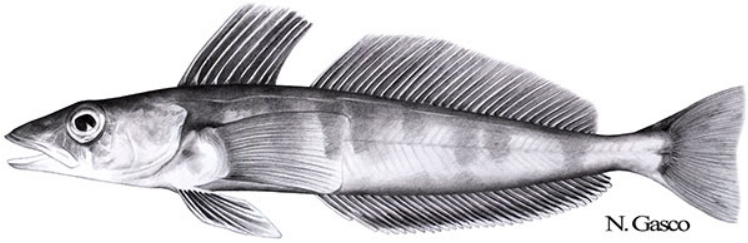
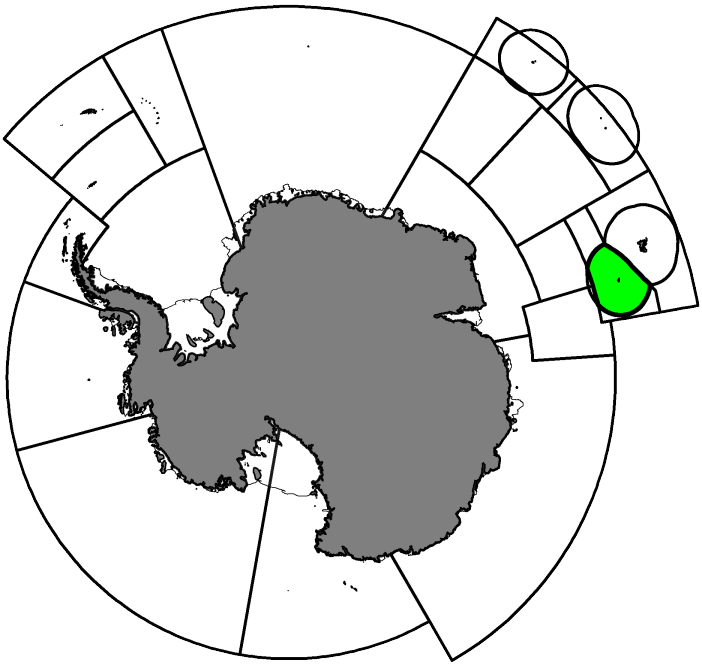
Fishery Report 2024: *Champsocephalus gunnari* at Heard Island (Division 58.5.2)

CCAMLR Secretariat

07 April 2025



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, "2024" refers to the 2023/24 CCAMLR fishing season (from 1 December 2023 to 30 November 2024). Coastlines and ice shelves: UK Polar Data Centre/BAS and Natural Earth. Projection: EPSG 6932.

Contents

1. Introduction to the fishery

1.1. History

This 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.

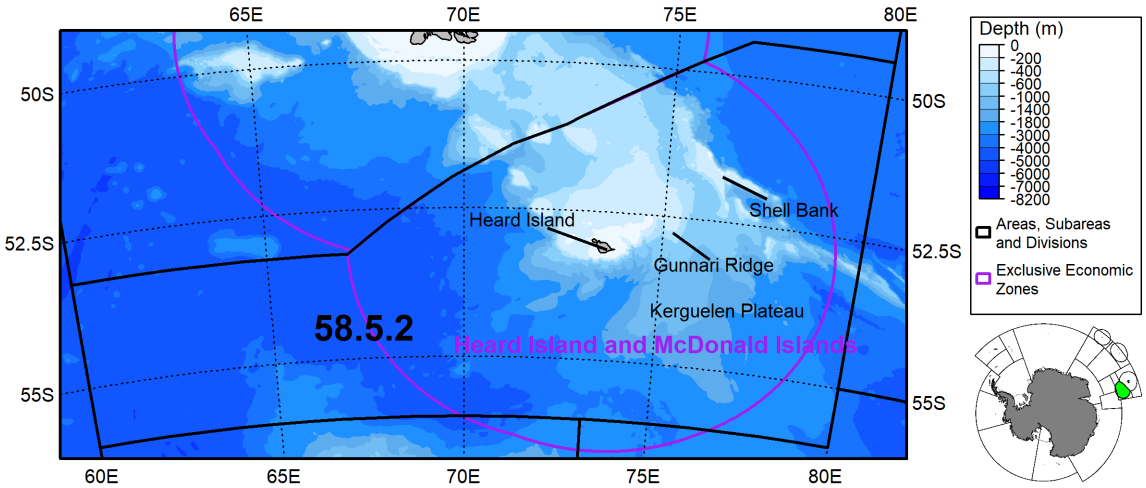


Figure 1: Map of the region discussed in this report. Coastlines and ice shelves: UK Polar Data Centre/BAS and Natural Earth. Bathymetry: GEBCO. Projection: EPSG 6932 (rotated).

1.3. Active vessels

In 2024, 1 vessel 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 2024, 22 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
2023	1	2616	336
2024	1	714	22

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 CM 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
2023	1663	45	80	<1	769	<1	120	15	7357	50	1
2024	1663	5	80	<1	769	<1	120	<1	195	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	2020	2021	2022	2023	2024
Vessel crew	by-catch	taxa identified	45	52	48	57	44
		records	3341	1577	2042	1813	936
Observer	mackerel icefish	specimens examined	25371	21488	16549	16017	5205
		length measurements	25341	21474	16508	15991	5202
		weight measurements**	25031	14216	16302	15820	5183
		sex identifications**	25371	21488	16549	16017	5205
		maturity stage identifications**	10138	5967	10766	5460	1940
		gonad weight measurements**	0	0	60	0	0
		otolith samples**	80	5	16	0	0
	by-catch	specimens examined	20802	10816	12635	7710	5144
		taxa identified	8	12	21	9	6
		length measurements	20776	10797	12609	7705	5139
		weight measurements**	20454	10684	12567	7645	5102
		standard length measurements*	17737	8834	10566	6674	4904
		wingspan measurements*	3054	1927	1941	1018	228
		pelvic length measurements*	0	0	0	0	0
		snout to anus measurements*	0	50	106	3	0
		sex identifications**	20802	10816	12635	7710	5144
		maturity stage identifications**	11518	5827	8154	4577	3069
		gonad weight measurements**	0	0	756	0	0
		otolith samples**	747	128	941	703	232

*: Species-dependent records
**: Voluntary records

Table 5. Summary of biological data for predominant by-catch groups reported by observers (from random subsets of hauls) in each of the last five seasons. Taxonomic identification may occur at different levels.

By-catch group	Variable	2020	2021	2022	2023	2024
Macrourus spp.	specimens examined	0	50	106	3	0
	taxa identified	0	1	3	1	0
	length measurements	0	50	106	3	0
	weight measurements**	0	50	105	3	0
	snout to anus measurements*	0	50	106	3	0
	sex identifications**	0	50	106	3	0
	maturity stage identifications**	0	50	97	3	0
	gonad weight measurements**	0	0	0	0	0
	otolith samples**	0	0	3	0	0
Skates and rays	specimens examined	3059	1929	1941	1030	228
	taxa identified	3	3	3	4	3
	length measurements	3049	1920	1935	1029	227
	weight measurements**	3030	1917	1937	1023	228
	wingspan measurements*	3054	1927	1941	1018	228
	pelvic length measurements*	0	0	0	0	0
	sex identifications**	3059	1929	1941	1030	228
	maturity stage identifications**	2218	1710	1745	603	136
	gonad weight measurements**	0	0	0	0	0
Icefish (other than gunnari)	specimens examined	7506	4956	6238	5065	3968
	taxa identified	1	2	1	1	1
	length measurements	7503	4953	6227	5063	3964
	weight measurements**	7374	4925	6211	5028	3926
	standard length measurements*	7506	4955	6223	5064	3956
	sex identifications**	7506	4956	6238	5065	3968
	maturity stage identifications**	2528	2403	3222	2561	2169
	gonad weight measurements**	0	0	53	0	0
	otolith samples**	111	0	282	123	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 hauls and do not individually examine all taxa; as such these figures are more representative of the distribution of biological observations than the catch of these taxa or their spatial distribution. At a coarse taxonomic level, the total catch of by-catch species groups is provided in section 2.2 above.

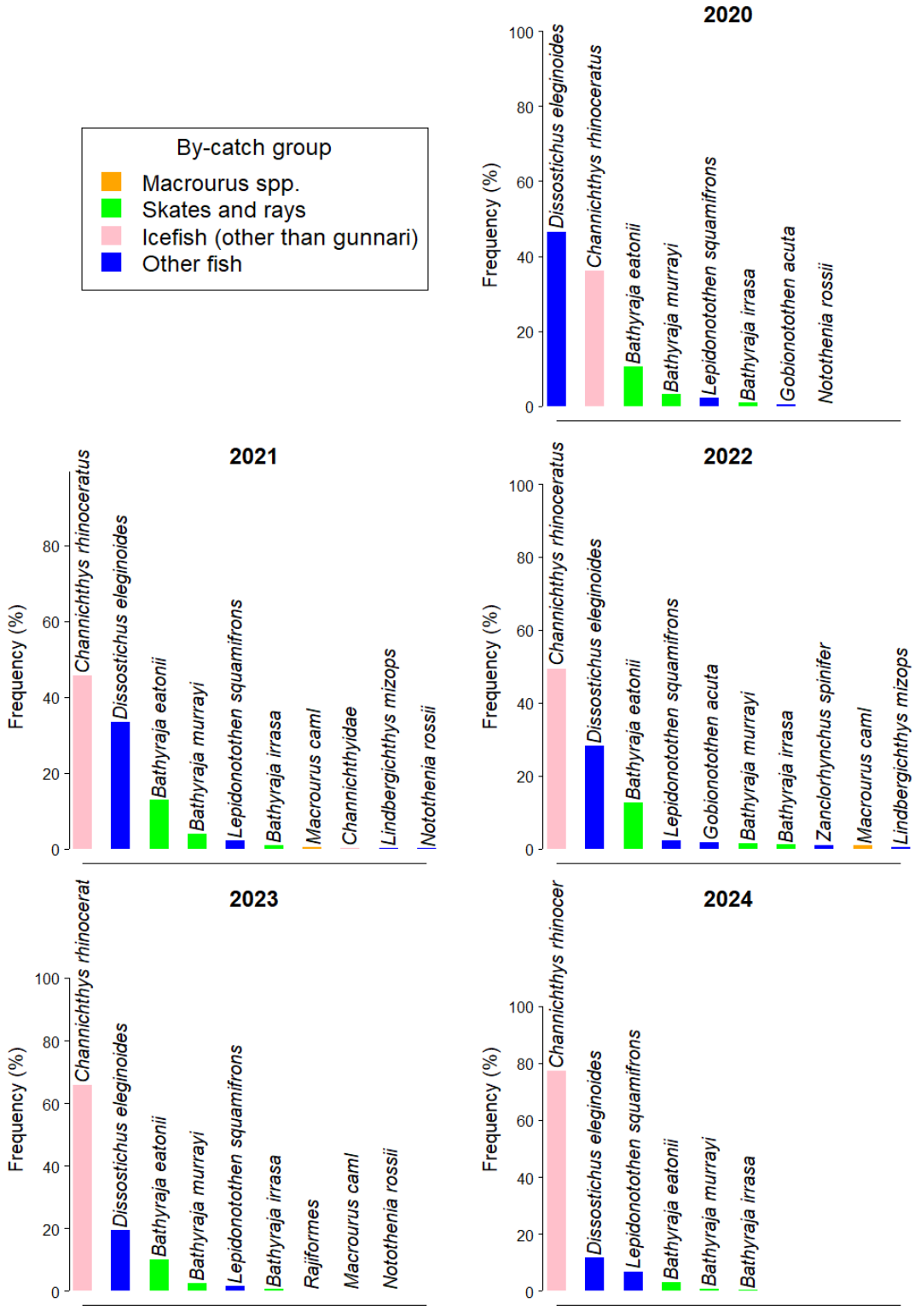


Figure 2. Relative frequencies of the most commonly examined by-catch taxa in each of the last five seasons, from the observer data (unweighted raw counts of individually examined specimens). Taxonomic identification may occur at different levels.

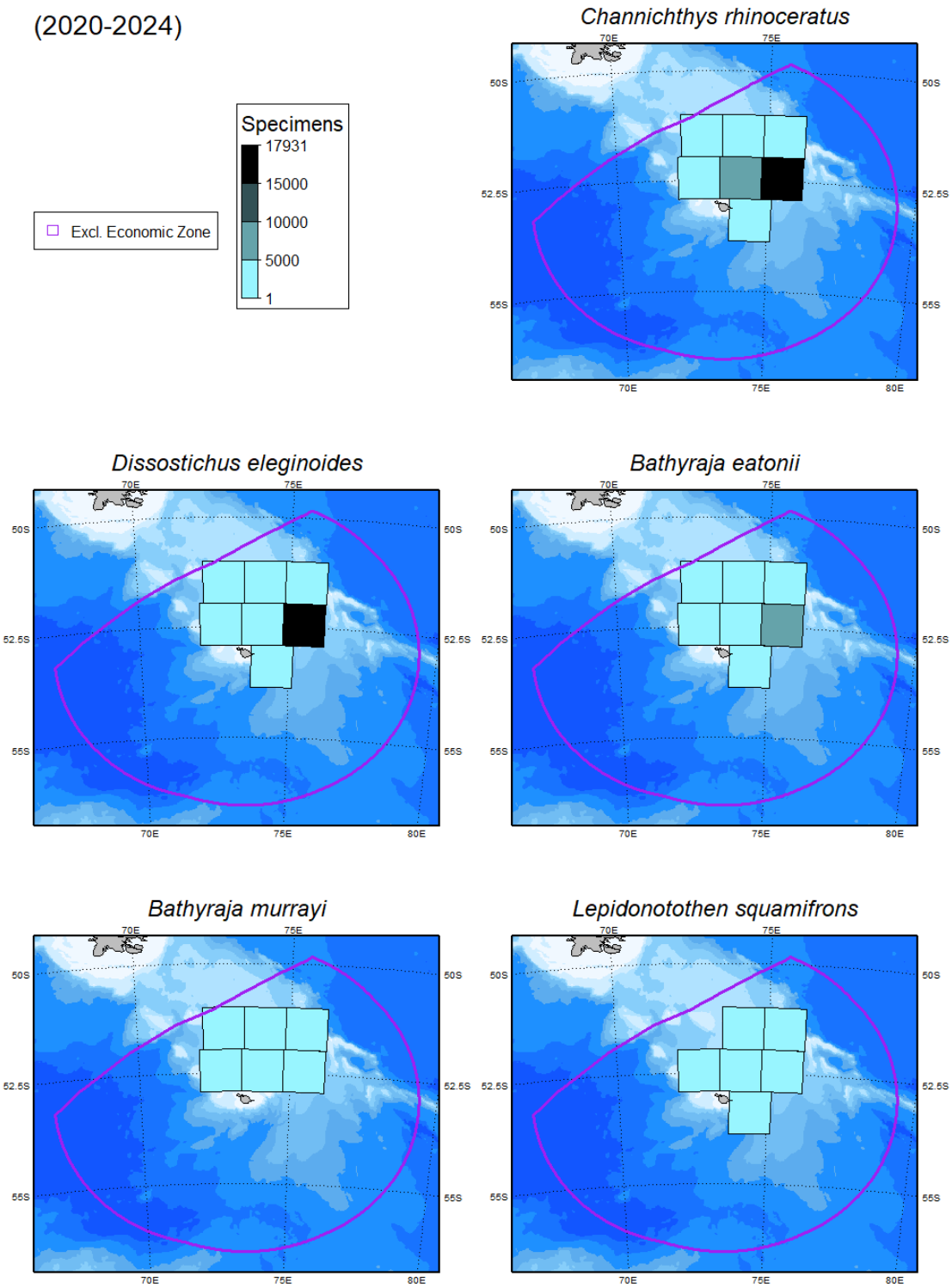


Figure 3. Spatial distribution of the most commonly examined by-catch taxa across the last five seasons, from the observer data (unweighted raw counts of individually examined specimens in each cell). The data were aggregated using equal area (100 km x 100 km) cells. Taxonomic identification may occur at different levels. Refer to Figure 1 for more details on the boundaries shown. Coastlines and ice shelves: UK Polar Data Centre/BAS and Natural Earth. Bathymetry: GEBCO. Projection: EPSG 6932 (rotated).

4.3. Length frequency distributions

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).

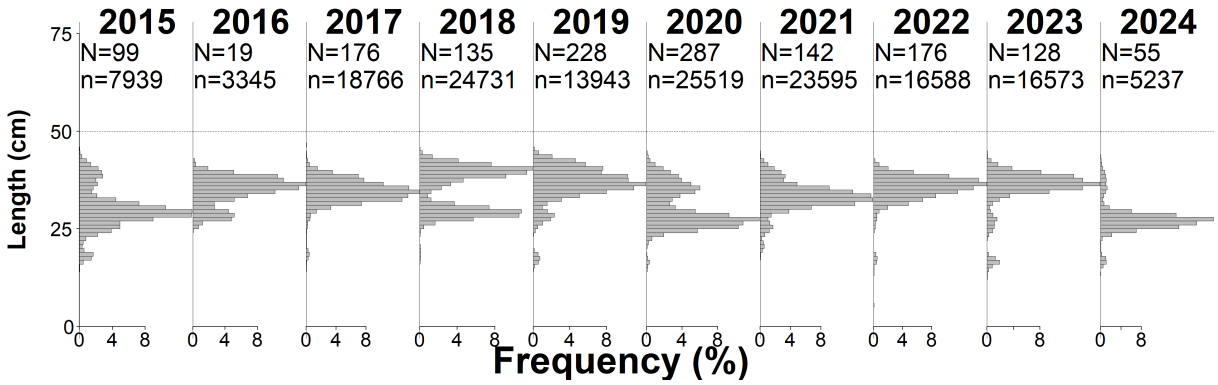


Figure 4. Annual length frequency distributions of *Champsocephalus gunnari* caught in this fishery. The number of hauls from which fish were measured (N) and the number of fish measured (n) in each year are indicated. Note: length frequency distributions are only shown where more than 150 fish were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

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

In 2024, the RSTS data presented in WG-FSA-IMAF-2024/58 Rev. 1, and updated biological parameters from WG-FSA-IMAF-2024/39 were used to update the catch limit for that fishery.

6. Stock status

6.1. Summary of current status

The 2024 survey estimated the biomass at 16,051 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 CAMLR 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 1,824 t. in the 2025 season and 1,723 t. in the 2026 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 2022, the Commission recognised that climate change is already having effects in the Convention Area (CCAMLR-41, paragraph 6.3) and agreed that it needed to act urgently to prepare for, and adapt to, the effects of climate change on the marine ecosystems within the Convention Area (CCAMLR-41, paragraph 6.5). The Commission noted (CCAMLR-41, paragraph 6.4) that the Scientific Committee had incorporated climate change into its advice (SC-CAMLR-41, paragraph 7.8) and through discussions at the SC-Symposium (SC-CAMLR-41, Annex 11) had also added climate change to the work plans and terms of reference of its Working Groups (SC-CAMLR-41, paragraph 7.14). The Commission adopted (CCAMLR-41, paragraph 6.28) Resolution 36/41.

In 2023, the Scientific Committee held a workshop on Climate Change (WS-CC-2023) which made recommendations regarding monitoring and management actions CCAMLR could progress to document and

track the effects of climate change in the Convention Area. The recommendations were incorporated into the workplan of the Scientific Committee. Further, the Scientific Committee recommended that summaries of evidence for changes in stock assessment parameters or processes that could be due to the effects of environmental variability or climate change be developed for all fisheries (SC-CAMLR-42, paragraph 2.149).

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

In 2024, Members developed summaries of evidence for changes in stock assessment parameters or processes that could be due to the effects of environmental variability or climate change, in the form of tables, for fisheries in Subarea 48.3, Divisions 58.5.1 and 58.5.2 and in the Ross Sea region (Table 6).

Table 6. Table summarising evidence for changes in stock assessment and population parameters or processes that could be due to the effects of environmental variability or climate change in the mackerel icefish fishery in Division 58.5.2 (WG-FSA-IMAF-2024/36).

Parameter or process	Population	Stock assessment
Recruitment	Icefish surveys show high interannual variability in year class strength. The drivers for interannual changes in recruitment have not been fully explored. Maschette and Welsford (2019) provided and initial hypothesis for the apparent shift in recruitment which occurred between 2008-2011.	Stock assessments for icefish assume no future recruitment in the two-year projection period. The stock assessments are based on the most recent estimate of recruitment from an annual trawl survey and therefore account for interannual variability in recruitment.
Biomass	As a result of highly fluctuating recruitment the population has shown highly variable biomass through time showing up to three-fold increases or decreases from one year to another.	The lower one-sided 95th confidence interval from a bootstrapped biomass estimate from the most recent trawl survey is used as the initial biomass in the stock assessment. This is done to account for the large interannual variability in observed in biomass estimates.
Length at maturity	Length at maturity has been investigated as part of Maschette et al. (2024) and has shown fluctuation in the size of maturity through time for both males and females with a generally increasing size of 50% maturity since 2008.	There is no maturity component in the stock assessment.
Stock-recruit relationship	The relationship between spawning stock and recruitment has not been thoroughly investigated.	Due to the stock assessment having no recruitment component there is no stock-recruitment relationship in the stock assessment.
Natural mortality	Natural mortality is uncertain. De la Mare (1998) estimated M to be around 0.30 for age 2 and above and 0.64 for age 3 and above based on a Heincke estimate for survivorship from age a to all older ages but acknowledge that these estimates were highly uncertain due to recruitment and sampling variability.	Within the stock assessment M is fixed at 0.4.
Growth rates	Growth rates appear to have changed through time with an increasing asymptotic average length (Linf) and a decreasing growth rate coefficient (K) (Maschette et al. 2024).	Within the time series of assessments growth has been estimated four times as part of the 1997; 2010; 2017 stock assessments and in Maschette et al. (2024).
Length-weight relationship	Annual Length-Weight relationships have shown some fluctuation through time although this is likely due to the presence or absence of size classes in the population (Maschette et al. 2024).	In the stock assessment estimates from the most recent trawl survey are used.
Sex ratio changes	No evidence of changes in sex ratio in the survey data through time (Maschette et al. 2024).	The stock assessment is an unsexed model.
Spatial distribution	No evidence in the change of spatial distribution through time has been observed (Maschette et al. 2024).	The stock assessment has no spatial components in the model.
Stock structure	Within Division 58.5.2 there have historically been three populations hypothesised. One on Shell Bank to the east of the plateau one on Pike Bank to the north-west of the plateau and one on the southern part of the plateau centred on Gunnari Ridge. The Pike bank population was heavily over fished prior to the establishment of the Australian and French EEZs and shows little signs of recovery. The fishery is limited to the population on the southern part of the plateau. Gunnari Ridge consistently shows the largest aggregations of adult icefish with Plateau Southeast and Platea West showing a patchier distribution with all age classes present.	
Locations of spawning and site fidelity	Gunnari Ridge is the primary area for spawning mackerel icefish. Icefish seem to move in and out of this area throughout the year.	

Additional Resources

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