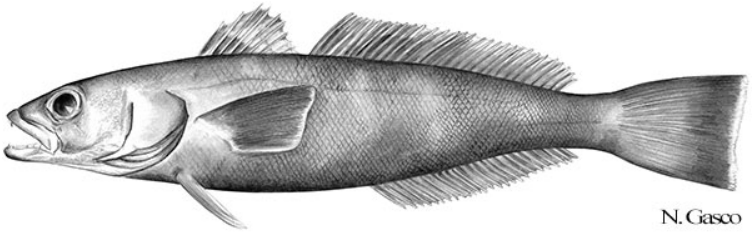
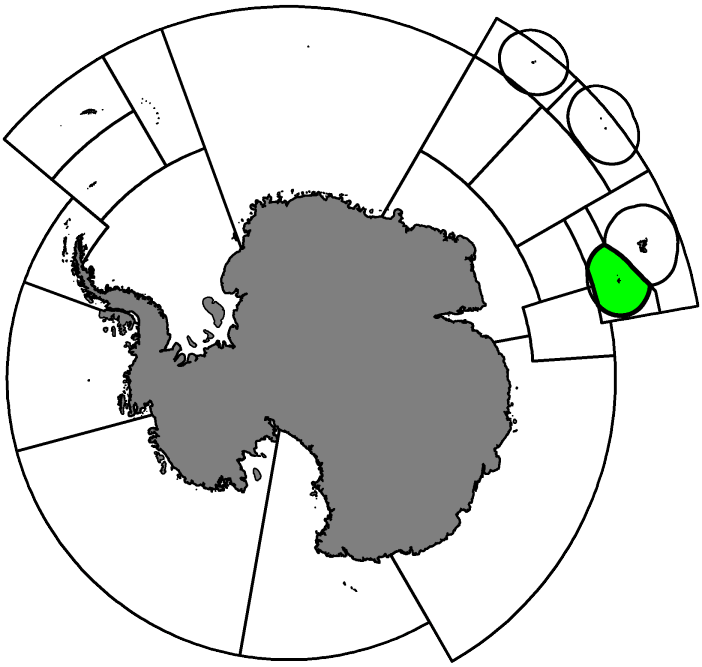
Fishery Report 2020: *Dissostichus eleginoides* at Heard Island (Division 58.5.2)

CCAMLR Secretariat

22 March 2021



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, "2020" refers to the 2019/20 CCAMLR fishing season (from 1 December 2019 to 30 November 2020).

Contents

1. Introduction to the fishery

1.1. History

This 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.

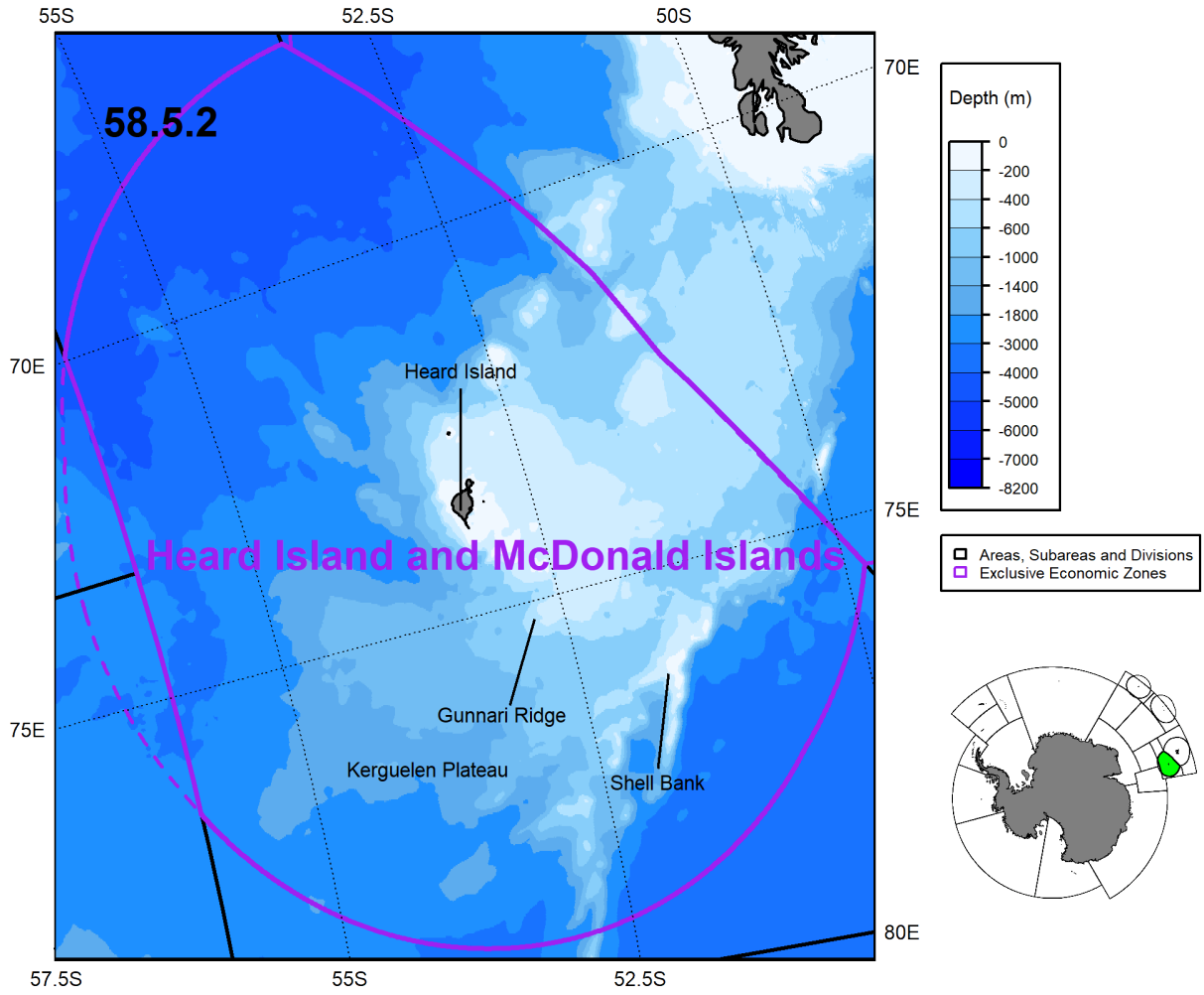


Figure 1: Map of the region discussed in this report.

1.3. Active vessels

In 2020, 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 2020, 3014 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		1811		1811	2	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	554	2327		2882	4	2873	531
2005	665	2266		2931	3	2787	265
2006	662	1769	72	2503	4	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	-

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 (macrourids, skates (Rajids) and other species) 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	*Macrouridae*				*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	-		<1	<1	-				-			
1998	-		<1	<1	-				-			
1999	-		<1	<1	-				-			
2000	-		4	4	-				-			
2001	-		1	1	-				-			
2002	50		3	3	-				-			
2003	465	3	1	5	-				-			
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

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 (Rajids, *C. rhinoceratus*, *L. squamifrons* and other species) in this fishery (see Conservation Measure 33-02 for details). Source: fine-scale data.

Season	Rajids					*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	-	0	<1	<1	-		<1	<1	-		7	7
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	-		113	113
2002	50		3	3	0	-	0	1	1	-		1	1	-		55	55
2003	120	5	7	13	0	-	0	<1	<1	-	<1	<1	<1	-	9	13	21
2004	120	62	11	73	155	150	0	1	1	80		3	3	50	107	59	166
2005	120	70	3	73	8412	150	0	2	2	80		2	2	50	144	9	153
2006	120	19	12	31	3814	150	0	3	3	80	<1	5	5	50	46	19	65
2007	120	8	10	18	7882	150	0	12	12	80	<1	10	10	50	70	18	87
2008	120	13	8	21	9155	150	0	29	29	80		20	20	50	94	21	116
2009	120	15	9	24	10290	150	0	46	46	80		26	26	50	130	14	145
2010	120	11	6	17	10382	150	0	26	26	80		48	48	50	114	10	124
2011	120	11	3	14	6838	150	0	23	23	80		26	26	50	163	8	172
2012	120	7	3	9	8484	150	0	42	42	80		34	34	50	99	12	111
2013	120	13	11	24	12602	150	0	25	25	80	<1	44	44	50	172	72	244
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	10	354
2016	120	20	1	22	32287	1663	0	9	9	80	<1	3	3	50	331	18	349
2017	120	30	2	31	43848	1663	0	2	2	80	<1	2	2	50	371	18	389
2018	120	21	1	23	31187	1663	0	2	2	80	<1	4	4	50	387	7	394
2019	120	25	<1	25	47657	1663	0	2	2	80	<1	<1	1	50	390	7	398
2020	120	6	<1	6	20769	1663	0	<1	<1	80	<1	4	4	50	121	4	125

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 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 km2.

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 CM 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-19/31); 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. A core 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	*Daption capense*	*Procellaria aequinoctialis*	*Procellaria cinerea*	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

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	*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			

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-19/03 for the 2019 survey.

4.2. 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.

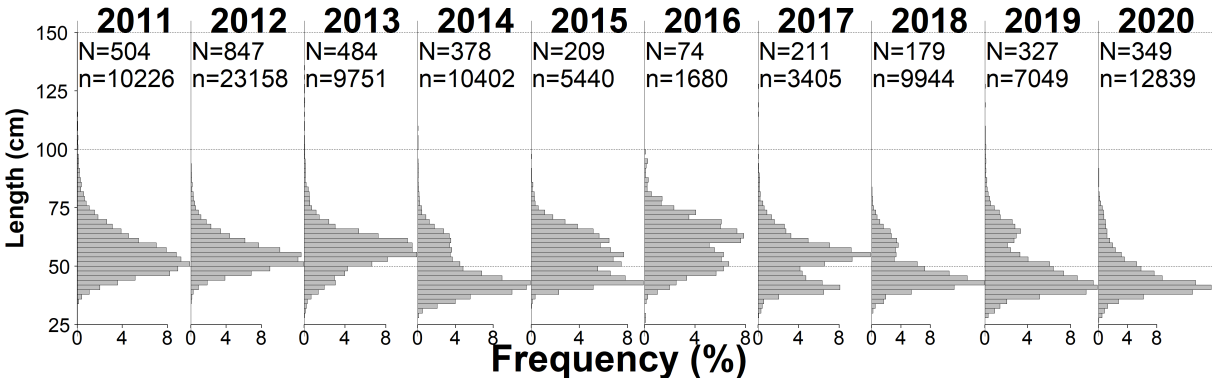


Figure 2. Annual length frequency distributions of *D. eleginoides* caught by trawl in this fishery. The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were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

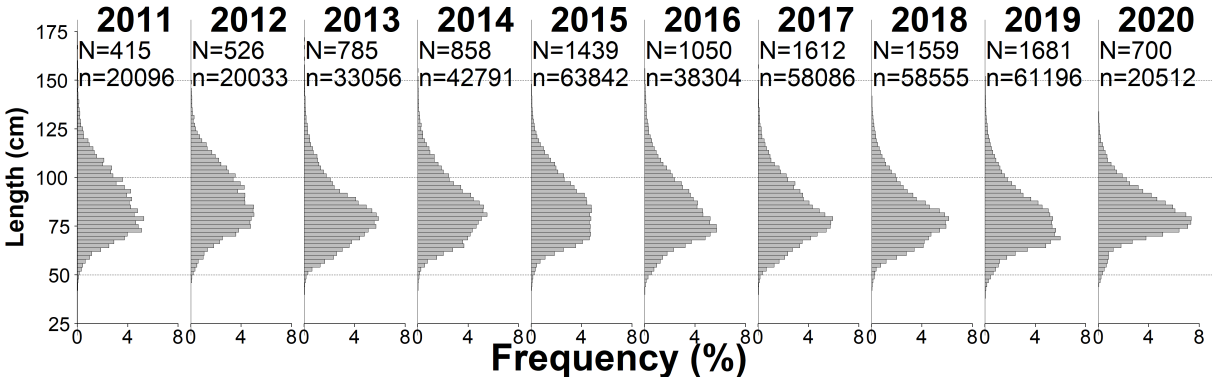


Figure 3. Annual length frequency distributions of *D. eleginoides* caught by longline in this fishery. The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were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

The majority of *D. eleginoides* caught by trawl measured between 25 and 100cm with a mode around 50-60cm, 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.

4.3. Tagging

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

To date, 70495 *D. eleginoides* have been tagged and released (12367 have been recaptured, 11434 of which were released in this area; Table 6).

Table 6. 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	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	3					**494**
2005	1701								266	88	16	5	9	8	4	3	5	6	11	2		1	1		**425**
2006	2430									220	179	51	26	13	11	12	19	9	11	4	7	1	1	1	**565**
2007	1841										200	120	35	21	13	6	12	10	13	9	3	2	1		**445**
2008	1741											50	61	25	14	9	31	20	25	10	6	5	1	2	**259**
2009	2423												89	100	52	15	28	40	51	14	28	5	8	7	**437**
2010	1768													55	65	14	18	55	37	10	20	14	13	8	**309**
2011	2398														124	150	54	46	46	32	36	37	23	9	**557**
2012	2986															161	124	53	48	43	62	46	28	17	**582**
2013	2002																31	58	99	46	54	57	23	22	**390**
2014	2126																	12	87	64	95	50	50	36	**394**
2015	8345																		85	285	386	311	250	171	**1488**
2016	5955																			54	254	319	262	154	**1043**
2017	6916																				67	367	396	316	**1146**
2018	6168																					58	423	201	**682**
2019	6798																						114	218	**332**
2020	5019																							37	**37**
Total	**70495**																								**11434**

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

During late March to mid April 2020, the annual random stratified trawl survey (RSTS) around Heard Island and McDonald Islands (HIMI) was conducted in CCAMLR Division 58.5.2 (SC-CAMLR-39/BG/35), with the completion of 151 stations. The survey was conducted on the FV Atlas Cove. Sampling protocols such as the design and the duration of the hauls were similar to recent surveys, but with a new set of randomly selected station points. However, only 18 of the 30 stations allocated in Plateau Deep East could be sampled due to damage to the trawl warps which prevented fishing on deeper stations.

The calculated biomass for 2020 of the target species *D. eleginoides* and *C. gunnari* in the survey area were the highest estimates for the past 10 years. Biomass estimates for the managed by-catch species *C. rhinoceratus* and *Macrourus* spp. remained at a high level and the estimate for *L. squamifrons* showed the first substantial increase since 2014. Among the three species of skate, biomass estimates show an upward trend over the last few years with of *Bathyraja murrayi* also being at the highest levels for the past 10 years.

Length measurements and sex were taken for nearly 17,000 fish and for more than half of those, biological measurements were also recorded. Otoliths were collected from *D. eleginoides* (763) and a number of other species, and 645 toothfish were tagged and released.

In 2019, catch removals due to killer and sperm whale interactions across subantarctic fisheries were estimated (WG-FSA-19/33).

6. Stock status

6.1. Summary of current status

The 2019 assessment model (WG-FSA-19/32) lead to a smaller estimate of the virgin spawning stock biomass B0 than that obtained in 2017, with an MCMC estimate of 70,519 tonnes (95% CI: 65,634-76,626 tonnes). The estimated SSB status at the end of 2019 was 0.51 (95% CI: 0.49-0.53).

6.2. Assessment method

The assessment model in 2019 was a single-sex, single-area, age-structured CASAL integrated stock assessment model (WG-FSA-19/32).

6.3. Year of last assessment, year of next assessment

Assessments are reviewed biennially, the last assessment was in 2019.

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

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