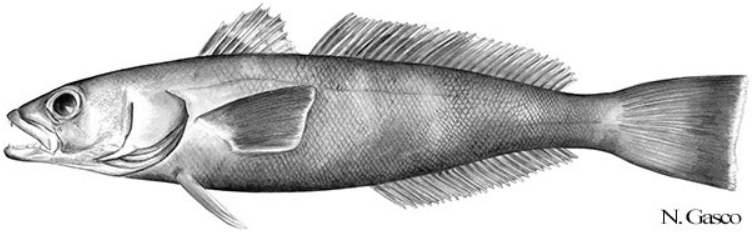
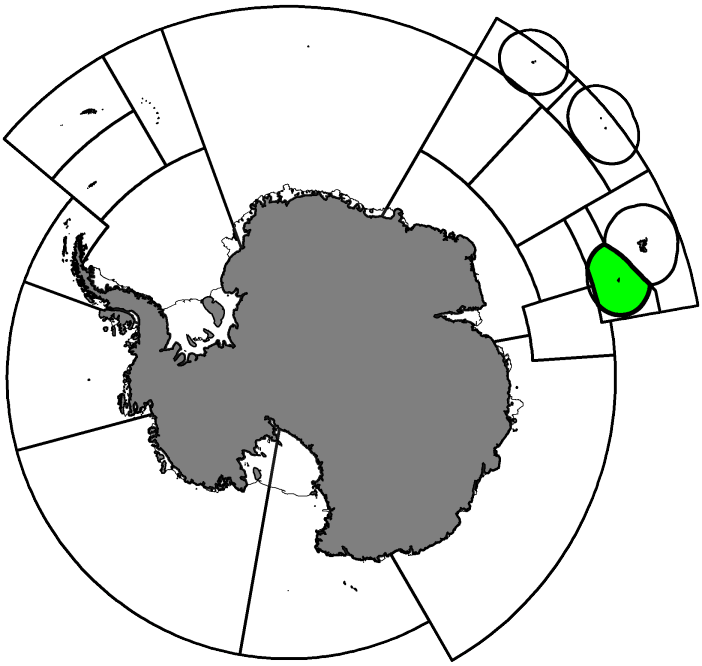
Fishery Report 2024: *Dissostichus eleginoides* at Heard Island (Division 58.5.2)

CCAMLR Secretariat

07 April 2025



Patagonian Toothfish, *Dissostichus eleginoides* Smitt, 1898.



Map of the management areas within the CAMLR Convention Area. The region discussed in this report is shaded in green. Throughout this report, "2024" refers to the 2023/24 CCAMLR fishing season (from 1 December 2023 to 30 November 2024). Coastlines and ice shelves: UK Polar Data Centre/BAS and Natural Earth. Projection: EPSG 6932.

Contents

1. Introduction to the fishery

1.1. History

This report describes the licensed fishery for Patagonian toothfish (*Dissostichus eleginoides*) in the area of the Australian Fishing Zone (AFZ) in Division 58.5.2. The area includes the AFZ surrounding Heard Island and McDonald Islands, and is located on the Kerguelen Plateau between 50°–56°S and 67°–79°E.

The fishery began in 1997 as a trawl fishery. Longline fishing was introduced in 2003 and both fishing methods continued to be used, with an increasing proportion of longline fishing in each year. Since 2013 almost the entire catch has been taken by longline.

The fishery is managed by the Australian Fisheries Management Authority (AFMA) in accordance with the Conservation Measures adopted by CCAMLR and Australian law. The annual catch limit is based on the management advice from CCAMLR. The current catch limits on the fishery for *Dissostichus* spp. in Division 58.5.2 are described in Conservation Measure 41-08.

1.2. Conservation Measures currently in force

The limits on the fishery for *D. eleginoides* in Division 58.5.2 are defined in Conservation Measure 41-08.

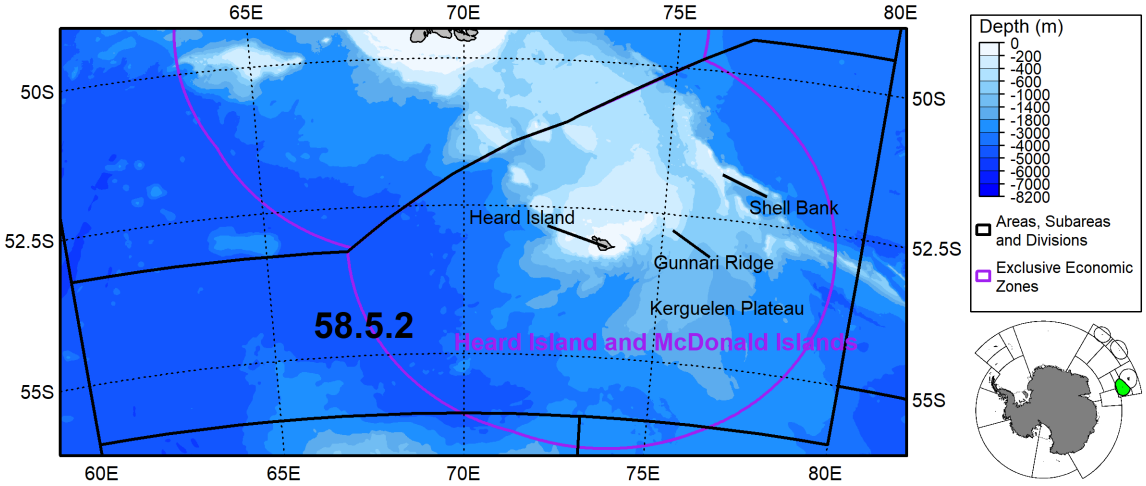


Figure 1: Map of the region discussed in this report. Coastlines and ice shelves: UK Polar Data Centre/BAS and Natural Earth. Bathymetry: GEBCO. Projection: EPSG 6932 (rotated).

1.3. Active vessels

In 2024, 3 vessels participated in this fishery.

2. Reported catch

2.1. Latest reports and limits

Reported catches of *Dissostichus eleginoides* are shown in Table 1. In this fishery, the catch of *D. eleginoides* reached a maximum of 4267 tonnes in 2015. In 2024, 2406 tonnes of *D. eleginoides* were caught.

Table 1. Catch and effort history for *Dissostichus eleginoides* in this fishery. Source: Fine scale data and past estimates for IUU catch (-: no fishing, or no IUU estimate available).

Season	Longline Catch (tonnes)	Trawl Catch (tonnes)	Pot Catch (tonnes)	Total Catch (tonnes)	Number of vessels	Catch limit (tonnes)	Estimated IUU catch (tonnes)
1997	-	1808	-	1808	1	3800	7117
1998	-	2966	-	2966	3	3700	4150
1999	-	3341	-	3341	2	3690	427
2000	-	3030	-	3030	2	3585	1154
2001	-	2599	-	2599	2	2995	2004
2002	-	2514	-	2514	2	2815	3489
2003	286	2468	-	2754	3	2879	1274
2004	552	2327	-	2879	3	2873	531
2005	665	2266	-	2931	3	2787	265
2006	656	1769	72	2497	3	2584	74
2007	624	1714	-	2338	2	2427	0
2008	835	1445	-	2280	3	2500	0
2009	1164	1155	13	2332	3	2500	0
2010	1237	1135	31	2404	3	2550	0
2011	1381	1104	32	2517	3	2550	-
2012	1369	1302	-	2671	3	2730	-
2013	2149	563	41	2753	4	2730	-
2014	2646	107	-	2754	4	2730	-
2015	4062	205	-	4267	7	4410	-
2016	2624	158	-	2783	4	3405	-
2017	3345	24	-	3369	4	3405	-
2018	3083	53	-	3136	4	3525	-
2019	3334	68	-	3402	5	3525	-
2020	2895	119	-	3014	5	3030	-
2021	2891	99	4	2995	5	3030	-
2022	2698	68	-	2766	4	3010	-
2023	2406	70	0	2476	3	3010	-
2024	2321	85	-	2406	3	2660	-

2.2. By-catch

A number of Conservation Measures, which ensure that impacts on the target and other species are minimised, currently apply to this fishery. Conservation Measure 33-02 specifies that there should be no directed fishing other than for the target species, with by-catch limits and move-on rules if the by-catch limits for any one haul are exceeded.

Catch limits for by-catch species groups are defined in Conservation Measure 33-02 and provided in Tables 2 and 3.

A quantitative risk assessment of the caml grenadier (*Macrourus caml*) was undertaken in 2015 and WG-FSA-15 recommended a catch limit of 409 tonnes for *M. caml* and Whitson's grenadier (*M. whitsoni*) combined based on the risk assessment in WG-FSA-15/63, and a catch limit of 360 tonnes for bigeye grenadier (*M. holotrachys*) and ridge-scaled grenadier (*M. carinatus*) combined based on the previous assessment from 2003. These by catch limits were introduced in 2016 and are reflected in Table 2.

Table 2. Reported catch and catch limits in tonnes for by-catch of Macrourids in this fishery (see CM 33-02 for details). Source: fine-scale data.

Season	*Macrourus* spp.				*M. caml* and *M. whitsoni*				*M. holotrachys* and *M. carinatus*			
	Catch Limit	Longline Catch	Trawl Catch	Total Catch	Catch Limit	Longline Catch	Trawl Catch	Total Catch	Catch Limit	Longline Catch	Trawl Catch	Total Catch
1997		-	0	0		-	-	-		-	-	0
1998		-	<1	<1		-	-	-		-	-	0
1999		-	<1	<1		-	-	-		-	-	0
2000		-	4	4		-	-	-		-	-	0
2001		-	1	1		-	-	-		-	-	0
2002	50	-	3	3		-	-	-		-	-	0
2003	465	3	1	4		-	-	-		-	-	0
2004	360	42	3	45		-	-	-		-	-	0
2005	360	72	2	74		-	-	-		-	-	0
2006	360	26	<1	27		-	-	-		-	-	0
2007	360	61	5	66		-	-	-		-	-	0
2008	360	81	5	86		-	-	-		-	-	0
2009	360	110	2	112		-	-	-		-	-	0
2010	360	100	3	102		-	-	-		-	-	0
2011	360	147	4	151		-	-	-		-	-	0
2012	360	89	3	92		-	-	-		-	-	0
2013	360	154	3	157		-	-	-		-	-	0
2014	360	175	1	176		-	-	-		-	-	0
2015	360	299	4	303		-	-	-		-	-	0
2016		-	-	-	409	78	1	80	360	220	0	220
2017		-	-	-	409	89	<1	90	360	235	<1	235
2018		-	-	-	409	100	4	104	360	253	<1	253
2019		-	-	-	409	101	4	105	360	250	<1	250
2020		-	-	-	409	48	<1	48	360	59	0	59
2021		-	-	-	409	66	<1	67	360	150	<1	150
2022		-	-	-	409	45	<1	46	360	113	<1	113
2023		-	-	-	409	48	<1	48	360	129	<1	129
2024		-	-	-	409	50	<1	50	360	98	<1	98

An analysis of the by-catch species unicorn icefish (*Channichthys rhinoceratus*) and grey rockcod (*Lepidonotothen squamifrons*) indicated that both species are widespread over the plateau in depths of <1,000m (WG-FSA-15/50). Up to 2015, the catch limits of *C. rhinoceratus* and *L. squamifrons*, 150 tonnes and 80 tonnes respectively, were based on assessments carried out in 1998 (SC-CAMLR-XVII, Annex 5). Catches of each of these species since 2004 have been well below the limits set by CCAMLR (Table 3). A quantitative risk assessment of *C. rhinoceratus* was undertaken in 2015 and WG-FSA-15 recommended a by-catch limit of 1,663 tonnes for *C. rhinoceratus*.

Table 3. Reported catch and catch limits in tonnes for by-catch (Skates and rays, *C. rhinoceratus*, *L. squamifrons* and other species) in this fishery (see CM 33-02 for details). Source: fine-scale data.

Season	Skates and rays					*C. rhinoceratus*				*L. squamifrons*				Other species			
	Catch Limit	Longline Catch	Trawl Catch	Total Catch	Number Released	Catch Limit	Longline Catch	Trawl Catch	Total Catch	Catch Limit	Longline Catch	Trawl Catch	Total Catch	Catch Limit	Longline Catch	Trawl Catch	Total Catch
1997		-	2	2	0		-	<1	<1		-	<1	<1		-	2	2
1998	120	-	2	2	0		-	<1	<1		-	<1	<1		-	29	29
1999		-	2	2	0		-	0	0		-	<1	<1		-	3	3
2000		-	6	6	0		-	<1	<1		-	<1	<1		-	3	3
2001	50	-	4	4	0		-	<1	<1		-	3	3		-	106	106
2002	50	-	3	3	0		-	1	1		-	1	1		-	44	44
2003	120	5	7	13	0		0	<1	<1		<1	<1	<1		<1	3	3
2004	120	62	11	73	155	150	0	1	1	80	0	3	3	50	2	44	46
2005	120	70	3	73	8412	150	0	2	2	80	0	2	2	50	2	3	5
2006	120	17	12	29	3814	150	0	3	3	80	<1	5	5	50	<1	5	5
2007	120	8	10	18	7882	150	0	12	12	80	<1	10	10	50	<1	2	2
2008	120	13	8	21	9155	150	0	29	29	80	0	20	20	50	<1	<1	<1
2009	120	15	9	24	10290	150	0	46	46	80	0	26	26	50	5	1	6
2010	120	11	6	17	10382	150	0	26	26	80	0	48	48	50	4	<1	4
2011	120	11	3	14	6838	150	0	23	23	80	0	26	26	50	5	1	6
2012	120	7	3	9	8484	150	0	42	42	80	<1	34	34	50	4	5	9
2013	120	13	11	24	12602	150	0	25	25	80	<1	44	44	50	5	53	58
2014	120	16	<1	16	19565	150	0	<1	<1	80	<1	2	2	50	5	<1	5
2015	120	19	5	24	37863	150	0	1	1	80	0	2	2	50	26	<1	26
2016	120	20	1	22	32287	1663	0	9	9	80	<1	3	3	50	12	7	19
2017	120	30	2	31	43848	1663	0	2	2	80	<1	2	2	50	16	15	31
2018	120	21	1	23	31187	1663	0	2	2	80	<1	4	4	50	12	1	14
2019	120	25	<1	25	47657	1663	0	2	2	80	<1	<1	1	50	15	2	17
2020	120	6	<1	6	20769	1663	0	<1	<1	80	<1	4	4	50	8	<1	9
2021	120	13	<1	14	28658	1663	0	2	2	80	<1	3	3	50	18	11	29
2022	120	27	<1	27	30003	1663	0	<1	<1	80	<1	3	3	50	25	<1	25
2023	120	13	<1	13	28761	1663	0	<1	<1	80	<1	2	2	50	10	<1	10
2024	120	8	<1	8	24205	1663	0	<1	<1	80	<1	4	4	50	12	2	14

Length-weight relationships, length-at-maturity data and estimates of abundance from survey data for rajids were presented in WG-FSA-05/70. An analysis of the skate tagging program (WG-FSA-13/22) indicated a recapture rate of <1% and an average distance between release and recapture of 4 nautical miles. An analysis of catch rates from 1997 to 2014 of the three skate species (Nowara et al., 2017) shows a decrease in the average total length of Eaton's skate (*Bathyraja eatonii*), but little evidence of depletion on the main trawl grounds. One of the skate species, the Kerguelen sandpaper skate (*B. irrasa*), showed a slight decline in catch rates in the deeper waters around Heard Island and McDonald Islands where the longline fishery operates. This study also calculated a growth rate of *ca.* 20mm per year, and a maximum age >20 years for *B. eatonii*, as estimated from tag returns.

In 2023, WG-FSA-2023/40 reported on a project to inform post-release survival rates of skates using pop-up satellite tags and to investigate capture-related stress through blood biomarkers. The survival and activity patterns of 24 Kerguelen sandpaper skates was evaluated using MiniPat pop-up archival satellite tags.

2.3. Vulnerable marine ecosystems (VMEs)

Fishing gear deployed on the seabed can have negative effects on sensitive benthic communities. The potential impacts of fishing gear on the benthic communities in Division 58.5.2 are limited by the small size and number of commercial trawl grounds and the protection of large representative areas of sensitive benthic habitats from direct effects of fishing within the Heard Island and McDonald Islands Marine Reserve, an IUCN Category 1a reserve where fishing is prohibited (SC-CAMLR-XXI/BG/18). The marine reserve covers a total area of 71,000 km^2.

By-catch of benthos has been monitored by observers since the early stages of the development of the fishery and the rate of benthos by-catch is generally lower in areas that have subsequently become the main fishing grounds as opposed to locations sampled in the Random Stratified Trawl Survey.

As Conservation Measure 22-06 does not apply to this area there are no CCAMLR VMEs or VME Risk Areas designated in Division 58.5.2.

2.4. Incidental mortality of seabirds and marine mammals

The level of risk of incidental mortality of birds in Division 58.5.2 is category 4 (average-to-high) (SC-CAMLR-XXX, Annex 8, paragraph 8.1). Longline fishing is conducted in accordance with Conservation Measures 24-02 and 25-02 for the protection of birds so that hook lines sink beyond the reach of birds as soon as possible after being put in the water. Between them, these measures specify the weight requirements for different longline configurations and the use of streamer lines and a bird exclusion device to discourage birds from accessing the bait during setting and hauling. Fishing season and season extensions are specified in Conservation Measure 41-08. If three seabirds are caught during the season extension by a given vessel, fishing during the season extension is to cease immediately for that vessel.

Seabird mortality rates during longline operations in this fishery remains low (WG-FSA-2019/31); The three most common species injured or killed in the fishery were Cape petrel (*Daption capense*), white-chinned petrel (*Procellaria aequinoctialis*) and grey petrel (*P. cinerea*) (Table 4).

Table 4. Number of reported birds caught (killed or with injuries likely to substantially reduce long-term survival) in this fishery in each fishing season.

Season	*Daption capense*	*Procellaria aequinoctialis*	*Procellaria cinerea*	*Thalassarche melanophris*	Other
1998		2			
2003					5
2004					2
2005		1			
2009	1				
2010	2				
2012					2
2013	1				
2014					1
2015					1
2016		1			2
2017			1		
2018		1	1		
2019		3			
2020		3			1
2021		3		1	1
2022					3
2023					1

Conservation Measure 25-03 is in force to minimise the incidental mortality of birds and mammals during trawl fishing. Measures include developing gear configurations which minimise the chance of birds encountering the net, and the prohibition of discharge of offal and discards during the shooting and hauling of trawl gear.

Mammal mortalities reported in the longline fishery in Division 58.5.2 (Table 5) mainly consist of Southern elephant seal (*Mirounga leonina*).

Low levels of sperm whale depredation have been observed in Division 58.5.2 since 2011 (WG-FSA-15/53). Sperm whale sightings occur exclusively in the April-June period.

Table 5. Number of reported mammals killed in this fishery in each fishing season.

Season	*Arctocephalus gazella*	*Mirounga leonina*	*Otaria byronia*	Otariidae, Phocidae	Phocidae
1998	2				
2003	1	3		1	
2004	2	1			
2005		1		1	
2006			1	2	
2007		1		1	
2008	1	1			
2009		2			
2012		1			
2013		5			
2014	1	1			
2015		2		2	
2016		7			2
2017		4		2	
2018		5			
2019		3			
2020		4			
2021		7			
2022		13			
2023		6			
2024		2			

3. Illegal, Unreported and Unregulated (IUU) fishing

No illegal, unreported and unregulated (IUU)-listed vessels were sighted in Division 58.5.2 inside the Heard Island and McDonald Islands Exclusive Economic Zone (EEZ) since 2006. However, surveillance reports indicate that IUU fishing activities did occur in Division 58.5.2 outside the Heard Island and McDonald Islands EEZ, and therefore brief fishing forays into the EEZ cannot be discounted. IUU fishing gear was also recovered in 2006 and 2011, indicating IUU fishing activities have potentially occurred in the region. Information from satellite surveillance trials indicated the presence of unidentified vessels in this Division outside the Heard Island and McDonald Islands EEZ in 2016. In May 2017, a section of gillnet was recovered during fishing operations in Division 58.5.2. Following the recognition of methodological issues in its assessment, no estimates of the IUU catch of *Dissostichus* spp. have been provided since 2011 (SC-CAMLR-XXIX, paragraph 6.5).

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. Data are collected during commercial fishing trips and during Random Stratified Trawl Surveys (RSTS). The surveys cover a geographic area over the whole of the plateau shallower than 1,000 m in Division 58.5.2 to determine abundance of *D. eleginoides*. These surveys have been conducted since 1990 with survey designs described in detail in WG-FSA-06/44 Rev. 1 and in WG-FSA-2022/07 for the 2022 survey.

4.2. Summary of available data

Both the vessel's crew and observers collect fishing effort, catch, and by-catch information.

The vessel's crew report by-catch 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 6 and 7.

Table 6. Summary of by-catch 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	2020	2021	2022	2023	2024
Vessel crew	by-catch	taxa identified	61	100	85	101	99
		records	4763	7238	7114	6317	5925
Observer	toothfish	specimens examined	29149	43151	49812	39242	38854
		length measurements	29103	43036	49513	39184	38725
		weight measurements	28856	42861	49449	39136	38677
		sex identifications	29149	43151	49812	39242	38854
		maturity stage identifications	22200	34878	43323	33134	33571
		gonad weight measurements	0	7	4486	199	33
		otolith samples	3157	4258	5813	3466	2660
	by-catch	specimens examined	19246	37044	38707	30572	27437
		taxa identified	18	27	57	22	25
		length measurements	19146	36920	38542	30472	27261
		weight measurements**	19115	36871	38600	30462	27289
		standard length measurements*	3117	7111	3715	3011	2231
		wingspan measurements*	2701	5510	10052	7349	6878
		pelvic length measurements*	0	0	0	0	0
		snout to anus measurements*	13393	24356	24794	20131	17584
		sex identifications**	19246	37044	38707	30572	27437
		maturity stage identifications**	10209	27833	28173	25981	20363
		gonad weight measurements**	0	0	7	0	41
		otolith samples**	252	862	588	824	470

*: Species-dependent records
**: Voluntary records

Table 7. 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	2020	2021	2022	2023	2024
Macrourus spp.	specimens examined	13425	24399	24818	20160	17699
	taxa identified	6	7	6	6	4
	length measurements	13340	24301	24700	20093	17583
	weight measurements**	13371	24299	24770	20115	17606
	snout to anus measurements*	13393	24354	24771	20129	17582
	sex identifications**	13425	24399	24818	20160	17699
	maturity stage identifications**	7252	20693	20179	19951	15114
	gonad weight measurements**	0	0	0	0	40
	otolith samples**	70	752	353	544	363
Skates and rays	specimens examined	2703	5521	10080	7389	6956
	taxa identified	6	4	5	5	7
	length measurements	2690	5499	10040	7357	6905
	weight measurements**	2689	5509	10036	7344	6909
	wingspan measurements*	2701	5510	10052	7349	6878
	pelvic length measurements*	0	0	0	0	0
	sex identifications**	2703	5521	10080	7389	6956
	maturity stage identifications**	1495	3327	6200	4199	3707
	gonad weight measurements**	0	0	0	0	0
Other fish	specimens examined	3118	7124	3809	3021	2780
	taxa identified	6	16	46	10	13
	length measurements	3116	7120	3802	3020	2771
	weight measurements**	3055	7063	3794	3001	2772
	standard length measurements*	3117	7111	3715	3011	2229
	sex identifications**	3118	7124	3809	3021	2780
	maturity stage identifications**	1462	3813	1794	1831	1541
	gonad weight measurements**	0	0	7	0	1
	otolith samples**	182	110	235	280	107

*: Species-dependent records
**: Voluntary records

The counts of by-catch taxa reported above (Table 7) 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.

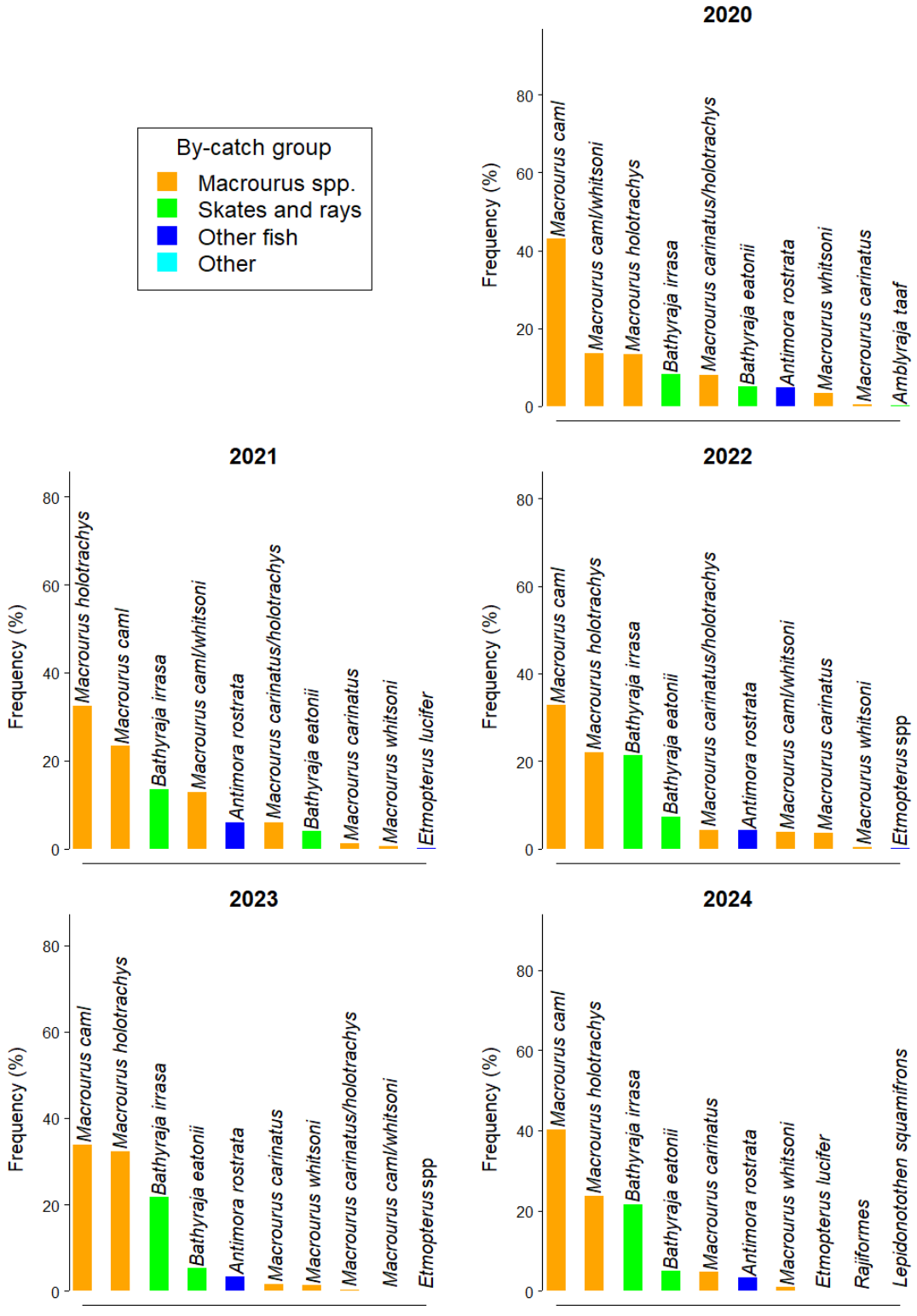


Figure 2. Relative frequencies of the most commonly examined by-catch taxa in each of the last five seasons, from the observer data (unweighted raw counts of individually examined specimens). Taxonomic identification may occur at different levels.

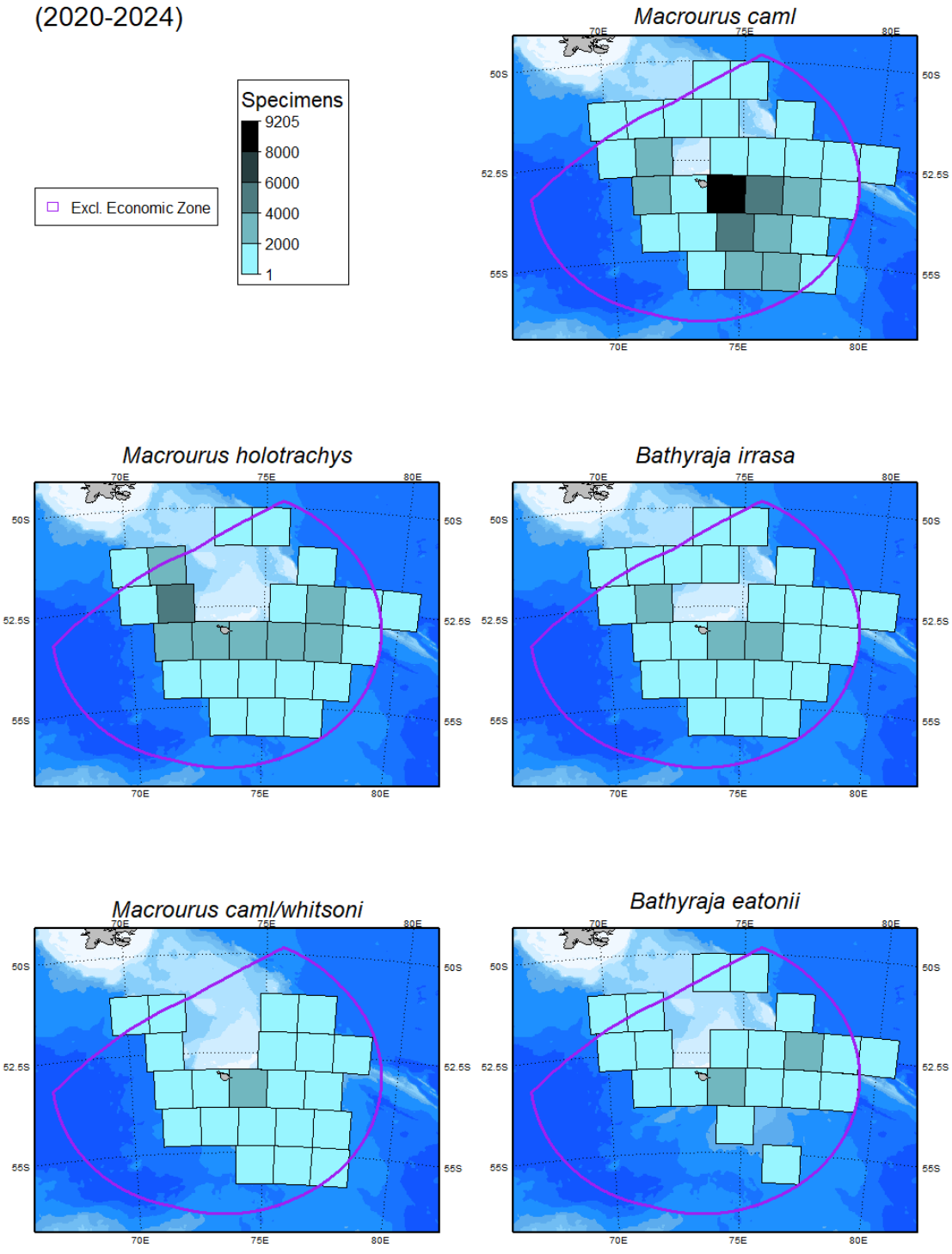


Figure 3. Spatial distribution of the most commonly examined by-catch taxa across the last five seasons, from the observer data (unweighted raw counts of individually examined specimens in each cell). The data were aggregated using equal area (100 km x 100 km) cells. Taxonomic identification may occur 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

Dissostichus eleginoides occurs throughout the Heard Island and McDonald Islands area of the Kerguelen Plateau in Division 58.5.2, from shallow depths near Heard Island to at least 3,000 m depth around the periphery of the plateau. Fish smaller than 60cm total length (TL) are predominantly distributed on the plateau in depths less than 500m, where a small number of areas of persistently high local abundance have been discovered. As fish grow, they move to deeper waters and are recruited to the fishery on the plateau slopes in depths of 450 to 800m where they are vulnerable to trawling. Some areas of high local abundance comprise the main trawling grounds where the majority of fish caught are between 50 and 75cm Total Length. Larger fish are seldom caught by trawling and there is evidence from tag recaptures and size distribution of the catch by depth that fish, as they grow, move into deeper water (>1,000m depth) where they are caught by longline.

The length frequency distributions of *D. eleginoides* caught by trawl and by longline in Division 58.5.2 are shown in Figures 4 and 5 respectively. Since the start of the fishery >500,000 fish have been measured in this division.

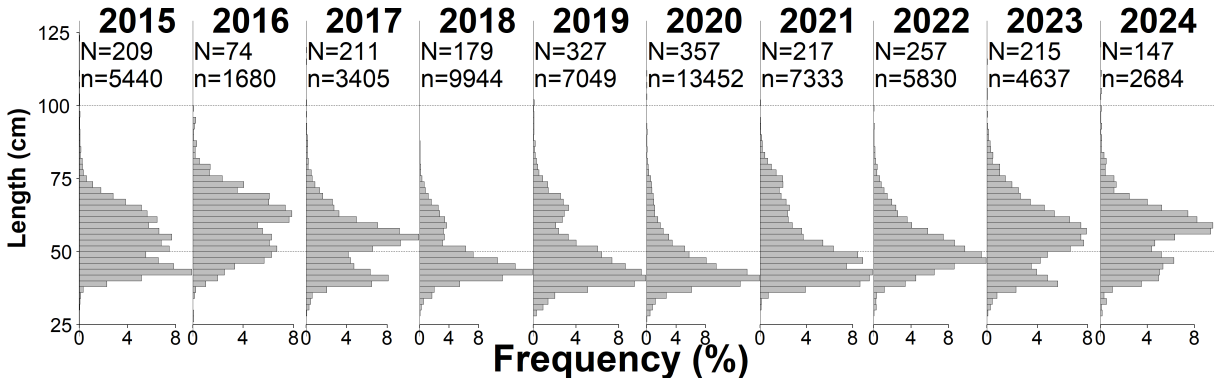


Figure 4. Annual length frequency distributions of *D. eleginoides* caught by trawl in this fishery. The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were measured.

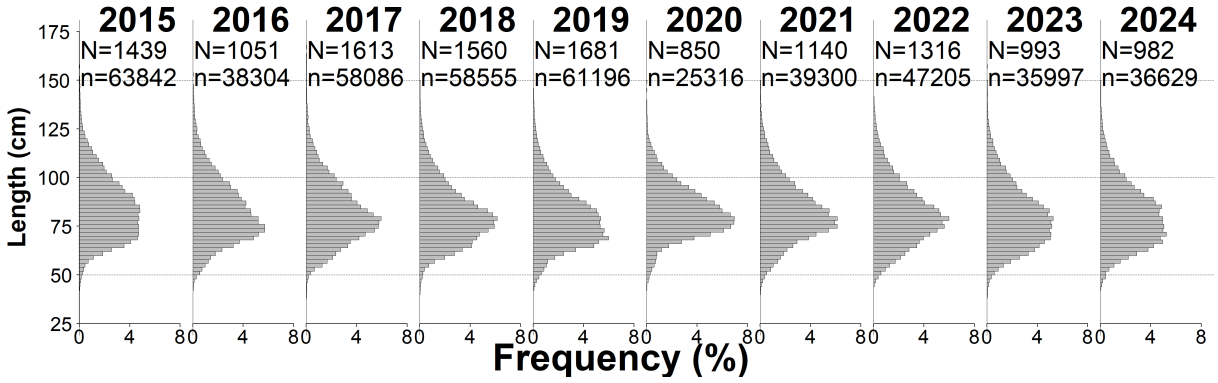


Figure 5. Annual length frequency distributions of *D. eleginoides* caught by longline in this fishery. The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were measured.

The majority of *D. eleginoides* caught by trawl measured between 25 and 100cm with a mode around 40-50cm, while those caught by longline measured between 50 and 125cm with a mode around 75cm. The length frequency distribution for the longline fishery includes larger fish because of gear selectivity and because the

longline fishery occurs in deeper water where larger toothfish occur. 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.

4.4. Tagging

A tagging study has been undertaken in Division 58.5.2 since the start of the commercial fishery in 1998.

To date, 91936 *D. eleginoides* have been tagged and released (17008 have been recaptured; Table 8).

Table 8. Recent numbers of *Dissostichus eleginoides* tagged and recaptured in the area for each fishing Season.

		Recaptured																												
Season	Tagged	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
1998	1073	72	66	24	10	10	4	2	1	1		2				1													**193**
1999	757		56	71	19	2	1	1		1				1			1												**153**
2000	1777			125	101	66	12	8	2	1			1				1		1										**318**
2001	1599				199	94	48	14	2	1		1			1	1	1												**362**
2002	1534					255	149	41	12	4	1		2					1	1										**466**
2003	1576						169	124	24	18	2	6	2	2	3	1	3	1	1	1									**357**
2004	1562							287	135	25	10	8	7	2	5		2	3	7	2									**493**
2005	1701								266	88	16	5	9	8	4	3	5	6	11	1		1	1		1				**425**
2006	2430									220	179	51	26	13	11	12	19	9	11	4	6	1	1	1	2	1			**567**
2007	1841										199	120	35	21	13	6	12	10	13	8	3	2	1		1		1		**445**
2008	1759											50	61	25	14	9	31	20	25	10	5	5	1	2	1			1	**260**
2009	2446												92	100	52	15	28	40	51	14	24	5	9	8	1	1	2		**442**
2010	1769													55	66	14	18	55	37	10	18	13	13	8	1	2		2	**312**
2011	2398														124	149	54	46	46	32	32	32	23	9	6	3	4	4	**564**
2012	2986															161	123	53	48	40	57	46	28	19	27	5		2	**609**
2013	2003																31	58	99	45	49	52	22	23	11	9	1	3	**403**
2014	2126																	12	87	61	84	46	52	37	23	8	13	1	**424**
2015	8347																		85	273	345	287	251	176	101	71	41	30	**1660**
2016	5947																			49	221	287	265	158	131	77	52	38	**1278**
2017	6903																				56	332	406	328	253	173	99	71	**1718**
2018	6167																					51	435	218	347	180	101	78	**1410**
2019	6819																						107	232	412	331	231	141	**1454**
2020	5107																							42	240	244	174	133	**833**
2021	6086																								49	393	257	269	**968**
2022	5343																									62	245	273	**580**
2023	5011																										57	222	**279**
2024	4869																											35	**35**
Total	**91936**																												**17008**

Historically, the tagging program had been largely restricted to releases and recaptures of fish caught by trawl on the main trawl ground (WG-FSA-14/43). Tagging data from the main trawl ground were used to estimate natural mortality independently of the CASAL assessment as described in Candy et al. (2011), while the limited spatial extent of the program and mixing of the population to other areas initially restricted the ability to include tagging data as an unbiased index of abundance in the stock assessment. With the start of longlining in 2003, tagging and recapturing of fish has become more widespread. However, the spatial distribution of longline fishing and tagging of fish has been highly variable between years and the level of fish movement and the period of complete mixing is still unknown. Tagging data have been included into the stock assessment since 2014 to inform stock abundance.

5. Research

In each year since 1997, a Random Stratified Trawl Survey (RSTS) is conducted to assess the abundance and biology of fish and invertebrate species. The survey provides information for input into the stock assessments for the two target species in this area, *D. eleginoides* and *C. gunnari*. Surveys have been conducted as consistently as possible each year to ensure a continuous time series of data from the fishery. The Random Stratified Trawl Surveys have two long-term aims:

- to assess the abundance of juvenile and adult *D. eleginoides* on the shallow and deep parts of the Heard Island Plateau (300m to 1000m); and
- to assess the abundance of *C. gunnari* on the Heard Island Plateau.

In 2019, catch removals due to killer and sperm whale interactions across subantarctic fisheries were estimated (WG-FSA-2019/33).

In 2021, the RSTS catch of Patagonian toothfish (*Dissostichus eleginoides*) was 77.9 t. - the second highest catch since the RSTS began and the catch of mackerel icefish (*Champsocephalus gunnari*) was 35.7 t. which represents an almost 5-fold increase in catch from 2020 (WG-FSA-2021/19). Biomass estimates for the managed by-catch species unicorn icefish (*Champsocephalus rhinoceratus*) showed a steady increase in catch whereas grey rockcod (*Lepidonotothen squamifrons*) was relatively similar to last year and the catch of *Macrourus* spp. has declined. All three species of skate were caught in lower numbers than has been the case in recent years (WG-FSA-2021/19).

In 2022, a new set of randomly selected haul stations were included in the RSTS (WG-FSA-2022/07). The catch of Patagonian toothfish (*Dissostichus eleginoides*) was 36.2 t. The catch of mackerel icefish (*Champsocephalus gunnari*) was 71 t. which is the largest catch in the history of the survey. Biomass estimates for most of the managed by-catch species were similar to the survey averages in recent years whilst the biomass of *Bathyraja murrayi* has declined. WG-FSA-2022/09 presented an update on stock parameters, including recruitment indices from the random stratified trawl survey, and Chapman estimates of vulnerable biomass from tag-recapture data. These data indicated that the stock trajectory was consistent with that predicted by the 2021 stock assessment model. Recent high survey biomass and strong cohorts of young fish in the survey catch composition also indicated the potential for a recruitment pulse between 2016 and 2018.

In 2023, a new set of randomly selected haul stations were included in the RSTS (WG-FSA-2023/49). The catch of Patagonian toothfish (*Dissostichus eleginoides*) was 66.8 t. The catch of mackerel icefish (*Champsocephalus gunnari*) was 16 t. Biomass estimates for most of the managed by-catch species were similar to the survey averages in recent years. Length and weight measurements were taken for 16,728 fish.

In 2024, WG-FSA-IMAF-2024 considered a large work program for integrated toothfish stock assessments, with a focus on the performance of the decision rules, the effects of spatial bias in tagging data, approaches to select recruitment data for stock status projections, and management strategy evaluations (WG-FSA-IMAF-2024, paragraphs 4.30–4.50). Papers summarising this work included WG-SAM-2024/17, WG-SAM-2024/22, WG-SAM-2024/23, WG-SAM-2024/24, WG-SAM-2024/25, WG-FSA-IMAF-2024/47 and WG-FSA-IMAF-2024/69. The stock assessment for this fishery was updated a part of the stock assessment workplan (WG-FSA-IMAF-2024/50; SC-CAMLR-43, paragraphs 3.7–3.8).

6. Stock status

6.1. Summary of current status

The 2024 assessment model (see Stock Assessment Report) led to a B0 MCMC estimate of 64,083 tonnes (95% CI: 60,139–68,635 tonnes). The estimated SSB status at the end of 2024 was 0.38 (95% CI: 0.38–0.38).

6.2. Assessment method

The assessment model in 2024 was a single-sex, single-area, age-structured Casal2 integrated stock assessment model (see Stock Assessment Report).

6.3. Year of last assessment, year of next assessment

Assessments are reviewed biennially, the last assessment was in 2024.

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).

Further, Australia presented a handbook for the adaptation of fisheries management to climate change which combines adaptive and ecosystem-based management approaches and is designed to guide fisheries managers, scientists and industry through a risk assessment process that can identify feasible options for responding to climate change. WS-CC-2023 noted that the approach provided by this handbook could be used for initial assessments of stocks within CCAMLR, and recommended that the Scientific Committee review this approach for the adaptation of fisheries management to climate change within CCAMLR. To inform those discussions, WG-FSA-2023/63 provided a summary report of a workshop held in May 2023 which utilised the framework from the handbook to identify risks and potential adaptation responses in the Patagonian toothfish (*Dissostichus eleginoides*) fishery in Division 58.5.2 around Heard Island and McDonald Islands (HIMI).

In 2024, Members developed summaries of evidence for changes in stock assessment parameters or processes that could be due to the effects of environmental variability or climate change, in the form of tables, for fisheries in Subarea 48.3, Divisions 58.5.1 and 58.5.2 and in the Ross Sea region (Table 9).

Table 9. Table summarising evidence for changes in stock assessment and population parameters or processes that could be due to the effects of environmental variability or climate change in the Patagonian toothfish fishery in Division 58.5.2 (WG-FSA-IMAF-2024/50).

Parameter or process		Evidence for trends and potential drivers
Recruitment	Mean recruitment	It is difficult to determine whether there are patterns in recruitment as current analyses related to temporal and spatial variability in the fishing footprint indicated possible issues with tagging data that in turn may have an impact on recruitment estimates derived from the model. Data from the annual fishery independent survey (RSTS) suggests no change in biomass or age class structure of Patagonian toothfish present in waters surveyed.
	Recruitment variability	The time series is currently not long enough to evaluate changes in variability, but the depletion rule has not been a constraint in the application of the decision rules in assessments.
Age at maturity		The age at maturity function for HIMI Patagonian toothfish was last re-estimated in 2017 (Yates et al. 2017). There is a current project underway which will allow a re-estimation in the future.
Stock-recruit relationship		The time series of recruitment is not long enough to determine if the stock recruitment relationship is being affected by climate change. Long term monitoring of mean recruitment and its relationship to spawning stock biomass may be able to be used to determine if changes in the relationship occur.
Natural mortality	From direct predation	Not known
	Not from direct predation	Not known
Growth rates		Analysis of length-weight residual patterns across cohorts could be reviewed to consider whether there are any changes in mean size at age.
Length-weight		The length-weight relationship was last estimated in 2019 (WG-FSA-19/32). Comparison to earlier estimates (for e.g. 1999) report similar patterns to this estimate.
Sex ratio changes		Reported annually in RSTS surveys but yet to be investigated in more detail.
Spatial distribution		There have been some changes in fishing effort over time as well as some strong concentration of effort in particular years which make it difficult to determine whether there have been changes in Patagonian toothfish distribution (Masere et al. 2024; Masere and Ziegler, 2024).
Stock structure	Revised	There has been no evidence to suggest the stock structure hypothesis for Patagonian toothfish in HIMI has altered from current stock structure hypotheses.
	Locations of spawning and site fidelity	Not known
Depredation mortality		To date there has been a relatively small amount of depredation documented at HIMI. Further, it seems to be significantly smaller than in other toothfish fisheries (Tixier et al. 2019).

Additional Resources

- Fishery Summary: pdf, html
- Species Description: pdf, html
- Stock Assessment Report: pdf
- Stock Annex: pdf
- Fisheries Documents Browser

References

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