FISHERY REPORT:
DISSOSTICHUS ELEGINOIDES **AND** *DISSOSTICHUS MAWSONI*
SOUTH SANDWICH ISLANDS (SUBAREA 48.4)

CONTENTS

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1. Details of the fishery

The fishery for *Dissostichus eleginoides* in Subarea 48.4 was initiated as a new fishery in 1992/93 following notifications from Chile and the USA (SC-CAMLR-XI, Annex 5, paragraph 6.22), and the adoption of CM 44/XI, which set a precautionary catch limit for *D. eleginoides* of 240 tonnes for that season. Subsequently, the USA withdrew from the fishery and the Chilean longline vessel abandoned fishing after one week of poor catches (SC-CAMLR-XII, Annex 5, paragraph 6.2). In addition, a Bulgarian-flagged longliner fished in November and December 1992 and reported a catch of 39 tonnes of *D. eleginoides* (SC-CAMLR-XII, Annex 5, paragraph 6.1).

2.　　Haul-by-haul data from the Chilean and Bulgarian vessels were submitted to CCAMLR, and WG-FSA used these data to estimate an annual yield of 28 tonnes of *D. eleginoides* for the subarea (SC-CAMLR-XII, Annex 5, paragraph 6.3, Table 1). The Commission adopted a precautionary catch limit for *D. eleginoides* of 28 tonnes per season. In addition, the taking of *D. mawsoni*, other than for scientific research purposes, was prohibited. These limits remained in force until 2004.

3.　　In 2004/05, the UK conducted a pilot tagging program using a fishing vessel. The vessel caught 27 tonnes of *D. eleginoides* and tagged 42 individuals, and the results of this research fishing were reported to WG-FSA (SC-CAMLR-XXIV, Annex 5, paragraphs 5.140 and 5.141).

4.　　Following the pilot study, the Commission agreed to an extensive mark-recapture experiment in Subarea 48.4 during the period from 2005/06 to 2007/08, with fishing conducted in accordance with CM 24-01 (CCAMLR-XXIV, paragraphs 11.46 and 11.47; SC-CAMLR-XXIV, paragraphs 4.113 to 4.117). The experiment resulted in a CASAL assessment of toothfish in the northern part of Subarea 48.4 in 2009.

5.　　In 2008, the Commission agreed to a continuation of the tagging experiment initiated in 2004/05 and to dividing Subarea 48.4 into a northern area (Subarea 48.4 North) and a southern area (Subarea 48.4 South), with a directed longline fishery on *D. eleginoides* in Subarea 48.4 North and *Dissostichus* spp. in Subarea 48.4 South.

6.　　The catch and by-catch limits in 2010/11 were as follows:

Subarea 48.4 North –

(i)　　a catch limit of 40 tonnes for *D. eleginoides*, derived from the CASAL assessment;

(ii)　　the continued prohibition of the taking of *D. mawsoni* other than for scientific research purposes;

(iii) the introduction of catch limits for by-catch species, with a limit for macrourids of 6.5 tonnes (16% of the catch limit for *D. eleginoides*) and a limit for rajids of 2.0 tonnes (5% of the catch limit for *D. eleginoides*).

Subarea 48.4 South –

(i) an experimental precautionary catch limit of 30 tonnes for *Dissostichus* spp. (*D. eleginoides* and *D. mawsoni* combined);

(ii) the introduction of a move-on rule for by-catch species, if the catch of rajids exceeds 5% of the catch of *Dissostichus* spp. in any one haul or set, or if the catch of macrourids reaches 150 kg and exceeds 16% of the catch of *Dissostichus* spp. in any one haul or set.
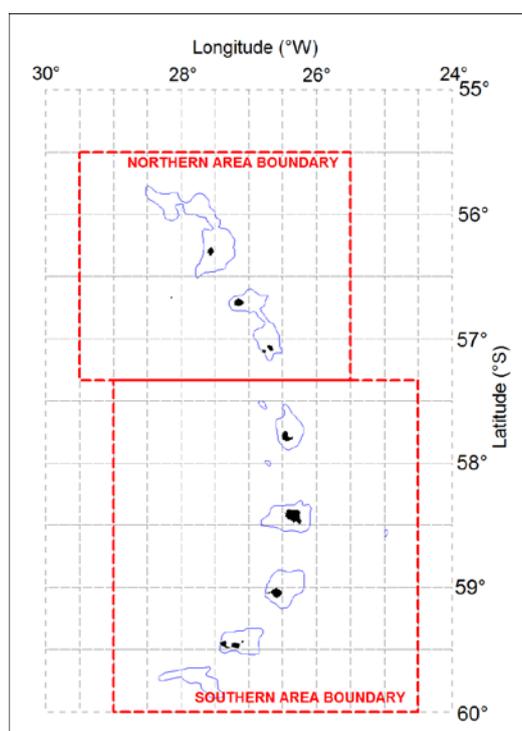
Figure 1: Positions of the boundaries of the northern area (Subarea 48.4 North) and southern area (Subarea 48.4 South) in Subarea 48.4. The 1 000 m depth contour is indicated.

1.1 Reported catch

7. Licensed longline vessels commenced fishing for *D. eleginoides* in Subarea 48.4 in 1991/92 and 1992/93; fishing was abandoned following poor catches. Fishing resumed in Subarea 48.4 North in 2004/05 with the implementation of the mark-recapture experiment which was extended to Subarea 48.4 South in 2008/09. In 2010/11, one New Zealand-flagged vessel and one UK-flagged vessel conducted research fishing and reported a total catch of 54 tonnes of *Dissostichus* spp. from Subarea 48.4 (Table 1a).

8.   The fishing season was from 1 December 2010 to 30 November 2011 and both areas remained opened to fishing during the prescribed season. The reported catch of *Dissostichus* spp. in the Northern Area and Southern Area was 37 tonnes and 17 tonnes respectively.

1.2 Total removals

9.   There is no information to derive an estimate of the level of IUU fishing in Subarea 48.4 (Table 1(a)).

Table 1(a): Catch history for *Dissostichus* spp. in Subarea 48.4 (Subarea 48.4 North and Subarea 48.4 South combined, source: STATLANT data for past seasons, and catch and effort reports for current season, WG-FSA-11/10 and past reports for IUU catch).

Season	Regulated fishery						Estimated IUU catch (tonnes)	Total removals (tonnes)
	Effort (number of vessels)		*Dissostichus* spp.					
			Catch limit (tonnes)*	Reported catch (tonnes)				
	Limit	Reported		*D. eleginoides*	*D. mawsoni*	Total		
1991/92	-	1	-	30	0	30	-	30
1992/93	-	1	240[a]	10	0	10	-	10
1993/94	-	0	28[a]	0	0	0	-	0
1994/95	-	0	28[a]	0	0	0	-	0
1995/96	-	0	28[a]	0	0	0	-	0
1996/97	-	0	28[a]	0	0	0	-	0
1997/98	-	0	28[a]	0	0	0	-	0
1998/99	-	0	28[a]	0	0	0	-	0
1999/00	-	0	28[a]	0	0	0	-	0
2000/01	-	0	28[a]	0	0	0	-	0
2001/02	-	0	28[a]	0	0	0	-	0
2002/03	-	0	28[a]	0	0	0	-	0
2003/04	-	0	28[a]	0	0	0	-	0
2004/05	-	1	100[b]	27	<1	27	-	27
2005/06	-	2	100[b]	18	<1	19	-	19
2006/07	-	2	100[b]	54	<1	54	-	54
2007/08	-	2	100[b]	98	<1	98	-	98
2008/09	-	2	150[c]	74	59	133	-	133
2009/10	-	2	116[d]	57	56	114	-	114
2010/11	-	2	70[e]	39	15	54	-	54

[a]   Applies to *D. eleginoides* in the subarea
[b]   Applies to *D. eleginoides* in Subarea 48.4 North only
[c]   75 tonnes for *D. eleginoides* in Subarea 48.4 North and 75 tonnes for *Dissostichus* spp. in Subarea 48.4 South
[d]   41 tonnes for *D. eleginoides* in Subarea 48.4 North and 75 tonnes for *Dissostichus* spp. in Subarea 48.4 South
[e]   40 tonnes for *D. eleginoides* in Subarea 48.4 North and 30 tonnes for *Dissostichus* spp. in Subarea 48.4 South

Table 1(b):   Catch of *Dissostichus* spp. in Subarea 48.4
               North (N) and Subarea 48.4 South (S) (source:
               fine-scale data pro-rated by total reported catch
               in Table 1(a)). Subarea 48.4 South was closed
               to fishing between 2004/05 and 2007/08.

Season	D. eleginoides		D. mawsoni	
	N	S	N	S
2004/05	27			
2005/06	18		<1	
2006/07	54		<1	
2007/08	98		<1	
2008/09	59	15	<1	59
2009/10	40	17	<1	56
2010/11	36	3	1	14

1.3 Size distribution of catches

10.   Most *D. eleginoides* caught in the fishery ranged from 80 to 140 cm in length, with a
broad mode at approximately 90–130 cm (Figure 2). *Dissostichus mawsoni* caught in
Subarea 48.4 South had a mode at approximately 140–170 cm.
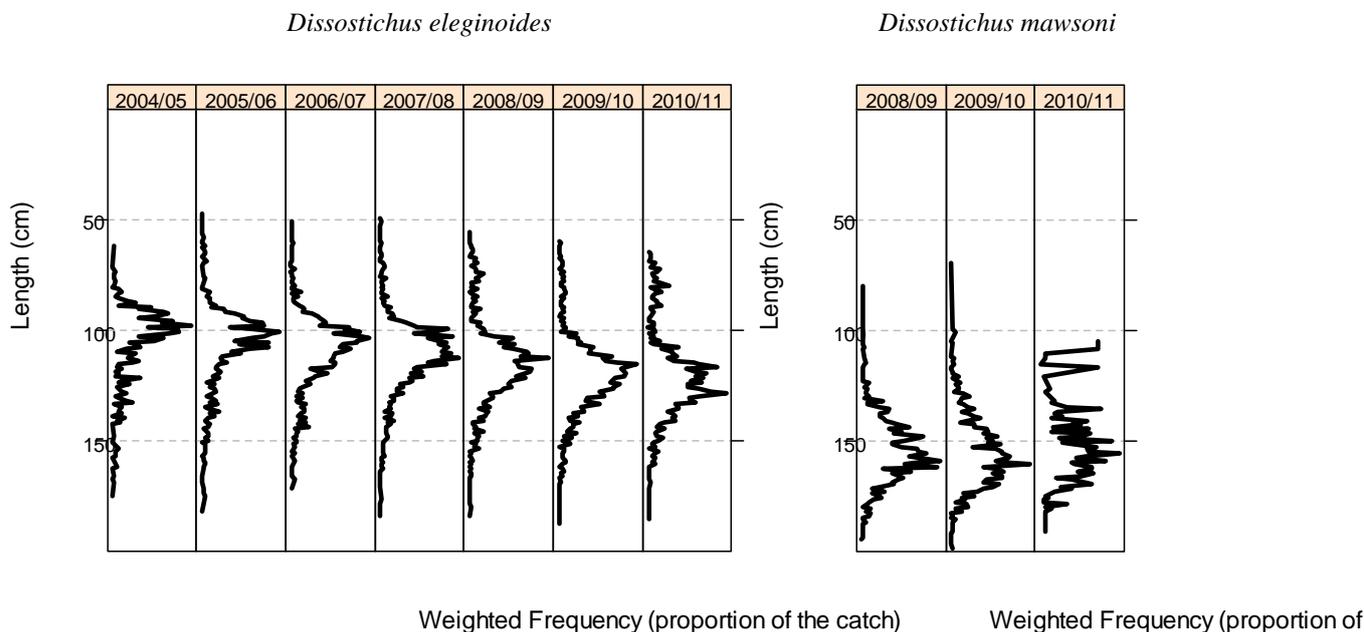
Figure 2:   Catch-weighted length frequencies for *Dissostichus eleginoides* and *Dissostichus mawsoni*
             in Subarea 48.4 (source: observer, fine-scale and STATLANT data).

2. Stocks and areas

11.   WG-FSA-09/17 and 09/18 provided a comprehensive analysis of the distribution of the two species in Subarea 48.4 (Figure 3).
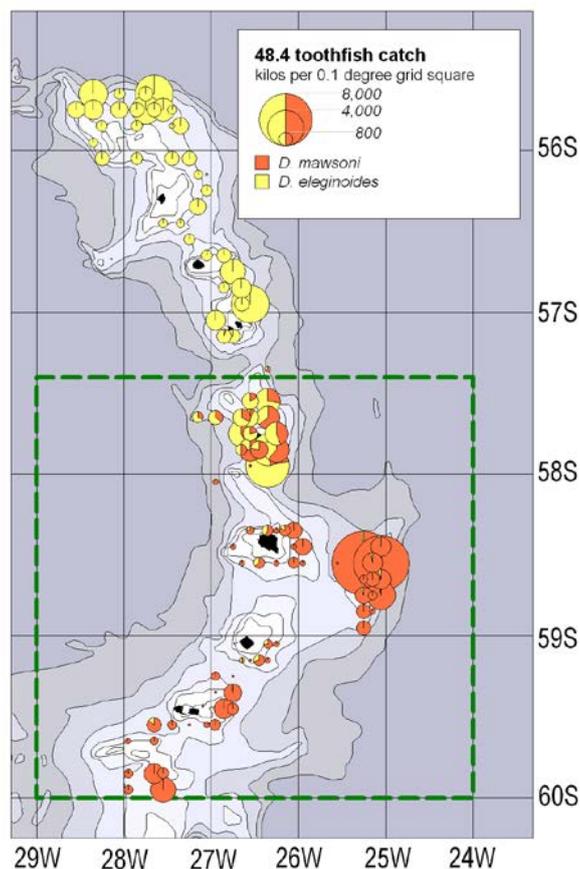
Figure 3:   Catch distribution of the two *Dissostichus* species in Subarea 48.4.

3. Assessment of the northern stock of *D. eleginoides*

3.1 Mark-recapture data

12.   Since 2005/06, vessels operating in this fishery have been required to tag and release *Dissostichus* spp. at a rate of five fish per tonne of green weight caught. A total of 2 172 *D. eleginoides* and 489 *D. mawsoni* have been tagged and released, and 110 *D. eleginoides* and 27 *D. mawsoni* have been recaptured in that subarea (Table 2).

Table 2:   Number of individuals of *Dissostichus* spp. tagged and released (a) and tagging rates (b) reported by vessels operating in the exploratory fishery for *Dissostichus* spp. in Subarea 48.4 since 2006/07, and total number of tagged fish released and recaptured (c). (Source: observer data and catch and effort reports)

(a) Number of individuals of *Dissostichus* spp. tagged and released. The number of *D. eleginoides* is indicated in brackets.

Flag State	Vessel name	Season				
		2006/07	2007/08	2008/09	2009/10	2010/11
New Zealand	*San Aspiring*	252 (251)	252 (252)	432 (309)	310 (162)	135 (110)
UK	*Argos Froyanes*		252 (252)		310 (256)	
	Argos Georgia			319 (249)		173 (115)
	Argos Helena	40 (40)				

(b) Tagging rate (number of fish tagged per tonne of green weight caught) of *Dissostichus* spp.

Flag State	Vessel name	Season				
		2006/07	2007/08	2008/09	2009/10	2010/11
New Zealand	*San Aspiring*	5.2	5.1	5.8	5.4	5.8
UK	*Argos Froyanes*		5.2		5.5	
	Argos Georgia			5.4		5.7
	Argos Helena	6.4				
Required rate		5	5	5	5	5

(c) Total number of tagged *Dissostichus* spp. released and recaptured in Subarea 48.4.

Season	Number tagged and released			Number recaptured		
	D. eleginoides	*D. mawsoni*	Total	*D. eleginoides*	*D. mawsoni*	Total
2004/05	42	0	42	0	0	0
2005/06	134	10	144	0	0	0
2006/07	291	1	292	2	0	2
2007/08	504	0	504	23	0	23
2008/09	558	193	751	29	2	31
2009/10	418	202	620	32	22	54
2010/11	225	83	308	24	3	27
Total	2172	489	2661	110	27	137

3.2 Length frequency

13.   Length-frequency data from the fishery for *D. eleginoides* in Subarea 48.4 North suggests the presence of a single modal length class progressing each year (Figure 4). The 2008/09 data suggested the recruitment of a new strong year class into the fishery (70–80 cm length class). This was also observed in the 2009/10 and 2010/11 length-frequency data, although it will be difficult to estimate the relative size of this year class before it has fully recruited in to the fishery.
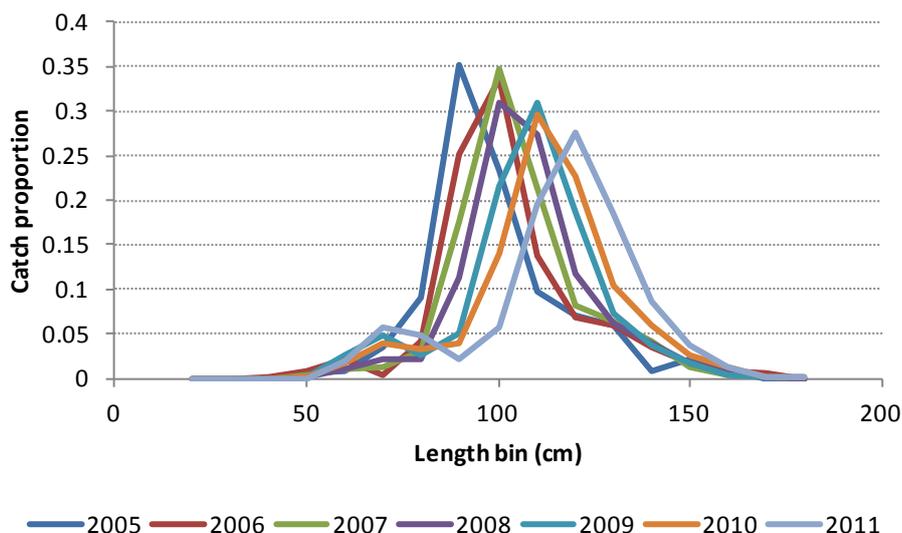
Figure 4:   Catch length frequencies of *D. eleginoides* in Subarea 48.4 North by season.

3.3 Stock assessment

14.   WG-FSA-11/38 presented an updated assessment for Subarea 48.4 *D. eleginoides* using CASAL software. The assessment model is for Subarea 48.4 North only. The model incorporated catch-at-length data from 2004/05 to 2010/11, with the exception of 2008/09 for which catch-at-age data was used based on ageing of a random sample of otoliths collected during the 2008/09 season. Size-at-age data were also included to inform estimates of von Bertalanffy parameters within the model. CPUE data were not included in the model and the model did not include earlier catches in 1991 and 1992 in line with the 2010 Assessment (SC-CAMLR-XXIX, Annex 8, Appendix N). The inclusion of catch-at-age data required an additional fleet to be added to the model for the 2008/09 season, though using the same selectivity-at-age as that estimated for the catch fleet for 2004/05 to 2010/11. Consequently the model can still be thought of as a single fleet model as used in the 2010 assessment.

15.   Data from the fishery in Subarea 48.4 were used to estimate biological parameters for the stock, although some parameter values were taken from the Subarea 48.3 model if insufficient data were available to estimate the parameter values for the Subarea 48.4 stock. These were:

- natural mortality – 0.13

- stock recruitment parameters – steepness 0.75

- maturation parameters – maturation proportion-at-length from the Subarea 48.3 assessment

- tag loss rate – 0.0064

- tagging mortality rate – 0.1, at the upper end of estimates of those available for Subarea 48.3 to reflect the large size of animals in Subarea 48.4

- tag detection probability – 1.

16. The Working Group agreed that this model should be used to assess the *D. eleginoides* stock in Subarea 48.4 North.

3.4 CASAL model structure and assumptions

Population dynamics

17. The CASAL population model used in the assessment of toothfish in Subarea 48.4 was a combined-sex, single-area, three-season model. The annual cycle was defined as follows: the first season (December to April) is where only recruitment (at the start) and natural mortality occurs; the second season, ranging from the beginning of May to the end of August, includes both natural mortality and fishing and contains the spawning period – half the mortality in that particular season being accounted for before spawning occurs; the final season runs from the beginning of September to the end of November, thus completing the annual cycle, with only natural mortality occurring. It was assumed throughout that the proportions of natural mortality and growth that occurred within each season were equal to that season's length as a proportion of a year. The models were run over the years 1990 to 2011, with an initial unexploited equilibrium age structure, and with a Beverton-Holt stock-recruit relationship with fixed steepness.

Model estimation

18. The catch proportions-at-length data were fitted to the model-expected proportions-at-length composition, using a multinomial likelihood.

19. Tag-release events for the years 2005 to 2010 were incorporated into the model with recaptures used from 2006 to 2011. Within-year/season recaptures were omitted from the observations to allow for possible incomplete mixing in the first few months after release. Tag-release and recapture events occurred during the fishing season (season 2), with a probability of detection of recaptured tags of 1. The estimated numbers of scanned fish for each length class relevant to those in the recapture data were calculated using the total catch biomass, the catch-at-length proportions and the mean weight of the fish.

20. In each year, the length frequencies of releases and recaptures ranged from 20 to 220 cm in 10 cm length bins.

Data weighting

21. The appropriate effective sample sizes to be used to weight the length-frequency data, and the levels of possible over-dispersion apparent in the estimated tagged populations, were

investigated. For both sets of observations, standard formulae were used to estimate these quantities after an initial MPD run of the model with the original sample sizes/dispersion values, implementing the same reweighting process as used in the assessment of *D. eleginoides* in Subarea 48.3 (Appendix TOP483). The actual effective sample sizes/dispersion values predicted by the model's fit to the relevant dataset were then adopted, and a secondary MPD run was performed. Tag over-dispersion was fixed at 9.0 for release events, as used in previous assessments for the stock.

Penalties

22. Two types of penalties were included within the model. First, a penalty on the catch constrained the estimated harvest rate in any year from exceeding a specified maximum, set at 0.999 (see the *U_max* parameter in the fishery definition in the population.csl file) in the CASAL assessment models. Second, a tagging penalty discouraged population estimates that were too low to allow the correct number of fish to be tagged.

Priors

23. Table 3 shows the free parameters estimated in the CASAL model, along with their respective bounds and prior parameterisations.

Table 3: Free parameters, and their priors and bounds in the CASAL assessment models.

Parameter	Prior	Lower bound	Upper bound
B_0 (virgin SSB)	Uniform-log	500	5000
k (von Bertalanffy)	Uniform	0.03	0.15
L_∞ (von Bertalanffy)	Uniform	110	250
t_0 (von Bertalanffy)	Uniform	-2	0
a_1 (max. sel. age)	Uniform	1	50
s_L (left sel. decay)	Uniform	0.05	50
s_R (right sel. decay)	Uniform	0.05	500
YCS	Lognormal	0.001	20

3.5 Selectivity and growth

24. A double normal selectivity was assumed, of the form:

$$s(l) = 2^{-\left[\frac{(l-a_1)}{s_L}\right]^2}, \qquad (l \leq a_1)$$
$$2^{-\left[\frac{(l-a_1)}{s_R}\right]^2}, \qquad (l > a_1)$$

where $s(l)$ is the selectivity at length l, a_1 is the age at maximum selectivity and s_L and s_R are decay parameters for the left and right hand limbs respectively.

3.6 Point-estimate (MPD) results

25.   A single assessment model was run for WG-FSA. CASAL estimates of biomass and selectivity parameters were similar to those from the previous season, though the shape of the VB growth curve was slightly different, with an increased L_∞ and decreased k in the updated model (Table 4).

Table 4:   Summary of selected parameter values estimated by the CASAL model, comparing updated values with those from the previous season. Values given to four significant figures.

Final season	B_0 (tonnes)	Selectivity parameters (see equation 1)	Growth parameters
2009/10	1114	a_{50} 11.41, a_{to95} 4.266	k 0.06255, L_∞ 160.3, t_0 −1.490*
2010/11	1550	a_1 15.85, s_L 4.321, s_R 10.93	k 0.04079, L_∞ 216.6, t_0 −0.7972

*   Fixed parameter in the 2010 assessment.

26.   Model-fit diagnostics and goodness-of-fit achieved by the reference model are shown in Figures 5 to 13.
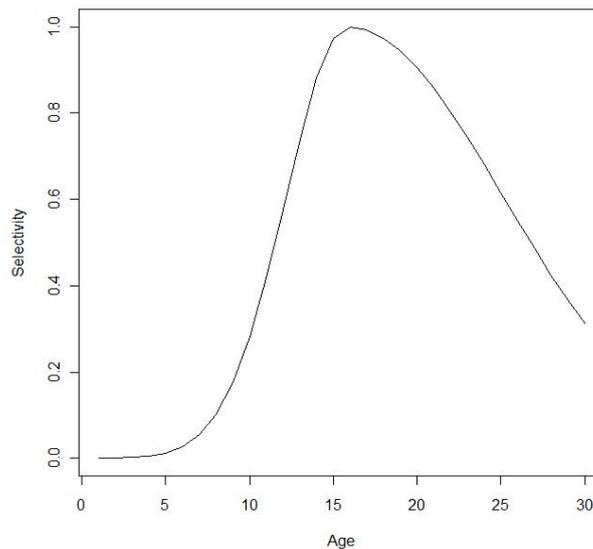
Figure 5:   Estimated logistic selectivity curve in the assessment model.
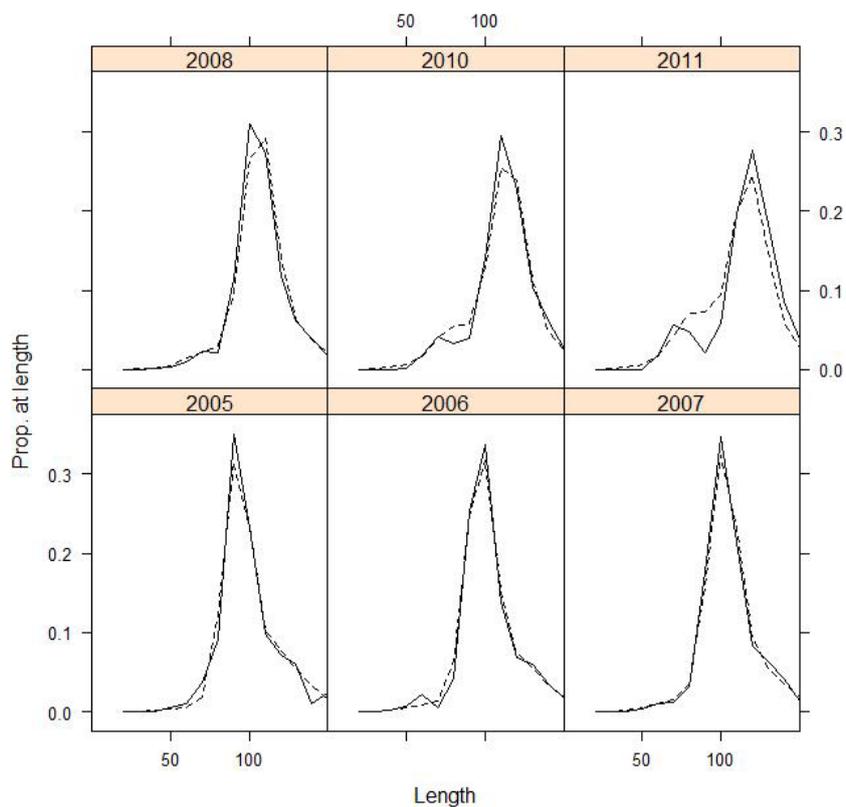
Figure 6: Fit to fleet catch-length frequencies for the assessment model. The full and dotted lines represent the observed and predicted length frequencies respectively.
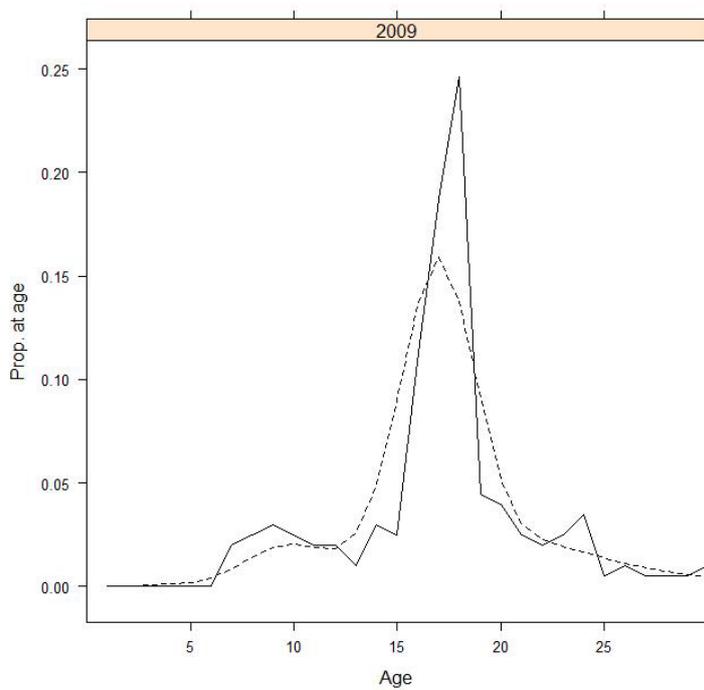
Figure 7: Fit to fleet catch-age proportions for the assessment model. The full and dotted lines represent the observed and predicted length frequencies respectively.
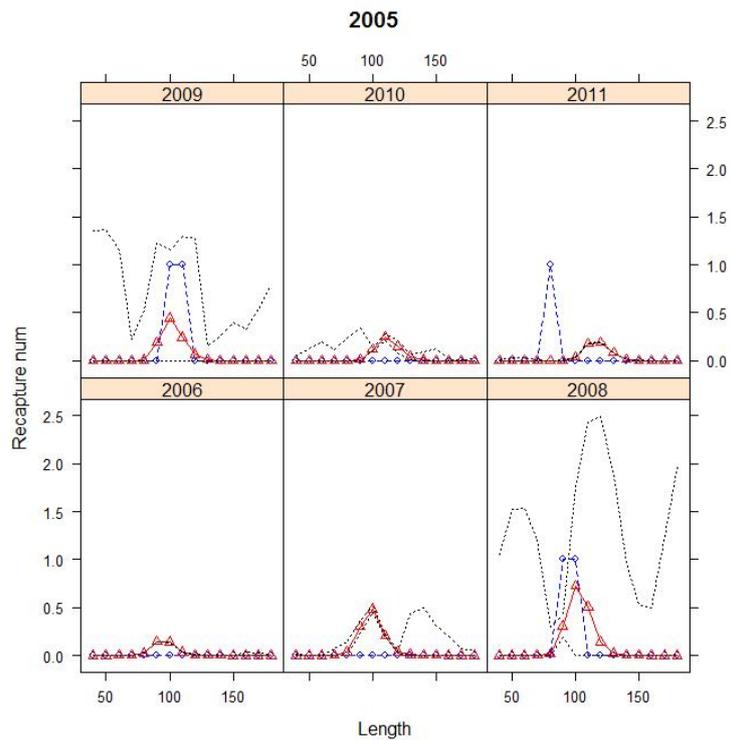
2005

Figure 8: Fits to the 2005 tag-release data – observed recapture probabilities are the circles, expected recaptures are the broken red lines with triangles (s.e's also shown by dotted lines).
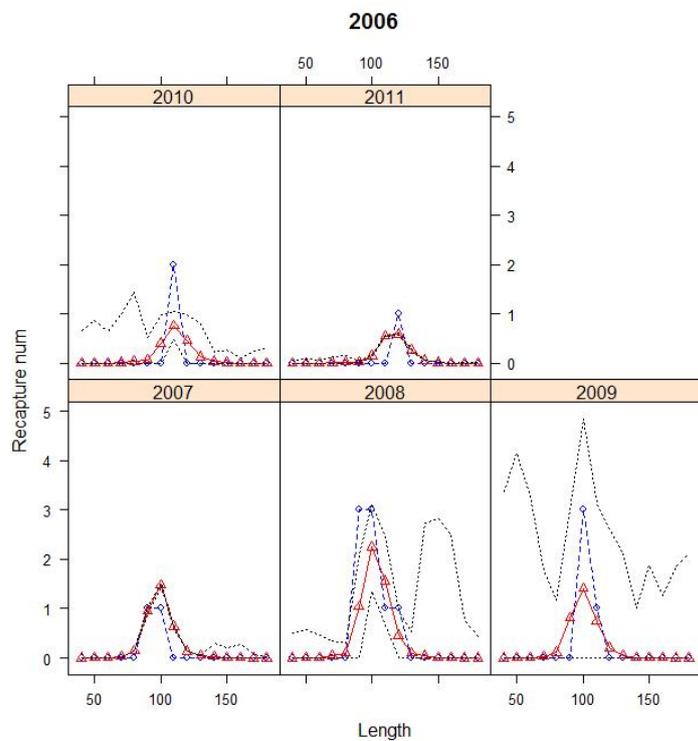
2006

Figure 9: Fits to the 2006 tag-release data – observed recapture probabilities are the circles, expected recaptures are the broken red lines with triangles (s.e's also shown by dotted lines).
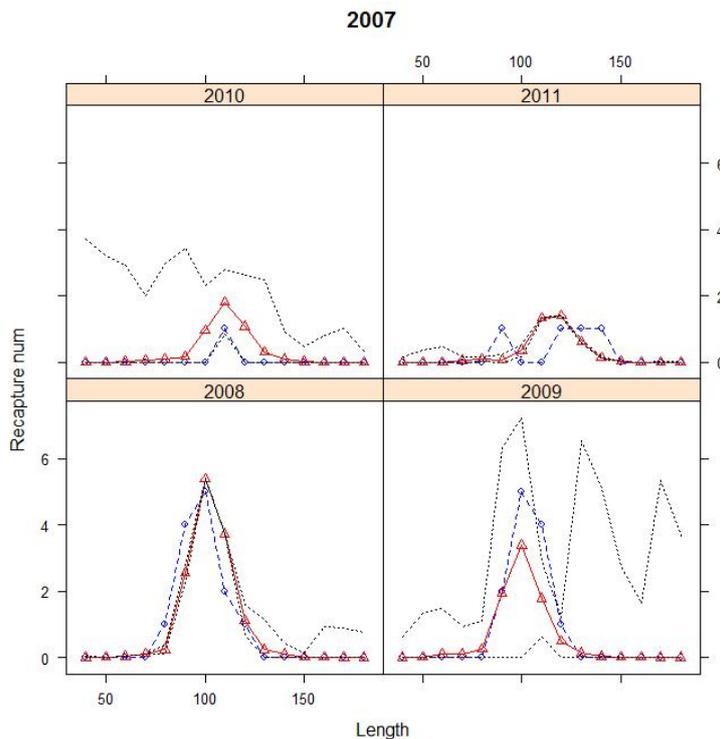
2007

Figure 10: Fits to the 2007 tag-release data – observed recapture probabilities are the circles, expected recaptures are the broken red lines with triangles (s.e's also shown by dotted lines).
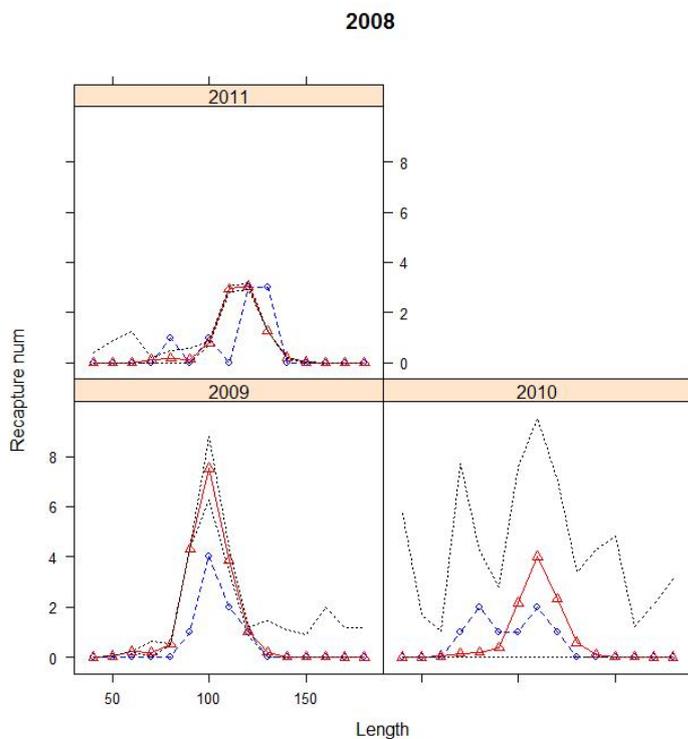
2008

Figure 11: Fits to the 2008 tag-release data – observed recapture probabilities are the circles, expected recaptures are the broken red lines with triangles (s.e's also shown by dotted lines).
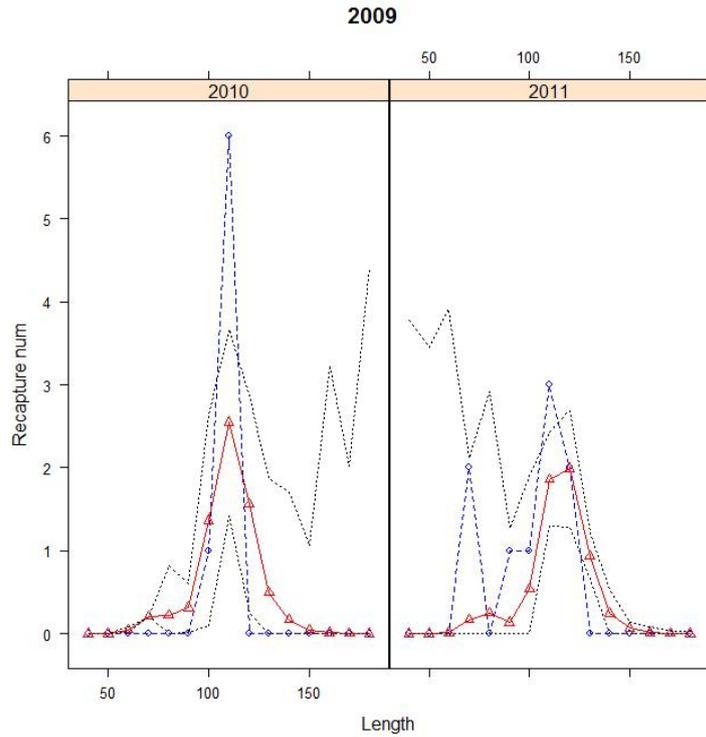
Figure 12: Fits to the 2009 tag-release data – observed recapture probabilities are the circles, expected recaptures are the broken red lines with triangles (s.e's also shown by dotted lines).
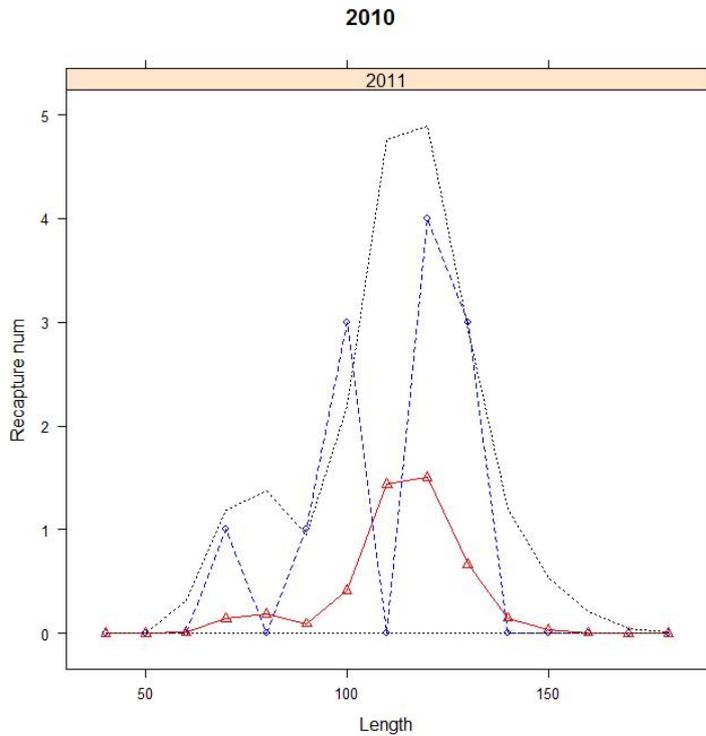
Figure 13: Fits to the 2010 tag-release data – observed recapture probabilities are the circles, expected recaptures are the broken red lines with triangles (s.e's also shown by dotted lines).

27.   Stock trajectories and key indices are shown in Figure 14.
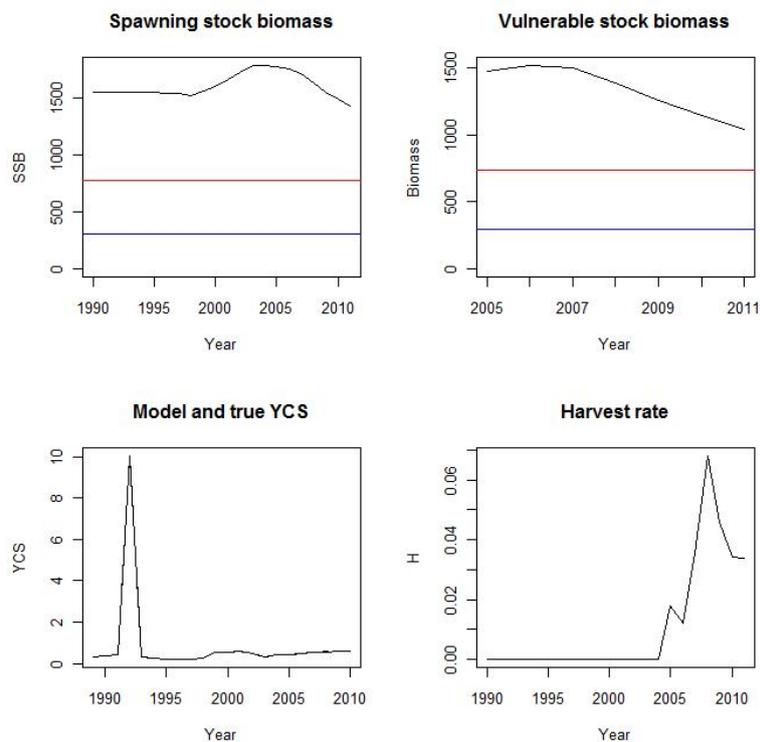
Figure 14:   Stock trajectories for the assessment model.

28.   Good fits were achieved to catch-at-length and catch-at-age datasets with reasonable fits to tag-recapture data. The fits are particularly good considering the short time series available for the datasets. There is a strong decline in selectivity for 16 year old and older fish (Figure 5).

29.   Figure 15 shows the likelihood profile for the current assessment model for the virgin biomass parameter. Tag recapture data, catch-at-age and catch-at-length suggest a higher biomass, particularly recaptures of tags released in 2008.
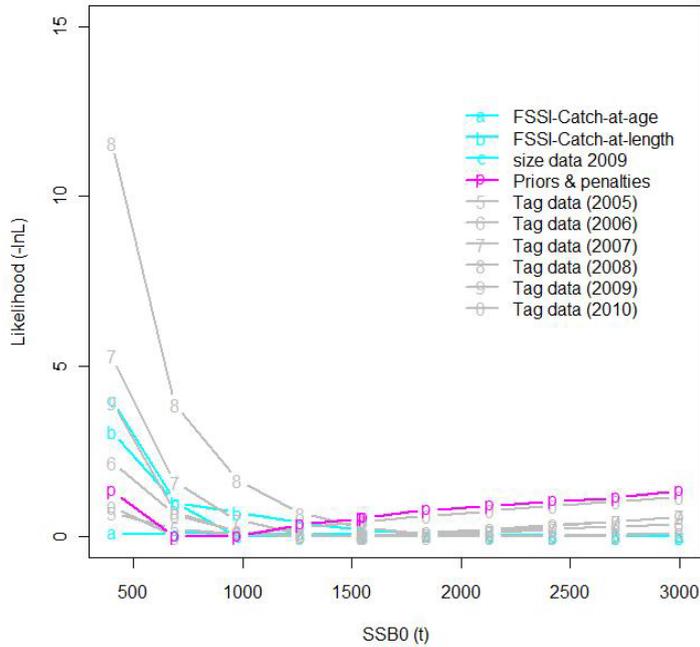
Figure 15: Likelihood profiles for the reference model for Subarea 48.4 N. The legend refers the particular curve in the figure to the relevant dataset etc. used in the assessment. FSSICatch is the catch-at-length proportions.

3.7 MCMC results

30. The uncertainty in the MCMC samples about the posterior median is large (Table 5), primarily due to the low levels of data available. The convergence of the MCMC chains was assessed using the methods already outlined in WG-FSA-05 (SC-CAMLR-XXIV, Annex 5).

Table 5: Median biomass and 95% CIs for the initial equilibrium SSB (B_0), the current SSB (B_{2010}) and the ratio of current to initial SSB (B_{2010}/B_0).

Model	B_0 (tonnes)		$B_{current}$ (tonnes)		$B_{current}/B_0$	
2009 Model	997	(547.4–2487.1)	1103	(546.6–2777.3)	1.09	(0.82–1.41)
2010 Model	991.4	(552.1–2122.3)	1160.7	(597.9–2587.4)	1.14	(0.90–1.51)
2011 Model	1655	(1078–2592)	1537	(909.3–2531)	0.9272	(0.8476–0.9737)

3.8 Sensitivity runs

31. No sensitivity runs were undertaken.

3.9 Yield calculations

32.   CASAL allows the historic stock dynamics to be projected into the future, for a variety of future scenarios. A constant catch projection allows calculation of the long-term yield that satisfies the CCAMLR decision rules:

(i)   Choose a yield γ_1, so that the probability of the spawning biomass dropping below 20% of its median pre-exploitation level, over a 35-year harvesting period, is 10% (depletion probability).

(ii)   Choose a yield γ_2, so that the median escapement in the SSB over a 35-year period is 50% of the median pre-exploitation level, at the end of the projection period.

(iii)   Select the lower of γ_1 and γ_2 as the yield.

33.   The depletion probability was calculated as the proportion of samples from the Bayesian posterior, where the predicted future SSB was below 20% of B_0 in the respective sample of any one year, for each year in the 35-year projection period.

34.   The level of escapement was calculated as the proportion of samples from the Bayesian posterior, where the projected future status of the SSB was below 50% of B_0 in the respective sample, at the end of the 35-year projection period.

35.   Lognormal recruitment was used for the projection with a CV of 1.0. The reason for this very high variability is the identification in the current assessment of a single dominating cohort. Because of this very high recruitment variability, the future catch limit was constrained by the first (γ_1) decision rule. Figure 16 shows the historic and future SSB dynamics for a constant yield of 48 tonnes projected from 2012 to 2046.
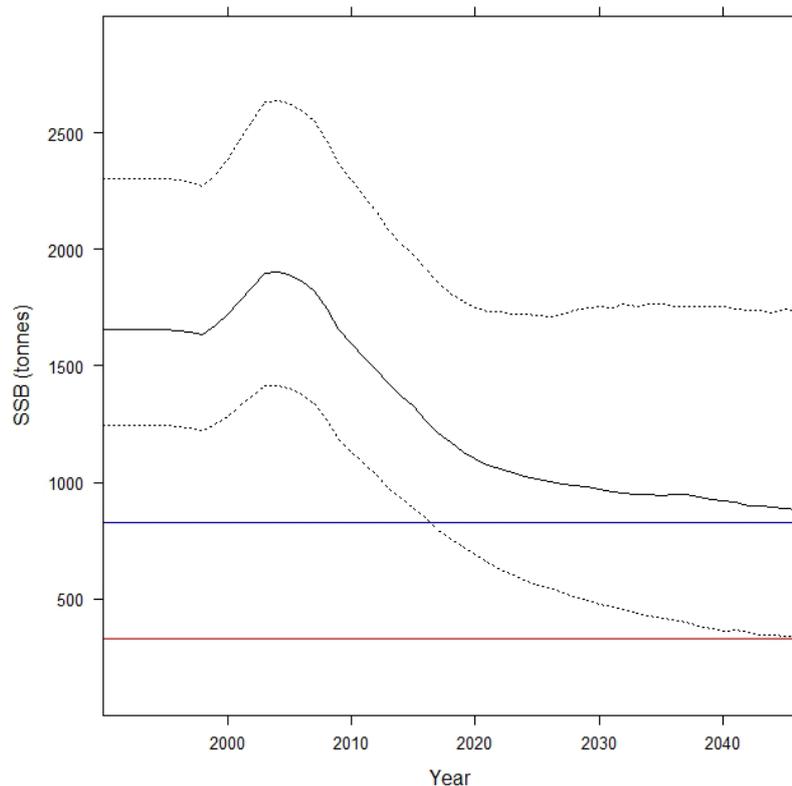
Figure 16: Historic and projected SSB dynamics for a constant future (2012–2046) yield of 48 tonnes. The solid line represents the median with the dotted lines representing the 80% credible interval. The blue and red lines are the medians of 50% and 20% of virgin biomass respectively.

3.10 Future work

36.   The Working Group recommended that the model be developed to include data from fishing in Subarea 48.4 South, such that the sub-population of *D. eleginoides* in the north of this area is incorporated into the assessment.

4. Assessment of toothfish in Subarea 48.4 South

37.   A three-year tagging experiment was completed in 2010/11 in Subarea 48.4 South. No full assessment is currently available. Due to reduced catches and low tag returns realised in the last year of the experiment, the UK proposed to extend the tagging experiment for a fourth year in Subarea 48.4 South in 2011/12, carrying forward the original proposal objectives from 2009 as detailed in WG-FSA-09/18. The proposed tagging experiment has the objective of providing the data required for assessments of the population structure, size, movement and growth of both *D. eleginoides* and *D. mawsoni* in the Southern Area of 48.4. It also provides an opportunity to investigate the degree of mixing of *D. eleginoides* populations between the North and South and, therefore, validate the stock assessment of this species in the Northern Area. The Working Group discussed the proposal and noted that detailed discussion and a

review of the research had been undertaken when this research was first proposed. The proposal to extend the research for a further year was discussed in reference to the new research criteria as proposed in WG-SAM (SC-CAMLR-XXX, Annex 5, paragraphs 2.48 and 2.49) and the Working Group were satisfied that the research met all the relevant criteria. It was recommended that all the conservation measures related to this fishery be carried over into 2011/12.

38.   Petersen estimates from tag recaptures to date suggest a vulnerable population of approximately 600 tonnes for *D. mawsoni*. Limited tag recaptures of *D. eleginoides* suggest a vulnerable biomass in the region of 150 to 350 tonnes. This is consistent with the estimate made in 2010 (SC-CAMLR-XXIX, Annex 8). Application of the γ from the most recent Subarea 48.3 assessment (0.038) to the current estimates of vulnerable biomass results in a yield estimate of 33 tonnes.

5. By-catch of fish and invertebrates

5.1 By-catch removals

39.   Catches of by-catch species groups (macrourids, rajids and other species) reported in fine-scale data, and number of rajids cut from lines and released alive, are summarised in Tables 6 and 7. In 2009/10, catch limits for by-catch species were introduced in Subarea 48.4 North and by-catch move-on rules were introduced in Subarea 48.4 South at 16% of the toothfish catch where more than 150 kg of macrourids were caught.

Table 6:   Catch history for by-catch species in Subarea 48.4 North (macrourids, rajids and other species) and number of rajids released alive in Subarea 48.4 (source: fine-scale data).

Season	Catch limit		Catches taken		Rajids – number released	Other species reported catch (tonnes)
	Macrourids (tonnes)	Rajids (tonnes)	Macrourids (tonnes)	Rajids (tonnes)		
2004/05	-	-	3	0	0	<1
2005/06	-	-	5	1	4359	<1
2006/07	-	-	14	2	6515	<1
2007/08	-	-	16	4	8276	<1
2008/09	12	4	12	1	6501	<1
2009/10	6.5	2	4	1	3742	<1
2010/11	6.5	2	3	1	3647	<1

Table 7:   Catch history for by-catch species in Subarea 48.4 South (macrourids, rajids and other species) and number of rajids released alive in Subarea 48.4 (source: fine-scale data).

Season	Catches taken		Rajids – number released	Other species reported catch (tonnes)
	Macrourids (tonnes)	Rajids (tonnes)		
2008/09	14	<1	3266	<1
2009/10	12	<1	2441	<1
2010/11	2	<1	983	<1

5.2 Assessment of impacts on affected populations

40.   The distribution of rajids and macrourids in Subarea 48.4 has been investigated and initial results of their distributions were provided in WG-FSA-09/17 and 09/18. To date, 472 skates have been tagged in Subarea 48.4 North, including 106 in 2010/11. Rajids are generally distributed to the east, compared to toothfish being generally distributed to the north and west. In Subarea 48.4 South, rajids are not so common, although 451 have now been tagged, including 113 in 2010/11. To date there have been three rajiids recaptured in Subarea 48.4 South.

41.   Although catch rates for macrourids in Subarea 48.4 North were initially high at the start of the fishery, vessels have altered their fishing techniques and rates have subsequently dropped to 8% of the catch weight for *D. eleginoides*. Both macrourid and rajid catches were within the catch limits in 2010/11.

42.   Macrourid catches were previously thought to almost entirely comprise *Macrourus whitsoni*. Genetic analyses now suggest that the macrourid population may comprise two species, including *M. whitsoni* and a new undescribed *Macrourus* species (WG-FSA-10/33).

5.3 Identification of levels of risk

43.   None available for this fishery.

5.4 Mitigation measures

44.   By-catch limits and move-on rules are included in the annual conservation measure established for this fishery (CM 41-03). WG-FSA recommended that the move-on rules for macrourids and rajids should remain unchanged in 2010/11. In addition, mitigation measures for rajids include using Year-of-the-Skate protocols for releasing skates caught alive.

45.   In 2010/11, the total catch of macrourids was 1.8 tonnes, representing 10.7% of the catch of *Dissostichus* spp. and the rajid by-catch was 0.1 tonnes, representing 0.3% of the *Dissostichus* spp. catch. The move on rule was triggered 4 times, representing less than 1% of the hauls made, this is down on the 8% in the previous year and the 70% in the first year that the rule was brought in.

6. By-catch of birds and mammals

6.1 By-catch removals

46.   There have been no observed seabird mortalities in the Subarea 48.4 fishery (Table 8).

Table 8:   Seabird by-catch limit, observed mortality rate and total estimated mortality in Subarea 48.4.

Season	Mortality rate (birds per thousand hooks)	Total estimated mortality (number of birds)
2004/05	0	0
2005/06	0	0
2006/07	0	0
2007/08	0	0
2008/09	0	0
2009/10	0	0
2010/11	0	0

47.   There have been no observed marine mammal mortalities in the Subarea 48.4 fishery.

48.   No additional data were provided this year on distribution of seabirds, WG-IMAF therefore agreed the level of risk of incidental mortality of seabirds in Subarea 48.4 remains at category 3 (Medium) (SC-CAMLR-XXX, Annex 8).

6.2 Mitigation measures

49.   CM 25-02 applies to this fishery, except paragraph 5, if requirements of CM 24-02 are met. There is a limit of three (3) seabirds per vessel during daytime setting. Fishing in December, January, February, March, October and November shall be in accordance with CM 24-02.

7. Ecosystem implications/effects

50.   No evaluation available for this fishery.

8. Harvest controls and management advice

8.1 Conservation measures

51.   The limits on the fishery for *D. eleginoides* and *D. mawsoni* in Subarea 48.4 are defined in CM 41-03. The limits in force and the Working Group's advice to the Scientific Committee for the forthcoming season are summarised in Table 9.

Table 9:   Limits on the fishery for *Dissostichus eleginoides* and *D. mawsoni* in Subarea 48.4 in force (CM 41-03) and advice to the Scientific Committee for 2011/12.

Element	Limit in force	Advice for 2011/12
Access	Subarea 48.4 North: directed longline fishery on *Dissostichus eleginoides*	Carry forward
	Subarea 48.4 South: directed longline fishery on *Dissostichus* spp.	Carry forward
Catch limit	Subarea 48.4 North: precautionary catch limit for *D. eleginoides* was 40 tonnes and the taking of *D. mawsoni*, other than for scientific research purposes, is prohibited.	Revise
	Subarea 48.4 South: precautionary catch limit for *Dissostichus* spp. was 30 tonnes	Revise
Season	1 December to 30 November	Carry forward
By-catch	Subarea 48.4 North: precautionary catch limits for *Macrourus* spp. (6.5 tonnes) and rajids (2.0 tonnes).	Revise
	Subarea 48.4 South: By-catch move-on rules for *Macrourus* spp. (more than 150 kg and 16% of toothfish catch in one haul) and rajids (5%).	Carry forward
Mitigation	In accordance with CM 25-02, except paragraph 5, if requirements of CM 24-02 are met.	Carry forward
	Fishing in December, January, February, March, October and November shall be in accordance with CM24-02.	
	Limit of three (3) seabirds per vessel during daytime setting.	
Observers	At least one (1) scientific observer appointed in accordance with the CCAMLR Scheme of International Scientific Observation.	Carry forward
Data	Five-day catch and effort reporting	Carry forward
	Haul-by-haul catch and effort data	Carry forward
	Biological data reported by the CCAMLR scientific observer.	Carry forward
Research	Each vessel taking part in the fishery for *D. eleginoides* shall undertake a tagging program in accordance with the CCAMLR tagging protocol.	Carry forward
	Toothfish tagged at a rate of at least five fish per tonne green weight caught.	Carry forward
Environmental protection	Regulated by CM 26-01.	Carry forward

8.2 Management advice

52.   The Working Group recommended the following limits for toothfish and by-catch in Subarea 48.4:

Subarea 48.4 North –

(i)   a catch limit of 48 tonnes for *D. eleginoides*

(ii)   the continued prohibition of the taking of *D. mawsoni* other than for scientific research purposes

(iii) maintenance of catch limits for by-catch species, with a limit for macrourids of 7.5 tonnes (16% of the catch limit for *D. eleginoides*) and a limit for rajids of 2.5 tonnes (5% of the catch limit for *D. eleginoides*).

Subarea 48.4 South –

(i) a catch limit of 33 tonnes for *Dissostichus* spp. (*D. eleginoides* and *D. mawsoni* combined)

(ii) maintenance of a move-on rule for by-catch species, with a macrourid trigger of 150 kg and 16% of the catch of *Dissostichus* spp., and a trigger for rajids set at 5% of the catch of *Dissostichus* spp.