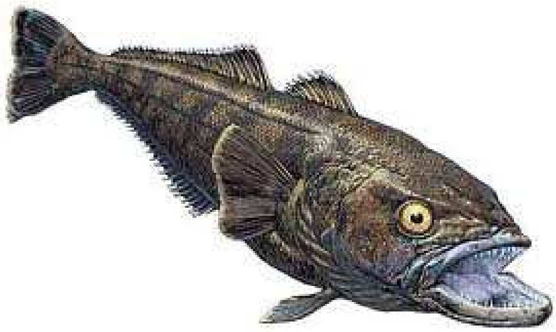
STATUS REPORT

Dissostichus eleginoides



2012

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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 Trot line (Fig. 1) are the fishing gears used.

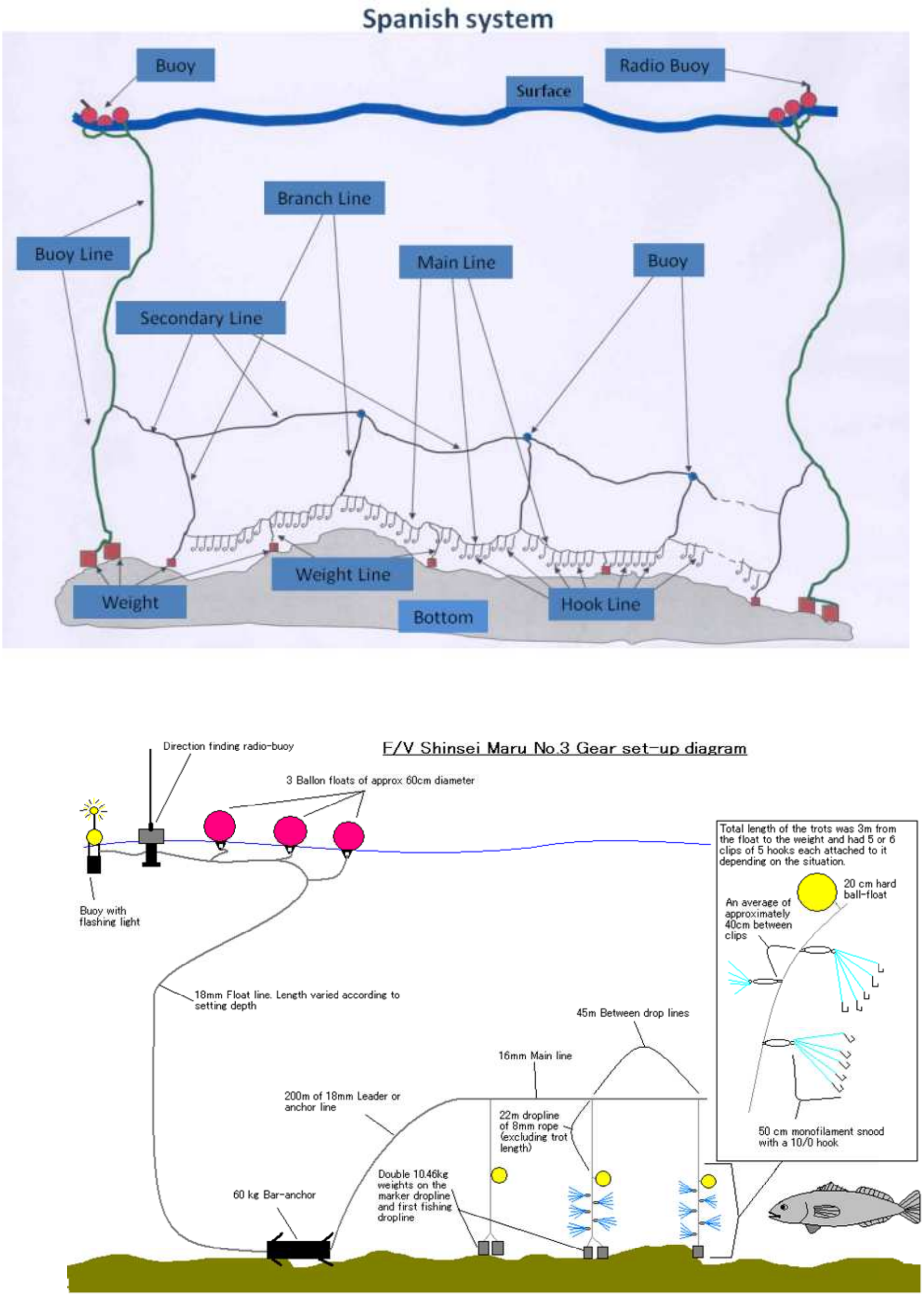


Figure 1 – Fishing gears used to fish *D. eleginoides*: Spanish longline system (top) and the Trot line (bottom).

1.2 Spatial and temporal distribution of fishing

In SEAFO CA, the fishery (2010-12) took place in Division D concentrating on seamounts in Subdivision D1, at Discovery seamount and also at seamounts located in the western part of Division D (Figs. 2-4).

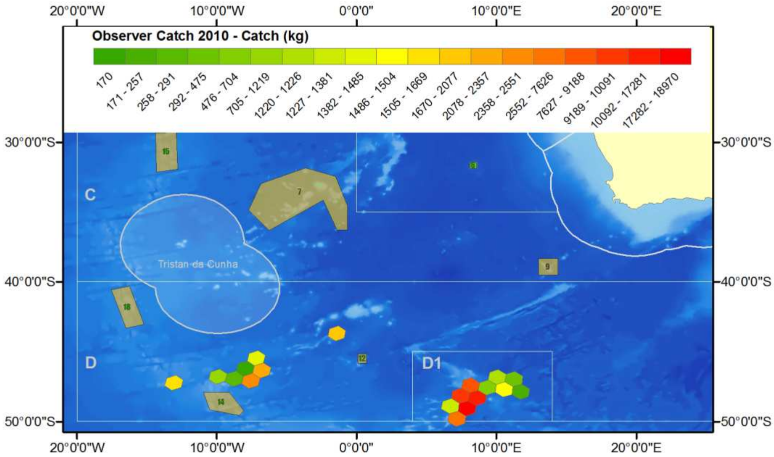


Figure 2 – Observer Catch of Patagonian toothfish (*Dissostichus* eleginoides) aggregated to 100km diameter hexagonal cells (2010).

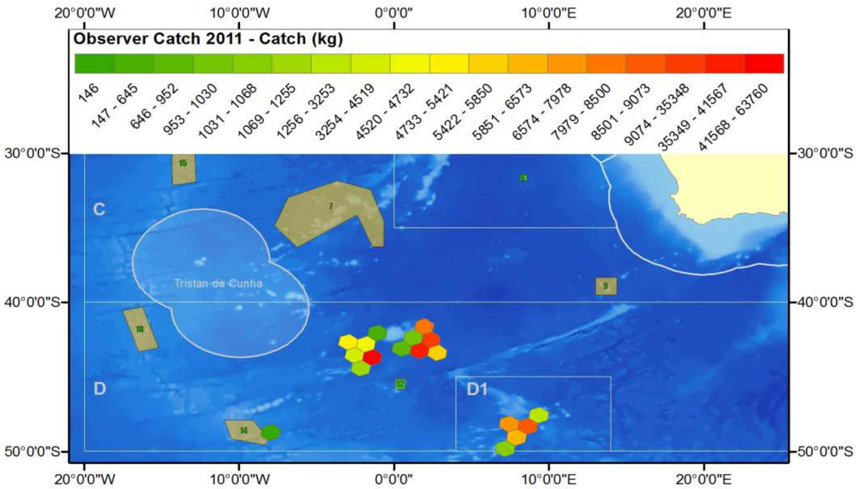


Figure 3 – Observer Catch of Patagonian toothfish (*Dissostichus* eleginoides) aggregated to 100km diameter hexagonal cells (2011).

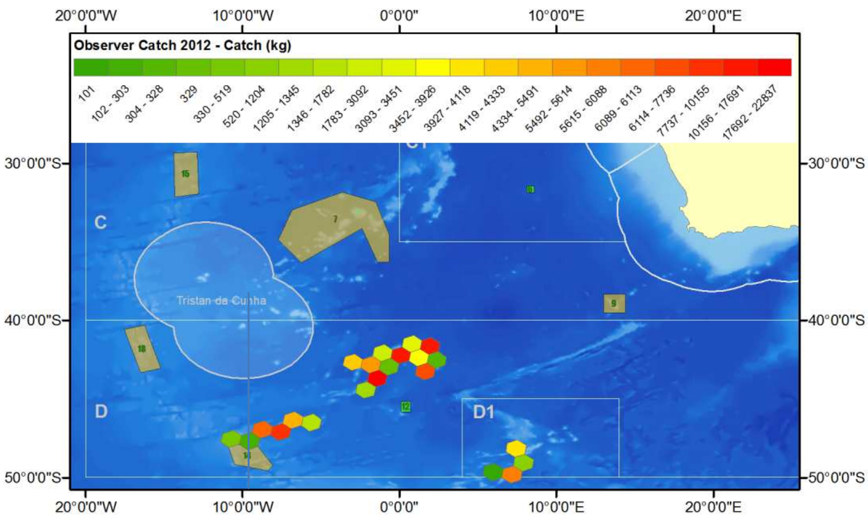


Figure 4 – Observer Catch of Patagonian toothfish (*Dissostichus* eleginoides) aggregated to 100km diameter hexagonal cells (Jan-Oct 2012).

1.3 Reported landings and discards

Landings

Table 1 present data on Patagonian toothfish catches listed by country, as well as fishing gear and the management Area in which the catch was taken. Annual catches varied between 18 and 210t.

Table 1: Catches (t) of Patagonian toothfish by Spain, Japan and Republic of South Korea

Nation	**Spain**	**Japan**	**South Korea**	**South Africa**	
Management Area	**D**	**D**	**D**	**D**	**D1**
Fishing method	**Longline**	**Longline**	**Longline**	**Longline**	**Longline**
Catch details	**(t)***	**(t)***	**(t)***	**(t)***	**(t)***
1976					
1977					
1978					
1993					
1994					
1995					
1996					
1997					
1998					
1999					
2000					
2001					
2002	18				
2003	101	47	245		
2004	6	124			
2005	N/F	158	10		
2006	11	155			
2007	N/F	166			
2008	N/F	122	76		
2009	N/F	86	65		
2010	26	54			
2011	N/F	159	N/F	15	28
2012**	N/F	86	N/F	24	12

N/F means no fishing. Blank fields mean no data available.

***** Whole weight

****** Provisional (1st week October 2012)

Discards

In Japanese Patagonian toothfish fisheries, discards are likely to be relatively low due to the commercial value of the species. The species discards are mainly comprise specimens infected by parasites that destroy completely the muscle (Y. Nishikawa, pers. comm.).

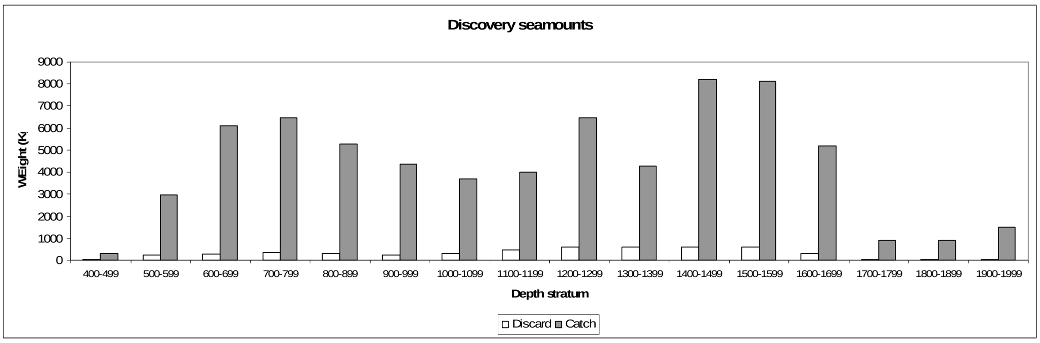
Table 2 Discards reported in kilograms.

Taxa	2009	2010	2011	2012
GRV	5,922	2,693	22,413	23,890
ANT	4,911	1,801	4,794	4,506
TOP	0	2,439	6,031	3,044
Other*	2,041	192	65	269
KCX	1	38	0	0

TOP: Patagonian toothfish (*Dissostichus eleginoides*); GRV: (*Grenadiers nei*); ANT: (*Antimora rostrata*); KCX: King crabs (KCX – Lithodidae)

Other includes*: Abyssal grenadier (*Coryphaenoides armatus*), Antarctic rockcods, noties nei (*Nototheniidae*), Butterfly kingfish (*Gasterochisma melampus*), Conger eels, etc. nei (*Congridae*), Globose king crab (*Paralomis formosa*), Harbour seal (*Phoca vitulina*), Kaup's arrowtooth eel(*Synaphobranchus kaupii*), Kerguelen sandpaper skate (*Bathyraja irrasa*), Lepidion codlings nei (*Lepidion spp*), Marine fishes nei (*Osteichthyes*), Moray cods nei (*Muraenolepis spp*), Ratfishes nei (*Hydrolagus spp*), Rays, stingrays, mantas nei (*Rajiformes*), Ridge scaled rattail (*Macrourus carinatus*), Smallhead moray cod (*Muraenolepis microcephalus*), Various sharks nei (*Selachimorpha(Pleurotremata*)

Figure 5 presents discards and catches from Discovery and Meteor seamount by depth stratum. Discards represent less than 10% of the catches and there is no clear trend of the discard rate with depth.



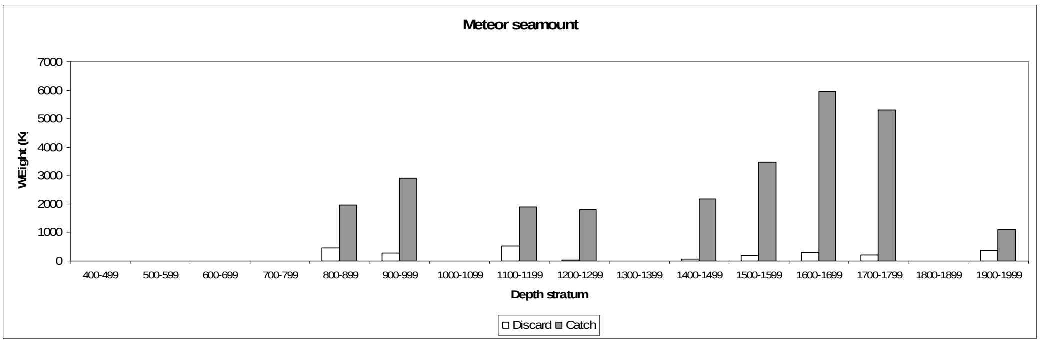


Figure 5 – Total weight of discards and of catches from the Discovery and Meteor seamounts for the years 2010 and 2011.

1.4 IUU catch

Apparent IUU fishing activity in the SEAFO CA has been report by vessel to the Secretariat, but the extent of this is currently unknown.

2. Stock distribution and identity

Patagonian toothfish, is a southern circumpolar, euribathic species (70-1600m), associated with shelves of the sub-Antarctic islands usually north of 55º S. 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 6) and El Cano Ridge in the South Indian Ocean (López-Abellán and Gonzalez, 1999, López-Abellán, 2005).

In SEAFO area 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 this species is driven by the sub-Antarctic front which extends into the SEAFO area.

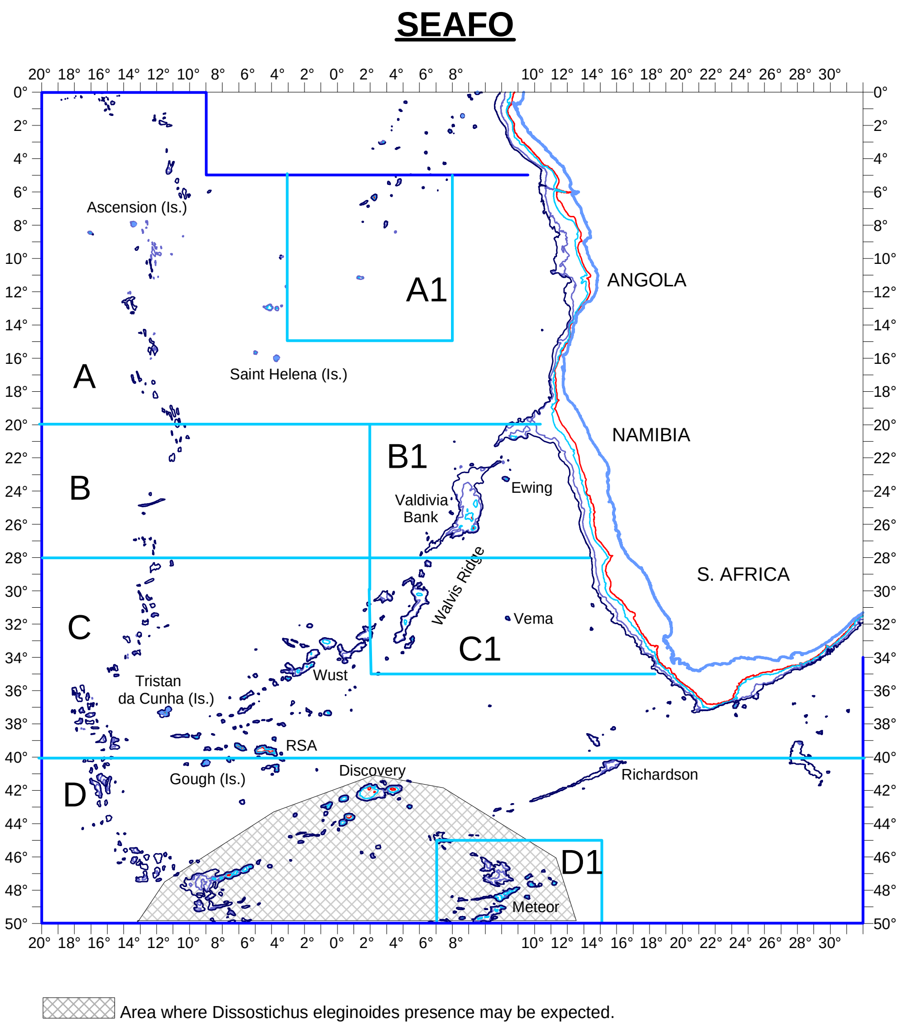


Figure 6 – Species geographical distribution in the SEAFO CA (source: Species profile on the SEAFO website)..

3. Life history parameters and information

3.1 Length frequencies

Fig. 7 shows the total length frequency distributions based on the observer data, while Fig. 8 for those by sex based on the Japanese exploratory fishing data.

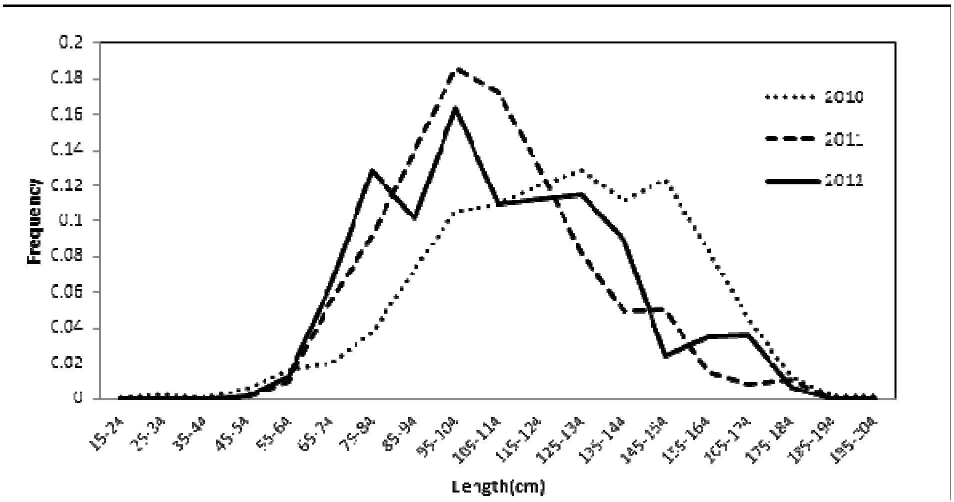


Figure 7 – Total length frequency distributions based on the observer data (2010-2012).
n (2010)=3,371, n (2011)=6,608 and n(2012)=5,046

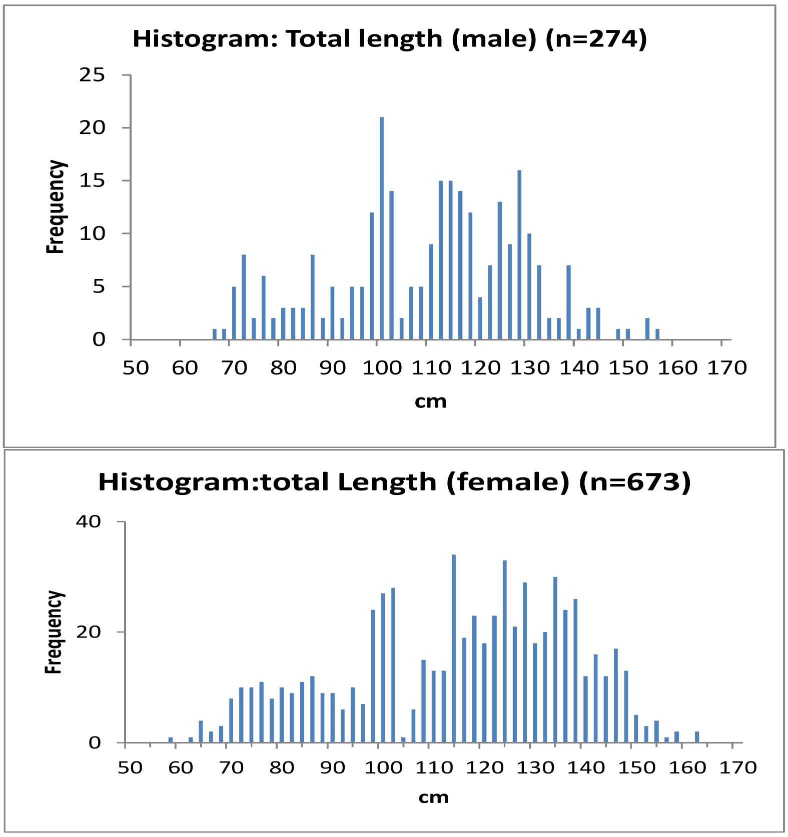


Figure 8 – Total length frequency distributions by sex based on the Japanese exploratory fishing data (2012).

Figure 9 shows the mean length of *D. Eleginoides* by year at three different seamount complexes within Division D, as well as, mean depth by year. The length data is derived from biological samples and were not extrapolated to the total catch. Mean lengths of fish caught were larger in the west and east (D1) part than those caught at the central-north area (Discovery seamount). At the east and west seamounts the annual mean size and depth decline over years (2009-2011). It might be that depth is the main factor for the mean length differences between areas.

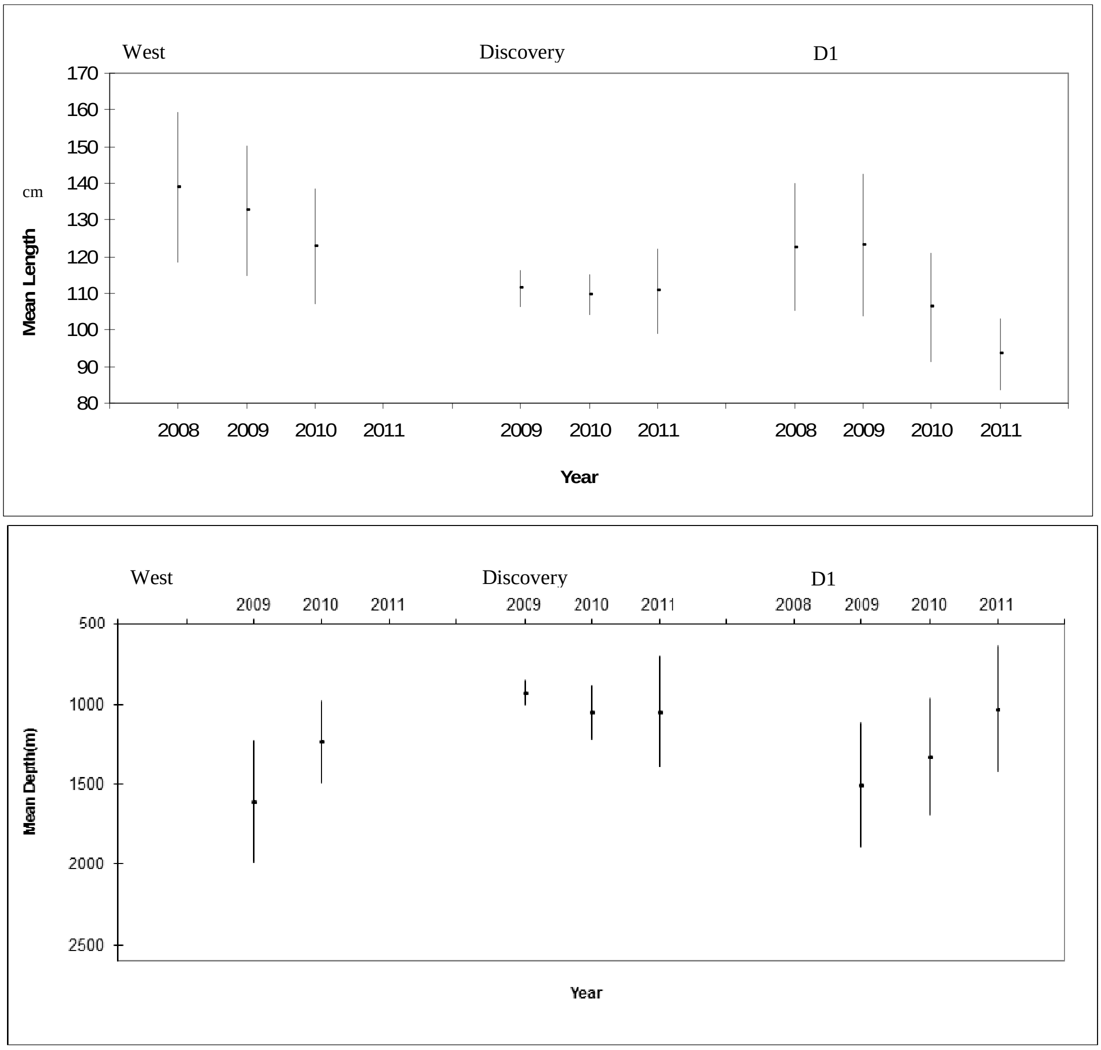


Figure 9 – *D. eleginoides*. Mean depth (m) (above) of fishing and mean length (cm) (below) of *Dissostichus eleginoides* at different seamounts complexes of in Division D the SEAFO CA for 2008, 2009, 2010 and 2011 (point represents means and bar for the range – min-max).

3.2 Length-weight relationships

Fig. 10 shows the length-weight relationships by sex based on the Japanese exploratory fishing in 2012.

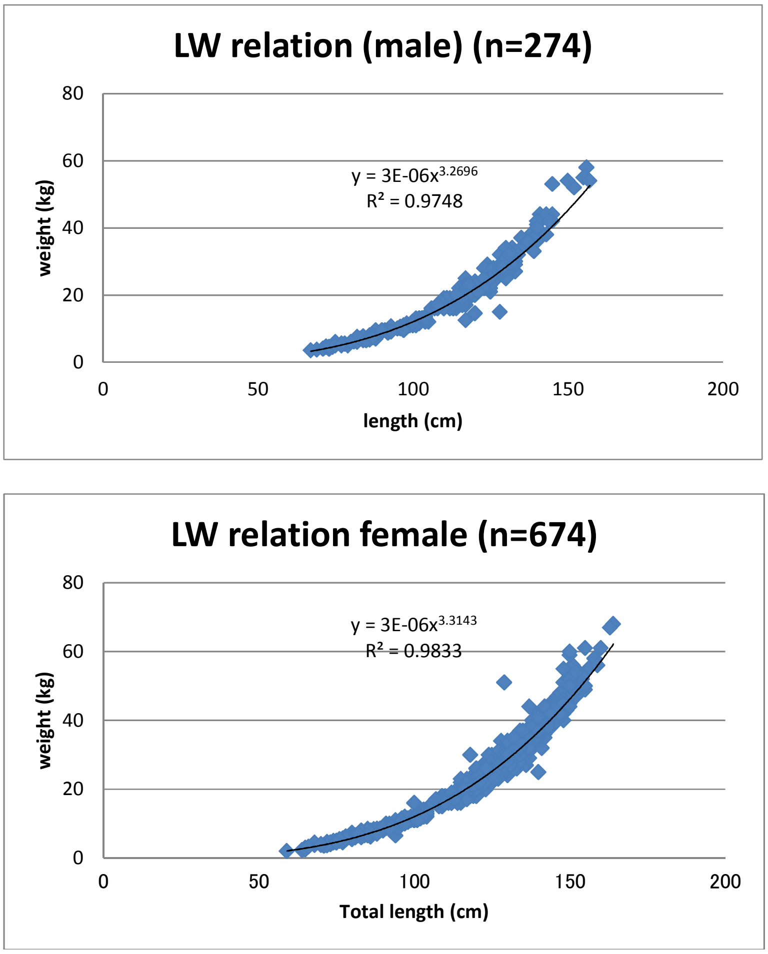


Figure 10 – Length-weight relationships by sex based on the Japanese exploratory fishing in 2012.

3.3 Age data and growth parameters

Dissostichus eleginoides Smitt, 1898

K=0.08 year^-1; Linf=126; t0=-0.7 (CCAMRL estimates)
Maximum age= 50 years (Horn, 2002)

3.4 Reproductive parameters

Dissostichus eleginoides Smitt, 1898

Spawning season July-August (CCAMLR area 48.6). No data available for the SEAFO CA.
Length of 1st maturity: 81 cm TL in males and 89 cm TL in females (Arana, 2012)

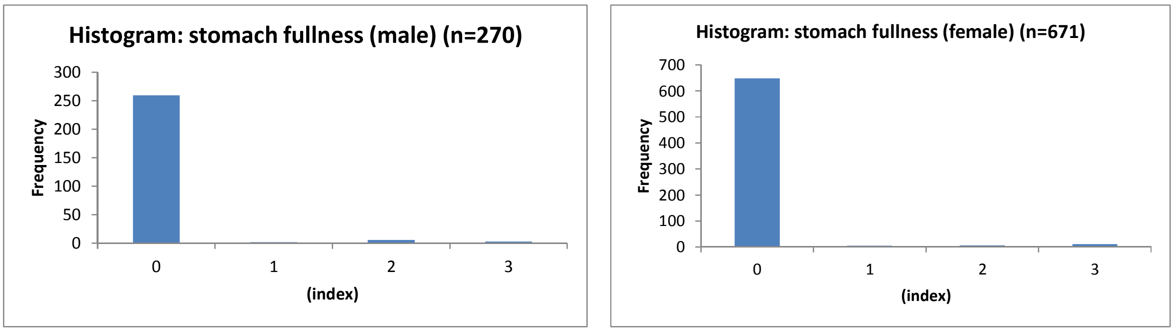
3.5 Natural mortality

Dissostichus eleginoides Smitt, 1898

M ~ 0.13 (CCAMRL estimate)

3.6 Feeding and trophic relationships (including species interaction)

Fig. 11 shows the digestive state by sex based on the Japanese exploratory fishing in 2012.



Digestive state	0	Undigested
	1	Mixed digestive states
	2	Half digested - able to ID
	3	Souplike with only bones

Figure 11 – Digestive state by sex based on the Japanese exploratory fishing in 2012.

3.7 Tagging and migration

No tagging experiments are conducted in the SEAFO CA, thus there are no information on the migration of the species.

4. Stock assessment

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. Not enough CPUE data points to construct a reliable standardized CPUE trend, as a result no new standardization of CPUE was conducted for the 2012 assessment.

4.2 Data used

(1) Catch (2003-2012)

SEAFO database

(2) Nominal CPUE (Table 3) - To be moved to the APPENDIX

Table 3 Sources of nominal CPUE

Type	Sources
Japan (2003-2008)	Logbook data
Japan (2009-2012)	Observer data
Korea (2005-2006)	Company data
Korea (2007-2009)	Logbook data

4.3 Methods used

4.4 Results

4.5 Discussion

4.5 Conclusion

5. Ecosystem implications/effects

5.1 Incidental and bycatch statistics (fish, invertebrates, seabirds, cetaceans, turtles)

Table 4 shows the by-catch species in the Patagonian toothfish (*Dissostichus eleginoides)* Fishery and its weights based on the observer reports.

Table 4 Bycatch from the Patagonian toothfish fisheries (Kg).

	2009		2010		2011	2012	
Species	**D**	**D1**	**D**	**D1**	**D**	**D**	**D1**
GRV	89	5,833	4,140	4,537	2,2414	23,705	186
ANT	126	4,786	453	1348	4,794	4,442	65
BYR	1,794						
MCC	336	896					
BEA	360						
MZZ				168			
SRX					30	124	
MRL	108			1	2	37	
COX	2				21	75	
SKH	90						
LEV	36		4	0			
KCX		1	3	35			
HYD						31	
BUK			17				
NOX					7		
MWS					6		
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*); 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*).

5.2 VME incidental catch

Table 5 shows the bycatch species and its amount based on the observer data (2010-2012). Fig. 16 shows their distributions including those from all other gears.

Table 5 Bycatch from Patagonia toothfish fishery (Kg).

	2010		2011	2012
Species	**D**	**D1**	**D**	**D**
Gorgonians (Gorgoniidae)	33.9	13.6	3.8	30.3
Hard corals, madrepores nei (Scleractinia)	2.1	0.1	15.4	17.6
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		

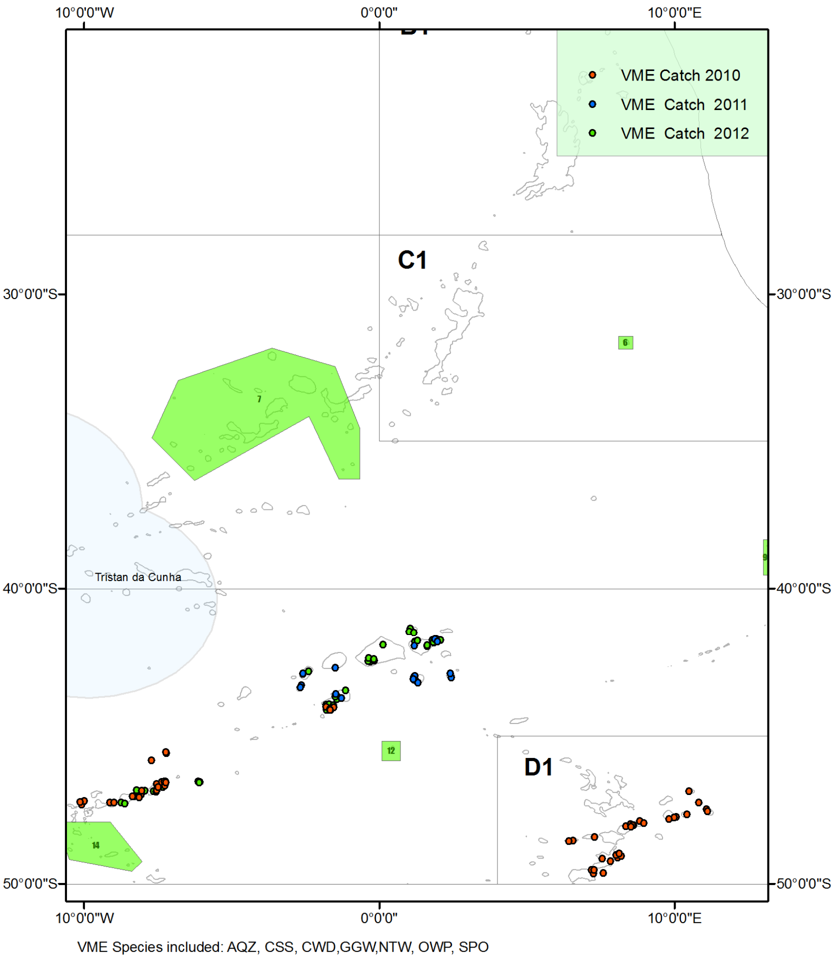


Figure 16 – Locations from all SEAFO fisheries of VME species – majority from Longline (2010-2012 Oct.)

5.3 Incidental and bycatch mitigation methods

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

5.4 Lost and abandoned gear

Fig. 17 shows locations and amount of the lost gears based on the observer data in 2011 and 2012.

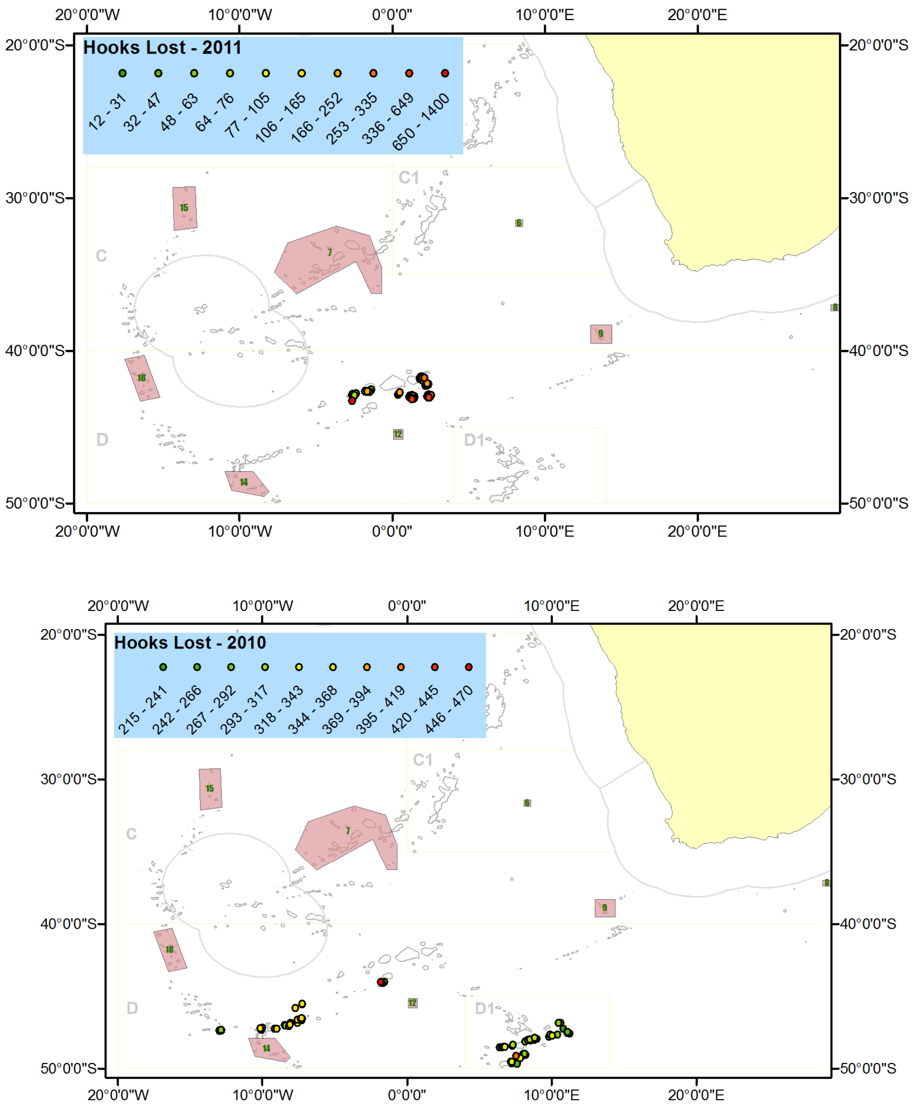


Figure 17 – Locations and amount of the lost gears (hooks with attached short line) based on observer data (2011-2012).

6. Biological reference points and harvest control rules

Not established yet in the SEAFO CA.

7. Current conservation measures

- ⇨ Conservation Measure 04/06: On the Conservation of Sharks Caught in Association with Fisheries Managed by SEAFO
- ⇨ Conservation Measure 07/06: Relating to Interim Measures to Amend the Interim Arrangement of the SEAFO Convention
- ⇨ Conservation Measure 08/06: Establishing a List Of Vessels Presumed To Have Carried Out Illegal, Unreported And Unregulated Fishing Activities in the South-East Atlantic Fisheries Organization (SEAFO) Convention Area

- Conservation Measure 13-09: Interim Prohibition of Transshipments - at – Sea in the SEAFO Convention Area and to Regulate Transshipments in Port
- Conservation Measure 14-09: To Reduce Sea Turtle Mortality in SEAFO Fishing Operations.
- Conservation Measure 15-09: On Reducing Incidental By-catch of Seabirds in the SEAFO Convention Area.
- Conservation Measures 18/10 on the Management of Vulnerable Deep Water Habitats and Ecosystems in the SEAFO Convention Area
- Conservation Measures 19/10 on Retrieval of Lost Fixed Gear
- Conservation Measure 20/10: on Total Allowable Catches and related conditions for Patagonian Toothfish, Orange Roughy, Alfonsino and Deep-Sea Red Crab in the SEAFO Convention Area in 2011 and 2012
- Conservation Measure 22/11: on Bottom Fishing Activities in the SEAFO Convention Area

8. State of stock and management advice

Suggestion: Status QUO.

9. References

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Nishida, T. Rademeyer, R., Ijima, H., Sato, K., Matsumoto, T., Kitakado, T. and Fonteneau, A. (2012). Stock and risk assessments on yellowfin tuna (*Thunnus albacares*) in the Indian Ocean by AD Model Builder implemented Age-Structured Production Model (ASPM) and Kobe I + II software. IOTC-2012-WPTT14-40 Rev_1.

Prager, M. (2004) User's Manual for ASPIC: A Stock-Production Model Incorporating Covariates (ver. 5) and auxiliary programs, Population Dynamics Team, Center for Coastal Fisheries and Habitat Research, National Oceanic and Atmospheric Administration, 101 Pivers Island Road, Beaufort, North Carolina 28516 USA: National Marine Fisheries Service Beaufort Laboratory Document BL-2004-01.

APPENDIX – Descriptive analyses work on data from the D. eleginoides fishery

Methods used

Descriptive analyses

Results

Nominal CPUE of Japan and Korea are available (Figs. 12-13).

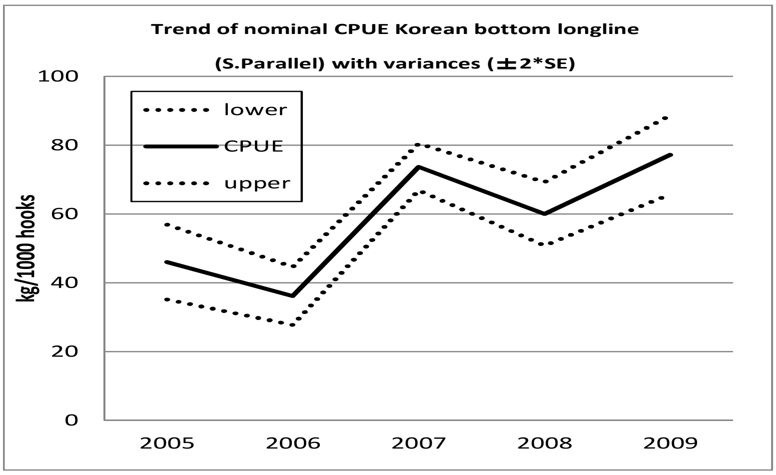

Figure 12 – Trend of nominal CPUE of bottom longline (Korea: Spanish parallel line) with variances (±2*SE).

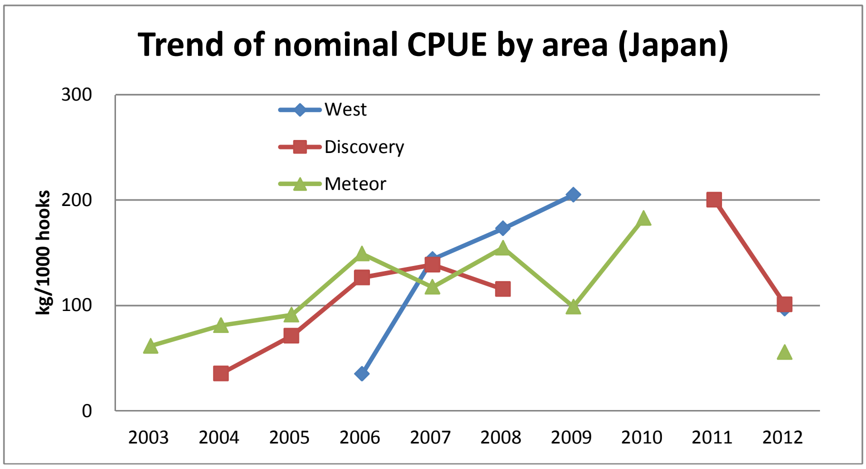

Figure 13 – Trend of nominal CPUE of Patagonian toothfish by area (Japan) (2003-2012)

Figure 14 shows the results of the descriptive analyses the relation of effort and catch.

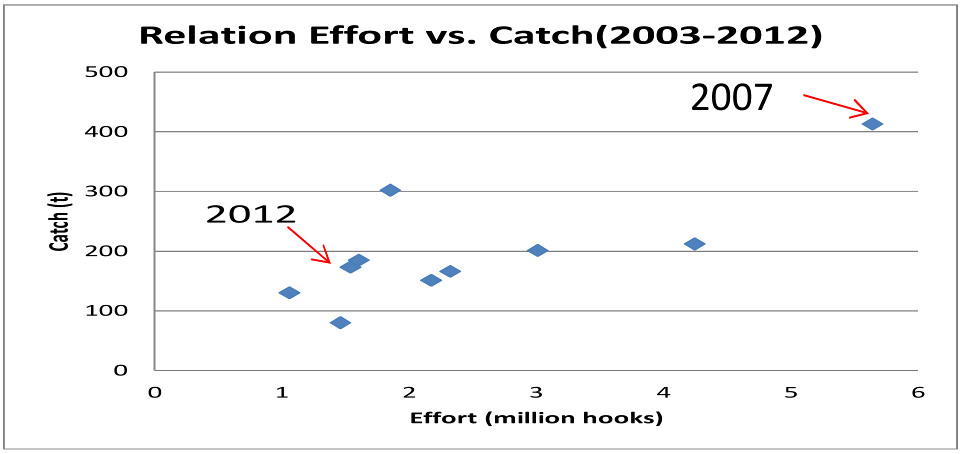

Figure 14. Relation between effort and catch (2003-2012).

Discussion

Standardization of CPUE and stock assessment (ASPIC) were conducted in the 2010 SC using 8 years of data points. Then SC recognized difficulties and impossibilities with a limited data less than 10 years. At least 15 years of good quality of catch and effort data need to be collected in order to conduct robust (reliable) CPUE standardization and the stock assessments. Hence, by following the suggestions made by the 2010 SC, CPUE standardization and a simple production model such as ASPIC were not conducted as we expect similar situation with only extra 2 years data points.

In the near future at least 15 years data are accumulated; CPUE standardization and ASPIC should be implemented as a first step. If sufficient data on size/age are available, intermediate stock assist models with age structure such as VPA (Virtual Population Analyses), ASPM (Age Structured Production Model), and SCAA (Statistical Catch-At-Age) should be attempted. In the long future, if tagging data are available, more complicated integrated space based stock assessments such as SS3 and MULTIFAN-CL may be attempted. Fig. 15 depicts the relation of three major types of stock assessment models (Nishida et al, 2012).

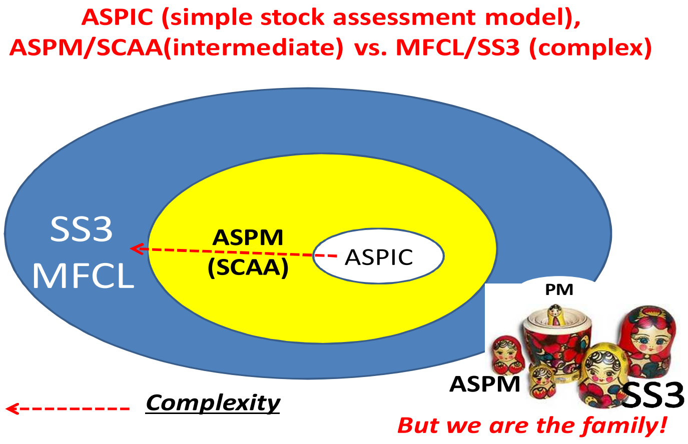

Figure 15 – Relation of three major types of stock assessment models (Nishida *et. al*. 2012).

Conclusion

As only 10 years catch and effort are available, it was not possible to conduct standardization of CPUE and simple production model analyses such as ASPIC, based on the lessons learned in the 2010 SC. Based on the exploratory data analyses, it was found that mean lengths and depths showed decreasing trends (2009-2011) while nominal CPUE showed an increasing trend during 2003-2011 then decreased in 2012. With this information it is not possible to provide the status of the Patagonian toothfish stock in the SEAFO CA.