APPENDIX E

FISHERY REPORT: EXPLORATORY FISHERY FOR *DISSOSTICHUS* SPP. IN DIVISION 58.4.2

CONTENTS

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1. Details of the fishery

The exploratory fishery for *Dissostichus* spp. in Division 58.4.2 was first agreed by the Commission in 1999/2000. This was a trawl fishery which was permitted in association with a new fishery for *Chaenodraco wilsoni*, *Lepidonotothen kempi*, *Trematomus eulepidotus* and *Pleuragramma antarcticum* (Conservation Measure 186/XVIII). The exploratory trawl fishery was also permitted in 2000/01, and in 2001/02 in association with a new fishery for *Macrourus* spp. In 2002/03, the fishery for *Dissostichus* spp. in Division 58.4.2 changed to an exploratory longline fishery.

2. In 2007/08, the exploratory fishery for *Dissostichus* spp. in Division 58.4.2 was limited to Australian, Japanese, Korean, Namibian, New Zealand, South African, Spanish Ukrainian and Uruguayan vessels using longlines only (Conservation Measure 41-05). The precautionary catch limit for *Dissostichus* spp. was 780 tonnes, of which no more than 260 tonnes could be taken in SSRUs A, C and E (see Figure 1). Two other SSRUs (B and D) were closed to fishing. Fishing was prohibited in depths less than 550 m in order to protect benthic communities. The catch limits for by-catch species were defined in Conservation Measure 33-03. The fishing season was from 1 December 2007 to 30 November 2008.

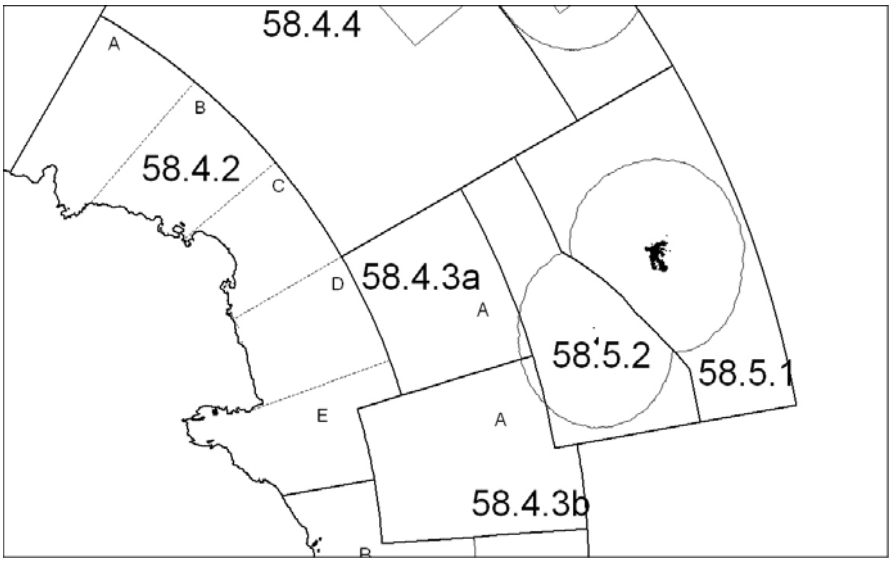

Figure 1: General map of Division 58.4.2 and location of SSRUs (A–E in that division).

1.1 Reported catch

3. Licensed longline vessels have fished the exploratory fishery for *Dissostichus* spp. in Division 58.4.2 since 2003/04, and the target species is *D. mawsoni* (Tables 1(a) and (b)). In 2007/08, three vessels fished in SSRUs A, C and E and reported a total catch of 217 tonnes of *Dissostichus* spp. (Table 1(b), Figure 1); this catch represented 28% of the precautionary catch limit for the fishery.

4. The reported catches of *Dissostichus* spp. in SSRUs A, C and E were 54.0 tonnes (21% of catch limit), 37.2 tonnes (14% of catch limit) and 125.3 tonnes (48% of catch limit) respectively (CCAMLR-XXVII/BG/15, Table 2).

Table 1(a): Catch history for *Dissostichus* spp. in Division 58.4.2 (source: STATLANT data for past seasons, and catch and effort reports for current season, WG-FSA-08/10 Rev. 2 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		
2002/03	1	1	500	0	117	117	98	215
2003/04	-	1	500	0	20	20	197	217
2004/05	8	4	780	1	125	126	86	212
2005/06	7	3	780	<1	163	164	192	356
2006/07	8	3	780	0	124	124	197	321
2007/08	14	3	780	<1	216	217	0	217

Table 1(b): Catch of *Dissostichus* spp. in Division 58.4.2 reported by SSRU (source: fine-scale data pro-rated by total reported catch in Table 1(a)).

Season	*D. eleginoides*					*D. mawsoni*				
	A	B	C	D	E	A	B	C	D	E
2002/03			<1		<1			17	16	84
2003/04					<1				5	14
2004/05			1		<1	62		15		48
2005/06					<1	4		4	<1	156
2006/07	<1				<1	58				65
2007/08					<1	54		37		125

1.2 IUU catch

5. Information on IUU fishing indicated that approximately 799 tonnes of *Dissostichus* spp. had been taken during IUU fishing in Division 58.4.2 between 2002/03 and 2006/07, and there was no evidence of IUU fishing in 2007/08 (Table 1(a)). The total removal of *Dissostichus* spp. is estimated at 1 538 tonnes.

1.3 Size distribution of catches

6. Most *D. mawsoni* caught in the fishery ranged from 50 to 170 cm in length (Figure 2). A bimodal distribution was observed from 2002/03 to 2004/05, with broad modes at approximately 60–80 cm and 130–160 cm, while the distribution in 2005/06, 2006/07 and 2007/08 peaked at 125–150 cm. The modal peak at 60–80 cm was not seen in 2005/06, 2006/07 and 2007/08. The detailed distribution of catches will have to be investigated in order to understand these changes.

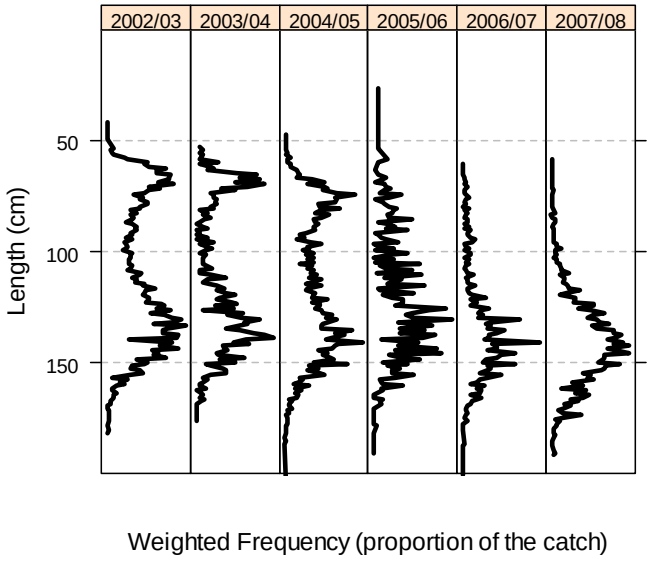

Figure 2: Catch-weighted length frequencies for *Dissostichus mawsoni* in Division 58.4.2 (source: observer, fine-scale and STATLANT data, and the length–weight relationship was taken from observations on *D. mawsoni* in Subarea 88.1).

2. Stocks and areas

7. The Working Group noted that the two-stock 'east and west' hypothesis could also be simply a differential immature/mature distribution of animals of one stock, as is seen in the Ross Sea. It was agreed that even though the (very low) number of tag returns might support a two-stock hypothesis, the sample size is currently so low that both hypotheses are equally plausible.

8. The most likely areas where *D. mawsoni* spawn are the Pacific Antarctic Ridge north of the Ross Sea and the Amundsen Ridge in the Amundsen Sea. In the Cooperation Sea the most likely area of spawning is BANZARE Bank. Spawning occurs in winter and may extend into autumn or spring (WG-FSA-08/14).

9. The Working Group noted that results confirm the hypotheses that juvenile fish inhabit mostly the shelf, while larger fish live on the slope and pre-spawning fish are found either on their northward spawning migration or inhabit the deeper slope.

3. Parameter estimation

3.1 Observations

10. Vessels operating in this fishery are required to conduct fishery-based research in accordance with Conservation Measure 41-01. This includes the collection of detailed catch, effort and biological data (Annex 41-01/A), the setting of research lines (Annex 41-01/B) and participation in the tagging program (Annex 41-01/C).

11. Vessels, on first entry into an SSRU, are required to make 10 research longline hauls. A further 10 research hauls are required during the course of fishing. The number of research hauls reported in fine-scale data are summarised in Table 2.

12. Vessels are also required to tag and release *Dissostichus* spp. at a rate of three fish per tonne of green-weight catch, and vessels may discontinue tagging once 500 fish have been tagged. A total of 1 374 *D. mawsoni* and 25 *D. eleginoides* (total 1 399 fish) have been tagged and released, and no recaptures have been reported from that division (Table 3). Of the fish tagged and released, 561 were in SSRU A, 185 in SSRU C and 653 in SSRU E. No fish were tagged in SSRU D in the first two years of the fishery when that SSRU was open to fishing.

Table 2: Research (R) and commercial (C) longline hauls reported by vessels operating in the exploratory fishery for *Dissostichus* spp. in Division 58.4.2 (source: fine-scale data).

Season	Flag State	Vessel name	SSRU	Number of hauls		
				R	C	Total
2002/03	Australia	*Eldfisk*	5842C	21	17	38
		Eldfisk	5842D	16	4	20
		Eldfisk	5842E	20	63	83
2003/04	Australia	*Eldfisk*	5842D	10	8	18
		Eldfisk	5842E	19	9	28
2004/05	Chile	*Globalpesca II*	5842A	20	2	22
		Globalpesca II	5842E	8		8
	Korea, Republic of	*Bonanza No. 707*	5842A	15	38	53
		Bonanza No. 707	5842C	*	18	18
	New Zealand	*Janas*	5842A	15	2	17
		Janas	5842E	20	7	27
	Spain	*Arnela*	5842E	13	7	20
2005/06	Chile	*Globalpesca I*	5842A	8		8
		Globalpesca I	5842C	4		4
		Globalpesca I	5842D	1		1
		Globalpesca I	5842E	18	16	34
	Korea, Republic of	*Insung No. 2*	5842E	20	22	42
	Spain	*Galaecia*	5842E	19	2	21
2006/07	Korea, Republic of	*Insung No. 1*	5842A	10	9	19
		Insung No. 1	5842E	2		2
		Jung Woo No. 2	5842A	16	22	38
	Namibia	*Antillas Reefer*	5842E	19	36	55
2007/08	Korea, Republic of	*Insung No. 1*	5842A	20	7	27
		Insung No. 1	5842C	10	5	15
	Namibia	*Antillas Reefer*	5842A	20	2	22
		Paloma V	5842E	20	26	46

* Research hauls were not identified in the data.

Table 3: Number of individuals of *Dissostichus* spp. tagged and released and the tagging rate (fish per tonne of green weight caught) reported by vessels operating in the exploratory fishery for *Dissostichus* spp. in Division 58.4.2. The number of *D. eleginoides* is indicated in brackets. The total number of tagged fish recaptured to date in Division 58.4.2 is also included. (Source: observer data and catch and effort reports.)

Season	Flag State	Vessel name	*Dissostichus* spp. tagged and released		
			Number of fish		Tagging rate
2002/03	Australia	*Eldfisk*	-		-
2003/04	Australia	*Eldfisk*	-		-
2004/05	Chile	*Globalpesca II*	145	(7)	5.79
	Korea, Republic of	*Bonanza No. 707*	141	(5)	2.57
	New Zealand	*Janas*	45	(2)	1.17
	Spain	*Arnela*	11	(0)	1.34
2005/06	Chile	*Globalpesca I*	24	(1)	0.91
	Korea, Republic of	*Insung No. 2*	101	(0)	0.8
	Spain	*Galaecia*	11	(0)	1.03
2006/07	Korea, Republic of	*Insung No. 1*	88	(0)	4.36
		Jung Woo No. 2	74	(0)	1.94
	Namibia	*Antillas Reefer*	86	(0)	1.32
2007/08	Korea, Republic of	*Insung No. 1*	248	(0)	3.01
	Namibia	*Antillas Reefer*	48	(1)	5.44
		Paloma V	377	(9)	3.01
Total number of fish tagged and released			1 399	(25)	
Total number of tagged fish recaptured in Division 58.4.2			0	(0)	

3.2 Fixed parameter values

13. None available for this fishery.

4. Stock assessment

14. WG-FSA-08/63 examined expected tag-recapture rates in new and exploratory *Dissostichus* spp. fisheries in the southern Indian Ocean sector. In particular, the paper considered the potential for tagging programs in new and exploratory fisheries to yield sufficient data to be of use in determining catch limits in the early stages of fishery development. Scenarios were developed using a range of tag-release rates, tag-detection rates, natural mortality, fish movement out of the fishery, and IUU removals in order to estimate the expected numbers of tag-returns. Even under 'worst-case' assumptions (e.g. lower detection rates, higher tag mortality, high levels of emigration and high IUU) tag-recaptures were still expected to be considerably higher than currently observed in Divisions 58.4.1 and 58.4.2. The paper concluded that if current tag-recapture rates continue, then tag-based assessments of stock status in Divisions 58.4.1 and 58.4.2 are likely to remain uncertain in the short to medium term, and fishing should remain focused in areas where tag-releases have been concentrated until these uncertainties can be addressed.

15. Progress on assessing the exploratory fishery in Divisions 58.4.1 and 58.4.2 was presented in WG-SAM-08/4 and a summary was provided in SC-CAMLR-XXVII, Annex 7, paragraphs 3.1 to 3.5. WG-SAM recommended that WG-FSA use the methods described in

this paper to provide management advice for the *Dissostichus* spp. fishery in this division, once a number of modifications had been made (SC-CAMLR-XXVII, Annex 7, paragraph 4.3). WG-SAM also recommended that tagging be continued at the current rate in these divisions.

16. An updated assessment of the exploratory fisheries in Divisions 58.4.1 and 58.4.2, including the minor modifications requested by WG-SAM, was provided in WG-FSA-08/43. The authors compared estimates of abundance for these areas using four methods: comparative CPUE trends, local depletions, a constant recruitment model and mark–recapture data. Recapture rates were so low that a reliable stock assessment based on these data was not possible, and instead they presented estimates of the number of expected tag-returns given the estimated biomass. Estimates of biomass by SSRU were moderately consistent between CPUE comparisons and local depletion methods. However, the predicted estimates of tag-recaptures were much higher than those observed. The paper provided tentative estimates of precautionary yield from Divisions 58.4.1 and 58.4.2, noting that these are substantially lower than the existing catch limits.

17. The Working Group noted that the full uncertainty in the longline CPUE in the two areas had not been incorporated into the assessment. For the purposes of providing advice on potential catch limits for the open SSRUs in Divisions 58.4.1 and 58.4.2, a further analysis was carried out which incorporated the uncertainty in CPUE into the biomass estimates for the SSRUs obtained using the comparative CPUE method detailed in WG-FSA-08/43. SSRU-specific yield calculations were calculated assuming an exploitation rate of 0.05 (which appears to be a sustainable exploitation rate for the assessed *Dissostichus* spp.) multiplied by the biomass estimate. Estimates of yield were also made for SSRUs 5841C, 5842A and 5842E based on depletion-derived biomass estimates. These are the only SSRUs for which depletion estimates were available over several years, from which the most recent best-fit depletion was selected. Yields were calculated separately for the median, 25 percentile and 75 percentile biomass values for each SSRU. The results of the analysis are presented in Table 4.

Table 4: Yield estimates (tonnes) assuming a 5% exploitation rate by SSRU using the median, 25 percentile (25%), and 75 percentile (75%) biomass levels calculated using the comparative CPUE and depletion-derived methods. Estimates are relative to the 2006/07 fishing season.

	SSRU				
	5842A		5842C	5842E	
Method	CPUE	Depletion	CPUE	CPUE	Depletion
Median	24	10	9	37	42
25%	1	9	0	24	36
75%	47	12	18	50	48
Current catch limit	260		260	260	
2007/08 catch	54		37	125	
Range in catches	4–62		4–37	14–156	

18. Dr L. Pshenichnov (Ukraine) noted that the estimation of fished areas of Divisions 58.4.1 and 58.4.2 have not been corrected for the closed SSRUs of Divisions 58.4.1 and 58.4.2. He noted that the assumption that CPUE is proportional to toothfish density is not correct for a longline fishery, and that this leads to an increase in the uncertainty of the analysis. He further noted that the biomass of toothfish was estimated by means of an

unknown constant (the catchability) (WG-FSA-08/43). Catchability of longline as a whole, and longlining of toothfish in particular, is unknown and should not be used for biomass estimation. He also considered that catches of immature (1–4 years old) fish in Division 58.4.2 (WG-FSA-08/23) using bottom trawls are similar to those found in other subareas which suggests that recruitment and biomass of fish in this division is also similar to those subareas. This is inconsistent with the summary of WG-FSA-08/43.

19. The Working Group considered that although the estimates of yield from the analysis were uncertain, the results suggested that the size of the *Dissostichus* spp. population in these two divisions was likely to be small and that the current catch limits were unlikely to be sustainable. The Working Group therefore recommended that the catch limits be reduced in each of the open SSRUs in Divisions 58.4.1 and 58.4.2 to the estimates of yield based on the median biomass estimates provided in Table 4. The Working Group also recalled the work of WG-SAM which considered that catches of 10 tonnes were unable to provide useful information to enable the assessment of a stock except in circumstances of well-designed research programs testing clear hypotheses (SC-CAMLR-XXVII, Annex 7, paragraph 4.6). Therefore, the Working Group further recommended that SSRUs with a yield of less than 20 tonnes be closed to fishing.

5. By-catch of fish and invertebrates

5.1 By-catch removals

20. Catches of by-catch species groups (macrourids, rajids and other species) reported in fine-scale data, their respective catch limits, and number of rajids cut from lines and released alive are summarised in Table 5. The by-catch in this fishery consists predominantly of macrourids (up to 28 tonnes per season). Catches of rajids of up to 3 tonnes per season have been reported.

21. The Working Group noted that the reported catch of macrourids in the fishery in 2004/05 was relatively higher (22% of the catch of *Dissostichus* spp.) when fishing was concentrated in SSRU A, than in other seasons (2–10% of the catch of *Dissostichus* spp.) when fishing was concentrated in SSRU E.

Table 5: Catch history for by-catch species (macrourids, rajids and other species), catch limits and number of rajids released alive in Division 58.4.2. Catch limits are for the whole fishery (see Conservation Measure 33-03 for details). (Source: fine-scale data.)

Season	Macrourids		Rajids			Other species	
	Catch limit (tonnes)	Reported catch (tonnes)	Catch limit (tonnes)	Reported catch (tonnes)	Number released	Catch limit (tonnes)	Reported catch (tonnes)
2002/03	250	12	250	0	-	100	1
2003/04	80	1	50	0	-	100	0
2004/05	124	28	50	3	3	60	2
2005/06	124	4	50	0	-	60	1
2006/07	124	7	50	0	-	60	0
2007/08	124	12	50	0	-	60	1

5.2 Assessment of impacts on affected populations

22. None available for this fishery.

5.3 Identification of levels of risk

23. None available for this fishery.

5.4 Mitigation measures

24. The Commission has agreed that, where possible, vessels should release rays from the lines by cutting the snoods when the rays are still in the water, unless requested not to do so by the scientific observer during the biological sampling period (CCAMLR-XXIV, paragraph 4.51). The Commission has been requested to review this mitigation practice (see SC-CAMLR-XXVI, Annex 5, paragraph 5.53).

6. By-catch of birds and mammals

6.1 By-catch removals

25. Details of seabird by-catches are summarised in Table 6.

Table 6: Seabird by-catch limit, observed mortality rate and total estimated mortality of seabird by-catch in Division 58.4.2 (from SC-CAMLR-XXVII, Annex 6, Table 3).

Season	By-catch limit (number of birds)	Mortality rate (birds/thousand hooks)	Total estimated mortality (number of birds)
2002/03	3*	-	-
2003/04	3*	-	-
2004/05	3*	0	0
2005/06	3*	0	0
2006/07	3*	0	0
2007/08	3*	0	0

* Per vessel during daytime setting

26. No marine mammal interactions or mortalities were reported.

27. Ad hoc WG-IMAF assessed the risk level of seabirds in this fishery in Division 58.4.2 as category 2 (average to low) (SC-CAMLR-XXVI/BG/31).

6.2 Mitigation measures

28. Conservation Measure 25-02 applies to this fishery and in recent years has been linked to an exemption for night setting in Conservation Measure 24-02 and subject to a seabird by-catch limit. Offal and other discharges are regulated under Conservation Measure 26-01.

7. Ecosystem implications/effects

29. No evaluation available for this fishery.

8. Harvest controls and management advice

8.1 Conservation measures

30. The limits on the exploratory fishery for *Dissostichus* spp. in Division 58.4.2 are defined in Conservation Measure 41-05. The limits in force and the Working Group's advice to the Scientific Committee for the forthcoming season are summarised in Table 7.

Table 7: Limits on the exploratory fishery for *Dissostichus* spp. in Division 58.4.2 in 2007/08 (Conservation Measure 41-05) and advice to the Scientific Committee for 2008/09.

Element	Limit in force	Advice for 2008/09
Catch limit	Precautionary catch limit for *Dissostichus* spp. was 780 tonnes, and catch limits for each SSRU was as follows: A – 260 tonnes; B – 0 tonnes; C – 260 tonnes; D – 0 tonnes; E – 260 tonnes.	Review
Season	1 December to 30 November	Same period
By-catch	Regulated by CM 33-03	Review
Mitigation	In accordance with CM 25-02, except paragraph 4 if requirements of CM 24-02 are met.	Carry forward
	Limit of three (3) seabirds per vessel during daytime setting.	Carry forward
Observers	At least two (2) scientific observers, one of whom shall be 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	Fishery-based research in accordance with CM 41-01, including the collection of detailed catch, effort and biological data (Annex 41-01/A), setting of research hauls (Annex 41-01/B) and tagging (Annex 41-01/C).	Carry forward
	Toothfish tagged at a rate of at least three fish per tonne green weight caught.	Carry forward
Environmental protection	Regulated by CM 26-01.	Carry forward
	No offal discharge.	

8.2 Management advice for *Dissostichus* spp. in Divisions 58.4.1 and 58.4.2

31. In 2006 the Scientific Committee noted several features of exploratory *Dissostichus* spp. fisheries in the southern Indian Ocean (Subarea 58.4) which gave cause for concern as to the status of the resource in this area, and the lack of a scientific basis for setting catch limits (SC-CAMLR-XXV, paragraphs 4.184 to 4.192). In its management advice for this and other exploratory fisheries, the Scientific Committee requested urgent consideration by Members of methods for collecting data and of assessing these stocks.

32. WG-FSA-08/43 detailed preliminary stock assessments of the open SSRUs in Divisions 58.4.1 and 58.4.2. The primary method of assessment used comparative CPUE, seabed area and the assessment-predicted Ross Sea biomass to estimate stock size in each open SSRU within the division. Where local depletions were significant, a Leslie depletion analysis was also used to estimate SSRU biomass. Tagging information was not used due to the very low number of returns reported from the division.

33. The Working Group considered that although the estimates of yield from the analysis were uncertain, the results suggested that the size of the *Dissostichus* spp. population in Divisions 58.4.1 and 58.4.2 was likely to be small and that the current catch limits were unlikely to be sustainable. The Working Group therefore recommended that the catch limits be reduced in each of the open SSRUs in Divisions 58.4.1 and 58.4.2 to the estimates of yield based on the median biomass estimates provided in Table 4 (paragraph 17). The Working Group also recalled the work of WG-SAM which considered that catches of 10 tonnes were unable to provide useful information to enable the assessment of a stock except in circumstances of well-designed research programs testing clear hypotheses (SC-CAMLR-XXVII, Annex 7, paragraph 4.6). Therefore, the Working Group further recommended that SSRUs with a yield of less than 20 tonnes be closed to fishing.

34. The Working Group recommended that vessels entering a new SSRU in Subareas 48.6 and 58.4 should be required to carry out 10 research sets with a maximum hook number of 5 000 (as part of Conservation Measure 41-01) on a stratified random basis through prescribed areas within that SSRU before carrying out their commercial fishing. Sets would be carried out on, or close to, supplied positions within strata based on fishable area where that information is available. Alternate positions could be supplied to replace any positions that were unfishable for any reason. It considered that the prescribed areas could be identified and random positions generated during the week of the 2008 meeting of the Scientific Committee if it agreed to this recommendation. It also considered that, if carried out annually by the same vessels, the research sets could be used to develop a time series of relative abundance indices.