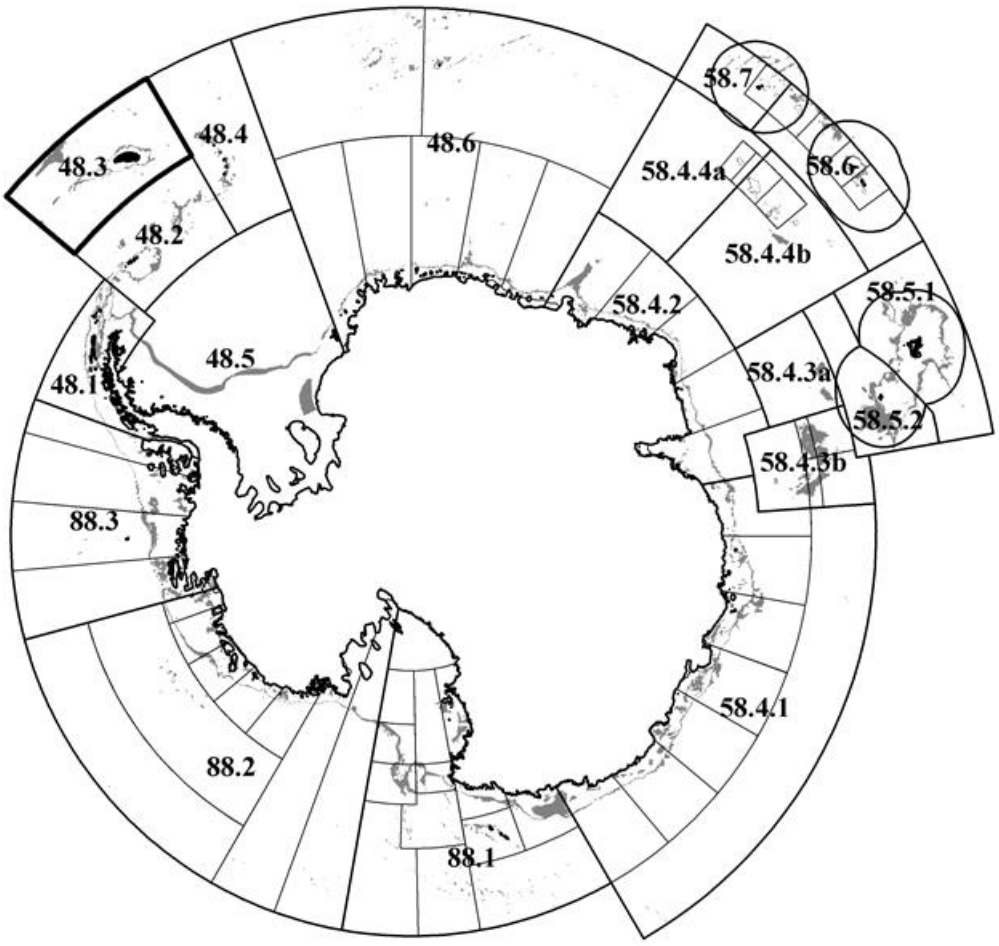
Fishery Report 2014: *Champsocephalus gunnari*
South Georgia (Subarea 48.3)



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The map on the cover page shows the management areas within the CAMLR Convention Area, the specific region related to this report is outlined in bold. Depths between 600 and 1 800 m are shaded.

Throughout this report the CCAMLR fishing season is represented by the year in which that season ended, e.g. 2014 represents the 2013/14 CCAMLR fishing season (from 1 December 2013 to 30 November 2014).

FISHERY REPORT 2014: *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 seabirds. 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 four or five vessels operating. The fishery was conditionally certified as sustainable by the Marine Stewardship Council in 2010.

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 2014 it was set at 4 635 tonnes (Table 1). In 2014, the fishing season started on 1 December 2013 and ended on 30 November 2014. The total catch of *C. gunnari* in 2014 was 33 tonnes.

5. Catch data from this fishery highlight high 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. 2013) are therefore always lower than those for the first year. Annual catches, relative to 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	-	-	93 595
1978	-	-	7 472
1979	-	-	809
1980	-	-	8 795
1981	-	-	27 903
1982	-	-	54 040
1983	-	-	178 824
1984	-	-	35 743
1985	-	-	628
1986	-	-	21 008
1987	-	-	80 586
1988	1	35 000	36 054
1989	-	0	3
1990	-	8 000	8 135
1991	-	26 000	44
1992	-	0	5
1993	-	9 200	0
1994	-	9 200	13
1995	-	0	10
1996	-	1 000	0
1997	-	1 300	0
1998	1	4 520	6
1999	1	4 840	265
2000	2	4 036	4 114
2001	5	6 760	960
2002	5	5 557	2 667
2003	4	2 181	1 986
2004	7	2 887	2 683
2005	7	3 574	200
2006	5	2 244	2 169
2007	5	4 337	4345
2008	5	2 462	2 491
2009	5	3 834	1 834
2010	3	1 548	12*
2011	2	2 305	12*
2012	3	3 072	999
2013	3	2 933	1 370
2014	3	4 635	33

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

IUU catch

6. There has been no evidence of IUU activity in this fishery.

Size distribution of the catches

7. Length frequencies for *C. gunnari* from 2005 to 2014 are presented in Figure 1. 2014 catches (to October) are strongly bimodal, indicating two strong year classes, however, note that sample sizes are low. 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.

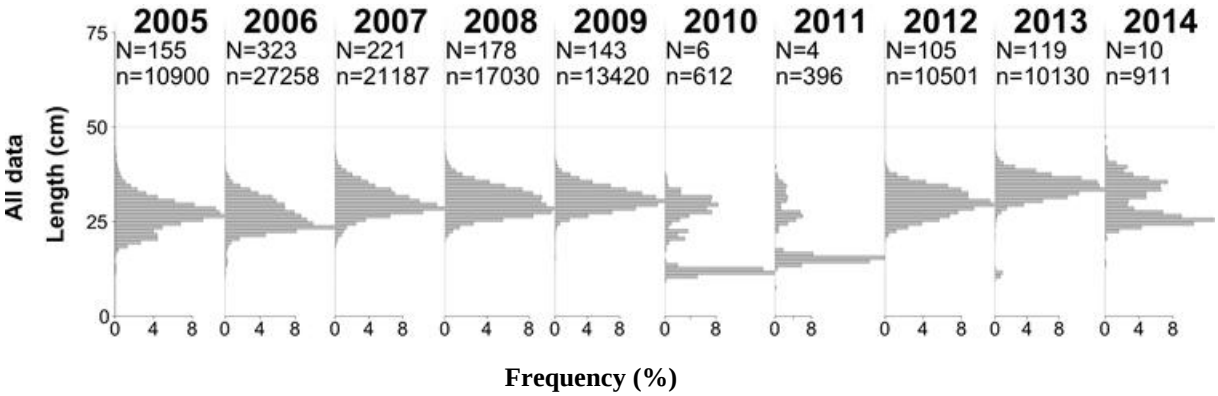

Figure 1: Length frequencies for *Champsocephalus gunnari* in Subarea 48.3 from observer data showing the number of hauls (N) and the number of fish measured (n) in each year at the top of each panel. Note that in 2010 and 2011 data are primarily from research hauls. Figures for 2014 are based on reported catch data as of October 2014; fishing was ongoing.

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 purposes of stock assessment. *Champsocephalus gunnari* is considered a semi-pelagic species; young (0+ and 1+) fish are found in the pelagic zone, but fish become more demersal with increased age/size.

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 2013, there were no new estimates of standing stock available from acoustic surveys.

Trawl surveys

10. In January 2013, the UK undertook a random stratified bottom trawl survey of the South Georgia and Shag Rocks shelf (WG-FSA-13/17). The survey, the 16th 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). The 2013 survey covered the whole shelf area: 70 random, spatially stratified, hauls were completed covering depths of between 100 and 320 m.

11. Overall estimated biomass of *C. gunnari* used in the assessment was 106 548 tonnes (WG-FSA-13/27); the survey biomass was the highest recorded since 1990.

Parameter values

Fixed parameters

12. In 2013 the growth parameters used in the assessment were those used by CCAMLR in previous years (SC-CAMLR-XXVI, Annex 5, Appendix O, Table 5) (Table 2, below). Abundance and length parameters were updated according to the 2013 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	0.0002
Length to mass	B	3.35
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 (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.

14. Details of the 2014 stock assessment are set out in WG-FSA-13/27. The assessment in 2013 indicated that the stock was close to the highest level in the time series, with the median demersal biomass estimated at 106 548 tonnes, and a one-sided lower 95% confidence interval of 49 640 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 2013 demersal trawl survey indicates a catch limit for *C. gunnari* in Subarea 48.3 of 4 635 tonnes for 2014 and 2 659 tonnes for 2015.

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	1 470	0	300	0	300	0	300	<1	2 200	<1
2000	1 470	0	300	0	300	0	300	0	2 200	0
2001	1 470	<1	300	0	300	0	300	6	2 200	<1
2002	1 470	<1	300	<1	300	0	300	5	2 200	5
2003	1 470	0	300	0	300	0	300	5	2 200	<1
2004	1 470	0	300	0	300	0	300	3	2 200	<1
2005	1 470	<1	300	<1	300	<1	300	25	2 200	1
2006	1 470	0	300	1	300	0	300	6	2 200	<1
2007	1 470	<1	300	<1	300	0	300	<1	2 200	0
2008	1 470	<1	300	<1	300	0	300	<1	2 200	<1
2009	1 470	<1	300	<1	300	0	300	<1	2 200	<1
2010	1 470	<1	300	<1	300	0	300	<1	2 200	0
2011	1 470	0	300	<1	300	0	300	<1	2 200	0
2012	1 470	<1	300	<1	300	24	300	<1	2 200	<1
2013	1 470	<1	300	<1	300	<1	300	<1	2 200	<1
2014	1 470	<1	300	<1	300	0	300	2	2 200	<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 birds and 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 no incidental mortalities in 2014.

Table 4: Number of seabirds 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				

Identification of levels of risk

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

Mitigation measures for incidental mortality of birds and 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 seabirds 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 seabirds, 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 2013 trawl found that *E. superba* dominated the diet of *C. gunnari* although differences between areal strata were evident. In the southwest region *T. gaudichaudii* was the dominant diet item, with fish and *T. gaudichaudii* comprising the majority of the diet at Shag Rocks.

25. Preliminary analysis of long-term data series from UK trawl surveys (1986–2013) indicates that abundance of previously overexploited fish (*C. gunnari* and *N. rossi*) may now be slowly increasing (WG-FSA-13/26). 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 are defined in CM 42-01 and summarised in Table 5.

27. The catch limit for *C. gunnari* should be set at 2 659 tonnes in 2015 based on the outcome of the short-term assessment presented in WG-FSA-13/27.

Table 5: Limits on the fishery for *Champsocephalus gunnari* in Subarea 48.3 in force (summarised from CM 42-01).

Element	Limits in force
Access (gear)	Pelagic trawling only
Access (area)	Fishing prohibited within 12 n miles of South Georgia from 1 March to 31 May
Catch limit	2 659 tonnes
Move-on rule	Move on if >100 kg caught of which >10% by number are <240 mm TL
Season	1 December to 30 November
By-catch	By-catch rates as in CM 33-01 to apply, plus the move-on rule specified in CM 42-01 paragraph 6.
Seabird mitigation	In accordance with CM 25-03 Use of net binding and additional weights to codend Any vessel catching 20 seabirds to cease fishing

(continued)

Table 5 (continued)

Element	Limits in force
Observers	Each vessel to carry at least one CCAMLR scientific observer and may include one additional scientific observer
Data	Five-day catch and effort reporting Haul-by-haul catch and effort data Biological data reported by the CCAMLR scientific observer
Target species	*Champsocephalus gunnari* By-catch is any species other than *C. gunnari*
Research	No requirement
Environmental protection	Regulated by CM 26-01 No offal discharge