

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

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1. Details of the fishery

1.1 Reported catch

The trawl fishery for *Champscephalus gunnari* in Division 58.5.2 has caught 263 tonnes from a catch limit of 1 210 tonnes in the 2005/06 fishing season (Conservation Measure 42-02). Historical reported catches along with the respective catch limits and number of vessels active in the fishery are shown in Table 1.

Table 1: Catch history for *Champscephalus gunnari* in Division 58.5.2 (source: STATLANT data and catch and effort reports).

Season	Reported effort (number of vessels)	Catch limit (tonnes)	Reported catch (tonnes)
1971/72			5 860
1973/74			7 525
1974/75			9 710
1976/77			15 201
1977/78			5 166
1989/90			2
1991/92			5
1992/93			3
1994/95		311	0
1995/96		311	0
1996/97	1	311	227
1997/98	3	900	115
1998/99	1	1 160	2
1999/00	2	916	137
2000/01	2	1 150	1 136
2001/02	2	885	865
2002/03	2	2 980	2 345
2003/04	2	292	78
2004/05	2	1 864	1 851
2005/06	1	1 210	263

1.2 IUU catch

2. There was no evidence of IUU activity in this fishery.

1.3 Size distribution of the catches

3. Catch-weighted length frequencies from observer, fine-scale and STATLANT data for 1996/97 to 2005/06 are presented in Figure 1.

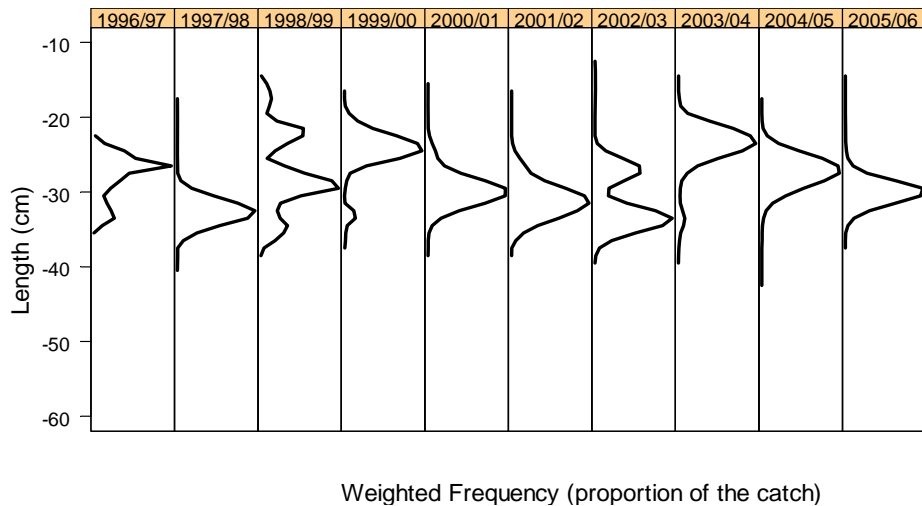


Figure 1: Catch-weighted length frequencies for *Champsocephalus gunnari* in Division 58.5.2 derived from observer, fine-scale and STATLANT data reported by 5 October 2006. The plots include data from both the commercial fishery and research trawl surveys.

4. With respect to the catch-weighted length frequencies in Figure 1, the Working Group recalled the apparent progression in the cohorts in Figure 1 from 1999/2000 to 2002/03, and noted a similar pattern evident from 2003/04 to 2005/06, but recalled that:

- (i) the length frequencies reflect lengths of fish in the catch and not the whole population;
- (ii) there is a minimum size limit for *C. gunnari* in this fishery of 240 mm to protect juvenile fish (younger than 2.5 years) and that if the proportion of fish smaller than this size exceeds 10% in a haul then the vessel must move to a new fishing area;
- (iii) the modal lengths will be dependent on the time of the year in which the fishery was prosecuted and the potential density-dependent growth that might occur (SC-CAMLR-XX, Annex 5, Appendix D; WAMI-01/4);
- (iv) abundance of fish cannot be inferred from these plots;
- (v) the cohorts represented in these plots need to be interpreted from the survey data, which surveys the whole population.

2. Stocks and areas

5. 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 indicate that stocks on the Heard Plateau and Shell Bank have different size structure and recruitment patterns. The Working Group agreed that in light of this the two areas should be treated as separate stocks for assessment purposes (WG-FSA-97 – 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 for the 2006/07 season.

3. Parameter estimation

3.1 Estimation methods

Standing stock

6. The results of a bottom trawl survey in 2006 were summarised in WG-FSA-06/42 Rev. 1 and 06/43 Rev. 1. This had been undertaken according to the same design as in previous surveys for this region. Estimates of standing stock biomass for the Heard Island Plateau were made using the bootstrap procedure.

Population structure

7. The distribution of densities-at-age was derived using the CMIX program and bounding the mean length for ages 1, 2, 4 and 5 (Table 2). The Working Group noted that the 2006 Australian bottom trawl survey had sampled a large cohort corresponding to age 4+ fish. It is evident that the very strong year class, present in the 2002 survey as juvenile *C. gunnari*, in the 2003 survey as 1+ fish, in the 2004 survey as 2+ fish and in the 2005 survey as 3+ fish, remains dominating the population structure in 2006 (Figure 2). This is consistent with the prediction from the 2003, 2004 and 2005 assessments. Details of the fit are presented in Table 3.

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

Parameter	Value
Size range included	150–400 mm
Bounds	Age 1: 102–176 mm Age 2: 200–262 mm Age 4: 318–355 mm Age 5: 359–383 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 (0.07, 0.01)
No. function calls	1 000
Reporting frequency	100
Stopping criteria	1E-10
Frequency for convergence testing	5
Simplex expansion coefficient	1

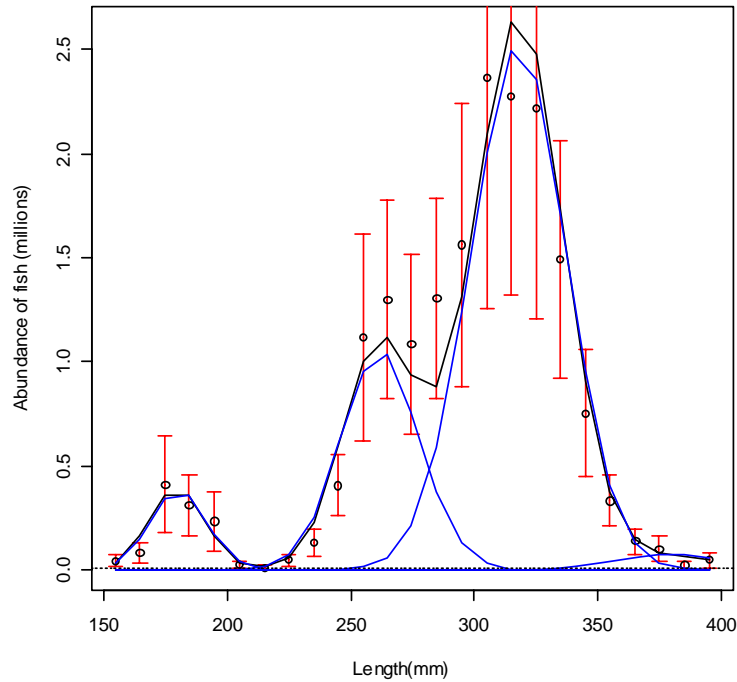


Figure 2: Size distribution of *Champsocephalus gunnari* from the 2006 bottom trawl survey in Division 58.5.2 with standard errors. Cohorts were present in ages 1, 2, 4 and 5. The plot is dominated by age-4+ fish.

Table 3: Results generated from CMIX analyses for *Champsocephalus gunnari* in Division 58.5.2.

	Component 1 (age 1+)	Component 2 (age 2+)	Component 3 (age 4+)	Component 4 (age 5+)
Mean length (mm)	180	262	318	381
SD (mm)	10.7	15.0	18.0	21.3
Total density (numbers km ⁻²)	50.4	195.6	565.3	15.1
SD of component density	23.1	61.5	154.4	17.0
Sum of observed densities =	823.4			
Sum of expected densities =	823.6			
Intercept =	1.09			
Slope =	0.051			

8. The Working Group noted that the observed distribution was consistent with previous analyses of cohort structure that indicated the population is dominated by a single year class at present. As yet, there is no sign of another strong year class in the area.

Other parameters

9. There were no changes to other parameter values.

3.2 Parameter values

Fixed parameters

10. The fixed parameters remain unchanged from previous assessments (Table 4).

Table 4: Fixed parameters used in the 2006 assessment of *Champscephalus gunnari* in Division 58.5.2.

Component	Parameter	Value	Units
Natural mortality	M	0.4	y^{-1}
VBGF	K	0.323	y^{-1}
VBGF	t_0	0.275	y
VBGF	L_∞	457	mm
Length-to-mass	' a '	2.629E-10	kg/mm
Length-to-mass	' b '	3.515	

Standing stock

11. Similar to last year, an estimate of standing stock biomass was calculated using the bootstrap procedure. The area of seabed sampled, and an estimate of the one-sided lower 95% CI of biomass was calculated (Table 5).

Table 5: Seabed areas within three geographic strata used to bootstrap estimates of biomass.

Nominal date of survey – 19 May 2006				
Survey strata	Locality	Seabed area (km ²)	Biomass (tonnes) (SE)	One-sided lower 95% CI (tonnes)
1	Gunnari Ridge	520.7	1 537 (689)	525
2	Plateau southeast	10 620	672 (221)	349
3	Plateau west	10 440	188 (96)	53.9
Totals	Plateau and Gunnari Ridge	21 581	2 396 (748)	1300*

* This value is not the sum of the individual stratum values because it is the one-sided lower 95% confidence bound of all data pooled across strata. Some strata are more variable than others and, as a result, the bounds in these strata may end up being much lower relative to the mean. Note that the mean estimates of biomass for each strata add up to the total.

Removals

12. No *C. gunnari* were caught following the survey (5 May to 3 June 2006).

Initial age structure

13. The proportion of density-at-age was derived from the CMIX program for ages 1+ to 5+. Mean length-at-age was estimated using bounds derived from the VBGF parameters (Table 6). Standard deviation of length-at-age was also estimated.

Selectivity

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

Recruitment

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

Proportion of biomass-at-age

16. An estimate of the proportion of biomass-at-age was calculated and presented in Table 6. This demonstrates that the age-4+ cohort contributes to both the highest number and biomass of animals within the population.

Table 6: Calculation of the proportion of biomass-at-age derived for the truncated length-density distribution.

Age	Density (%)	Mean length (mm)	Weight (kg)	Density (number/km ²)	Prop. biomass
1	6	180	0.02	50.4	0.01
2	24	262	0.08	195.6	0.14
4	68	318	0.16	565.3	0.81
5	2	381	0.31	15.1	0.04

4. Stock assessment**4.1 Model structure and assumptions**

17. 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.

Model configuration

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

Category	Parameter	Value
Recruitment age	Start	2.5 years
	Fully selected	3 years
Plus class accumulation		10 years
Oldest age in initial structure		10 years
Maturity	L_{m50}	0 mm***
	Range: 0 to full maturity	0 mm
Spawning season	Set so that the status of the stock is determined at the start of each year.	30 Nov–30 Nov
Simulation specification	Number of runs	1
Individual trial specifications	Years to remove initial age structure*	1
	Year prior to projection**	2005
	Reference start date	01/12
	Years to project stock in simulation	2
	Reasonable upper bound for annual F	5.0
	Tolerance for finding F in each year	0.000001

* Set to 1 since no catches were made after the survey, else set to 0.

** GYM requires first year of 2005/06 split-year.

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

Decision rules

18. 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.

19. To achieve this, the one-sided lower 95% confidence bound of the biomass estimate is used as the starting point for the projection.

4.2 Model results

20. A single deterministic short-term projection of yield in 2005/06 (year 1) was calculated for the Heard Plateau and Gunnari Ridge. Yield estimates derived from the short-term projections of all cohorts of fish for the 2005/06 season are:

	All cohorts
Actual yield in year 1 (2006/07)	172 tonnes
Estimated yield in year 2 (2007/08)	132 tonnes

21. The Working Group noted that the 4+ cohort had been reproductively mature for two years and it was likely that the cohort would disappear this year (SC-CAMLR-XX, Annex 5, Appendix D, Figure 1). The Working Group agreed that yield estimates should be based on only those year classes likely to be available to the fishery (<4+ in 2005/06). The yield estimate for 2006/07 using this scenario is:

	Fish <4+ only
Actual yield in year 1 (2006/07)	42 tonnes
Yield in year 2 (2007/08)	44 tonnes

4.3 Sensitivity analyses

22. No specific sensitivity analyses were undertaken at the meeting.

4.4 Discussion of model results

23. The projection of fish of all age classes from 2005/06 gives a projected yield of 172 tonnes in the 2006/07 season and 132 tonnes in the 2007/08 season. If only the year classes likely to be available to fishing in the projection period are used, then the estimated yield is 42 tonnes in the coming season, and 44 tonnes in the 2007/08 season. Yield in the second year is slightly increased due to the recruitment to the fishery in 2007/08 of the small 1+ age class evident in the 2006 survey.

24. In considering these different options, the Working Group noted that:

- (i) the catch limit for 2005/06 was set in 2005 with the expectation that the dominant 4+ cohort would be unavailable to the fishery in 2006/07;
- (ii) the absence of any indication of a strong 1+ or 2+ year class in the 2006 survey, indicates that yields are likely to be low in future until a cohort as large as the 1+ cohort detected in the 2003 survey becomes evident.

4.5 Future research requirements

25. The Working Group agreed that further work on developing a management procedure for *C. gunnari* is a high priority (SC-CAMLR-XX, Annex 5, Appendix D). It also recommended that biological parameters and cohort progression be reviewed based on survey and catch data.

5. By-catch of fish and invertebrates

5.1 By-catch removals

26. 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. The reported by-catch was *Channichthys rhinoceratus* (17.04 tonnes), grenadiers (0.04 tonnes), *Lepidonotothen squamifrons* (0.02 tonnes) and rajids (<0.01 tonnes). The reported by-catch in the trawl fishery from observer data during the 2005/06 season for *C. gunnari* was low at 6% of the total catch (WG-FSA-06/37 Rev. 1).

Table 8: Total reported by-catch (tonnes) for four species between 1995/96 and 2005/06 in the *Champsocephalus gunnari* trawl fishery to 5 October 2006. LIC – *Channichthys rhinoceratus*; NOS – *Lepidonotothen squamifrons*; GRV – *Macrourus* spp.; SRX – rajids.

Fishing season	LIC	Limit	NOS	Limit	GRV	Limit	SRX	Limit	Other	Limit
1995/96	0		0		0		0		0	5%*
1996/97	2		0		0		1		2	50**
1997/98	2	80	3	325	0		0	120	2	50
1998/99	1	150	0	80	0		0		0	50
1999/00	2	150	0	80	0		0		1	50
2000/01	1	150	0	80	0	50	0	50	0	50
2001/02	3	150	0	80	0	50	1	50	0	50
2002/03	21	150	0	80	0	465	20	120	4	50
2003/04	6	150	0	80	1	360	3	120	1	50
2004/05	34	150	0	80	0	360	5	120	2	50
2005/06	17	150	0	80	0	360	0	120	0	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

27. Insufficient information was available to update assessments.

28. No stock assessments of individual by-catch species were undertaken in 2006. By-catch limits of *C. rhinoceratus* and *L. 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 5.245 to 5.249).

5.3 Mitigation measures

29. Conservation Measure 33-02 currently applies to this fishery. Move-on rules are included in the annual conservation measure established for this fishery (e.g. Conservation Measure 42-02).

6. By-catch of birds and mammals

30. No seabirds were killed in the trawl fishery in Division 58.5.2 in 2005/06. In 2004/05, eight seabirds were observed killed (5 black-browed albatrosses and 3 white-chinned petrels). Five other bird mortalities (2 black-browed albatrosses and 3 white-chinned petrels) were reported by the vessel crew to the observer (SC-CAMLR-XXIV, Annex 5, Appendix O, paragraphs 202 and 203). Seabirds were released alive in 2002 (1), 2003 (11) and 2004 (13). No incidents of marine mammal by-catch occurred while fishing for *C. gunnari* in 2005/06. The provisions of Conservation Measure 25-03 apply to this fishery.

7. Ecosystem implications/effects

31. Bottom 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).

8. Harvest controls for the 2005/06 season and advice for 2006/07

8.1 Conservation measures

Table 9: Summary of provisions of Conservation Measure 42-02 for *Champsoccephalus gunnari* in Division 58.5.2 and advice to the Scientific Committee for the 2006/07 season.

Paragraph and topic	Summary of CM 42-02 for 2005/06	Advice for 2006/07	Paragraph reference
1. Access (gear)	Trawling only		
2. Access (area)	Definition of area open for fishing		
3.	Chart illustrating area open (Annex 42-02/A)		
4. Catch limit	1 210 tonnes	Revise to 172 tonnes or 42 tonnes pending discussion	21, 22
5. Move-on rule	Move on if >100 kg caught of which >10% by number are less than minimum size (24 cm).		
6. Season	1 December 2005 to 30 November 2006	Update	
7. By-catch	By-catch rates as in CM 33-02 to apply.		
8. Mitigation	In accordance with CM 25-03.		
9. Observers	Each vessel to carry at least one scientific observer and may include one additional CCAMLR scientific observer.		
10. Data: catch and effort	(i) Ten-day reporting system as in Annex 42-02/B (ii) Monthly fine-scale reporting system as in Annex 42-02/B on haul-by-haul basis.		
11. Target species	<i>Champsoccephalus gunnari</i> By-catch is any species other than <i>C. gunnari</i> .		
12. Data: biological	Fine-scale reporting system as in Annex 42-02/B. Reported in accordance with the Scheme of International Scientific Observation.		

8.2 Management advice

32. The Working Group recommended that the yield in 2006/07 be no more than 42 tonnes.

33. The Working Group recommended that the Scientific Committee consider the following in providing advice to the Commission on Conservation Measure 42-02:

- (i) Prior patterns in population dynamics of *C. gunnari* in Division 58.5.2 are such that the dominant 4+ age class is unlikely to be available to the fishery in 2006/07. Therefore the Working Group supported a scenario where projected yields were estimated only for classes <4+. As these year classes are low in abundance, the estimated yield is low, at 42 tonnes in the coming season, and 44 tonnes in the 2007/08 season. Yield in the second year is slightly increased

due to the recruitment to the fishery in 2007/08 of the small 1+ age class evident in the 2006 survey. In considering this scenario, the Working Group noted that a low yield estimate was not unexpected, as:

- (a) the catch limit for 2005/06 was set in 2005 with the expectation that the dominant 4+ cohort would be unavailable to the fishery in 2006/07;
 - (b) the absence of any indication of a strong 1+ or 2+ year class in the 2006 survey, indicates that yields are likely to be low in future until a cohort as large as the 1+ cohort detected in the 2003 survey becomes evident;
- (ii) A catch limit as low as 42 tonnes may be difficult to target commercially without over-catch. There is also a small risk that the trawl fishery for *D. eleginoides* in Division 58.5.2 might take *C. gunnari* as a by-catch. However, the Working Group noted that the by-catch of *C. gunnari* in the trawl fishery targeting *D. eleginoides* in Division 58.5.2 has never been large (<0.1 tonnes in 2005/06; WG-FSA-06/37 Rev. 1, Table 5).

34. The Working Group recommended that other measures in the conservation measure be retained.

35. The Working Group recommended that further work on developing a management procedure for *C. gunnari* is a high priority (SC-CAMLR-XXIV, Annex 5, Appendix M, paragraph 26).