

**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 78 tonnes in 2010/11 to October 2011 (CM 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
2007/08	1	220	199
2008/09	1	102	83
2009/10	1	1 658	352
2010/11	1	78	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 2009/10 are presented in Figure 1. Data from 2006/07 and 2010/11 have not been included because the total catch for that season was 1 tonne.

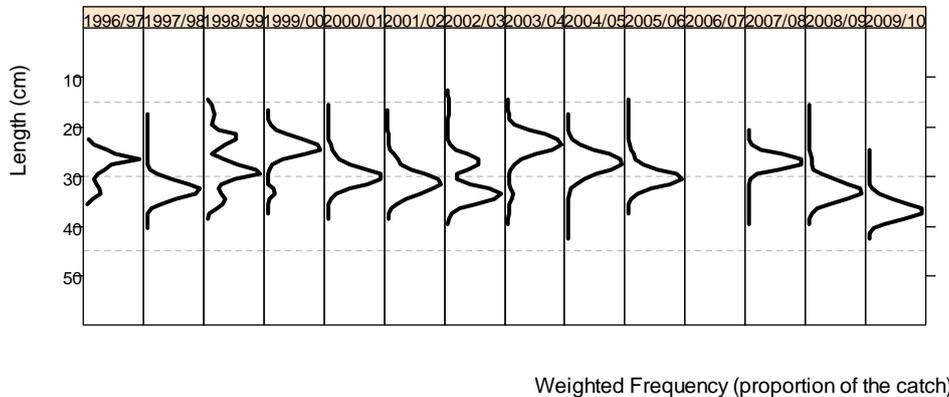


Figure 1: Catch-weighted length frequencies for *Champsocephalus gunnari* in Division 58.5.2 (source: observer, fine-scale and STATLANT data). The plots include data from both the commercial fishery and research trawl surveys.

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, and 2007/08 to 2009/10 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 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). *Champocephalus 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 2007/08 season.

### 3. Parameter estimation

#### 3.1 Estimation methods

##### Standing stock

6. The results of three bottom trawl surveys undertaken between April 2010 and May 2011 were summarised in WG FSA-11/24. The surveys had been undertaken according to the same design as in previous surveys for this region. 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 location of sample stations in relation to Heard Island and McDonald Islands is shown in Figure 2.

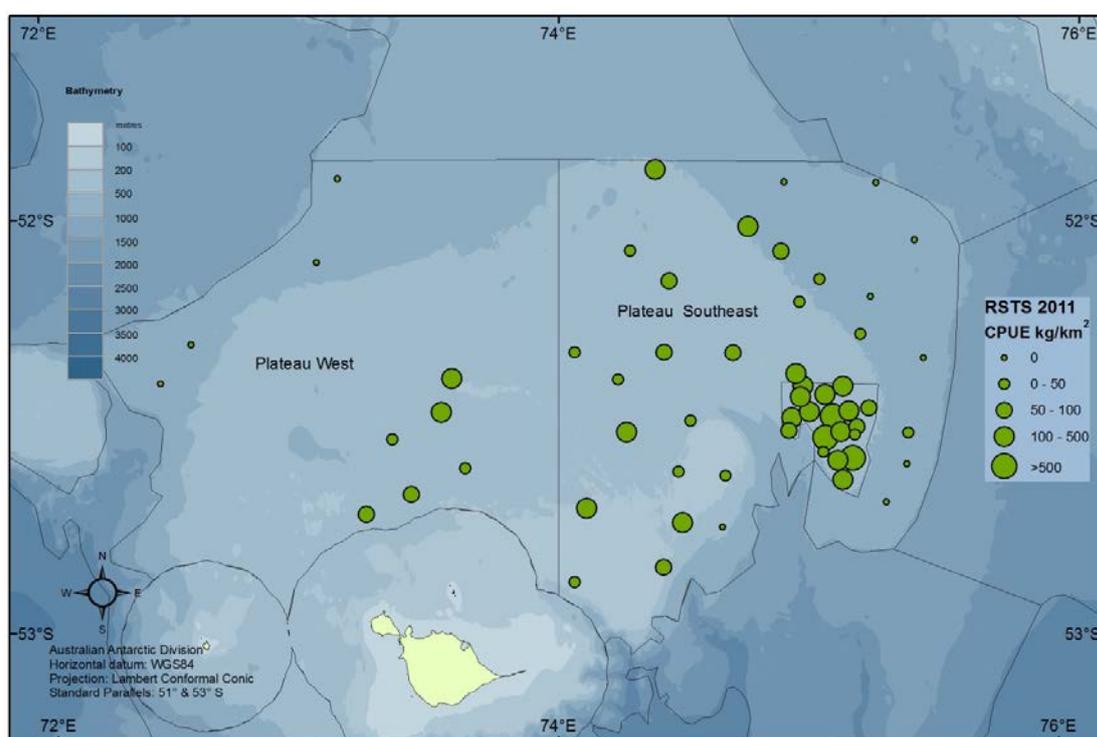


Figure 2: Strata and sampling hauls from the 2011 random stratified trawl survey in Division 58.5.2 used in the 2011 *Champocephalus gunnari* assessment. Points are locations of hauls, with 10 stations in Plateau West, 18 stations in Gunnari Ridge and 30 stations in Plateau Southeast.

Population structure

7. 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 Working Group noted that the 2008 to 2011 Australian bottom trawl surveys had sampled a large cohort, which dominated the population structure in 2010 as the 4+ year class, but appears to have declined rapidly over the past year (Figure 3). A new 1+ and 2+ cohort was also detected. 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	140–460 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

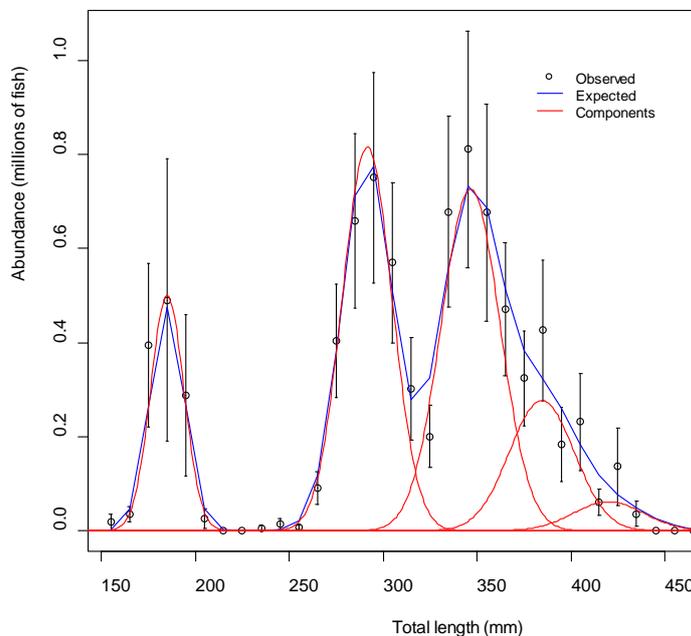


Figure 3: Size distribution of *Champscephalus gunnari* from the 2011 random stratified trawl survey in Division 58.5.2 with standard errors. Cohorts were present in ages 1+– 5+. Unusually for this stock, 4 or 5 consecutive year classes are present in the population simultaneously.

Table 3: Results generated from CMIX analyses for *Champscephalus gunnari* from the 2011 RSTS 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	291	347	384	420
SD (mm)	8.8	13.3	15.6	17.2	18.7
Total density (numbers km <sup>-2</sup> )	51.2	126.0	131.9	55.4	13.4
SD of component density	23.1	26.6	37.2	25.7	15.0
Sum of observed densities = 384.3					
Sum of expected densities = 377.8					
Intercept = 1.000					
Slope = 0.0422					

### Other parameters

8. There were no changes to other parameter values.

## 3.2 Parameter values

### Fixed parameters

9. 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 2011/12 season. The other fixed parameters remain unchanged from previous assessments (Table 4).

Table 4: Fixed parameters used in the 2010 assessment of *Champscephalus gunnari* in Division 58.5.2.

Component	Parameter	Value	Units
Natural mortality	$M$	0.4	y <sup>-1</sup>
VBGF	$K$	0.379	y <sup>-1</sup>
VBGF	$t_0$	0.057	y
VBGF	$L_\infty$	438	mm
Length-to-mass	' $a$ '	2.629E-10	kg/mm
Length-to-mass	' $b$ '	3.515	

### Standing stock

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

Table 5: Seabed areas within three geographic strata used to bootstrap estimates of biomass. Nominal date of survey = 20 April 2011.

Stratum	Estimate	SE	Lower CI	Upper CI	One-sided lower 95% CI
Gunnari Ridge	169.3	44.7	93.8	263.1	103.3
Plateau SE	659.1	146.0	396.7	955.8	433.6
Plateau W	595.6	228.2	206.9	1045.4	258.4
Pooled	1424.0	295.8	901.7	2044.1	973.5

### Removals

11. No *C. gunnari* were caught following the survey (14 April to 4 May 2011).

### Initial age structure

12. The proportion of density-at-age was derived from the CMIX program for ages 1+ to 5+ as described above (Table 6).

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+	185.0	51.2	0.024	1.8
2+	291.5	126.0	0.121	22.0
3+	346.6	131.9	0.222	42.2
4+	384.5	55.4	0.320	25.6
5+	420.0	13.4	0.437	8.5

### Selectivity

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

### Recruitment

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

### Proportion of biomass-at-age

15. An estimate of the proportion of biomass-at-age was calculated and presented in Table 6. This shows that no single age class is dominant in the population, with the majority of the biomass made up by the 1+ to 3+ cohorts.

## 4. Stock assessment

### 4.1 Model structure and assumptions

16. 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	Values
Age structure	Plus class accumulation	10 years
	Oldest age in initial structure	11 years
Initial population structure	Age class density	See Table 2
Weight-at-age	Weight-length parameter – $A$ (kg)	$2.6 \times 10^{-10}$ kg
	Weight-length parameter – $B$	3.515
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 $F$	5
	Tolerance to finding $F$	1E-08
	Tolerance for resolving catches	0.01
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: 15 Apr, 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	2010***
	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 2010/11 split-year.

### Decision rules

17. 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.

18. To achieve this, the one-sided lower 95% confidence bound of the biomass estimate for 1+, 2+ and 3+ age classes (66% of total estimated biomass or 482 tonnes) is used as the starting point for the projection, reflect the expectation that the 4+ and 5+ age class will be lost later in 2011.

### **4.2 Model results**

19. A single deterministic short-term projection of yield in 2011/12 (year 1) was calculated for the Heard Plateau and Gunnari Ridge. Yield estimates derived from the short-term projections for the 2010/11 season are:

Target fishing mortality rate (yr <sup>-1</sup> )	Yield (tonnes)	
	2011/12	2012/13
0.144	101	82

### **4.3 Sensitivity analyses**

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

### **4.4 Discussion of model results**

21. The projection of fish of 1+ - 3+ age classes from 2010/11 gives a projected yield of 101 tonnes in the 2011/12 season and 82 tonnes in the 2012/13 season. Yield estimates are likely to alter after 2011/12 following the survey planned in 2012, as small juveniles may begin to be more fully recruited to the survey gear.

### **4.5 Future research requirements**

22. The Working Group recommended considerations 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

23. 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 1995/96 and 2009/10 in the *Champscephalus gunnari* trawl fishery. Limits apply to all fisheries in Division 58.5.2. LIC – *Channichthys rhinoceratus*; NOS – *Lepidonotothen squamifrons*; GRV – *Macrourus* spp.; SRX – rajids. (Source: fine-scale data)

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	5	50
2003/04	6	150	0	80	1	360	3	120	1	50
2004/05	34	150	0	80	0	360	5	120	3	50
2005/06	29	150	0	80	0	360	7	120	2	50
2006/07	3	150	0	80	0	360	0	120	0	50
2007/08	8	150	0	80	0	360	2	120	7	50
2008/09	7	150	1	80	0	360	7	120	8	50
2009/10	52	150	0	80	1	360	12	120	6	50
2010/11	1	150	1	80	0	360	0	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

24. Insufficient information was available to update assessments.

25. No stock assessments of individual by-catch species were undertaken in 2011. By 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

26. 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. By-catch of birds and mammals

27. Seabird by-catch in the fishery targeting *C. gunnari* in Division 58.5.2 remains low with no observed seabird mortality for the 2010/11 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
2002/03	1309		2	2	2
2003/04	1215				
2004/05	1301		5	3	
2005/06	1086				
2006/07	936				2
2007/08	700				
2008/09	39				
2009/10	138	1			
2010/11	329				

28. No incidents of marine mammal by catch have been observed while fishing for *C. gunnari* since 2005/06.

29. In 2011, as in previous years, WG-IMAF assessed the level of risk of incidental mortality of seabirds in Division 58.5.2 as category 4 (average-to-high) (SC-CAMLR-XXX, Annex 8).

### 6.1 Mitigation measures

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

## 7. Ecosystem implications/effects

31. 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).

32. 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

33. The Working Group noted a proposal by Australia to introduce a limit reference point in the *Champscephalus gunnari* fishery in Division 58.5.2. The Working Group recalled that the population on the plateau around Heard Island and McDonald Islands had historically undergone large periodic fluctuations in stock size, and hence the catch limit recommended using the decision rules also fluctuated widely. The Working Group noted that a strict application of the decisions rules could result in a commercial catch limit even at relatively low levels of stock biomass. The Working Group agreed that the limit reference point for such stocks may be recommended in the interim of more formal assessment of the likelihood that the decision rules will achieve CCAMLRs' objectives.

34. The Working Group 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. The Working Group recommended that the conservation measures applying to the fisheries in Division 58.5.2 be modified accordingly.

35. 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, 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.

36. As the assessment for catch in 2011/12 indicates a lower one-sided 95% of biomass less than 1 000 tonnes, it was recommended that the limit reference point be applied, and a 30 tonne research and by-catch limit be applied pending the results of a planned survey in 2012.

37. 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 *Chamsocephalus gunnari* in Division 58.5.2 in force (CM 42-02) and advice to the Scientific Committee for 2011/12.

Element	Limits in force	Advice for 2011/12
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	78 tonnes	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>Chamsocephalus 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

38. The Working Group recommended that the Scientific Committee consider a catch limit for *C. gunnari* in 2011/12 of 0 tonnes, with a 30 tonne research and by-catch limit.