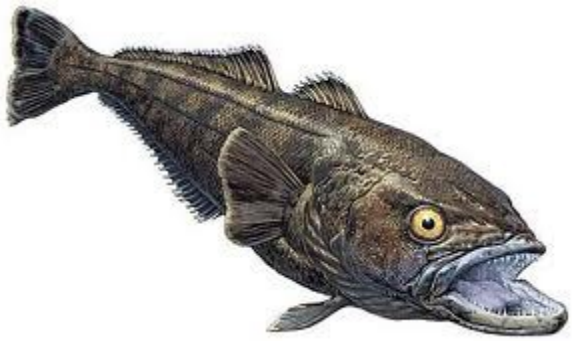
APPENDIX VIII – Stock Status Report – Patagonian toothfish

STATUS REPORT

Dissostichus eleginoides

Common Name: Patagonian toothfish

FAO-ASFIS Code: TOP



2014

Updated: 9-Oct-14

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1. Description of the fishery

1.1. *Description of fishing vessels and fishing gear*

Fishing for Patagonian toothfish in the SEAFO CA started around 2002. The main fishing countries working in the area include vessels from Japan, South Korea, Spain and South Africa. Historically a maximum of four vessels per year fished in the SEAFO CA. The Spanish longline system and the Trotline (Fig. 1) are the fishing gears commonly used.

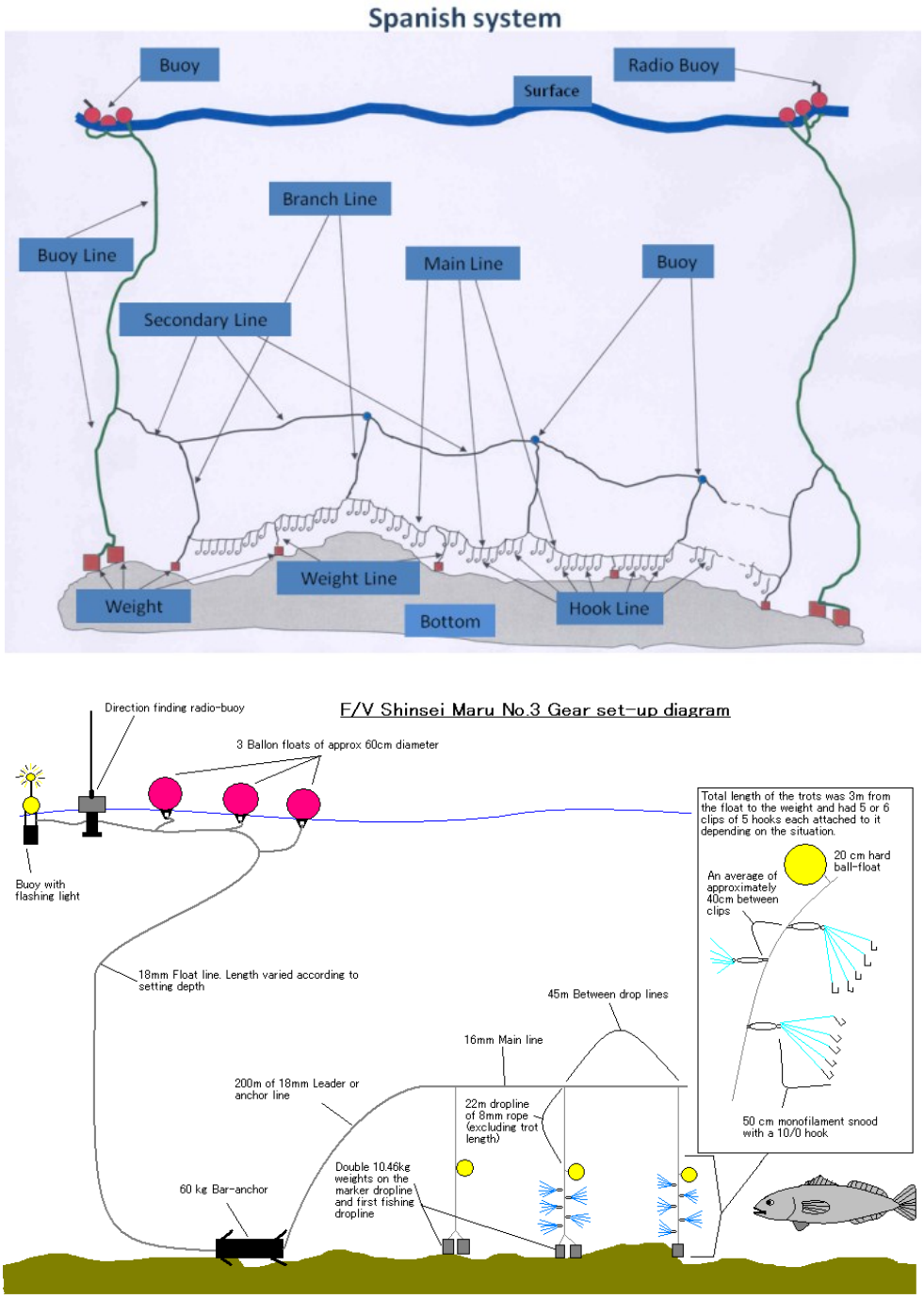
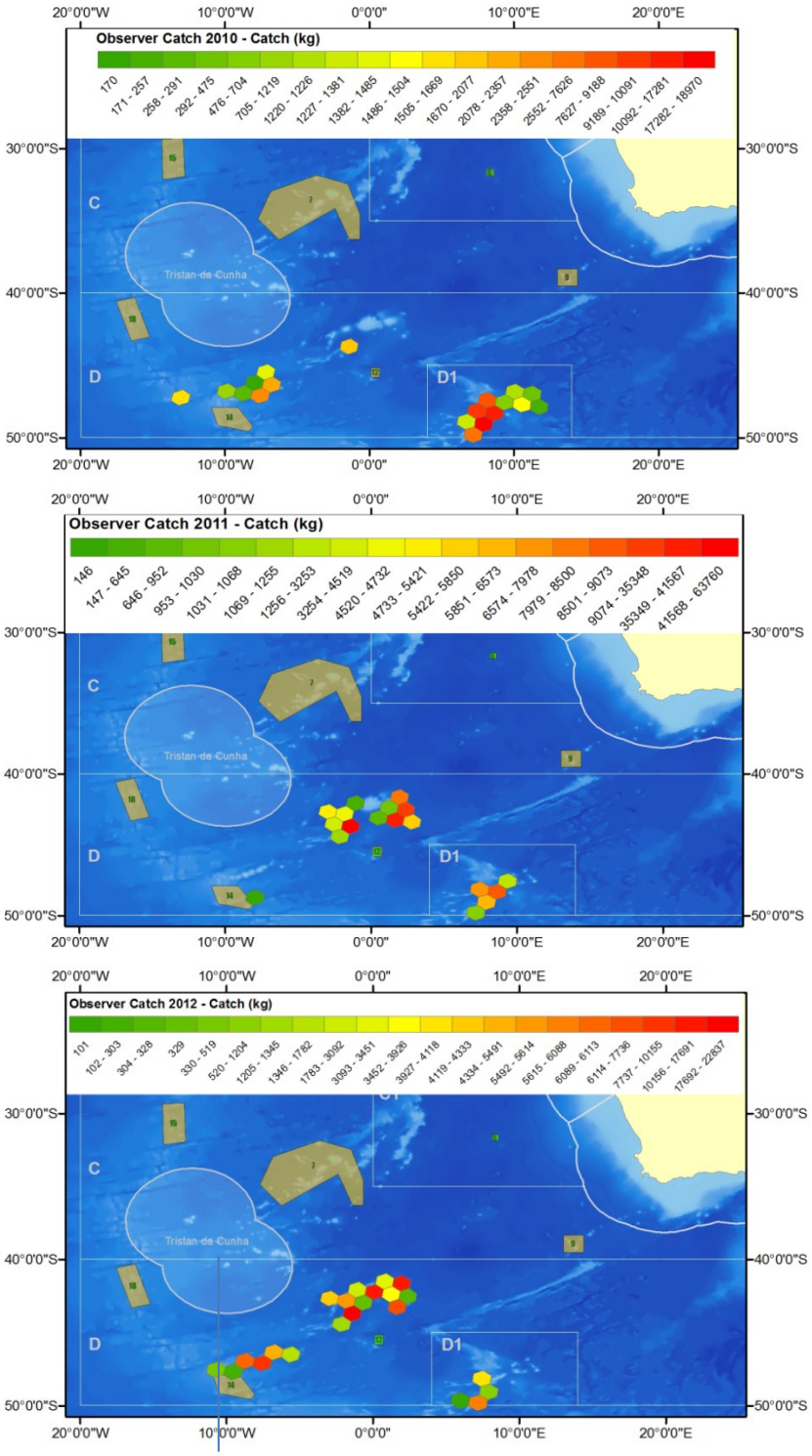


Figure 1: Fishing gears used to fish *D. eleginoides*: Spanish longline system (top) and the Trotline (bottom).

1.2. *Spatial and temporal distribution of fishing*

In SEAFO CA, the fishery from 2010 to 2013 took place in Sub-Area D, being concentrated over seamounts in Division D1, at Discovery seamount and also at seamounts located in the western part of Sub-Area D (Fig. 2).



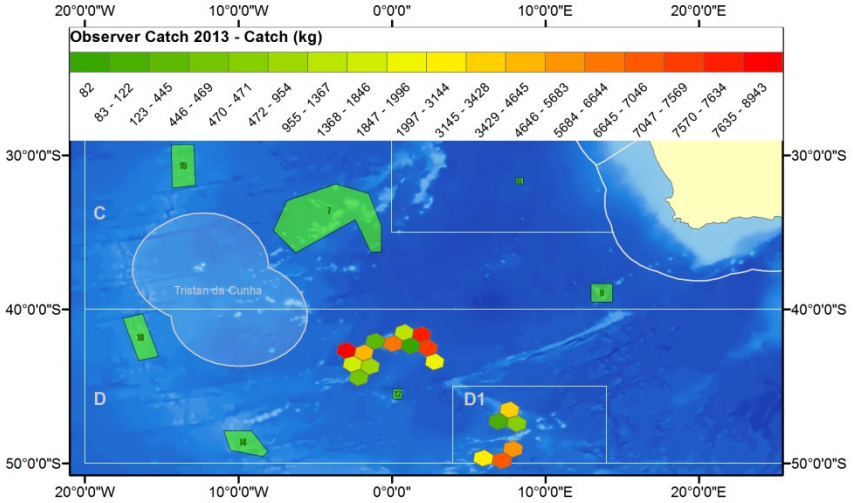


Figure 2: Reported catch of Patagonian toothfish (*Dissostichus eleginoides*) aggregated to 100km diameter hexagonal cells (2010, 2011, 2012 and 2013).

Table 1: Number of sets by year and location.

Year	Western	Discovery	D1- Meteor
2010	27	5	118
2011	1	207	54
2012	68	207	25
2013	0	108	57
2014	0	56	0

Table 1 shows that the main fishing ground is located on Discovery seamount and also in D1 but less hauls were deployed in the western seamounts of Sub-Area D.

1.3. *Reported retained catches and discards*

Table 2 presents data on Patagonian toothfish catches and discards listed by country, as well as fishing gear used and the management area from which catches were taken. Annual catches varied between 18t (2002) and 393t (2003). Discards were mainly due to parasite infection of fish. In the last three years with complete data (2011, 2012 and 2013) retained catches were 202, 122 and 60 t respectively and the annual weight of discarded specimens was 6, 3 and 3 t in the three year period.

Table 2: Catches (tons) of Patagonian toothfish (*Dissostichus eleginoides*) by South Africa, Spain, Japan and Korea.

Nation	Spain		Japan				Korea				South Africa			
Fishing method	Longlines		Longlines				Longlines				Longlines			
Management Area	D0		D0		D1		D0		D1		D0		D1	
Catch details (t)	Retained	Discarded	Retained	Discarded	Retained	Discarded	Retained	Discarded	Retained	Discarded	Retained	Discarded	Retained	Discarded
2002	18													
2003	101		47				245							
2004	6		124											
2005	N/F	N/F	158				15							
2006	11		155				7							
2007	N/F		166				247							
2008	N/F	N/F	122	0	N/F	N/F	79							
2009	N/F	N/F	86	0	74	0	16	0	46	0	N/F	N/F	N/F	N/F
2010	26	0	N/F	N/F	54	2	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2011	N/F	N/F	159	6	N/F	N/F	N/F	N/F	N/F	N/F	15	0	28	0
2012	N/F	N/F	86	3	N/F	N/F	N/F	N/F	N/F	N/F	24	0	12	0
2013	N/F	N/F	41	2	19	1	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2014*	N/F	N/F	26**		N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F

N/F = No Fishing. Blank fields = No data available. *Provisional (Aug 2014). **Based on 5-day reports.

Retained and discarded bycatch from the patagonian toothfish fishery are presented in Table 3. The two most important species (in terms of weight) are grenadiers (GRV) and Blue antimora (ANT).

Table 3: Retained and discarded bycatch from the Patagonian toothfishfisheries (kg).

	2009				2010				2011		2012				2013			
	Retained		Discarded		Retained		Discarded		Retained	Discarded	Retained		Discarded		Retained		Discarded	
Species	D0	D1	D0	D1	D0	D1	D0	D1	D0	D0	D0	D1	D0	D1	D0	D1	D0	D1
GRV			89	5 833	4 047	1 936	93	2 601		22 414			23 705	186			7 273	869
ANT			126	4 786			453	1 348		4 794			4 442	65			796	610
BYR	1 221		573															
MCC			336	896														
BYR																		
BEA	360																	
MZZ								168										
SRX										30			124				20	
MRL			108					1		2			37				1	
COX			2							21			75					
SKH			90															
LEV			36				4											
KCX				1			3	35									83	10
HYD													31				17	
BUK							17											
NOX										7								
MWS										6								
ETF																	3	
SEC													2					
SSK							2											
CKH							1	1										
KCF			1															

ANT: Blue antimora (*Antimora rostrata*); BEA: Eaton's skate (*Bathyraja eatonii*); BYR: Kerguelen sandpaper skate (*Bathyraja irrasa*); COX: Conger eels, etc. nei (*Congridae*); CKH: Abyssal grenadier (*Coryphaenoides armatus*); BUK: Butterfly kingfish (*Gasterochisma melampus*); HYD: Ratfishes nei (*Hydrolagus spp*); LEV:Lepidion codlings nei (*Lepidion spp*); KCX: King crabs, stone crabs nei (*Lithodidae*); MCC: Ridge scaled rattail (*Macrourus carinatus*); GRV: Grenadiers nei (*Macrourus spp*); MWS: Smallhead moray cod (*Muraenolepis microcephalus*); MRL: Moray cods nei (*Muraenolepis spp*); NOX:Antarctic rockcods, noties nei (*Nototheniidae*); MZZ: Marine fishes nei (*Osteichthyes*); KCF: Globose king crab (*Paralomis formosa*); Blackbelly lantern shark (*Etmopterus lucifer*); SEC: Harbour seal (*Phoca vitulina*); SRX: Rays, stingrays, mantas nei (*Rajiformes*); SKH: Various sharks nei (*Selachimorpha(Pleurotremata)*); (Rajiformes); SSK: Kaup's arrowtooth eel (*Synaphobranchus kaupii*).

1.4. *IUU catch*

IUU fishing activity in the SEAFO CA has been reported to the Secretariat latest in 2012, but the extent of IUU fishing is at present unknown.

2. Stock distribution and identity

Patagonian toothfish is a southern circumpolar, eurybathic species (70-1600m), associated with shelves of the sub-Antarctic islands usually north of 55ºS. Young stages are pelagic (North, 2002). The species occurs in the Kerguelen-Heard Ridge, islands of the Scotia Arc and the northern part of the Antarctic Peninsula (Hureau, 1985; DeWitt et al., 1990). This species is also known from the southern coast of Chile northward

to Peru and the coast of Argentina, especially in the Patagonian area (DeWitt, 1990), and also present in Discovery and Meteor seamounts in the SE Atlantic (Figure 3) and El Cano Ridge in the South Indian Ocean (López-Abellán and Gonzalez, 1999, López-Abellán, 2005).

In SEAFO CA the stock structure of the species is unknown. The CCAMLR Scientific Committee in 2009 noted that in most years (since 2003) the main species caught in CCAMLR sub-area 48.6 (adjacent to and directly south of SEAFO Division D) is *D. eleginoides*. The distribution of the species appears to be driven by the sub-Antarctic front which extends into the SEAFO CA.

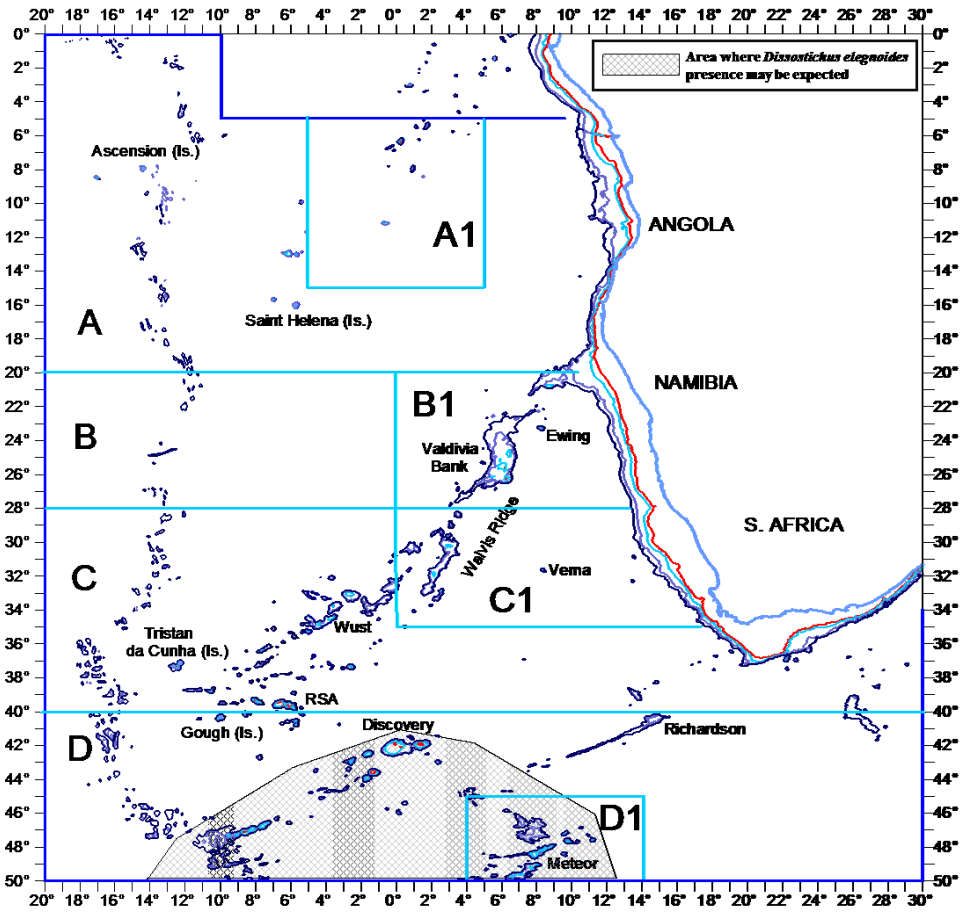


Figure 3: Species geographical distribution in the SEAFO CA (source: Species profile on the SEAFO website).

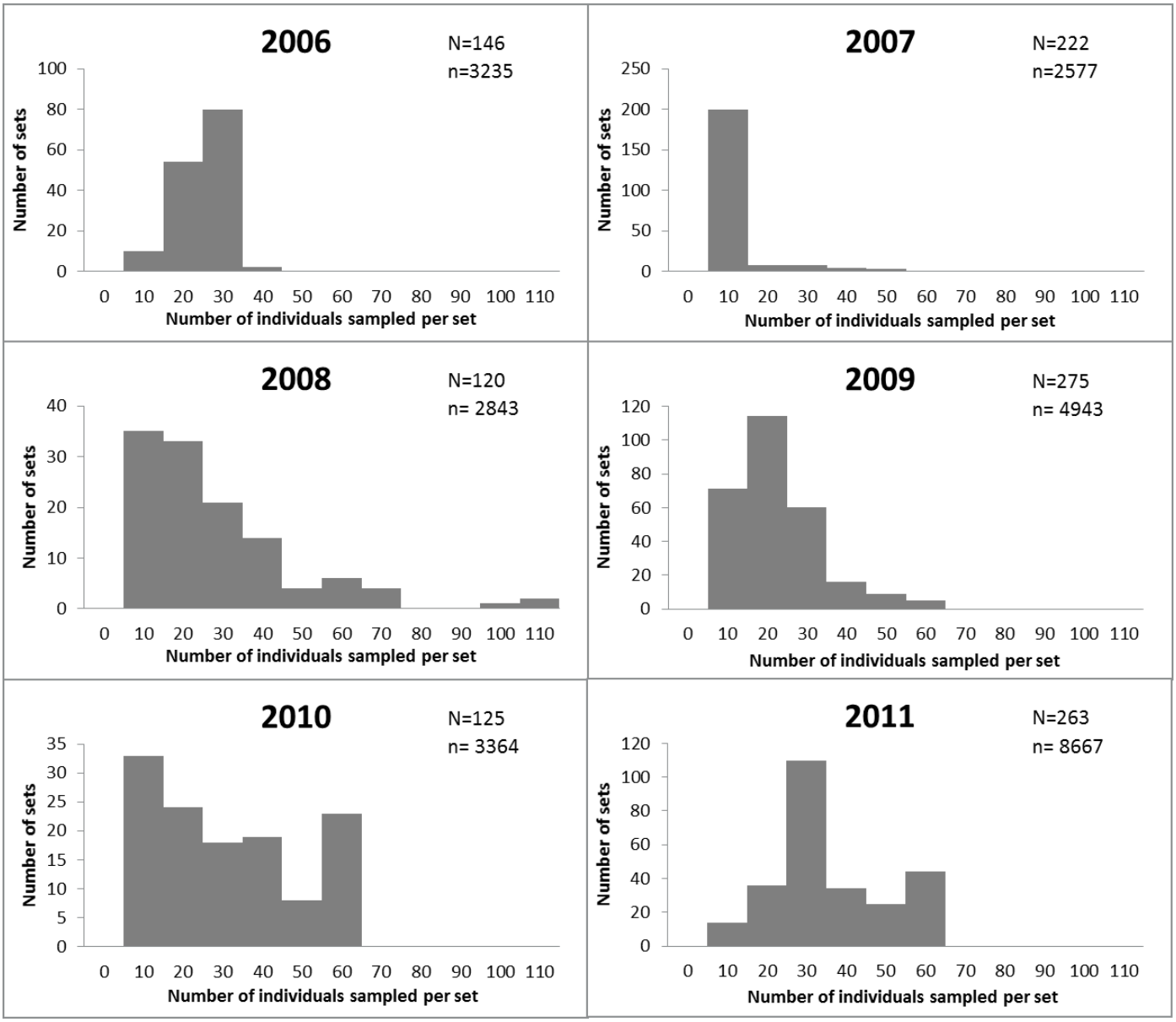
3. Data available for assessments, life history parameters and other population information

3.1. *Fisheries and surveys data*

The number of fishing sets sampled from 2006 onwards indicates a good sampling level in line with the SEAFO preliminary guidelines for data collection (Table 4). On average 20 specimens were measured per sampled fishing set, which is considered acceptable given the length range of the exploited population. It will be necessary to apply in future this sampling effort of 20 individuals in all sampled fishing sets (Figure 4).

Table 4: Annual analysis of sampling effort conducted on board fishing vessel.

Year	No. of Sets sampled	Mean number of Individuals sampled per set	Min. Individuals sampled per set	Max. Individuals sampled per set	Mean sample size/tonne
2006	146	22.16	1	31	-
2007	222	11.61	1	57	-
2008	120	23.69	2	110	-
2009	275	17.97	1	58	0.13
2010	125	26.91	1	60	0.32
2011	263	32.95	1	60	0.16
2012	298	20.58	1	57	0.17
2013	164	19.87	1	70	0.32
2014	55	13.11	2	20	0.21



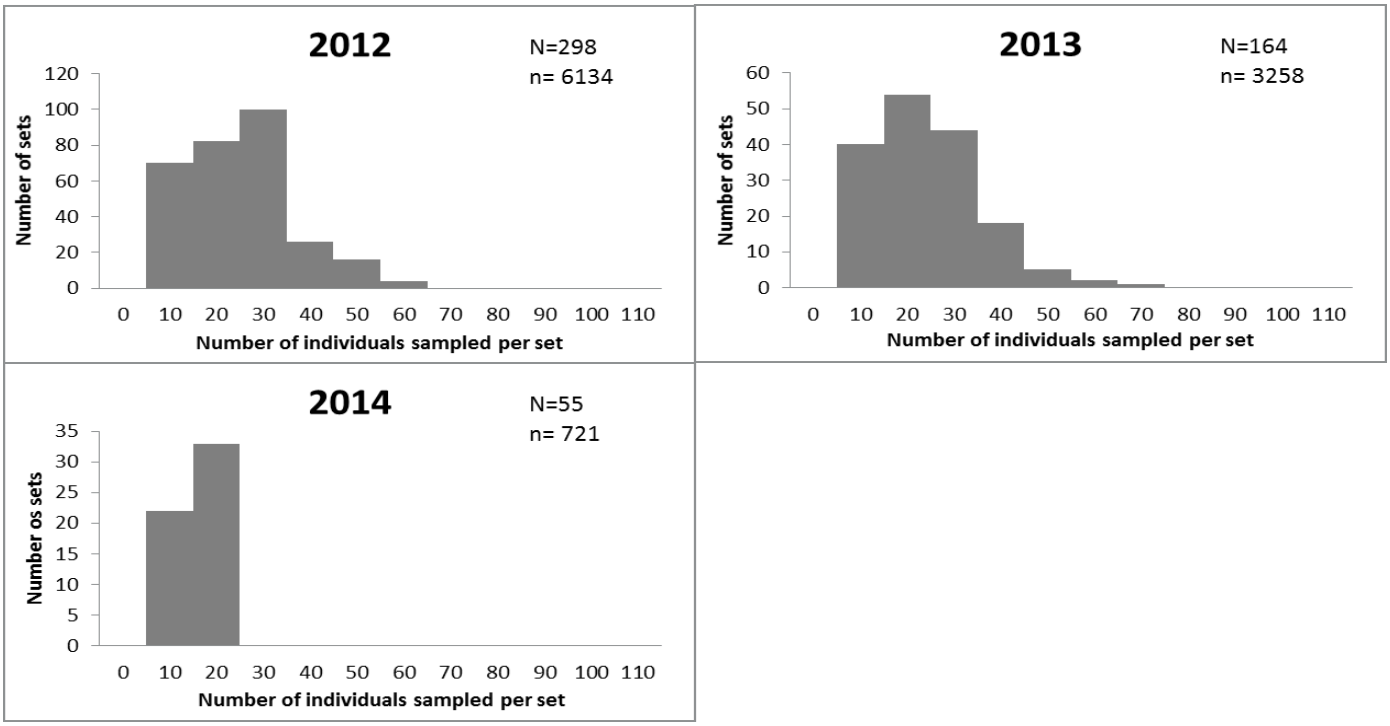


Figure 4: Frequency distribution of sample size per set. Data from Observer Reports submitted to SEAFO. N = number of sets sampled per year; n = total number of individuals sampled.

3.2. *Length data and frequency distribution*

Figure 5 shows the annual total length frequency distributions of Patagonian toothfish catches based on the observer data from all fleets submitted to SEAFO. Length frequency distributions for the period 2006-2013 suggest a shift towards smaller lengths in the catches in more recent years. The proportion of large fish appears to be declining.

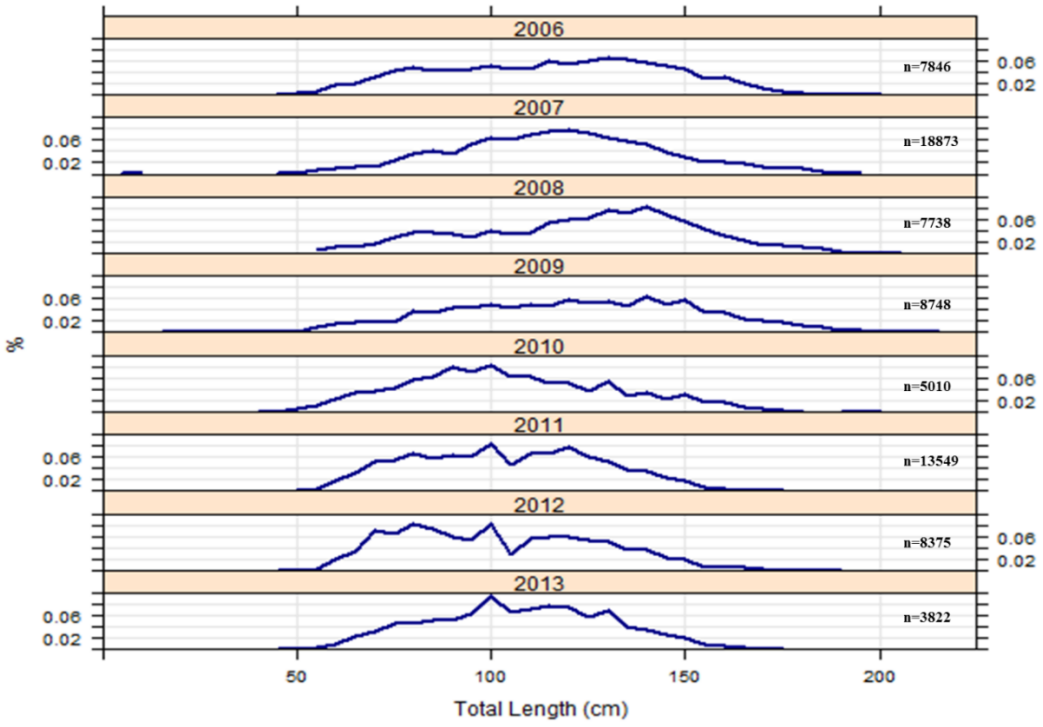


Figure 5: Annual total length frequency distributions *D. eleginoides* raised to total catches per year for SEAFO CA Sub-Area D.

3.3. *Length-weight relationships*

Table 5 shows the length-weight relationships by sex based on observer data from Japanese fleet in 2013.

Table 5: Length-weight relationships by sex (based on 2013 Japanese observer data)

Samples	a	b	r^2	n
Males	1E-06	3.4484	0.9768	405
Females	2E-06	3.4296	0.9579	860

3.4. *Age data and growth parameters*

There is no available information for this species in SEAFO CA.

3.5. *Reproductive parameters*

There is no available information for this species in SEAFO CA.

3.6. *Natural mortality*

There is no available information for this species in SEAFO CA.

3.7. *Feeding and trophic relationships (including species interaction)*

There is no available information for this species in SEAFO CA.

3.8. *Tagging and migration*

Eleven specimens were tagged in Subarea D in 2006 and fourteen in 2010 (Spanish flagged Viking Bay vessel). However, there is no available information on recoveries of tagged specimens or on tagged specimens tagged at adjacent areas of CCAMLR.

4. Stock assessment status

Previously two attempts of stock assessment were conducted using a Stock-Production Model (ASPIC). See SEAFO SC Report 2011 (Pages 80-81); and SEAFO SC Report 2013 (Pages 15-16).

In 2014 the Japanese and South African CPUE time-series (2010-2013 and 2011-2012, respectively) and global catch for 2002-2013 were used in an exploratory run of ASPIC, but due to the CPUE time-series being too short, the analyses were not considered appropriate as a basis for assessment and management advice. Japanese catch at length data for the years 2006-2013 was used for an exploratory LCA and yield per recruit analysis.

4.1. *Available abundance indices and estimates of biomass*

Currently the only data that can be used for the assessment of Patagonian toothfish abundance within the SEAFO CA are the catch and effort data. The time series of CPUE data based on observer reports submitted to SEAFO were insufficiently extensive to construct a reliable standardized CPUE trend (Japanese data 2010-2013, South Africa 2011-2012). It was indicated that a time-series of Japanese logbook data for the period 2003-2012 exists but not yet submitted to the SEAFO database thus not available for analyses in 2014.

4.2. *Data used*

Data were not used for formal assessments.

4.3. *Methods used*

No assessment was conducted, only exploratory analyses (see above).

4.4. *Results*

No validated assessment results can be provided, only considerations based on exploratory analyses. The trends in CPUE, length frequencies, results of the ASPIC run (although based on a too limited time-series), as well as the exploratory LCA and yield per recruit provided the same perception that the stock is not being overexploited.

4.5. *Discussion*

Unfortunately the time-series of CPUE data available for assessments remain too short to carry out reliable analyses. In the future, more extensive data series may become available (e.g. the Japanese logbook series 2003-2013), and the SC stressed the need to explore alternative assessment methods in addition to those explored until now. A further shortcoming is the uncertainty of the growth parameters of toothfish in the SEAFO CA.

4.6. *Conclusion*

The different exploratory analyses carried out this year suggest that the stock is not currently overexploited.

4.7. *Biological reference points and harvest control rules*

It is not currently possible to derive reference points in order to provide more robust evaluation of harvesting levels in relation to e.g. MSY or proxies thereof. No biomass estimates can be provided.

With the current perception of the exploitation of Patagonian toothfish, and based on available data on CPUE and catch, the SC expresses the opinion that a harvest control rule should be developed. A candidate HCR might be the following:

$$TAC_{y+1} = \begin{cases} TAC_y \times (1 + \lambda_u \times slope) & if \quad slope \geq 0 \\ TAC_y \times (1 + \lambda_d \times slope) & if \quad slope < 0 \end{cases}$$

Where 'Slope' = average slope of the Biomass Indicator (CPUE) in the recent 5 years; and
λu :TAC control coefficient if slope > 0 (Stock seems to be growing) : λu=1
λd :TAC control coefficient if slope < 0 (Stock seems to be decreasing) : λd=2

The TAC generated by this HCR is constrained to ± 5% of the TAC in the preceding year.

This HCR has been successfully applied by NAFO for Greenland halibut, a species with a life history strategy similar to that of Patagonian toothfish.

5. Incidental mortality and bycatch of fish and invertebrates

5.1. *Incidental mortality (seabirds, mammals and turtles)*

In the SEAFO database there are records of three seabirds having been caught during Japanese longline daytime fishing in 2014. The seabirds caught were recorded by the ID codes "PUG" – *Puffinus gravis* (Great shearwater) & "DIM" – *Thalassarche melanophris* (Southern black-browed albatross).

5.2. *Fish bycatch*

Table 3 shows the bycatch speciesin the Patagonian toothfish (*Dissostichus eleginoides)* Fishery and its weights based on the observer reports. SC noted that the major bycatch is grenadiers (Macrouridae - GRV) and the bycatch is discarded. The impact of this bycatch on grenadiers spp. is unknown.

5.3. *Invertebrate bycatch including VME taxa*

Table 6 shows the bycatch of VME species and its amount based on the observer data for the period 2010-2014. Figure 7 shows their geographic location.

Table 6: Bycatch from Patagonia toothfish fishery (kg).

	2010		2011	2012	2013	2014*
Species	**D**	**D1**	**D**	**D**	**D**	**D**
Gorgonians (Gorgoniidae)	33.9	13.6	3.8	30.3	1.2	2.3
Hard corals, madrepores nei (Scleractinia)	2.1	0.1	15.4	17.6		2.8
Black corals and thorny corals (Antipatharia)	3.9	0.5		0.2		
Basket and brittle stars (Ophiuroidea)	1.3	2.0				
Sea pens (Pennatulacea)	1.0	0.3		0.0		
Soft corals (Alcyonacea)	0.2	1.0		1.2		
Feather stars and sea lilies (Crinoidea)	0.9	0.1				

• Provisional (Aug 2014)

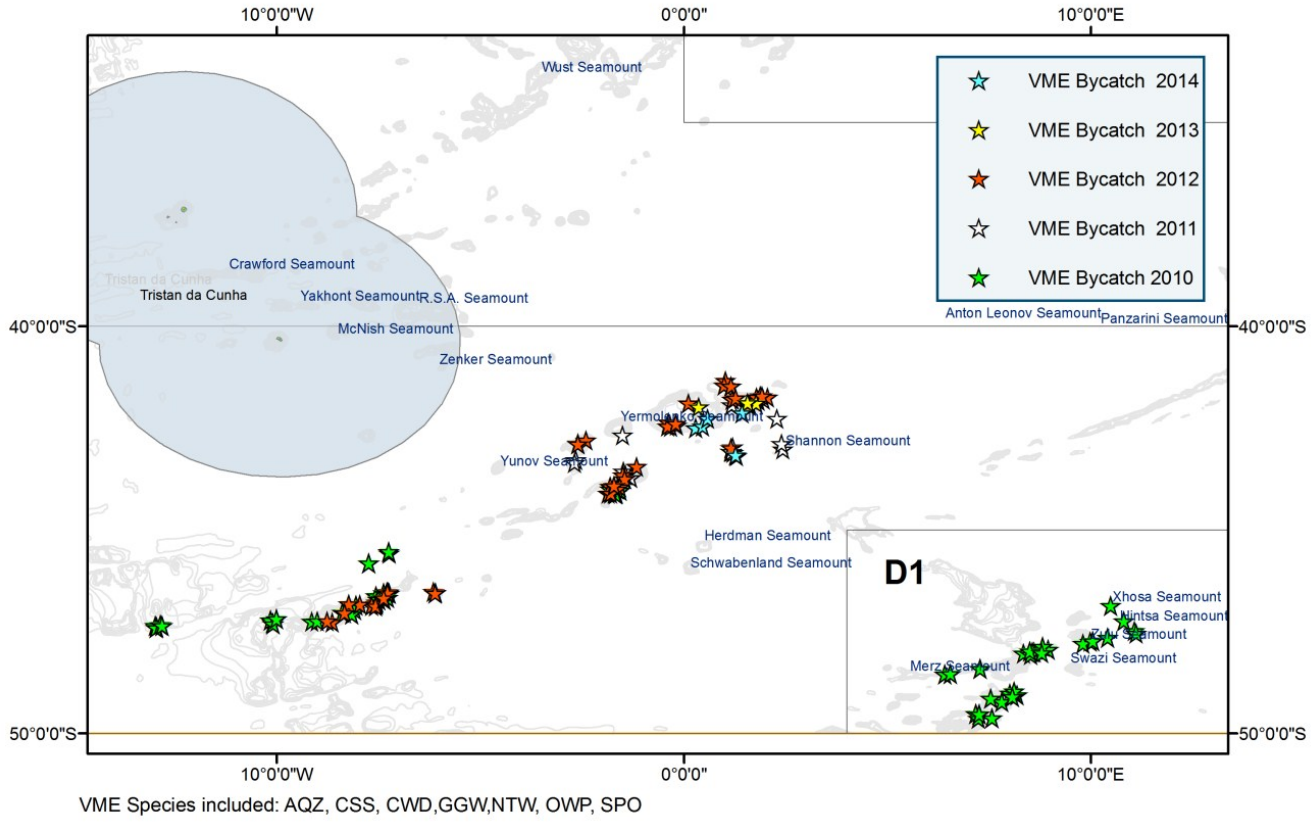


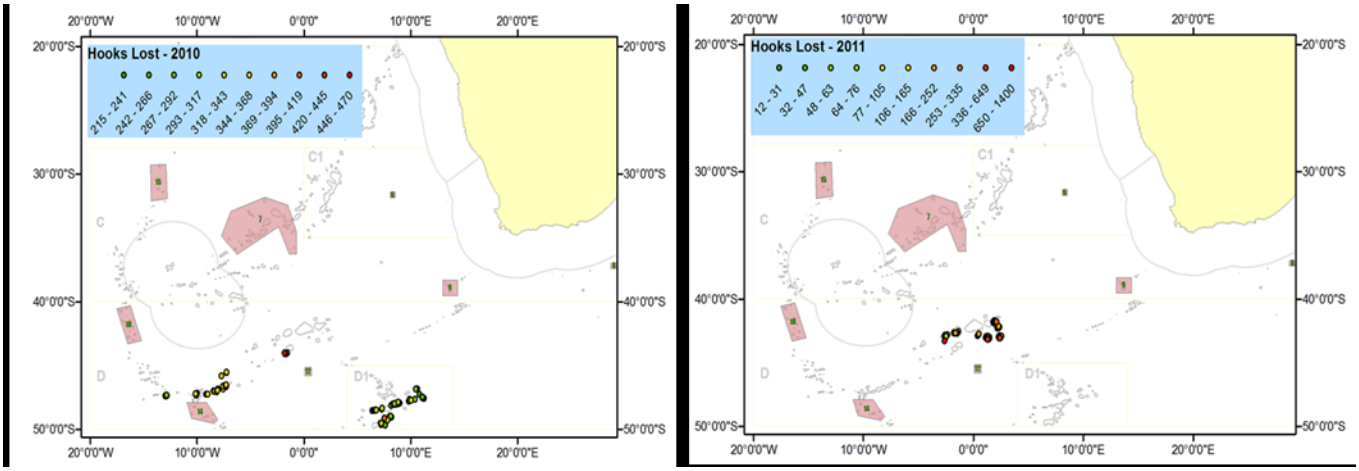
Figure 7: Locations for incidental bycatch of VME species from SEAFO Patagonian toothfish fishery.

5.4. *Incidental mortality and bycatch mitigation methods*

Offal dumping during hauling and bird scaring devices (Tori lines) are mandated to mitigate seabird bycatch.

5.5. *Lost and abandoned gear*

Figure 8 shows locations and amount of the lost gears based on the observer data from 2010 to 2013.



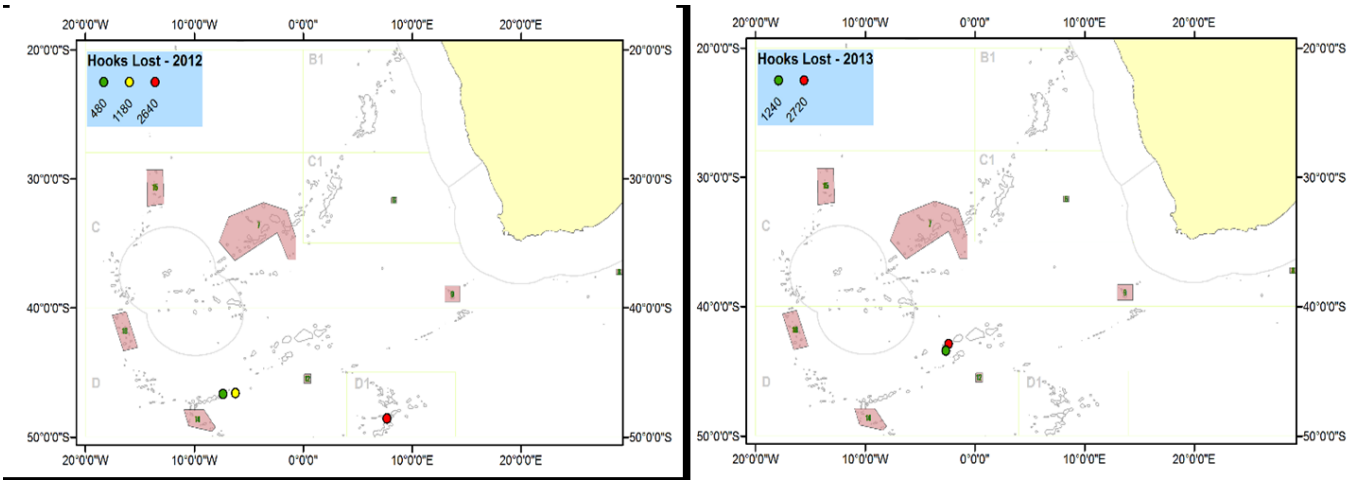


Figure 8: Locations and amount of the lost gears (hooks with attached short line) based on observer data (2011-2013).

5.6. *Ecosystem implications and effects*

There is no formal evaluation available for this fishery.

6. Current conservation measures and management advice

In 2013 the Commission adopted a TAC of 276t in Sub-Area D, and zero tonnes for the remainder of the SEAFO CA for 2014 and 2015 (CM 27/13). Thus, no TAC advice on Patagonian toothfish was provided for this year.

Table 7: Other Conservation Measures that are applicable to this fishery

Conservation Measure 04/06	On the Conservation of Sharks Caught in Association with Fisheries Managed by SEAFO
Conservation Measure 14/09	To reduce sea turtle mortality in SEAFO fishing operations.
Conservation Measure 25/12	On reducing incidental bycatch of Seabirds in the SEAFO Convention Area
Conservation Measure 18/10	Management of Vulnerable Deep Water Habitats and Ecosystems in the SEAFO Convention Area
Conservation Measure 27/13	Total Allowable Catches and related conditions for Alfonsino and Orange Roughy for 2014 for Patagonian Toothfish and Deep-Sea Red Crab for 2014 and 2015 in the SEAFO Convention Area.
Conservation Measure 26/13	Bottom fishing activities in the SEAFO Convention Area

The SC suggests that a harvest control rule (HCR) be adopted, and proposed such a rule in Section 4.7

7. References

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