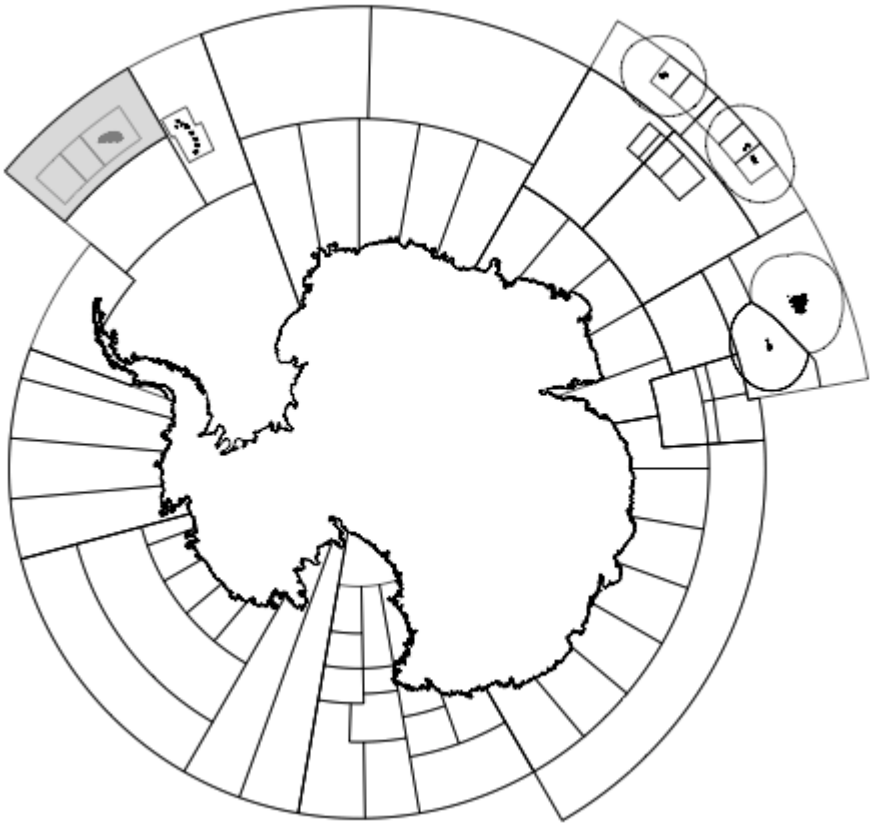
CCAMLR

Commission for the Conservation of Antarctic Marine Living Resources
Commission pour la conservation de la faune et la flore marines de l'Antarctique
Комиссия по сохранению морских живых ресурсов Антарктики
Comisión para la Conservación de los Recursos Vivos Marinos Antárticos

FISHERY REPORT

Fishery Report 2017: *Champsocephalus gunnari* South Georgia (Subarea 48.3)



The map above shows the management areas within the CAMLR Convention Area, the specific region related to this report is shaded.

Throughout this report the CCAMLR fishing season is represented by the year in which that season ended, e.g. 2015 represents the 2014/15 CCAMLR fishing season (from 1 December 2014 to 30 November 2015).

Fishery Report 2017: *Champsocephalus gunnari*
South Georgia (Subarea 48.3)

Details of the fishery

1. Mackerel icefish (*Champsocephalus gunnari*) grow rapidly to a maximum size of 55 cm, reaching a marketable size of 30 cm in three years. Icefish inhabit the shelf all around South Georgia and also at Shag Rocks, forming large aggregations. They feed on krill and their abundance has been linked to interannual variations in krill abundance. Spawning takes place in shallow water, with eggs laid on the seafloor. Larvae are pelagic and may be caught in coastal areas during late winter. Icefish predators include Antarctic fur seals (*Arctocephalus gazella*) and gentoo penguins (*Pygoscelis papua*).

2. Fishing for *C. gunnari* began in Subarea 48.3 in the late 1970s, with large catches taken by Eastern European vessels. Catches peaked in 1983 at a reported 178 000 tonnes. Following concerns about the depletion of stocks, CCAMLR closed the fishery in the early 1990s. The fishery was later reopened, but with a highly conservative catch limit, and was restricted to pelagic trawling to avoid impacts on non-target species. Conservation measures, including requirements to clean nets and ensure that they sink quickly, also reduced incidental mortality of birds. By-catch and incidental mortality is now low.

3. Currently, the fishing activity in Subarea 48.3 focuses on an area to the northwest of South Georgia. Vessels use pelagic trawls with a minimum mesh size of 90 mm. In recent years, the catch limit for this fishery has been between 1 500 and 5 000 tonnes, with up to four or five vessels operating. The fishery was conditionally certified as sustainable by the Marine Stewardship Council in 2010 and was recertified, condition-free, in 2016.

Reported catch

4. In Subarea 48.3 a pelagic trawl fishery targets *C. gunnari.* The annual catch limit for this fishery is described in Conservation Measure (CM) 42-01 and for 2017 it was set at 2 074 tonnes (Table 1). The total catch of *C. gunnari* in 2017 was 66 tonnes.

5. Catch data from this fishery highlight heavy exploitation in the late 1970s and a peak in 1983 (Table 1). CCAMLR closed the bottom trawl fishery in the early 1990s. The fishery reopened as a pelagic trawl fishery in 1995. Catch limits have been set biennially since 2012. Catch limits are based on a precautionary harvest control rule, assuming there is no recruitment in the second year of the assessment period. Catch limits for the second year of an assessment period (e.g. 2017) are therefore always lower than those for the first year. Annual catches, relative to the catch limit, are variable depending on the extent of participation in the fishery. They are also influenced by both interannual variation in the icefish population abundance and the availability of fish to the fishery (i.e. changes in the location and depth of fish).

Table 1: Catch history (commercial and research catches) for *Champsocephalus gunnari* in Subarea 48.3. (Source: STATLANT data for past seasons, and catch and effort reports for current season.)

Season	Reported effort (number of vessels)	Catch limit (tonnes)	Reported catch (tonnes)
1977	-	-	93595
1978	-	-	7472
1979	-	-	809
1980	-	-	8795
1981	-	-	27903
1982	-	-	54040
1983	-	-	178824
1984	-	-	35743
1985	-	-	628
1986	-	-	21008
1987	-	-	80586
1988	1	35000	36054
1989	-	0	3
1990	-	8000	8135
1991	-	26000	44
1992	-	0	5
1993	-	9200	0
1994	-	9200	13
1995	-	0	10
1996	-	1000	0
1997	-	1300	0
1998	1	4520	6
1999	1	4840	265
2000	2	4036	4114
2001	5	6760	960
2002	5	5557	2667
2003	4	2181	1986
2004	7	2887	2683
2005	7	3574	200
2006	5	2244	2169
2007	5	4337	4345
2008	5	2462	2491
2009	5	3834	1834
2010	3	1548	12*
2011	2	2305	12*
2012	3	3072	999
2013	3	2933	1370
2014	4	4635	33
2015	2	2695	277
2016	1	3461	2
2017	1	2074	66

* Catches in 2010 and 2011 were primarily from the research surveys.

Illegal, unreported and unregulated (IUU) catch

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

Size distribution of the catches

7. Length frequencies for *C. gunnari* from 2008 to 2017 are presented in Figure 1. These length-frequency distributions of catches are not standardised and hence the interannual variability shown reflects differences in fishing times, seasons, locations, gears and methods (e.g. research vs. commercial trawls) in addition to differences in the fished population. The data from 2010 and 2011 are primarily from a small number of research hauls.

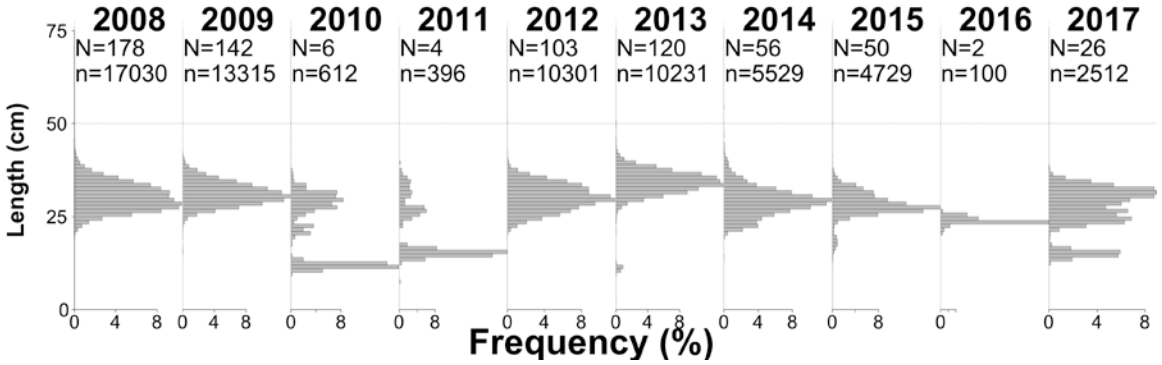


Figure 1: Length frequencies for *Champsocephalus gunnari* in Subarea 48.3 from observer data showing the number of hauls (N) and the number of fish measured (n) in each season at the top of each panel. Note that in 2010 and 2011 data are primarily from research hauls.

Stocks and areas

8. Within Subarea 48.3, *C. gunnari* is restricted to the shelf area generally shallower than 350 m. Differences in length distribution have been noted between Shag Rocks (rocky outcrops around 150 n miles to the northwest of South Georgia) and South Georgia, although these differences are not thought to represent separate stocks for stock assessment purposes. *Champsocephalus gunnari* is considered a semi-pelagic species; young (0+ and 1+) fish are found strictly in the pelagic zone, while adult fish move more towards the demersal zone.

Parameter estimation

Estimation methods

Acoustic surveys

9. Previous acoustic studies have demonstrated that *C. gunnari* of all sizes/ages spend time in midwater and indicated that bottom trawl surveys significantly underestimate *C. gunnari* biomass (see WG-FSA-SAM-04/20). In 2017, there were no new estimates of standing stock available from acoustic surveys.

Trawl surveys

10. In January/February 2017, the UK undertook a random stratified bottom trawl survey of the South Georgia and Shag Rocks shelf (WG-FSA-17/44). The survey, the 18th of its type, employed the same trawl gear and survey design as previous UK surveys in Subarea 48.3, which have operated since 1986 (see WG-FSA-10/38 and 15/26). The 2017 survey covered the whole shelf area: 72 random and spatially stratified hauls were completed covering depths of between 100 and 350 m.

11. Overall estimated biomass of *C. gunnari* used in the assessment was 91 531 tonnes (WG-FSA-17/47). The estimate of survey biomass was well above average and the second highest since 2000.

Parameter values

Fixed parameters

12. In 2017 the growth parameters used in the assessment were those used by CCAMLR in previous years (Table 2). Abundance and length parameters were updated according to the 2017 survey results.

Table 2: Biological parameters assumed for *Champsocephalus gunnari* in Subarea 48.3.

Component	Parameter	Value
Natural mortality	M	0.71
VBGF	K	0.17
VBGF	t_0	–0.58
VBGF	L_∞	55.7
Length to mass (cm to t)	A	0.000157
Length to mass	B	3.409
Maturity range: 0 to full maturity		1

Stock assessment

13. The use of the length-based model to set catch limits for *C. gunnari* in Subarea 48.3 was endorsed at the 2010 meeting of the Working Group on Fish Stock Assessment (WG-FSA-10) (SC-CAMLR-XXIX, Annex 8, paragraph 5.164). The assessment used survey data on length densities and biomass density without the need to identify age-specific cohorts. Methods of aggregating the length distributions from multiple hauls using a mean of positive values (as previous assessments in this Subarea), or a sum (equivalent to a mean of all values) were considered by WG-FSA-17 (WG-FSA-17/51). It was agreed that the assessment should change to using the sum, which reduces the likelihood of over-representing young fish in the population length distribution when small fish are clustered in particular survey strata.

14. Details of the 2015 stock assessment are set out in WG-FSA-15/25. The assessment in 2015 indicated that the stock was slightly above the average of the time series, with the median demersal biomass estimated at 59 081 tonnes, and a one-sided lower 95% confidence interval of 36 530 tonnes.

15. The CCAMLR harvest control rule, using a length-based approach, has been demonstrated to provide robust precautionary estimates of catch limits and exploitation rates for *C. gunnari* in Subarea 48.3 (WG-SAM-13/31 Rev. 1). Application of the method to the January 2015 demersal trawl survey indicates a catch limit for *C. gunnari* in Subarea 48.3 of 3 461 tonnes for 2016 and 2 074 tonnes for 2017.

By-catch of fish

By-catch removals

16. Table 3 lists catch limits and catches of the most common by-catch species: humped rockcod (*Gobionotothen gibberifrons*), marbled rockcod (*Notothenia rossii*), grey rockcod (*Lepidonotothen squamifrons*), South Georgia icefish (*Pseudochaenichthys georgianus*) and blackfin icefish (*Chaenocephalus aceratus*). By-catch is consistently low in this fishery (Table 3).

Table 3: Reported catch and catch limits for by-catch species (*Gobionotothen gibberifrons*, *Notothenia rossii*, *Lepidonotothen squamifrons*, *Pseudochaenichthys georgianus* and *Chaenocephalus aceratus*) in the fishery for *Champsocephalus gunnari* in Subarea 48.3 (see CM 33-01 for details). (Source: fine-scale data.)

Season	*Gobionotothen gibberifrons* (tonnes)		*Notothenia rossii* (tonnes)		*Lepidonotothen squamifrons* (tonnes)		*Pseudochaenichthys georgianus* (tonnes)		*Chaenocephalus aceratus* (tonnes)	
	Limit	Reported	Limit	Reported	Limit	Reported	Limit	Reported	Limit	Reported
1999	1470	0	300	0	300	0	300	<1	2200	<1
2000	1470	0	300	0	300	0	300	0	2200	0
2001	1470	<1	300	0	300	0	300	6	2200	<1
2002	1470	<1	300	<1	300	0	300	5	2200	5
2003	1470	0	300	0	300	0	300	5	2200	<1
2004	1470	0	300	0	300	0	300	3	2200	<1
2005	1470	<1	300	<1	300	<1	300	25	2200	1
2006	1470	0	300	1	300	0	300	6	2200	<1
2007	1470	<1	300	<1	300	0	300	<1	2200	0
2008	1470	<1	300	<1	300	0	300	<1	2200	<1
2009	1470	<1	300	<1	300	0	300	<1	2200	<1
2010	1470	<1	300	<1	300	0	300	<1	2200	0
2011	1470	0	300	<1	300	0	300	<1	2200	0
2012	1470	<1	300	<1	300	24	300	<1	2200	<1
2013	1470	<1	300	<1	300	<1	300	<1	2200	<1
2014	1470	<1	300	2	300	0	300	2	2200	1
2015	1470	0	300	0	300	0	300	0	2200	<1
2016	1470	0	300	0	300	0	300	0	2200	<1
2017	1470	1	300	3	300	2	300	1	2200	1

Mitigation measures for by-catch

17. The by-catch limits are set out in CM 33-01 and specific by-catch related move-on rules (whereby a vessel must move at least 5 n miles from a location where significant amounts of by-catch were hauled) are detailed in CM 42-01, paragraph 6.

Incidental mortality of seabirds and marine mammals

Incidental mortality reported

18. The incidental mortality rates for grey-headed albatross (*Thalassarche chrysostoma*), black-browed albatross (*T. melanophrys*) and white-chinned petrel (*Procellaria aequinoctialis*) are presented in Table 4. There were three incidental mortalities reported in 2017, all of which were white-chinned petrels.

Table 4: Number of birds killed in the trawl fishery in Subarea 48.3.

Fishing season	Trawls observed	*Thalassarche chrysostoma*	*T. melanophrys*	*Procellaria aequinoctialis*	Other
2001	350	5	46	41	
2002	431		18	49	1
2003	182	1	7	31	
2004	238	1	26	59	1
2005	277		9	1	1
2006	587	1	11	21	1
2007	391	1	2	3	
2008	247			3	2
2009	174		6	5	
2010	69			1	1
2011	5				
2012	106				
2013	61			2	
2014	29				
2015	49				
2016	16				
2017	32			3	

Identification of levels of risk

19. The level of risk of incidental mortality of birds in Subarea 48.3 remains at category 5 (high) (SC-CAMLR-XXX, Annex 8, paragraph 8.1).

Mitigation measures for incidental mortality of seabirds and marine mammals

20. CM 25-03 applies to this fishery. It sets out technical measures to minimise bird by-catch and relates to: net monitoring cables, vessel lighting, discarding of offal, net cleaning, net sinking (nets are most likely to trap birds when they are on the surface of the water) and streamer lines (bird scarers).

21. CM 42-01 has a further mitigation measure that, should any vessel catch a total of 20 birds, it shall cease fishing and shall be excluded from further participation in the fishery in that year.

Ecosystem implications/effects

22. The current pelagic trawl fishery for *C. gunnari* in Subarea 48.3 has minimal impact on the benthic ecosystem. There is a small by-catch of other icefish species, but this is typically much smaller than the catch limits for these species (Table 3). *Champsocephalus gunnari* play an important role in the ecosystem of the South Georgia shelf as predators of krill (*Euphausia superba*), other euphausiids and the hyperiid amphipod (*Themisto gaudichaudii*) and as prey species of fur seals and gentoo penguins. *Champsocephalus gunnari* may also be consumed by juvenile toothfish in years of high *C. gunnari* abundance at Shag Rocks.

23. Estimates of *C. gunnari* standing stock have been shown to vary in relation to krill abundance at South Georgia, and in years of poor krill availability, *C. gunnari* condition is poorer and larger quantities are likely to be consumed by both fur seals and gentoo penguins, which are normally krill-dependent predators.

24. Samples taken on the 2017 trawl survey found a higher than expected proportion of the amphipod *Themisto* sp. in the diet of *C. gunnari* although differences between areal strata were evident. (WG-FSA-17/44). This contrasts with the majority of years at South Georgia where *E. superba* constitutes the major prey item in the diet of *C. gunnari*.

25. Preliminary analysis of long-term data series from UK trawl surveys (1986–2017) indicates that abundance of previously overexploited fish (*C. gunnari* and *N. rossi*) may now be slowly increasing (WG-FSA-17/44). Time-series analysis of length-frequency data of *C. gunnari* from five Argentine surveys between 1993 and 2013 also indicates a steady increase in densities of adult fish (WG-FSA-13/65).

Current management advice and conservation measures

26. The limits on the fishery for *C. gunnari* in Subarea 48.3 for the forthcoming season are defined in CM 42-01: www.ccamlr.org/measure-42-01-2017.