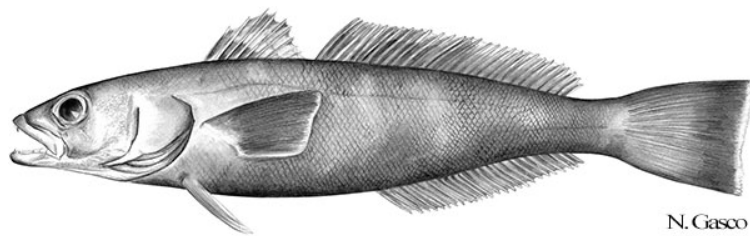


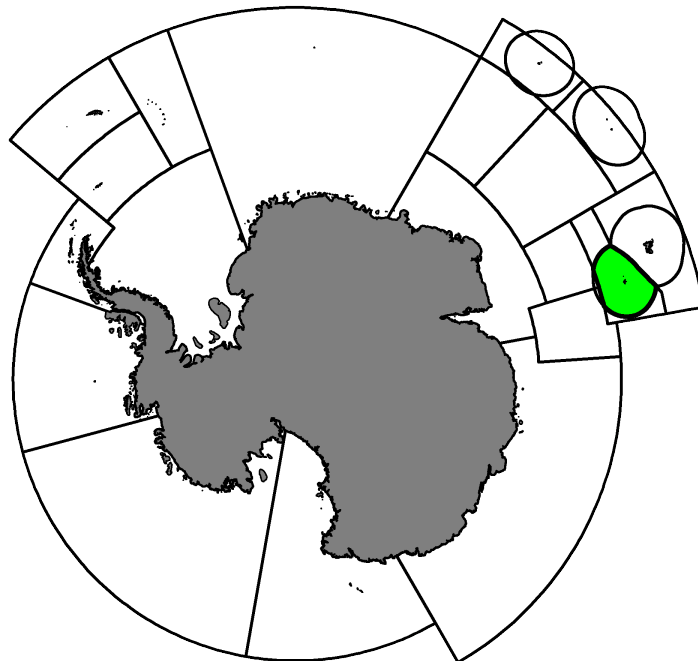
# Fishery Report 2021: *Dissostichus eleginoides* at Heard Island (Division 58.5.2)

CCAMLR Secretariat

27 May 2022



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, “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 fishery 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, 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 2015 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](#).

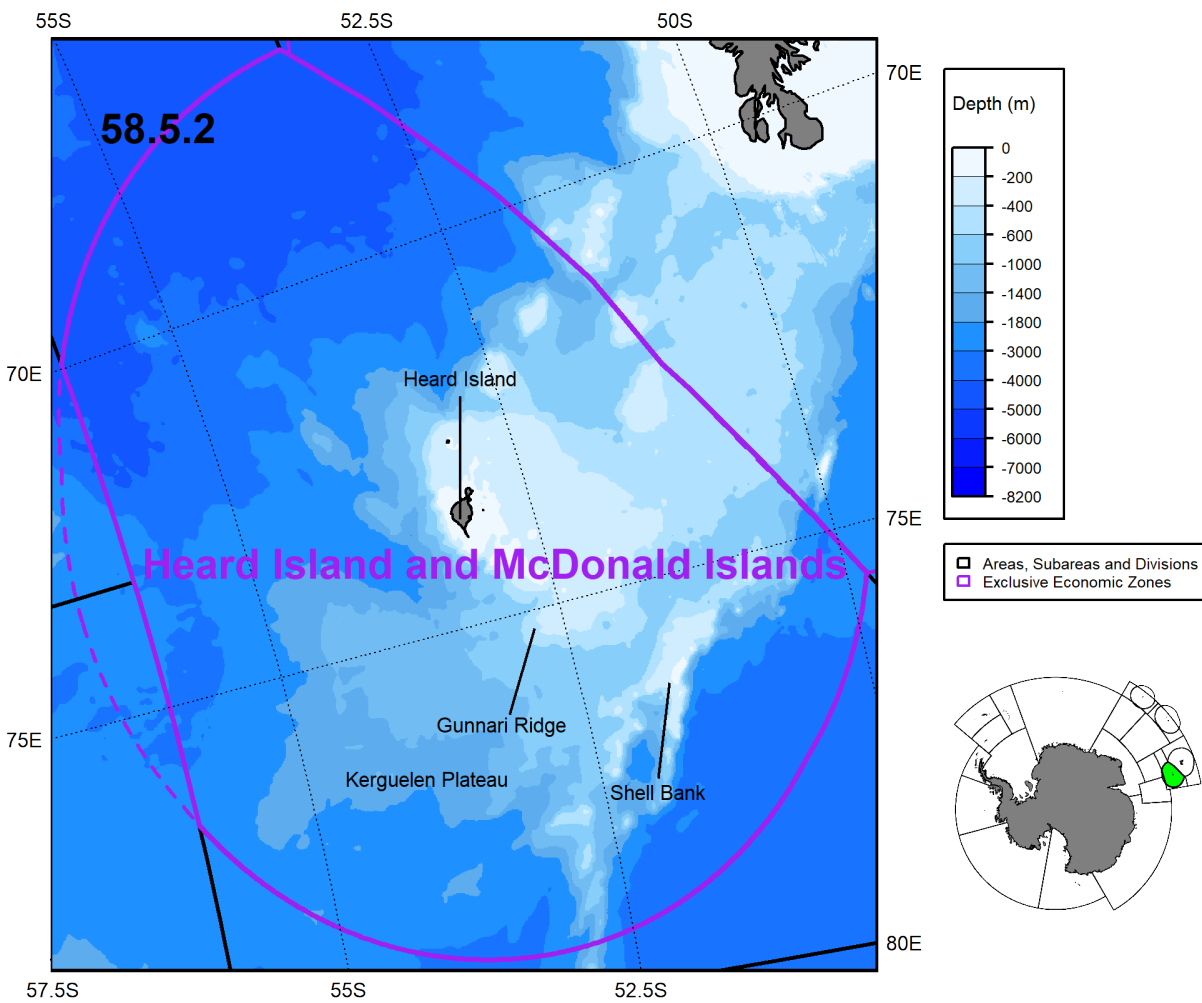


Figure 1: Map of the region discussed in this report.

### 1.3. Active vessels

In 2021, 5 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 2021, 2994 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 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	30	2402	3	2550	0
2011	1381	1104	34	2518	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	2994	5	3030	-

## 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, the by-catch limits for incidentally caught species and the move-on rules if the 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 Conservation Measure [33-02](#) for details). Source: fine-scale data.

Season	<i>Macrourus</i> spp.				<i>M. caml</i> and <i>M. whitsoni</i>				<i>M. holotrachys</i> and <i>M. carinatus</i>			
	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	-				-				-			
1998	-		<1	<1	-				-			
1999	-		<1	<1	-				-			
2000	-		4	4	-				-			
2001	-		1	1	-				-			
2002	50		3	3	-				-			
2003	465	3	1	4	-				-			
2004	360	42	3	45	-				-			
2005	360	72	2	74	-				-			
2006	360	26	<1	27	-				-			
2007	360	61	5	66	-				-			
2008	360	81	5	86	-				-			
2009	360	110	2	112	-				-			
2010	360	100	3	102	-				-			
2011	360	147	4	151	-				-			
2012	360	89	3	92	-				-			
2013	360	154	3	157	-				-			
2014	360	175	1	176	-				-			
2015	360	299	4	303	-				-			
2016	-				409	78	1	80	360	220		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		59
2021	-				409	66	<1	67	360	150	<1	150

An analysis of the by-catch species unicorn icefish (*Channichthys rhinocerus*) 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. rhinocerus* 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. rhinocerus* was undertaken in 2015 and WG-FSA-15 recommended a by-catch limit of 1,663 tonnes for *C. rhinocerus*.

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

Season	Skates and rays					<i>C. rhinoceros</i>				<i>L. squamifrons</i>				Other species			
	Catch Limit	Longline Catch	Trawl Catch	Total Catch	Number Re-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	-	0	<1	<1	-		<1	<1	-		4	4
1998	120		2	2	0	-	0	<1	<1	-		<1	<1	-		31	31
1999	-		2	2	0	-	0			-		<1	<1	-		5	5
2000	-		6	6	0	-	0	<1	<1	-		<1	<1	-		12	12
2001	50		4	4	0	-	0	<1	<1	-		3	3	-		111	111
2002	50		3	3	0	-	0	1	1	-		1	1	-		51	51
2003	120	5	7	13	0	-	0	<1	<1	-	<1	<1	<1	-	9	12	20
2004	120	62	11	73	155	150	0	1	1	80		3	3	50	106	58	164
2005	120	70	3	73	8412	150	0	2	2	80		2	2	50	144	8	152
2006	120	17	12	29	3814	150	0	3	3	80	<1	5	5	50	43	18	61
2007	120	8	10	18	7882	150	0	12	12	80	<1	10	10	50	70	17	86
2008	120	13	8	21	9155	150	0	29	29	80		20	20	50	94	13	107
2009	120	15	9	24	10290	150	0	46	46	80		26	26	50	130	13	143
2010	120	11	6	17	10382	150	0	26	26	80		48	48	50	114	9	123
2011	120	11	3	14	6838	150	0	23	23	80		26	26	50	163	8	171
2012	120	7	3	9	8484	150	0	42	42	80	<1	34	34	50	99	11	110
2013	120	13	11	24	12602	150	0	25	25	80	<1	44	44	50	172	67	239
2014	120	16	<1	16	19565	150	0	<1	<1	80	<1	2	2	50	196	2	198
2015	120	19	5	24	37863	150	0	1	1	80		2	2	50	344	9	353
2016	120	20	1	22	32287	1663	0	9	9	80	<1	3	3	50	331	10	341
2017	120	30	2	31	43848	1663	0	2	2	80	<1	2	2	50	371	17	388
2018	120	21	1	23	31187	1663	0	2	2	80	<1	4	4	50	387	6	393
2019	120	25	<1	25	47657	1663	0	2	2	80	<1	<1	1	50	390	7	397
2020	120	6	<1	6	20769	1663	0	<1	<1	80	<1	4	4	50	121	2	123
2021	120	13	<1	14	28658	1663	0	2	2	80	<1	3	3	50	248	12	260

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*), shows 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.

### 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<sup>2</sup>.

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 subarea there are no CCAMLR VMEs or VME Risk Areas designated in Division 58.5.2.

### 2.4. Incidental mortality of seabirds and marine mammals

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).

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.



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	<i>Daption capense</i>	<i>Procellaria aequinoctialis</i>	<i>Procellaria cinerea</i>	<i>Thalassarche melanophris</i>	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

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.

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.

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

Season	<i>Arctocephalus gazella</i>	<i>Mirounga leonina</i>	<i>Otaria byronia</i>	<i>Otariidae, Phocidae</i>	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			

### 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-2021/19](#) for the 2021 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	2017	2018	2019	2020	2021
Vessel crew	by-catch	taxa identified	46	62	65	61	100
		records	8322	7686	8491	4763	7238
Observer	toothfish	specimens examined	60683	61569	64564	29149	43151
		length measurements	60591	61531	64432	29103	43036
		weight measurements	59613	60726	64371	28856	42861
		sex identifications	58790	59942	64564	29149	43151
		maturity stage identifications	58764	54200	55991	22200	34878
		gonad weight measurements	21	9	33	0	7
		otolith samples	6130	6450	6551	3157	4258
	by-catch	specimens examined	52706	56032	47863	19246	37044
		taxa identified	25	22	26	18	27
		length measurements	52269	55655	47653	19146	36920
		weight measurements**	52062	46868	47609	19115	36871
		standard length measurements*	0	950	3223	3117	7111
		wingspan measurements*	10251	9953	13412	2701	5510
		pelvic length measurements*	0	0	0	0	0
		snout to anus measurements*	31198	35402	31150	13393	24356
		sex identifications**	35843	51591	47863	19246	37044
		maturity stage identifications**	32119	38948	38255	10209	27833
		gonad weight measurements**	0	0	1	0	0
		otolith samples**	2045	1777	1300	252	862

\*: 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	2017	2018	2019	2020	2021
<i>Macrourus</i> spp.	specimens examined	31409	35550	31195	13425	24399
	taxa identified	6	6	6	6	7
	length measurements	31073	35260	31055	13340	24301
	weight measurements**	31181	34483	31117	13371	24299
	snout to anus measurements*	31197	35402	31149	13393	24354
	sex identifications**	20890	35128	31195	13425	24399
	maturity stage identifications**	20886	28900	29187	7252	20693
	gonad weight measurements**	0	0	1	0	0
	otolith samples**	1685	1360	1203	70	752
Skates and rays	specimens examined	10319	9984	13436	2703	5521
	taxa identified	5	5	4	6	4
	length measurements	10226	9902	13372	2690	5499
	weight measurements**	10226	9886	13402	2689	5509
	wingspan measurements*	10251	9953	13412	2701	5510
	pelvic length measurements*	0	0	0	0	0
	sex identifications**	10316	9984	13436	2703	5521
	maturity stage identifications**	6597	4481	7769	1495	3327
	gonad weight measurements**	0	0	0	0	0
Other fish	specimens examined	10978	10498	3232	3118	7124
	taxa identified	14	11	16	6	16
	length measurements	10970	10493	3226	3116	7120
	weight measurements**	10655	2499	3090	3055	7063
	standard length measurements*	0	950	3223	3117	7111
	sex identifications**	4637	6479	3232	3118	7124
	maturity stage identifications**	4636	5567	1299	1462	3813
	gonad weight measurements**	0	0	0	0	0
	otolith samples**	360	416	95	182	110

\*: Species-dependent records

\*\*: Voluntary records

#### 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 2 and 3 respectively. Since the start of the fishery >500,000 fish have been measured in this division.

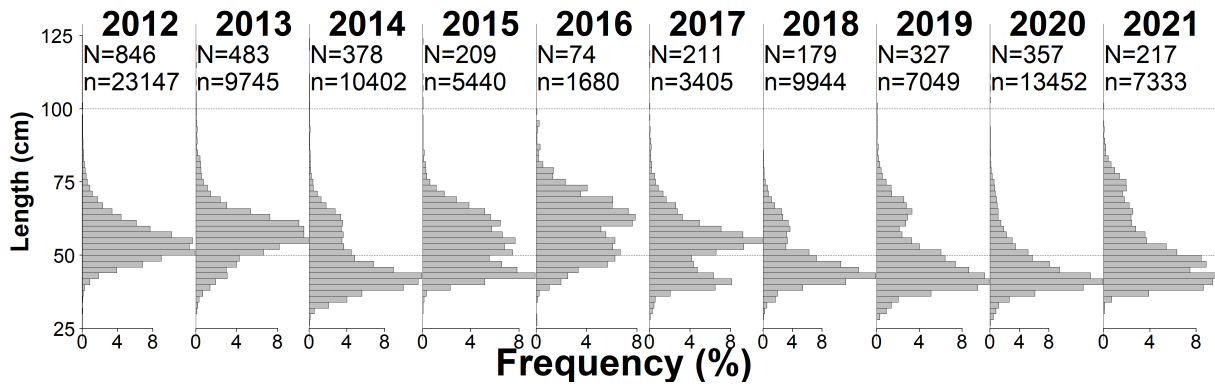


Figure 2. Annual length frequency distributions of *D. eleginoides* caught by trawl in this fishery. The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were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

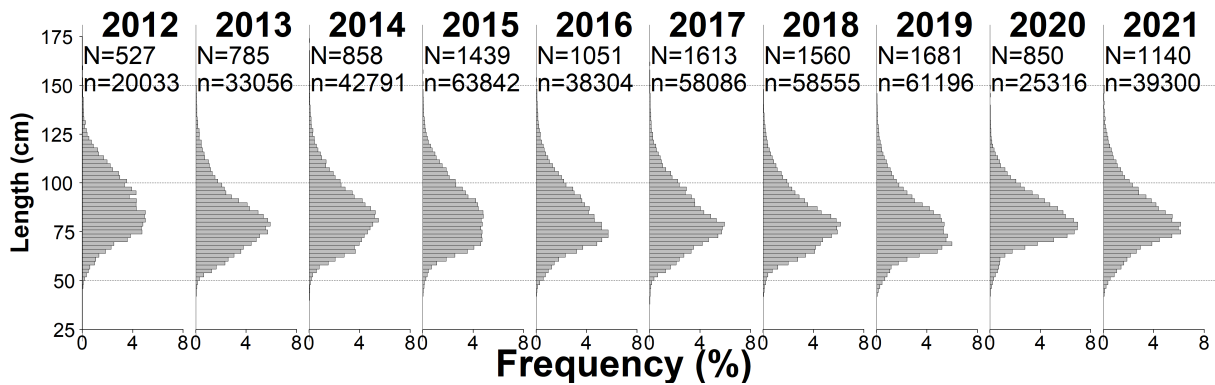


Figure 3. Annual length frequency distributions of *D. eleginoides* caught by longline in this fishery. The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were 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, 76712 *D. eleginoides* have been tagged and released (7114 have been recaptured, 12871 of which were released in this area; Table 8).

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

Season	Tagged	Recaptured																							Total		
		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		2021	
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			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	566	
2007	1841										199	120	35	21	13	6	12	10	13	8	3	2	1		1	444	
2008	1759											50	61	25	14	9	31	20	25	10	5	5	1	2	1	259	
2009	2446												92	101	52	15	28	40	51	14	24	5	9	8	1	440	
2010	1769													55	66	14	18	55	37	10	18	14	13	8	1	309	
2011	2398														124	150	54	46	46	32	32	32	23	9	6	554	
2012	2986															161	124	53	48	40	57	46	28	19	27	603	
2013	2003																	31	58	100	45	49	52	22	23	391	
2014	2126																		12	87	61	85	46	52	37	403	
2015	8347																			85	273	345	288	251	176	101	1519
2016	5947																				49	221	287	265	158	131	1111
2017	6903																					56	327	406	328	253	1370
2018	6167																						49	438	218	348	1053
2019	6819																							107	232	412	751
2020	5106																								42	240	282
2021	6086																									49	49
Total	76712																										12871

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 (300 to 1000m); and
- to assess the abundance of *C. gunnari* on the Heard Island Plateau.

In 2021, the 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 2019, catch removals due to killer and sperm whale interactions across subantarctic fisheries were estimated ([WG-FSA-2019/33](#)).

## 6. Stock status

### 6.1. Summary of current status

The 2021 assessment model (see [Stock Assessment Report](#)) led to a slightly smaller estimate of the virgin spawning stock biomass B0 than that obtained in 2019, with an MCMC estimate of 69,210 tonnes (95% CI: 64,811-74,758 tonnes). The estimated SSB status at the end of 2021 was 0.45 (95% CI: 0.44-0.47), in line with the projection from the 2019 stock assessment.

### 6.2. Assessment method

The assessment model in 2021 was a single-sex, single-area, age-structured CASAL 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 2021.

## 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.*

*The institutional and management approach taken by CCAMLR, including the ecosystem-based approach, the establishment of large marine protected areas, and scientific monitoring programmes, provides measures of resilience to climate change.*

There is no formal evaluation of the impacts of climate change and environmental variability available for this particular fishery.

### Additional Resources

- Fishery Summary: [pdf](#), [html](#)
- Species Description: [pdf](#), [html](#)
- Stock Assessment Report: [pdf](#)
- Stock Annex: [pdf](#)
- [Fisheries Documents Browser](#)

### References

- Candy, S.G., D.C. Welsford, T. Lamb, J.J. Verdouw and J.J. Hutchins. 2011. Estimation of natural mortality for the Patagonian toothfish at Heard and McDonald Islands using catch-at-age and aged mark-recapture data from the main trawl ground. CCAMLR Science, 18: 29-45.
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