	1	**5**
2019	168										2	6	**8**
2020	229												
Total	**2401**												**111**

Table 4. Number of *Dissostichus eleginoides* tagged and recaptured in the area for each fishing Season.

		Recaptured														
Season	Tagged	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
2005	42		2	2		1				1						**6**
2006	134	2	8	5	2	1	1	2			2	1				**24**
2007	291		13	12	1	4	5	4	2	1			2	2		**46**
2008	504			8	11	7	11	10	4	3	6	6	2	3	2	**73**
2009	558			3	16	12	11	8	2	5	3	3		1	4	**68**
2010	418				2	12	2	12	4	1	4	2	2	2	3	**46**
2011	222							2	3		4	2	1	1	1	**14**
2012	302							7	3	2	2	2	5	3	1	**25**
2013	470								23	19	15	7	1	4	3	**72**
2014	223									20	12	9	1	2	2	**46**
2015	226										11	12	7	4	1	**35**
2016	225											5	1	4	3	**13**
2017	159											1	1	1	2	**5**
2018	87													1	3	**4**
2019	73														3	**3**
2020	102															
Total	**4036**															**480**

5. Research

Historically, a precautionary approach has been applied in treating the Subarea 48.4 *D. mawsoni* as a separate stock. Based on the biological characteristics of the catches in Subarea 48.4, and the surrounding regions, the *D. mawsoni* around the southern South Sandwich Islands are now hypothesised as being part of a much larger stock that extends south into Subarea 48.2, 48.6 and possibly 48.5 (WG-FSA-19/27).

6. Stock status

6.1. Summary of current status

A CASAL based assessment of *D. eleginoides* indicated that the stock was at 67% of B0 in 2019 (WG-FSA-19/29).

The five-year (2015-2019) average biomass of *D. mawsoni* in this Subarea, estimated from mark-recapture data was 1,187 tonnes (WG-FSA-19/27).

6.2. Assessment method

The stock of *D. eleginoides* in this Subarea is assessed using a combined-sex, single-area integrated CASAL stock assessment (WG-FSA-19/29).

A Preliminary tag-recapture based population assessment of *D. mawsoni* was presented in 2019 (WG-FSA-19/27).

6.4. Year of last assessment, year of next assessment

Assessments are reviewed biennially, the last assessment for *D. eleginoides* was in 2019.

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.

References

McMillan, P., T. Iwamoto, A. Stewart and P.J. Smith. 2012. A new species of grenadier, genus *Macrourus* (Teleostei, Gadiformes, Macrouridae) from the southern hemisphere and a revision of the genus. Zootaxa, 3165: 1-24.

Additional Resources

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