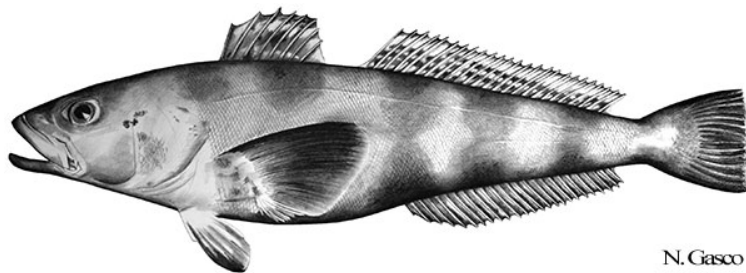


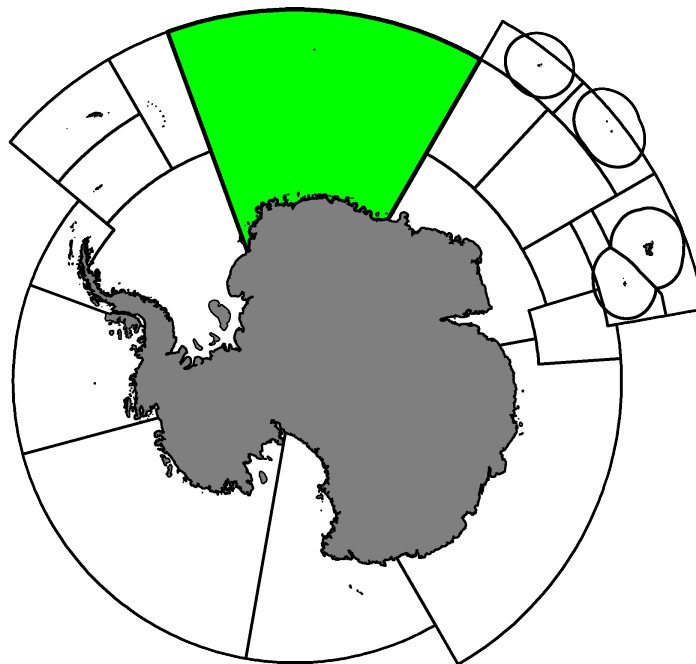
Fishery Report 2021: *Dissostichus mawsoni* in Subarea 48.6

CCAMLR Secretariat

27 May 2022



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, “2021” refers to the 2020/21 CCAMLR fishing season (from 1 December 2020 to 30 November 2021).

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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.

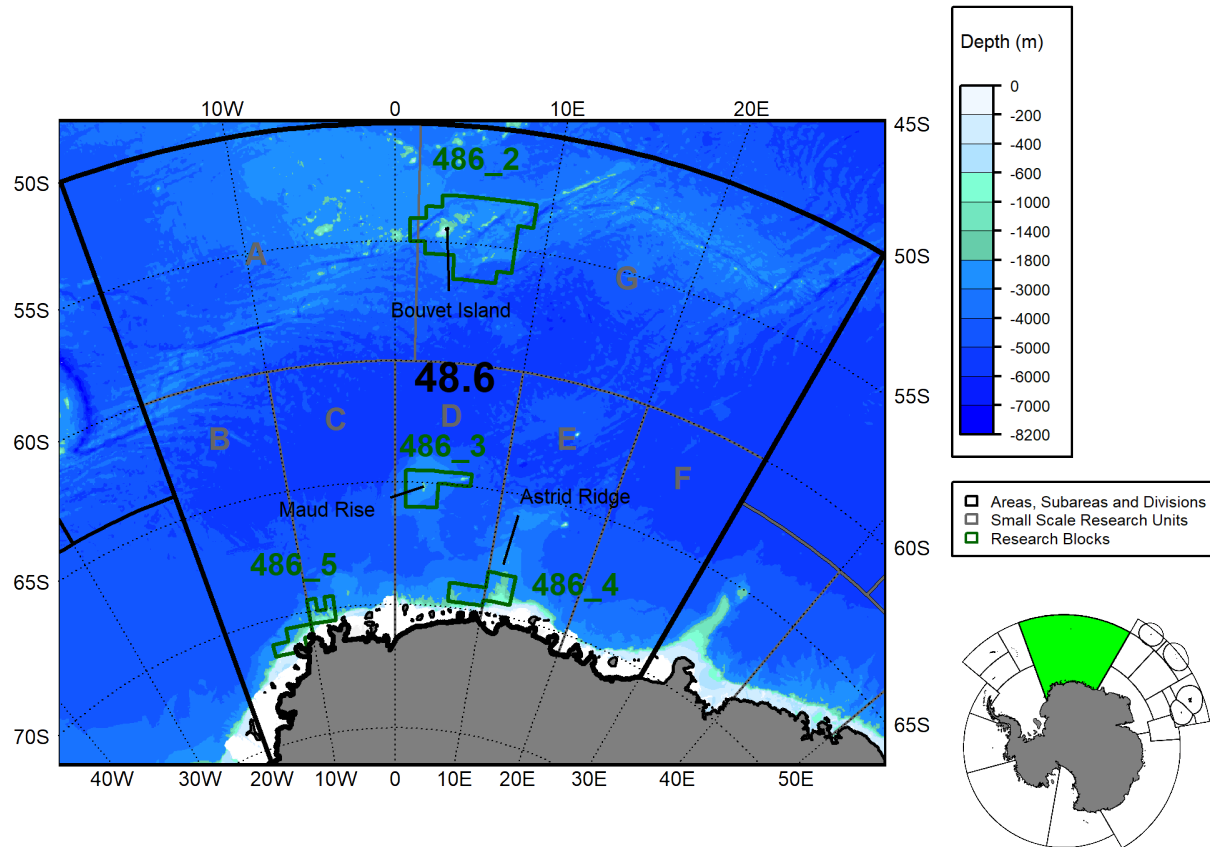


Figure 1: Location of Small Scale Research Units and Research Blocks in Subarea 48.6. The fishable depth range (600m-1800m) is highlighted in shades of green.

1.3. Active vessels

In 2021, 2 vessels participated in this fishery. For the 2022 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 2021, 5 tonnes of *D. eleginoides* and 351 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)	<i>D. eleginoides</i>	<i>D. mawsoni</i>	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	-
2021	2	568	5	351	-

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 2021 for *Dissostichus mawsoni* in Subarea 48.6. Source: Fine scale data.

Research Block	Catch limit	Catch (% of catch limit)
486_2	112	100 (89.3%)
486_3	30	30 (100%)
486_4	163	108 (66.3%)
486_5	263	113 (43%)

2.2. By-catch

Catch limits for by-catch species groups (*Macrourus* spp., skates and rays, 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 *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	<i>Macrourus</i> 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)
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	2 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	10	33	<1	22	107	2
2021	91	11	29	<1	75	91	3

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. 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	2552	3307	2495	2901	2301
		VME indicator units > 5 and < 10	0	0	0	0	0
		VME indicator units > 10	0	0	0	0	0
	by-catch	taxa identified	9	16	18	10	8
Observer	VME	records	580	887	519	707	724
		line segments	1301	1221	926	1081	972
		taxa identified	14	12	17	16	11
	toothfish	weight or volume measurements	81	61	126	242	69
		specimens examined	7433	9465	6700	7172	6909
		length measurements	7416	9465	6700	7172	6909
		weight measurements	6831	9454	6700	7172	6845
		sex identifications	6815	9422	6679	7172	6896
		maturity stage identifications	6828	9433	6690	7170	6907
		gonad weight measurements	6817	8791	5173	5397	3132
	by-catch	otolith samples	3798	3948	4750	3416	3171
		specimens examined	3663	5484	4072	5139	4337
		taxa identified	11	21	11	10	11
		length measurements	1331	3603	2100	1221	2168
		weight measurements**	3663	5483	4063	5135	4237
		standard length measurements*	0	0	98	0	5
		wingspan measurements*	13	3	2	0	0
		pelvic length measurements*	9	3	2	0	0
		snout to anus measurements*	2328	3285	3247	3910	2893
		sex identifications**	11	5	3694	3383	3954
		maturity stage identifications**	7	2	3688	1938	1065
		gonad weight measurements**	0	0	3490	2394	911
		otolith samples**	0	3	326	2	137

*: 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
<i>Macrourus</i> spp.	specimens examined	2328	3262	3381	3915	2883
	taxa identified	4	5	5	3	5
	length measurements	0	1451	1416	0	724
	weight measurements**	2328	3262	3372	3912	2845
	snout to anus measurements*	2324	3262	3247	3910	2883
	sex identifications**	0	0	3327	3373	2830
	maturity stage identifications**	2	0	3318	1930	896
	gonad weight measurements**	0	0	3129	2388	815
	otolith samples**	0	3	324	0	133
Skates and rays	specimens examined	9	3	2	0	0
	taxa identified	1	2	1	0	0
	length measurements	9	3	2	0	0
	weight measurements**	9	3	2	0	0
	wingspan measurements*	9	3	2	0	0
	pelvic length measurements*	9	3	2	0	0
	sex identifications**	9	3	2	0	0
	maturity stage identifications**	5	0	2	0	0
	gonad weight measurements**	0	0	2	0	0
Other fish	specimens examined	1325	2157	689	1224	1454
	taxa identified	5	5	5	7	6
	length measurements	1321	2147	682	1221	1444
	weight measurements**	1325	2156	689	1223	1392
	standard length measurements*	0	0	0	0	5
	sex identifications**	2	2	365	10	1124
	maturity stage identifications**	0	2	368	8	169
	gonad weight measurements**	0	0	359	6	96
	otolith samples**	0	0	2	2	4

*: Species-dependent records

**: Voluntary records

4.3. 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 150 cm (Fig. 2).

Dissostichus eleginoides exhibits broader length distributions with the majority ranging from 60 to 150 cm in TL (Fig. 3).

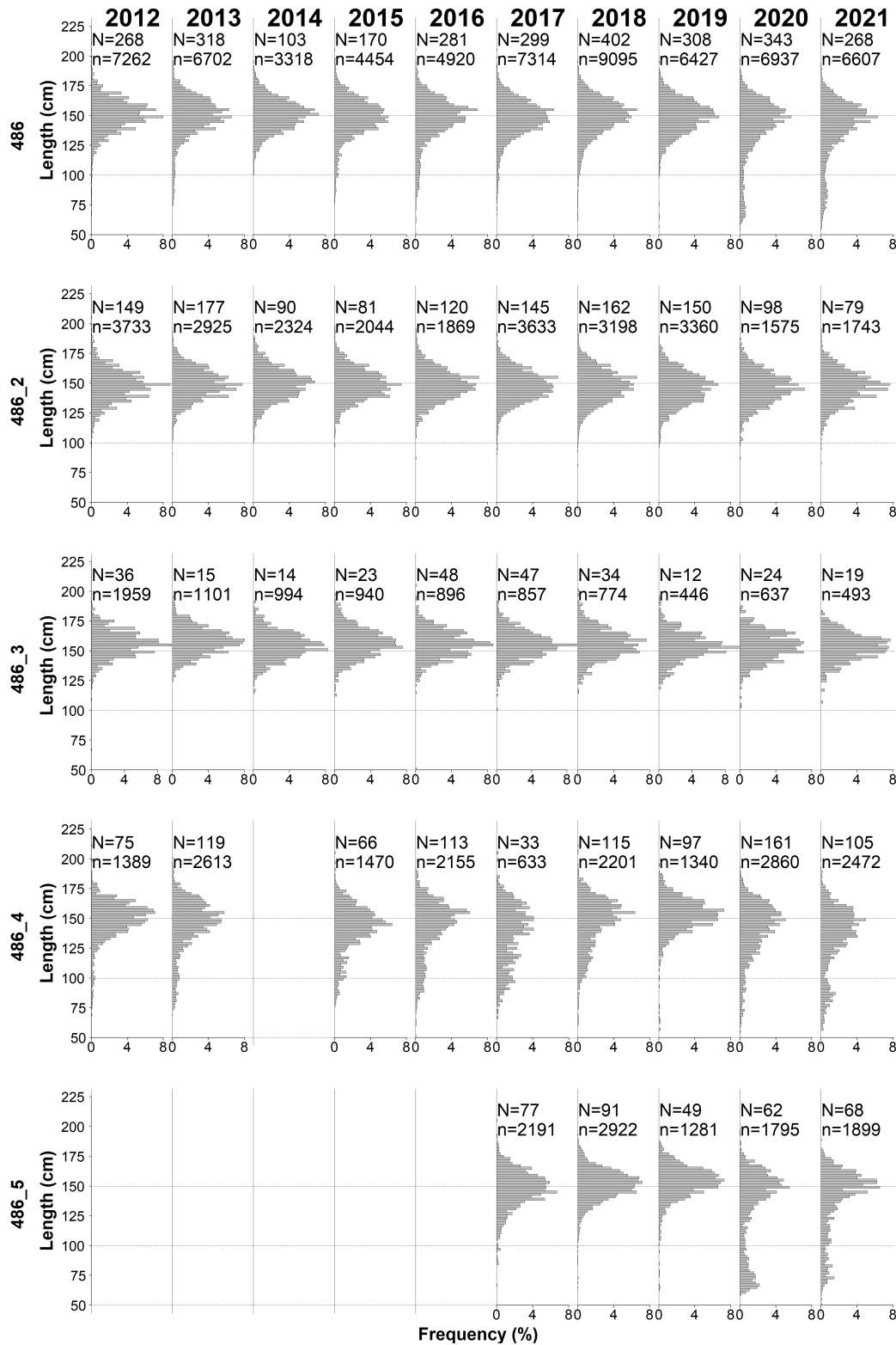


Figure 2. Annual length frequency distributions of *Dissostichus mawsoni* caught in Subarea 48.6 (top panel) and in each Research Block (lower panels). The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions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

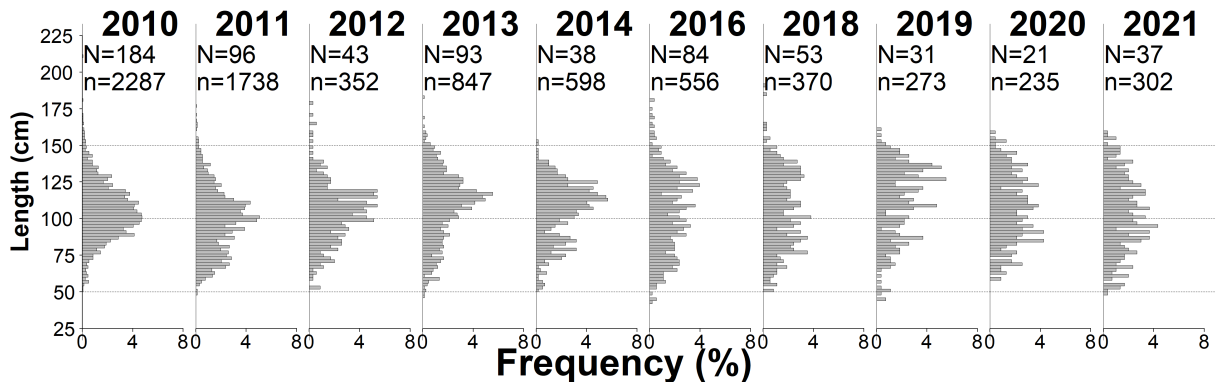


Figure 3. Annual length frequency distributions of *D. eleginoides* caught in Subarea 48.6. The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were measured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

4.4. 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 6). 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 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											
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Spain	Tronio										5 (80,NC)	5 (76.1,NC)	5.1 (74.7,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,-)	
Japan	Shinsei Maru No. 8												5.2 (81,76.8)
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, 19711 *D. mawsoni* have been tagged and released (515 have been recaptured; Table 7), and, 1437 *D. eleginoides* have been tagged and released (33 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											
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Spain	Tronio										914 (64)	696 (44)	845 (42)
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)	
Japan	Shinsei Maru No. 8												939 (20)
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)	1784 (62)

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											
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Spain	Tronio										1 (0)	21 (2)	1 (0)
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)	
Japan	Shinsei Maru No. 8												36 (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)	37 (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 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.

In 2019, [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 the continental shelf, which may be consistent with the single Atlantic population hypothesis.

In 2021, Japan, Spain and South Africa presented the final report of the multi-member longline survey, outlining their fishing activities, collected data, and progress and achievements of objectives ([WG-FSA-2021/50](#)). In addition, Japan presented their progress towards and integrated CASAL stock assessment ([WG-FSA-2021/49](#)) and spatial modelling of by-catch ([WG-FSA-2021/48](#)).

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 2021, following comments and suggestions from WG-SAM-2021, Japan, South Africa and Spain presented a revised proposal for continuing their multi-Member research ([WG-FSA-2021/38](#)), which was endorsed by the Commission ([CCAMLR-40](#), paragraph 6.40).

5.2.2. Objectives

Objective 1: Providing an assessment of the stock status including size/age structure of *D. mawsoni*.

Objective 2: Investigating ecological traits of *D. mawsoni*.

Objective 3: Improving the knowledge about Antarctic marine ecosystems.

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), 2019 ([SC-CAMLR-38](#), paragraphs 3.97 to 3.101) and 2021 ([SC-CAMLR-40](#), paragraph 3.99).

6. Stock status

6.1. Summary of current status

As a data-limited fishery, this fishery does not yet have such estimates. Notable efforts are ongoing ([WG-FSA-2021/49](#)).

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](#)