SOUTH EASTATLANTIC FISHERIES ORGANISATION (SEAFO)

REPORT OF THE SEAFO SCIENTIFIC COMMITTEE

29 September – 10 October 2014
Windhoek, Namibia

Scientific Committee of SEAFO
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1 Opening and welcome remarks by the Chairperson

1.1 The 10th Annual Meeting of the SEAFO Scientific Committee (SC) was convened on 29 September to 10 October 2014 at the Safari Hotel & Court, Windhoek, Namibia. The Chairperson, Mr. Paulus Kainge, opened the meeting and welcomed all delegates. He emphasized that it would be a discussion of scientific issues and that all delegates were expected to freely express their scientific views so that issues can be resolved and the best possible advice forwarded to the Commission.

2 Adoption of agenda and meeting arrangements

2.1. SC adopted the agenda with minor revisions (Appendix I). Members were informed of practical arrangements for the meeting by the Executive Secretary

3 Appointment of Rapporteur

3.1 After nomination and secondment, Mr. Erich Maletzky was appointed as rapporteur for the Scientific Committee meeting.

4 Introduction of Observers

4.1 Observers from the Fisheries Observer Agency (FOA) in Namibia and the Food and Agriculture Organisation (FAO) attended the 10th SEAFO Scientific Committee and are listed under the "Observers" section of Appendix II.

5 Introduction of Delegates

5.1 A total of 11 Scientific Committee members, excluding the SEAFO Secretariat, attended the 10th SEAFO Scientific Committee meeting (see Appendix II for list of participants). No member from Angola attended.

6 Review of submitted SEAFO working documents and any related presentations, allocation to the agenda items

6.1 A total of 17 working documents were submitted to the Scientific Committee for review and consideration during the 2014 SC meeting (Appendix III).

7 Presentation by Consultant on the peer review of stock assessment methods used by SC.

7.1 To inform the stock assessment expert from the FAO, Mr. Pedro de Barros, on stock assessment methods used by the SEAFO SC to date, brief presentations were given by SC members regarding available data for the different SEAFO stocks as well as assessment methods used. An initial response by the expert was that given the data described for the different stocks, some of the assessment approaches employed by the SC were adequate and that during the current SC meeting additional assessment methods would be considered to compliment and/or enhance assessment methods already used by the SC.

7.2 All SEAFO stocks, for which assessments had been conducted in the past, were revisited consecutively over a four day period – with existing and additional (new) assessments methods being reviewed in plenary. For the **deep-sea red crab,** stock the GLM standardized CPUE initiated in 2013 was re-run with new data (2013 & 2014) and incorporating variable previously not considered (depth & soak time) being included. An exploratory Length Cohort Analysis (LCA) and Yield per Recruit (Y/R) was also run using length-frequency data from the fishery. For the **Patagonian toothfish**, A Stock Production Model Incorporating Covariates (ASPIC) model used in the past was reviewed in plenary, and an LCA and Y/R were run. For the **Southern boarfish,** stock the local depletion model used in the past was presented. Although existing information on **orange roughy** were reviewed during the meeting, no assessment options were considered for this stock during the meeting. The assessment review process was then concluded with the evaluation of harvest control rules and the possibility of application to various SEAFO stocks.

7.3 Summary of stock assessment exploration:

7.3.1 SC extensively reviewed available data for the following stocks and explored the following approaches:

7.3.2 Patagonian toothfish

A 4-year (2009-2012) time series of catch and effort data was available. There are valid length structured data for the more recent 8 years. The length structure and corresponding Catch-at-Length (CAL) was found to be appropriate for further analysis, however, no age structured data are available and catch at age analysis could not be done. However, the catch and standardized CPUE data were sufficient to apply ASPIC. In addition an LCA was run based on estimated CAL matrix. Both methods provided the perception that current harvesting rate is below F_{msy}. This perception was supported by the almost invariable size distribution through the time series. In future assessments the SC should continue to explore and apply these and alternative methods. Regarding recommendation of catch levels SC decided to develop harvest control rules appropriate to this SEAFO fishery.

7.3.3 Pelagic armourhead

SC decided to use the depletion model applied in 2012 together with estimators of potential yield. No other approaches could be explored due to data deficiency (insufficient length samples and too short time series of catch and effort data). Also for this species a precautionary harvest control rule was proposed and applied.

7.3.4 Alfonsino

The situation in terms of data availability was the same for alfonsino as for armourhead. A depletion model was considered but could not be applied due to the insufficient number of data to fit the regression.

7.3.5 Deep-sea red crab

An 8-year (2007-2014) time series of catch and effort data are available. There are also valid length frequency data for the most recent 5 years (2010-2014). The length frequency samples and corresponding CAL were found to be appropriate for further analysis, however, no age structured data are available and catch at age analysis could not be done. The exploratory runs of the Length-based analyses (LCA + length-based Y/R) carried out using the available information, (despite the uncertainties in the growth parameters adopted that prevented the SC from adopting a final assessment). No growth parameters were available for the *C. erytheiae* in the SEAFO CA. Growth parameters for *C. maritae* in the Namibian EEZ were available but could not be used, because the species were found to be genetically different.

These methods were then used to address agenda point 12 and 15 respectively.

8 Report by the Executive Secretary presenting all landings, incidental bycatch and discard tables updated to July 2014.

8.1 The Executive Secretary presented data and related information submitted by CPs, including additional information made available by SC members. All retained and discarded catches are presented in the landings tables (Appendix IV).

8.2 Historical catch statistics for the SEAFO CA may still be regarded as incomplete. A table with the available data from 1995 to 1998 was listed in the report of the 1st annual meeting of the Commission (SEAFO, 2004). These data were based on a report by Japp (1999). Some data were derived from the "1975-2005 FAO Southeast Atlantic capture production database" and are added to the current tables of annual catch figures (Appendix IV).

8.3 It is the responsibility of individual CPs to collect, validate and forward all SEAFO data to the SEAFO Secretariat Data Manager. The Secretariat noted that there is scope for improvement and that improved reporting would ensure timely incorporation of the data into the SEAFO Database in order to facilitate the work of the SC.

Missing or incomplete historical records

8.4 It was agreed that the Secretariat will compile a list of data currently recorded in the SEAFO Database and forward that to the CPs to validate and flag any missing data.

8.5 Issues in need of attention:

- ⇨ data known by the Secretariat to be missing from the SEAFO Database (i.e. incomplete data);
- ⇨ any other SEAFO data that exist within CP archives but that the Secretariat may not be aware of; and
- ⇨ continued exploration of archived data in non-CP sources in co-operation with FAO.

8.6 SC agreed that for missing and historic data the Secretariat will, if possible, be specific in terms of time periods where data are known to be missing – based on any reference data the Secretariat may have. Some data and logbooks previously sent by the EU to SEAFO appear to be missing, and this issue will be investigated further by the Secretariat. If not recovered, these data may have to be resubmitted, and to facilitate this, the Secretariat would provide a precise request.

Recent data and needs for improvements

8.7 It was concluded that data from 2013, i.e. the most recent year with presumed complete data, are valid. This relates to landings and activity data, VMS records (except for the Korean trawl fishery), and ancillary data collected by observers (e.g. biological data, records of VME-indicator taxa). The 2014 data are obviously incomplete and preliminary, and e.g. Japan noted that fisheries would be conducted later in the year. Korea had not been and may not be fishing in SEAFO in 2014.

8.8 The Secretariat had no information suggesting unauthorised fishing in new fishing areas in 2013-September 2014, nor IUU fishing or records of catches of VME-indicators above thresholds.

8.9 The major issue of concern, however, is that despite the decision in 2013 to submit logbook data, only Namibia submitted logbook data for 2014. This prevented the SC from pursuing analyses based on logbooks this year.

8.10 The Secretariat further noted that during the amendment of the Observer Forms the total catch was omitted from the Pot Fishery Form and that this was the reason why no catch data were captured during the 2014 season. Total catch should therefore be added to the form. It was further noted that in some instances catch had still to be estimated based on the 5-day catch reports due to missing data from preferred sources. Ideally it would enhance the confidence in the data if data from several sources could be compared, i.e. official landings, 5-d catch report, observer reports, and logbooks.

8.11 Some minor issues regarding bycatch of non-target fish species were discovered and would be investigated by SC members. It was noted that very limited information had been submitted on incidental catches of seabirds, and the question was raised if underreporting might occur.

8.12 Issues in need of attention:
- ⇨ submission of logbook data by all CPs conducting fishing in the SEAFO area;
- ⇨ re-insertion of "total catch" fields in the pot and longline observer forms (resolved during the meeting);
- ⇨ insertion of 'lost gear' fields in all observer forms (resolved during the meeting); and
- ⇨ continued focus on bycatch species and incidental catches of seabirds.

9 Review results of the Japanese 2014 exploratory fishing survey

9.1 SC did not receive a report for review because the exploratory fishing had not been completed at the time of the 2014 SC meeting.

9.2 However, Japan had submitted a proposal for continued exploratory fishing in 2015 (Appendix IV). The proposal was discussed by the SC and evaluated in relation to the provisions of the current exploratory fishing protocol (CM 26/13). The SC noted that the VME regulations and the associated 'exploratory fishing protocol' may be revised in 2014 and that the Commission may require evaluation of the proposal against the revised rules.

9.3 The plan includes exploratory longline fishing for Patagonian toothfish in eight squares adjacent to existing fishing areas, on the Discovery Seamount complex and an area to the west of that. The methods and sampling protocol is essentially the same as in Japanese proposals for exploratory fishing in 2013 and 2014. It was concluded that the proposal generally satisfies the requirements for sampling of data for stock assessments and VME-indicators. The SC appreciates that new data are being generated on target fish species and VMEs.

9.4 SC noted that the use of the Japanese longline system is relatively harmless to benthos and would be unlikely to cause significant adverse impacts on VMEs that may occur in the exploratory area. The trot line fishing gear and method will provide presence-absence information on VME indicators and weight of bycatch of these indicators on trot lines. Some SC members noted, however, that suspended trot lines will not provide information on abundance or density of VME-indicators on the seabed.

9.5 SC also noted that the proposal describes that the experiment in a given square comprises 10 exploratory longline sets followed by fishing based on the survey data collection protocol under the global TAC.

9.6 The proposal included reference to collection of detailed sea-bed maps but does not specify whether bathymetry maps generated during the fishing experiments will be made available to SEAFO. SC would consider such data valuable for future evaluations.

9.7 SC recommends the 2015 Japanese exploratory fishing plan, with the reservation concerning effort restriction after the 10 experimental hauls. The SC asks the Commission to consider this issue.

10 Review landings, spatial and temporal distribution of fishing activity and biological data on non-benthic bycatch species

10.1 The SC reviewed and updated all landings data on bycatch species – see tables 6-18 of Appendix II. VMS data were presented by the Secretariat and provided a useful overview of fishing activity in the past year.

10.2 SC agreed that as of 2014, to assess bycatch species in terms of TAC-specific fisheries, only bycatch records above **10%** of the total catch (over the last three years) will be assessed in terms of the spatial and temporal catch distribution. SC agreed to categorize catch records into two categories: [1] Retained and discarded TAC species; and [2] Retained and Discarded bycatch.

10.3 Spatial data on fishing activity based on logbook data were incorporated in some stock status reports.

11 Review the spatial distribution of reported catches of benthic organisms (corals, sponges etc.)

11.1 Figure 1 provides an updated map of VME indicator records by year. There were no recorded encounters over the period 2010-2014 of bycatches exceeding the current VME threshold levels.

- ⇨ Trawl: no more than 600 kg of live sponges and/or 60 kg of live coral in existing fishing areas and more than 400 kg of live sponges and/or 60 kg of live coral in new fishing areas.
- ⇨ Longline: at least 10 VME-indicator units (1 unit = 1kg or 1 litre of live coral and/or live sponge) in one 1200m section of line or 1000 hooks, whichever is the shorter, in both existing and new fishing areas;
- ⇨ Pot set – at least 10 VME-indicator units (1 unit = 1kg or 1 litre of live coral and/or live sponge) in one 1200m section of line in both existing and new fishing areas.

11.2 For details on catches of VME indicator species see Appendix V.

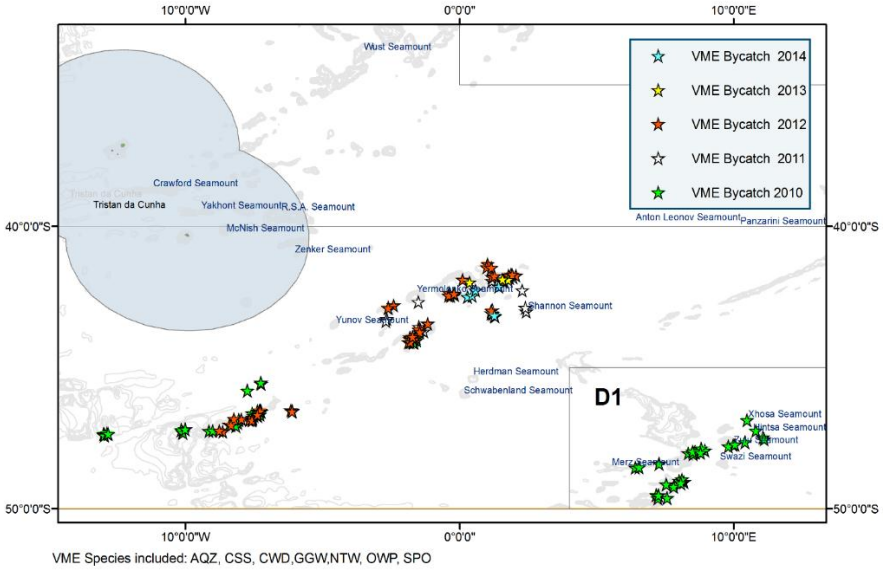

Figure 1: Spatial distribution of VME indicator bycatch as recorded by fishing activities within the CA.

12 Review Stock Status Reports

12.1 All stock status reports were reviewed and updated. These are presented as follows:

- ⇨ Alfonsino - Appendix VI;
- ⇨ Deep-Sea Red Crab - Appendix VII;
- ⇨ Patagonian toothfish - Appendix VIII;
- ⇨ Pelagic armourhead/Southern boarfish - Appendix IX;
- ⇨ Orange roughy - Appendix X.

13 Review research activities in the SEAFO CA

13.1 No new information related to research activities in the SEAFO CA were submitted to the SC for 2014.

14 Examine, where appropriate, assessments and research done by neighbouring organisations

14. 1 Namibia reported that no research and assessment were conducted for orange rough within the EEZ in 2014. South Africa, however, reported that annual assessments based on commercial data for Patagonian toothfish are conducted within the EEZ and will forward relevant information to the SC for consideration during 2015. SC reviewed research done in CCAMLR and used growth parameters for Patagonian toothfish during the 2014 stock assessment.

15 Review Total Allowable Catches and related management conditions for Alfonsino, Orange Roughy and Armourhead

15.1 The SC reviewed the Total Allowable Catches (TAC) and related management measures for alfonsino, orange roughy and pelagic armourhead. For all of these stocks, the SC decided to propose harvest control rules to address the issue of defining TAC proposals in the future. These are contained in respective Stock Status Reports (Appendices VI; VII; VIII; IX & X) and/or in Section 26 of this report, further details.

16 Review of progress re development of an ID guide for fish, crustaceans, incidental bycatch species

16.1 The SC Chairperson informed the meeting that the consultant is finalizing the species list for inclusion into the ID guide, and it is expected that the ID guide will be completed by the end of 2014.

17 Discussion on the upcoming Nansen scientific survey in January/Feb 2015

17.1 The SC was informed of a planned scientific research survey onboard the RV Dr. Fridtjof Nansen under joint collaboration between the FAO Deep-sea Program and EAF Nansen Project. The survey is an attempt to gather fishery-independent data on SEAFO stocks and VME indicators for use in future work of the SC. The main aim of the survey is to collect biological (commercial, bycatch & VME species) data and geochemical (oceanographic & bathymetry) data from the Walvis Ridge.

17.2 An invitation was extended to SC to take ownership of the survey and ensure good participation on the survey by members from SEAFO CPs. It was suggested that the SEAFO Secretariat should be the custodians of data collected on the survey – with copies in the Nansen data repository. Arrangements for storing biological samples will be agreed on before departure date of the survey.

17.3 Invitations to CPs to nominate scientists to participate would be issued by the Secretariat and FAO.

18 Discuss the (1) Report of the South-Eastern Atlantic regional workshop to facilitate the description of ecologically or biologically significant marine areas and (2) the Report of the FAO Regional Workshop on Vulnerable Marine Ecosystems (VMEs) in the SE Atlantic Ocean and the implications thereof for SEAFO

18.1 The SC took note of the EBSA workshop report and noted that two candidate EBSAs are located within the SEAFO CA.

18.2 The SC took note of the report from the regional VME workshop in the SE Atlantic Ocean and the FAO Observer appreciated that input from the workshop had contributed to the further development of the VME database, the ABNJ Deep-sea Project as well as to enhance knowledge on current VME practices.

18.3 A short demonstration was provided to the SC on the progress of the VME database currently being developed under the auspices of the FAO. Focus was given to the functionalities of the VME database, the different datasets it contains, outputs obtainable from the database and the inputs

required to be validated by relevant parties (RFMOs). The Secretariat will update available datasets on the VME database and welcomes feedback from SC.

19 SC responsibility towards the executing of the SEAFO part of the FAO-led ABNJ program

19.1 Feedback on the GEF-supported FAO ABNJ Deep seas Project was given to SC. The ABNJ Deep Seas Project is one of four projects under the FAO-led ABNJ Program/Common Oceans (www.commonoceans.org). The ABNJ Deep-Sea Project was endorsed in June and is now moving into implementation. It has four foci:
[1] Legal &Policy;
[2] VMEs & EBSAs;
[3] Adaptive Management & Planning; and
[4] Area-based Planning.

19.2 The project has a number of global activities defined which are:
[a] the update of the worldwide review of DSF;
[b] creation of the VME Portal and database; and
[c] VME current practices, process report and associated workshop (Feb 2015).

19.3 It was noted that other upcoming activities relevant to SEAFO include the project inception meeting (late 2014-15); the encounter protocol meeting (May 2015); development of an industry symposium (Sep 2015); and the global review of best practices on assessments and management of key deep-sea species (4th quarter 2015). Ongoing activities, of relevance to SEAFO, include the development of the deep-sea ID guide for elasmobranchs and sponges. A draft catalogue and field guide for elasmobranchs are available for the SE Atlantic.

19.4 Pilot activities in the SEAFO area include:
[1] support to assessment and management of deep-sea stock;
[2] survey of fish and VMEs in SEAFO CA;
[3] development of Smart Forms for fisheries monitoring and data collection; and
[4] support for observer training including species identification.

20 Compile recommendations to Commission on the depth distribution of species caught during mid-water trawling, and whilst targeting Southern boarfish/Pelagic armourhead and/or Alfonsino. The Scientific Committee should propose a regime (bycatch scheme, move-on-rules etc.) to manage the TACs of Southern boarfish/Pelagic armourhead and Alfonsino.

20.1 **Analysis of the depth distribution of species:**

A straightforward analysis on the depth distribution of species caught in the midwater trawl fishery was conducted to determine the proportions of pelagic armourhead and alfonsino in the total catch. Depth was also considered in the analysis to determine if there is any correlation between the species proportions (i.e. number of fish caught from a specific species) and depth. However, only bottom depth (not fishing gear depth) was available for this analysis. Figure 2 illustrates the results of the analysis of pelagic Armourhead versus alfonsino over depth for the available catch data from the midwater fishery over the period 2010-2013.

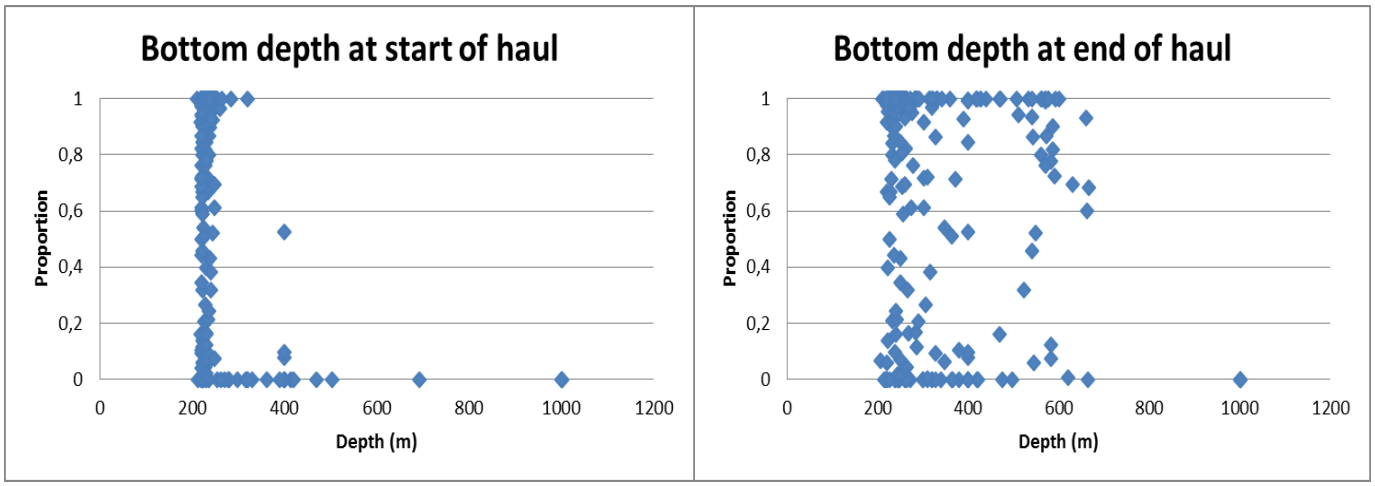

Figure 2: Catch proportions of armourhead relative to the combined catch of armourhead and alfonsino at start and end haul bottom depths of the midwater fishery.

20.2 From the results of the analysis it is clear that there is no direct relationship between the proportions of pelagic armourhead caught and bottom depth. Therefore, no rule to manage the TAC for the two target species of the midwater trawl fishery may be set exclusively based on bottom depth.

20.3 **Fishing regime (Proposal):**

However, the SC has carefully considered the catch data from the midwater trawl fishery and notes that the midwater trawl fleet do possess the technological capabilities and know-how to target one specific species (e.g. alfonsino) with only minor bycatches of the other (i.e. pelagic armourhead). Catch data have shown that midwater trawl vessels can consecutively target the two species, but can also target both species at the same time (i.e. in the same haul). Thus, the nature of the midwater trawl fishery (i.e. two species with independent TACs) requires continuous monitoring of catches relative to the species-specific TACs. The SC thus proposes a method by which to ensure the near real-time monitoring of catches from the midwater trawl fishery –and in so doing ensure that the TACs are not exceeded for the respective species.

20.3.1 Proposed catch and bycatch monitoring:

[a] Any vessels engaging in midwater trawl fisheries should send daily catch reports to the Secretariat.

[b] Based on these daily catch reports, the cumulative catches of armourhead and alfonsino should be closely monitored by the Secretariat.

[c] Fishing activities should be developed by first targeting one species (first target species).

[d] When the Secretariat determines that 95% of the TAC for that species is reached in the management unit, the midwater fleet should be instructed by the Secretariat to move to another location and/or target the other species (second target species); or exit the management unit if this target change is not possible.

[e] A total bycatch of 5% of the first target species TAC is allowed to be taken when targeting the second species in the same management unit.

20.4 The daily reporting requirement, as mentioned in point 1, is in use in other fisheries and appears technically feasible, but may still be challenging in this particular fishery. The SC does not have the competence to fully evaluate this aspect.

20.5 SC recommends that the proposed monitoring and bycatch regime be considered for the directed boarfish and alfonsino fishery.

21 Compile a report on results from bottle tests emanating from cf. Conservation Measure 25/12 - Reducing Incidental Bycatch of Seabirds in the SEAFO Convention Area Review proposal for a new Conservation Measure on vulnerable marine ecosystems in the SEAFO Convention Area.

21.1 SC was informed that the Japanese vessel caught three seabirds during day-fishing operations, and subsequently reverted back to night-fishing operation. The bottle test experiments were conducted successfully and results submitted to the Secretariat via the Observer forms.

22 Review proposal for a new Conservation Measure on vulnerable marine ecosystems in the SEAFO Convention Area.

22.1 The SC took note of the proposal from Norway, and noted that this is a proposal to The Commission regarding amendments to Conservation Measure 26/13. The SC considered scientific aspects of the proposal but had few comments at this stage. One comment was that the encounter provisions may not fully account for cumulative sub-threshold catches of VME indicators in the same fishing location.

23 The Scientific Committee should establish a protocol and guidelines for fisheries research.

The agenda item refers to the Commission report from 2013, Ch. 6.4.3., requesting the SC to establish a protocol and guidelines for fisheries research in the SEAFO CA.

Initially, it was noted that the request from the Commission concerns the entire CA, not specific subareas of the CA to which specific management measures apply, e.g. as specified in the VME regulations (new and existing fishing areas, and closed areas).

The SC also noted that the Commission has not defined "fisheries research". The SC therefore assumed that that would be a task for the SC. Establishing such a definition was considered a necessary first step and prerequisite for developing guidelines for that activity. It would furthermore be necessary to describe as precisely as possible differences between fisheries research and other activities of exploratory nature that may occur in the CA.

1 Definitions of fisheries research, basic marine science, and exploratory fishing.

Fisheries research shall as a primary objective create a firm basis for fisheries management advice. As all other sciences, fisheries research shall satisfy best scientific practices and standards. The objective is fulfilled by conducting repeatable experiments, field investigations, and data analyses that collectively enhance the quality of: a) resource and ecosystem assessments, b) evaluations of negative impacts on non-target species, incidental by-catch species and VMEs, and c) measures implemented to mitigate negative impacts on stocks and VMEs. Top priority outputs from fisheries research are data and analyses on:

1) target fisheries resources;
2) non-target resources and organisms occurring as incidental by-catch;
3) ecosystems that may be impacted by fisheries (e.g. VMEs);
4) fishing technologies, methods and strategies facilitating sustainable fisheries.

In terms of motivation, methodology requirements and reporting obligations the demands are usually more extensive on fisheries research than on less rigorous exploratory activity such as e.g. exploratory fisheries which typically may not have to fully satisfy scientific best practice standards (see below).

Fisheries research may be distinguished from primarily *curiosity-driven marine science* which, independent of the utility of the results in relation to management and commercial interests, aims to study the environment, organisms, and ecosystems in order to explain patterns and processes in the sea. In terms of scientific rigor, however, there is basically not a major difference between these two categories.

Exploratory fisheries, however, are fishing experiments solely or primarily aimed to discover new resources or new fishing grounds and are as such from the outset motivated by commercial interest. Exploratory fisheries will thus normally not satisfy the above definition of fisheries research. Management measures may require that parties conducting exploratory fishing collect data relevant for stock assessments and evaluation of ecosystem impacts (normally handled by observers). However, the collection of data for scientific use is rather a required by-product than a primary objective of the exploratory fishing effort.

There is overlap between these three categories and also mutual benefits from all. However, there are also important differences, and the SC advices that protocols and guidelines established by SEAFO should take account of the different characters and requirements of the three activity categories.

2 International obligations to facilitate science

With assistance from the FAO observer present during the meeting, the SC sought legal guidance on what provisions are included in UNCLOS with regards to marine science activity, including fisheries research. UNCLOS dedicates Part XIII to marine scientific research. The basic principle is that all States and competent international organizations have the right to conduct marine scientific research subject to the rights and duties of other States (art. 238), and that they must promote and facilitate research (art. 239) and international cooperation to this end (art. 242). States and competent international organizations have a duty to create 'favourable conditions' for research through bi- and multilateral agreements (art. 243), and must make available proposed major programmes and knowledge resulting from the research (art. 244)

Voluntary instruments also encourage fisheries research and international collaboration (e.g. the FAO Code of Conduct for Responsible Fisheries, FAO International Guidelines for the Management of Deep-sea Fisheries in the High Seas).

3 Protocols

UNCLOS seems to provide a clear basis for the development of protocols for carrying out scientific research, including through competent Regional Fisheries Bodies (RFBs), especially when the RFB is the 'competent international organization' that is involved in the research or under whose auspices it is carried out.

In SEAFO exploratory fishing with bottom-touching fishing gear is already defined and regulated by protocols applying to such fisheries in 'new fishing areas' and, if new technology is adopted, in 'existing fishing areas' (CM 26/13). The SC has thus assumed that the request 6.4.3 did not concern exploratory fishing, and that accordingly the Commission does not anticipate an amended protocol for exploratory fishing.

Fisheries research, as distinguished above from exploratory fishing, is not regulated by an existing SEAFO protocol. The same applies to basic marine science activity as described above.

The SC notes, however, that while the legal advice suggests that that SEAFO as an RFB has an opportunity to develop protocols for science, it should probably be clarified if the SEAFO has a legal mandate to regulate these activities. Fisheries Research, and certainly not general marine science, is not *per se* fisheries. Imposing protocols on

the parties undertaking such efforts may be stretching the mandate of SEAFO too far. Until the legal mandate is clarified, a task clearly beyond the mandate of the SC, the SC has refrained from considering such protocols.

4 Guidelines

SEAFO may, however, establish best practice guidelines for fisheries research and basic marine science activity in the CA. These would be guidelines which CPs and third parties are *requested* to adhere to when conducting fisheries research and basic marine science in the SEAFO CA. Guidelines would have to become well publicized and should be made available to parties intending to submit letters of intent pertaining to research activity in the area.

The primary purpose of such guidelines should be to facilitate that high-quality science may be conducted freely and to the benefit of all while also ensuring that the activity is conducted in a manner which does not cause significant adverse impacts (SAI) on the marine ecosystems and organisms, including fisheries resources.

To avoid SAI, planning and conduct of the research activity would have to take into account regulatory measures for fish stocks and VMEs, including the area-based regulations, adopted by SEAFO. Furthermore, guidelines should ensure that data and results of relevance to the SEAFO mandate concerning fisheries and biodiversity is being made available to the organization for use by the SC.

On this basis, the SC proposed the following guidelines pertaining to the entire SEAFO CA:

Provisional guidelines for fisheries research and basic marine science activity in the SEAFO Convention Area.

Any party intending to conduct fisheries research as well as other basic marine science activity in the SEAFO CA is requested to adhere to the following guidelines during the planning, field and publication phases of the activity:

1. Planning phase
   - 1.1 The party is requested to submit to SEAFO, preferably no later than 6 months of the intended period of sea-going activity, a letter of intent explaining the activity being planned. In return, the SEAFO Executive Secretary will provide guidance on any management measures that may be relevant to the intended research activity, as well forms and routines for submitting reports and/or data.
   - 1.2 Upon receiving the response from SEAFO, the party is requested to submit, no later than 1 month prior to the sea-going activity, a more detailed plan outlining methods to be used, what areas will be sampled, sampling intensity, samples generated, and data gathered. Evaluated against SEAFO measures, the plan should also provide information on what measures will be implemented to mitigate anticipated negative impacts on fisheries resources and biodiversity, in particular VMEs.
   - 1.3 Upon receipt the letter of intent and detailed plan should be forwarded for information and comments to all SEAFO CPs and the SEAFO SC.

2. Experimental and field phases
   - 2.1 During the field experiment every effort should be made to avoid activity compromising the SEAFO measures implemented to conserve fisheries resources and biodiversity, especially VMEs. This applies in all subareas of the SEAFO CA but is particularly important in subareas closed to commercial fishing in order to protect vulnerable marine ecosystems (VMEs).
   - 2.2 Sampling levels should satisfy scientific standards and requirements specific to the research being conducted, but excessive sampling of fisheries resources and organisms associated with VMEs should be avoided. The use of invasive sampling methods in benthic environments, especially in areas where VMEs may occur, should preferably be avoided. If invasive sampling cannot be fully excluded from the sampling design, (e.g. tow lengths of trawls, lengths of longlines, and sampling with bottom-touching benthos samplers) should be carefully planned and monitored in order to minimize sampling to a level satisfying the sampling design required for the analyses but at the same time preventing excessive redundancy.

2.3 Sampling of regulated species (e.g. fish resources) is encouraged to the extent that such sampling facilitates provision of much needed data to the SEAFO SC. Care should be taken to avoid incentives to sample excessively by e.g. facilitating or allowing marketing of retained excessive catches. Care should also be taken to avoid the need for discarding of superfluous samples of such species.

2.4 During the conduct of field sampling, considerations should be given to how to facilitate timely post-cruise reporting of data and results of relevance to SEAFO.

2.5 Vessels are requested convey VMS signals or equivalent positional data to SEAFO. This request applies to registered research vessels as well as vessels of other categories conducting research, e.g. commercial fishing vessels chartered or otherwise engaged in science activity led and conducted by the scientific party referred to under Pt. 1.1.

3. Publication and data provision phase

3.1 Cruise reports, at least those made available in the public domain, should be provided to SEAFO as soon as possible after the completion of the cruise. The SEAFO Executive Secretary will forward such reports to the CPs for information.

3.2 Any publication deemed relevant to SEAFO resulting from the research activity described under Pt 1 should be submitted to SEAFO and thereby made available for the work of the SEAFO Scientific Committee. This request remains valid throughout the life-time of the project/research programme under which the activity was conducted.

3.3 Parties are requested to submit data of relevance to the assessments and evaluations conducted under the mandate of the SEAFO SC. Such data, marked with source and origin, will be stored in a Secure SEAFO database. Restrictions on use and reference requirements will be agreed between the party and the SEAFO Executive Secretary.

3.4 If raw data cannot be submitted to SEAFO, then aggregate data at an agreed level of aggregation may be made available. Of particular significance would be data on VME indicator species occurrence and density, i.e. data seldom available from fisheries-independent sources.

Recommendation:
The SC proposes that The Commission adopts the provisional guidelines proposed for fisheries research involving sea-going activity in the SEAFO CA.

The Commission may consider if there is a need for specific guidelines for fisheries research and other marine science activity in the closed areas, including what research activity is required to consider re-opening of closures.

24 The Scientific Committee should report on the need for fishing gear regulations (e.g. mesh size regulations).

24.1 With the present information the SC is not able to determine, with certainty, that there is a need for technical gear regulations for any of the SEAFO fisheries.

24.2 The SC noted that the main objective for regulating gear specifications, in particular mesh size, is to protect the juvenile component of the resource/stock being targeted. In the SEAFO context this has relevance for only two fisheries: [1] the deep-sea red crab pot fishery; and [2] the midwater trawl fishery.

24.3 The SC has information on gear types and characteristics of pots and trawls being used in the SEAFO CA (see Section 1.1 of relevant Stock Status Reports). The current gear in the pot fishery does not

appear to catch juveniles. For the trawl fishery, using trawls with codend mesh size of 120mm, the lack of valid size distribution data prevents the SC from carrying out analyses.

24.4 In the longline fishery directed at toothfish the SC has noted a reduction overtime in the proportion of large fish. Whether or not this reflects gear selectivity changes or changes in the size structure of the stock is uncertain, but the SC has not recorded major changes in the gear characteristics in the Japanese longlines being used. An issue in this fishery is discarding of grenadiers, but it is unknown if technical regulations could mitigate or reduce this bycatch further.

24.5 Therefore, no advice can be given at this stage regarding the need for fishing gear regulations.

25 The Scientific Committee should develop standardized conversion factors for all SEAFO target species.

25.1 The SC deliberated on the standardized (i.e. to be used by all fleets) conversion factors issue as directed by The Commission, and noted that in SEAFO conversion factors have relevance to only the deep-sea red crab, Patagonian toothfish and pelagic armourhead fisheries.

25.2 No conversion factors currently exist for the SEAFO deep-sea red crab fishery. However, with all deep-sea red crabs caught in the SEAFO CA currently being landed at Walvis Bay, Namibia, SC considered it appropriate to use conversion factors calculated for the *C. maritae* fishery from neighbouring Namibia (Table 2) – until such time that conversion factors for SEAFO are defined. Conversion factors for the Namibian deep-sea red crab fishery were defined on the basis of the various crab products processed onboard the vessel – products which are clearly discernable from the Captain's log sheets and at the point of landing. Due to the nature of these crab products (i.e. the fact that crab products are size specific – meaning that certain products can only be processed if crabs within the required size range are caught), the conversion factors for deep-sea red crab are considered to be constant over time.

Table 2: Conversion factors from the Namibian *C. maritae* fishery – to be applied to the SEAFO deep-sea red crab fishery.

PRODUCT FORM	WHOLE WEIGHT EQUIVALENT	CONVERSION FACTOR
Crab leg (with shell) (95 - 151 mm)	13.30%	7.52
Crab Sections (68 - 154 mm)	58.50%	1.71
Whole round	100.00%	1.00
Flake (1 mm) (from shoulders) 95-110 mm	18.20%	5.49
Flake (1 mm) (residue from above) 95 - 110 mm	8.20%	12.20
Flake (10 mm)	33.10%	3.02
Flake (5 mm) (80-94 mm)	30.30%	3.30
Flake (5 mm) (95- 110 mm)	16.70%	5.99
Flake (1 mm) (residue from above) 80 - 94 mm	5.60%	17.86
Flake-machine size not recorded shoulder	38.00%	2.63
Flake-machine size not recorded 80 - 94mm	21.00%	4.76
Leg (without shell) (95 - 154 mm)	8.41%	11.89

25.3 SC, however, noted that a section for recording data needed to calculate conversion factors do exist in the observer forms for the deep-sea red crab fishery, and that observers need to be instructed to complete these forms per trip. This will ensure more accurate conversion factors are calculated for the SEAFO deep-sea red crab species.

Patagonian toothfish:

25.4 Conversion Factors (CFs) of Patagonian toothfish from the process weight (head, tail and gut removed weight) to the whole weight in Japanese longline are computed by the observer 4-5 times per trip by different time and area. Then total catch is computed using these conversion factors. This means that no constant conversion factors are used. The variation in conversion factors over time, as calculated on different vessels, is minimal. Converion factors recorded in the SEAFO CA are as follows:

Japan

- ⇨ 2013: 1.72 (range: 1.68-1.80)
- ⇨ 2014: 1.70 (range: 1.71-1.74)

Korea

- ⇨ 2007: 1.70
- ⇨ 2008: 1.75

Spain

- ⇨ 2010: 1.70

25.5 If a standardized CF is needed then SC recommends using1.70 for the conversion of Patagonian toothfish to whole round weight.

Pelagic armourhead:

25.6 Conversion factor used to convert processed fish to whole weight. Conversion factor between green weight and final product in the event that catch is recorded on the basis of weight of processed product.

25.7 Conversion factors (CF) uses the weight difference between sample green weight and processed weight to calculate the whole harvest catch, usually in the form of CF = Processed Wt. (HG)/Green Wt. Processed Wt. means HG weight (Headedand Gutted). Conversion factor recorded in the SEAFO CA by Korea is 1.70 for both 2011 and 2012.

25.8 Vessel used Conversion Factors and Observer Calculated Conversion Factors are recorded periodically during the fishing operation and should be included in the Conversion Factors form of the Scientific Observer Forms.

Macrouridae:

25.9 Although Macrouridae is not a target species the SC noted that data on CFs (based on Spanish Observer Data – 2010) exists and noted that this conversion factor for HGT was recorded as 2.70.

25.10 The SC noted that some vessels fishing in the SEAFO CA did not provide data on conversion factors; hence no analysis based on this source could be conducted by the SC.

25.11 Based on other information SC proposed that for the interim the *C. maritae* CFs be applied to the SEAFO **deep-sea red crab** fishery until such time that the needed data on the *C. erytheiae* species is obtained. For the **Patagonian toothfish** limited CF data exist and based on this data SC recommend an HGT (head, gutted & tailed) CF of 1.70. For the **pelagic armourhead** very limited CF data exist and based on this data SC recommend an HG CF of 1.70. An alternative to constant CFs is area and time specific CFs capturing the variation over time and space in condition factor. This would require ample sampling at regular intervals during the fishing period.

26 Advice and recommendations to the Commission on issues emanating from the 2014 meeting.

Agenda Point 7:

26.1 The SC noted with appreciation that the contributions made by the external expert from FAO, Mr. Pedro de Barros, and the discussions with him significantly enhanced the results accomplished during the 2014 SC meeting. This has created a good basis for future work on stock evaluations. The SC recommends that the presence of an external expert might be considered for future meetings.

Agenda Point 9:

26.2 SC recommends the 2015 Japanese exploratory fishing plan, with the reservation concerning effort restriction after the 10 experimental hauls. The SC asks the Commission to consider this issue.

Agenda Point 15:

Alfonsino:

26.3 In 2012 the Commission adopted a TAC of 200t for the SEAFO CA for 2013 and 2014 (CM 27/13).

26.4 In accordance with the proposed harvest control rule (HCR), using the average catch from 2010-2012, the recommended TAC is 132 tons for the Division B1 for 2015-2016. Considering the possibility that alfonsino occurs outside B1 the SC maintains its recommendation from 2012 for a TAC for the entire SEAFO CA of 200 tons of which a maximum of 132 tons may be taken in B1.

Patagonian toothfish:

26.5 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.

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

Pelagic armourhead:

26.7 In 2013 the Commission could not reach consensus on a TAC for southern boarfish/pelagic armourhead, consequently, the fisheries is open in 2014. The only CP fishing armourhead in the 2010-2013 fishery, i.e. Korea, declared that the precautionary approach would be respected and that a total catch of 300 tonnes in Division B1 would not be exceeded.

26.8 The Commission furthermore requested that the Scientific Committee assess the southern boarfish/pelagic armourhead and present a TAC in 2014.

26.9 The SC recommends that a TAC, corresponding to the output level resulting from using the HCR based on the average catch of 2011 and 2012, is set at 143 t.

Orange roughy:

26.10 SC recommends the continuation of the moratorium for 2015 and 2016 on directed fishery in Division B1 and allowance for bycatch limit as proportion (10%) of the average of landings from the last five years with positive catches (i.e. 2001-2005), equivalent to 4 tonnes. A precautionary TAC of 50 tonnes is set for the remainder of the SEAFO CA.

Deep-sea red crab:

26.11 The SC noted that adopting an HCR might be considered for the deep-sea red crab fishery and suggested such a rule.

Agenda Point 20:

26.12 SC recommends that the proposed monitoring and bycatch regime (see Section 20.3) be considered for the directed boarfish and alfonsino fishery.

Agenda Point 21:

26.13 SC was informed that a Japanese vessel caught three seabirds during day-fishing operations, and subsequently reverted back to night-fishing operations. The bottle test experiments were conducted successfully and results submitted to the Secretariat via the Observer forms.

Agenda Point 23:

26.14 The SC proposes that The Commission adopts the provisional guidelines proposed for fisheries research involving sea-going activity in the SEAFO CA.

26.15 The Commission may consider if there is a need for specific guidelines for fisheries research and other marine science activity in the closed areas, including what research activity is required to consider re-opening of closures.

Agenda Point 24:

26.16 No advice can be given at this stage regarding the need for fishing gear regulations.

Agenda Point 25:

26.17 The SC noted that some vessels fishing in the SEAFO CA did not provide data on conversion factors; hence no analysis based on this source could be conducted by the SC.

26.18 Based on other information, SC proposed that for the interim the *C. maritae* Conversion Factors be applied to the SEAFO **deep-sea red crab** fishery until such time that the needed data on the *C. erytheiae* species is obtained. For the **Patagonian toothfish,** limited Conversion Factor data exist and based on this data SC recommend an HGT (head, gutted & tailed) Conversion Factor of 1.70. For the **pelagic armourhead** very limited Conversion Factor data exist and based on this data SC recommend an HG Conversion Factor of 1.70. An alternative to constant Conversion Factors is area and time specific Conversion Factors capturing the variation over time and space in *condition factor* of the fish. This would require ample sampling at regular intervals during the fishing period.

27 Review 2014 work program and agree on the 2015 work program.

27.1 The SC discussed the work program for 2015 and outlined activities still pending for the remainder of 2014 as follows:

- ⇨ Training of observers from developing countries on High Seas scientific sampling procedures.
- ⇨ FAO ABNJ Deep-Sea Project activity.
- ⇨ Nansen survey (Jan-Feb 2015) follow-up.
- ⇨ Guidelines on handling and submission of Logbook data, required for landings validation, to the SEAFO Secretariat.
- ⇨ Secretariat to provide potential fishing areas for the current target species based upon bathymetry.
- ⇨ SC to compile, for individual target species and assessment types, the required data fields for submission to the SEAFO Data Manager.

28 Any other matters.

None.

29 Budget for 2015.

29.1 Under the SC work plan (see Agenda Point 27) there is one item that may require funding:

- ⇨ FAO ABNJ Deep-Sea Project – one SC member to attend the workshop on the "Assessment and Management of Deep-Sea Species" during the 3rd or 4th quarter of 2015.

29.2 The SC therefore requests a provision of N$40 000 to facilitate this SC activity.

30 Adoption of the report.

30.1 The report was adopted.

31 Date and place of the next meeting.

SC proposes the following:
Date: 30 September - 9 October 2015
Venue: Namibia – unless other venues are identified.

32 Closure of meeting

32.1 On Friday 10 October 2014 at 17h25, the Chairperson declared the 10th SEAFO Scientific Committee meeting closed. The Chairperson expressed his satisfaction for the work accomplished and thanked all participants for their valuable contributions.

33 References

Anon. (2012) – The stock assessment workshop for North Pacific Armourhead, Shimizu, Shizuoka, Japan. Workshop Report. March 2012

Gulland J.A. (1971) – The Fish Resources of the Ocean. Fishing News (Books), West By fleet, 255 pp.

Japp D. (1999) –An updated review of the catch statistics in the SEAFO Area was prepared by D.W. Japp, Fisheries & Oceanographic Support Services cc, Cape Town for consideration at the SEAFO Meeting in Cape Town on 27 September 1999. Unpublished.

NAFO WP 2012 – NAFO Working Paper 12/6. 34th Annual Meeting September 2012. 12pp.

SEAFO (2004) – Report of the 1st Annual of the Commission Meeting (http://www.seafo.org/CommAnnualReports.html)

APPENDIX I – Agenda for 10th SEAFO Scientific Committee Meeting

APPENDIX II – List of Participants

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No participation in the 10th SEAFO SC meeting.

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APPENDIX III – List of Working Documents submitted for the 10th SEAFO SC Meeting

Document Ref. Number	Agenda Item	Document Title	Provider
DOC/SC/00/2014	All	List of documents	Secretariat
DOC/SC/01/2014	All	Provisional agenda of the 10th Annual Meeting of the Scientific Committee	Secretariat
DOC/SC/02/2013	All	Provisional Annotated Agenda of the 10th Annual Meeting of the Scientific Committee	Secretariat
DOC/SC/04/2014	8/10/11	2014 Landing tables	Secretariat
DOC/SC/05/2014	9	Working document on the Japanese 2014 exploratory fishing survey.	Japan
DOC/SC/06/2014	12	Stock Status Report *Dissostichus eleginoides*	Luis Abellan
DOC/SC/07/2014	12	Stock Status Report *Hoplostethus atlanticus*	
DOC/SC/08/2014	12	Results of Deep-sea Red Crab genetic analysis	
DOC/SC/09/2014	12	Stock Status Report of Southern boarfish/pelagic amourhead	Ivone Figueiredo
DOC/SC/10/2014	12	Stock Status Report of Alfonsino *Beryx splendens*	
DOC/SC/11/2014	14	CCAMLR assessment of Patagonian toothfish in Area 48.6	Secretariat
DOC/SC/12/2014	14	CCAMLR 2013 SC report	Secretariat
DOC/SC/13/2014	18	FAO VME workshop Report (Swakopmund)	Secretariat
DOC/SC/14/2014	18	EBSAS workshop Report (Swakopmund)	Secretariat
DOC/SC/15/2014	22	SEAFO CM26-13 track changes	Norway
DOC/SC/16/2014	22	SEAFO Memo VME - Norway	Norway
DOC/SC/17/2014	22	VME Measures small amendments	Norway

APPENDIX IV – Landings, discards and bycatch tables

Retained & Discarded TAC species

Table 1: 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.

Table 2. Catches (tons) of Orange roughy (*Hoplostethus atlanticus*) made by Namibia, Norway and Republic of South Africa.

Nation	**Namibia**		**Norway**		**South Africa**	
Fishing method	**Bottom trawl**		**Bottom trawl**		**Bottom trawl**	
Management Area	**B1**		**A1**		**B1**	
Catch details (t)	**Retained**	**Discarded**	**Retained**	**Discarded**	**Retained**	**Discarded**
1995	40		N/F			
1996	8		N/F			
1997	5		22		27#**	
1998	N/F	N/F	12			
1999	<1		N/F	N/F		
2000	75		0			
2001	94		N/F	N/F		
2002	9		N/F	N/F		
2003	27		N/F	N/F		
2004	15		N/F	N/F		
2005	18		N/F	N/F		
2006	N/F	N/F	N/F	N/F		
2007	N/F	N/F	N/F	N/F	N/F	N/F
2008	N/F	N/F	N/F	N/F	N/F	N/F
2009	N/F	N/F	N/F	N/F	N/F	N/F
2010	N/F	N/F	N/F	N/F	N/F	N/F
2011	N/F	N/F	N/F	N/F	N/F	N/F
2012	N/F	N/F	N/F	N/F	N/F	N/F
2013	N/F	N/F	N/F	N/F	N/F	N/F
2014*	N/F	N/F	N/F	N/F	N/F	N/F

N/F = No Fishing. Blank fields = No data available.
* Provisional (Aug 2014)
** Sum of Catches from 1993 to 1997.
#Values taken from the Japp (1999).

Table 3a: Catches (tons) of Alfonsino (*Beryx spp.*) made by various countries.

Flag State	Namibia		Norway		Russia		Portugal		Ukraine		Korea	
Fishing method	Bottom trawl		Bottom trawl		Bottom trawl		Bottom trawl		UNK		Mid-water trawl	
Management Area	B1		A1		UNK		UNK		UNK		B1	
Catch details (t)	Retained	Discarded	Retained	Discarded	Retained	Discarded	Retained	Discarded	Retained	Discarded	Retained	Discarded
1976					252#							
1977					2972#							
1978					125#							
1993									172§			
1994												
1995	1#		N/F	N/F								
1996	368#		N/F	N/F					747§			
1997	208#		836		2800#				392§			
1998	N/F	N/F	1066		69§							
1999	1		N/F	N/F			3§					
2000	<1		242				1§					
2001	1		N/F	N/F			7§					
2002	0		N/F	N/F			1§					
2003	0		N/F	N/F			5§					
2004	6		N/F	N/F	210							
2005	1		N/F	N/F	54							
2006	N/F	N/F	N/F	N/F	N/F	N/F	<1					
2007	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2008	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2009	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2010	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	159	0
2011	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	165	0
2012	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	172	0
2013	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	13	0
2014*	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F

* Provisional (Aug 2014) N/F = No Fishing. Blank fields = No data available.
UNK = Unknown. # = Values taken from the Japp (1999). § = Values from FAO Two species targeted, however, *Beryx splendens* constitutes majority of the catch total.

Table 3b: Catches (tons) of Alfonsino (*Beryx spp*.) made by various countries.

Nation	Spain		Poland		Cook Island		Mauritius		Cyprus		South Africa	
Fishing method	Mid-water trawl and Longlines		UNK		Bottom trawl		Bottom trawl		Bottom trawl		Bottom trawl	
Management Area	UNK		UNK		UNK		UNK		UNK		B1	
Catch details (t)	Retained	Discarded	Retained	Discarded	Retained	Discarded	Retained	Discarded	Retained	Discarded	Retained	Discarded
1976												
1977												
1978												
1993												
1994												
1995			1964§								60#	
1996											109#	
1997	186§										124#	
1998	402§											
1999												
2000												
2001	2											
2002												
2003	2											
2004	4				142		115		437			
2005	72											
2006	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2007	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2008	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2009	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2010	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2011	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2012	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2013	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2014*	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F

* Provisional (Aug 2014) N/F = No Fishing. Blank fields = No data available. UNK = Unknown.

= Values taken from the Japp (1999). § = Values from FAO

Two species targeted: *Beryx splendens* represents majority of catch.

Table 4: Catches (tons) of Deep-sea red crab (*Chaceon spp*., considered to be mostly *Chaceon erytheiae*).

Nation	Japan		Namibia		Spain		Portugal	
Fishing method	Pots		Pots		Pots		Pots	
Management Area	B1		B1		UNK		A	
Catch details (t)	Retained	Discarded	Retained	Discarded	Retained	Discarded	Retained	Discarded
2001					<1			
2002								
2003					5			
2004					24			
2005	253	0	54					
2006	389							
2007	770		3	0			35	
2008	39							
2009	196		N/F	N/F	N/F	N/F	N/F	N/F
2010	200	0			N/F			
2011	N/F	N/F	175	0	N/F	N/F	N/F	N/F
2012	N/F	N/F	198	0	N/F	N/F	N/F	N/F
2013	N/F	N/F	196	0	N/F	N/F	N/F	N/F
2014*	N/F	N/F	135	0	N/F	N/F	N/F	N/F

* Provisional (Aug 2014)
N/F = No Fishing.
Blank fields = No data available.
UNK = Unknown.

Table 5a: Catches (tons) of pelagic armourhead (*Pseudopentaceros richardsoni*).

Nation	Namibia		Russia		Ukraine		South Africa	
Fishing method	Bottom trawl		Bottom trawl		Bottom trawl		Bottom trawl	
Management Area	B1		B1		UNK		B1	
Catch details (t)	Retained	Discarded	Retained	Discarded	Retained	Discarded	Retained	Discarded
1976			108					
1977			1273					
1978			53					
1993			1000		435§			
1994								
1995	8				49		530	
1996	284				281		201	
1997	559				18		12	
1998	N/F							
1999	N/F							
2000	20							
2001	N/F							
2002	N/F							
2003	4							
2004								
2005								
2006								
2007								

2008								
2009	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2010	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2011	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2012	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2013	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2014*	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F

* = Provisional (Aug 2014)
N/F = No Fishing.
Blank fields = No Data Available.
UNK = Unknown.
§ = Values from FAO

Table 5b: Catches (tons) of Pelagic armourhead (*Pseudopentaceros richardsoni*).

Nation	**Spain**		**Cyprus**		**Korea**	
Fishing method	**Bottom trawl and Longline**		**Bottom trawl**		**Mid-water trawl**	
Management Area	**B1**		**UNK**		**B1**	
Catch details (t)	**Retained**	**Discarded**	**Retained**	**Discarded**	**Retained**	**Discarded**
1976						
1977						
1978						
1993						
1994						
1995						
1996						
1997						
1998						
1999						
2000						
2001	<1					
2002						
2003	3					
2004	3		22			
2005						
2006						
2007						
2008						
2009	N/F	N/F	N/F	N/F	N/F	N/F
2010	N/F	N/F	N/F	N/F	688	0
2011	N/F	N/F	N/F	N/F	135	0
2012	N/F	N/F	N/F	N/F	152	<1
2013	N/F	N/F	N/F	N/F	13	0
2014*	N/F	N/F	N/F	N/F	N/F	N/F

* = Provisional (Aug 2014)
N/F = No Fishing.
Blank fields = No Data Available.
UNK = Unknown.
§ = Values from FAO

Retained & Discarded Bycatch species

Table 6: Catches (tons) of oreo dories (*Allocyttus verucossus, Neocyttus rhombiodalis, Allocyttus guineensis*). Smooth oreo dories- *Pseudocyttus maculatus.*

Nation	Russia		Cyprus		Mauritius		Namibia	
Fishing method	UNK		UNK		UNK		Bottom trawl	
Management Area	UNK		UNK		UNK		UNK	
Catch details (t)	Retained	Discarded	Retained	Discarded	Retained	Discarded	Retained	Discarded
1995							<1	
1996							0	
1997							35	
1998							N/F	N/F
1999							3	
2000							33	
2001							14	
2002							1	
2003							1	
2004	<1		21		25		0	
2005							4	
2006								
2007								
2008								
2009								
2010	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0
2014*	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F

* Provisional (Aug 2013)
N/F = No Fishing. Blank fields = No data available. UNK = Unknown.

Table 7: Catches (tons) of Wreckfish (*Polyprion americanus*). (WRF)

Nation	Portugal	
Fishing method	Longlines	
Management Area	A	
Catch details (t)	Retained	Discarded
2004	1	
2005		
2006	6	
2007	9	
2008		
2009	0	0
2010	0	0
2011	0	0
2012	0	0
2013	N/F	N/F

2014*	N/F	N/F

* Provisional (Aug 2014)
N/F = No Fishing. Blank fields = No data available. UNK = Unknown.

Table 8: Catches (tons) of Blackbelly rosefish (*Helicolenus* spp.). (BRF)

Nation	**Korea**	
Fishing method	**Mid-water trawl**	
Management Area	**B1**	
Catch details (t)	**Retained**	**Discarded**
2010	161	0
2011	47	0
2012	44	0
2013	4	0
2014*	N/F	N/F

* Provisional (Aug 2014)

Table 9: Catches (tons) of Imperial Blackfish (*Schedophilus ovalis*). (HDV)

Nation	**Korea**	
Fishing method	**Mid-water trawl**	
Management Area	**B1**	
Catch details (t)	**Retained**	**Discarded**
2010	24	0
2011	35	0
2012	24	0
2013	<1	0
2014*	N/F	N/F

* Provisional (Aug 2014)

Table 10: Catches (tons) of Silver Scabbardfish (*Lepidotus caudatus*). (SVS)

Nation	**Korea**	
Fishing method	**Mid-water trawl**	
Management Area	**B1**	
Catch details (t)	**Retained**	**Discarded**
2010	30	0
2011	15	0
2012	2	0
2013	0	<1
2014*	N/F	N/F

* Provisional (Aug 2014)

Table 11: Catches (tons) of Mackerel (*Scomber japonicus*). (MAZ)

Nation	Korea	
Fishing method	**Mid-water trawl**	
Management Area	**B1**	
Catch details (t)	**Retained**	**Discarded**
2010	50	0
2011	0	0
2012	0	0
2013	0	0
2014*	N/F	N/F

* Provisional (Aug 20141)

Table 12: Catches (tons) of Cape Horse Mackerel (*Trachurus capensis*). (HMC)

Nation	Korea	
Fishing method	**Mid-water trawl**	
Management Area	**B1**	
Catch details (t)	**Retained**	**Discarded**
2010	1	0
2011	0	0
2012	0	0
2013	0	0
2014*	N/F	N/F

* Provisional (Aug 2014)

Table 13: Catches (tons) of Cape Bonnetmouth (*Emmelichthys nitidus*). (EMM)

Nation	Korea	
Fishing method	**Mid-water trawl**	
Management Area	**B1**	
Catch details (t)	**Retained**	**Discarded**
2010	11	0
2011	2	0
2012	<1	0
2013	0	0
2014*	N/F	N/F

* Provisional (Aug 2014)

Table 14: Catches (tons) of Oilfish (*Ruvettus pretiosus*). (OIL)

Nation	Korea	
Fishing method	**Mid-water trawl**	
Management Area	**B1**	
Catch details (t)	**Retained**	**Discarded**
2010	5	0

2011	13	0
2012	7	<1
2013	<1	0
2014*	N/F	N/F

* Provisional (Aug 2014)

Table 15: Catches (tons) Gemfish (*Roudi escolar*, *Promethichthys prometheus*). (PRP)

Nation	**Korea**	
Fishing method	**Mid-water trawl**	
Management Area	**B1**	
Catch details (t)	**Retained**	**Discarded**
2010	0	0
2011	0	0
2012	<1	0
2013	0	0
2014*	N/F	N/F

* Provisional (Aug 2014)

Table 16: Catches (tons) of Orange bellowfish (NPR)

Nation	**Korea**	
Fishing method	**Mid-water trawl**	
Management Area	**B1**	
Catch details (t)	Retained	Discarded
2010	0	0
2011	0	0
2012	0	<1
2013	0	<1
2014*	N/F	N/F

* Provisional (Aug 2014)

Table 17: Catches (tons) of Grenadiers nei (*Macrourus* spp.) (GRV)

Nation	Spain				Japan				Korea		South Africa			
Fishing method	Longlines				Longlines				Longlines		Longlines			
Management Area	D0		D1		D0		D1		D0		D0		D1	
Catch details (t)	Retained	Discarded	Retained	Discarded	Retained	Discarded	Retained	Discarded	Retained	Discarded	Retained	Discarded	Retained	Discarded
2009	N/F	N/F	N/F	N/F	0	0	0	6	0	<1	N/F	N/F	N/F	N/F
2010	4	<1	2	0	0	0	0	3	N/F	N/F	N/F	N/F	N/F	N/F
2011	N/F	N/F	N/F	N/F	0	22	0	0	N/F	N/F	0	0	0	0
2012	N/F	N/F	N/F	N/F	0	21	0	0	N/F	N/F	0	3	0	<1
2013	N/F	N/F	N/F	N/F	0	7	0	<1	N/F	N/F	N/F	N/F	N/F	N/F
2014*	N/F	N/F	N/F	N/F					N/F	N/F	N/F	N/F	N/F	N/F

* Provisional (Aug 2014)

Table 18: Catches (tons) of Blue antimora (*Antimora rostrata*). (ANT)

Nation	Spain				Japan				Korea				South Africa			
Fishing method	Longlines				Longlines				Longlines				Longlines			
Management Area	D0		D1		D0		D1		D0		D1		D0		D1	
Catches (t)	Ret	Dis	Ret	Dis	Ret	Dis	Ret	Dis	Ret	Dis	Ret	Dis	Ret	Dis	Ret	Dis
2009	N/F	N/F	N/F	N/F	0	0	0	5	0	<1	0	<1	N/F	N/F	N/F	N/F
2010	0	<1	0	<1	0	0	0	1	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2011	N/F	N/F	N/F	N/F	0	5	0	0	N/F	N/F	N/F	N/F	0	0	0	0
2012	N/F	N/F	N/F	N/F	0	4	0	0	N/F	N/F	N/F	N/F	0	<1	0	<1
2013	N/F	N/F	N/F	N/F	0	<1	0	<1	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2014*	N/F	N/F	N/F	N/F					N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F

* Provisional (Aug 2014) N/F = No Fishing Ret = Retained Dis = Discarded

APPENDIX V – Data on catches of VME indicator species within the SEAFO CA

Table 1: Provisional list of benthic invertebrate VME indicator species/groups for the SEAFO CA.

Group / Species code	Phylum / Order / Family	Common name
PFR	Porifera	Sponges
GGW	Gorgonacea (Order)	Gorgonian corals
AZN	Anthoathecatae (Family)	Hydrocorals
CSS	Scleractinia (Order)	Stony corals
AQZ	Anthipatharia (Order)	Black corals
ZOT	Zoantharia (Order)	Zoanthids
AJZ	Alcyonacea (Order)	Soft corals
NTW	Pennatulacea (Order)	Sea pens
BZN	Bryozoa	Erect bryozoans
CWD	Crinoidea (Class)	Sea lilies
OWP	Ophiuroidea (Class)	Basket stars
SZS	Serpulidae (Family)	Annelida
SSX	Ascidiacea (Class)	Sea squirts

Table 2: Catches (kg) of Gorgonians (VME indicators).

Nation	**Japan**	**Spain**
Management Area	**D**	**D**
Fishing method	**LLS**	**LLS**
Catch details	Bycatch (kg)	Bycatch (kg)
2010	0	47.5
2011	3.8	N/F
2012	30.3	N/F
2013	1.2	N/F
2014*	2.3	N/F

***** Provisional (Aug 2014)
N/F = No Fishing. Blank fields = No data available.

Table 3: Catches (kg) of Black corals and thorny corals (VME indicators).

Nation	**Japan**	**Spain**	**Korea**
Management Area	**D**	**D**	**B1**
Fishing method	**LLS**	**LLS**	**MT**
Catch details	**Bycatch (kg)**	**Bycatch (kg)**	**Bycatch (kg)**
2010	0	4.4	0
2011	0	N/F	0

2012	0.02	N/F	0
2013	0	N/F	0.4
2014*	0	N/F	N/F

***** Provisional (Aug 2014)
N/F = No Fishing. Blank fields = No data available.

Table 4: Catches (kg) of Scleractinia (VME indicators).

Nation	**Japan**	**Spain**
Management Area	**D**	**D**
Fishing method	**LLS**	**LLS**
Catch details	**Bycatch (kg)**	**Bycatch (kg)**
2010	0	2.2
2011	15.4	N/F
2012	17.6	N/F
2013	0	N/F
2014*	2.8	N/F

***** Provisional (Aug 2014)
N/F = No Fishing. Blank fields = No data available.

Table 5: Catches (kg) of sea pens (VME indicators) (NTW)

Nation	**Japan**	**Spain**
Management Area	**D**	**D**
Fishing method	**LLS**	**LLS**
Catch details	**Bycatch (kg)**	**Bycatch (kg)**
2010	0	1.3
2011	0	N/F
2012	0.02	N/F
2013	0	N/F
2014*	0	N/F

***** Provisional (Aug 2014)
N/F = No Fishing. Blank fields = No data available.

Table 6: Catches (kg) of sponges (VME indicators).

Nation	**Japan**	**Spain**
Management Area	**D**	**D**
Fishing method	**LLS**	**LLS**
Catch details	**Bycatch (kg)**	**Bycatch (kg)**

2010	0	29.7
2011	0	N/F
2012	0	N/F
2013	0	N/F
2014*	0	N/F

***** Provisional (Aug 2014)
N/F = No Fishing. Blank fields = No data available.

Table 7: Catches (kg) of Zoanthids (VME indicators).

Nation	**Japan**	**Spain**
Management Area	**D**	**D**
Fishing method	**LLS**	**LLS**
Catch details	**Bycatch (kg)**	**Bycatch (kg)**
2010	0	0.3
2011	0	N/F
2012	0	N/F
2013	0	N/F
2014*	0	N/F

***** Provisional (Aug 2014)
N/F = No Fishing. Blank fields = No data available.

Table 8: Catches (kg) of soft corals (VME indicators).

Nation	**Japan**	**Spain**
Management Area	**D**	**D**
Fishing method	**LLS**	**LLS**
Catch details	**Bycatch (kg)**	**Bycatch (kg)**
2010	0	0.3
2011	0	N/F
2012	0	N/F
2013	0	N/F
2014*	0	N/F

***** Provisional (Aug 2014)
N/F = No Fishing. Blank fields = No data available.

Table 9: Catches (kg) of sea lilies (VME indicators).

Nation	**Japan**	**Spain**
Management Area	**D**	**D**

Fishing method	LLS	LLS
Catch details	Bycatch (kg)	Bycatch (kg)
2010	0	1.0
2011	0	N/F
2012	0.02	N/F
2013	0	N/F
2014*	0	N/F

***** Provisional (Aug 2014)
N/F = No Fishing. Blank fields = No data available.

APPENDIX VI – Stock Status Report – Alfonsino

STATUS REPORT

Beryx splendens

Common Name: Alfonsino

FAO-ASFIS Code: ALF

2014

Updated: 9-Oct-14

TABLE OF CONTENTS

1. Description of the fishery

1.1 Description of fishing vessels and fishing gear

The Korean trawl fishery in the SEAFO CA started in 2010 using trawl nets by two fishing vessels, F/V Adventure and F/V Dongsan Ho. Table 1 and Fig. 1-3 show the gear specifications for F/V Adventure. HAMPIDJAN NET, bottom fishing, is a two-piece net, 66 m in length. The head rope is 48 m long; the ground rope is 50 m; the height, width and girth of the net are 5.5 m, 30 m and 100 m, respectively. The cod-end mesh size is 120 mm. The ground gear is 50 m in length and 903 kg in weight, and the float is 1,018 kg. MANUFACTURED NET is a four-piece net with the overall length of 66.9 m. The lengths of the head rope and ground rope are 59.0 m and 77.9 m, respectively. The height, width and girth of the net are 5.5 m, 200 m and 83 m, respectively. The cod-end mesh size is 120 mm. The ground is 77.9 m in length and the weight of the ground is 2,068 kg. The float is 913 kg with the floating rate of 44%. MIDWATER NET is 210 m long. The lengths of head rope and ground ropes are 93.6 m. The height and width of the net are 70.0 m and 240~260 m respectively. The girth of the net is 816 m. The cod-end mesh size is 120 mm.

Table 1: Gear specifications for F/V Adventure.

Gear Specifications		bottom fishing HAMPIDJAN	bottom fishing (custom manufactured)	midwater
Otter board	type	VRS-TYPE	VRS-TYPE	VRS-TYPE
	material	Steel	Steel	Steel
	size (mm)	2,300 x 4,030	2,750 x 4,900	1,854 x 3,818
	weight (kg)	3,930	4,320	2,000
	under water weight (kg)	2,619	2,473	1,145
Trawl Net	purpose	bottom fishing (figure1)	bottom fishing (figure2)	midwater fishing (figure3)
	net length overall(m)	66	66.9	210.0
	head rope (m)	48	59.0	93.6
	ground rope (m)	50	77.9	93.6
	net height (m)	5.5	5.5	70
	net width (m)	30	200	240~260
	net girth (m)	100	83	816
	mesh size (mm)	120	120	120

F/V Dongsan Ho is a stern trawler which has two types of fishing gears; midwater trawl net and bottom trawl net - this vessel will not be operating in the future. The gear used for the operation in the SEAFO Convention Area is the midwater KITE gear (Fig. 3 & 4), which consist of ropes, whose upper part has kites and lower part has chains. The height of the net's gate is approximately 50 m, and the total length is around 280 m. When set the midwater net, the gear sinks underwater, whose sinking depth is controlled by wire ropes. Bottom trawl net is that PE Net (Fig. 1 & 2) is used in the SEAFO Area, to which upper and

lower parts plastic buoys and rubber balls are attached respectively. When set the bottom net, the gear sinks underwater, and the depth is controlled by warp wires.

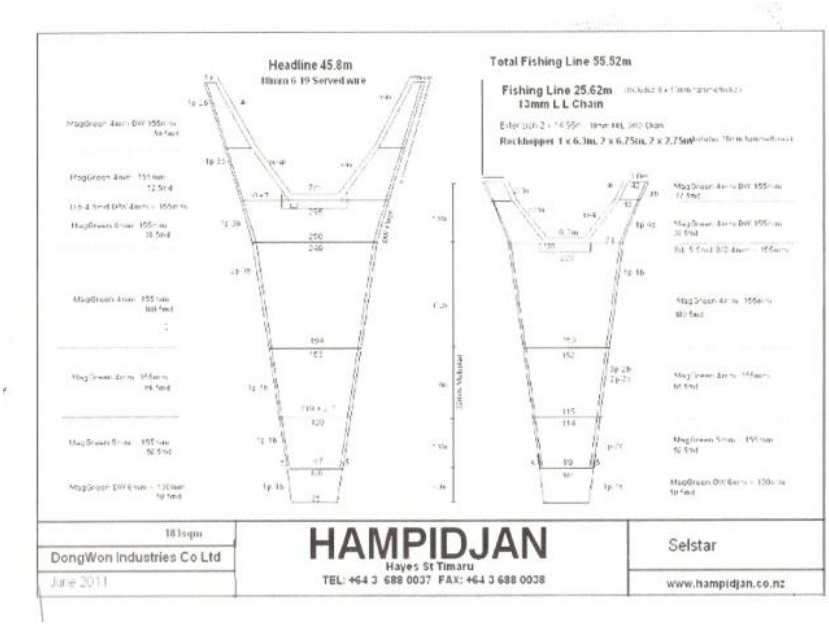


Figure 1: Diagram of HAMPIDJAN NET of the F/V Adventure.

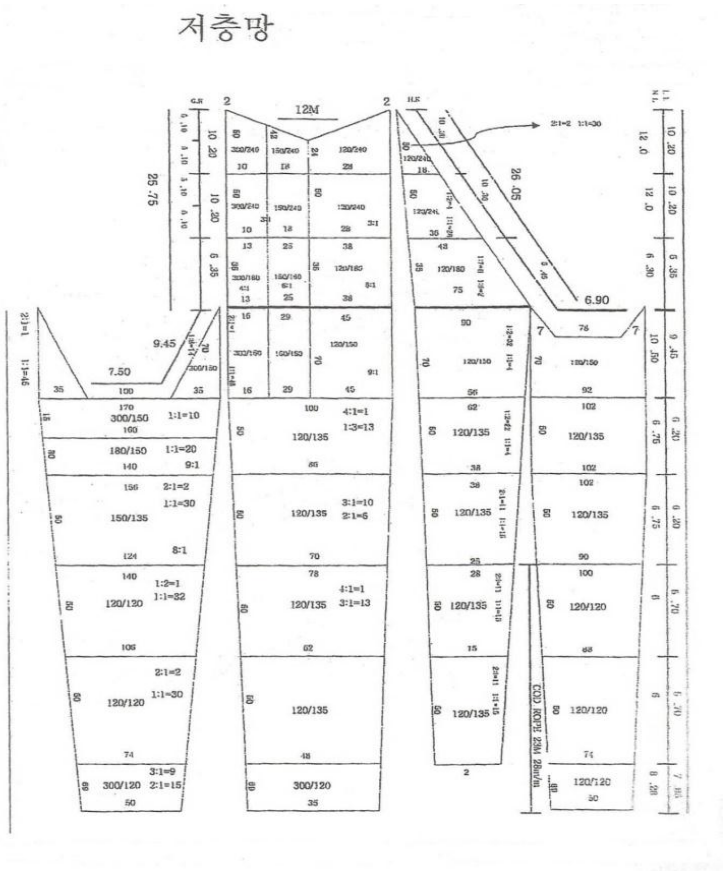


Figure 2: Drawing of the Custom Manufactured Bottom Trawl Net of the F/V Adventure.

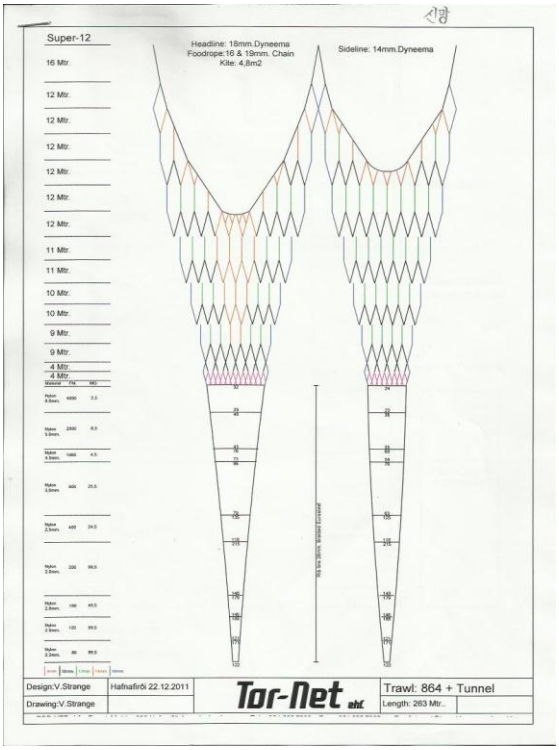


Figure 3: Drawing of midwater trawl net of the F/V Adventure.

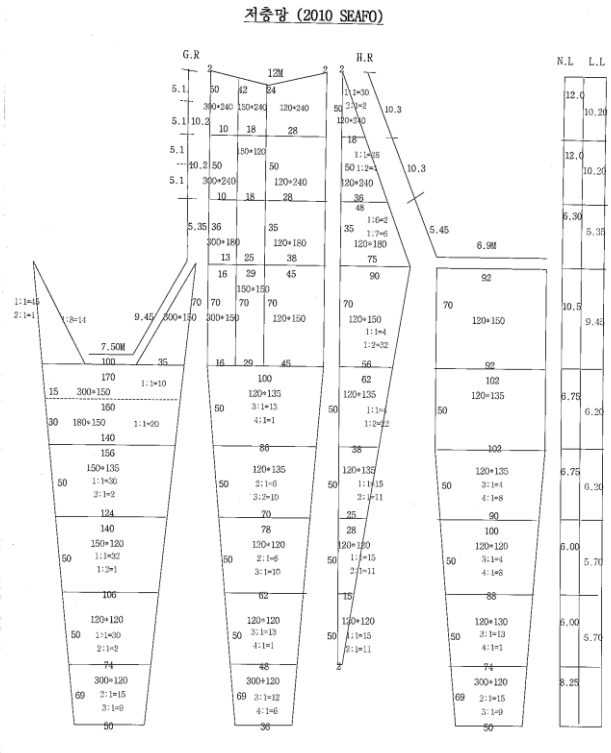


Figure 4: Drawing of midwater trawl net of the F/V Dongsan Ho.

1.2 Spatial and temporal distribution of fishing

During the period from 2010 to 2011 Korean trawl vessels (Dongsan Ho and/or Adventure) caught Alfonsino mainly in the northern part and in the southern part of Division B1in 2012 and 2013 (Fig. 5-8). It was possible to distinguish two or three main areas or fishing grounds in Division B1.

Table 1: The total number of sets from which alfonsino catches were derived for the period 2010-2013.

2010	2011	2012	2013
19	15	28	7

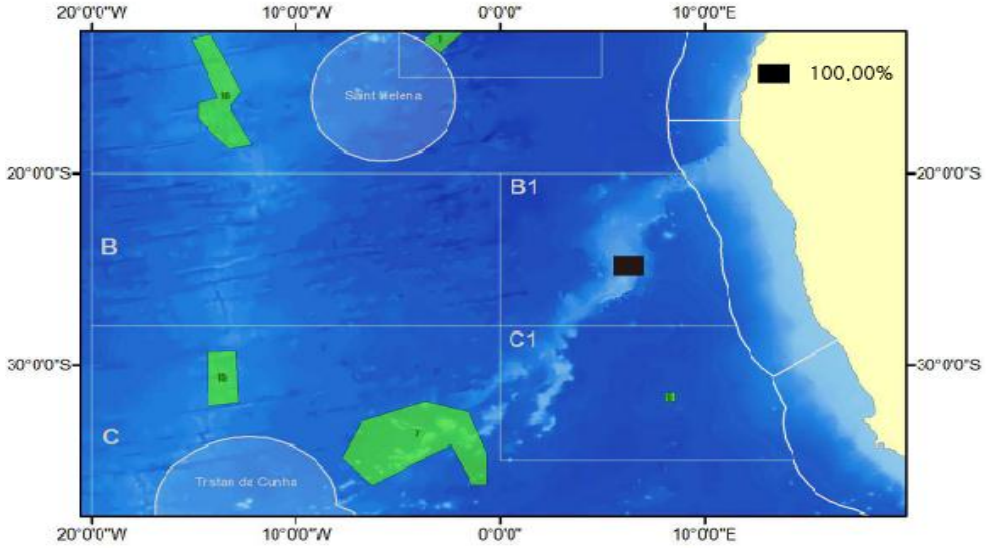


Figure 5: Annual estimated catch (1.6 tonnes) of Alfonsino in 2013 derived from the Observer Reports aggregated to 100km diameter rectangle.

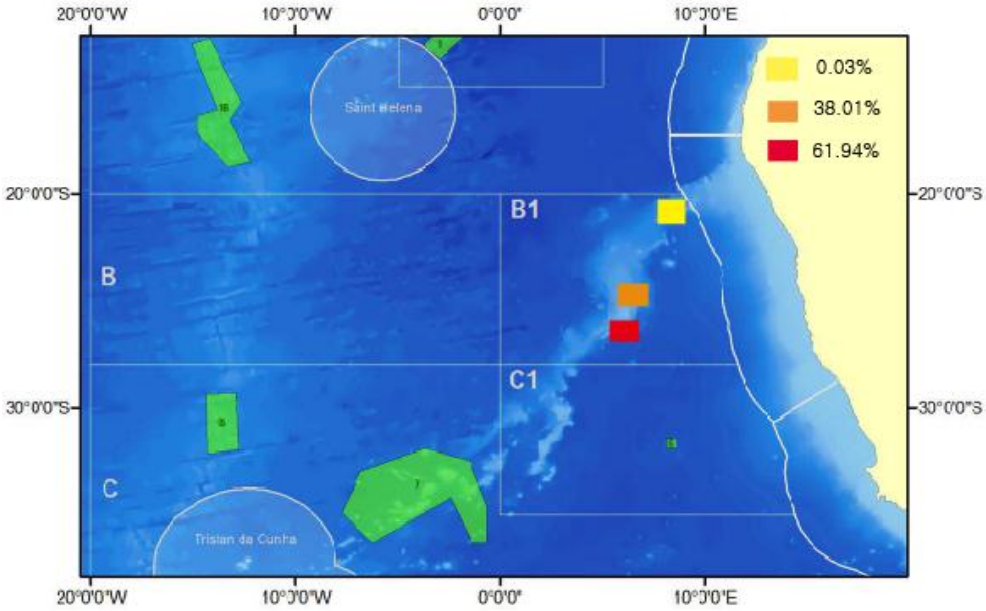


Figure 6: Annual estimated catch of Alfonsino in 2012 derived from the Observer Reports aggregated to 100km diameter rectangle.

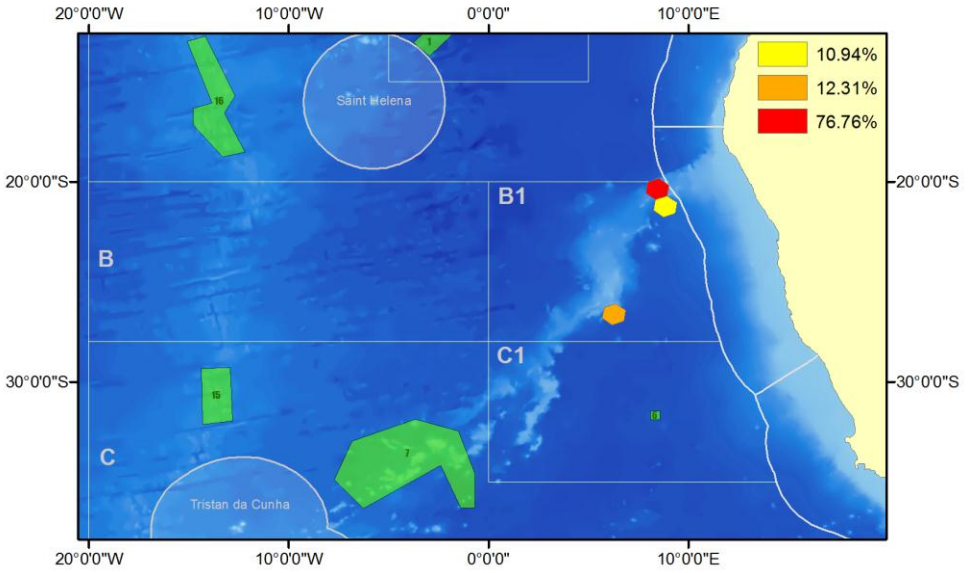


Figure 7: Annual estimated catch of Alfonsino in 2011 derived from the Observer Reports aggregated to 100km diameter hexagonal cells.

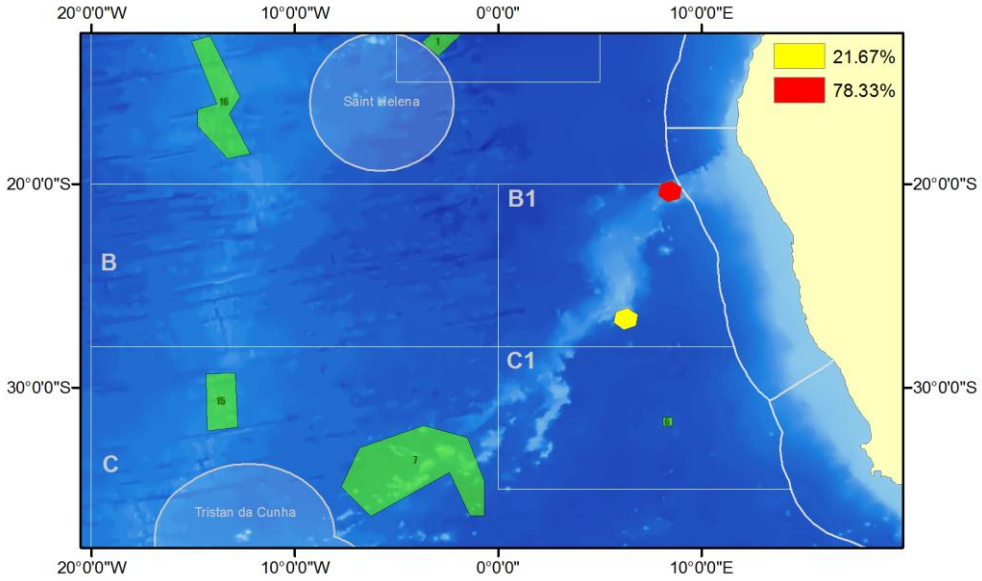


Figure 8: Annual estimated catch of Alfonsino in 2010 derived from the Observer Reports aggregated to 100km diameter rectangle hexagonal cells

1.3 Reported retained catches and discards

Table 2 presents alfonsino catches by country, as well as fishing gear and the divisions in which the catch was taken. Historically, the main fishing countries worked in the SEAFO CA included Russia (bottom trawl) in the late 1970s, Ukraine in the mid-1990s, Russia (bottom trawl), Norway (bottom trawl), Spain (MWT /BLL), Poland and Namibia (bottom trawl) in the late 1990s. In recent years South Korea conducted a trawl fishery for 4 years and the reported landings during 2010 to 2013 were, 198 tonnes, 196 tonnes, 172 tonnes and 1.6 tonnes, respectively. Historically the highest catches of the fish were recorded by Russia with 2,972 and 2,800 tons in 1977 and 1997 respectively, Poland 1,964 tonnes in 1995, and Norway 1,066 tons in 1998.

Table 2a: Catches (tonnes) of alfonsino (*B. splendens*) made by various countries. Values in *italics* are taken from Japp (1999). Values in **bold** are from the FAO.

Flag State	**Namibia**		**Norway**		**Russia**		**Portugal**		**Ukraine**		**Korea**	
Fishing method	**Bottom trawl**		**Bottom trawl**		**Bottom trawl**		**Bottom trawl**		**UNK**		**Mid-water trawl**	
Management Area	**B1**		**A1**		**UNK**		**UNK**		**UNK**		**B1**	
Catch details (t)	**Retained**	**Discarded**	**Retained**	**Discarded**	**Retained**	**Discarded**	**Retained**	**Discarded**	**Retained**	**Discarded**	**Retained**	**Discarded**
1976					252#							
1977					2972#							
1978					125#							
1993									172§			
1994												
1995	1#		N/F	N/F								
1996	368#		N/F	N/F					747§			
1997	208#		836		2800#				392§			
1998	N/F	N/F	1066		69§							
1999	1		N/F	N/F			3§					
2000	<1		242				1§					
2001	1		N/F	N/F			7§					
2002	0		N/F	N/F			1§					
2003	0		N/F	N/F			5§					
2004	6		N/F	N/F	210							
2005	1		N/F	N/F	54							
2006	N/F	N/F	N/F	N/F	N/F	N/F	<1					
2007	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2008	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2009	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2010	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	159	0
2011	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	165	0
2012	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	172	0
2013	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	2	0
2014*	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F

* Provisional (Aug 2014) N/F = No Fishing. Blank fields = No data available. UNK = Unknown. # = Values taken from the Japp (1999).
§ = Values from FAO Two species targeted, but *Beryx splendens* constitutes majority of the catch total.

Table 2b: Catches (tonnes) of alfonsino (*B. splendens*) made by various countries. Values in *italics* are taken from Japp (1999). Values in **bold** are from the FAO.

Nation	**Spain**		**Poland**		**Cook Island**		**Mauritius**		**Cyprus**		**South Africa**	
Fishing method	**Mid-water trawl and Longlines**		**UNK**		**Bottom trawl**		**Bottom trawl**		**Bottom trawl**		**Bottom trawl**	
Management Area	**UNK**		**UNK**		**UNK**		**UNK**		**UNK**		**B1**	
Catch details (t)	**Retained**	**Discarded**	**Retained**	**Discarded**	**Retained**	**Discarded**	**Retained**	**Discarded**	**Retained**	**Discarded**	**Retained**	**Discarded**
1976												
1977												
1978												
1993												
1994												
1995			1964§								60#	
1996											109#	
1997	186§										124#	
1998	402§											
1999												
2000												
2001	2											
2002												
2003	2											
2004	4				142		115		437			
2005	72											
2006	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2007	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2008	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2009	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2010	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2011	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2012	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2013	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2014*	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F

* Provisional (Aug 2014) N/F = No Fishing. Blank fields = No data available. UNK = Unknown. # = Values taken from the Japp (1999).
§ = Values from FAO Two species targeted, but *Beryx splendens* constitutes majority of the catch total.

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

Alfonsino has a global distribution and has been reported from all tropical and temperate oceans (excluding from the northeast Pacific and Mediterranean Sea) between latitudes of about 65° N and 43° S. It occurs from depths of about 25 m to at least 1300 m (Busakhin 1982). In the Atlantic Ocean the species occurs at both at western (Gulf of Maine to the Gulf of Mexico) and eastern Atlantic (off south Western Europe and the Canary Islands to South Africa) (Fig. 9).This species is benthopelagic: adults inhabit the outer shelf (180 m) and slope to at least 1,300 m depth, probably moving further from the bottom at night but ascending to feed in midwater during the night; often found over seamounts and underwater ridges. There is no information on migration behaviour.

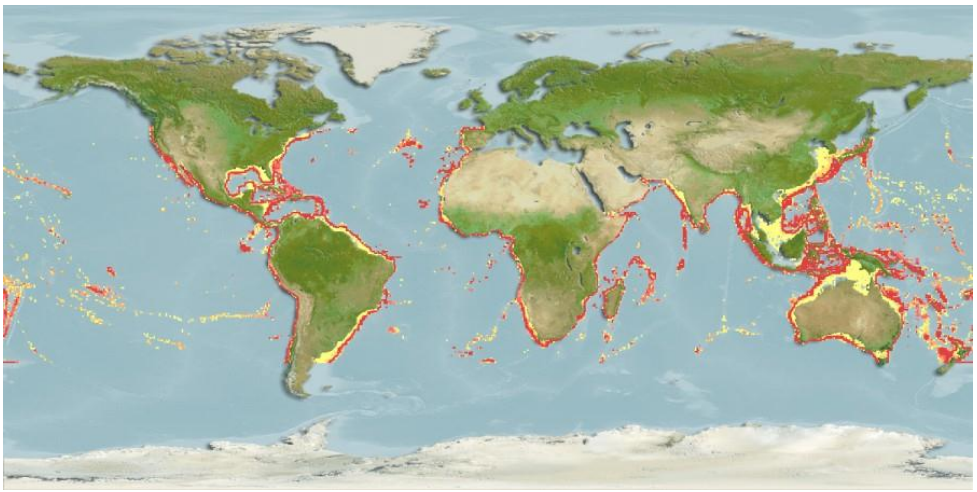


Figure 9: The predicted/potential distribution of alfonsino (*B. splendens*) based on habitat suitability considerations (FishBase).

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

3.1 Fisheries and surveys data

Non-availability of the historical data and fishing trends for fishing activities in the SEAFO CA prevent application of standard assessment methods. However, only catch and effort (per haul) data for a period of three years (2010-2012) are available for quantitative stock assessment.

3.2 Length data and frequency distribution

Using the data collected by Korean trawl fisheries between 2010 and 2013, the length frequency distributions were analysed (Table 3). In 2013 the length sampling was insufficient.

In 2011 the length of alfonsino in the southern area of Division B1 was the largest with average 26.5 cm

and 28.0 cm at the 3rdquartile, with two modes at 22 cm and 27 cm. In the southern area of Division B1 the length of the fish was also the largest in 2011 and reached about 50 cm fork length. No trend appeared in 2012 (May-June) due to paucity of samples (23 samples). The length of the species in the northern part was larger than that of southern part of B1 in 2012.

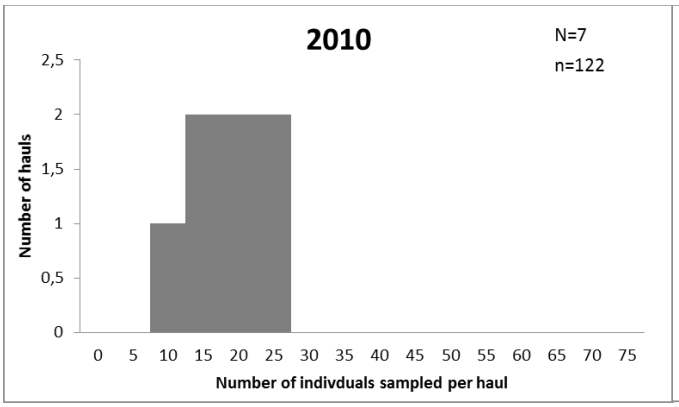
Females tend to have a higher von Bertalanffy L_{inf} value than males, but growth appears relatively similar between areas (i.e., east and west Atlantic, and North and South Pacific) (Lehodey & Grandperrin 1996, Rico et al. 2001, Gili *et al.*, 2002).

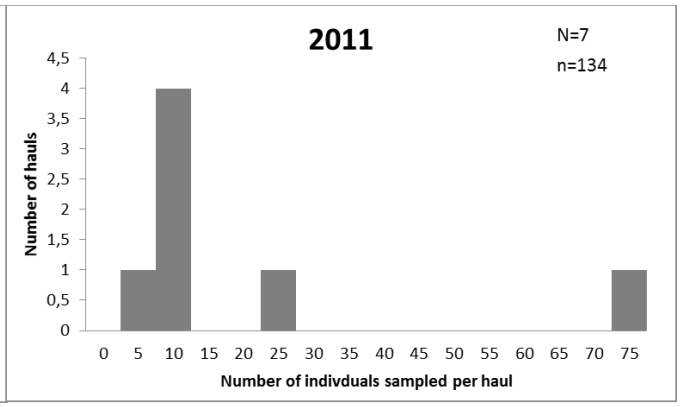
Table 3: Results of length composition of Alfonsino collected by Korean vessels in Division B1 (2010-2012).

	2010		2011		2012 (5~6)		2012(11)	
	South	North	South	North	South	North	South	North
No. of samples	200	841	174	593	514	23	77	-
Minimum length	19.0	17.0	20.0	15.0	17.0	26.0	24.0	-
Maximum length	42.0	47.0	50.0	48.0	34.0	35.0	39.0	-
Average length	25.8	24.8	26.5	27.8	24.8	31.0	31.5	-
Median length	25.0	24.0	25.0	28.0	25.0	32.0	32.0	-
1stquartile length	23.0	22.0	23.0	25.0	23.0	30.0	29.0	-
3rdquartile length	27.0	26.0	28.0	31.0	26.0	32.5	34.0	-

Table 4: Summary of fork length distribution of Alfonsino (*Beryx splendens*) by depth for 2010-2013.

	2010		2011		2012(5~6)		2012(11)	
	South	North	South	North	South	North	South	North
No. of Samples	841	200	174	593	514	23	77	-
Average Depth (m)	210.9	211.1	229.6	238.4	323.8	288.5	248.2	-
Average FL (cm)	25.8	24.8	26.5	27.8	24.8	31.0	31.5	-





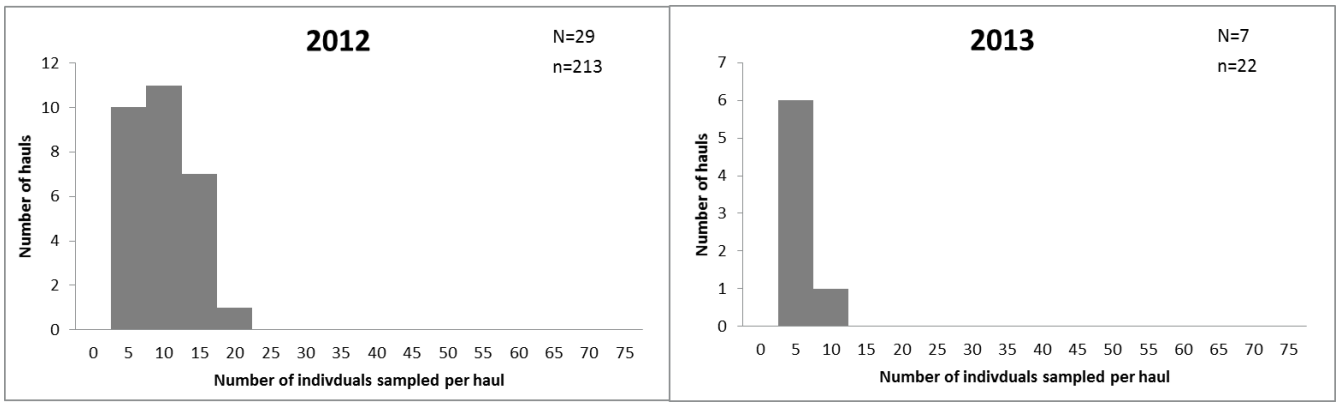


Figure 10: The number of individuals of Alfonsino sampled per haul over the period 2010 to 2013 in the SEAFO CA. Data from Observer Reports submitted to SEAFO. N = number of hauls sampled per year; n = total number of individuals sampled.

Table 5: Number of sets by year, minimum and maximum number of individuals per set and the number of individuals sampled during the period 2010 to 2013 in the SEAFO CA.

Year	No. of Sets Observed	Mean Individuals	Min. Individuals	Max. Individuals	Mean sample size/tonnes
2010	7	17.429	10	25	0.92
2011	7	19.143	5	75	1.36
2012	29	7.345	1	16	0.06
2013	7	3.143	1	7	1.94

3.3 Length-weight relationships

Figure 11 shows the length and weight relationship of Alfonsino for 2010-2013. Two parameters of the length-weight relationship were 0.022 for α and 3.010 for β of combined sex of Alfonsino.

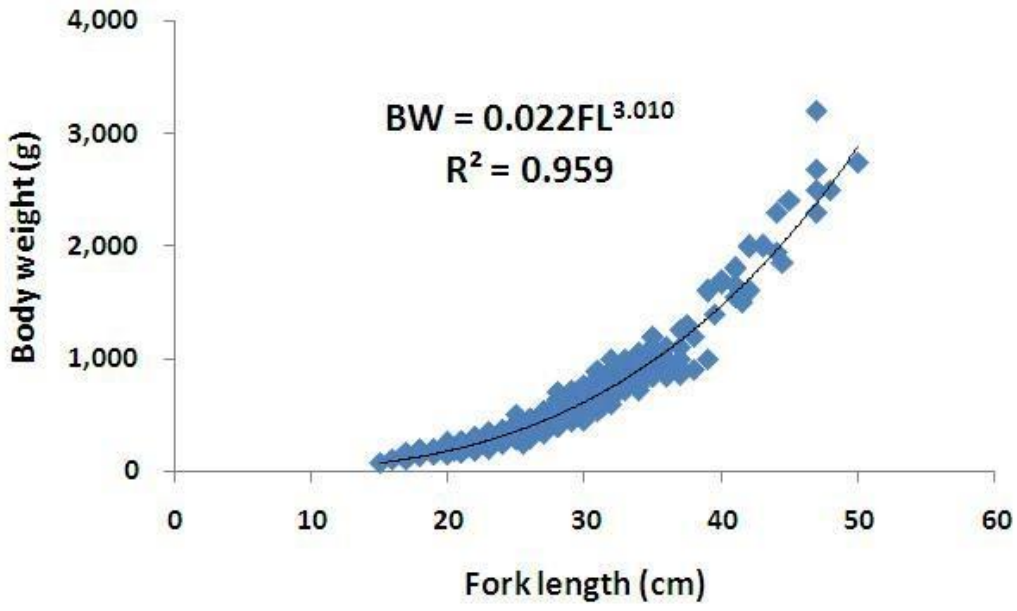


Figure 11: Relationship between length and weight of Alfonsino (*B. splendens*) in the SEAFO CA for 2010 - 2013.

3.4 Age data and growth parameters

The maximum observed age of Alfonsino in the Guinean Gulf was 20 years. The species is known to aggregate and thus is vulnerable to overfishing.

The growth parameters of Alfonsino were estimated as K=0.097 $year^{-1}$, L_{inf}=48 cm, and t_0=-3.08$year^{-1}$ using the specimens from Guinean Gulf (López-Abellán *et al*. 2008).

3.5 Reproductive parameters

The annual numbers and proportion of the fish by gonad maturity stage by Korean trawl fisheries during the period of 2010 - 2013 are presented in Table 6 and Figure 13. The proportion of immature fishes was 99.4%, 91.4%, 98.6% and 97.1% in 2010, 2011, 2012 and 2013, respectively. The fish, which is in pre-spawning and spawning gonad stages, appeared from October indicating that the spawning season may start from sometime after October. To get more accurate reproduction results of alfonsino in the SEAFO Area, there is a need to collect data for a few more years.

Table 6: Annual number of fish by maturity stages of alfonsino (*B. splendens*) in the SEAFO CA for 2010 to2013.

Year	Month	Maturity stage				
		Immature	Developing	Pre-spawning	Spawning	Spent
2010	Sep	882	66	6	0	0
	Oct	33	6	0	0	0
	Nov	0	20	0	0	0
2011	Jan	95	239	0	0	0
	Sep	37	1	0	0	0
	Oct	18	20	12	0	0
	Nov	26	77	34	2	0
2012	May	16	7	0	0	0
	Jun	452	32	0	0	0
	Nov	29	40	3	5	0
2013	Oct	42	4	0	0	0
	Nov	28	25	3	0	0

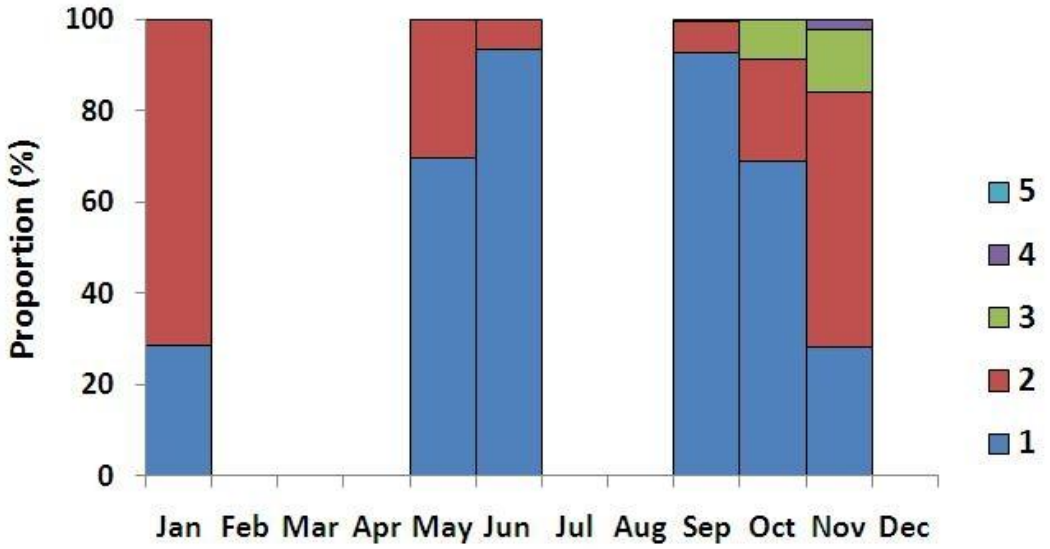


Figure 12: The proportion of maturity stage of alfonsino in the SEAFO CA for 2010-2013.(1: immature, 2: developing, 3: pre-spawning, 4: spawning, and 5: spent).

3.6 Natural mortality

There is no available information to derive estimates of natural mortality rates for the SEAFO CA.

3.7 Feeding and trophic relationships (including species interaction)

There is no available information and data in the SEAFO CA.

3.8 Tagging and migration

No tagging and migration studies on Alfonsino have been done in the SEAFO Area.

4. Stock assessment

4.1 Available abundance indices and estimates of biomass

There is no available information and data in the SEAFO CA. CPUE in the Korea trawl fishery in B1 was explored as a potential index of biomass to be used for future evaluation of biomass trends.

4.2 Data used

The data used to calculate CPUE of alfonsino were derived from fishing hauls in which the total catch of *Beryx splendens* represented more than 80% of the total combined catch per set of *P. richardsoni* and *Beryx splendens* caught by Korean trawls around the Valdivia Bank. This criterion is used since the catches of these two species are negatively correlated, i.e. when one of these two species occurs in the haul the other is usually very low.

In each haul the estimate of CPUE of *Beryx splendens* is represented as the ratio of total catch of the species by the haul duration time.

4.3 Methods used

Nominal CPUE was used to derive a perception of the development of the fishery in the period 2010-2012.

The SC explored the possibility of applying a local depletion model (DeLury, 1947; Leslie and Davis, 1939). It was decided, however, not to pursue this option as the data did not satisfy the assumptions of the method.

4.4 Results

The progression in CPUE over time showed marked variability and no clear trend as observed in figure 14.

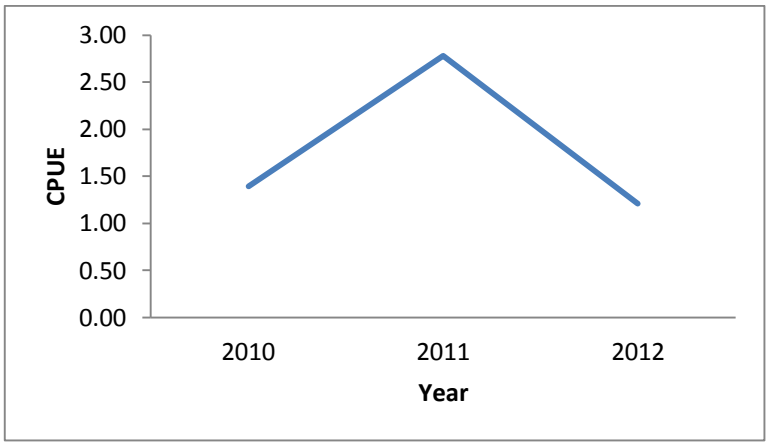


Figure 13: Plot of nominal CPUE for 2010-2012.

4.5 Discussion

It should be recognized that the data available for assessment is extremely sparse and represents a short time series. The perception of the stock as described is based on only 3 years (2010-2012) of catch and effort data. Catch and effort data for 2013 was not used in the assessment of the nominal CPUE due to an incomplete fishing season. Length frequency distributions could not be derived based on the insufficient length samples submitted to the Secretariat.

4.6 Conclusion

Catch and effort data per haul on Alfonsino were collected by Korean vessels for only 4 years from 2010 to 2013, however, only 2011-2012 were used for assessment due to an incomplete fishing season for 2013. These data, although short in series, could be used to get a perception of the trend in nominal CPUE.

4.7 Biological reference points and harvest control rules

No biological reference points could be determined and the SC suggests to use an empirical Harvest Control Rule (HCR) to regulate the fishery until the data situation is improved. A candidate HCR consists of the average catch of the last three years to which a 20% uncertainty cap is applied.

ICES Harvest Control Rules, Category 5: Data poor stocks (only landings data). Calculation of average catch for three years (2010- 2012) as C_{Y-1}

$$C_{Y-1} = \frac{\sum_{y-3}^{y-1} C_i}{3} = \frac{159 + 165 + 172}{3} = 165$$

And calculation of the catch advise for 2015 as:

$$C_{Y+1} = 0.8 \times C_{Y-1} = 0.8 * 165 = 132\text{t}$$

5. Incidental mortality and by-catch of fish and invertebrates

5.1 Incidental mortality (seabirds, mammals and turtles)

No by-catch of seabirds, mammals and turtles were reported.

5.2 Fish by-catch

In the case of SE Atlantic fisheries, Alfonsino is often found in association with other fish species as, for example, in 2011 the following species (per ton) were caught; Boarfish (*Capros aper*) 14 tonnes, Blackbelly rosefish (*Helicolenus actylopterus*) 3 tonnes, Imperial blackfish (*Schedophilus ovalis*) 6 tonnes, Oilfish (*Ruvettus pretiosus*) 8 tonnes, and Silver scabbardfish (*Lepidopus caudatus*) 4 tonnes.

5.3 Invertebrate by-catch including VME taxa

In the past the main method used to catch alfonsino appears to have been bottom trawling. In the recent fishery both midwater and bottom trawls seem to have been used. Trawling for this species on seamounts impacts habitat (Clark and O'Driscoll, 2003, Koslow et al., 2001), but the precise impact of this on invertebrate populations on the seamounts is unknown. There are observations of sub-threshold catches of VME indicators for 2013 (Fig. 14).

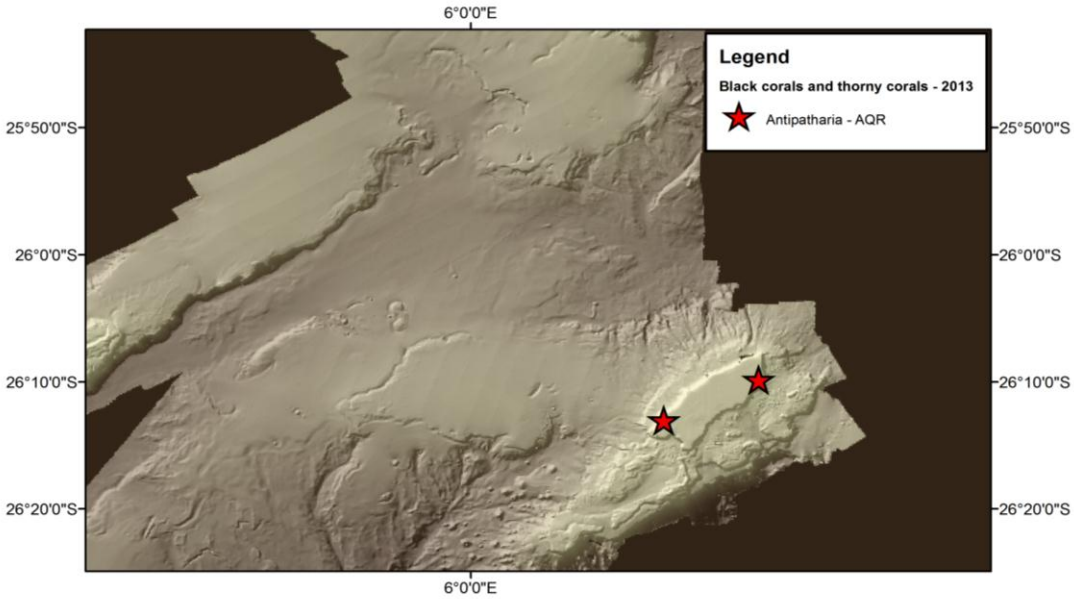


Figure 14: Locations of VME bycatches recorded from the alfonsino fishery during 2013.

5.4 Incidental mortality and by-catch mitigation methods

By-catch mitigation measures to reduce incidental mortality for seabirds, mammals and turtles are in place (see current conservation measures in section 6).

5.5 Lost and abandoned gear

There was no reported lost and abandoned gear from the trawl fisheries for Alfonsino in the SEAFO CA.

5.6 Ecosystem implications and effects

See section 5.3 above.

6. Current conservation measures and management advice

In 2012 the Commission adopted a TAC of 200t the SEAFO CA for 2013 and 2014 (CM 27/13).

In accordance with the proposed HCR, using the average catch from 2010-2012, the recommended TAC is 132 tons for the Division B1 for 2015-2016. Considering the possibility that Alfonsino occurs outside B1 the SC maintains its recommendation from 2012 for a TAC for the entire SEAFO CA of 200 tons of which a maximum of 132 tons may be taken in B1.

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 By-catch of Seabirds in the SEAFO Convention Area
Conservation Measure 18/10	on the Management of Vulnerable Deep Water Habitats and Ecosystems in the SEAFO Convention Area
Conservation Measure 27/13	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 26/13	on Bottom Fishing Activities in the SEAFO Convention Area

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APPENDIX VII – Stock Status Report – Deep-sea red crab

STATUS REPORT

Chaceon erytheiae

Common Name: Deep-sea red crab

FAO-ASFIS Code: GER

2014

Updated: 9-Oct-14

TABLE OF CONTENTS

8. Description of the fishery

1.1 Description of fishing vessels and fishing gear

Data within the SEAFO database indicate that the deep-sea red crab (DSRC) resource has been utilized by two nations primarily, Namibia and Japan. The Namibian-flagged vessel, *FV Crab Queen 1*, known to fish crab in the SEAFO CA is a 49.61m, 1989-built steel vessel with an onboard holding capacity of 610m^3. The vessel can process on average 1200 traps (i.e. three sets with 400 traps each) per day.

During 2005 an older Japanese-flagged vessel, *FV Kinpo Maru no. 58*, conducted crab fishing activities in the SEAFO CA. This vessel was built in 1986, is 62.60m in length and has an onboard holding capacity of 648m^3. The *Kinpo Maru*, however, was replaced by the *FV Seiryo Maru* which is 37.06m in length, was built in 1987 and has an on-board holding capacity of 289 m^3.

The Namibian and Japanese vessels' gear setup (set deployment & design) are very similar. Both vessels use the same type of fishing gear – known as Japanese beehive pots (Fig. 1). The beehive pots are conical metal frames covered in fishing net with an inlet shoot (trap entrance – Fig. 1) on the upper side of the structure and a catch retention bag on its underside. When settled on the seabed the upper side of the trap are roughly 50cm above the ground ensuring easy access to the entrance of the trap. The trap entrance leads to the kitchen area of the trap – which is sealed off by a plastic shoot that ensures all crabs end up in the bottom of the trap.

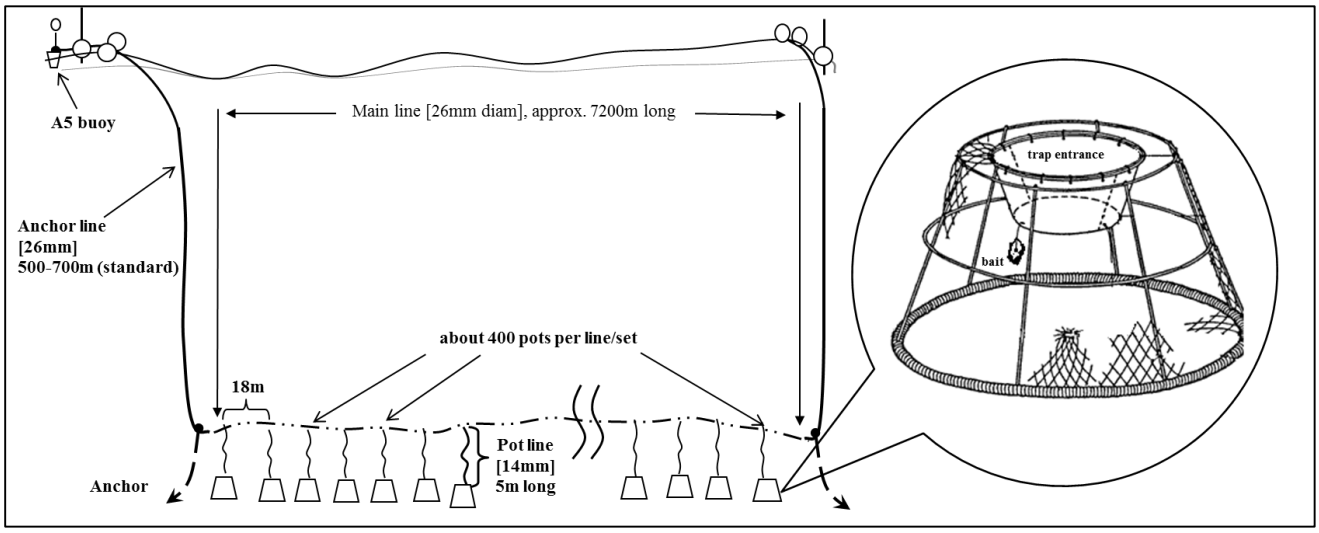

Figure 1: Deep-sea red crab fishing gear setup (set deployment and design) and illustration of a Japanese beehive pot (shown in enlarged form on the right).

One set or pot line consists of about 200-400 beehive pots, spaced roughly 18m apart, on a float line attached to two (start & end) anchors for keeping the gear in place on the seabed (Fig. 1). The start & end points of a set are clearly marked on the surface of the water with floats and one A5 buoy that denotes the start of a line. Under this setup (i.e. 400pots at 18m intervals) one crab fishing line covers a distance of roughly 7.2km (3.9nm) on the sea floor and sea surface.

1.2 Spatial and temporal distribution of fishing

In the SEAFO Convention Area fishing for deep-sea red crab is focussed mainly on *Chaceon erytheiae* on Valdivia Bank – a fairly extensive seamount that forms part of the Walvis Ridge (Fig. 2-6). This seamount is located in Division B1 of the SEAFO CA and has been the main fishing area of the crab fishery since 2005 when the resource was accessed by Japan. Records from the SEAFO database indicate that fishing for crab in this area occurred over a depth range of 280-1150m.

Table 1: The total number of sets from which deep-sea red crab catches were derived for the period 2010-2014.

2010	2011	2012	2013	2014
181	133	129	103	107

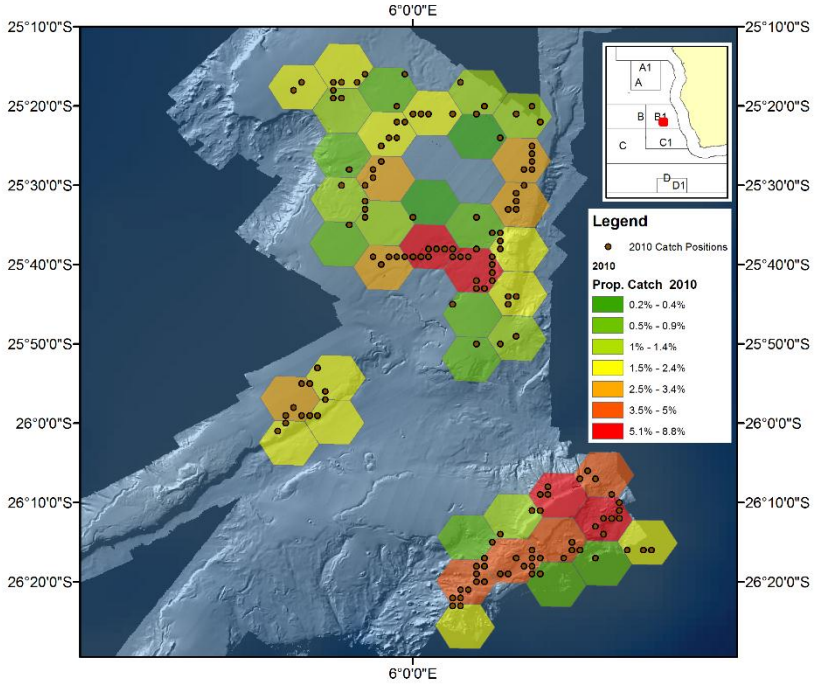

Figure 2: The 2010 catch distributions for deep-sea red crab in Division B1 aggregated to a 10 km^2 hexagonal area.

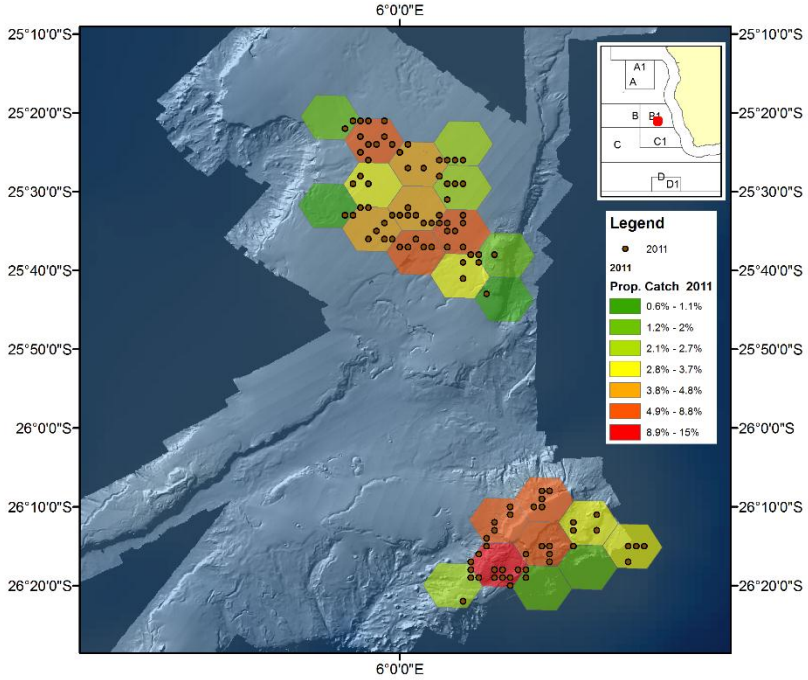

Figure 3: The 2011 catch distributions for deep-sea red crab in Division B1 aggregated to a 10 km^2 hexagonal area.

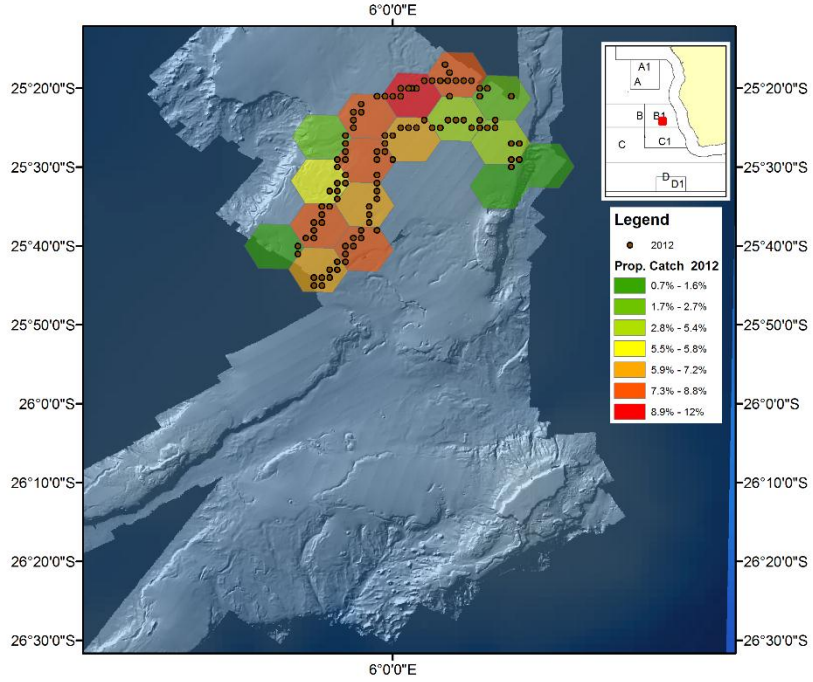

Figure 4: The 2012 catch distributions for deep-sea red crab in Division B1 aggregated to a 10 km^2 hexagonal area.

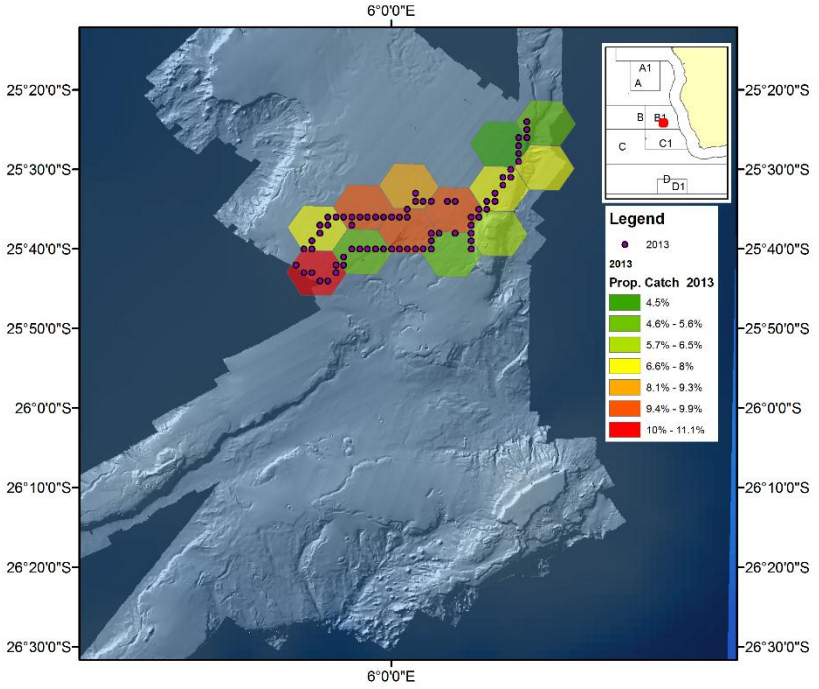

Figure 5: The 2013 catch distributions for deep-sea red crab in Division B1 aggregated to a 10 km^2 hexagonal area.

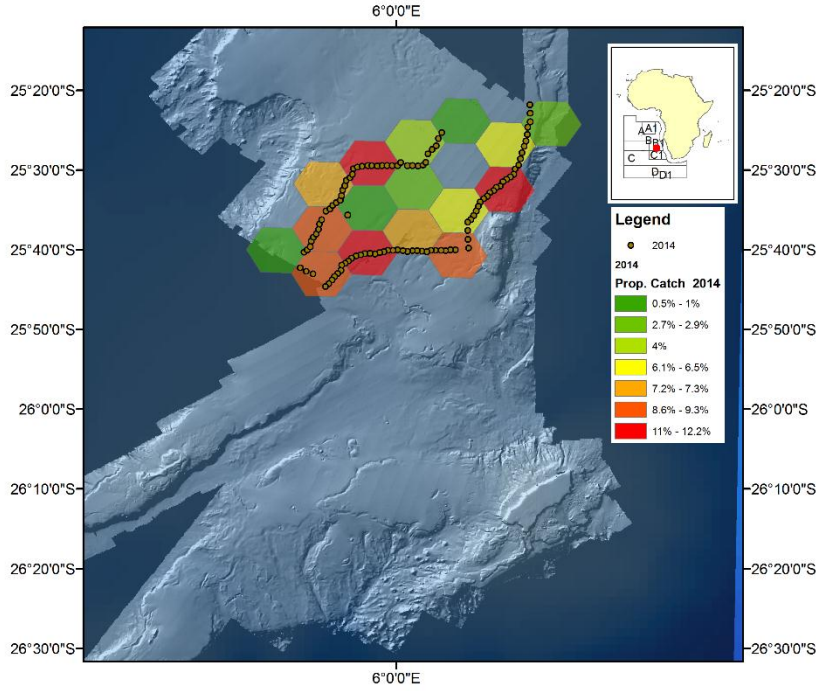

Figure 6: The 2014 catch distributions for deep-sea red crab in Division B1 aggregated to a 10 km^2 hexagonal area.

1.3 Reported landings and discards

Reported landings (Table 2) comprise catches made by Japanese, Namibian, Spanish and Portuguese-flagged vessels to date from 2003-2014. As is evident from Table 2 the two main players in the SEAFO crab fishery are Japan and Namibia, respectively, with Spanish and Portuguese vessels having only

sporadically fished for crab in the SEAFO CA over the period 2003 to 2007. Spanish-flagged vessels actively fished for crab in the SEAFO CA during 2003 and 2004, whereas Portuguese-flagged vessels only fished for crab once during the 2007 season (Table 2).

Table 2: Catches (tonnes) of deep-sea red crab (Chaceon spp. – considered to be mostly *Chaceon erytheiae*).

Nation	Japan		Namibia		Spain		Portugal	
Fishing method	Pots		Pots		Pots		Pots	
Management Area	B1		B1		UNK		A	
Catch details (t)	Retained	Discarded	Retained	Discarded	Retained	Discarded	Retained	Discarded
2001					<1			
2002								
2003					5			
2004					24			
2005	253	0	54					
2006	389							
2007	770		3	0			35	
2008	39							
2009	196		N/F	N/F	N/F	N/F	N/F	N/F
2010	200	0			N/F			
2011	N/F	N/F	175	0	N/F	N/F	N/F	N/F
2012	N/F	N/F	198	0	N/F	N/F	N/F	N/F
2013	N/F	N/F	196	0	N/F	N/F	N/F	N/F
2014*	N/F	N/F	135	0	N/F	N/F	N/F	N/F

* Provisional (Aug 2014)
N/F = No Fishing.
Blank fields = No data available.
UNK = Unknown.

Being a pot fishery, the deep-sea red crab fishery has an almost negligible bycatch impact. To date only 5kg of teleost (Marine nei and European sprat) fish discards have been recorded, during 2010, from this fishery.

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.

9. Stock distribution and identity

One species of deep-sea red crab has been recorded in Division B1, namely *Chaceon erytheiae* (López-Abellán *et al*. 2008), and is thus considered the target species of this fishery. Aside from the areas recorded in catch records the overall distribution of *Chaceon erytheiae* within the SEAFO CA is still unknown.

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

3.1 Fisheries and surveys data

Fishery-dependent data exist only for more recent years (2010-2014) of the SEAFO deep-sea red crab fishery (Fig. 7). Biological data from the fishery comprise gender-specific length-frequency, weight-at-length, female maturity and berry state data.

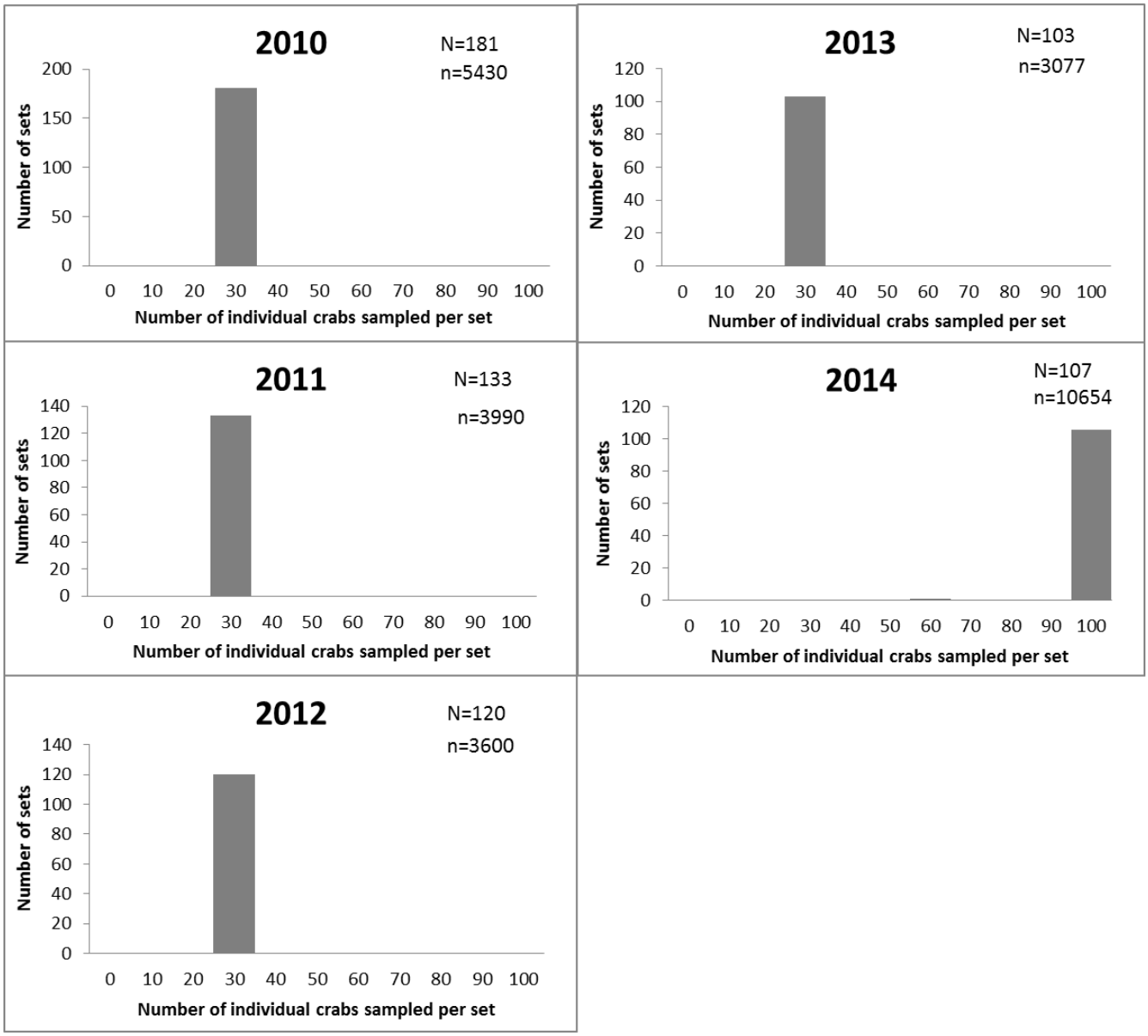

Figure 7: Illustration of sampling frequencies (2010-2014) from the deep-sea red crab commercial fleet within the SEAFO CA. Notes: N = total number of sets recorded per year; n = total number of crabs sampled.

Very limited fisheries-independent data on deep-sea red crabs exists for the SEAFO CA. A total of 479 deep-sea red crabs were sampled during the 2008 Spanish-Namibia survey on Valdivia Bank. The data was collected over a depth range of 867-1660m.

3.2 Length data and frequency distribution

Available length-frequency data for crabs caught in the SEAFO CA over the period 2010-2014 are presented in Figure 8. Length-frequency data from all areas sampled in Division B1 were pooled as no significant differences were detected between areas.

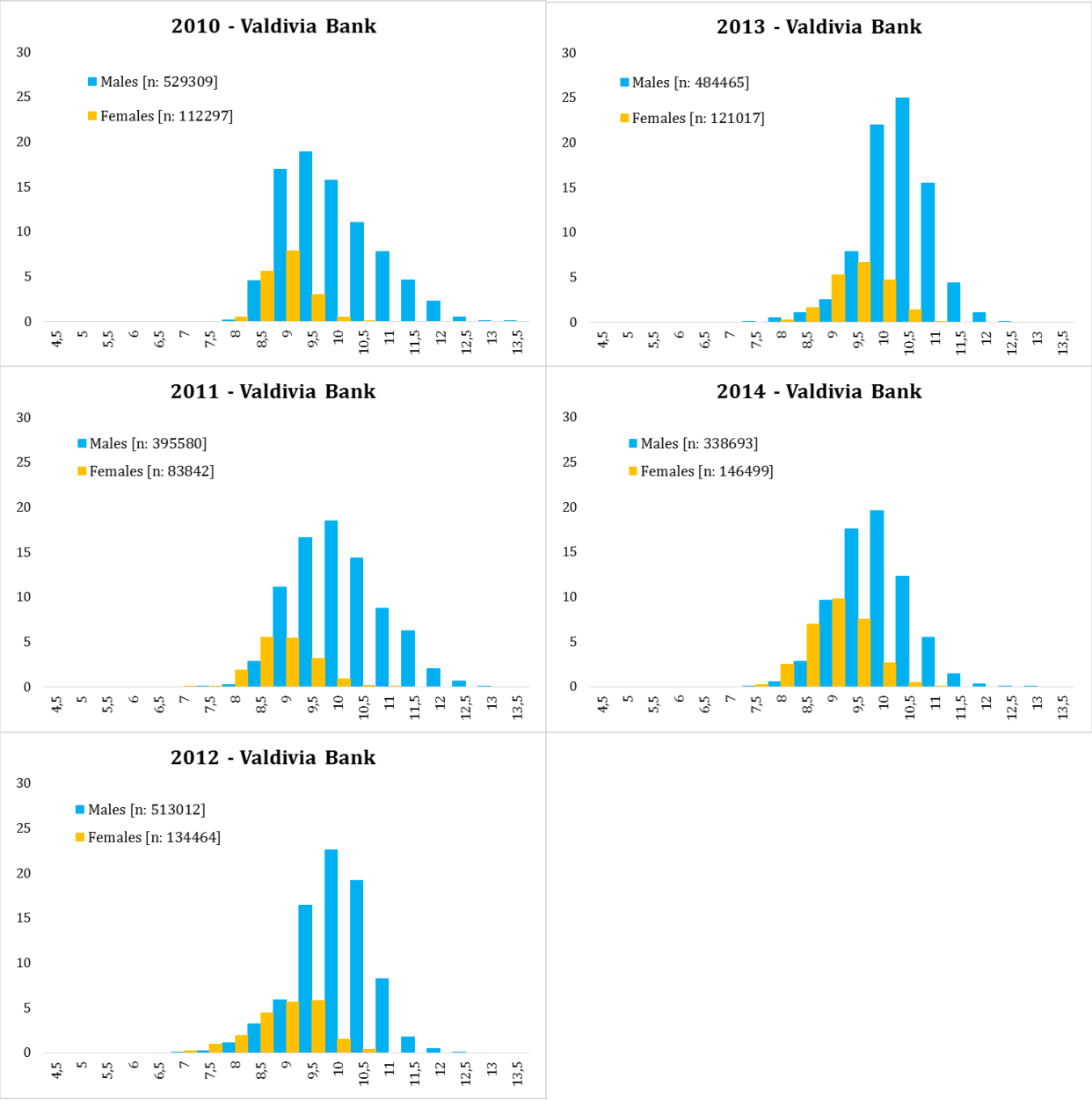

Figure 8: Length frequencies – raised to total catches – of crab caught on Valdivia Bank [2010-2014].

For the period 2010-2014 there have been no significant changes in the female crab size distribution (Fig. 8). The male crab size distribution changed from a wider size distribution in 2010 and 2011, where larger male crabs were recorded, to a slightly narrowed size distribution in 2012-2014 of smaller crabs. Sex ratio from crab commercial samples fluctuated around 4:1 in favour of male crabs – a well-known bias of the commercial traps used in this fishery.

3.3 Length-weight relationships

Length-weight relationship derived from catches on Valdivia Bank reveal the gender-specific growth disparity (Fig. 9). Male crabs grow at a faster rate than females and thus attain much larger sizes than female crabs. This species attribute, however, is not unique to *Chaceon erytheiae* and has been recorded for other crab species in the *Chaceon* genus (Le Roux 1997). Data from the 2008 survey show a much more coherent length-weight relation for both male and female crabs (Fig. 10).

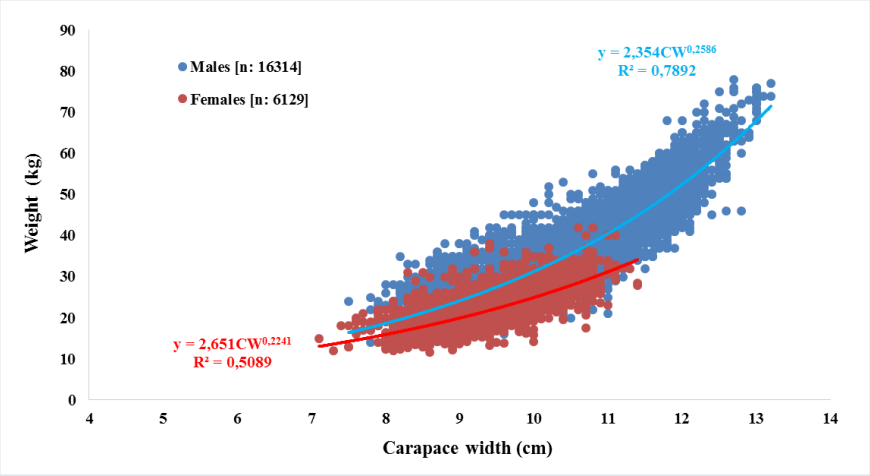

Figure 9: Length-at-weight data for *Chaceon erytheiae* as recorded from catches on Valdivia Bank (2008-2014). Red text show female length-weight relationship, blue text show male length-weight relationship.

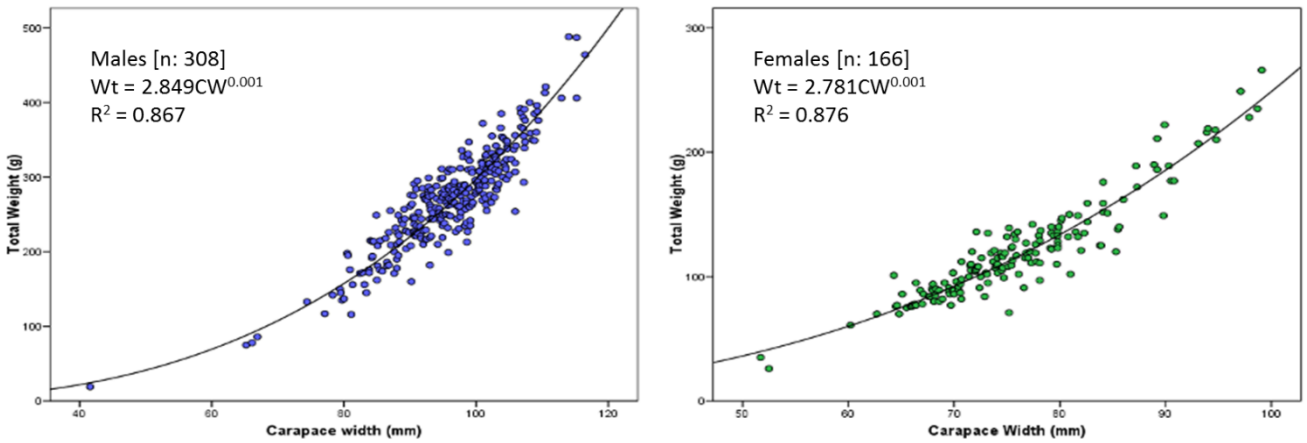

Figure 10: Length-at-weight data for *Chaceon erytheiae* as recorded from the 2008 Spain-Namibia survey (López-Abellán *et al*. 2008)

3.4 Age data and growth parameters

No information exists on the age and growth attributes of *Chaceon erytheiae*.

3.5 Reproductive parameters

Very limited reproductive data exist for *Chaceon erytheiae* from commercial samples. This dataset constitute female maturity and berry data collected during 2010-2014. However, the mating and spawning seasons for *C. erytheiae* within the SEAFO CA are still unknown.

3.6 Natural mortality

No natural mortality data exist for *Chaceon erytheiae*.

3.7 Feeding and trophic relationships (including species interaction)

No data exist for *Chaceon erytheiae*.

3.8 Tagging and migration

No data on migration exist for *Chaceon erytheiae* in the SEAFO CA.

11. Stock assessment status

4.1 Available abundance indices and estimates of biomass

Currently the only data available for the assessment for *C. erytheiae* abundance within the SEAFO CA are the catch and effort data from which a limited catch-per-unit effort (CPUE) series can be constructed.

4.2 Data used

The available SEAFO data (2005-2014) for purposes of considering possible assessment strategies are presented in Table 3.

Table 3: Description of the entire deep-sea red crab database highlighting important datasets.

Year	Flag State	Data Type - Source	Brief Description [NB Data Groups only]
2005	JPN	Catch Data – Observer Report	Set data (vessel ID, set-haul positions & dates), Depth, Catch, Effort - (157 records).
2007	NAM	Catch Data – Observer Report	Set data (vessel ID, set-haul positions & dates), Depth, Catch, Effort - (10 records - sets).
2010	JPN	Catch & Biological Data – Observer Report	Set data (vessel ID, set-haul positions & dates), Depth, Length, Weight, Catch, Effort - (Catch: 181 records, Biological: 5430 records).
2011	NAM	Catch & Biol. Data – Observer Report	Set data (vessel ID, set-haul positions & dates), Depth, Length, Weight, Catch, Effort - (Catch: 133 records, Biological: 3990 records).
2012	NAM	Catch & Biol. Data – Obs. Report & Captain's Logbook [log sheet data]	Set data (vessel ID, set-haul positions & dates), Depth, Length, Weight, Catch, Effort - (Catch: 129 records, Biological: 3600 records).
2013	NAM	Catch Data – Captain's Logbook [log sheet data]	Set data (vessel ID, set-haul positions & dates), Depth, Catch, Effort - (Catch: 103 records, Biological: 3090 records).
2014	NAM	Catch Data – Captain's	Set data (vessel ID, set-haul positions and dates), Depth,

		Logbook [log sheet data]	Length, Weight, Catch, Effort – (Catch: 107 records, Biological: 10660 records)

4.3 Methods used

CPUE Standardization:
In 2014 another attempt was made at standardizing the CPUE with the emphasis of including variables previously omitted (i.e. depth and soak time). In addition to this it was agreed that the number of pots and soak time both be used to calculate effort. Thus for the 2014 standardization only the kg/pot-hour CPUE was considered as the correct unit for effort.

Table 4: Description of the sets of catch and effort data available for the CPUE standardization.

2005	2007	2010	2011	2012	2013	2014
157	10	181	133	129	103	107

The records from year 2007 were excluded from the analysis as they were derived from an area not exploited in the remaining years and, constituting only 10 sets, were not comparable to datasets from the rest of the data series.

The following variables from each record were considered in the model:
Year = A 12-month period – explanatory variable (covariate).
Semester = A calendar semester in a fishing year – explanatory variable (covariate).
VesselID = Identification code for a participating vessel – explanatory variable (covariate).
Zone = Identification code for a fishing area – explanatory variable (covariate).
Depth = Fishing depth – explanatory variable (covariate).
SoakTime = Period of time for which baited crab pots are left in the water - explanatory variable (covariate).
CPUE = Catch/number of pots*hour – response variable.

An exploratory data analysis was performed before the adjustment of the generalized linear model (GLM) to evaluate the relationship of variables and CPUE. A GLM was applied using the stepwise AIC procedure to select the best model. The GLM was derived following Quinn and Deriso (1999) as:

$$U_{ijk} = U_0 \prod_i \prod_j P_{ij}^{X_{ij}} e^{\varepsilon_{ijk}} \quad [1]$$

…where U is the observed CPUE, U_0 is the reference CPUE, P_{ij} is a factor *i* at level *j*, and X_{ij} takes a value of 1 when the j^{th} level of the factor P_{ij} is present and 0 when it is not. The random error ε_{ijk} for observation k is a normal random variable with 0 mean and standard deviation σ. Thus the generalized linear model for the error distribution of U is a follows:

$$U_{ijk} = \beta_0 + \sum_{i=1}^{p} \sum_{j=1}^{n_j-1} X_{ij}\beta_{ij} + \varepsilon_{ijk} \quad [2]$$

Since the model described by equations 1 and 2 might be over-parameterized, it is common to set a factor coefficient to zero, usually the first, whereupon the remaining n_{j-1} coefficients of each factor *i* represent incremental effects relative to the reference level. Coefficients obtained by fixing a factor level will differ

with the choice of reference level. However, the relative differences among the estimated coefficients will not be affected by the choice of constraint.

Following Francis (1999), coefficients for factor *i* were transformed to "canonical" coefficients over all levels *j* calculated relative to their geometric mean (Starr, personal communication, March 2012). Geometric mean is calculated as:

$$\bar{\beta} = \sqrt[n_j]{\prod_{j=1}^{n_j} \beta_{ij}}$$

The canonical coefficient is

$$\beta_i{}' = \frac{\beta_i}{\bar{\beta}}$$

As CPUE analysis is done in the non-log space, the non-log space canonical coefficient is equivalent to

$$b' = e^{\beta_i - \bar{\beta}}$$

Although several factors could contribute to the variation in CPUE, the year of capture is usually given special significance: variations between years in this factor are interpreted as relative changes in the annual abundance of the crab.

The resulting series of 'fishing year' canonical coefficients is termed as the "Standardized" annual CPUE index and can be calculated as: if the year is the reference year 0, and β'_{20} if the year is some other year and β'_{2i} the CPUE index for year *i* relative to the reference year 0 is estimated as.

Finally, the procedure followed to fit the model was as follows:

1. Fit the GLM with each explanatory variable from a maximum set of predictor variables against CPUE.
2. Select the model (factors to enter into the model) using the AIC criterion using the Stepwise Algorithm implement in MASS package.
3. Calculate R^2 based on model deviance and number of degrees of freedom for selected model.
4. The selected explanatory variables in the GLM were used to estimate a time series of CPUE indexes based on the relationship between CPUE vs. available predictive variables.

Exploratory – LCA & Y/R:
In addition to the CPUE standardization an exploratory Length Cohort Analysis (LCA) and Length-based Yield Per Recruit (Y/R) analysis were run. These exploratory analyses used the estimated catch at length obtained by raising length-frequency data from commercial samples using 5 mm size classes, and growth parameters based on the *Chaceon maritae* species, adjusted to the maximum sizes observed in the *Chaceon erytheiae* species. An Excel implementation of the LCA and the Y/R was used.

4.4 Results

Results from the CPUE standardization are presented below to illustrate some of the more important outputs and methods applied.

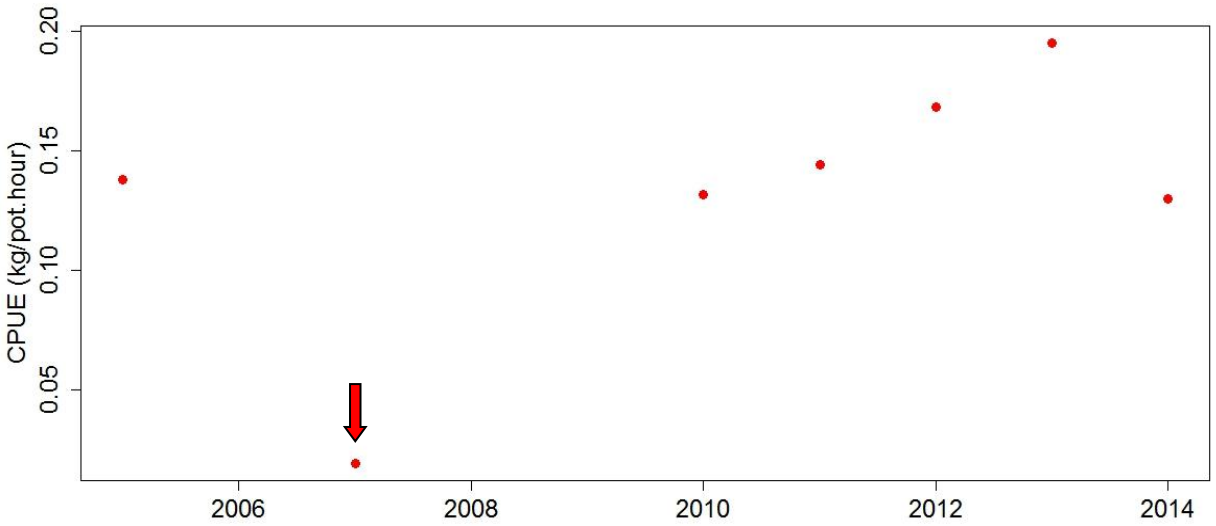

Figure 11: Mean CPUE (kg/pot.hour) across showing the disparity of the 2007 dataset with the rest of the dataset.

The maximum set of model parameters offered to the stepwise selection procedure was:

$$CPUE = \beta_0 + \beta_1 \text{ Year} + \beta_2 \text{ VesselID} + \beta_3 \text{ Depth} + \beta_4 \text{ Zone} + \beta_5 \text{ Semester} + \beta_6 \text{ SoakTime} + \varepsilon$$

A stepwise backward model selection procedure was deployed in selecting the covariates, to the model. The model with lowest Akaike value (AIC) was selected as the best model, since it has a better predictive power. The best model was then used for further analysis.

$$CPUE = \beta_0 + \beta_1 \text{ Year} + \beta_3 \text{ Depth} + \beta_4 \text{ Zone} + \beta_6 \text{ SoakTime} + \varepsilon$$

Table 5 presents the estimates of the coefficients, standard error and *t* values for different levels of the factors entered into the selected model. Model, covariate year, depth and soak time are very significant with a p-value $2.2*10^{-16}$, p-value 3.929^{-12} and p-value 6.019^{-07}that means these covariate influence the deep-sea red crab catch rates

Table 5: ANOVA results for the CPUE model.

Covariates	Df	Deviance	Residual Df	Residual Deviance	Pr(>Chi)
NULL			812	2.10918	
Year	5	0.37309	807	1.73609	< 2.2e-16 ***
VesselID	0	0.00000	807	1.73609	
Depth	291	0.74319	516	0.99290	3.929e-12***
Zone	2	0.00262	514	0.99027	0.4227
as.factor(SEMESTER)	1	0.00061	513	0.98966	0.5266
SoakTime	311	0.68185	202	0.30781	6.019e-07***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

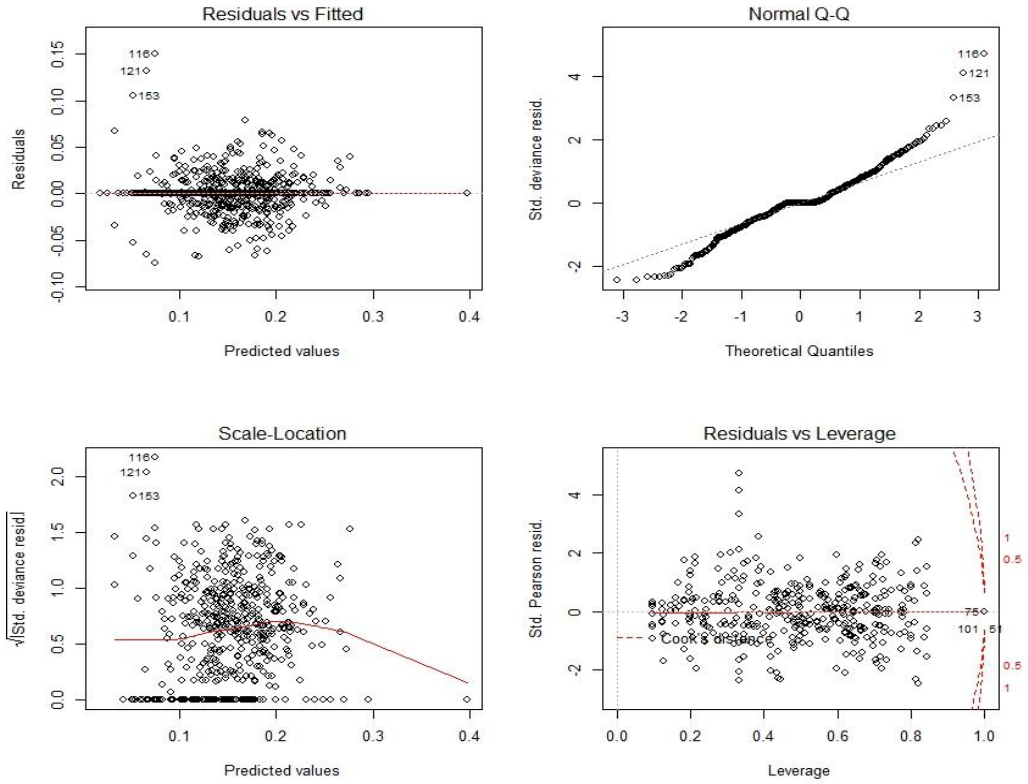

Figure 12: QQ and studentized residual plots of the best lognormal fit model for retained catch CPUE (kg/pot.hour).

Model diagnostics of the best model were assessed. This involved checking for normality of the residuals and the spread of the residuals across the fitted values. The diagnostic plots showed that model assumptions are not violated. The qqplots of the residuals indicated that the model residuals were slightly skewed towards the upper and lower tail. However this skewedness is of few data point relative to the amount of data presented. We have therefore considered the data to be normally distributed (Fig. 12). Plots of the residuals versus fitted values indicated evenly distributed data points, no apparent striking patterns in this plot (Fig. 12). Therefore there is no evidence of non-constant error variance in the residual plot and independence assumption also appeared reasonable.

Results from the standardized CPUE exercise suggest that CPUE has fluctuated over a very narrow range (of 0.9 and 1.08) during the period 2005 to 2014 – and that the CPUE, with the exception of 2010, remained relatively constant (at around 1) during this period of time (Fig. 13).

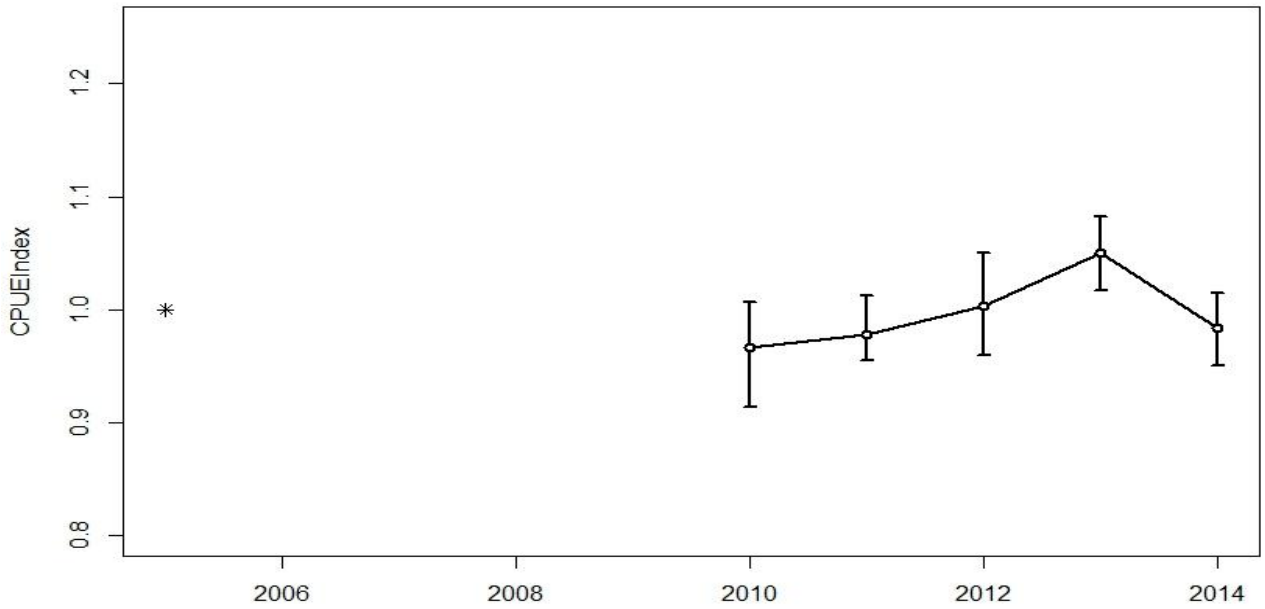

Figure 13: Trends in catch CPUE indexes for catches per pot-hour of crabs – with soak time as a categorical variable (factor). Standardized Index: black line with standard deviation (error bars/whiskers).

4.5 Discussion

The CPUE standardization conducted during 2014 for the SEAFO deep-sea red crab was a follow up on the initial attempt of 2013. Two additional parameters, depth and soak time, were added to the model and the CPUE was formalized to kg/pot-hour. The CPUE standardization revealed that, although the data series is very short, there was no change in the CPUE trend since 2010 and that it is well within range of the 2005 CPUE.

Furthermore the exploratory LCA, although inconclusive, revealed that the SEAFO deep-sea red crab resource currently is not under any risk of over-exploitation. LCA revealed that the current fishing mortality is reasonable and the stock is in a stable condition. There are no sign of overfishing looking at the CPUE and the length frequency data. LCA has proven to be an alternative assessment method, provided that data collections on the growth parameters are improved.

SC also noted that sampling on deep-sea red crab is quite good, but not all valuable data are available hence it is affecting our choice of an assessment method.

SC discussed the possibility of applying the harvest rule and it was decided that the Greenland Halibut harvest control rule used in NAFO may be the most appropriate option for deep-sea red crab.

4.6 Conclusion

The biological data series obtained from the SEAFO deep-sea red crab fishery, although short, is of relatively good quality. Nevertheless, important data such as growth parameter for the *C. erytheiae* stock, which will enhance the cohort analyses of the resource, was not available for the SEAFO CA and emphasis needs to be given in collecting this data for future assessments.

4.7 Biological reference points and harvest control rules

At this point in time it should be noted that no biological reference points exist for this stock in the SEAFO CA.

However, it is worthwhile to note that the *C. erytheiae* stock, based on the grounds of it being a long-lived and relatively stable stock, is a good candidate for an empirical Harvest Control Rule (HCR) similar to that applied to the Greenland halibut stock by the North Atlantic Fisheries Organization (NAFO). This is a simple HCR that merely considers that slope of an abundance index such as the CPUE and applies a catch limit to future years based in the current year's TAC. The concept is as follows:

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

Slope: average slope of the Biomass Indicator (CPUE, Survey) in recent 5 years

- λ_u :TAC control coefficient if slope > 0 (Stock seems to be growing) : λ_u=1
- λ_d :TAC control coefficient if slope < 0 (Stock seems to be decreasing) : λ_d=2
- TAC generated by the HCR is constrained to ± 5% of the TAC in the preceding year.

For the interim this is considered to be a fairly good starting point, given the current status of the C *erytheiae* resource, until such time that additional data are available for more advance stock assessment approaches.

12. Incidental mortality and bycatch of fish and invertebrates

5.1 Incidental mortality (seabirds, mammals and turtles)

No incidental catches of seabirds, mammals and turtles have been recorded from the deep-sea red crab fishery to date.

5.2 Fish bycatch

Incidental and bycatch records from the deep-sea red crab fishery indicate that only one species is currently impacted by this fishery.

Table 6: Incidental (bycatch) catch from the deep-sea red crab fishery (kg).

	2009	2010	2011	2012
Species	-	**B1**	-	-
***MZZ**		5.23		

*** Marine Nei fishes (*Osteichthyes*)**

5.3 Invertebrate bycatch including VME taxa

No VME bycatches have been recorded from the deep-sea red crab fishery to date.

5.4 Incidental mortality and bycatch mitigation methods

There currently exist no incidental and bycatch mitigation measures for the deep-sea red crab fishery in the SEAFO CA.

5.5 Lost and abandoned gear

No lost and abandoned gear data have been reported for the deep-sea red crab fishery in the SEAFO CA.

5.6 Ecosystem implications and effects

The SEAFO deep-sea red crab fishery has very limited to no negative ecosystem impacts in terms of it temporal and spatial context.

13. Current conservation measures and management advice

In 2013 the Commission adopted a TAC of 200t in Division B1, and 200t in the remainder of the SEAFO CA for 2014 and 2015 (CM 27/13). Accordingly the SC did not provide TAC advice for this stock during 2014.

The SC noted that adopting an HCR might be considered for the deep-sea red crab fishery and suggested such a rule.

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

Conservation Measure 04/06	Conservation of sharks caught in association with fisheries managed by SEAFO.
Conservation Measure 14/09	Reduce sea turtle mortality in SEAFO fishing operations.
Conservation Measure 18/10	Management of vulnerable deep water habitats and ecosystems in the SEAFO Convention Area.
Conservation Measure 25/12	Reducing incidental bycatch of seabirds in the SEAFO Convention Area.
Conservation Measure 26/13	Bottom fishing activities in the SEAFO Convention Area.

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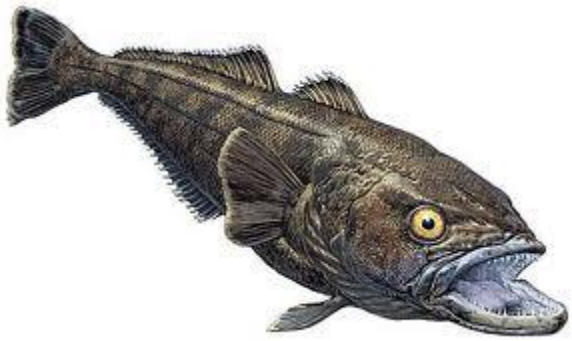
APPENDIX VIII – Stock Status Report – Patagonian toothfish

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.

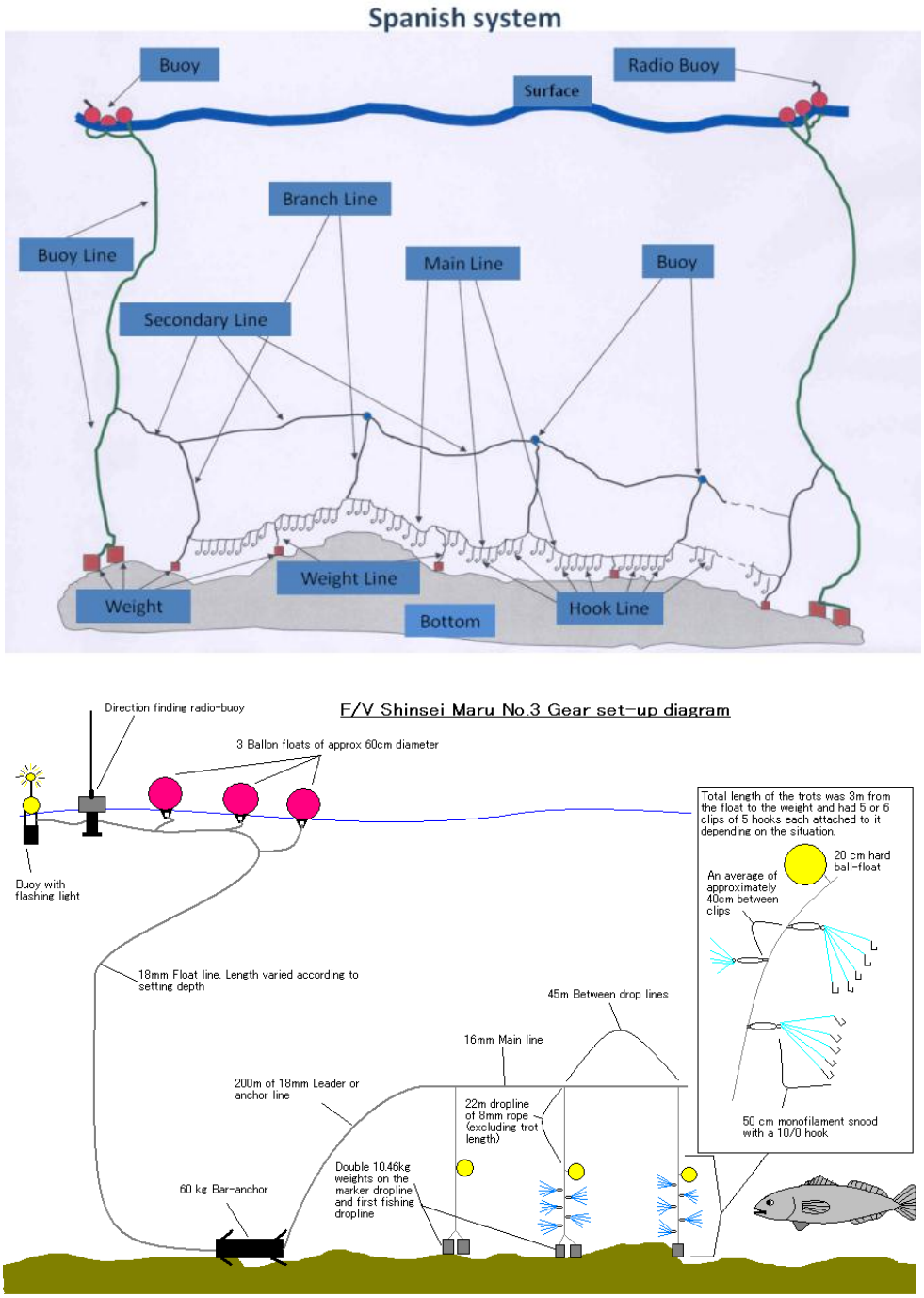
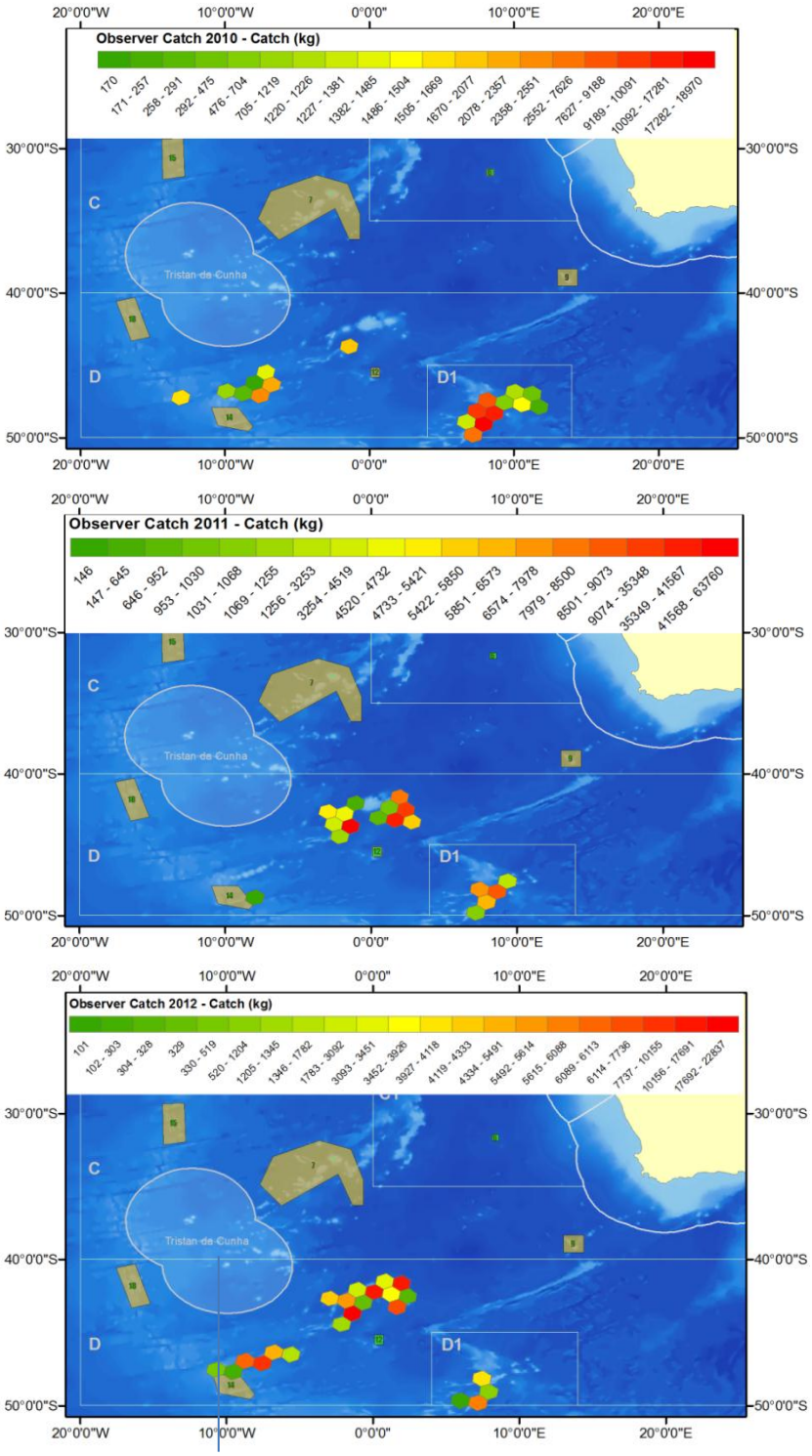


Figure 1: Fishing gears used to fish *D. eleginoides*: Spanish longline system (top) and the Trotline (bottom).

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).



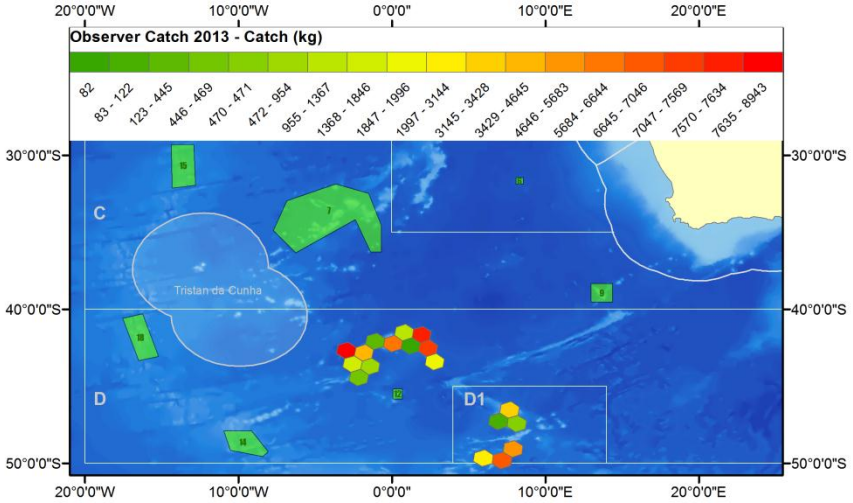


Figure 2: Reported catch of Patagonian toothfish (*Dissostichus eleginoides*) aggregated to 100km diameter hexagonal cells (2010, 2011, 2012 and 2013).

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.

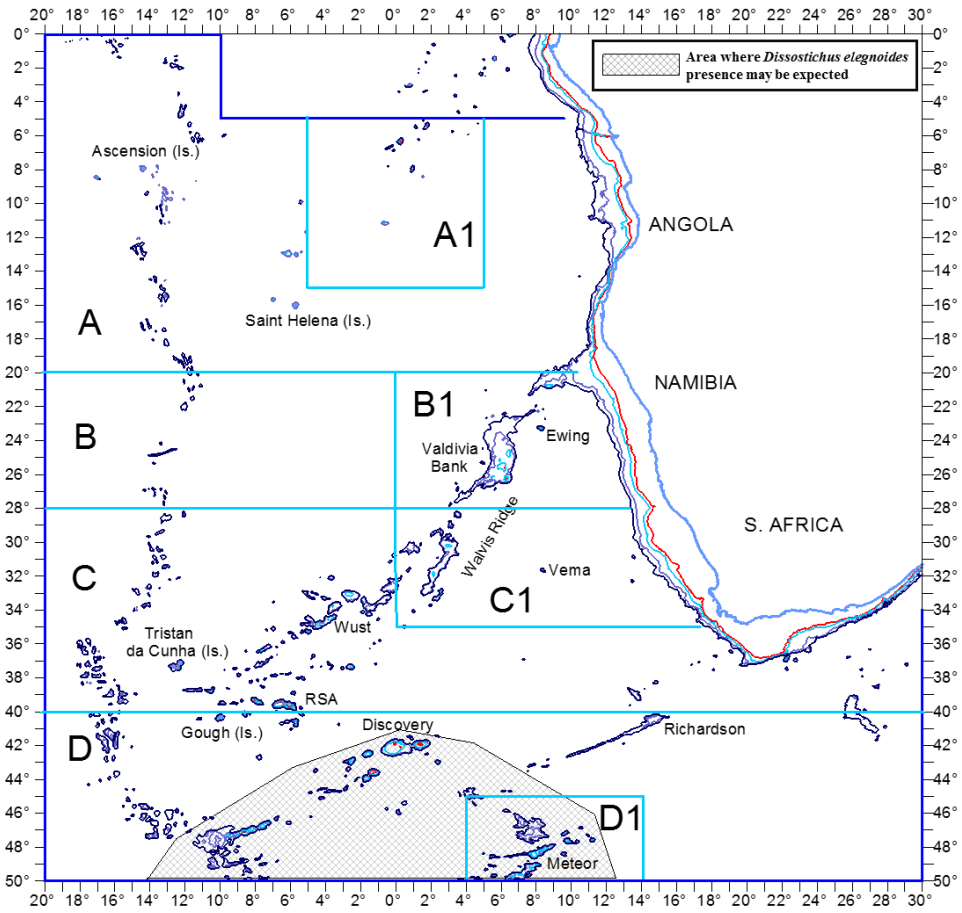


Figure 3: Species geographical distribution in the SEAFO CA (source: Species profile on the SEAFO website).

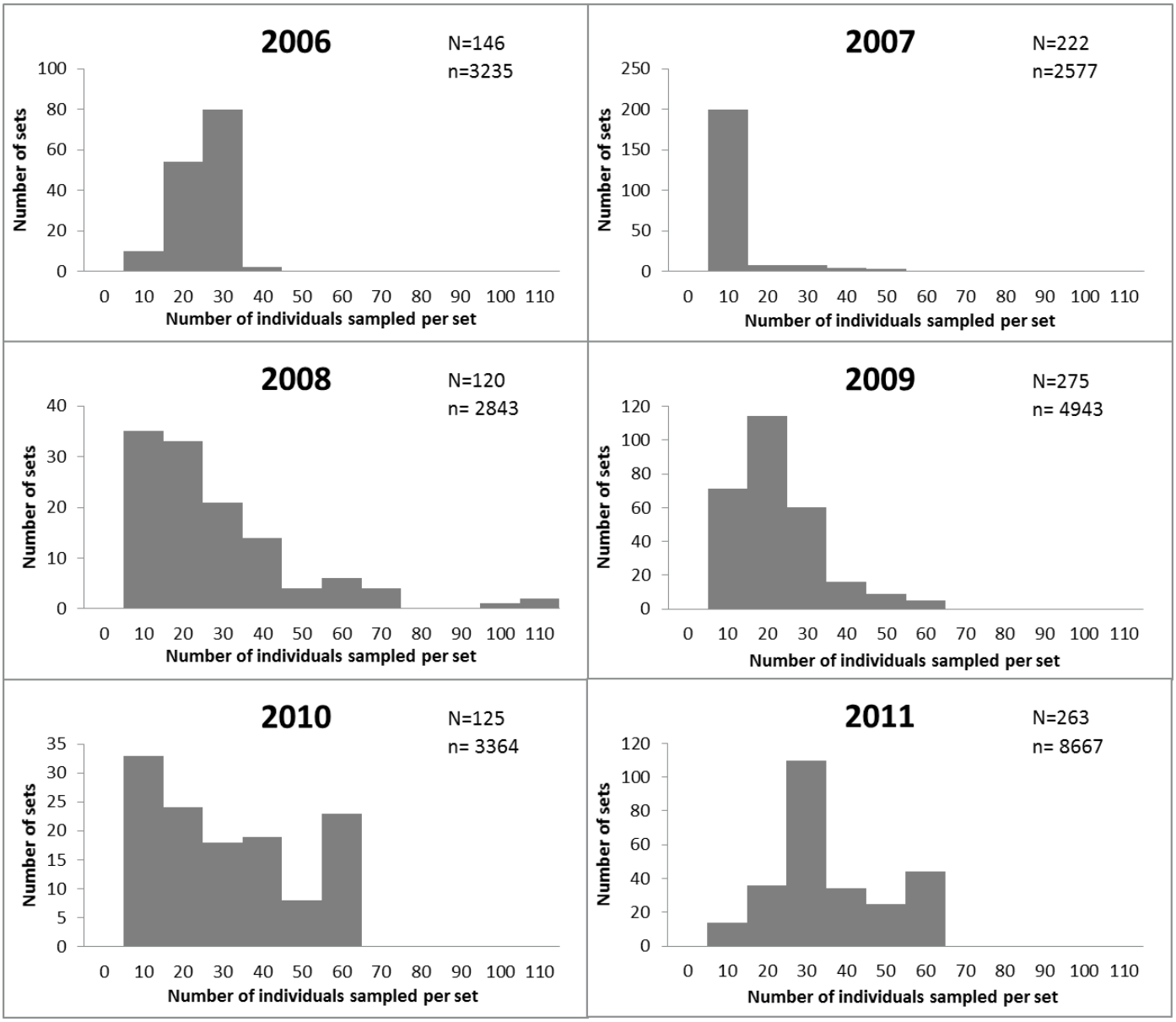
3. Data available for assessments, life history parameters and other population information

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



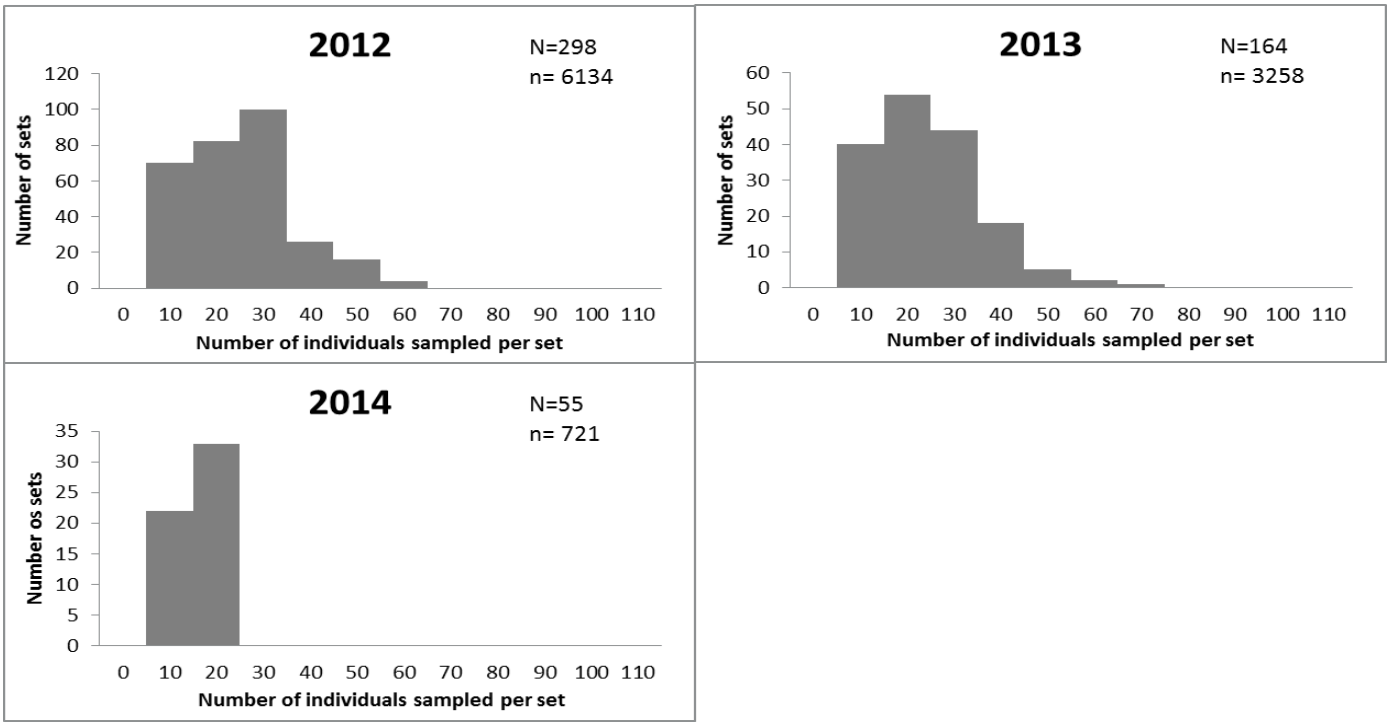


Figure 4: Frequency distribution of sample size per set. Data from Observer Reports submitted to SEAFO. N = number of sets sampled per year; n = total number of individuals sampled.

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.

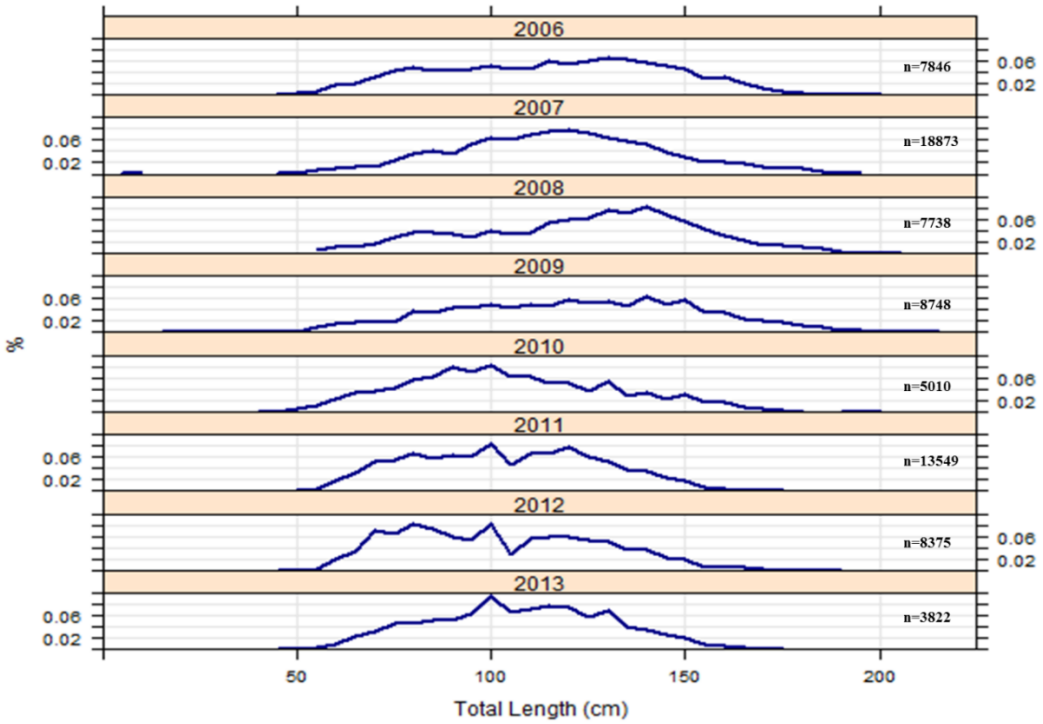


Figure 5: Annual total length frequency distributions *D. eleginoides* raised to total catches per year for SEAFO CA Sub-Area D.

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)

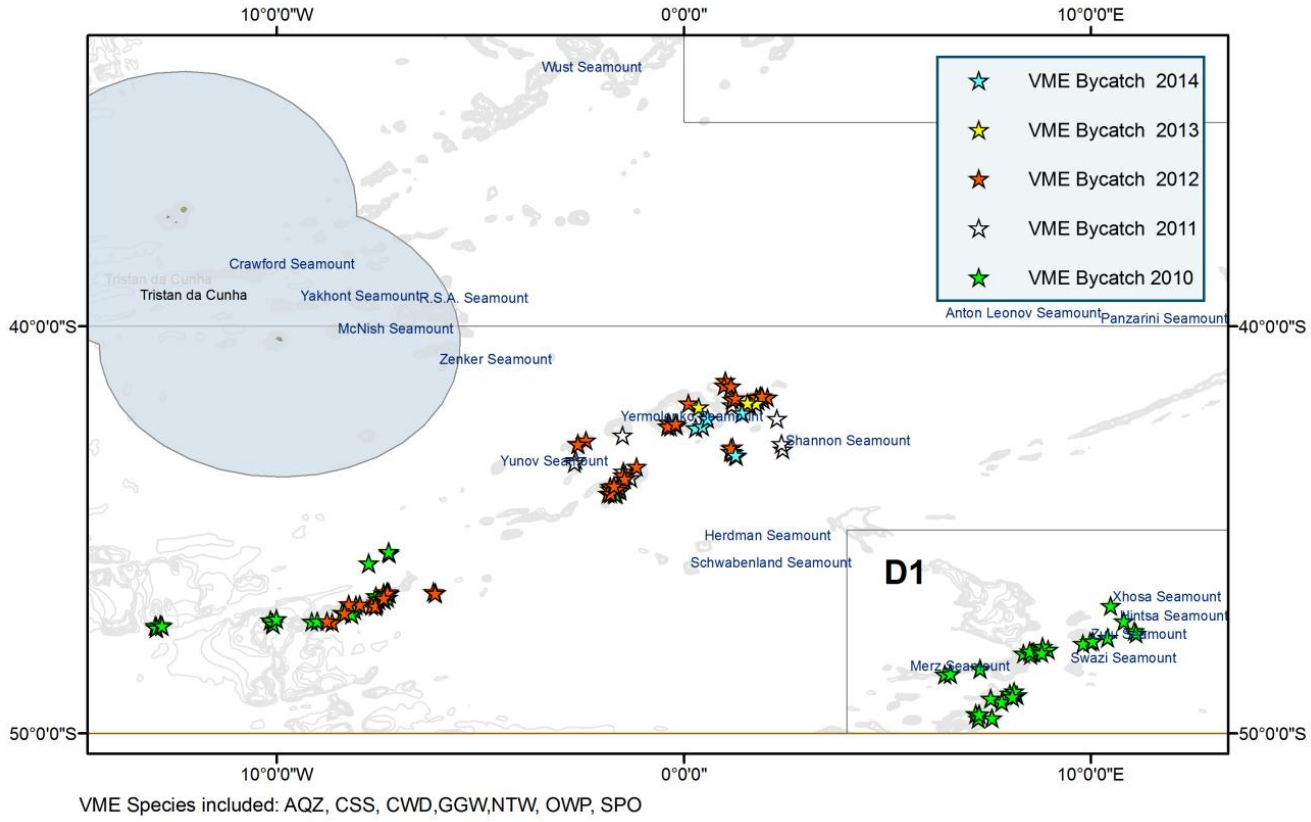


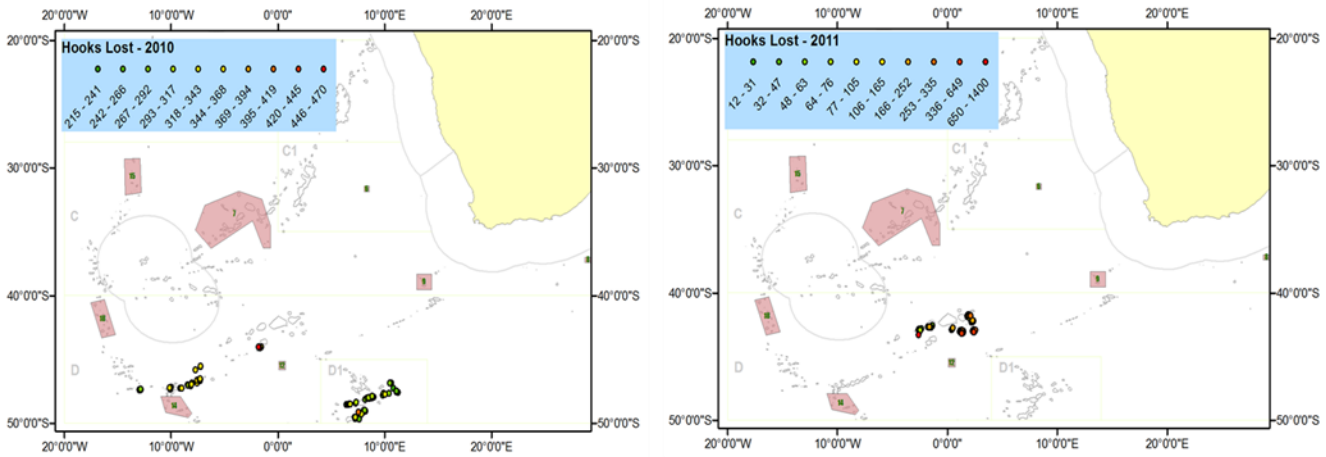
Figure 7: Locations for incidental bycatch of VME species from SEAFO Patagonian toothfish fishery.

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.



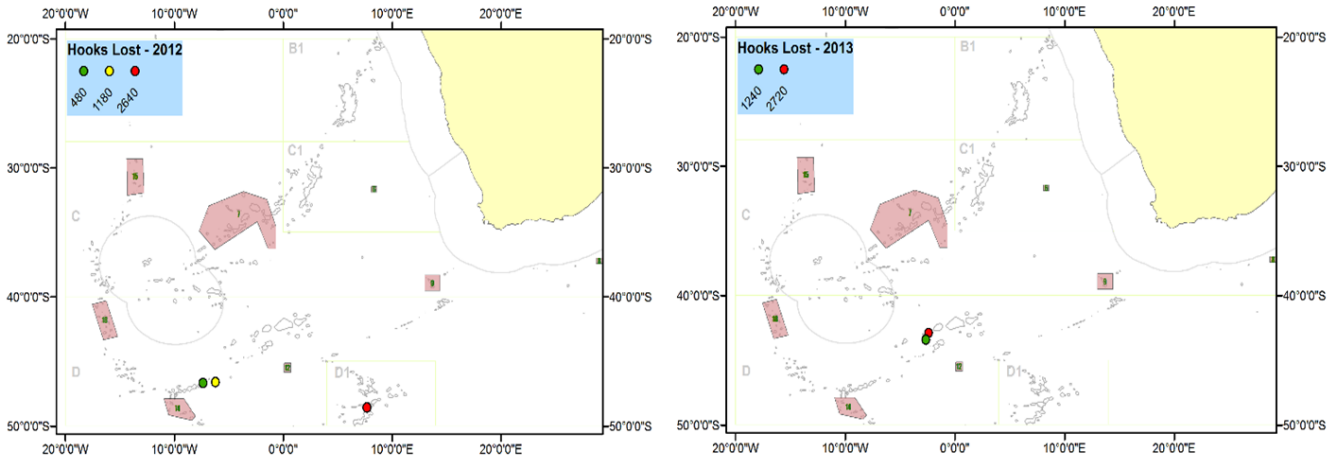


Figure 8: Locations and amount of the lost gears (hooks with attached short line) based on observer data (2011-2013).

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

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APPENDIX IX – Stock Status Report – Pelagic armourhead/Southern boarfish

STATUS REPORT

Pseudopentaceros richardsoni

Common names: Pelagic armourhead, Southern boarfish

FAO-ASFIS Code: EDR

2014

Updated: 9-Oct-14

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15. Description of the fishery

15.1 Description of fishing vessels and fishing gear

The only fishery for pelagic armourhead (southern boarfish) in recent years has been the Korean trawl fishery for southern boarfish that started in 2010. In the period 2010-2013 two fishing vessels participated, F/V Adventure and F/V Dongsan Ho, and there was no fishery this year as of September 2014. The fishery is described as a midwater trawl fishery, but the observer records submitted to SEAFO include a high proportion of hauls recorded as "Demersal" (94% of the observed tows). Whether or not these trawls were bottom trawls remains uncertain, and this is an issue that needs further attention and clarification.

Table 1 and Figs. 1-4 provide the gears specifications for gears available on the stern trawler F/V Adventure.

- The HAMPIDJAN NET is a bottom otter trawl with two-piece nets of 66 m in length. The head rope is 48 m long; ground rope is 50 m; the height, width and girth of the net are 5.5 m, 30 m and 100 m, respectively. The cod-end mesh size is 120 mm. The ground gear is 50 m in length and 903 kg in weight, and the float is 1,018 kg.
- The MANUFACTURED NET is a four-piece net with an overall length of 66.9 m. The lengths of the head rope and ground rope are 59.0 m and 77.9 m, respectively. The height, width and girth of the net are 5.5 m, 200 m and 83 m, respectively. The cod-end mesh size is 120 mm. The ground is 77.9 m in length and the weight of the ground is 2,068 kg. The float is 913.200 kg with the floating rate of 44%.
- The MIDWATER NET is 210 m long. The lengths of head rope and ground ropes are 93.6 m. The height and width of the net are 70.0 m and 240-260 m, respectively. The girth of the net is 816 m and the cod-end mesh size is 120 mm.

Table 1: Specifications of trawls used at F/V Adventure.

Gear Specifications		HAMPIDJAN NET bottom trawl	MANUFACTURED NET bottom trawl	MIDWATER NET
Otter board	type	VRS-TYPE	VRS-TYPE	VRS-TYPE
	material	Steel	Steel	Steel
	size (mm)	2,300 x 4,030	2,750 x 4,900	1,854 x 3,818
	weight (kg)	3,930	4,320	2,000
	under water weight (kg)	2,619	2,473	1,145
Trawl Net	purpose	bottom fishing (figure1)	bottom fishing (figure2)	mid-water fishing (figure3)
	net length overall(m)	66	66.9	210.0
	head rope (m)	48	59.0	93.6
	ground rope (m)	50	77.9	93.6
	net height (m)	5.5	5.5	70
	net width (m)	30	200	240~260
	net girth (m)	100	83	816
	mesh size (mm)	120	120	120

F/V Dongsan Ho is a stern trawler operates two types of fishing gear; mid-water trawl net and bottom trawl net. The gear used for the fishing operations in the SEAFO CA was the mid-water KITE gear (Fig.4), that includes ropes in which the upper part has kites and lower part chains. The height of the net's gate is approximately 50 m, and the total length is around 280 m. When net is settled, it sinks underwater and the sinking depth of the net is controlled by the wire ropes. The bottom trawl net PE Net is also used in the SEAFO CA. The upper and lower parts of the net have attached plastic buoys and rubber balls respectively. As in the case of KITE gear the wire ropes control the sinking depth of the settled gear.

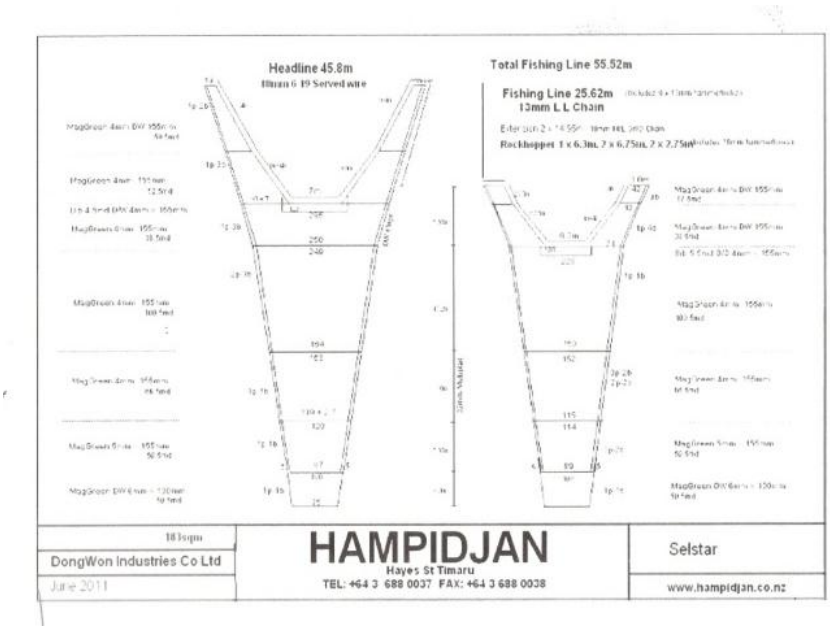


Figure 1: Diagram of HAMPIDJAN NET of F/V Adventure.

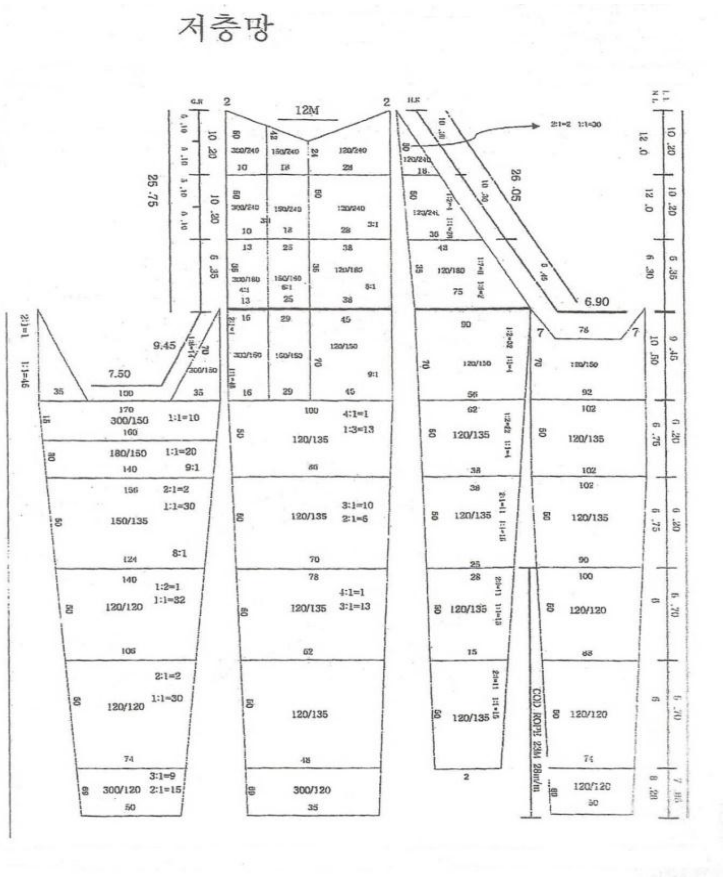


Figure 2: Drawing of the Custom Manufactured Bottom Trawl Net of F/V Adventure.

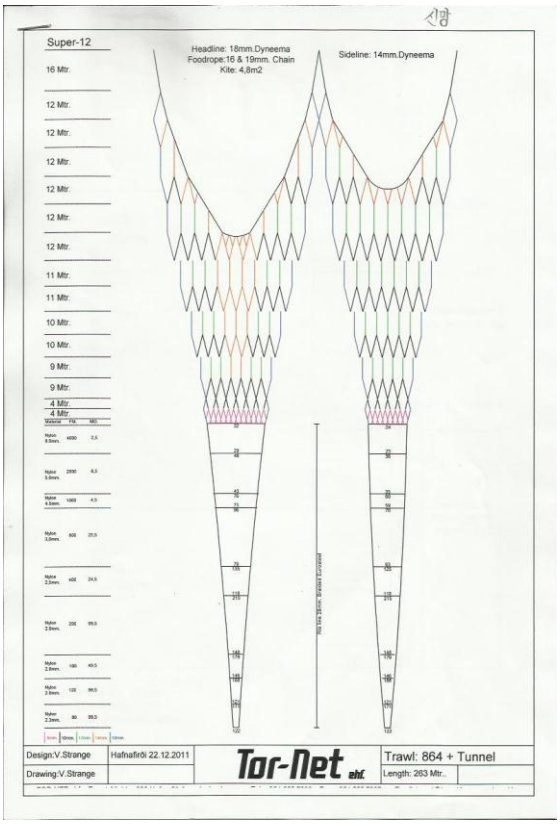


Figure 3: Drawing of mid-water trawl net of F/V Adventure.

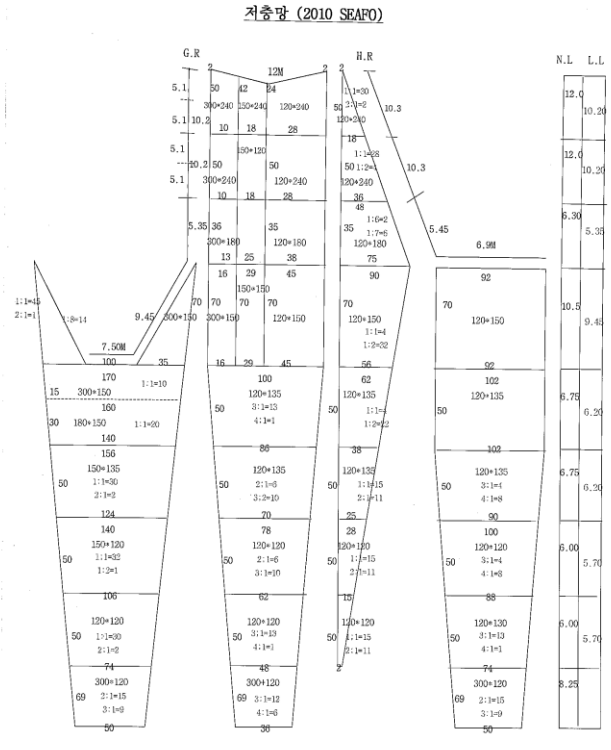
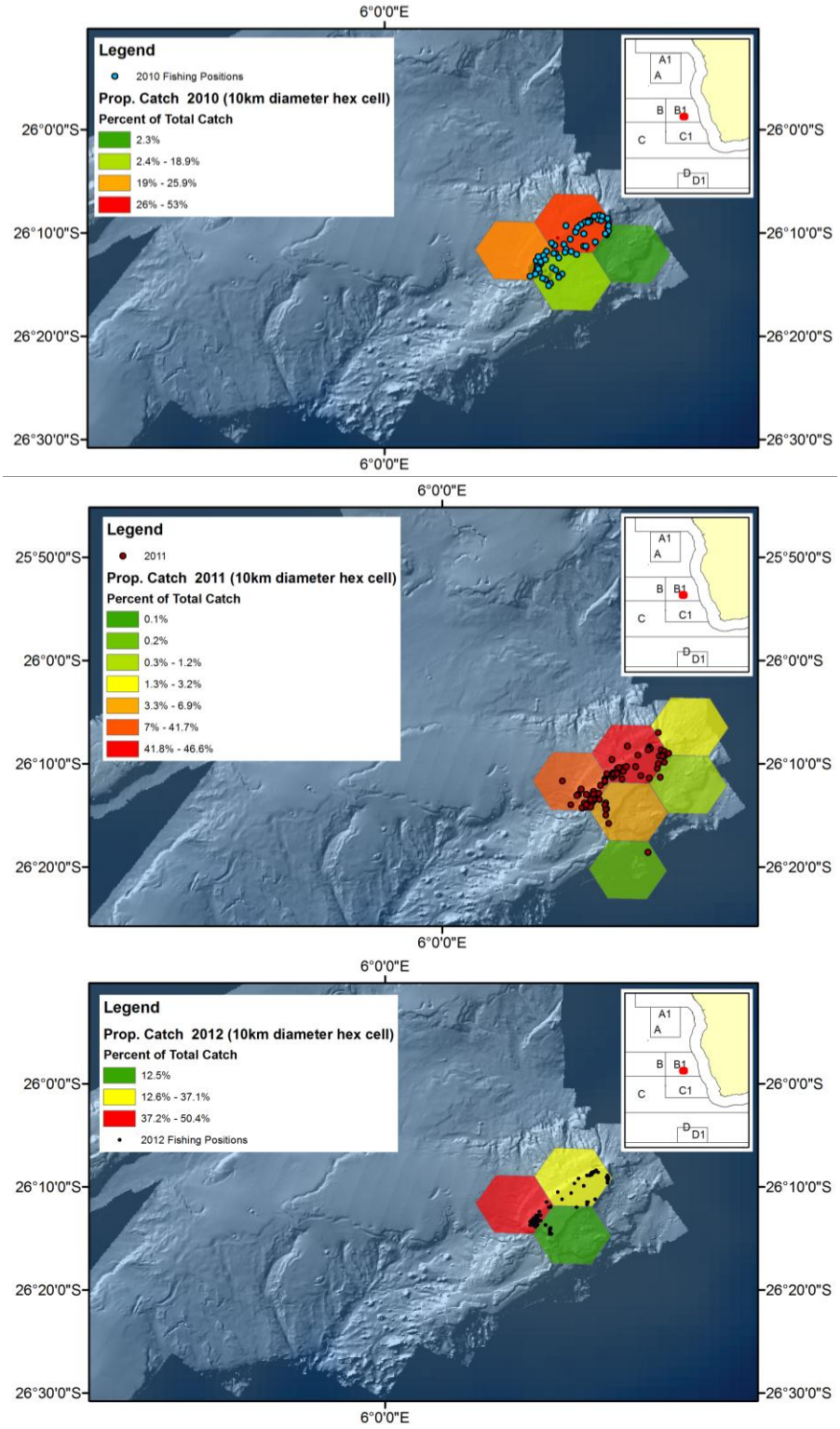


Figure 4: Drawing of mid-water trawl net of F/V Dongsan Ho.

15.2 Spatial and temporal distribution of fishing

During the period from 2010 to 2013 Korean trawler vessels (Dongsan Ho and/or Adventure) conducted a targeted fishery for pelagic armourhead in the southern and northern parts of the Valdivia Bank, in Division B1 of the SEAFO CA (Figure 5). In 2013, a single haul was also conducted at North Walvis Ridge in Division B1 (Table 1, Fig. 5, lower).



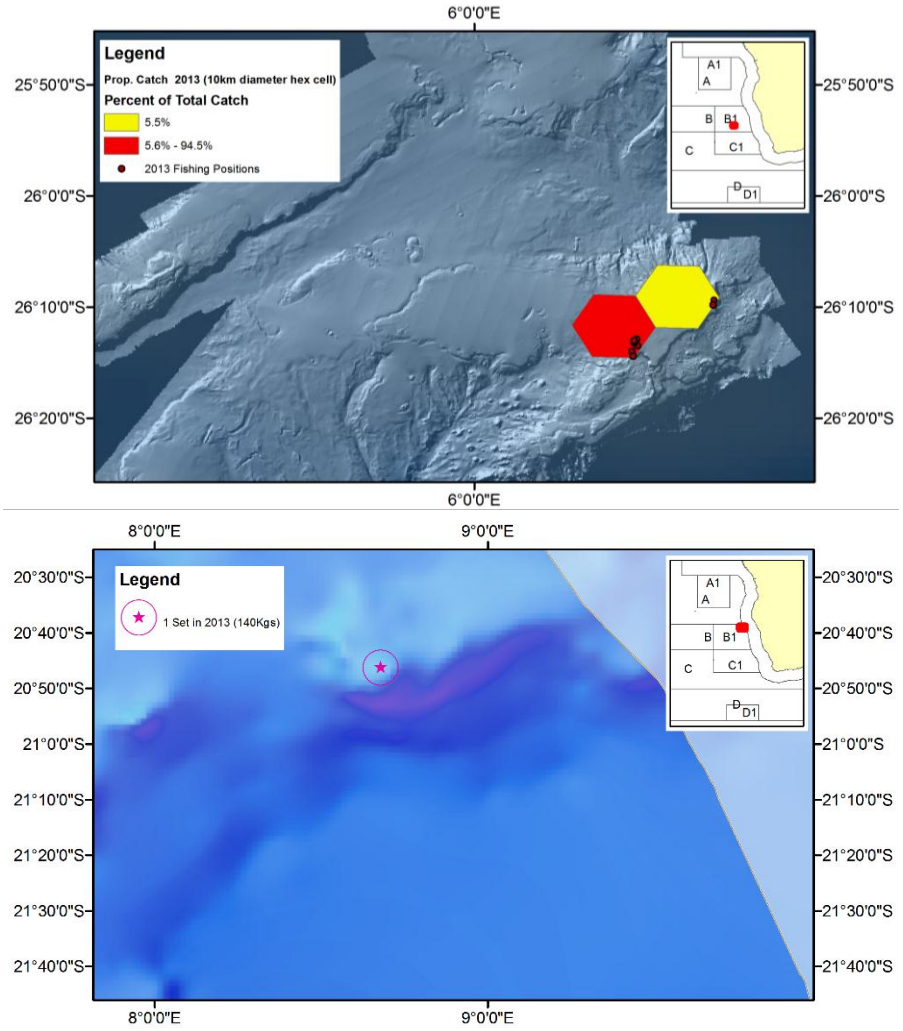


Figure 5: Spatial distribution of fishing positions and reported catches of pelagic armourhead(*P. richardsoni*) aggregated to 10km diameter hexagonal cells, 2010-2013. Lower map shows the single fishing position in the NE seamount of B1 (NE Walvis Ridge) reported in 2013. Data from observer reports submitted to SEAFO until Sept. 2014.

Table 1: Number of trawl hauls by year and location (ref. Fig. 5).

Year	Valdivia Bank	North Walvis Ridge
2010	63	
2011	88	
2012	117	
2013	9	1
2014	N/F	N/F

15.3 Reported retained catches and discards

Starting in 1976, Table 2 presents the historical records of annual catches and bycatches of pelagic armourhead by country, fishing gear and the SEAFO CA sub-divisions. The main fishing countries were:

- Russia that operated with bottom trawlers in the late 1970s and 1993;
- Ukraine (bottom trawl) fishing in the mid-1990s.
- Namibia and South Africa (bottom trawlers) in the mid-1990s;
- South Korea primarily operating with mid-water trawl in the period 2010-2013.

The higher annual catches were recorded by Russia with 1,273 and 1,000 t in 1977 and 1993, respectively, and by Korea with 688 t in 2010. Spain and Cyprus landed small catches in 2 and 1 years, respectively.

Table 2: Reported catches (tonnes) of pelagic armourhead*(Pseudopentaceros richardsoni*) from the SEAFO CA**.** Data reported by SEAFO CPs and other flag states reporting to SEAFO, and from FAO.

Nation	**Namibia**		**Russia**	**Ukraine**	**South Africa**		**Spain**		**Cyprus**	**Rep. of Korea**	
Management Area	B1		B1	UNK	B1		B1		UNK	**B1**	
Fishing method	BT		BT	BT	BT		BT / LL		BT	**MT**	
Catch details	(t)		(t)	(t)	(t)		(t)		(t)	**(t)**	
	Catch	Discard	Catch	Catch	Catch	Discard	Catch	Discard	Catch	Catch	**Discard**
1976			108								
1977			1273								
1978			53								
1993			1000	435 FAO							
1994											
1995	8			49	530						
1996	284			281	201						
1997	559			18	12						
1998	N/F										
1999	N/F										
2000	20										
2001	N/F						<1				
2002	N/F										
2003	4						3				
2004							3		22		
2005											
2006											
2007											
2008											
2009	N/F		N/F	N/F	N/F		N/F		N/F	N/F	
2010	N/F		N/F	N/F	N/F		N/F		N/F	688	**0**
2011	N/F		N/F	N/F	N/F		N/F		N/F	135	**0**
2012	N/F		N/F	N/F	N/F		N/F		N/F	152	**<1**
2013	**N/F**		**N/F**	**N/F**	**N/F**		**N/F**		**N/F**	**13**	**0**
2014* **	**N/F**		**N/F**	**N/F**	**N/F**		**N/F**		**N/F**	**N/F**	

N/F = no fishing
UNK = Unknown
Blank fields = No data available.
******* Provisional (July 2014)
FAO= values from FAO
TB = Bottom Trawl
TM = Mid-water Trawl
LL = Longline

15.4 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.

16. Stock distribution and identity

The Pentacerotid *Pseudopentaceros richardsoni* (Smith 1844) is a southern circumglobal, benthopelagic species inhabiting outer shelf and upper continental shelves as well as seamounts and underwater ridges (100-1000 m) between 0 and 1 000 m depth (Heemstra, 1986). The species inhabits such habitats at e.g. Tristan de Cunha, on the Walvis Ridge and seamounts off South Africa (Southeast Atlantic); south of Madagascar (Western Indian Ocean) as well as in southern Australia, New Zealand and the Southeast Pacific. The potential distribution area in the SEAFO CA and adjacent waters is shown in Figure 6. It is unlikely that the species is abundant south of about 40^{O}S, i.e. in Sub-Area D.

It is known from adjacent areas that adults inhabit the steep and flat hard bottoms down to 800 m on the seamounts and underwater ridges in the open ocean. Eggs, larvae and juveniles are pelagic. Pelagic armourhead recruit to the summit of the seamounts after approximately 4 years of pelagic life and thereafter aggregates.

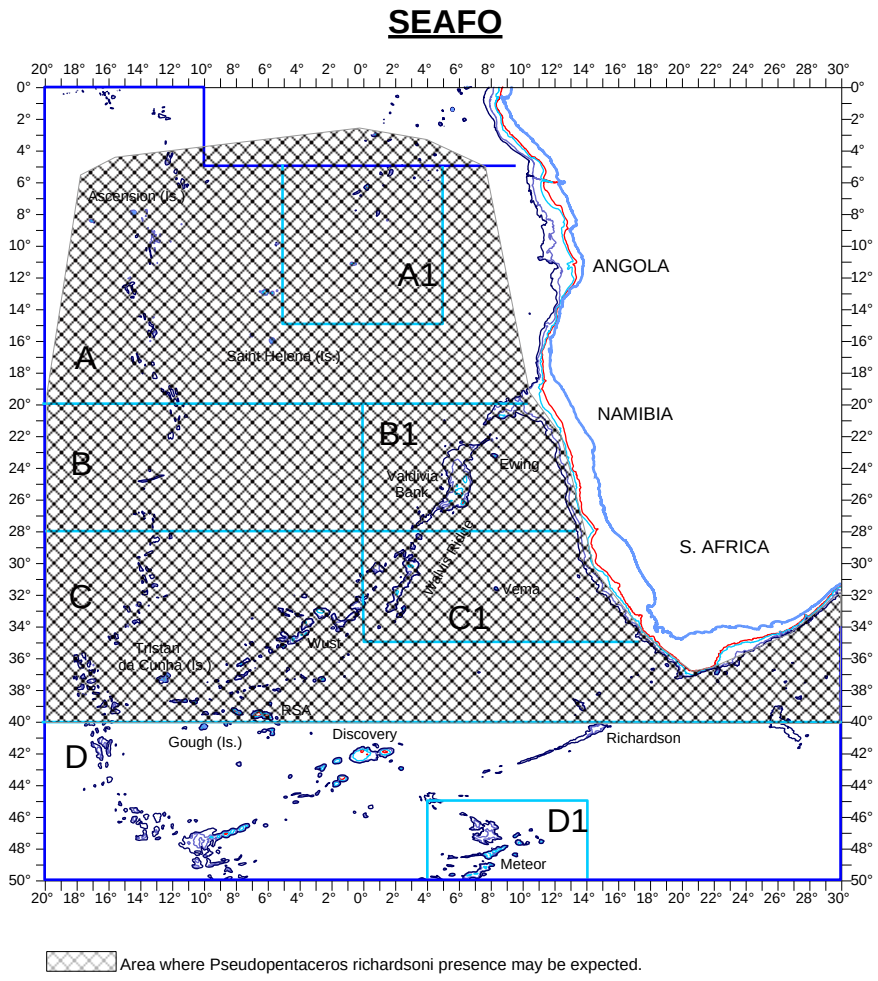


Figure 6: Potential geographical distribution of *P. richardsoni* in the SEAFO CA and adjacent waters (source: Species profile on the SEAFO website referring to several sources).

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

17.1 Fisheries and survey data

Geo-referenced data on catch and effort were available from haul-by-hauls observer reports for the entire time-series of the recent Korean fishery (2010-2013). Logbooks were not available.

No survey data from the period of the fishery was available from the area fished commercially or any other area of the SEAFO CA.

17.2 Length data and length frequency distributions

In 2014 the SC reviewed length data collected by observers on Korean fishing vessels mainly operating in Valdivia Bank (Subdivision B1) in the period 2010-2013. No fishery has been conducted as of September 2014.

Due to insufficient sampling, it was impossible to derive reliable length compositions of the catches (see below). Length frequency distributions and length data (e.g. ranges and mean lengths) presented in 2013 or earlier SC reports are considered invalid.

Data on sampling levels are provided in Figure 7 and Table 3. The majority of trawl tows were sampled by observers, but in all years the sampling level in terms of total number of fish sampled, and number of individual sampled/tow (and per tonne) was inadequate. The sampling level even declined during the period 2010-2013.

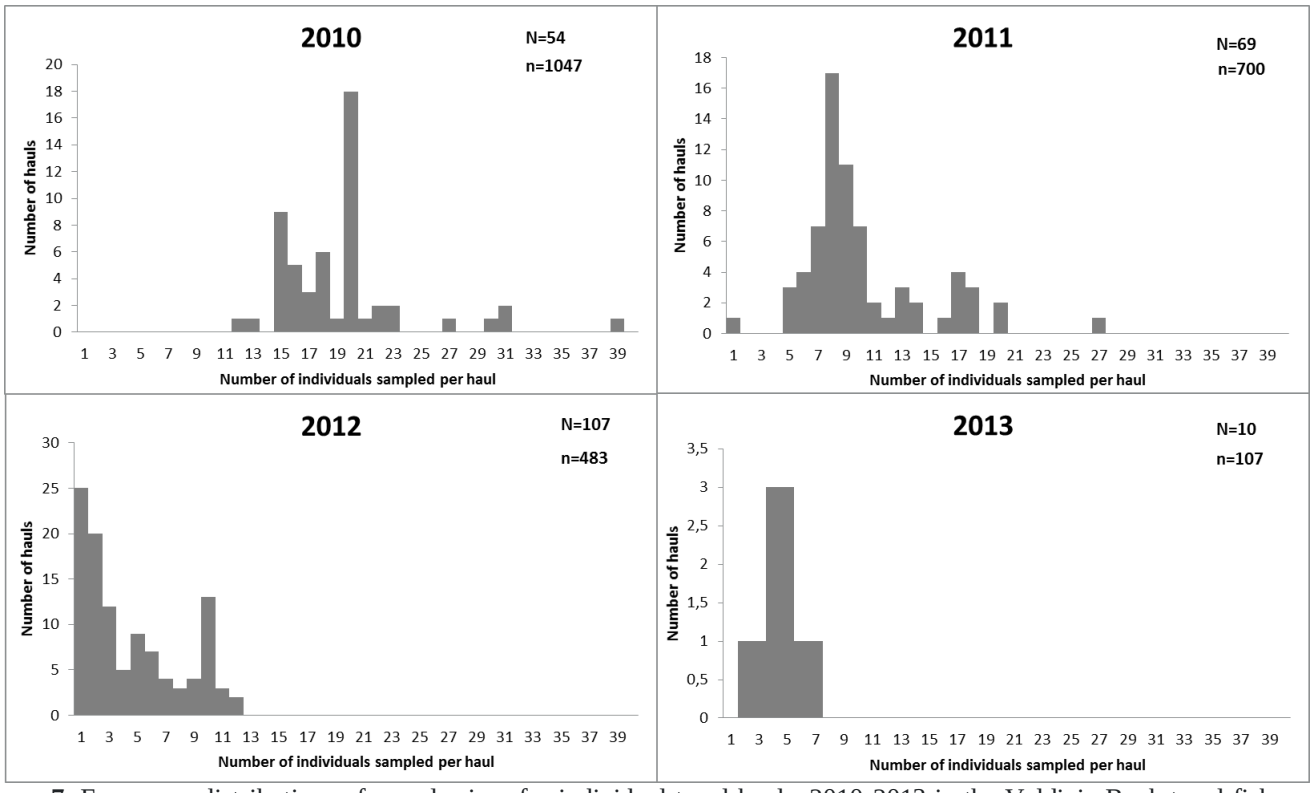


Figure 7: Frequency distributions of sample sizes for individual trawl hauls, 2010-2013 in the Valdivia Bank trawl fishery for pelagic armourhead. The source is observer reports submitted to SEAFO until September 2014. N = total number of hauls sampled; n= total number of boarfish sampled.

Table 3: Samples and sampling levels resulting from observer observations of the trawl on Valdivia Bank. Data on pelagic armourhead only, as officially submitted to SEAFO until Sept. 2014.

Year	No. of trawl tows sampled	Mean #ind. sampled/tow	Min. #ind. sampled/tow	Max. #ind. sampled/tow	Mean #ind. sampled/tonne
2010	54	19.3	12	39	0.03
2011	69	10.1	1	27	0.09
2012	107	4.5	1	12	0.03
2013	10	4.5	2	7	0.35

17.3 Length-weight relationships

The weight-length relationship of pelagic armourhead (for the two sexes combined) derived from samples collected by observers in 2010-2012 was: $W = 0.016\ L^{3.048}$ ($r^2 = 0.96$).

17.4 Age data and growth parameters

There is no available information for SEAFO CA.

17.5 Reproductive parameters

The frequencies of pelagic armourhead by maturity stage and sampling month for the period 2010 – 2012 are shown in Table 4.

The fishing activity in SEAFO CA 2010-2012 was restricted to May and June, and the observer data suggest high proportions of pre-spawning and spawning stages (Fig. 8) and that spawning occurs after May but probably before September. This period is different from that observed in the Southwest Indian Ocean, i.e. between October and December (López-Abellán et al. 2007). However, in neither area were the entire year sampled.

A maturity ogive based on the above data suggests 44.1 cm FL as the likely size at 50% maturity (Fig. 9).

Table 4: Annual number of fish by maturity stage of Pelagic armourhead (*Pseudopentaceros richardsoni*) in the SEAFO CA for 2010-2012. Source: observer samples from Korean fishery.

Year	Month \ Maturity stage	Immature	Developing	Pre-spawning	Spawning	Spent
2010	Sep	0	504	159	0	0
	Oct	0	437	107	0	0
	Nov	0	84	26	0	0
2011	Jan	14	78	27	0	0
	Sep	59	75	4	0	0
	Oct	30	26	13	0	0
	Nov	0	16	27	2	0
2012	May	0	0	38	96	0
	Jun	0	0	69	352	0

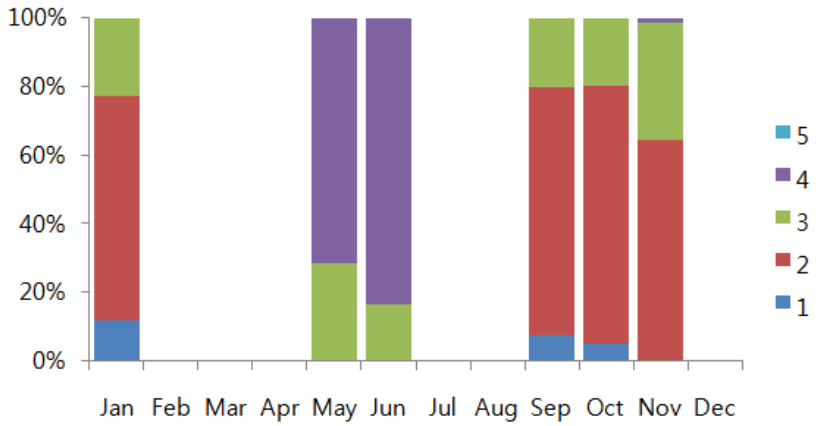


Figure 8: The proportion of maturity stage by month of Pelagic armourhead (*Pseudopentaceros richardsoni*) in the SEAFO CA for 2010-2012 (1: immature, 2: developing, 3: pre-spawning, 4: spawning and 5: spent).

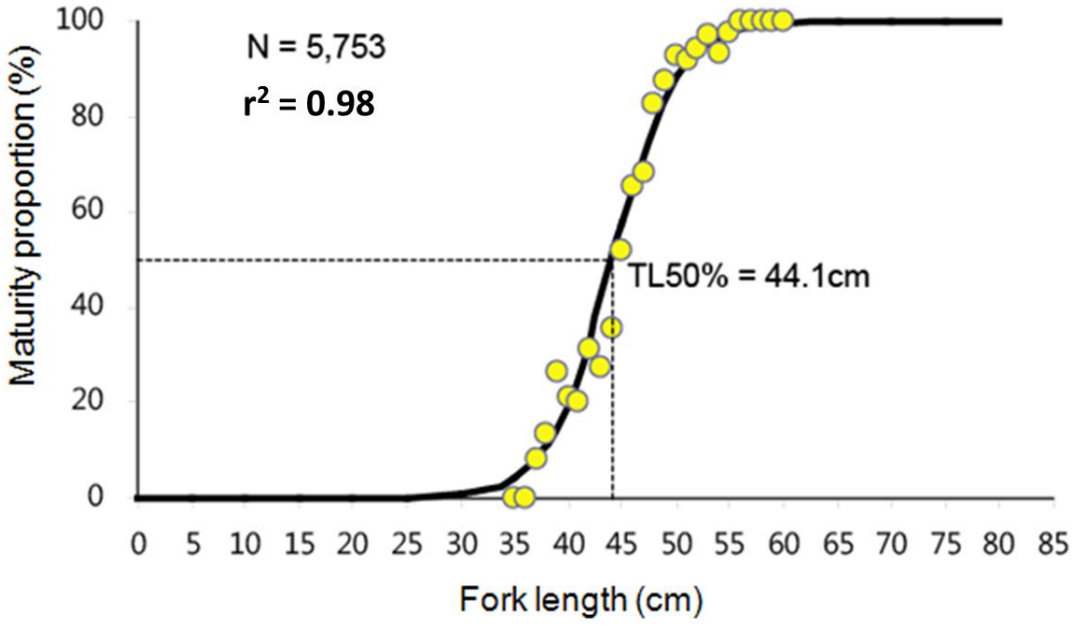


Figure 9: The maturity proportion by length of pelagic armourhead (*Pseudopentaceros richardsoni*) on the Valdivia Bank in the SEAFO CA (Sub-Area B1).

17.6 Natural mortality

Empirical natural mortality estimates for pelagic armourhead were calculated by different methods and using the estimates of growth parameters derived from growth studies on the same species from the Southwest Indian Ocean (López-Abellán et al. 2008a) and on Valdivia Bank during the Spanish-Namibian research surveys reported on earlier (López-Abellán et al. 2008b).

The growth parameters fitted were: K=0.27 year-1; L_{inf}=65.1 cm; and t_0=-0.34 year-1. The maximum observed age of the pelagic armourhead in the Southwest Indian Ocean was 14 years.

The values of empirical natural mortality obtained using different methods were determined using the Fishmethods R package:

Method	M
Pauly (1980) - Length Equation	0.457
Hoenig (1983) - Joint Equation	0.316
Hoenig (1983) - Fish Equation	**0.300**
Alverson and Carney (1975)	0.253
Roff (1984)	0.417
Gunderson and Dygert (1988)	0.089

The natural mortality M=0.3 for the pelagic armourhead calculated using the Hoenig´s method was considered acceptable and used in the analyses below. The effect of using M=0.2 was illustrated. The average longevity for stocks in the data set used by Hoenig (1983) is the age at which about 1.5% of the stock remains alive (Hewitt and Hoenig, 2005).

17.7 Feeding and trophic relationships (including species interaction)

There is no available information for SEAFO CA.

17.8 Tagging and migration

There is no available information SEAFO CA.

18. Stock assessment status

Populations of *P. richardsoni*, particularly the adult exploited fraction, have patchy distributions. The species occurs in a restricted depth stratum on the summit of seamounts and oceanic banks. Simple analyses of catch per unit of effort (CPUE) in the recent fisheries may be used as an indicator of biomass and may reveal temporal abundance trends. However, provided that sufficient input data are available, the pattern of distribution makes the use of local depletion analysis a potentially useful tool to evaluate the status of the population in specific areas. In the case of the SEAFO CA the actual fishing grounds in the recent fishery were primarily located in a small area of about 200 km2 on Valdivia Bank (see Ch. 1.2). If sufficient length data are available, cohort analyses based on length may be possible.

Processes and discussions in previous SC sessions are available in the Scientific Committee reports (SEAFO SC Report 2012 (Pages 21-23); SEAFO SC Report 2013 (Pages 17-18). In 2014 the exploration of different approaches continued. Depletion estimators were recalculated and the Gulland approach adopted to estimate maximum sustainable yield (MSY) based on the estimate if initial biomass derived from the depletion model. Also, the SC considered length-based analyses as potentially complementary approaches to evaluate exploitation status, but due to the shortage of length data (Ch. 3.2.), that exploration was abandoned.

Depletion estimators are widely used in fish and wildlife studies to estimate population abundance (Seber, 2002; Hilborn and Walters, 1992). These estimators assume a simple linear relationship between CPUE and cumulative effort (DeLury, 1947) or cumulative catch (Leslie and Davis, 1939). Data available suggest that prior to 2010 the stock was unexploited and consequently the Gulland (1971) method may be an approach to estimate MSY.

18.1 Available abundance indices and estimates of biomass

Catch & effort data was available for the years 2010-2013 and used to calculate CPUE, as an indicator of stock biomass.

18.2 Data used

The data used above were derived from fishing hauls in which the total catch of *P. richardsoni* represented more than 80% of the total catch of *P. richardsoni* plus Beryx splendens. This criterion was adopted because catches of these two species are highly negatively correlated, i.e. when one of these two species occurs in the haul the other is usually very low (Fig. 11).

In each haul the estimate of CPUE of *P. richardsoni* is represented as the ratio of total catch of the species by the haul duration.

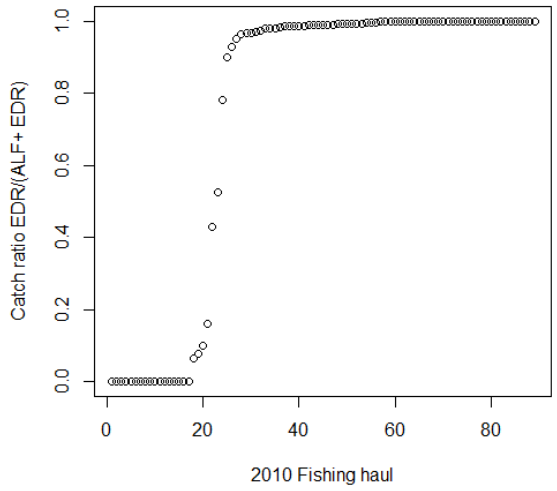


Figure 10: The 2010 estimates of ratio of total catch *Pseudopentaceros richardsoni* by the total catch of *Pseudopentaceros richardsoni* and *Beryx splendens* by haul by Korean trawl vessels.

18.3 Methods used

In addition to simple evaluations of CPUE trends, the local depletion model was run (see above) for further exploration. This model assumes that no recruitment and emigration/immigration to the fishing area occur during a particular season of fishing. Under these assumptions, catch rates will decline with continued fishing until all the fish have been removed. A linear regression model is adjusted to CPUE and the corresponding temporal cumulative catches. Through this model the total biomass available at the beginning of the season will thus correspond to the total catch that corresponds to local extinction, i.e. point that intersects the x-axis.

The uncertainties of the estimates were determined by bootstrapping method. A total of 2000 bootstrap samples were derived from the input data and based on bootstrap estimates of the parameter and through this confidence interval for each parameter was derived accordingly.

The Gulland approach to estimating MSY was adopted to generate provisional estimates of MSY (Gulland, 1971; Garcia et al. 1989): MSY = 0.5*B*M, where B is unexploited (virgin) biomass and M the estimate of instantaneous natural mortality rate.

18.4 Results

The time-series showed that the CPUE declined sharply from 2010 to 2011 and remained low during 2011, 2012, and 2013 (Fig. 10). In 2014 there was no fishery, hence no data on CPUE.

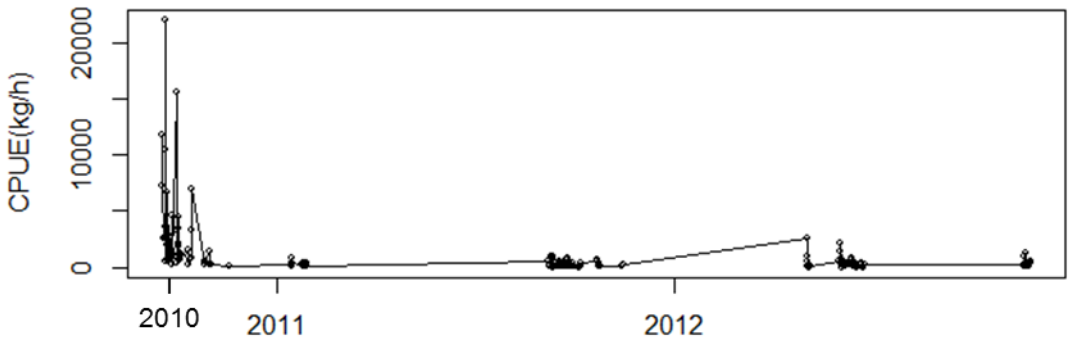
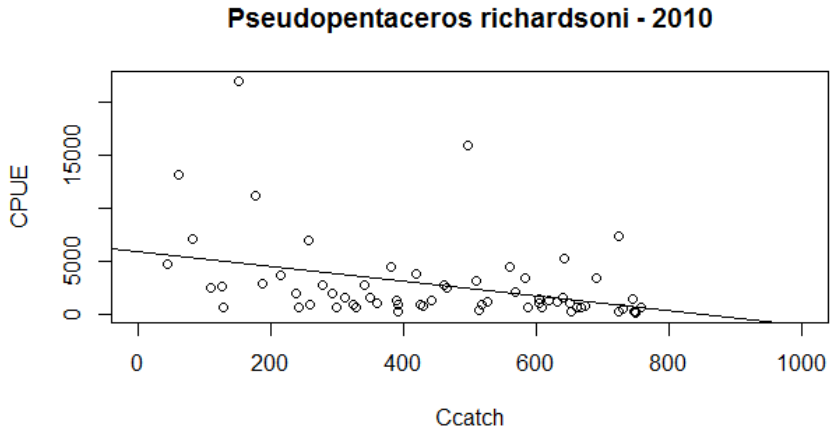


Figure 11: Time-series of catch per unit of effort (CPUE, kg/trawl hour), i.e. set-by-set data, for pelagic armourhead from 2010 to 2013. Source: observer reports submitted to SEAFO.

Figure 12 presents the CPUE against cumulative catch and the adjusted regression lines for 2010 and 2011. The 2010 biomass estimate at the beginning of the fishing season (851 t) was considered a proxy of the unexploited biomass. Table 6 shows estimates of the biomass at the beginning of the fishing seasons in 2010 and 2011, as well as the 25% and 75% percentiles.



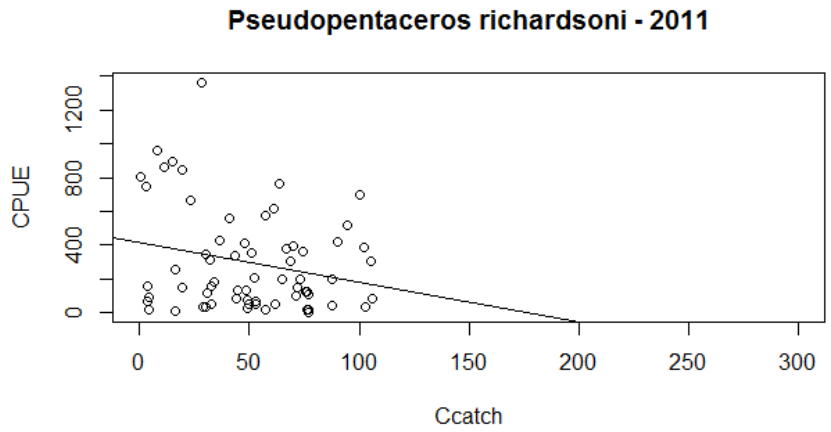


Figure 12: The CPUE against cumulative catch (catch, tonne) of *Pseudopentaceros richardsoni* and the adjusted regression lines for 2010 and 2011. Note the different scales on the CPUE axes.

Table 6: Summary statistics of the biomass (t) at the beginning of the fishing season derived from 2000 bootstrap re-sampling estimates.

Year	25 Percentile	Estimate	75 Percentile
2010	751	851	1096
2011	137	176	229

Applying the Gulland formula, and assuming a virgin biomass of 851t and M = 0.3, resulted in an estimate of MSY = 128 t. The corresponding estimate using M = 0.2 is MSY = 85 t.

18.5 Discussion

The results obtained show strongly decreasing biomass indices (CPUE) from the years 2010 and 2011 (in 2011 the CPUE was approximately 16% of that in 2010). The CPUE continued at similar levels through the time-series until and including 2013.

The data available for the fishery on the Valdivia Bank were only sufficient to apply exploratory relatively simple assessment methods to study stock trends and status and derive provisional estimates of MSY. The exploratory model run for 2010 showed a significant negative regression slope and the regression explained near 40% of the variance. These exploratory runs provided a similar perception of the stock development as depicted by the CPUE series.

18.6 Conclusion

The catches of *P. richardsoni* were from a directed fishery on Valdivia Bank, in a very small area, where the species concentrate as adults. These two aspects make the species highly vulnerable to overfishing. The SC did not have valid size or age distributions allowing evaluation of trends in size-age structure of the stock through the time-series. No data on recruitment was available. Under the assumption of a 4-year recruitment age, it is expected that until 2015 the entries in the population come from year classes born prior to 2010, i.e. before the fishery started.

The current perception of the stock fished primarily on the Valdivia Bank is that it is reduced to a low level.
There is no information on recruitment processes and dynamics, and it is not known whether the concentrations of the species constitute a self-sustaining population or are sustained by immigration/influx

of larvae and juveniles from other areas. The abundance of recruiting year classes is unknown due to lack of age data and pre-recruit data. It is therefore unknown if the present abundance level on Valdivia Bank is above or below a level at which recruitment is impaired.

Recovery of the stock and fishery on Valdivia will require that the fishing intensity is controlled and kept at a much reduced level to facilitate recruitment and a reversion of the negative CPUE trend. A recovery plan may be required (see Ch 4.7).

The 2010-2013 fishery for armourhead was mainly conducted on the Valdivia Bank. A single catch was, however, also reported from a seamount in the NE corner of B1. In Figure 6 the generalized distribution area of the species was provided. However, the species is restricted to depths less than 800m and mostly less than 600m. The actual areas of suitable character and depth, i.e. shallower than 600m and north of 40oN, are few and widely dispersed (Figure 13). Fisheries expanding into other areas also have to be closely monitored and regulated (Ch 4.7).

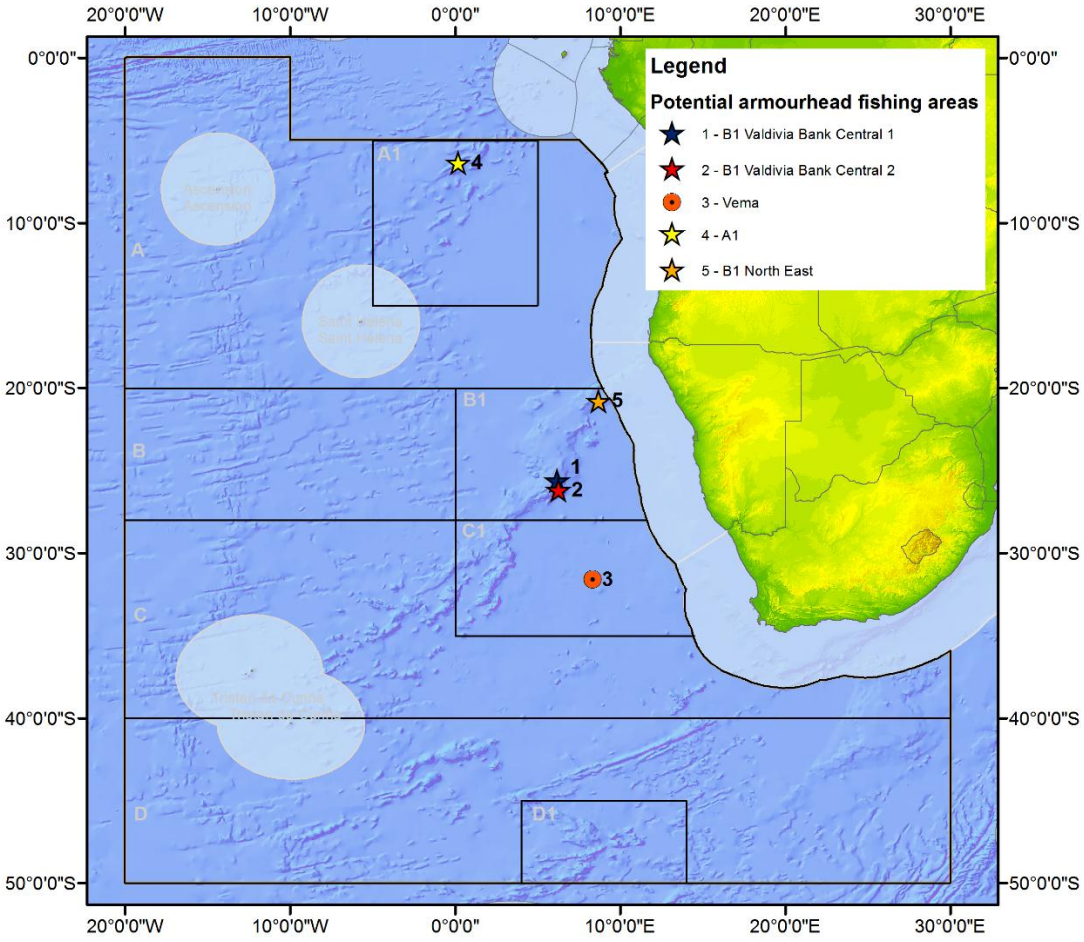


Figure 13: Bathymetry of the SEAFO CA and locations with bottom depths of 600m or less.

18.7 Biological reference points and harvest control rules

Apart from the provisional estimate of MSY=128 t (Ch. 4.4), no reference points have been estimated and found to be valid. The main reason is the shortage of basic data to carry out assessments. Harvest control rules have not been implemented, but a suggestion is provided by the SC in 2014.

In view of the current perception of the stock as being at a low level, the SC recommends that a harvest control rule is implemented and suggests as a candidate HCR 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.

The application of the proposed HCR in the future requires a base level of catch in 2015.

19. Incidental mortality and bycatch of fish and invertebrates

19.1 Incidental mortality (seabirds, mammals and turtles)

There are no reports of incidental bycatches of birds, mammals and turtles in the armourhead fishery.

19.2 Fish bycatch

Observer reports document that bycatch species in the pelagic armourhead fishery on Valdivia Bank were blackbelly rosefish, imperial blackfish, oilfish, Cape bonnetmouth, and silver scabbardfish. Among these alfonsino, blackbelly rosefish, imperial blackfish, and oilfish were the most abundant species (Table 7).

Minor catches of Japanese mackerel (*Scomber japonicas*) (50 t in 2010), Cape horse mackerel (*Trachurus capensis*), and the longspine bellowfish (*Notopogon xenosoma*) were also recorded in the Korean observer reports, but it is uncertain whether these species occurred in the armourhead fishery. The identification of the latter species is also uncertain.

Table 7:Bycatch from pelagic armourhead / southern boarfish (*Pseudopentaceros richardsoni*) fishery.

	2010	**2011**	**2012**	**2013**
Species (FAO code)	**B1**	**B1**	**B1**	**B1**
BRF	161	42	35	4
HDV	24	35	24	<1
OIL	5	13	7	<1
EMM	11	2	<1	0
GEM	0	0	<1	0

SVS	30	15	2	0

BRF: Blackbelly rosefish (*Helicolenus mouchezi*); HDV: Imperial blackfish (*Schedophilus ovalis*); OIL: Oilfish (*Ruvettus pretiosus*); EMM: Cape bonnetmooth (*Emmelichthys nitidus*) and PRP: Roudi escolar (*Promethichthys prometheus*)??, SVS: silver scabbardfish (*Lepidotus caudatus*).

19.3 VME indicator incidental catch

Korean observers recorded 0.4 kg of VME indicator species in 2013 and less than 1 kg in previous years of the 2010-2013 armourhead fishery on Valdivia Bank. Apparently, catches never exceeded the agreed SEAFO threshold levels.

19.4 Incidental and bycatch mitigation methods

There are no relevant technical mitigation measures implemented specifically for the armourhead fishery.

19.5 Lost and abandoned gear

There were no reported lost and abandoned gear resulting from the armourhead fishery

19.6 Ecosystem implications and effects

There is no formal evaluation available for this fishery.

20. Current conservation measures and management advice.

In 2013 the Commission could not reach consensus on a TAC for southern boarfish/pelagic armourhead, consequently, the fisheries is open in 2014. The only CP fishing armourhead in the 2010-2013 fishery, i.e. Korea, declared that the precautionary approach would be respected and that a total catch of 300 tonnes in Division B1 would not be exceeded.

The Commission furthermore requested that the Scientific Committee assess the southern boarfish/pelagic armourhead and present a TAC in 2014.

The SC recommends that a TAC corresponding to the output level resulting from the HCR using the average catch in 2011 and 2012, i.e. 143 t.

Table 8: 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 By-catch of Seabirds in the SEAFO Convention Area
Conservation Measure 18/10	on the Management of Vulnerable Deep Water Habitats and Ecosystems in the SEAFO Convention Area
Conservation Measure 27/13	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 26/13	on Bottom Fishing Activities in the SEAFO Convention Area

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APPENDIX X – Stock Status Report – Orange roughy

STATUS REPORT

Hoplostethus atlanticus

Common Name: Orange roughy

FAO-ASFIS Code: ORY

2014

Updated: 9-Oct-14

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22. Description of the fishery

1.1 Description of fishing vessels and fishing gear

The nature of the fishery has changed over the last couple of years. Exploration for Orange roughy first started in South Africa prior to 1994 but emphasis soon shifted to Namibia when an exploratory fishing license was given to a Namibian fishing company to search for commercial deep-water fish species. The fishery expanded, extending their fishing range into SEAFO CA. By 2008, a three year moratorium on orange roughy was enforced and the fishery has not been re-opened yet.

Table 1 shows vessels that operated between 1995 and 2005 in the SEAFO CA. These vessels were also involved in the Alfonsino fishery during the same period.

Table 1: Orange roughy: Fleet information, Division B1.

Flag	ID	Name	Length	GRT	Built	HP	IRCS
Nam	L737	Southern Aquarius	54		01/01/1974	3000	V5SH
Nam	L913	Emanguluko	31	483.00	01/01/1990	1850	V5SD
Nam	L892	Petersen	43	650.00	01/01/1979		V5RG
Nam	L861	Will Watch	69	1587.00	01/01/1972	2116	ZMWW
Nam	L918	Hurinis	37	784.00	01/01/1987	1680	V5SW
Maur	L1159	Bell Ocean II	57	1899.00	01/01/1990	3342	3BLG
Nam	L830	Seaflower	92	3179.75	01/01/1972	4800	V5HO

Seven Namibian vessels (Table 1) were involved for the period that the fishery occurred in the SEFO CA. The vessels employed the standard New Zealand "Arrow" rough bottom trawl with cut-away lower wings. Sweep and bridle lengths were 100 meters and 50 meters respectively. A "rockhopper" bobbin rig was used. The net had a 5-6 meter headline height when towed at 3- 3.5 knots and had an estimated wingspread of 15 meters. The cod end had a mesh of 110 mm. Each vessel spends on average 12 days at sea.

1.2 Spatial and temporal distribution of fishing

Fishing mainly occurred on Ewing seamount and Valdivia Bank within the SEAFO CA. These operations started in 1995 and continued until 2005, with the exception of 1998 when no fishing took place. The fishing season usually extends from January to December and catches peak in winter months (May to July), which coincides with the spawning season of orange roughy.

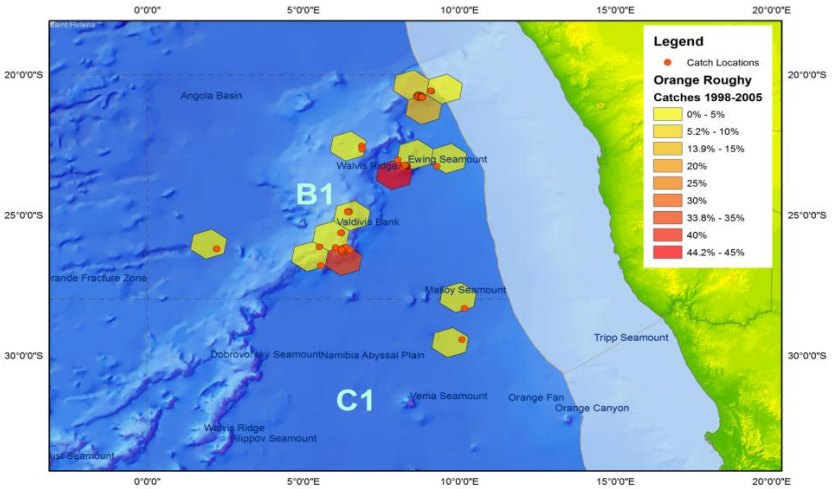

Figure 1: Geographical location of fishing activities in the SEAFO CA.

1.3 Reported retained catches and discards

For all the fishing grounds the home port is the same as the landing port, with Walvis Bay and Lüderitz the most important ports. All available landing information is presented in Table 2. However, the bulk of orange roughy catches were recorded within the Namibian EEZ (Table 3). A total of 1270 trawls were made landing about 290 tonnes of orange roughy.

Table 2: Catches of orange roughy made by Namibia, Norway and RSA.

Nation	**Namibia**		**Norway**		**South Africa**	
Fishing method	**Bottom trawl**		**Bottom trawl**		**Bottom trawl**	
Management Area	**B1**		**A1**		**B1**	
Catch details (t)	**Retained**	**Discarded**	**Retained**	**Discarded**	**Retained**	**Discarded**
1995	40		N/F			
1996	8		N/F			
1997	5		22		27#**	
1998	N/F	N/F	12			
1999	<1		N/F	N/F		
2000	75		0			
2001	94		N/F	N/F		
2002	9		N/F	N/F		
2003	27		N/F	N/F		
2004	15		N/F	N/F		
2005	18		N/F	N/F		
2006	N/F	N/F	N/F	N/F		
2007	N/F	N/F	N/F	N/F	N/F	N/F
2008	N/F	N/F	N/F	N/F	N/F	N/F
2009	N/F	N/F	N/F	N/F	N/F	N/F
2010	N/F	N/F	N/F	N/F	N/F	N/F
2011	N/F	N/F	N/F	N/F	N/F	N/F
2012	N/F	N/F	N/F	N/F	N/F	N/F
2013	N/F	N/F	N/F	N/F	N/F	N/F
2014*	N/F	N/F	N/F	N/F	N/F	N/F

N/F = No Fishing. Blank fields = No data available.
* Provisional (Aug 2014)
** Sum of Catches from 1993 to 1997.
# Values taken from the Japp (1999).

Table 3: Orange roughy landings (tonnes) in SEAFO CA and Namibian EEZ

Year	SEAFO CA	Namibian EEZ
1994	N/F	1 872
1995	40	6 288
1996	8	17 381
1997	5	14 729
1998	N/F	10 040
1999	<1	2 699
2000	75	1 344
2001	94	874
2002	9	1 985
2003	27	1 730
2004	15	1 106
2005	18	297
2006	N/F	429
2007	N/F	288

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.

23. Stock distribution and identity

Orange roughy (*Hoplostethus atlanticus*) is distributed globally (Fig. 3), but predominantly in the Southern Hemisphere. In the SE Atlantic orange roughy may most probably be regarded as a single stock (management unit). In the BCLME region that species occurs within the economic zones of each of the coastal states as well as in the SEAFO CA.

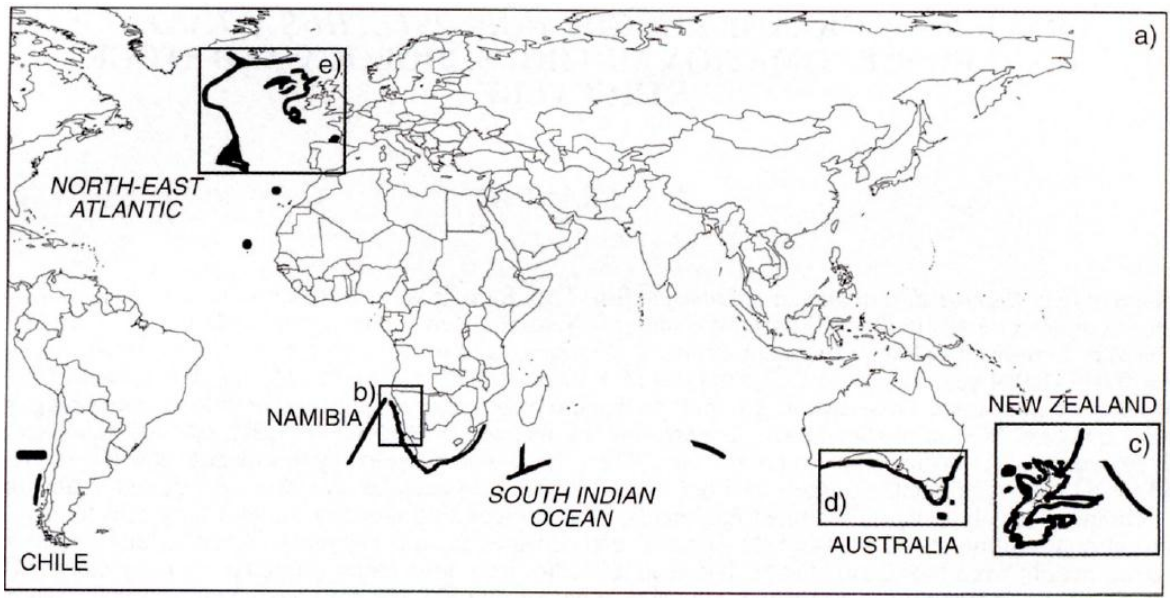

Figure 3: Global distribution of orange roughy (Branch, 2001).

The aggregating behaviour of orange roughy contributed to its vulnerability to overexploitation globally. Spawning aggregations of orange roughy have been targeted in Namibia during winter. Outside the spawning seasons catches were found to be lower due to a more dispersed resource. Orange roughy are also extremely slow-growing and estimates of maximum age are in excess of 100 years.

Recruitment to the fishery is poorly understood as juveniles are not found in significant quantities. Adults have been caught in small amounts in both Angolan and South African waters, but not in large spawning aggregations as in Namibia. Orange roughy distribution also extends beyond the economic zones of the BCLME countries with good catches reported for example on the Valdivia Bank on the South Atlantic Ridge as well as on the fringes of the Agulhas Bank and Walvis Ridge in the southern Benguela.

24. Data available for assessment, life history parameters and other population information

24.1 Fisheries and survey data

Catch records for the period 1995 to 2005 are available (see Table 2 above). The number of hauls made per year are depicted in table 4 and shows that more hauls were recorded in years when the catches were high.

No orange roughy survey has been conducted in the SEAFO CA.

Table 4: The total number of hauls from which orange roughy catches were derived for the period 1999-2004.

1999	2000	2001	2002	2003	2004
16	330	297	40	63	48

24.2 Length data and frequencies distribution

No information available for SEAFO CA.

24.3 Length-weight relationships

No information available for SEAFO CA.

24.4 Age data and growth parameters

No information available for SEAFO CA.

24.5 Reproductive parameters

No information available for SEAFO CA.

24.6 Natural mortality

No information available for SEAFO CA.

24.7 Feeding and trophic relationships (including species interaction)

No information available for SEAFO CA.

24.8 Tagging and migration

No information available for SEAFO CA.

25. Stock assessment

25.1 Available abundance indices and estimates of biomass

The catch per trawl trend was used as an indicator of the CPUE trend and is illustrated in figure 4. The CPUE was the highest in 1995 and thereafter decreased rapidly to reach the lowest CPUE in 1999. Since then the CPUE seems to have stabilized at a low level until 2005 after which there are no data.

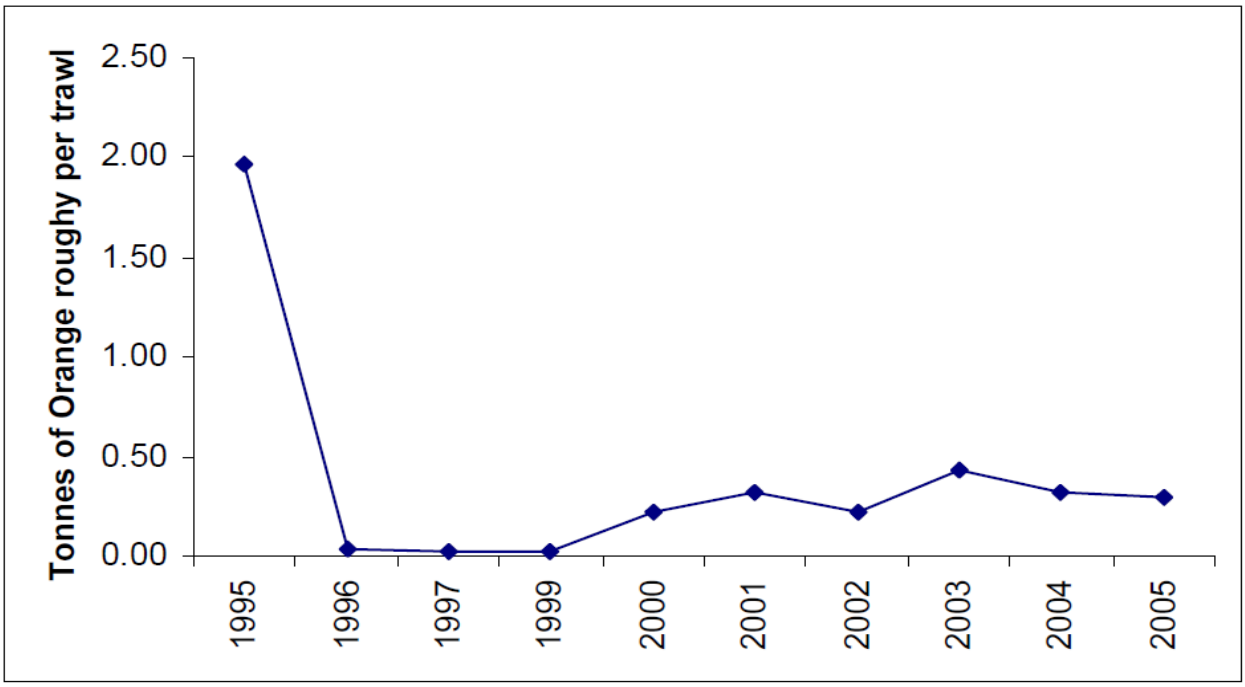

Figure 4: CPUE of orange roughy in tonnes per trawl in Division B1 (SEAFO SC Report 2006).

25.2 Data used

No data since 2005 available.

25.3 Methods used

No data since 2005 available.

25.4 Results

No new data, therefore no results.

25.5 Discussion

25.6 Conclusion

Since there is no fishery in recent years or any other independent data available within the SEAFO CA, no assessment can be done at the moment. However, future assessments for orange roughy should be separated according to fishing ground, similar to what has been done for the New Zealand orange roughy resource.

25.7 Biological reference points and harvest control rules

No biological reference points and/or harvest control rules have been established for this stock as yet.

26. Incidental mortality and bycatch of fish and invertebrates

26.1 Incidental and bycatch statistics (seabirds, mammals and turtles)

No information available for the SEAFO CA.

26.2 Fish bycatch

No information available for the SEAFO CA.

26.3 Invertebrate bycatch including VME taxa

No information available for the SEAFO CA.

26.4 Incidental mortality and bycatch mitigation methods

No information available for the SEAFO CA.

26.5 Lost and abandoned gear

No lost and abandoned gear data was reported for Orange roughy fishery in the SEAFO CA.

26.6 Ecosystem implications and effects

There has been no orange roughy fishery since 2006 in the SEAFO CA, thus there are no perceived negative impacts from this fishery.

27. Current conservation measures and management advice

27.1 Current conservation measures

The 2014 management measure pertaining to orange roughy in the SEAFO CA (CM 27/13) is a moratorium (zero TAC) on directed fishery in Division B1 and a TAC of 50 tonnes for the remainder of the SEAFO CA. Other conservation measured relevant for orange roughy fishery is shown in Table 5 below.

Table 5: Conservation measure relevant to Orange roughy 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	On the Management of Vulnerable Deep Water Habitats and Ecosystems in the SEAFO Convention Area
Conservation Measure 27/13	On Total Allowable Catches and related conditions for Patagonian Toothfish, Orange Roughy, Alfonsino and Deep-Sea Red Crab in the SEAFO Convention Area in 2014
Conservation Measure 26/13	On Bottom Fishing Activities in the SEAFO Convention Area

27.2 Management advice

SC considered available data on orange roughy since the inception of the fisheries in SEAFO CA. The fishery started in 1993 and lasted for about 13 years. The fishery was dominated by Namibian vessels and other nations (Norway and South Africa) only joined for shorter periods. During this period, more than 7 vessels fished in the SEAFO CA for orange roughy and over 1270 trawls were made with a total catch of about 290 tonnes. CPUE was the highest in 1995 and thereafter decreased rapidly to reach the lowest CPUE level in 1999. Since then CPUE seems to have levelled at a low level. In the last nine years no fishing has been reported in the SEAFO CA.

There is no reliable data series available for orange roughy within the SEAFO CA, as a result SC cannot conduct proper assessment of the orange roughy stock within the Convention area. SC recommends whenever possible, that orange roughy assessment should be done separately for each aggregation area found in the SEAFO CA and subsequent quotas.

SC recommends the continuation of the moratorium for 2015 and 2016 on directed fishery in Division B1 and allowance for bycatch limit as proportion (10%) of the average of landings from the last five years with positive catches (i.e. 2001-2005), equivalent to 4 tonnes. A precautionary TAC of 50 tonnes is set for the remainder of the SEAFO CA.

A comprehensive harvest control rule should be developed for orange roughy and should facilitate recovery.

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APPENDIX XI – Proposal for exploratory fishing within the SEAFO CA during 2015

PLAN OF EXPLORATORY FISHING IN NEW BOTTOM FISHING GROUND IN THE SEAFO CONVENTION AREA IN 2015

Member country: Japan
Date of submission: SEPTEMBER, 2014

1. Harvest Plan

(1) Purpose

In 2011, existing bottom fishing areas have been identified in response to 2006 UNGA resolution 61/105. This has resulted to split some of fishable sea mountains shallower than 2000m such as Discovery Seamounts into existing and new bottom fishing areas.

There is no clear geographical (seafloor-topological) boundary around Discovery Seamounts so it is considered that fish might move across the boundary of existing and new bottom fishing areas. Furthermore VME information, fish distribution, detailed sea bed map, etc. in new bottom fishing area will never be known unless fishing activities occur there.

We believe that collecting such primary information in new bottom fishing areas is meaningful and accumulating such information could contribute to achieve the objective of the SEAFO Convention to ensure the long term conservation and sustainable use of fishery resources. Under this circumstance, we have developed a plan to conduct the exploratory longline fishing in new bottom fishing areas in 2015 as follows:

(2) Target Species

Dissosticus spp. (Patagonian toothfish)

(3) Period

Around March/2015 – August/2015 changeable due to fishing condition/plan

(4) Areas (Box 1)

Area (1) Discovery area (six $1^{o}x1^{o}$ areas)

(41:00-42:00°S/ 01:00°W-00:00°), (42:00-43:00°S/ 01:00°W-00:00°),
(42:00-43:00°S/ 00:00°-01:00°E), (43:00-44:00°S/ 00:00°-01:00°E),
(43:00-44:00°S/ 01:00°W-00:00°), (41:00-42:00°S/ 02:00°-03:00°E)

Area (2) Western area (two $1^{o}x1^{o}$ areas)

(46:00-47:00°S/ 05:00W°-04:00°W), (46:00-47:00°S/ 06:00W°-05:00°W)

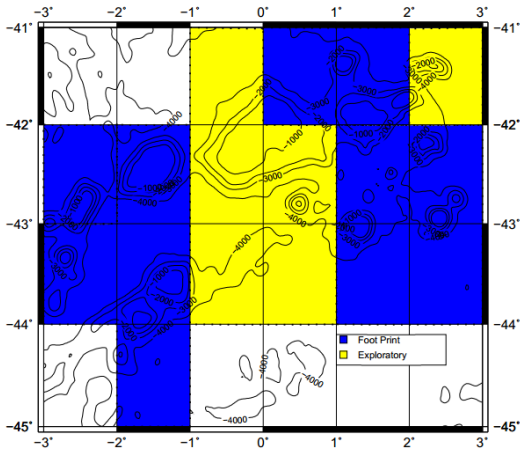
BOX 1 Two exploratory fishing areas (2015)

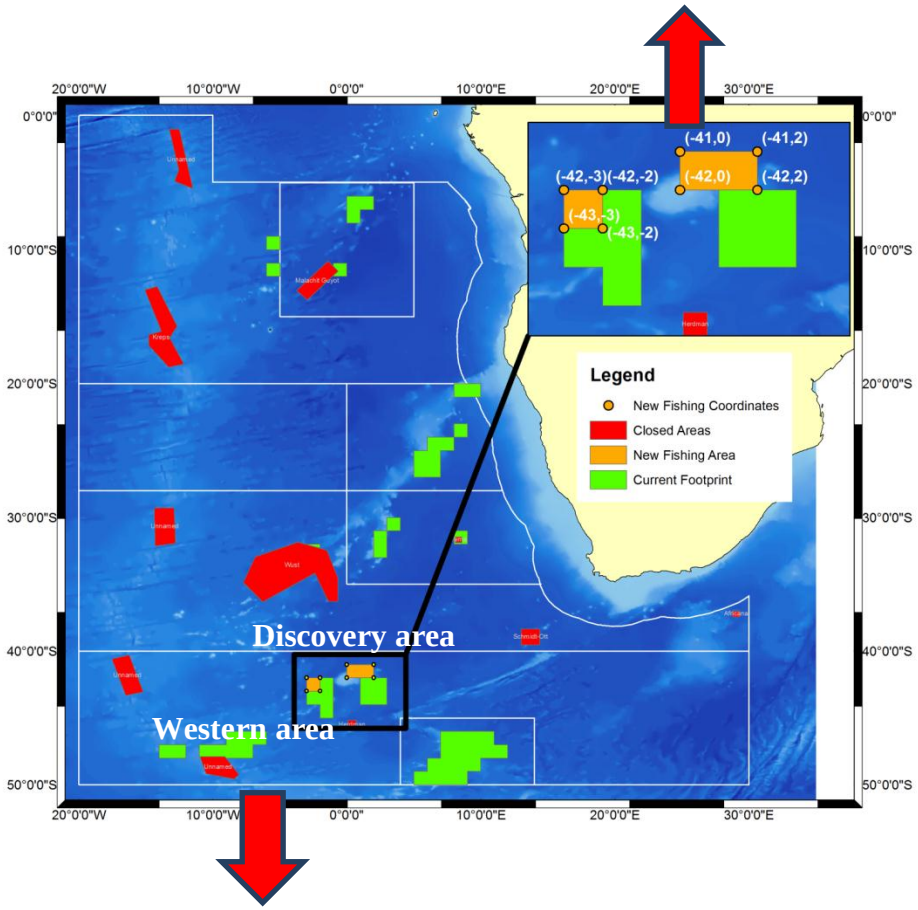
Area (1) Discovery area (right)

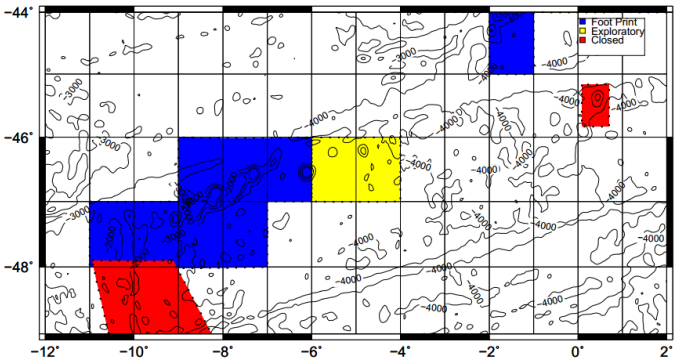
Legend

Existing fishing areas

Exploratory fishing areas







Area (2) Western area (left)

Legend

Existing fishing areas

Exploratory fishing areas

Closed areas

(5) Methods

The exploratory fishing will be conducted following the step 1 and 2 below.

Step 1

On the first entry of the research area, the first 10 hauls shall be research hauls and must satisfy following criteria.

- Each research haul must be separated by not less than 3 NM from any other research haul, distance to be measured from the geographical mid-point of each research haul.
- Each haul shall comprise at least 3500 hooks and no more than 5000 hooks.
- Each haul shall have a soak time of not less than 6 hours, measured from the time of completion of the setting process to the beginning of the hauling process.

Step 2

On completion of 10 research hauls, the vessel is exempted from setting research hauls and may continue to fish within the research area. The same data will be also collected as in the research hauls.

(6) Observer

One observer will be assigned to collect necessary information described in this proposal, which will be reported to the SEAFO Secretariat and the Scientific Committee meeting in 2015.

2. Mitigation plan to prevent significant adverse impact to vulnerable marine ecosystems.

The vessel will be fully compliant with Annex 3 ,4 and 5 in Conservation measure 26/13.

3. Data collection

The observer will collect the following data while the vessel is engaged in exploratory fishing.

Patagonian tooth fish (*Dissosticus eleginoides)*
- Total catch in weight/line
- Length measurement / Maximum 50fish/line
- Weight, sex, maturity, gonad state / Maximum 30fish/line

Rattail (Macrourid spp.)
- Total catch in weight/line
- Length and weight measurement / Maximum 10pcs/line

Other bycatch species
- Total catch in weight/line by the lowest taxon possible

VME
VME data according to interim VME data collection protocol set out in Annex 4 of Conservation Measure 26/13.

4. Impact assessments

The vessel has been using Trot line fishing method in the Convention area. During the exploratory fishing in new bottom fishing area, the vessel will employ the same fishing method.

Fishing gear configuration (Fig. 1)

- 201 drop lines per standard main line of 9,000m (one drop line every 45mof main line).
- One drop line has 5 cluster with 5 snoods and hooks. = 25 hooks per drop line.
- Distance between clusters is about 40cm. Snood length is about 50cm.
- Distance between the bottom cluster to concrete weight is about 1m.

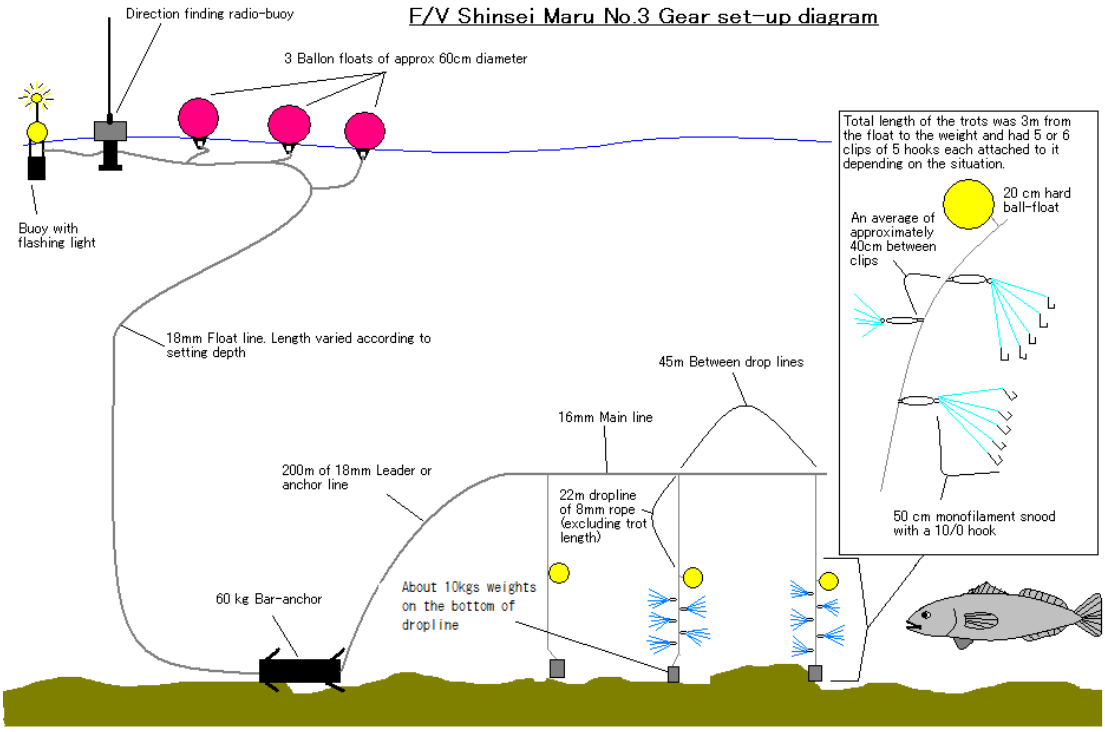


Fig.1 Fishing gear configuration (trot line)

Expected behaviour and feature of fishing gear

- Trot line normally sinks vertically since the weight is attached on the bottom of each drop line.
- The line is hauled vertically by using hydraulic driven line hauler.
- Only both end of anchors and concrete weights are on the seabed constantly.
- Bottom section of drop lines, hooks and snoods could be on the seabed occasionally

Taking above into consideration, **the trot line would have much less impact against VME** in comparison with other fishing method such as Auto-line and Spanish line since the most part of main lines and snoods with hooks are constantly on the seabed with these methods.

5. Vessel Information

(1)	Name of fishing vessel	Shinsei Maru No.3
	Previous names (if known)	Same as above
	Registration number	128862
	IMO number (if issued)	8520094
	External markings	Vessel marked with name and international radio call sign. White hull and white superstructure
	Port of registry	Yaizu – Japan
(2)	Previous flag (if any)	N/A
(3)	International Radio Call Sign	JAAL
(4)	Name of vessel's owner(s)	TAIYO A&F CO., LTD.
	Address of vessel owner(s)	4-5,TOYOMI-CHO,CHUO-KU,TOKYO,JAPAN
Beneficial owner(s) if known		Same as above
(5)	Name of licence owner	Same as the owner
Address of licence owner (operator)		
(6)	Type of vessel	Longline fishing vessel
(7)	Where was vessel built	Shimizu, Shizuoka, Japan
When was vessel built		1985
(8)	Vessel length overall LOA (m)	47.2
(9)	Details of the implementation of the tamper-proof requirements of the VMS device installed	The vessel is fitted with MAR-GE Argos VMS system. This is a sealed unit which has own GPS inside to ensure the independence from other acoustic devices and protected with official seals that indicate whether the unit has been accessed or tampered.
(10)	Name of operator	Same as the owner
Address of operator		Same as the owner
(11)	Names and nationality of master and, where relevant, of fishing master	Master: Fuminori Kojima , Japanese Fishing master : Masayuki Matsumura , Japanese
(12)	Type of fishing method(s)	Bottom longline
(13)	Vessel beam (m)	8.7
(14)	Vessel gross registered tonnage	735
(15)	Vessel communication types and numbers (INMARSAT A, B and C)	INMARSAT -FB : 773190498 INMARSAT –C : 432521000@satmailc.com
(16)	Normal crew complement	33
(17)	Power of main engine(s) (kW)	735
(18)	Carrying capacity (tonne)	250M/T
	Number of fish holds	4 holds
Capacity of all holds (m^3)		502.4 m^3
(19)	Any other information in respect of each licensed vessel they consider appropriate (e.g. ice classification) for the purposes of the implementation of the conservation measures adopted by the Commission.	N/A