

**Fishery Report: *Champscephalus gunnari* (ANI)
Heard Island (Division 58.5.2)**

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Throughout this report the CCAMLR fishing season is represented by the year in which that season ended, e.g. 2012 represents the CCAMLR fishing season from 1 December 2011 to 30 November 2012.

**FISHERY REPORT: *CHAMPSOCEPHALUS GUNNARI* (AND)
HEARD ISLAND (DIVISION 58.5.2)**

1. Details of the fishery

1.1 Reported catch

1. The limits on the trawl fishery for *Champsoccephalus gunnari* in Division 58.5.2 are described in Conservation Measure (CM) 42-02. In 2012, the fishery was closed to commercial operation and a catch limit of 30 tonnes of *C. gunnari* was set aside for research and by-catch. Historical reported catches of *C. gunnari*, along with catch limits and number of vessels active in the fishery, are shown in Table 1.

Table 1: Catch history for *Champsoccephalus gunnari* in Division 58.5.2. (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)
1972	-	-	5 860
1974	-	-	7 525
1975	-	-	9 710
1977	-	-	15 201
1978	-	-	5 166
1990	-	-	2
1992	-	-	5
1993	-	-	3
1995	-	311	0
1996	-	311	0
1997	1	311	227
1998	3	900	115
1999	1	1 160	2
2000	2	916	137
2001	2	1 150	1 136
2002	2	885	865
2003	2	2 980	2 345
2004	2	292	78
2005	2	1 864	1 851
2006	1	1 210	660
2007	1	42	1
2008	1	220	199
2009	1	102	83
2010	1	1 658	352
2011	1	78	1
2012	1	0 (30)*	4

* Research and by-catch limit in brackets.

1.2 IUU catch

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

1.3 Size distribution of the catches

3. Length frequencies for *C. gunnari* from 1997 to 2012 are presented in Figure 1. These length-frequency distributions of catches are unweighted and the interannual variability shown in the figure may reflect differences in the fished population but are also likely to be biased by changes in factors such as the characteristics/number of vessels in the fishery and the spatial and temporal distribution of fishing. A description of how length data are used in assessments is provided in the relevant section of this report. Data from 2007 and 2011 have not been included because the total catch for that season was 1 tonne.

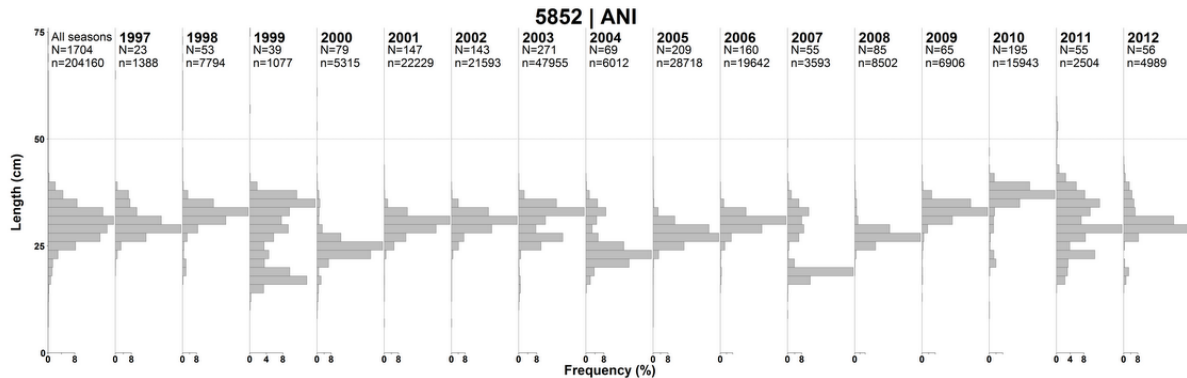


Figure 1: Length frequencies for *Champsocephalus gunnari* in Division 58.5.2 using observer data from both the commercial fishery and research trawl surveys with the number of hauls (N) and the number of fish measured (n) in each year at the top of each pane.

2. Stocks and areas

4. Within Division 58.5.2 this species is restricted to the shelf area in the vicinity of Heard Island in water generally shallower than 500 m. Previous analyses indicated that stocks on the Heard Plateau and Shell Bank have different size structures and recruitment patterns. In 1997 the Working Group agreed that in light of this, the two areas should be treated as separate stocks for assessment purposes (see SC-CAMLR-XVI, Annex 5). *Champsocephalus gunnari* have been absent, or present in very low abundances, on Shell Bank over recent years. Due to their low abundance observed in the current year, no assessment has been conducted for the Shell Bank stock since the 2008 season.

3. Parameter estimation

3.1 Estimation methods

Survey abundance

5. The results of the bottom trawl surveys undertaken between March and May 2012 were summarised in WG-FSA-12/26. The surveys had been undertaken according to the same design as in previous surveys for this region. The location of sample stations in relation to Heard Island and McDonald Islands is shown in Figure 2.

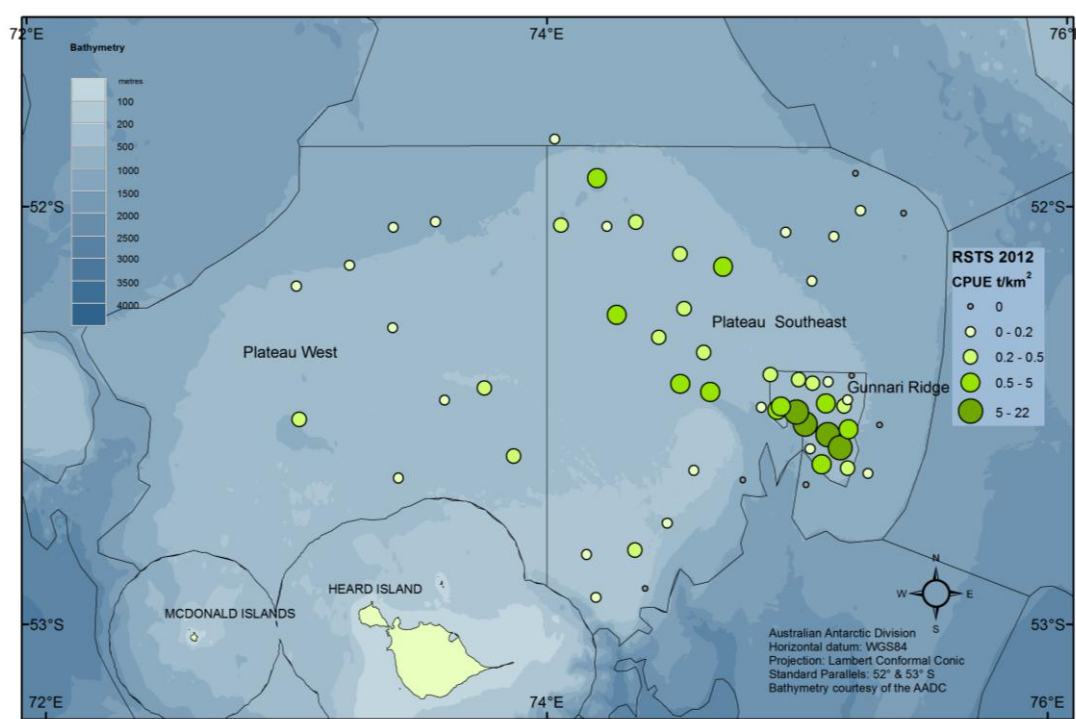


Figure 2: Strata and sampling hauls from the 2012 random stratified trawl survey in Division 58.5.2 used in the 2012 *Champsocephalus gunnari* assessment. Points are locations of hauls, with 10 stations in Plateau West, 18 stations in Gunnari Ridge and 30 stations in Plateau Southeast.

Population structure

6. The distribution of densities-at-age was derived using the CMIX program and selecting the mean length for ages 1–5 by eye (Table 2). The pattern of five consecutive year classes, first detected in 2011, has persisted in the 2012 survey, however, a large 2+ cohort now dominates the population (Figure 3). Details of the fit are presented in Table 3.

Table 2: Input parameters for the CMIX analysis of *Champsocephalus gunnari* length density in Division 58.5.2.

Parameter	Value
Size range included	140–450 mm
Bounds	Age 1: 150–200 mm Age 2: 270–320 mm Age 3: 325–360 mm Age 4: 365–400 mm Age 5: 405–420 mm
SDs related linearly to the mean	Yes
Bounds on intercept (start, step)	1, 50 (15, 1.0)
Bounds on slope (start, step)	0.0, 0.4 (1.0, 0.1)
No. function calls	1 000
Reporting frequency	100
Stopping criteria	1E-6
Frequency for convergence testing	5
Simplex expansion coefficient	1

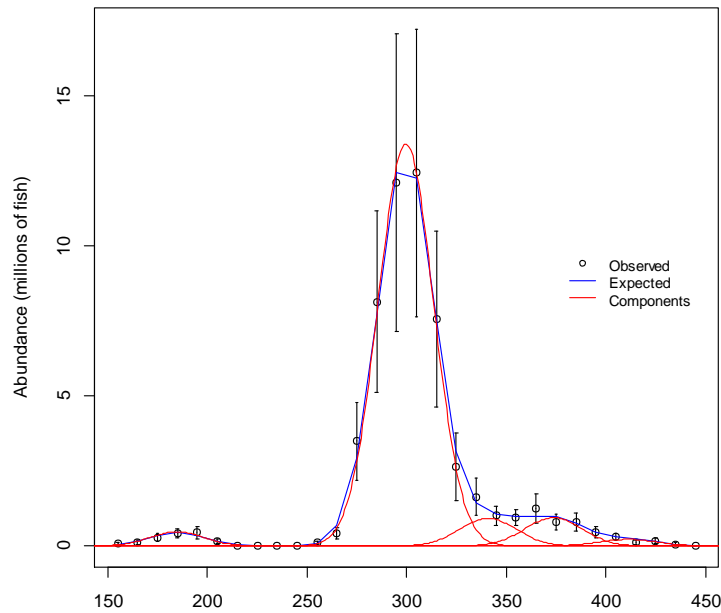


Figure 3: Size distribution of *Champsocephalus gunnari* from the 2012 random stratified trawl survey in Division 58.5.2 with standard errors. Cohorts were present in ages 1+ to 5+. As seen in 2011, four or five consecutive year classes are present in the population simultaneously.

Table 3: Results generated from CMIX analyses for *Champsocephalus gunnari* from the 2011 random stratified trawl survey in Division 58.5.2.

	Component 1 (age 1+)	Component 2 (age 2+)	Component 3 (age 3+)	Component 4 (age 4+)	Component 3 (age 5+)
Mean length (mm)	185	300	341	374	411
SD (mm)	13.2	13.9	14.2	14.3	14.5
Total density (numbers km ⁻²)	73.2	2167.4	150.8	157.0	37.0
SD of component density	23.6	608.8	107.4	116.6	39.0
Sum of observed densities = 2595					
Sum of expected densities = 2585					
Intercept = 1.000					
Slope = 0.0422					

3.2 Parameter values

Fixed parameters

7. The length–weight parameters used in the assessment were re-estimated based on the fish captured during the 2012 survey. This resulted in a higher expected weight-at-length than the previous parameters used, which were estimated based on surveys in the early 1990s (de la Mare et al., 1998).

8. Growth parameters were re-evaluated in 2010 from size-at-age for cohorts that were sufficiently large for their modal length and well characterised in assessments between 2000 and 2010 (WG-FSA-10/12). These values were used in the assessment for the 2013 season. The other fixed parameters remain unchanged from previous assessments (Table 4).

Table 4: Fixed parameters used in the 2012 assessment of *Champocephalus gunnari* in Division 58.5.2.

Component	Parameter	Value	Units
Natural mortality	M	0.4	y^{-1}
VBGF	K	0.379	y^{-1}
VBGF	t_0	0.057	y
VBGF	L_∞	438	mm
Length-to-mass	' a '	7.00E-10	kg/mm
Length-to-mass	' b '	3.360	

Standing stock

9. Estimates of SSB for the Heard Island Plateau were made using the bootstrap procedure using the routine outlined in Appendix 1 of WG-FSA-10/12, using data from the most recent survey. The estimates of the median and one-sided lower 95% CI of biomass are shown in Table 5.

Table 5: Abundance (tonnes) of *Champocephalus gunnari* in the vicinity of Heard Island in Division 58.5.2 estimated by bootstrapping hauls from the trawl survey in April/May 2012. SE = standard error; Lower CI, Upper CI = lower and upper confidence intervals respectively; LOS 95% CI = lower one-sided 95% confidence interval.

Stratum	Estimate	SE	Lower CI	Upper CI	LOS 95% CI
Gunnari Ridge	2451	958	792	4337	967
Plateau SE	2340	493	1446	3345	1584
Plateau W	1899	277	1419	2375	1468
Pooled	6691	1260	4383	9196	4718

Removals

10. No *C. gunnari* were caught following the survey (30 April to 5 May 2011).

Selectivity

11. A linear selectivity vector was used for *C. gunnari*, starting at 2.5 years and fully selected at age 3.

Recruitment

12. The short-term projection of *C. gunnari* does not include recruitment data.

Initial age structure and proportion of biomass-at-age

13. Estimates of the age structure, as estimated using CMIX, and the proportion of biomass-at-age are shown in Table 6. This shows that the 2+ age class was dominant in the population in 2011, with the majority of the biomass made up by the 1+ to 3+ cohorts.

Table 6: Calculation of the proportion of biomass-at-age derived from the survey length-density distribution. Note that these calculations use length-weight parameters re-estimated in 2012.

Age class	Mean length (mm)	Density ($n \text{ km}^{-2}$)	Mean weight (kg)	Proportion of biomass (%)
1+	185	73	0.029	0.5
2+	299	2167	0.145	75.7
3+	341	151	0.227	8.3
4+	374	157	0.309	11.7
5+	411	37	0.424	3.8

4. Stock assessment

4.1 Model structure and assumptions

14. The GYM, used routinely for the assessment of long-term yield of other species in the CAMLR Convention Area, configured to perform the short-term projection, was used; the model configuration is provided in Table 7.

Table 7: GYM model configuration for the assessment of *Champscephalus gunnari* in Division 58.5.2.

Category	Parameter	Values
Age structure	Plus class accumulation	10 years
	Oldest age in initial structure	11 years
Initial population structure	Age class density	See Table 6
Weight-at-length	Weight-length parameter – <i>A</i> (kg)	7.0×10^{-10} kg
	Weight-length parameter – <i>B</i>	3.36
Maturity	L_{m50} (set so that the status of the whole stock is being monitored)	0 mm*
	Range: 0 to full maturity	0 mm
Spawning season	Set so that status of the stock is determined at the end of each year	30 Nov–30 Nov
Fishery information	Upper bound to annual <i>F</i>	5
	Tolerance to finding <i>F</i>	1E-08
	Tolerance for resolving catches	0.01

(continued)

Table 7 (continued)

Category	Parameter	Values
Future projection	Age first selected	2.5
	Age fully selected	3.0
	Relative fishing effort	Date: 1 Dec, Effort: 1
	Selectivity varied from last	Yes
	Age first selected	2.5
	Age fully selected	3.0
	Relative fishing effort	Date: 1 Dec, Effort: 0 Date: 2 May, Effort: 0
	Catch after survey	0 kg
Simulation specifications	Number of runs in simulation	1
Individual trial	Years to remove initial age structure	0**
Specifications	Year prior to projection	2011***
	Reference start date in year	1 Dec
	Increments in year	365
	Years to project stock in simulation	2
	Reasonable upper bound for annual F	5.0
	Tolerance for finding F in each year	0.000001

* Maturity is not used in the short-term projection. It is set to 0 to allow the GYM to monitor the whole population.

** Set to 0 since no icefish were captured after the survey, else set to 1.

*** GYM requires first year of the 2011/12 split-year.

Decision rules

15. To assess a catch level such that fishing should not, without any substantial risk, (specified in this instance as no more than 5% probability):

reduce the spawning stock biomass to below 75% of the level that would occur in the absence of fishing within the two years following an abundance biomass estimate provided by a survey.

16. To achieve this, the lower one-sided 95% confidence bound of the biomass estimate for 1+, 2+ and 3+ age classes (66% of total estimated biomass or 482 tonnes) was used as the starting point for the projection, reflecting the expectation that the 4+ and 5+ age classes will be lost later in 2012.

4.2 Sensitivity analyses

17. A range of scenarios were conducted in 2012 to test the sensitivity of the icefish assessment and presented in WG-FSA-12/28. Sensitivity tests indicated that the convention of using the lower one-sided 95th percentile of the survey biomass estimate is effective at accounting for uncertainty in mortality and growth rates.

4.3 Discussion of model results

18. The scenario used for the 2012 stock assessment used the approach used in 2011, with updated length–weight parameters. The projection of fish of 1+ to 3+ age classes from 2012 gives a projected yield of 679 tonnes in the 2013 season and 573 tonnes in the 2014 season.

4.4 Future research requirements

19. The Working Group recommended consideration of whether the parameter estimates from the revised growth model were tracking population change in response to the environment or were due to changes in the way the CMIX method identified cohorts.

5. By-catch of fish and invertebrates

5.1 By-catch removals

20. The total reported by-catch (tonnes) of fish taken in the trawl fishery for *C. gunnari* in recent years is indicated in Table 8 from fine-scale C2 data.

Table 8: Total reported by-catch (tonnes) for four species between 1996 and 2012 in the *Champscephalus gunnari* trawl fishery. Limits apply to all fisheries in Division 58.5.2. LIC – *Channichthys rhinoceros*; NOS – *Lepidonotothen squamifrons*; GRV – *Macrourus* spp.; SRX – rajids. (Source: fine-scale data.)

Fishing season	LIC catch	Limit	NOS catch	Limit	GRV catch	Limit	SRX catch	Limit	Other catch	Limit
1996	0		0		0		0		0	5%*
1997	2		<1		0		<1		2	50**
1998	2	80	3	325	0		<1	120	2	50
1999	<1	150	<1	80	<1		<1		<1	50
2000	2	150	<1	80	<1		<1		<1	50
2001	1	150	<1	80	0	50	<1	50	<1	50
2002	3	150	<1	80	<1	50	<1	50	<1	50
2003	21	150	<1	80	<1	465	20	120	5	50
2004	6	150	<1	80	<1	360	3	120	1	50
2005	34	150	<1	80	<1	360	5	120	3	50
2006	29	150	<1	80	<1	360	7	120	2	50
2007	3	150	<1	80	0	360	<1	120	<1	50
2008	8	150	<1	80	<1	360	2	120	7	50
2009	7	150	<1	80	<1	360	7	120	8	50
2010	52	150	<1	80	<1	360	12	120	6	50
2011	1	150	1	80	<1	360	<1	120	2	50
2012	2	150	<1	80	1	360	<1	120	1	50

* 5% move-on rule if individual haul exceeds 5%, limit not specified.

** Move-on rule if catch of any by-catch species exceeds 5% of target species.

5.2 Assessments of impact on affected populations

21. No stock assessments of individual by-catch species were undertaken in 2012. The catch limits of *Channichthys rhinoceratus* and *Lepidonotothen squamifrons* are based on assessments carried out in 1998 (SC-CAMLR-XVII, Annex 5, paragraphs 4.204 to 4.206) and by-catch limits of the grenadier *Macrourus carinatus* are based on assessments carried out in 2002 and 2003 (SC-CAMLR-XXII, Annex 5, paragraphs 5.244 to 5.249).

5.3 Mitigation measures

22. CM 33-02 currently applies to this fishery. Move-on rules are included in the annual conservation measures established for this fishery (e.g. CM 42-02).

6. Incidental mortality of birds and mammals

6.1 Incidental mortality reported

23. Seabird by-catch in the fishery targeting *C. gunnari* in Division 58.5.2 remains low with no observed seabird mortality for the 2012 season (Table 9).

Table 9: Number of seabirds killed in the trawl fishery in Subarea 48.3. DAC – *Daption capense*; DIM – *Thalassarche melanophrys*; PRO – *Procellaria aequinoctialis*.

Fishing season	Trawls observed	DAC	DIM	PRO	Other
2003	1309		2	2	2
2004	1215				
2005	1301		5	3	
2006	1086				
2007	936				2
2008	700				
2009	39				
2010	138	1			
2011	329				
2012	58				

24. No incidents of marine mammal by-catch have been observed while fishing for *C. gunnari* since 2006.

6.2 Identification of levels of risk

25. The level of risk of incidental mortality of seabirds in Division 58.5.2 is category 4 (average-to-high) (SC-CAMLR-XXX, Annex 8, paragraph 8.1).

6.3 Mitigation measures

26. The provisions of CM 25-03 apply to this fishery.

7. Ecosystem implications/effects

27. Bottom trawl and midwater trawl gear is used to target both *C. gunnari* and *Dissostichus eleginoides* in Division 58.5.2. The potential impacts of fishing gear on benthic communities are limited by the small size and number of commercial trawl grounds, a strategy of fishing trawling gear lightly, and the protection of large areas sensitive to the effects of bottom trawling (SC-CAMLR-XXIII, Annex 5, paragraph 5.211).

28. Research is currently being undertaken by Australia to develop ecosystem models for the Heard Island Plateau, including *C. gunnari* and their main predators, which will subsequently be used to inform management strategy evaluations on the *C. gunnari* fishery (SC-CAMLR-XXVI/BG/06, paragraph 21).

8. Harvest controls and management advice

8.1 Conservation measures

29. In 2011 it was agreed that, where the stock assessment of *C. gunnari* in Division 58.5.2 indicated a stock biomass of less than 1 000 tonnes or the decisions rules indicated a catch limit of less than 100 tonnes, a commercial catch limit would not be set. Instead, a 30 tonne combined research and by-catch limit would apply, which would allow the annual trawl survey to continue to monitor the stock, and accommodate by-catch of icefish that may occur in the *D. eleginoides* trawl fishery in this division.

30. The Working Group noted that the rationale for limit reference points would be strengthened by a more detailed evaluation of the performance of the CCAMLR Decision Rules, as recommended by the Workshop on Approaches to Managing Icefish (SC-CAMLR-XX, Annex 5, Appendix D), taking into account stock-specific biology and ecosystem role. The Working Group encouraged Members to conduct such evaluations, and that limit reference points should be revised accordingly.

31. As the assessment for catch in 2013 indicates a lower one-sided 95% of biomass greater than 1 000 tonnes and a catch limit of greater than 100 tonnes, it was recommended that the limit reference point not be applied in 2013.

32. The limits on the fishery for *C. gunnari* in Division 58.5.2 are defined in CM 42-02. The limits in force and the Working Group's advice to the Scientific Committee for the forthcoming season are summarised in Table 10.

Table 10: Limits on the fishery for *Champscephalus gunnari* in Division 58.5.2 in force (CM 42-02) and advice to the Scientific Committee for 2012/13.

Element	Limits in force	Advice for 2013
Access (gear)	Trawling only.	Carry forward
Access (area)	Definition of area open for fishing. Chart illustrating area open (Annex 42-02/A).	Carry forward Carry forward
Catch limit	0 tonnes, 30-tonne research and by-catch limit	Revise
Move-on rule	Move on if >100 kg caught of which >10% by number are less than minimum size (24 cm).	Carry forward
Season	1 December to 30 November	Same period
By-catch	By-catch rates as in CM 33-02 to apply.	Carry forward
Mitigation	In accordance with CM 25-03.	Carry forward
Observers	Each vessel to carry at least one scientific observer and may include one additional CCAMLR scientific observer.	Carry forward
Data	Ten-day reporting system as in Annex 42-02/B Monthly fine-scale reporting system as in Annex 42-02/B on haul-by-haul basis. Fine-scale reporting system as in Annex 42-02/B. Reported in accordance with the Scheme of International Scientific Observation.	Carry forward
Target species	<i>Champscephalus gunnari</i> By-catch is any species other than <i>C. gunnari</i> .	Carry forward
Environmental protection	Regulated by CM 26-01. No offal discharge.	Carry forward

8.2 Management advice

33. The Working Group recommended that the Scientific Committee consider a catch limit for *C. gunnari* in 2013 of 679 tonnes, and in the absence of a trawl survey in 2013, a catch limit of 573 tonnes in the 2014 season.

Reference

de la Mare, W.K., R. Williams and A.J. Constable. 1998. An assessment of the mackerel icesh (*Champscephalus gunnari*) off Heard Island. *CCAMLR Science*, 5: 79–101.