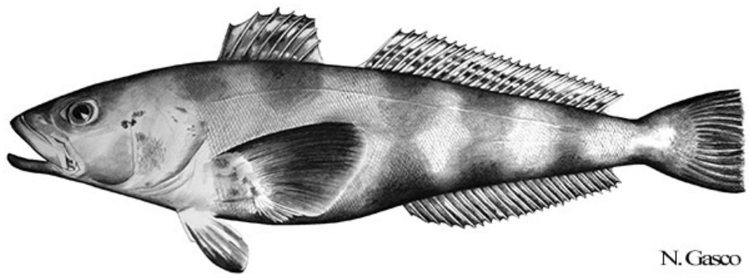
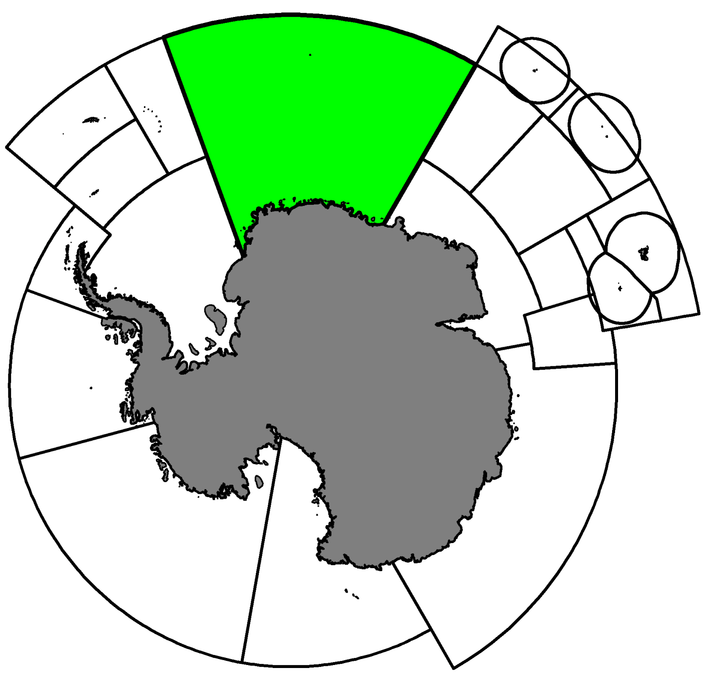
Fishery Report 2020: *Dissostichus mawsoni* in Subarea 48.6

CCAMLR Secretariat

16 March 2021



Antarctic Toothfish, *Dissostichus mawsoni* Norman, 1937.



Map of the management areas within the CAMLR Convention Area. Subarea 48.6, 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 exploratory longline fishery for Antarctic toothfish (*Dissostichus mawsoni*) in Subarea 48.6. This fishery began as a new fishery in 1997 (Conservation Measure 114/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), 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 predominant species in this subarea 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 Subarea 48.6 are described in Conservation Measure 41-04. From 2008 to 2013, the precautionary catch limit for *Dissostichus* spp. was set at 400 tonnes; 200 tonnes north of 60°S (Small-Scale Research Units (SSRUs) A and G) and 200 tonnes south of 60°S (SSRUs B-F). In 2014, the catch limit was revised to 538 tonnes and applied to a suite of research blocks (see Fig. 1). The target species was revised to *D. mawsoni* in 2017.

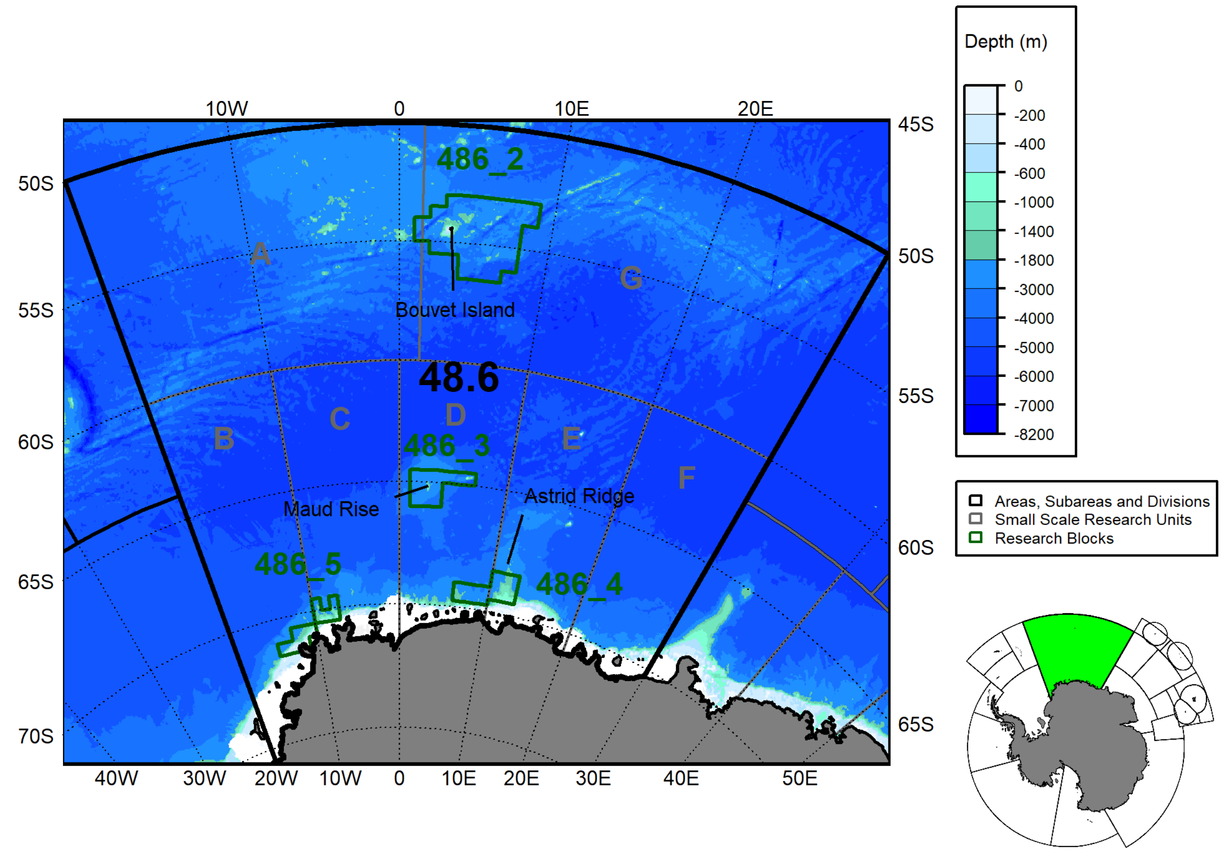


Figure 1: Location of Small Scale Research Units and Research Blocks in Subarea 48.6. The fishable depth range (600m-1800m) is highlighted in shades of green.

1.3. Active vessels

In 2020, 3 vessels participated in this fishery. For the 2021 fishing season, a total of 3 vessels notified their intention to participate in this fishery (1 from Japan; 1 from South Africa; 1 from Spain).

1.4. Timeline of spatial management

In 2014, five research blocks were designated in Subarea 48.6 with catch limits applied to each research block. These research blocks were designed to ensure that research fishing occurred in those areas with the highest probability of recapturing tagged fish; fishing in this subarea is restricted to the research blocks only.

In 2015, the Scientific Committee agreed that the boundaries of research block 486_4 should be revised to include the proposed extension along the continental shelf and exclude the area of Astrid Ridge north of latitude 68° 20′ S (SC-CAMLR-XXXIV, paragraphs 3.236 to 3.240). The location of research blocks in this subarea is shown in Figure 1.

In 2016 Research Block 486_1 was removed from the research fishing in 48.6 (SC-CAMLR-XXXV paragraph 2.7 (i))

2. Reported catch

2.1. Latest reports and limits

Reported catches of *Dissostichus* spp. in Subarea 48.6 are shown in Table 1. In this fishery, the catch of *D. mawsoni* reached a maximum of 517 tonnes in 2018. In 2020, 4 tonnes of *D. eleginoides* and 333 tonnes of *D. mawsoni* were caught.

The catches reported in Subarea 48.6 include catch data 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) are also quarantined and are 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)
2004	1	910	7		-
2005	2	910	47	2	-
2006	1	910	100	63	-
2007	3	910	78	34	-
2008	1	400	12	11	-
2009	2	400	17	93 (q: 173)	-
2010	3	400	50	243 (q: 100)	-
2011	4	400	31 (q: 1)	317 (q: 42)	-
2012	2	400	6	375	-
2013	2	400	15	275	-
2014	2	538	9	145	-
2015	2	538	1	188	-
2016	2	538	9	232	-
2017	2	510	2	435	-
2018	2	557	6	517	-
2019	2	625	6	376	-
2020	3	670	4	333	-

The catch limits by research block are indicated in Table 2 as defined in Conservation Measure 41-04. The catches of *D. mawsoni* by research block are indicated in Table 2.

Table 2: Catch and catch limits by Research Block in 2020 for *Dissostichus mawsoni* in Subarea 48.6. Source: Fine scale data.

Research Block	Catch limit	Catch (% of catch limit)
486_2	140	70 (50%)
486_3	38	37 (97.4%)
486_4	163	124 (76.1%)
486_5	329	97 (29.5%)

2.2. By-catch

Catch limits for by-catch species groups (macrourids, rajids and other species) are defined at the scale of Research Blocks in Conservation Measure 33-03 and shown at the Subarea scale for each fishing season 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 (Conservation Measure 33-03).

If the catch of *Macrourus* spp. taken by a single vessel in any two 10-day periods in a single area to which a catch limit applies 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 fishing season (Conservation Measure 33-03).

The by-catch in Subarea 48.6 consists predominantly of macrourids (Table 3).

Table 3. Reported catch and catch limits for by-catch species (*Macrourus* spp., Rajids and others) in this fishery (see Conservation Measure 33-03 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)
2004	146	<1	100	0	0	120	0
2005	146	6	100	<1	0	120	<1
2006	146	10	100	0	0	120	3
2007	146	13	100	<1	0	120	2
2008	62	1	100	0	0	140	<1
2009	64	4 q	100	<1 q	0 q	140	1 q
2010	64	10 q	100	0	0	140	<1 q
2011	64	8 q	100	0	0	140	1 q
2012	64	6	100	<1	2	140	<1
2013	64	18	100	0	0	140	2
2014	86	2	100	0	0	120	<1
2015	86	5	100	0	0	120	1
2016	86	10	100	0	0	120	1
2017	81	8	27	0	0	81	1
2018	88	15	27	<1	12	88	3
2019	100	6	31	<1	44	100	1
2020	107.2	10	33.5	<1	22	107.2	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. 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 Subarea 48.6.

2.4. Incidental mortality of seabirds and marine mammals

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.

The risk level for birds in this fishery in Subarea 48.6 is category 1 (low) south of 55°S, and category 2 (average to low) north of 55°S (SC-CAMLR-XXX, Annex 8, paragraph 8.1).

There have been no observed seabird mortality reported by vessels in Subarea 48.6 in this fishery.

There have been no observed mammal mortality reported by vessels in Subarea 48.6 in this fishery.

3. Illegal, Unreported and Unregulated (IUU) fishing

IUU fishing activity was not recorded in Subarea 48.6 between 2006 and 2012, however, IUU gear was first reported in 2013 (CCAMLR-XXXII/BG/09). The first reported vessel sighting in Subarea 48.6 was in 2014 of the IUU-listed vessel Viking. There is compelling evidence of IUU activity in Subarea 48.6 (specifically around Maud Rise and Astrid Ridge) with vessel sightings and vessel detection as well as recovery of gillnet reported annually from 2013 to 2016.

4. Data collection

4.1. Data collection requirements

Daily catch and effort reporting (total catch and number of hooks set and retrieved in the last 24 hours) is required in this fishery according to Conservation Measure 23-07. Haul by haul data, submitted in accordance with Conservation Measure 23-04, includes the time, location and catch of all species (by weight and number of individuals). 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 length frequency distributions of the catches of *D. mawsoni* and *D. eleginoides* for the ten most recent seasons across the entire subarea and in each Research Block are presented in Figures 2 and 3 and indicate a consistent difference in modal size between the two species. 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 Subarea 48.6 fishery ranged from 120 to 180 cm in total length (TL), with a relatively consistent mode at approximately 130-160 cm (Fig. 2).

Dissostichus eleginoides exhibits broader length distribution with the majority ranging from 60 to 150 cm in TL (Fig. 3). A shifting mode may be seen throughout the time series with length distribution skewed towards smaller fish early in the time series and towards larger fish in more recent seasons (Fig. 3).

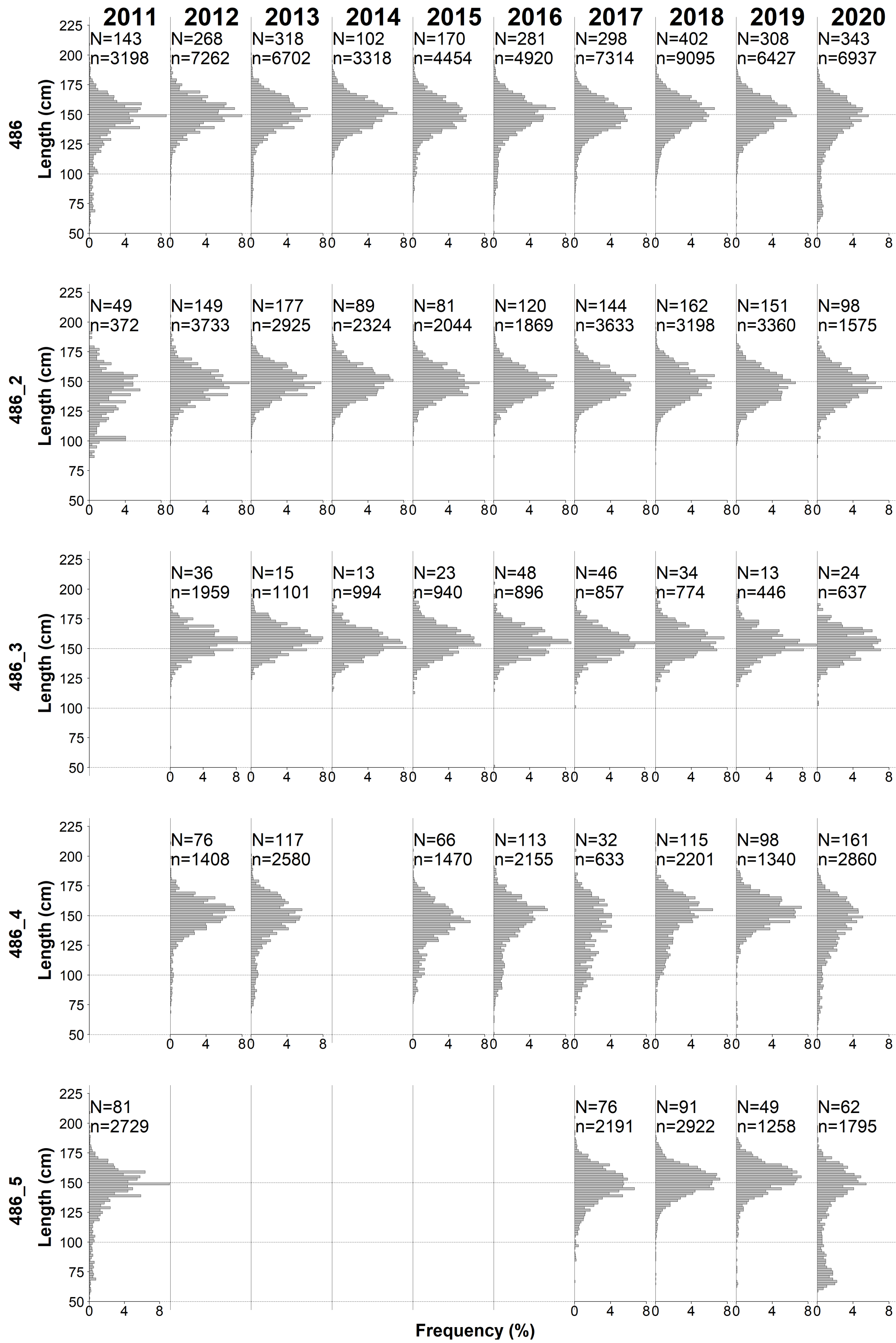


Figure 2. Annual length frequency distributions of *Dissostichus mawsoni* caught in Subarea 48.6 (top panel) and in each Research Block (lower panels). The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were measured.

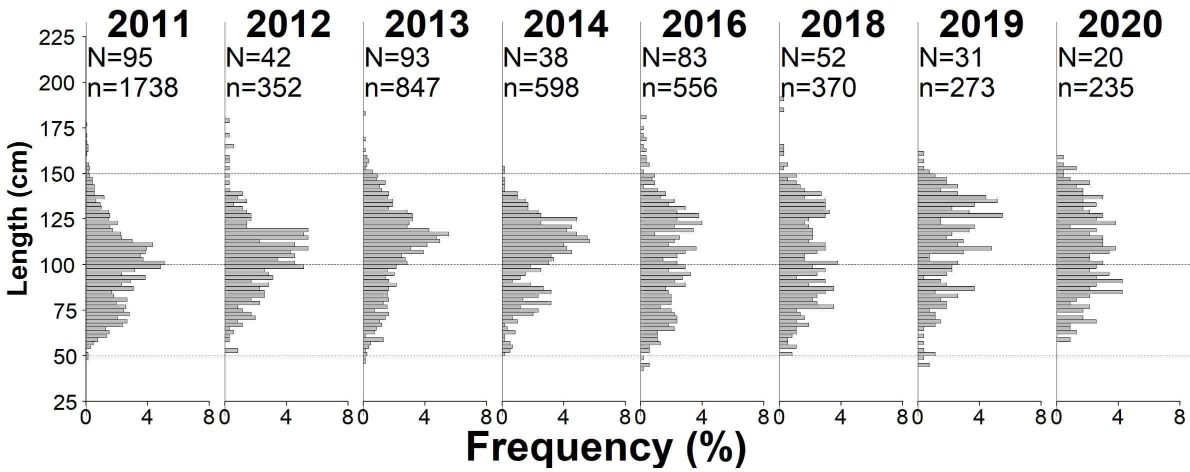


Figure 3. Annual length frequency distributions of *D. eleginoides* caught in Subarea 48.6. The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were measured.

4.3. Tagging

Since 2012, vessels have been required to tag and release *Dissostichus* spp. at a rate of 5 fish per tonne of total catch (Table 5). The tag-overlap statistic estimates the similarity between the size distributions of the fish that are tagged and those that are caught by a vessel. Each vessel catching more than 10 tonnes of each species of *Dissostichus* is required to achieve a minimum tag-overlap statistic of 60% (Conservation Measure 41-01 Annex 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	2013	2014	2015	2016	2017	2018	2019	2020
Spain	Tronio										5 (80,NC)	5 (76.1,NC)
Japan	Shinsei Maru No. 3	3.1 (68.8,40.8)	3 (93.7,NC)	5.1 (82.8,NC)	5.6 (74.8,77.7)	5.2 (81.9,70.8)	6.1 (83.1,NC)	5.5 (84.8,62.1)	5.2 (74.7,NC)	5.2 (78.8,NC)	5.3 (76.7,74.3)	5.1 (81.1,-)
Republic of Korea	Hong Jin No. 701		4 (95,84.5)									
Republic of Korea	Insung No. 1	3.2 (NC,32.1)										
South Africa	Koryo Maru No. 11		3.3 (NC,84.7)	5.2 (62.7,65.7)	5.7 (59.6,70.7)	4.9 (80.9,NC)	5.4 (86.8,NC)	5.2 (72.4,NC)	5.2 (82.4,NC)	5.2 (76.7,NC)		5.1 (63.1,NC)

To date in this area, 17927 *D. mawsoni* have been tagged and released (453 have been recaptured; Table 6), and, 1418 *D. eleginoides* have been tagged and released (33 have been recaptured; Table 7).

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	2013	2014	2015	2016	2017	2018	2019	2020
Spain	Tronio										914 (64)	696 (44)
Japan	Shinsei Maru No. 3	560 (1)	594 (1)	1225 (14)	969 (10)	692 (13)	923 (13)	731 (25)	1684 (34)	1821 (56)	1021 (52)	577 (15)
Republic of Korea	Hong Jin No. 701		441 (0)									
Republic of Korea	Insung No. 1	0 (2)										
South Africa	Koryo Maru No. 11		10 (0)	651 (19)	442 (5)	57 (4)	190 (4)	503 (15)	577 (26)	886 (28)		425 (6)
	Total	**560 (3)**	**1045 (1)**	**1876 (33)**	**1411 (15)**	**749 (17)**	**1113 (17)**	**1234 (40)**	**2261 (60)**	**2707 (84)**	**1935 (116)**	**1698 (65)**

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	2013	2014	2015	2016	2017	2018	2019	2020
Spain	Tronio										1 (0)	21 (2)
Japan	Shinsei Maru No. 3	38 (4)	0 (0)	14 (0)	130 (2)	55 (2)	0 (0)	47 (2)	7 (1)	14 (0)	45 (1)	0 (0)
Republic of Korea	Hong Jin No. 701		52 (1)									
Republic of Korea	Insung No. 1	310 (3)										
South Africa	Koryo Maru No. 11		79 (0)	57 (1)	94 (6)	1 (0)	11 (0)	14 (2)	1 (0)	2 (1)		1 (0)
	Total	**348 (7)**	**131 (1)**	**71 (1)**	**224 (8)**	**56 (2)**	**11 (0)**	**61 (4)**	**8 (1)**	**16 (1)**	**46 (1)**	**22 (2)**

5. Research

5.1. Status of the science

Catch limits for CCAMLR's fisheries for *D. mawsoni* and *D. eleginoides* for the 'assessed' fisheries in Subareas 48.3, 88.1 and 88.2 and Division 58.5.2 are set using fully integrated stock assessments; more basic approaches are used for the 'data-limited' fisheries (in Subarea 48.6 and in Area 58 outside the exclusive economic zones (EEZs)). The management of data-limited fisheries has been a major focus of attention in CCAMLR in recent years after the acknowledgement that commercial fishing and routine observer data collection 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: a prospecting phase, a biomass estimation phase and an assessment development phase, with a set of decisions and reviews 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. A collaborative research program has been undertaken by Japan and South Africa since 2013 to enhance data collection and analysis in this subarea.

WG-FSA-2019/05 examined movements of tagged Antarctic toothfish (*Dissostichus mawsoni*) for subarea 48.6 in relation to life history hypotheses. Most of long-distance movements occurred in westward direction along continental shelf, which may be consistent with the single Atlantic population hypothesis. Meanwhile, no migrations of tagged fish between northern seamounts (Research Blocks 486_2 and 486_3) and southern shelf areas (Research Blocks 486_4 and 486_5), which correspond to spawning and feeding grounds, respectively, have been observed to date. The lack of tag movement between the two areas is similar to those observed in the Amundsen Sea region (SSRUs 88.2C-H) where few tags move between northern seamount area and shelf area.

Japan is in the process of developping an integrated stock assessment for this fishery, and in 2019 presented a preleminary assessment focusing on Research Block 486_2 (WG-FSA-19/21).

In 2019, Japan, Spain and South Africa presented a report of a multi-member longline survey (WG-FSA-19/22).

5.2. Research plans

5.2.1. Background Due to a lack of suitable data, robust stock assessment models able to yield advice on catch limits in accordance with CCAMLR decision rules have not yet been developed for the fisheries in Subarea 48.6 and Divisions 58.4.1, 58.4.2 and 58.4.3a. SC-CAMLR-XXX (paragraph 3.127) concluded that the research plans developed in line with Conservation Measure 41-01, Annex 41-01/B, were unlikely to lead to assessments in these fisheries in the next 3-5 years, and designated them as data-limited exploratory fisheries (SC-CAMLR-XXX, paragraph 3.122). To rectify this situation, the Scientific Committee recommended a number of changes to Conservation Measure 41-01 (SC-CAMLR-XXX, paragraphs 3.128 to 3.133), most notably the requirement for Members to submit multi-year research plans that aim at collecting sufficient data to develop robust assessment models within a 3 to 5 year period.

Both Japan (WG-FSA-12/60 Rev. 1) and South Africa (WG-FSA-12/30 and 12/31) responded by submitting proposals to WG-FSA-12 to undertake research in Subarea 48.6. The Working Group developed a joint research plan for Subarea 48.6 drawing from both of the proposals. The goal of the research plan was to generate sufficient data to undertake a tag-based assessment of the *Dissostichus* spp. stocks in Subarea 48.6 by 2018. To maximise the probability of recapturing tagged fish, research was limited to four research blocks (Fig. 1) and a maximum sample size of 200 tonnes of *Dissostichus* spp. north of 60°S and 200 tonnes south of 60°S (41-04, 2012). In addition, Japan and South Africa voluntarily imposed species-specific limits for each research block based on estimates of stock size per research block given in the research plan proposed by Japan (WG-FSA-12/60 Rev. 1). Japan and South Africa commenced implementing the research plan in December 2012.

Following discussions in 2013 in response to revised estimates of abundance per research block and calculations undertaken during the 2013 meeting of the Working Group on Statistics, Assessments and Modelling (WG-SAM-13) and to operational difficulties experienced by Japan and South Africa, the research plan for 2014 was revised (CM 41-04, 2013) by setting species-specific limits for each research block and by including a fifth research block.

During 2013, the limit set for Patagonian toothfish (*Dissostichus eleginoides*) for research block 486_2 was very low leading to operational difficulties. As a result, the majority of *D. eleginoides* caught were tagged and released. To resolve the problem, a limit was placed on *D. eleginoides* for research blocks 486_1 and 486_2 combined. It was recommended that the vessels access research block 486_1 only after completing sampling of Antarctic toothfish (*Dissostichus mawsoni*) in research block 486_2 and then only if the *D. eleginoides* limit had not been reached. Research fishing activities and observer data collection are now focused on *D. mawsoni*, as reflected in Table 2.

In 2019, Japan described its progress towards the development of an integrated stock assessment model, initially focused on Research Block 486_2 (WG-FSA-19/21).

5.2.2. Objectives In 2019, Japan, Spain and South Africa presented a report of a multi-member longline survey (WG-FSA-19/22). Seven research objectives were outlined by the three Members (see also WG-FSA-19/23 Rev.1):

Objective 1: An assessment of the stock status of *D. mawsoni* using CASAL (WG-FSA-19/21).

Objective 2: Improving the knowledge about the growth of *D. mawsoni* through otolith readings.

Objective 3: Improving the knowledge about the population structure of *D. mawsoni* using tag-recapture experiments.

Objective 4: Investigating ecological traits of *D. mawsoni* through stomach content analyses.

Objective 5: Revealing spatio-temporal pattern of bycatch species distribution.

Objective 6: Improving the knowledge about Antarctic marine ecosystems via sea ice and SST analysis.

Objective 7: Investigating effects of depredation.

5.3. Advice by the Scientific Committee

Research plans for subarea 48.6 were adopted by the Scientific Committee in 2013 (SC-CAMLR-XXXI, paragraph 3.137), 2014 (SC-CAMLR-XXXII, paragraphs 3.192, 3.195 and 3.196), 2016 (SC-CAMLR-XXXIII, paragraphs 3.187 and 3.188) and 2019 (SC-CCAMLR-38, paragraphs 3.97 to 3.101).

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. 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 regards to the area discussed in this report, it is worth noting recent research focused on the Maud Rise polynya and the mechanisms controlling its opening (e.g., Cheon and Grodon, 2019).

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