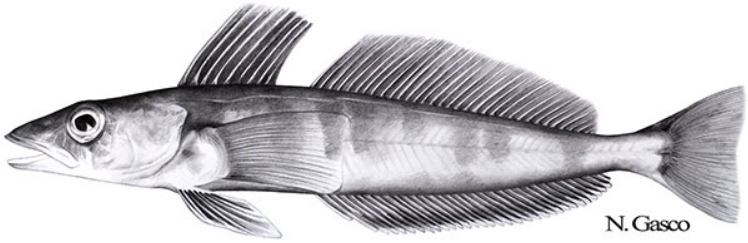
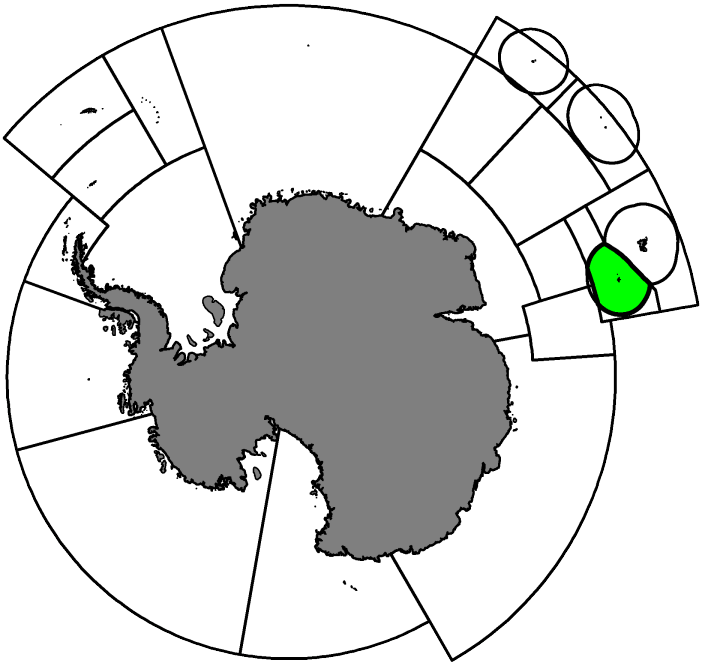
Fishery Report 2022: *Champsocephalus gunnari* at Heard Island (Division 58.5.2)

CCAMLR Secretariat

17 March 2023



Mackerel icefish, *Champsocephalus gunnari* Lönnberg, 1905.



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 fishery report describes the licensed fishery for mackerel icefish (*Champsocephalus gunnari*) 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 (Fig. 1). An Australian licensed trawl fishery for *C. gunnari* began in 1997, while other nations had fished in these waters during the 1970s prior to the declaration of the AFZ in 1979. The fishing methods used in this fishery are midwater and bottom trawl. 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.

1.2. Conservation Measures currently in force

The annual catch limit for this fishery (Table 1) is described in Conservation Measure 42-02.

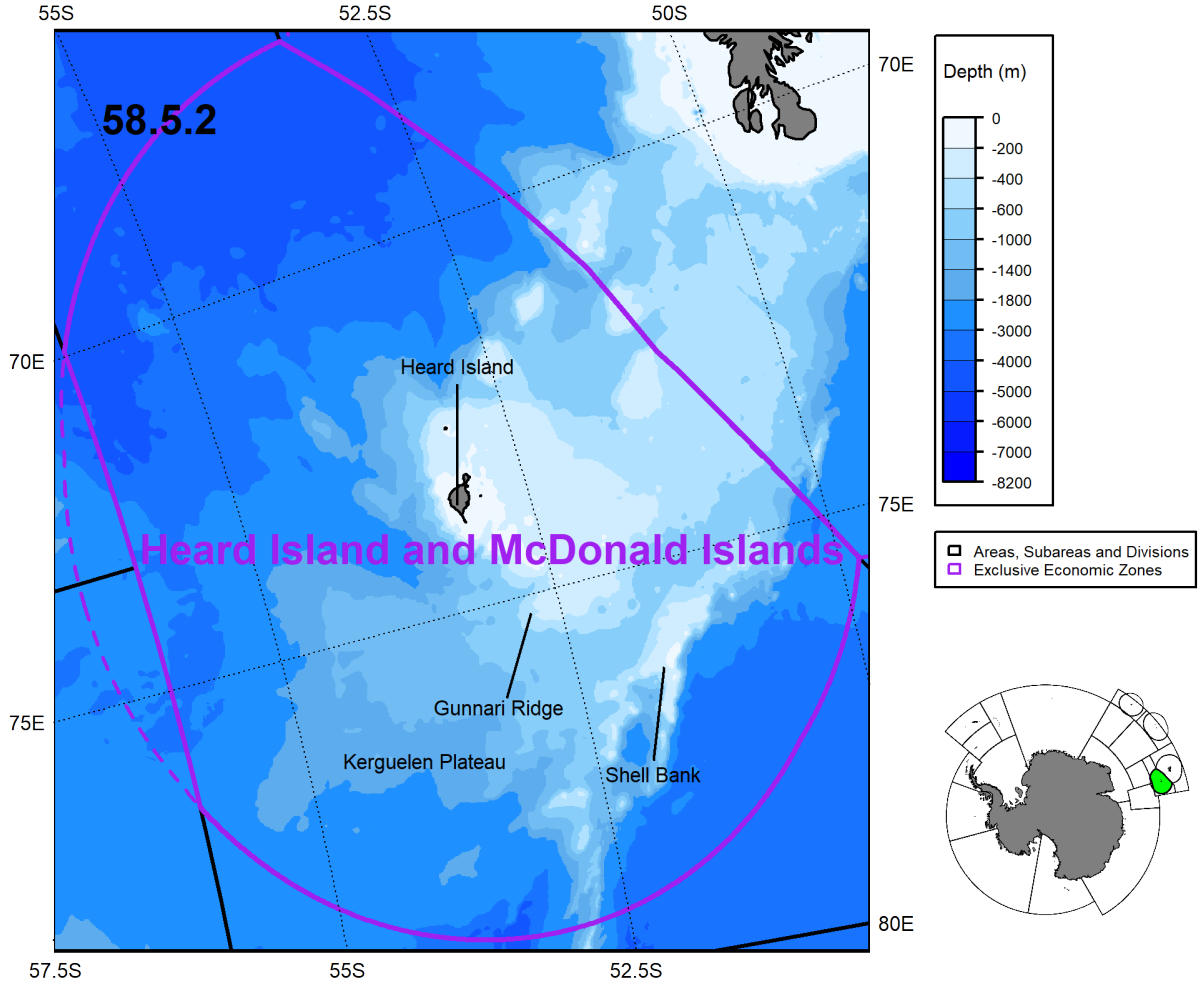


Figure 1: Map of the region discussed in this report.

1.3. Active vessels

In 2022, 3 vessels participated in this fishery.

2. Reported catch

2.1. Latest reports and limits

Reported catches of *C. gunnari* are presented in Table 1. In this fishery, the catch of *C. gunnari* reached a maximum of 2293 tonnes in 2003. In 2022, 1024 tonnes of *C. gunnari* were caught.

Table 1. Catch (tonnes) and effort history for *C. gunnari* in this fishery. Source: Fine scale data.

Season	Number of vessels	Catch limit (tonnes)	Catch
1997	1	311	207
1998	3	900	104
1999	1	1160	0
2000	2	916	87
2001	2	1150	1073
2002	2	885	966
2003	2	2980	2293
2004	2	292	84
2005	2	1864	1791
2006	2	1210	663
2007	1	42	1
2008	1	220	199
2009	1	102	99
2010	1	1658	365
2011	1	78	1
2012	1	0	4
2013	1	679	644
2014	1	1267	1123
2015	2	309	10
2016	1	482	469
2017	1	561	543
2018	1	526	515
2019	1	443	443
2020	1	527	507
2021	2	406	403
2022	3	1528	1024

2.2. By-catch

Catch limits for the most common by-catch species; unicorn icefish (*Channichthys rhinoceratus*), grey rockcod (*Lepidonotothen squamifrons*), *Macrourus* spp., skates (Rajids) and others are defined in Conservation Measure 33-02 and shown for each fishing season in Table 2. The by-catch limits in Conservation Measure 33-02 apply to all fisheries in Division 58.5.2 (including those targeting *D. eleginoides*).

Quantitative risk assessments of *C. rhinoceratus* and Caml grenadier (*Macrourus caml*) were undertaken in 2015 and presented in WG-FSA-15/50 and WG-FSA-15/63 respectively. WG-FSA recommended the catch limits be set to 1,663 tonnes for *C. rhinoceratus*. It also recommended that the limit derived from the risk assessment in WG-FSA-15/63 of 409 tonnes should apply for *M. caml* and Whitson's grenadier (*M. whitsoni*) combined, and the limit derived from the previous assessment of 360 tonnes should apply for bigeye grenadier (*M. holotrachys*) and ridge-scaled grenadier (*M. carinatus*) combined. The catch limits of grey rockcod (*Lepidonotothen squamifrons*) are based on assessments carried out in 1998 (SC-CAMLR-XVII, Annex 5, paragraphs 4.204 to 4.206). Catch limits for rajids (*Bathyraja* spp.) were set in 1997 (SC-CAMLR-XVI, paragraphs 5.119 to 5.122).

A number of Conservation Measures, which ensure that impacts on the target and other species are minimised, currently apply to this fishery. Conservation Measure 42-02 defines the boundaries of the fishery area, the season, the catch limit and the move-on rules if large quantities of *C. gunnari* smaller than the specified minimum legal length of 240mm are caught in a single haul. Conservation Measure 33-02 specifies

that there should be no directed fishing for species other than 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.

Table 2. Reported catch and catch limits for by-catch species (*Channichthys rhinoceratus*, *Lepidonotothen squamifrons*, *Macrourus* spp., Skates and rays, and others) in the fishery for *Champsocephalus gunnari* in Division 58.5.2 (see Conservation Measure 33-02 for details). Source: fine-scale data.

Season	*Channichthys rhinoceratus*		*Lepidonotothen squamifrons*		*Macrourus* spp.		Skates and rays			Other catch	
	Catch Limit (tonnes)	Reported Catch (tonnes)	Catch Limit (tonnes)	Reported Catch (tonnes)	Catch Limit (tonnes)	Reported Catch (tonnes)	Catch Limit (tonnes)	Reported Catch (tonnes)	Number Released	Catch Limit (tonnes)	Reported Catch (tonnes)
2004	150	6	80	<1	360	<1	120	3	0	50	<1
2005	150	34	80	<1	360	<1	120	5	0	50	2
2006	150	29	80	<1	360	<1	120	7	0	50	<1
2007	150	3	80	<1	360	0	120	<1	4	50	<1
2008	150	8	80	<1	360	<1	120	2	639	50	<1
2009	150	7	80	<1	360	<1	120	7	447	50	<1
2010	150	52	80	<1	360	<1	120	12	8936	50	3
2011	150	1	80	1	360	<1	120	<1	326	50	1
2013	150	48	80	2	360	<1	120	16	530	50	3
2014	150	144	80	5	360	<1	120	9	5686	50	10
2015	150	11	80	<1	360	<1	120	<1	217	50	<1
2016	1663	119	80	<1	769	0	120	28	2717	50	3
2017	1663	109	80	<1	769	0	120	44	1858	50	4
2018	1663	37	80	<1	769	0	120	26	1059	50	2
2019	1663	151	80	<1	769	<1	120	55	5702	50	4
2020	1663	236	80	1	769	<1	120	37	8815	50	5
2021	1663	79	80	<1	769	<1	120	36	2963	50	2
2022	1663	167	80	<1	769	<1	120	55	5439	50	2

2.3. Vulnerable marine ecosystems (VMEs)

Bottom trawl and midwater trawl gear is used to target both *C. gunnari* and Patagonian toothfish (*Dissostichus eleginoides*) in Division 58.5.2. The potential impacts of fishing gear on benthic communities are limited by the small area of commercial trawl grounds, a strategy of trawling gear lightly and the protection of large areas sensitive to the effects of bottom trawling within the Heard Island and McDonald Islands Marine Reserve, an IUCN Category 1a reserve, where fishing is prohibited. This marine reserve covers a total area of 71,200 km^2.

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

A summary of seabird mortality in this fishery is presented in Table 3. The two most common species injured or killed in this fishery were white-chinned petrel (*Procellaria aequinoctialis*) and black-browed albatross (*Thalassarche melanophris*).

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).

Since 2003 when two Antarctic fur seals (*Arctocephalus gazella*) were killed, no incidents of mammal mortalities have been observed in this fishery.

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

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	*Procellaria aequinoctialis*	*Thalassarche melanophris*	Other
1998	1		
2003		1	
2005	4	6	1
2006			1

3. Illegal, Unreported and Unregulated (IUU) fishing

There has been no evidence of illegal, unreported and unregulated IUU fishing activity in this fishery.

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 by-catch by coarse taxonomic groups given the taxonomic expertise required to discriminate similar species. Observers collect biological information on icefish and by-catch specimens at a finer taxonomic resolution, as well as data on individual specimens such as size and maturity.

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

Table 4. Summary of 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 icefish and by-catch taxa. Taxonomic identification may occur at different levels.

Data source	Data class	Variable	2018	2019	2020	2021	2022
Vessel crew	by-catch	taxa identified	26	42	45	53	48
		records	774	2876	3341	1577	2042
Observer	mackerel icefish	specimens examined	22217	13694	25371	21488	16549
		length measurements	22217	13693	25341	21474	16508
		weight measurements**	5408	3623	25031	14216	16302
		sex identifications**	6660	13694	25371	21488	16549
		maturity stage identifications**	4418	9265	10138	5967	10766
		gonad weight measurements**	0	0	0	0	60
		otolith samples**	67	65	80	5	16
	by-catch	specimens examined	16550	13841	20802	10816	12635
		taxa identified	8	15	8	12	21
		length measurements	16528	13833	20776	10797	12609
		weight measurements**	15283	13435	20454	10684	12567
		standard length measurements*	1147	11548	17737	8834	10566
		wingspan measurements*	2582	2229	3054	1927	1941
		pelvic length measurements*	0	0	0	0	0
		snout to anus measurements*	1	58	0	50	106
		sex identifications**	8268	13841	20802	10816	12635
		maturity stage identifications**	7586	10145	11518	5827	8154
		gonad weight measurements**	3	0	0	0	756
		otolith samples**	458	464	747	128	941

*: 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	1	58	0	50	106
	taxa identified	1	2	0	1	3
	length measurements	1	58	0	50	106
	weight measurements**	1	58	0	50	105
	snout to anus measurements*	1	58	0	50	106
	sex identifications**	0	58	0	50	106
	maturity stage identifications**	0	45	0	50	97
	gonad weight measurements**	0	0	0	0	0
	otolith samples**	0	0	0	0	3
Skates and rays	specimens examined	2598	2233	3059	1929	1941
	taxa identified	3	4	3	3	3
	length measurements	2594	2231	3049	1920	1935
	weight measurements**	2582	2220	3030	1917	1937
	wingspan measurements*	2582	2229	3054	1927	1941
	pelvic length measurements*	0	0	0	0	0
	sex identifications**	2598	2233	3059	1929	1941
	maturity stage identifications**	2482	1752	2218	1710	1745
	gonad weight measurements**	0	0	0	0	0
Icefish (other than gunnari)	specimens examined	6633	6282	7506	4956	6238
	taxa identified	1	1	1	2	1
	length measurements	6627	6278	7503	4953	6227
	weight measurements**	5784	6167	7374	4925	6211
	standard length measurements*	777	6281	7506	4955	6223
	sex identifications**	3391	6282	7506	4956	6238
	maturity stage identifications**	3055	3523	2528	2403	3222
	gonad weight measurements**	3	0	0	0	53
	otolith samples**	327	159	111	0	282

*: 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.

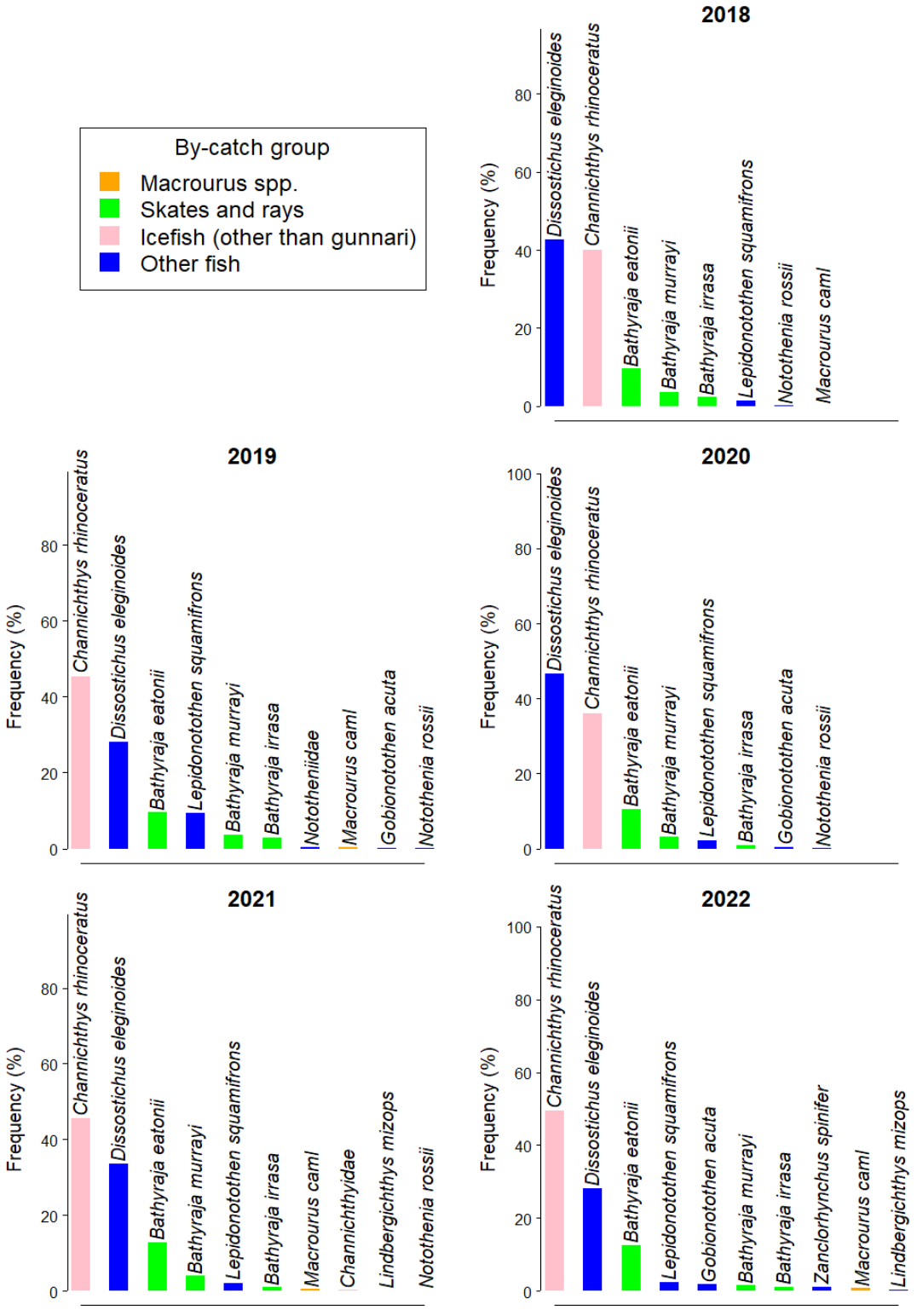


Figure 2. Relative frequencies of the most commonly examined by-catch taxa in each of the last five seasons, from the observer data (unweighted raw counts of individually examined specimens). Taxonomic identification may occur at different levels.

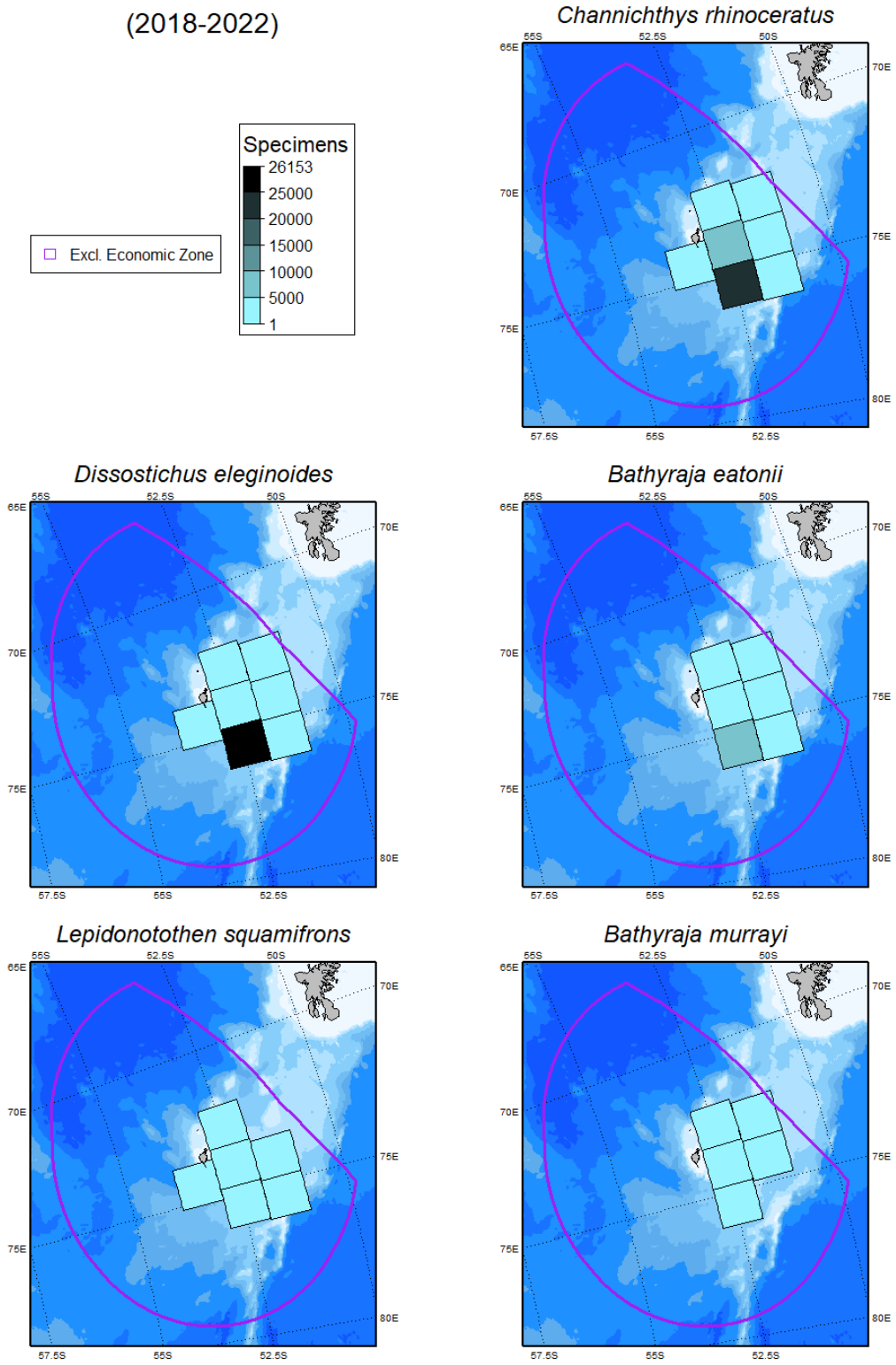


Figure 3. Spatial distribution of the most commonly examined by-catch taxa across the last five seasons, from the observer data (unweighted raw counts of individually examined specimens in each cell). The data were aggregated using equal area (100 km x 100 km) cells. Taxonomic identification may occur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

4.3. Length frequency distributions

Recent length frequency distributions of the catches of *C. gunnari* in this fishery are shown in Figure 4. 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. Only catch-weighted length frequency data derived from a random stratified trawl survey are used in assessments in this fishery. Nevertheless, the length frequencies for *C. gunnari* in Division 58.5.2 typically show multiple age/size cohorts progressing through the population over consecutive years (Fig. 4).

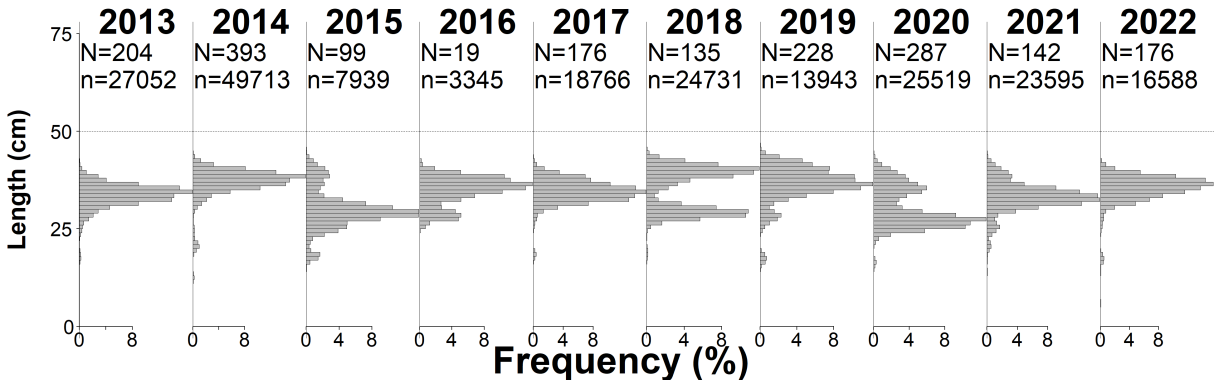


Figure 4. Annual length frequency distributions of *Champsocephalus gunnari* caught in this fishery. The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were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

5. Research

5.1. Status of the science

Within Division 58.5.2, *C. gunnari* is restricted to the shelf area in the vicinity of Heard Island in water generally shallower than 350m, and a non-contiguous area at Shell Bank to the northeast of the islands. The Heard Plateau and Shell Bank populations have different size structures and recruitment patterns. In 1997, the Working Group on Fish Stock Assessment agreed that in light of this, the two areas should be treated as separate stocks for assessment purposes (see SC-CAMLR-XVI, Annex 5, paragraph 4.277). Shell Bank has been closed to fishing since 1997 due to low population densities observed in annual surveys from 1997 to 2005.

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 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.

6. Stock status

6.1. Summary of current status

The 2022 survey showed a large 3+ cohort in the population and a high biomass, estimated at 53,162 tonnes (see Stock Assessment Report).

6.2. Assessment method

The Generalised Yield Model is used routinely for the assessment of short-term yield of *C. gunnari* in the CCAMLR Convention Area. The precautionary approach developed by CCAMLR requires the calculation of the level of mortality that would result in a probability not greater than 0.05 that the spawning stock would be less than 75% of the level it would have been if fishing had not occurred. This estimate is calculated using the bootstrap one-sided lower 95% confidence bound on the trawl survey biomass estimate, giving a two-year projection of the catch.

Following the same approach as employed in previous years, catches of 2,616 t. in the 2023 season and 1,857 t. in the 2024 season would satisfy the CCAMLR decision rules (see Stock Assessment Report).

6.3. Year of last assessment, year of next assessment

Assessments are reviewed annually.

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
- Stock Assessment Report: pdf
- Stock Annex: pdf
- Fisheries Documents Browser