Fishery Report 2023: *Dissostichus mawsoni* in Subarea 48.6

CCAMLR Secretariat

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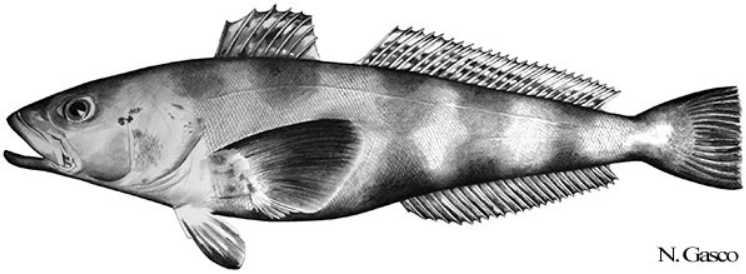
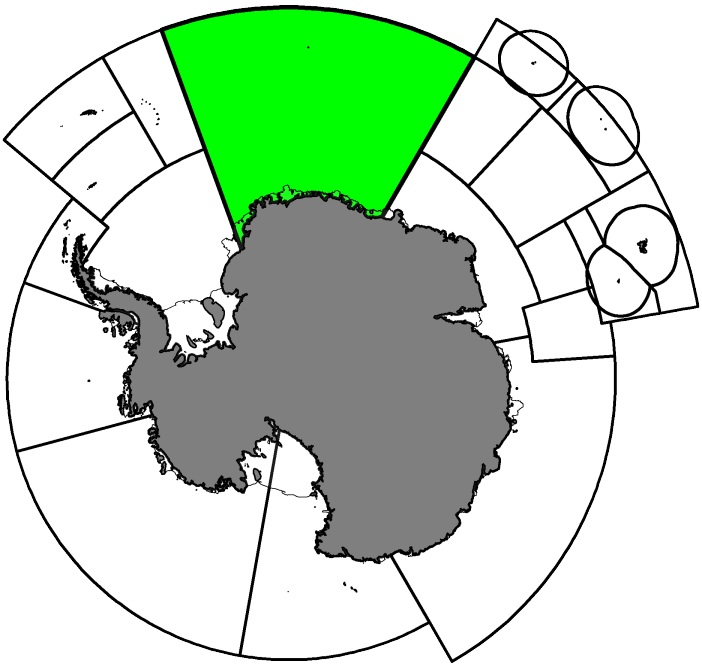


Antarctic Toothfish, *Dissostichus mawsoni* Norman, 1937.



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, "2023" refers to the 2022/23 CCAMLR fishing season (from 1 December 2022 to 30 November 2023). Coastlines and ice shelves: UK Polar Data Centre/BAS and Natural Earth. Projection: EPSG 6932.

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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 1999. 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*. For details on the development and management of this fishery, please refer to section 5.

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.

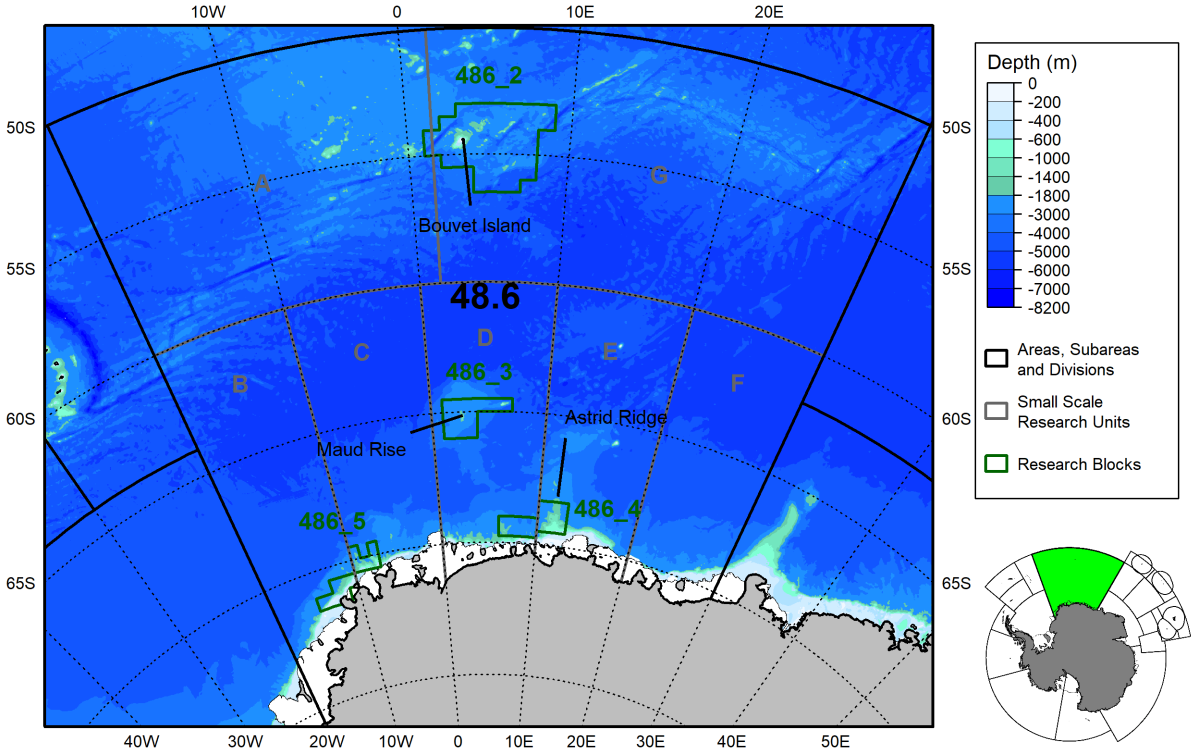

Figure 1: Location of Small Scale Research Units and Research Blocks in Subarea 48.6. The fishable depth range (600m-1800m) is highlighted in shades of green. Coastlines and ice shelves: UK Polar Data Centre/BAS and Natural Earth. Bathymetry: GEBCO. Projection: EPSG 6932 (rotated).

1.3. Active vessels

In 2023, 2 vessels participated in this fishery. For the 2024 fishing season, a total of 3 vessels notified their intention to participate in this fishery (1 from Japan; 1 from Spain; 1 from Uruguay).

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 2023, 1 tonnes of *D. eleginoides* and 356 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	0	-
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	-
2022	2	576	4	481	-
2023	2	485	1	356	-

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 2023 for *Dissostichus mawsoni* in Subarea 48.6. Source: Fine scale data.

Research Block	Catch limit	Catch (% of catch limit)
486_2	123	121 (98.4%)
486_3	37	37 (100%)
486_4	157	57 (36.3%)
486_5	168	141 (83.9%)

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).

Skates thought to have a high probability of survival are released at the surface in accordance with 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 CM 33-03 for details). q: by-catch data currently quarantined. Source: fine-scale data.

	Macrourus spp.		Skates and rays			Other catch	
Season	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
2022	92	11	29	<1	64	92	5
2023	78	7	24	<1	67	78	4

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, on a voluntary basis, for the 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	2019	2020	2021	2022	2023
Vessel crew	VME	line segments	2495	2901	2301	2613	2400
		VME indicator units > 5 and < 10	0	0	0	0	0
		VME indicator units > 10	0	0	0	0	0
	by-catch	taxa identified	18	10	8	13	13
		records	519	707	724	821	773
Observer	VME	line segments	926	1081	972	988	904
		taxa identified	17	16	11	13	8
		weight or volume measurements	126	242	69	136	57
	toothfish	specimens examined	6700	7172	6909	8307	6501
		length measurements	6700	7172	6909	8307	6501
		weight measurements	6700	7172	6845	8307	6501
		sex identifications	6679	7172	6896	8304	6472
		maturity stage identifications	6690	7170	6907	8293	6472
		gonad weight measurements	5173	5397	3132	7521	6359
		otolith samples	4750	3416	3171	3688	2350
	by-catch	specimens examined	4072	5139	4337	9319	3604
		taxa identified	11	10	11	9	14
		length measurements	2100	1221	2168	6469	1433
		weight measurements**	4063	5135	4237	9248	3597
		standard length measurements*	98	0	5	30	49
		wingspan measurements*	2	0	0	1	0
		pelvic length measurements*	2	0	0	0	0
		snout to anus measurements*	3247	3910	2893	6601	2355
		sex identifications**	3694	3383	3954	7805	2351
		maturity stage identifications**	3688	1938	1065	3750	2331
		gonad weight measurements**	3490	2394	911	3725	2032
		otolith samples**	326	2	137	0	0

*: 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	2019	2020	2021	2022	2023
Macrourus spp.	specimens examined	3381	3915	2883	6650	2396
	taxa identified	5	3	5	3	5
	length measurements	1416	0	724	3800	226
	weight measurements**	3372	3912	2845	6620	2396
	snout to anus measurements*	3247	3910	2883	6601	2347
	sex identifications**	3327	3373	2830	6636	2349
	maturity stage identifications**	3318	1930	896	3750	2329
	gonad weight measurements**	3129	2388	815	3674	2031
	otolith samples**	324	0	133	0	0
Skates and rays	specimens examined	2	0	0	0	0
	taxa identified	1	0	0	0	0
	length measurements	2	0	0	0	0
	weight measurements**	2	0	0	0	0
	wingspan measurements*	2	0	0	0	0
	pelvic length measurements*	2	0	0	0	0
	sex identifications**	2	0	0	0	0
	maturity stage identifications**	2	0	0	0	0
	gonad weight measurements**	2	0	0	0	0
Other fish	specimens examined	689	1224	1454	2669	1208
	taxa identified	5	7	6	6	9
	length measurements	682	1221	1444	2669	1207
	weight measurements**	689	1223	1392	2628	1201
	standard length measurements*	0	0	5	0	0
	sex identifications**	365	10	1124	1169	2
	maturity stage identifications**	368	8	169	0	2
	gonad weight measurements**	359	6	96	51	1
	otolith samples**	2	2	4	0	0

*: Species-dependent records
**: Voluntary records

The counts of by-catch taxa reported above (Table 5) correspond to specimens that have been individually sampled by observers. These are a subset of all the specimens counted by observers and are generally identified at a more precise taxonomic level. The figures below (Figs. 2 and 3) display the distribution of the most frequently examined by-catch taxa in time and space. It is important to note that observers sample a random subset of lines and do not individually examine all taxa; as such these figures are more representative of the distribution of biological observations than the catch of these taxa or their spatial distribution. At a coarse taxonomic level, the total catch of by-catch species groups is provided in section 2.2 above.

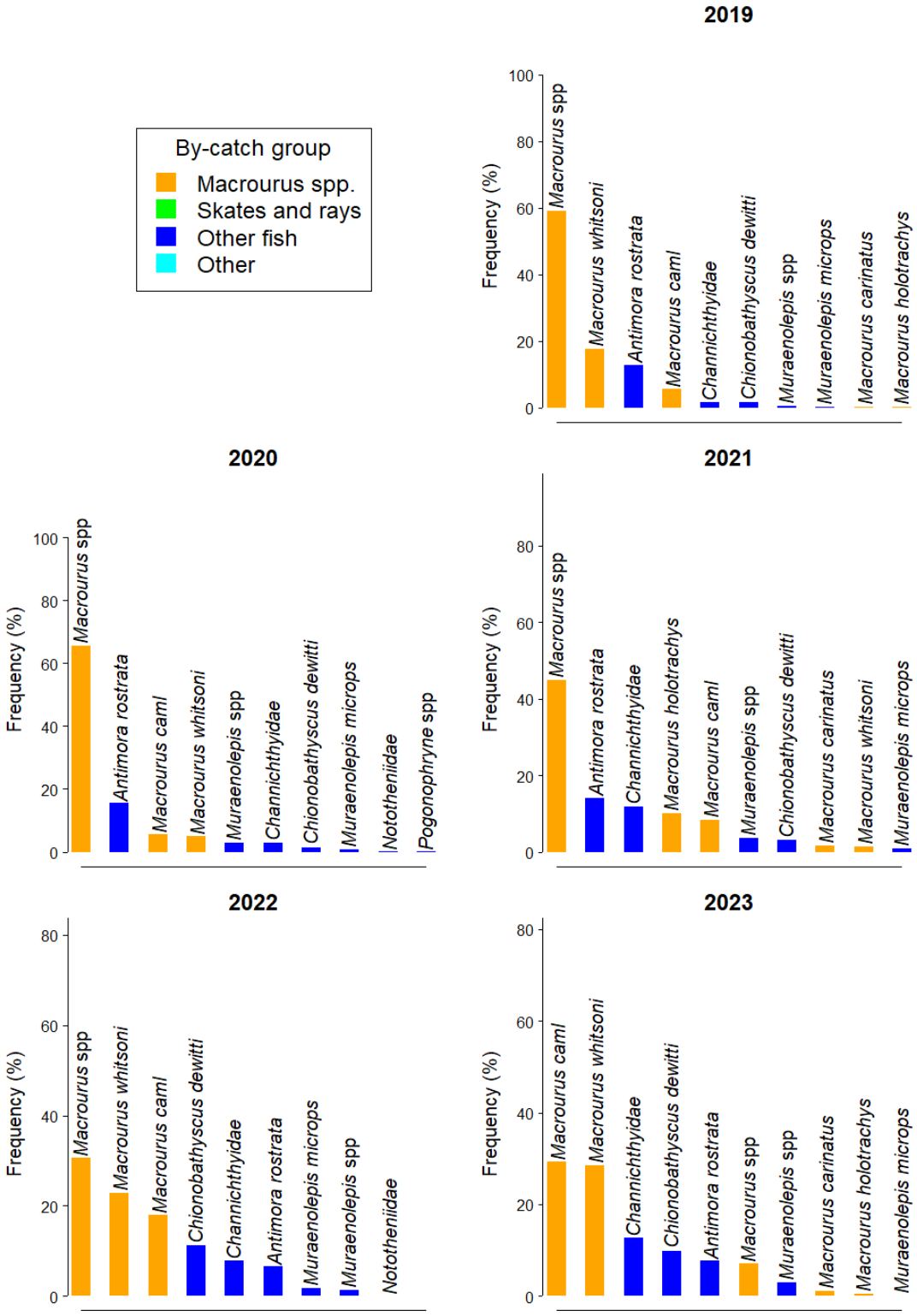

Figure 2. Relative frequencies of the most commonly examined by-catch taxa in each of the last five seasons, from the observer data (unweighted raw counts of individually examined specimens). Taxonomic identification may occur at different levels.

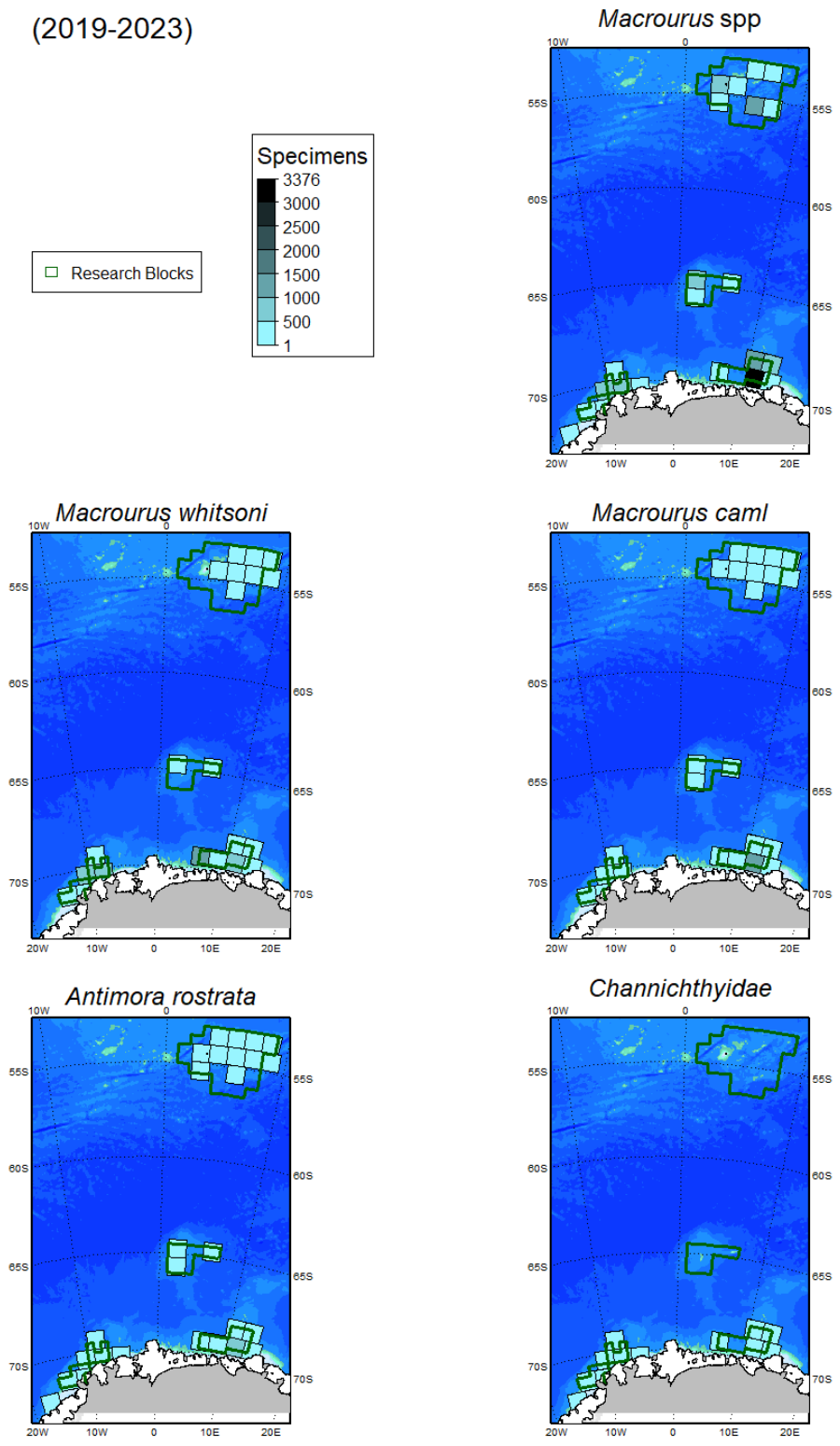

Figure 3. Spatial distribution of the most commonly examined by-catch taxa across the last five seasons, from the observer data (unweighted raw counts of individually examined specimens in each cell). The data were aggregated using equal area (100 km x 100 km) cells. Taxonomic identification may occur at different levels. Refer to Figure 1 for more details on the boundaries shown. Coastlines and ice shelves: UK Polar Data Centre/BAS and Natural Earth. Bathymetry: GEBCO. Projection: EPSG 6932 (rotated).

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 4 and 5 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. 4). Younger individuals may be caught in the Southern research blocks (486_4 and 486_5).

Dissostichus eleginoides exhibits broader length distributions with the majority ranging from 60 to 150 cm in TL (Fig. 5).

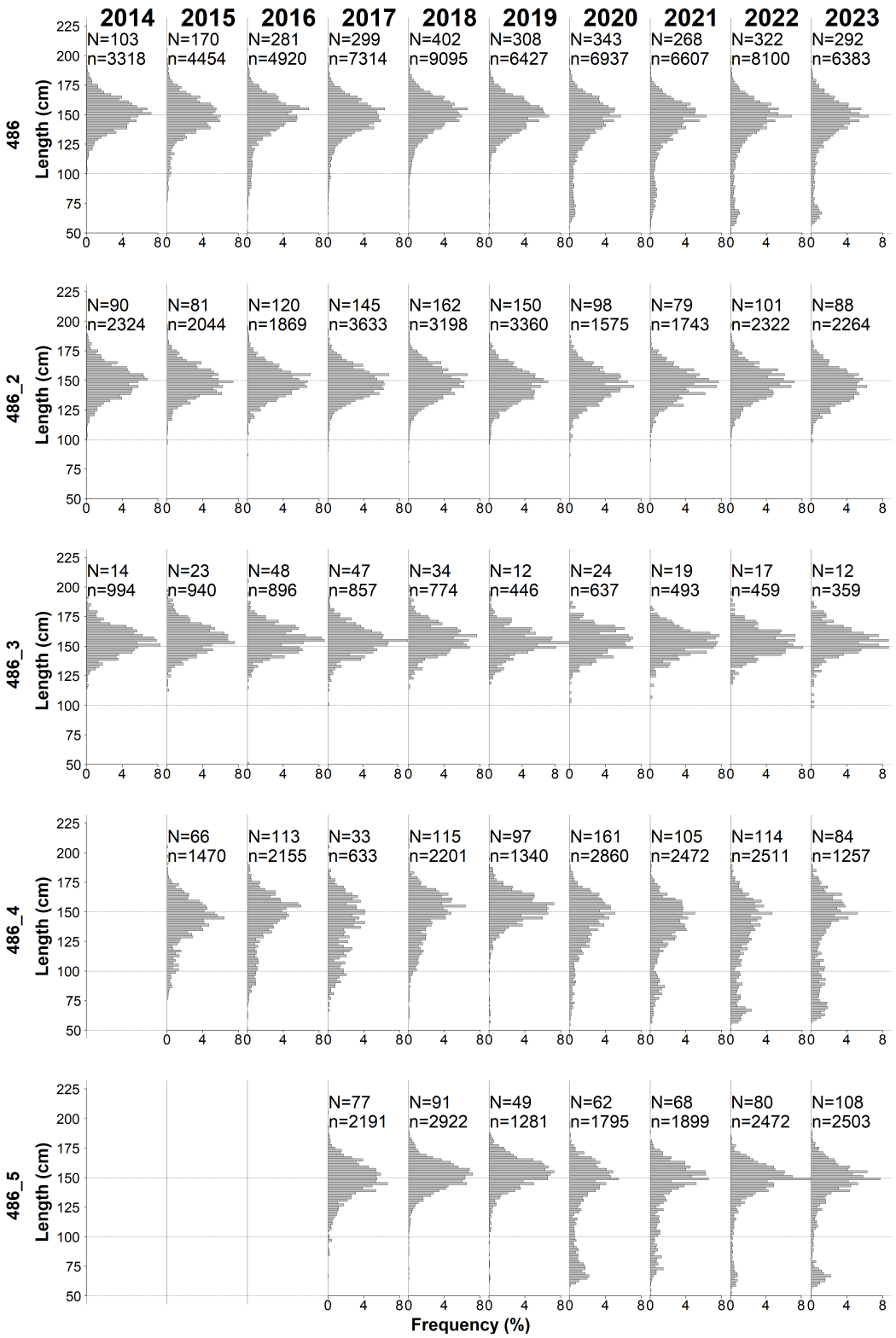

Figure 4. Annual length frequency distributions of *Dissostichus mawsoni* caught in Subarea 48.6 (top panel) and in each Research Block (lower panels). The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were measured in a given season/area.

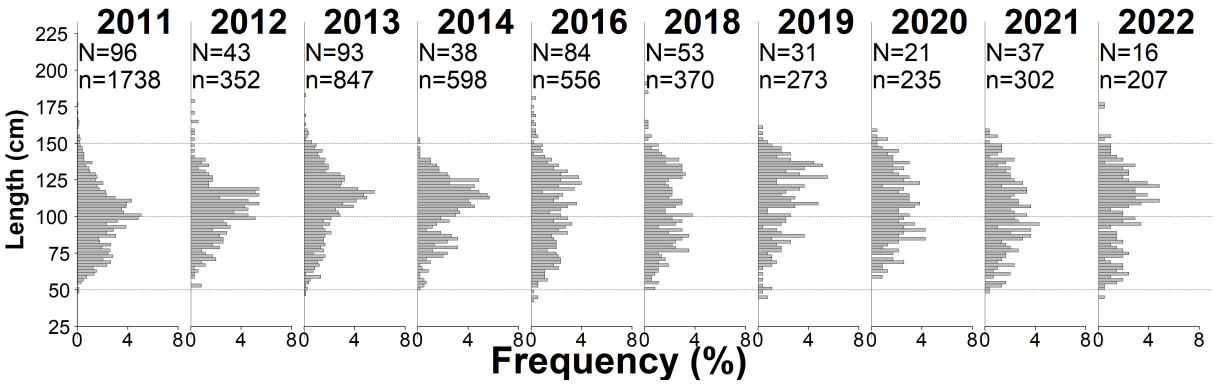

Figure 5. Annual length frequency distributions of *D. eleginoides* caught in Subarea 48.6 (mostly in research block 2). The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were measured in a given season.

4.4. 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). In the last row, the tagging rate and tag-overlap statistic were computed using all fish tagged and all fish caught in the area.

		Fishing Season													
Flag State	Vessel name	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Spain	Tronio										5 (76.3,NC)	5 (73.6,NC)	5.1 (72.7,NC)	5 (75.9,NC)	5.1 (76,-)
Japan	Shinsei Maru No. 3	3.1 (67.8,40.4)	3 (94.8,NC)	5.1 (84.7,NC)	5.6 (78,81.4)	5.2 (84.5,81.2)	6.1 (88.2,NC)	5.5 (85.8,66.5)	5.2 (71.8,NC)	5.2 (77.6,NC)	5.3 (77.9,75.7)	5.1 (79.9,-)			
Japan	Shinsei Maru No. 8												5.2 (79.4,80.7)	5.2 (83.6,NC)	5.1 (77.5,NC)
Republic of Korea	Hong Jin No. 701		4 (83.8,75.2)												
Republic of Korea	Insung No. 1	3.2 (NC,33.7)													
South Africa	Koryo Maru No. 11		3.3 (NC,80.8)	5.2 (70.4,70.2)	5.7 (68.3,78.3)	4.9 (77.2,NC)	5.4 (88.9,NC)	5.2 (74.7,NC)	5.2 (79.6,NC)	5.2 (78,NC)		5.1 (65.8,NC)			
Total		**3.1 (70.6,34.5)**	**3.4 (93.2,89.9)**	**5.1 (79.7,70)**	**5.6 (75.3,80.5)**	**5.2 (83.9,82.7)**	**6 (88.7,NC)**	**5.4 (81.2,70.4)**	**5.2 (74.5,NC)**	**5.2 (77.7,NC)**	**5.2 (78.1,76.8)**	**5.1 (77.1,NC)**	**5.1 (76.5,79.6)**	**5.1 (80.9,86.8)**	**5.1 (77.9,NC)**

To date in this area, 23966 *D. mawsoni* have been tagged and released (715 have been recaptured; Table 7), and, 1478 *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.

		Fishing Season													
Flag State	Vessel name	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Spain	Tronio										914 (64)	696 (44)	846 (42)	1518 (107)	1049 (57)
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)	928 (18)	759 (18)
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)**	**1785 (62)**	**2446 (125)**	**1808 (75)**

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.

		Fishing Season													
Flag State	Vessel name	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Spain	Tronio										1 (0)	21 (2)	1 (0)	2 (0)	0 (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)	29 (0)	10 (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)**	**31 (0)**	**10 (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 in the fished area. 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 long-distance movements occurred in a 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).

In 2022, a genomic study conducted in collaboration between UK and Spain scientists indicated that the *D. mawsoni* stock in Subarea 48.6 was likely panmictic (WG-FSA-2022/16), and an otolith chemistry study conducted in collaboration between China, Japan, Spain and South Africa scientists confirmed that fish moved frequently between research blocks (WG-FSA-2022/36). Japan, Spain and South Africa further reported on research fishing operations since 2013 (WG-FSA-2022/24 Rev. 1), as well as since the research plan continuation was endorsed (WG-SAM-2022/02). Japan in collaboration with New Zealand reported on progress towards modelling of grenadier relative abundance (WG-FSA-2022/33), and, Japan reported on progress towards a two-area population model for stock assessment using CASAL (WG-FSA-2022/23).

In 2023, Japan, Spain and South Africa presented a report on the multi-member longline survey, outlining their fishing activities, collected data, achievements of research objectives, and progress in the development of a Casal2 stock assessment (WG-FSA-2023/42). Japan also presented progress in the development of statistical modeling to estimate the abundance trends of grenadiers caught as by-catch in this fishery (WG-FSA-2023/33).

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).

In 2023, the research plan was updated noting that South Africa would not participate in the 2024 season (which was the final season of the 3 year plan, WG-SAM-2023/01 Rev 1.) and catch allocations were revised. Korea also signaled its intention to collaborate in the research (WG-SAM-2023/21).

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, including a transition to Casal2 software (WG-FSA-2023/42).

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

In 2022, the Commission recognised that climate change is already having effects in the Convention Area (CCAMLR-41, paragraph 6.3) and agreed that it needed to act urgently to prepare for, and adapt to, the effects of climate change on the marine ecosystems within the Convention Area (CCAMLR-41, paragraph 6.5). The Commission noted (CCAMLR-41, paragraph 6.4) that the Scientific Committee had incorporated climate change into its advice (SC-CAMLR-41, paragraph 7.8) and through discussions at the SC-Symposium (SC-CAMLR-41, Annex 11) had also added climate change to the work plans and terms of reference of its Working Groups (SC-CAMLR-41, paragraph 7.14). The Commission adopted (CCAMLR-41, paragraph 6.28) Resolution 36/41.

In 2023, the Scientific Committee held a workshop on Climate Change (WS-CC-2023) which made recommendations regarding monitoring and management actions CCAMLR could progress to document and track the effects of climate change in the Convention Area. The recommendations were incorporated into

the workplan of the Scientific Committee. Further, the Scientific Committee recommended that summaries of evidence for changes in stock assessment parameters or processes that could be due to the effects of environmental variability or climate change be developed for all fisheries (SC-CAMLR-42, paragraph 2.149).

Additional Resources

- Fishery Summary: pdf, html
- Species Description: pdf, html
- Trend Analysis: pdf, html
- Fisheries Documents Browser