

**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 *Champsoccephalus gunnari* in Division 58.5.2 has caught 1 791 tonnes from a catch limit of 1 864 tonnes in the 2004/05 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 *Champsoccephalus gunnari* in Division 58.5.2 (source: STATLANT data available from 1972 to 2004; 2005 from catch and effort reports).

Fishing season	Reported catch (tonnes)	Catch limit (tonnes)	Number vessels
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		*
1993/94	0		*
1994/95	0	311	*
1995/96	0	311	*
1996/97	227	311	1
1997/98	115	900	3
1998/99	2	1 160	1
1999/00	137	916	2
2000/01	1 136	1 150	2
2001/02	865	885	2
2002/03	2 345	2 980	2
2003/04	78	292	2
2004/05	1 791	1 864	2

* No information

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 2004/05 are presented in Figure 1.

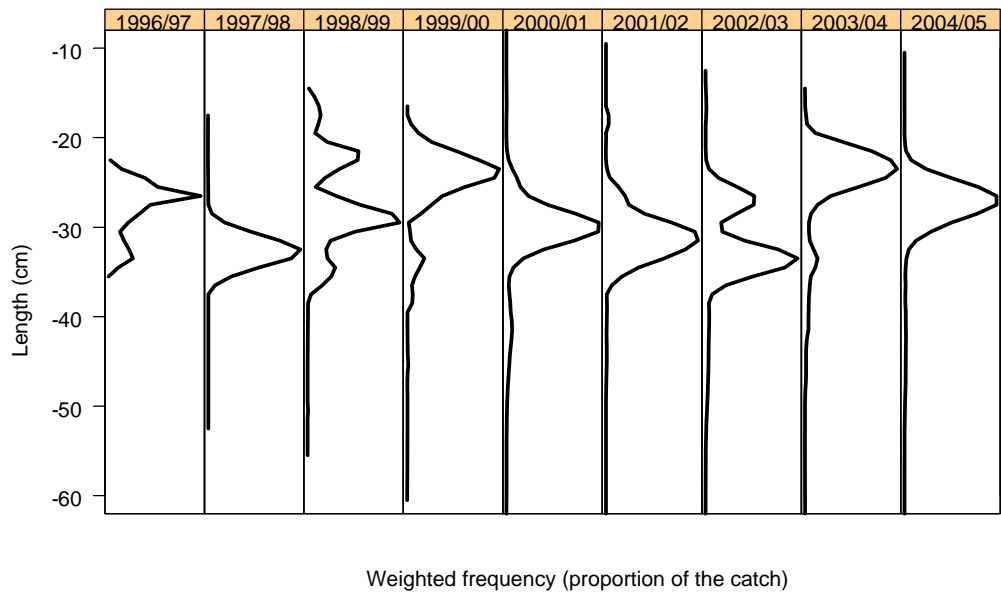


Figure 1: Catch-weighted length frequencies for *Champsocephalus gunnari* in Division 58.5.2 derived from observer, fine-scale and STATLANT data reported by 5 October 2005.

4. The Working Group observed the apparent progression in the cohorts in Figure 1 from 1999/2000 to 2002/03 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.

5. Dr R. O'Driscoll (New Zealand) noted that it would be useful to review the historical progression of the cohorts in the fishery and from the trawl surveys to clarify whether the conclusions of WAMI in 2001 and more recent analyses reviewed by the Working Group that *C. gunnari* has a low likelihood of reaching age 5, remain valid.

2. Stocks and areas

6. 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). *Champscephalus 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 2005/06 season.

3. Parameter estimation

3.1 Estimation methods

Standing stock

7. The results of a bottom trawl survey in 2005 were briefly summarised in WG-FSA-05/39. 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

8. The distribution of densities-at-age was derived using the CMIX program and fixing the mean length for ages 1, 3 and 5 (Table 2). The Working Group noted that the 2005 Australian bottom trawl survey had sampled a large cohort corresponding to age 3+ 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 and in the 2004 survey as 2+ fish, remains dominating the population structure in 2005 (Figure 2). This is consistent with the prediction from the 2003 and 2004 assessments. Details of the fit are presented in Table 3.

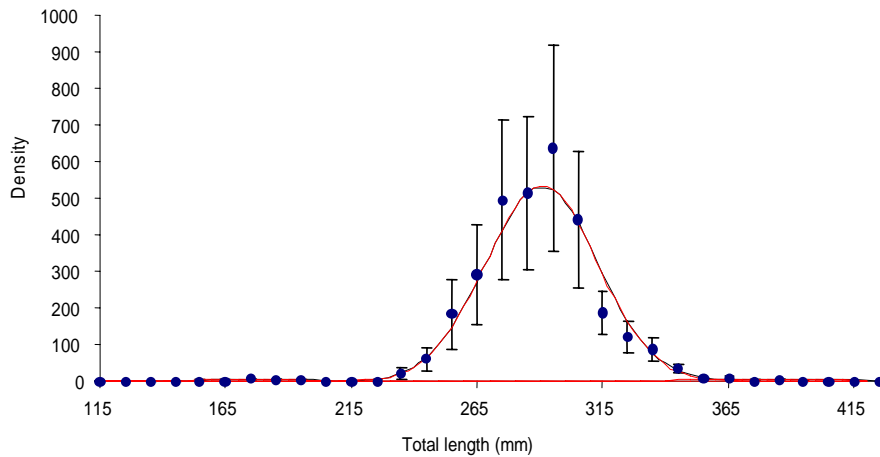


Figure 2: Size distribution of *Champsocephalus gunnari* from the 2005 bottom trawl survey in Division 58.5.2 with standard errors. Cohorts were present in ages 1, 3 and 5. The plot is dominated by age-3+ fish.

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

Parameter	Value
Size range included	150–420 mm
Means (no VBGF) (at time of survey)	Age 1: 176 mm (fitted) Age 3: 290 mm (fitted) Age 5: 380 mm (fitted)
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-6
Frequency for convergence testing	5
Simplex expansion coefficient	1

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

	Comp. 1 (age 1+)	Comp. 2 (age 3+)	Comp. 3 (age 5+)
Mean length (mm)	176	290	380
SD (mm)	13.7	22.1	28.5
Total density (numbers km ⁻²)	18	2975	31
SD of component density	6	637	24
Sum of observed densities =	3131		
Sum of expected densities =	3023		
Intercept =	1.00		
Slope =	0.0724		

9. 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

10. There were no changes to other parameter values.

3.2 Parameter values

Fixed parameters

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

Table 4: Fixed parameters used in the 2005 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

12. 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 – 14 June 2005				
Survey strata	Locality and depth range	Seabed area (km ²)	Biomass (tonnes) (SE)	One-sided lower 95% CI (tonnes)
1	Gunnari Ridge	520.7	5 571 (2 164)	2 444
2	Plateau southeast	10 620	2 674 (1 775)	684
3	Plateau west	10 440	517 (203)	221
Totals	Plateau and Gunnari Ridge	21 581	8 762 (2 878)	4 487*

* 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

13. No *C. gunnari* were caught following the survey (1 to 23 June 2005).

Initial age structure

14. 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

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

Recruitment

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

Proportion of biomass-at-age

17. An estimate of the proportion of biomass-at-age was calculated and presented in Table 6. This demonstrates that the age-3+ 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	0.006	195	0.021	18	0.001
3	0.984	268	0.119	2975	0.973
5	0.010	358	0.307	31	0.026

4. Stock assessment

4.1 Model structure and assumptions

18. 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**	2004
	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 2004/05 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

19. 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.

20. 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

21. A single deterministic short-term projection of yield in 2004/05 (year 1) was calculated for the Heard Plateau and Gunnari Ridge. Yield estimates derived from the short-term projections of age-3+ fish for the 2004/05 season are:

	Age-3+ fish
Actual yield in year 1 (2005/06)	647 tonnes
Estimated yield in year 2 (2006/07)	519 tonnes

22. The Working Group noted that the cohort had been reproductively mature for one year and that following another year it was likely that the cohort would disappear (SC-CAMLR-XX, Annex 5, Appendix D, Figure 1). The Working Group agreed that the current strategy of spreading catch over two years while meeting the escapement rule was to provide for two years of spawning (SC-CAMLR-XVI, Annex 5). It was agreed that one strategy for fishing on the 4+ year class would be to allow the catch to be taken in one year with no catch in the following year on that cohort. Such a catch would be estimated based on all fishing in one year and no catch in the second year while satisfying the decision rule over two years. The yield estimate for 2005/06 using this scenario is:

	Age-3+ fish
Actual yield in year 1 (2005/06)	1210 tonnes
Yield in year 2 (2006/07)	0 tonnes

4.3 Sensitivity analyses

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

4.4 Discussion of model results

24. The projection of age-3+ fish from 2004/05 gives a projected yield of 647 tonnes in the 2005/06 season in the scenario of spreading the catch over two years. If all catch is taken

in the first year, and zero catch on this cohort in the second year, then the yield could be 1 210 tonnes in the coming season. The Working Group agreed that either of these approaches would satisfy the objectives of the Commission.

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

- (i) the cohort has been reproductive for one year and will have 75% escapement over the next two years, having the opportunity to reproduce again;
- (ii) although it seems unlikely because of the absence of any indication of a strong 1+ year class in the 2005 survey, should a survey in 2006 show a 2+ cohort entering the fishable population, then it may be difficult to have a fishery in the 2006/07 season that results in a negligible catch of the current cohort, which would be 4+ during that survey;
- (iii) the strategy to date has been to spread risk over two years in order to provide greater opportunities for spawning by a cohort and, as such, it is not apparent what the consequence of changing that strategy might be in this case, given that it will be an older cohort, the natural mortality rate is variable between years and tends to increase substantially after age 4.

4.5 Future research requirements

26. 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

27. 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* (36 tonnes), grenadiers (2 tonnes) and rajids (3 tonnes). The reported by-catch in the trawl fishery from observer data during the 2004/05 season for *C. gunnari* was low at 2% of the total catch (WG-FSA-05/68).

Table 8: Total reported by-catch (tonnes) for four species between 1995/96 and 2003/04. 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	5	80	4	325	0		0	120	2	50
1998/99	4	150	0	80	0		0		0	50
1999/00	4	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	22	150	0	80	0	465	20	120	1	50
2003/04	6	150	0	80	1	360	3	120	1	50
2004/05	36	150	0	80	2	360	3	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

28. Updated length–weight relationships, length-at-maturity data and estimates of abundance from survey data for rajids were presented in WG-FSA-05/70. Insufficient information was available to update assessments.

29. No stock assessments of individual by-catch species were undertaken in 2005. By-catch limits of *C. 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 5.245 to 5.249).

5.3 Mitigation measures

30. 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

31. In the trawl fishery in Division 58.5.2, 11 seabirds were killed in 2004/05 (7 black-browed albatross and 4 white-chinned petrels). Seabirds were released alive in 2002 (1), 2003 (11) and 2004 (13) (Table O17). The provisions of Conservation Measure 25-03 apply to this fishery.

7. Ecosystem implications/effects

32. Bottom trawl gear is used to target both *C. gunnari* and *D. 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 2004/05 season and advice for 2005/06

8.1 Conservation measures

Table 9: Summary of provisions of Conservation Measure 42-02 for *Champscephalus gunnari* in Division 58.5.2 and advice to the Scientific Committee for the 2005/06 season.

Paragraph and topic	Summary of CM 42-02 for 2004/05	Advice for 2005/06	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	1 864 tonnes	Revise to 647 or 1 240 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 2004 to 30 November 2005	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>Champscephalus 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.		