

**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 tonne from a catch limit of 42 tonnes in 2006/07 (Conservation Measure 42-02). 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)
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	660
2006/07	1	42	1

1.2 IUU catch

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

1.3 Size distribution of the catches

3. Catch-weighted length frequencies for *C. gunnari* from 1996/97 to 2005/06 are presented in Figure 1. Data from 2006/07 have not been included.

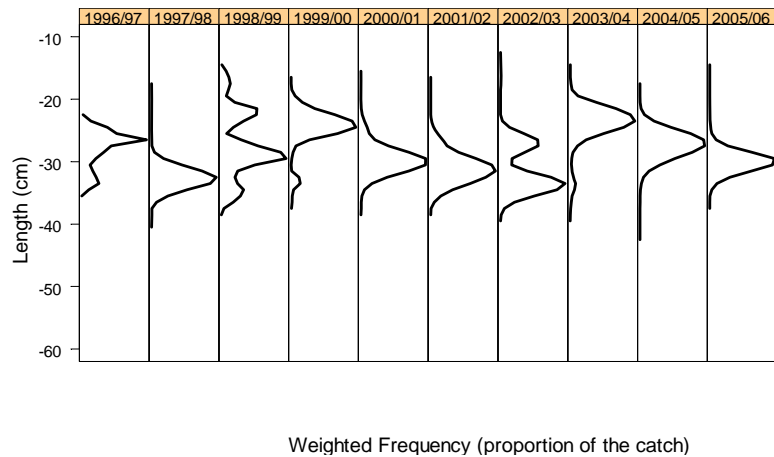


Figure 1: Catch-weighted length frequencies for *Champsocephalus gunnari* in Division 58.5.2 (source: observer, fine-scale and STATLANT data). The plots include data from both the commercial fishery and research trawl surveys.

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 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). *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 2006/07 season.

3. Parameter estimation

3.1 Estimation methods

Standing stock

6. The results of a bottom trawl survey in 2007 were summarised in WG-FSA-07/46 and 07/47. 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 using the routine outlined in Appendix 1 of WG-FSA-07/46.

Population structure

7. The distribution of densities-at-age was derived using the CMIX program and bounding the mean length for ages 1, 2, 3 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 *Champscephalus gunnari* length density in Division 58.5.2.

Parameter	Value
Size range included	130–410 mm
Bounds	Age 1: 185–195 mm Age 2: 220–278 mm Age 3: 285–327 mm Age 5: 367–389 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-5
Frequency for convergence testing	5
Simplex expansion coefficient	1

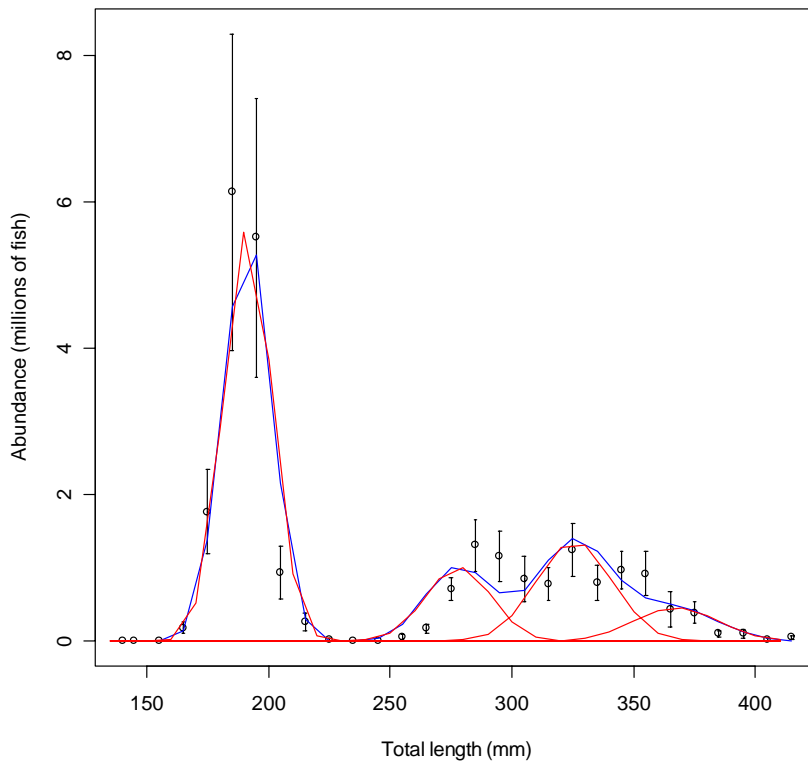


Figure 2: Size distribution of *Champsocephalus gunnari* from the 2007 random stratified trawl survey in Division 58.5.2 with standard errors. Cohorts were present in ages 1, 2, 3 and 5. The plot is dominated by age-1+ fish.

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 3+)	Component 4 (age 5+)
Mean length (mm)	191	278	326	367
SD (mm)	9.3	13.1	15.2	17
Total density (numbers km ⁻²)	643.5	159.9	246.9	93.1
SD of component density	165.8	40.1	67.3	36.5
Sum of observed densities = 1157.5				
Sum of expected densities = 1143.3				
Intercept = 1.00				
Slope = 0.044				

8. The Working Group noted that a strong 1+ year class is apparent in the catches from the trawl survey.

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 2007 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 = 15 July 2007.

Stratum	Estimate	SE	LowerCI	UpperCI	One-sided lower 95% CI
Gunnari Ridge	481.0	188.4	176.2	885.2	209.0
Plateau SE	981.4	229.3	563.9	1457.0	620.5
Plateau W	658.7	183.6	336.7	1013.3	380.1
Pooled	2121.1	356.9	1476.7	2839.6	1576.4

Removals

12. No *C. gunnari* were caught following the survey (2 to 21 July 2007).

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, except in the case of the 1+ cohort, where bounds were set around this obvious mode (Table 6). Standard deviation of length-at-age was also estimated.

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

Age class	Mean length (mm)	Density ($n \text{ km}^{-2}$)	Mean weight (kg)	Proportion of biomass (%)
1+	191	644	0.03	17.1
2+	278	160	0.10	15.8
3+	325	247	0.18	42.6
4+	-	-	-	-
5+	367	93	0.27	24.5

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-3+ cohort contributes the highest biomass of animals within the population, while the 1+ cohort is the most abundant numerically.

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**	2006
	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 2006/07 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 2007/08 (year 1) was calculated for the Heard Plateau and Gunnari Ridge. Similar to last year, yield estimates were based on only those year classes likely to be available to the fishery (<4+ in 2006/07). Yield estimates derived from the short-term projections for the 2007/08 season are:

Actual yield in year 1 (2007/08)	220 tonnes
Estimated yield in year 2 (2008/09)	340 tonnes

4.3 Sensitivity analyses

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

4.4 Discussion of model results

22. The projection of fish of all age classes from 2007/08 gives a projected yield of 220 tonnes in the 2006/07 season and 340 tonnes in the 2008/09 season. Yield in the second year is increased due to growth of the 2+ and 3+ cohorts, and the recruitment to the fishery in 2008/09 of the large 1+ age class evident in the 2007 survey. Yield estimates are likely to alter following the survey planned in 2008, as the current 1+ year class is more fully recruited to the sampling gear.

4.5 Future research requirements

23. 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

24. 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. Due to the very low catch (1 tonne) of *C. gunnari* taken in 2006/07, by-catch was low, with 3 tonnes of *Channichthys rhinoceratus* reported.

Table 8: Total reported by-catch (tonnes) for four species between 1995/96 and 2006/07 in the *Champtocephalus gunnari* trawl fishery. 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
2006/07	3	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

25. Insufficient information was available to update assessments.
26. No stock assessments of individual by-catch species were undertaken in 2007. 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

27. 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

28. In 2006/07, no seabirds were killed in the fishery targeting *C. gunnari*. In 2005/06, no seabirds were observed killed and in 2004/05 eight seabirds were observed killed (5 black-browed albatrosses and 3 white-chinned petrels). Five other seabird 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 and 2006/07. The provisions of Conservation Measure 25-03 apply to this fishery.

7. Ecosystem implications/effects

29. 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).
30. 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/6, paragraph 21).

8. Harvest controls and management advice

8.1 Conservation measures

31. The limits on the fishery for *C. gunnari* in Division 58.5.2 are defined in Conservation Measure 42-02. The limits in force in 2006/07 and the Working Group's advice to the Scientific Committee for the forthcoming 2007/08 season are summarised in Table 9.

Table 9: Limits on the fishery for *Champscephalus gunnari* in Division 58.5.2 in 2006/07 (Conservation Measure 42-02) and advice to the Scientific Committee for 2007/08.

Element	Limit in 2006/07	Advice for 2007/08
Access (gear)	Trawling only	Carry forward
Access (area)	Definition of area open for fishing	Carry forward
	Chart illustrating area open (Annex 42-02/A)	Carry forward
Catch limit	42 tonnes	Review
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	Carry forward
	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.	
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

32. The Working Group recommended that the catch limit for *C. gunnari* in 2007/08 be no more than 220 tonnes.

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

34. 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).