

**FISHERY REPORT: *DISSOSTICHUS ELEGINOIDES* PRINCE EDWARD ISLANDS
SOUTH AFRICAN EEZ (SUBAREAS 58.6 AND 58.7)**

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1. Details of the fishery

A licensed fishery within the South African EEZ at the Prince Edward Islands started in October 1996. Part of the South African EEZ is outside the CCAMLR Convention Area (Area 51) and part falls within Subareas 58.6 and 58.7 and Division 58.4.4 (Figure 1). Most fishing in the South African EEZ takes place to the north and the east of the Prince Edward Islands in Subareas 58.6 and 58.7 and Area 51, and this Fishery Report focuses on Subareas 58.6 and 58.7.

2. Although the fishery began in 1996, intelligence reports indicated that IUU vessels were operating in the area in 1995 and possibly 1994. Prior to the 2001/02 fishing season, the estimated IUU catch exceeded the reported catch for most years (Table 2). Since the start of the fishery, a maximum of seven operators have been licensed by South Africa to fish in any one year. Since 2001/02, only two licensed vessels have been used by these operators in any one year, and only one vessel was active in 2005/06 (Table 2).

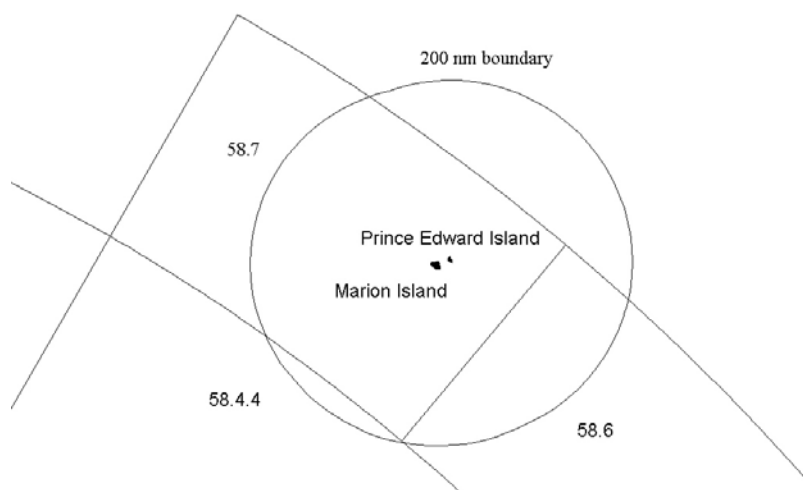


Figure 1: General map of the South African EEZ at the Prince Edward Islands and the boundaries of Subareas 58.6 and 58.7 and Division 58.4.4 in the CCAMLR Convention Area. Area 51 lies to the north of Subareas 58.6 and 58.7.

1.1 Reported catch (time series)

3. The total annual catches taken in Subarea 58.7 as reported to CCAMLR are presented in Table 1.

Table 1: Catch history for *Dissostichus eleginoides* in Subareas 58.6 and 58.7 in the Convention Area, and Area 51 outside the Convention Area (source: STATLANT data for past seasons, fine-scale data for current season, WG-FSA-07/10 Rev. 5 and past reports for IUU catch in Subarea 58.7; IUU catches in Subarea 58.6 are described in the Crozet Island Fishery Report – Appendix M).

Fishing season	Reported catch (tonnes)				Estimated IUU catch (tonnes)	Total removal (tonnes)
	Area 51	Subarea 58.6	Subarea 58.7	Total		
1995/96	0	73	869	942	4958	5900
1996/97	0	53	1193	1246	7327	8573
1997/98	0	267	637	903	598	1501
1998/99	0	275	301	576	173	749
1999/00	0	79	1015	1094	191	1285
2000/01	0	36	235	271	120	391
2001/02	0	67	98	165	78	243
2002/03	46	39	219	304	120	424
2003/04	33	71	133	237	48	285
2004/05	53	79	142	274	60	334
2005/06	22	27	124	172	0	172
2006/07	37	24	101	163	0	163

4. The status of the resource within the South African EEZ was assessed in WG-FSA-07/34 Rev. 1. For that assessment, the removals from the South African EEZ were estimated (Table 2). The reported catch column includes catches taken in the South African EEZ within Subareas 58.6 and 58.7 as well as catches from Area 51 outside the CCAMLR region (Figure 1). In WG-FSA-07/34 Rev. 1 the authors noted that the reported catches substantially underestimate total mortality, as losses through depredation by cetaceans are not included.

Table 2: Catch history for *Dissostichus eleginoides* in the South African EEZ as used in the assessment (source: WG-FSA-07/34 Rev. 1). The limited data for 1996 have been pooled with the 1996/97 season and catches for 2006/07 are based on part of a year only. Cetacean depredations, not included in the totals, are reported as beginning in 2000/01 and now constitute up to twice the total catch (e.g. total removals in 2006/07 would be 804 tonnes).

Fishing season	Vessels (non-IUU)	Catch limit (tonnes)	Reported landed catch (tonnes)	Estimated IUU catch (tonnes)	Total removals (tonnes)
1996/97	7	2 500	2 921	21 350	24 271
1997/98	4	3 000	1 011	1 808	2 819
1998/99	4	2 750	956	1 014	1 970
1999/00	3	2 250	1 562	1 210	2 772
2000/01	5	2 250	352	352	704
2001/02	2	600	200	306	506
2002/03	2	500	313	256	569
2003/04	2	500	268	156	424
2004/05	2	450	235	156	388
2005/06	1	450	165	156	203
2006/07	2	450	112	156	268

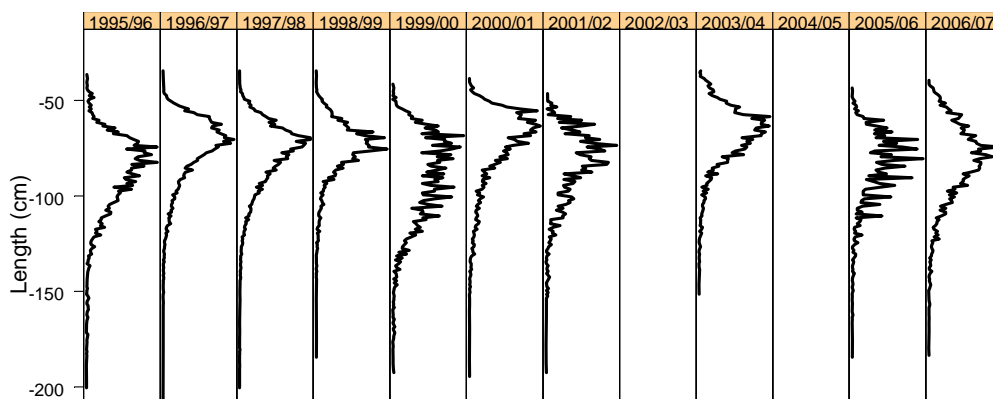
1.2 IUU catch

5. The estimated IUU catch in Subarea 58.7 is presented in Table 1 (IUU catches in Subarea 58.6 are described in the Crozet Island fishery report – Appendix M), whereas the estimated IUU catch from the South African EEZ (as used in the assessment in WG-FSA-07/34 Rev. 1) is presented in Table 2.

6. IUU fishing has occurred since at least 1995 (and possibly 1994), and initially the estimated IUU catch within the South African EEZ substantially exceeded the reported catch (Table 2). The IUU catch in the South African EEZ prior to 2003 (Table 2) was estimated as the sum of the IUU catch estimated for Subarea 58.7 and 50% of that estimated for Subarea 58.6 (Brandão et al., 2002). For 2003 to 2004 the IUU catch estimates are based on the number and duration of fishing activities of illegal vessels known, or believed, to have operated in the South African EEZ and on the average green weight tonnages from vessels operating legally in that area in the corresponding years (WG-FSA-05/58). The same amount of illegal take was assumed for 2005, 2006 and 2007 as for 2004 (WG-FSA-07/34 Rev. 1). Note that CCAMLR records indicated only one reported IUU vessel in this area during 2004, whereas other intelligence reports indicated that at least three IUU vessels were seen within the South African EEZ (WG-FSA-05/58). The latest IUU reports record a single vessel in Subarea 58.6 in 2005/06, which may or may not have been within the South African EEZ (WG-FSA-07/10 Rev. 5).

1.3 Size distribution of catches (time series)

7. Catch-weighted length frequencies for *D. eleginoides* caught by longline are presented in Figure 2. The data cover the period 1995/96 to the current season, except for 2002/03 and 2004/05 where fine-scale catch data are not available in the CCAMLR database. Most *D. eleginoides* caught by longline range from 50 to 120 cm in length, with a mode at approximately 60 to 90 cm.



Weighted Frequency (proportion of the catch)

Figure 2: Catch-weighted length frequencies for *Dissostichus eleginoides* caught by longline in the South African EEZ in Subareas 58.6 and 58.7 (source: observer, fine-scale and STATLANT data; there were no fine-scale data available for 2002/03 and 2004/05).

2. Stocks and areas

8. The South African EEZ around the Prince Edward Islands is mainly in Subarea 58.7 but extends east into Subarea 58.6, south into Division 58.4.4, and north of the Convention Area into Area 51 (Figure 1). However, there are currently no fishing grounds in the south of the South African EEZ. The majority of the fishery occurs down to about 1 500 m, but fishing depths in excess of 2 000 m have been recorded. Subarea 58.6 also includes the Crozet Islands to the east of the Prince Edward Islands. The current stock assessments do not consider the possibility that these island groups share the same toothfish stock.

3. Parameter estimation

3.1 Biological parameters

9. None of the parameters used in the assessment were derived specifically from this fishery, rather they have been assumed from work on toothfish in other areas within the Convention Area. The parameter values now used in the assessment are similar to those used in Subarea 48.3 (WG-FSA-07/53 Rev. 1) and indicate a stock of lower productivity.

Table 3: Parameter values used in the assessment of the toothfish stock in the South African EEZ at the Prince Edward Islands (source: WG-FSA-07/34 Rev. 1).

Component	Parameter	Value	Units
Natural mortality	M	0.13	y^{-1}
VBGF	K	0.067	y^{-1}
VBGF	t_0	-1.49	y
VBGF	L_{∞}	152.0	cm
Length to mass	' a '	2.54E-05	cm, kg
Length to mass	' b '	2.8	
Age-at-maturity	t_m	13	y
Age-at-recruitment	a_m	6	y
Steepness	h	0.75	

Standardised CPUE

10. Longline CPUE was standardised by applying only a log-linear model as described in Appendix 2 of WG-FSA-07/34 Rev. 1. This included interaction terms between year and area and year and month. The indices for each year were calculated by summing over the four areas within a year and month, weighting by the total area, and then averaging over the months. The Generalised Linear Mixed Model (GLMM) fitted in 2005/06 was not repeated. Catch rates were also standardised after inclusion of the estimated cetacean depletions.

Table 4: Standardised longline CPUE by season for *Dissostichus eleginoides* in the South African EEZ at the Prince Edward Islands (source: WG-FSA-07/34 Rev. 1). The indices for the 2006/07 season are based on data for part of a year only.

Fishing season	Log-linear CPUE (2006/07)	Log-linear CPUE (including cetacean predation)
1996/97	4.665	4.665
1997/98	1.229	1.229
1998/99	1.071	1.071
1999/00	0.623	1.038
2000/01	0.381	0.890
2001/02	0.393	1.180
2002/03	0.503	1.508
2003/04	0.286	0.857
2004/05	0.531	1.594
2005/06	0.317	0.952
2006/07	0.427	1.280

4. Stock assessment

4.1 Model structure and assumptions

11. A two-fleet age-structured production model (ASPM) was used to update the assessment of the status of the *D. eleginoides* resource in the South African EEZ at the Prince Edward Islands (WG-FSA-07/34 Rev. 1). The methodology is presented in detail in Appendix 1 of that paper. Relative to the assessment presented in WG-FSA-06/58, further data became available from the last part of 2006 and from the 2007 season. The model continues to use biological parameters very similar to those currently used in Subarea 48.3.

4.2 Model estimates

12. The resource is estimated to be at about 37% of its average pre-exploitation level in terms of spawning biomass. Estimated exploited biomass and projections under three levels of future catches for the base-case ASPM from WG-FSA-07/34 Rev. 1 are presented in Figure 3. Further model estimates are available in WG-FSA-07/34 Rev. 1.

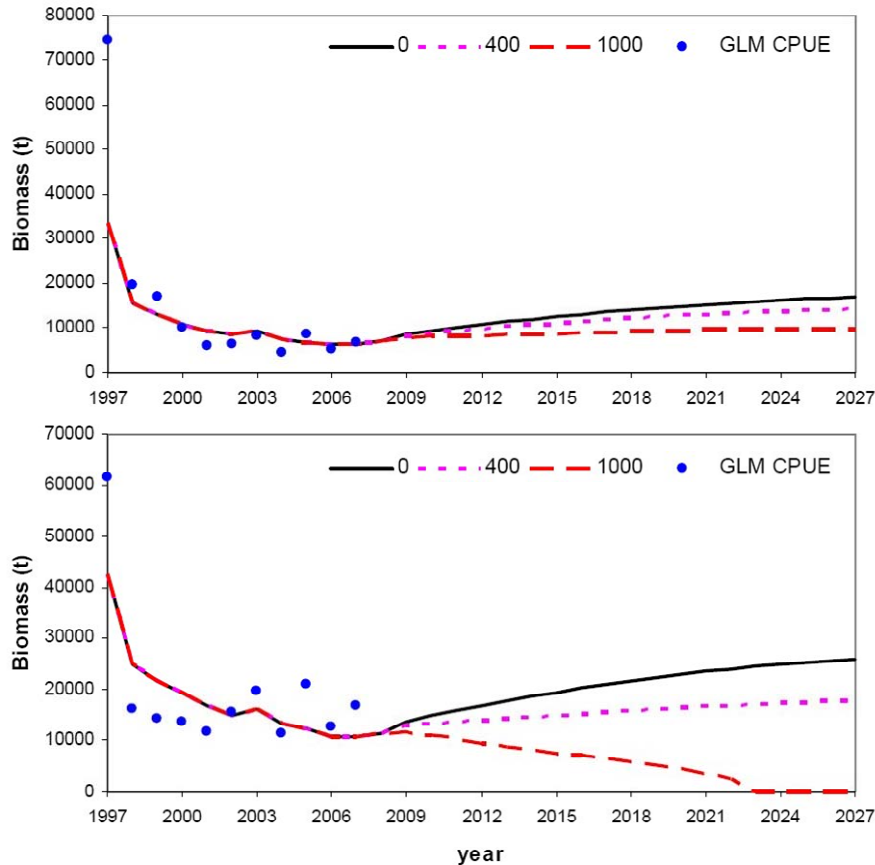


Figure 3: Log-linear standardised CPUE indices to which the ASPM was fitted (divided by the estimated catchability q to express them in biomass units) and estimated longline exploitable biomass, together with projections under future annual catches of 0, 400 and 1 000 tonnes (source: WG-FSA-07/34 Rev. 1). The upper panel is the 2006/07 base-case assessment and the lower panel is the same assessment with the inclusion of a maximum of 200% marine mammal depredation of catches. The base-case was fitted to CPUE and catch-at-length data (with a weight of 1.0 on the latter) with stochastic recruitment and a change in selectivity from 2003 onwards.

4.3 Sensitivity analyses

13. Two sensitivity tests were explored in WG-FSA-07/34 Rev. 1: the effect of the inclusion of up to 200% cetacean depredation and the removal of the extreme catch rate observed in 1996/97. With respect to the estimate of current spawning biomass relative to unfished spawning biomass, the inclusion of cetacean predation increased the estimate from about 37% to about 40%, while the exclusion of the 1996/97 CPUE index increased the estimate to about 38%.

4.4 Discussion of model results

14. The ASPM continues to show a reasonable fit to both the CPUE (except the initial high value) and the catch-at-length data. The exclusion of the 1996/97 CPUE index suggested

only a slightly better status for the resource. Previous assessments have indicated that the CPUE data and the catch-at-length data suggest different degrees of stock depletion. With the extra years of information, the two data sources now appear to be more consistent in their implications. The inclusion of cetacean predation also made little difference to the outcomes of the assessment.

15. At WG-FSA-SAM-06, it was suggested that a GLMM could be used in the analysis of CPUE. This was implemented, but the results were only used in the previous assessment as a sensitivity test (WG-FSA-06/58). In the present assessment, the analysis was restricted to more standard GLMs. It was recommended that the results from a GLMM continue to be used in a sensitivity test relative to the base case. The two-fleet implementation of the ASPM is an improvement over the previous model implementation. The model code, data and parameter initiation files have been deposited with the CCAMLR Secretariat.

16. The Working Group also noted that the advice on appropriate levels of future catch yield provided in the paper was not based on the CCAMLR decision rules.

4.5 Future research requirements

17. The Working Group encouraged South Africa to consider:

- (i) requesting that, rather than making assumptions about cetacean depredations, scientific observers on board its vessels should report on the extent of cetacean activity and to collect data on toothfish remains on longline hooks evidencing cetacean predation;
- (ii) in the absence of research surveys to consider a ‘commercial survey’ conducted as a component of commercial operations whereby certain locations are fished in a systematic manner each year to provide an index that is comparable over time.

5. By-catch of fish and invertebrates

5.1 Estimation of by-catch removals

18. Estimated annual by-catch removals from the longline fishery for *D. eleginoides* in the South African EEZ in Subareas 58.6 and 58.7, and Area 51, are reported in Table 5. The Working Group noted that the voluntary submission of accurate fine-scale data is still considered to be problematic and encouraged South Africa to submit more fine-scale data in the future.

Table 5: Catch history for by-catch species (macrourids, rajids and other species) taken in the longline fishery for *D. eleginoides* in the South African EEZ in Subareas 58.6 and 58.7 in the Convention Area, and Area 51 outside the Convention Area (source: fine-scale data).

Season	Macrourids				Rajids				Other species			
	Reported catch (tonnes)				Reported catch (tonnes)				Reported catch (tonnes)			
	51	58.6	58.7	Total	51	58.6	58.7	Total	51	58.6	58.7	Total
1995/96	0	0	0	0	0	0	0	0	0	0	0	0
1996/97	0	0	0	0	0	0	0	0	0	0	0	0
1997/98	0	0	0	0	0	0	1	1	0	0	1	1
1998/99	0	0	0	0	0	0	0	0	0	0	0	0
1999/00	15	12	47	74	2	2	3	7	4	0	7	11
2000/01	8	2	13	22	0	0	0	1	1	0	1	2
2001/02	3	2	2	7	0	0	0	0	0	0	0	0
2002/03*	-	-	-	-	-	-	-	-	-	-	-	-
2003/04	0	0	0	1	0	0	0	0	0	0	0	0
2004/05	0	0	0	0	0	0	0	0	0	1	45	47
2005/06	2	1	8	12	0	0	0	0	1	0	0	1
2006/07	3	2	5	10	0	0	0	0	1	0	1	2

* No fine-scale data

5.2 Assessments of impact on affected populations

19. It was not possible to assess the impacts on affected populations.

5.3 Mitigation measures

20. There are no mitigation measures in force to reduce fish and invertebrate by-catch.

6. By-catch of birds and mammals

6.1 Estimation of longline by-catch removals

21. Details of seabird by-catch (SC-CAMLR-XXVI, Annex 6, Part II, Table 2) are summarised in Table 6. Estimated potential seabird removals in the IUU fishery are summarised in SC-CAMLR-XXVI/BG/32.

Table 6: Estimated by-catch of seabirds in the South African EEZ in Subareas 58.6 and 58.7.

Fishing season	By-catch rate (birds/thousand hooks)	Estimated by-catch
1996/97	0.52	834
1997/98	0.194	528
1998/99	0.034	156
1999/00	0.046	516
2000/01	0.018	199
2001/02	0	0
2002/03	0.003	7
2003/04	0.025	39
2004/05	0.149	76
2005/06	0	0
2006/07	0	0

22. Ad hoc WG-IMAF assessed the level of risk of incidental mortality of seabirds in the fishery in the South African EEZ at the Prince Edward Islands (in both Subareas 58.6 and 58.7) as category 5 (high) (SC-CAMLR-XXVI/BG/31). For new and exploratory fisheries in areas of this risk level category, WG-IMAF recommendations are set out in SC-CAMLR-XXVI, Annex 6, Part II, Table 20.

6.2 Pot fishery by-catch

23. This fishery was active only in 2004 and 2005. No by-catch of seabirds or mammals was observed in this fishery.

6.3 Mitigation measures

24. South Africa has consistently required the application in this area of the mitigation measures recommended by CCAMLR with the exception of a closed season.

6.4 Interactions involving marine mammals with longline fishing operations

25. On one vessel, some limited observations by the industry in the 2004/05 season indicated a loss of two toothfish to toothed cetaceans for each whole toothfish landed when longlines were hauled. Longline operations are now concentrated in shallower waters to attempt to minimise such losses. The Working Group noted that this level of cetacean predation is much greater than suspected for other toothfish fisheries, and encouraged the deployment of a scientific observer by South Africa to gather further data on this (see also paragraph 17).

26. No marine mammal injuries or deaths were reported during the 2005/06 season (WG-FSA-07/8 Rev. 1, paragraphs 6 and 7).

7. Harvest controls and management advice

7.1 Management advice inside the EEZ

27. In 2005, the Scientific Committee noted that the advice on the appropriate levels of future catch provided in WG-FSA-05/58 (see also WG-FSA-06/58 and 07/34 Rev. 1) was not based on the CCAMLR decision rules. Therefore, the Working Group was unable to provide management advice for the fishery in the South African EEZ at the Prince Edward Islands. The Working Group recommended that CCAMLR decision rules also be used in estimating yields for this fishery and that the concerns over the sensitivity of the ASPM to weightings used for different data sources and the estimation of recruitment levels for forward projections be noted.

7.2 Management advice outside the EEZ

28. No new information was available on the state of fish stocks in Subareas 58.6 and 58.7 and Division 58.4.4 outside areas of national jurisdiction. The Working Group therefore recommended that the prohibition of directed fishing for *D. eleginoides*, described in Conservation Measures 32-10, 32-11 and 32-12, remain in force.

Reference

Brandão, A., D.S. Butterworth, B.P. Watkins and D.G.M. Miller. 2002. A first attempt at an assessment of the Patagonian toothfish (*Dissostichus eleginoides*) resource in the Prince Edward Islands EEZ. *CCAMLR Science*, 9: 11–32.