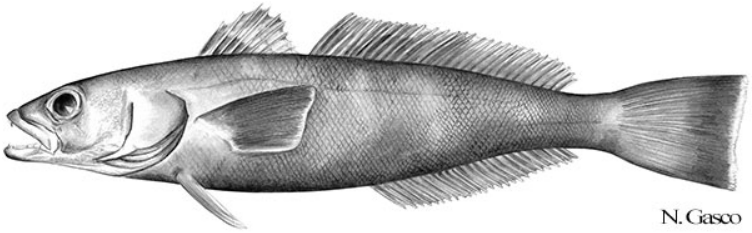
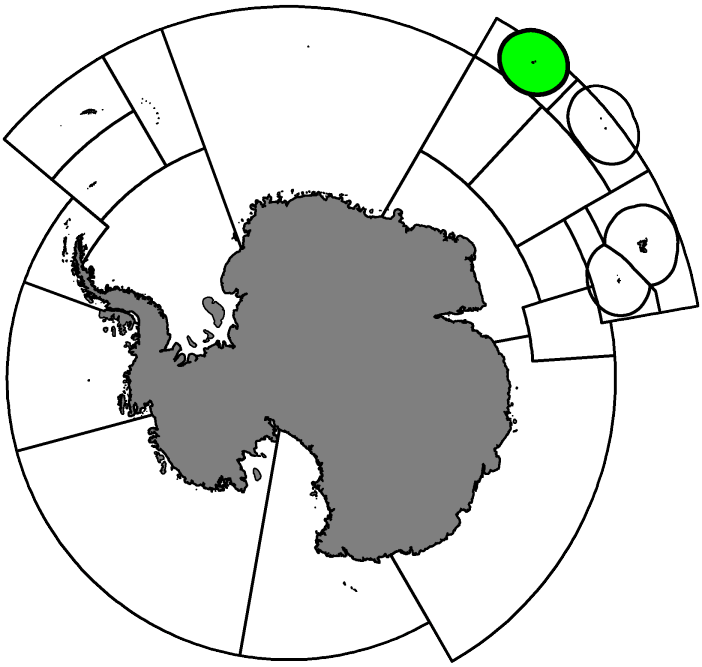
Fishery Report 2022: *Dissostichus eleginoides* at Prince Edward Islands South African EEZ (Subarea 58.7 and part of Area 51)

CCAMLR Secretariat

17 March 2023



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, "2022" refers to the 2021/22 CCAMLR fishing season (from 1 December 2021 to 30 November 2022).

Contents

1. Introduction to the fishery

1.1. History

This report describes the licensed longline fishery for Patagonian toothfish (*Dissostichus eleginoides*) in the South African Exclusive Economic Zone (EEZ) at the Prince Edward Islands. Within the CAMLR Convention Area, this EEZ is mostly situated within the boundaries of Subarea 58.7 and overlaps a small portion of Division 58.4.4a and also extends into FAO Area 51 outside the Convention Area. Fishing outside areas of national jurisdiction in either Subarea 58.7 or Division 58.4.4a is currently prohibited.

Reports of substantial illegal fishing prompted South Africa to establish a legal fishery in its EEZ in 1996 and five experimental permits, with a total catch limit of 2,500 tonnes, were issued for 1997.

Some experimental pot fishing was undertaken during 2004 and 2005, but historically, most of the catch was taken with autoline and Spanish longline. In 2008, trotlines were introduced in response to high levels of catch depredation by killer whales (*Orcinus orca*) and by 2011 these had largely replaced Spanish longlines.

1.2. Conservation Measures currently in force

Within the South African EEZ, catch limits for target and by-catch species, as well as vessel licensing, are assigned by South Africa. In 2005, South Africa licensed five operators with fixed proportional allocations and a catch limit of 450 tonnes, to undertake fishing in its EEZ at the Prince Edward Islands. Between 2006 and 2010, only one operator, holding 27% of the catch limit, had been active in the fishery but in 2010, a second vessel licensed to catch the remaining 73%, entered the fishery.

The limits in force and the advice of WG-FSA-2021 to the Scientific Committee for the 2022 season were:

(i) CCAMLR did not provide management advice for the fishery in the South African EEZ at the Prince Edward Islands for the forthcoming season as no new information was available on the state of fish stocks in Subarea 58.7 and Division 58.4.4a outside areas of national jurisdiction,

(ii) directed fishing for *D. eleginoides* in Subarea 58.7 and Division 58.4.4a, outside the South African EEZ (Conservation Measure 32-02), shall be prohibited.

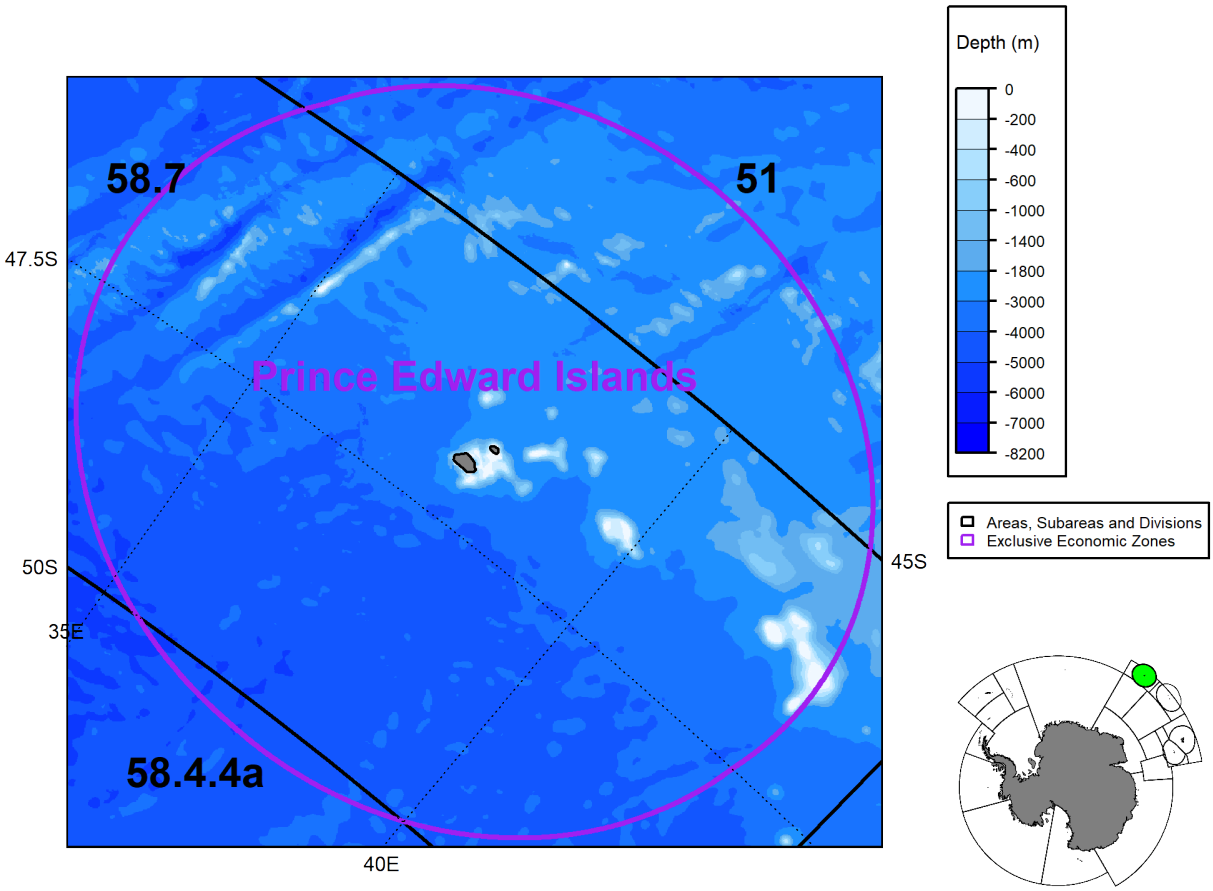


Figure 1: Map of the region discussed in this report.

1.3. Active vessels

In 2022, 2 vessels participated in this fishery.

2. Reported catch

2.1. Latest reports and limits

Reported catches of *Dissostichus eleginoides* are presented in Table 1. In this fishery, the catch of *D. eleginoides* reached a maximum of 1351 tonnes in 1997. In 2022, 69 tonnes of *D. eleginoides* were caught.

No targeted fishing activity is permitted within the Division 58.4.4a sector of the South African EEZ.

Table 1. Catch (tonnes) 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	Number of vessels	Catch	Estimated IUU catch (tonnes)
1996	5	799	-
1997	10	1351	-
1998	4	838	-
1999	2	96	-
2000	4	315	-
2001	3	55	-
2002	2	75	-
2003	-	-	-
2004	2	96	-
2005	1	99	-
2006	1	149	0
2007	2	189	0
2008	1	122	0
2009	2	45	0
2010	2	150	0
2011	2	122	0
2012	2	251	0
2013	2	180	0
2014	2	276	0
2015	2	309	0
2016	2	230	-
2017	2	67	-
2018	2	307	-
2019	2	266	-
2020	2	269	-
2021	2	365	-
2022	2	69	-

2.2. By-catch

Catch limits for by-catch species groups (*Macrourus* spp., skates and rays, and other species) are set by South Africa. The recent catch histories for by-catch species are provided in Table 2.

The by-catch in the South African EEZ consists predominantly of *Macrourus* spp. (Table 2), the majority of which are caught in the Subarea 58.7 sector of the EEZ.

Table 2. Reported catch for by-catch species (*Macrourus* spp., skates and rays, and other species) in this fishery. Source: fine-scale data.

Season	*Macrourus* spp.	Skates and rays		Other catch
	Reported Catch (tonnes)	Reported Catch (tonnes)	Number Released	Reported Catch (tonnes)
1996	0	0	0	0
1997	<1	0	0	<1
1998	0	<1	0	<1
1999	0	0	0	0
2000	58	5	0	15
2001	15	<1	0	1
2002	4	0	0	<1
2004	<1	0	0	0
2006	10	0	0	<1
2007	31	<1	0	4
2008	8	0	0	5
2009	3	<1	327	<1
2010	5	<1	283	1
2011	5	<1	255	2
2012	15	<1	4	1
2013	20	<1	0	2
2014	19	<1	0	5
2015	20	<1	0	6
2016	12	<1	12	3
2017	7	<1	0	2
2018	20	3	13	6
2019	6	7	240	4
2020	11	14	0	6
2021	15	3	1347	5
2022	9	<1	155	1

2.3. Vulnerable marine ecosystems (VMEs)

As Conservation Measure 22-06 does not apply to this Subarea there are no CCAMLR VMEs or VME Risk Areas designated in Subarea 58.7.

2.4. Incidental mortality of seabirds and marine mammals

The level of risk of incidental mortality of birds in the fishery in the South African EEZ at the Prince Edward Islands is considered to be high (category 5) (SC-CAMLR-XXX, Annex 8, paragraph 8.1).

The requirements of Conservation Measure 25-02 '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. There is an exemption to the requirement for night setting by achieving the sink rates described in Conservation Measure 24-02 and subject to a bird by-catch limit. South Africa has applied the mitigation measures recommended by CCAMLR within its EEZ, with the exception of a seasonal closure.

The three most common species injured or killed in the fishery were Southern giant petrel (*Macronectes giganteus*), Northern giant petrel (*Macronectes halli*) and white-chinned petrel (*Procellaria aequinoctialis*)

(Table 3).

Table 3. Number of reported birds caught (killed or with injuries likely to substantially reduce long-term survival) in this fishery in each fishing season.

Season	*Macronectes giganteus*	*Macronectes halli*	*Procellaria aequinoctialis*	Other
1996	3	1	131	20
1997	21	8	480	260
1998	11		459	7
2000			1	
2001			13	
2004	11	5		3

Depredation of the catch, particularly by toothed cetaceans, can contribute up to 50% of loss in catch landings in this fishery.

There have been no reports of incidental mortalities of mammals since 2000 in this fishery.

3. Illegal, Unreported and Unregulated (IUU) fishing

Although the illegal, unreported and unregulated (IUU) fishing in the South African EEZ at the Prince Edward Islands was first detected in 1995, the illegal exploitation of *D. eleginoides* is thought to have started in 1994 and continued until at least 2005.

An analysis presented by Brandão et al. (2002) estimated that the IUU catch of *D. eleginoides* for the South African EEZ in 1996 and 1997 was 21,350 tonnes, which is more than the total legal catch taken over the history of the fishery, including all IUU catch subsequent to 1997.

There have been no official reports of IUU fishing in the South African EEZ since 2006 and, 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). However, the recovery of IUU fishing gear and unconfirmed reports of IUU vessels in Subarea 58.6 and Division 58.4.4 indicate that undetected IUU activity may continue to occur in this area.

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.

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 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.

Although Conservation Measures 22-06 and 22-07 do not apply to this fishery, crew and observers may occasionally follow the sampling protocols outlined in Conservation Measure 22-07. To do so, lines are observed in segments (1000-hook sections or 1200m sections, whichever is the shorter) and the number of VME indicator units is reported (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). Based on the portion of the line monitored, observers further identify VME indicator organisms to the lowest taxonomic level possible.

Summaries of data reported to CCAMLR for the past five years are given in Tables 4 and 5.

Table 4. 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	2018	2019	2020	2021	2022
Vessel crew	VME	line segments	1120	358	512	1556	135
		VME indicator units > 5 and < 10	0	0	0	0	0
		VME indicator units > 10	0	0	0	0	0
	by-catch	taxa identified	4	3	3	4	4
		records	894	499	701	883	225
Observer	VME	line segments	856	546	193	998	223
		taxa identified	11	5	4	11	7
		weight or volume measurements	41	21	13	50	11
	toothfish	specimens examined	12528	6479	8482	14282	2595
		length measurements	12528	6479	8482	14280	2595
		weight measurements	12528	6479	8480	14277	2595
		sex identifications	12528	6441	8480	14275	2595
		maturity stage identifications	12528	6406	8464	14273	2591
		gonad weight measurements	12494	6370	8424	8487	2556
		otolith samples	3100	1994	1800	4134	766
	by-catch	specimens examined	3046	1863	2477	4754	1039
		taxa identified	10	4	8	11	6
		length measurements	2163	774	891	2647	327
		weight measurements**	3046	1863	2472	4713	1039
		standard length measurements*	0	0	0	30	0
		wingspan measurements*	41	36	1	13	0
		pelvic length measurements*	41	36	1	10	0
		snout to anus measurements*	1893	1074	1581	3252	711
		sex identifications**	5	22	799	1176	1
		maturity stage identifications**	0	4	1	1155	0
		gonad weight measurements**	0	1	1	0	0
		otolith samples**	0	0	0	1	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	2018	2019	2020	2021	2022
Macrourus spp.	specimens examined	1881	1090	1585	3247	711
	taxa identified	1	1	2	1	1
	length measurements	1036	1	0	1158	0
	weight measurements**	1881	1090	1581	3217	711
	snout to anus measurements*	1879	1074	1581	3239	711
	sex identifications**	2	2	594	726	0
	maturity stage identifications**	0	1	0	719	0
	gonad weight measurements**	0	1	0	0	0
	otolith samples**	0	0	0	0	0
Skates and rays	specimens examined	41	36	1	10	0
	taxa identified	2	1	1	1	0
	length measurements	3	36	1	10	0
	weight measurements**	41	36	1	10	0
	wingspan measurements*	41	36	1	10	0
	pelvic length measurements*	41	36	1	10	0
	sex identifications**	3	20	1	10	0
	maturity stage identifications**	0	3	0	10	0
	gonad weight measurements**	0	0	0	0	0
Other fish	specimens examined	1124	737	891	1497	328
	taxa identified	7	2	5	9	5
	length measurements	1124	737	890	1479	327
	weight measurements**	1124	737	890	1486	328
	standard length measurements*	0	0	0	10	0
	sex identifications**	0	0	204	440	1
	maturity stage identifications**	0	0	1	426	0
	gonad weight measurements**	0	0	1	0	0
	otolith samples**	0	0	0	1	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.

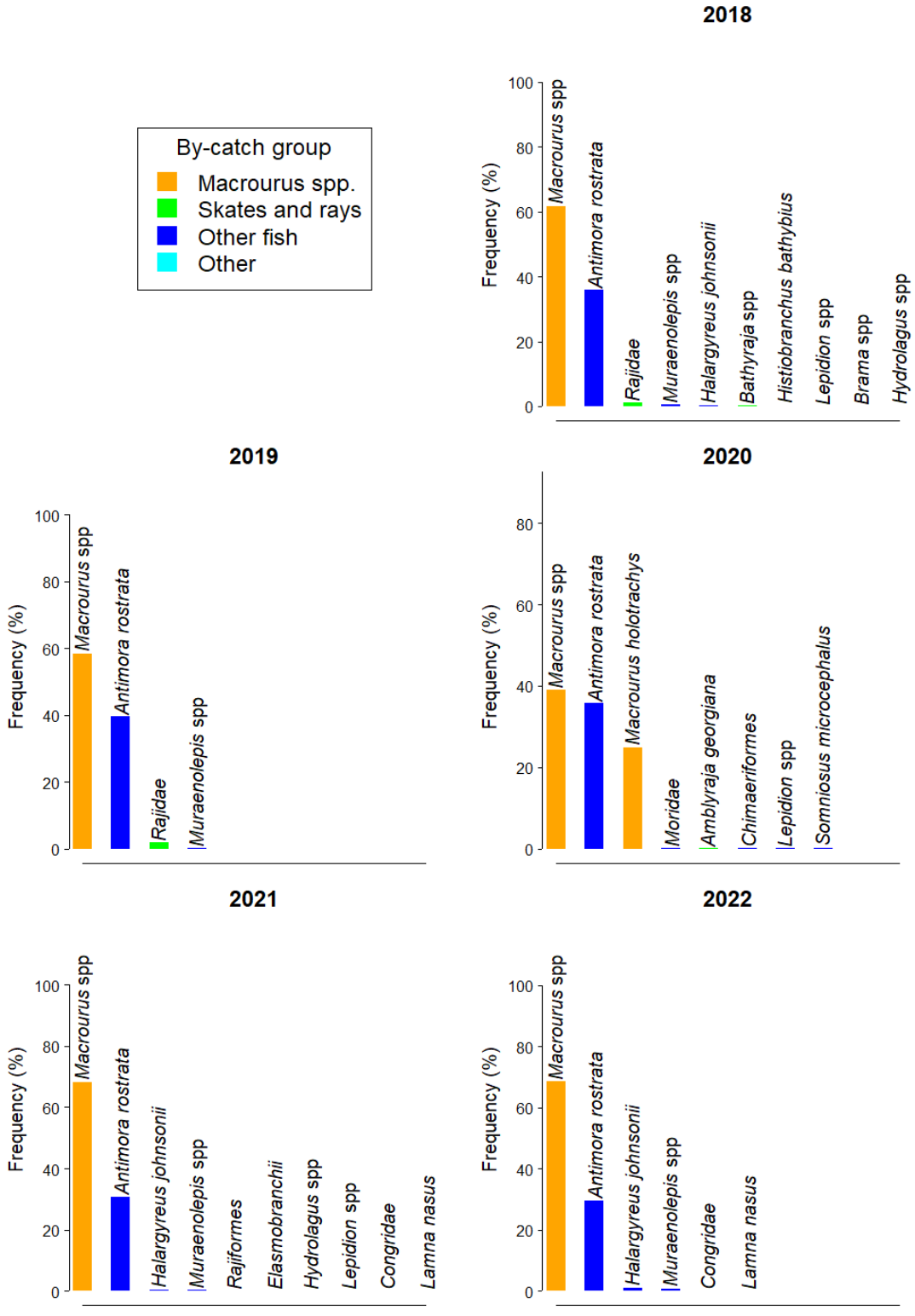


Figure 2. Relative frequencies of the most commonly examined by-catch taxa in each of the last five seasons, from the observer data (unweighted raw counts of individually examined specimens). Taxonomic identification may occur at different levels.

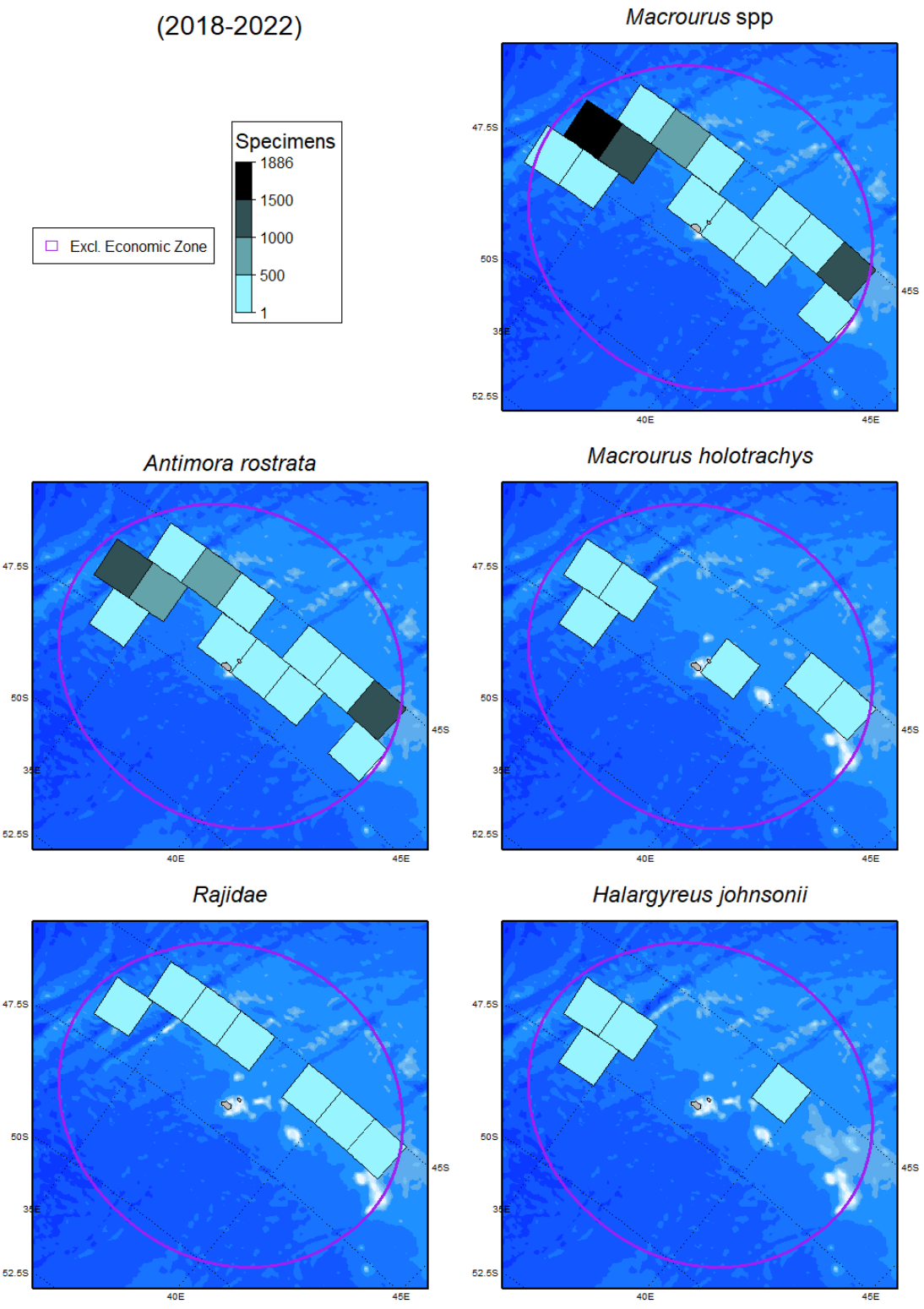


Figure 3. Spatial distribution of the most commonly examined by-catch taxa across the last five seasons, from the observer data (unweighted raw counts of individually examined specimens in each cell). The data were aggregated using equal area (100 km x 100 km) cells. Taxonomic identification may occur at different levels. Refer to Figure 1 for more details on the boundaries shown.

4.3. Length frequency distributions

The recent length frequency distributions of *D. eleginoides* caught in this fishery are shown in Figure 4. The majority of *D. eleginoides* caught by longline range from 50 to 150cm in length, with a broad mode for all seasons at approximately 75cm. 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.

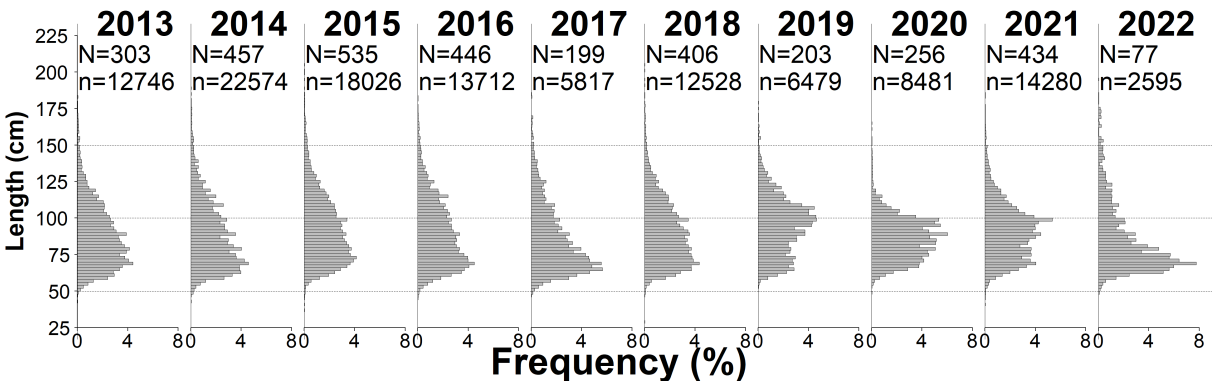


Figure 4. Annual length frequency distributions of *D. eleginoides* caught by longline in this fishery. The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were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

4.3. Tagging

To date in this area, 3143 *D. eleginoides* have been tagged and released (230 have been recaptured, 188 of which were released in this area; Table 6).

Table 6. Number of *Dissostichus eleginoides* tagged and recaptured in the area for each fishing Season.

		Recaptured													
Season	Tagged	2009	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
2006	148			1		1									**2**
2007	98	1				1									**2**
2008	115	3	3	1		2	2	1							**12**
2009	38				1										**1**
2010	83			2		1		2							**5**
2011	86		1		2	1	1		1						**6**
2012	155					3	3	2	1	2					**11**
2013	155					5	5		3	2		1	1		**17**
2014	291					3	13	10	4	7	1	2	1	1	**42**
2015	313						4	6	5	8	5	3		1	**32**
2016	240							1	1	4	3	1		2	**12**
2017	63									4					**4**
2018	326									2	7	5	3		**17**
2019	285											4	4	1	**9**
2020	300												9	4	**13**
2021	409													2	**2**
2022	38													1	**1**
Total	**3143**														**188**

Only a single tagged fish has been recorded to have moved between the French and South African EEZs and the current management approaches used by France and South Africa do not specifically consider the possibility that these island groups share the same toothfish stock.

5. Research

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

As this fishery is under South African jurisdiction, more details may be found here.

6.2. Assessment method

The status of *D. eleginoides* within the South African EEZ was first assessed in 2002 using an age-structured production model (ASPM) and was last reviewed by the Working Group on Fish Stock Assessment (WG-FSA) in 2007 (see SC-CAMLR-XXVI, Annex 5, Appendix N).

However, differences between the reported catch-per-unit-effort (CPUE) and catch-at-length data resulted in uncertainty in the assessment outputs. Thus, an operational management procedure (OMP) approach to address this uncertainty was developed in 2009 (SC-CAMLR-XXVII, Annex 7, paragraphs 6.1 to 6.3).

The OMP was not formally adopted by South Africa as a basis for management as only one of the five right holders (licensed to catch 27% of the catch limit) was active in the fishery between 2006 and 2010 and the catch limit was kept at 450 tonnes per annum from 2005 to 2010.

A revision of the OMP was attempted in 2011 but was hampered by the fact that the preferred gear type had shifted between 2008 and 2011 from Spanish longline to trotline gear. In order to standardise the catch rates (CPUE) between gear types, a two-year experiment using a general linear mixed model (GLMM), was initiated in 2012 and a precautionary catch limit of 320 tonnes per annum was set:

(i) a research allocation of 68.8% of the annual catch limit (220 tonnes per annum) was set aside for collection of catch data from Spanish longline/trotline pairs in 2012 and 2013 with a target of 100 Spanish/trot pairs per year

(ii) for each Spanish longline set, a trotline must be set within 3 nautical miles and within a period of one week either before or after the Spanish longline set

(iii) to compensate for the expected loss of revenue associated with setting Spanish longline gear, vessels were eligible to hold the catch from two further trotline sets against the research allocation.

6.3. Year of last assessment, year of next assessment

As this fishery is under South African jurisdiction, more details may be found here.

7. Climate Change and environmental variability

In 2018, a summary of the potential impacts of climate change on Southern Ocean fisheries (FAO 2018) highlighted the following key points:

The Antarctic region is characterized by complex interaction of natural climate variability and anthropogenic climate change that produce high levels of variability in both physical and biological systems, including impacts on key fishery taxa such as Antarctic krill. The impact of anthropogenic climate change in the short-term could be expected to be related to changes in sea ice and physical access to fishing grounds, whereas longer-term implications are likely to include changes in ecosystem productivity affecting target stocks. There are no resident human populations or fishery-dependent livelihoods in the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) Area, therefore climate change will have limited direct implications for regional food security. However, as an "under-exploited" fishery, there is potential for krill to play a role in global food security in the longer term. The institutional and management approach taken by CCAMLR, including the ecosystem-based approach, the establishment of large marine protected areas, and scientific monitoring programmes, provides measures of resilience to climate change.

In 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 also welcomed (CCAMLR-41, paragraph 6.8) the Scientific Committee's agreement to hold a workshop on climate change in the first half of 2023 (SC-CAMLR-41, paragraph 7.10) and encouraged the inclusion of a range of scientific experts as well as policy makers to foster integration of the best available science into management actions. The Commission adopted (CCAMLR-41, paragraph 6.28) Resolution 36/41.

Additional Resources

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

References

Brandão, A., D.S. Butterworth, B.P. Watkins and D.G.M. Miller. 2002. A first attempt at an assessment of the Patagonian toothfish (*Dissostichus eleginoides*) resource in the Prince Edward Islands EEZ. CCAMLR Science, 9: 11-32.