SOUTH EAST ATLANTIC FISHERIES ORGANIZATION

REPORT OF SEAFO SCIENTIFIC COMMITTEE

2009

Scientific Committee of SEAFO
The SEAFO Secretariat
P.O. Box 4297
Walvis Bay, Namibia
Phone: +264-64-220387
Facsimile: +264-64-220389
Email: info@seafo.org
Url: www.seafo.org

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Chairperson of Scientific Committee
Mr. Phil Large
mailto:phil.large@cefas.co.uk

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1. Opening of the Meeting

The 5th Annual Meeting of the SEAFO Scientific Committee (SC) was convened on 30 Sept-2 October 2009 at the Ministry of Fisheries and Marine Resources Building, Swakopmund, Namibia. The Meeting was opened by the Chairperson of the Scientific Committee, Mr. Philip A. Large who extended a warm welcome to attending participants. He highlighted the importance of the work of the Committee and expected outcomes of the Meeting.

2. Adoption of the Agenda and Arrangements

The agenda was revised to include and item on the development of the SEAFO Fishing Footprint. The revised agenda was adopted and is appended as Annex I of the SC Report.

The Executive Secretary informed the Meeting of practical organisation and arrangements.

3. Appointment of rapporteur

The Chair proposed to the Meeting that all participants should contribute to the writing of the report and as such there is no need to appoint a rapporteur. The Meeting accepted the Chair's suggestion.

4. Introduction of participants

In response to the Chair, participants introduced themselves. A total of 11 scientists representing Angola, EU, Namibia and Norway were present. Participants and their addresses are listed in Annex II of the SC Report.

5. Introduction of observers

Two observers from Japan (one scientist and one fishing Industry representative) and one observer from Brazil (the Project Leader of the South Atlantic MAR-ECO project, one observer from the BCC and one observer from Birdlife International were present. The observers and their addresses are listed in Annex II.

6. Report by the Chair of the Scientific Sub-Committee and comments by SC

The Scientific Committee (SC) acknowledged the excellent work done by the SSC. All the terms of reference for the SSC had been addressed are given in the SSC Report (Annex III of the SC Report). Below the SSC outcomes are summarised along with the SC response..

a. Source, analyse and compile catch and CPUE data for the main fish stocks (e.g. orange roughy, alfonsino, armourhead, deep-sea red crab, Patagonian toothfish) in terms of quantity and geographical positions for the SEAFO region using all existing information including observer data.

The quality and quantity of data from active fishing vessels has improved in the last two years. Historically there was no distinction between landings and catches, however discard information was available for the two longline vessels fishing to date in 2009. There is a general lack of fishing effort and biological (length, sex ratio, and maturity) data, primarily from the crab vessels.

For 2009, detailed catch positions for the crab fishery were not reported as specified in the new SEAFO logsheets and also no length frequency data were received. In contrast, the longline fishery provided relatively comprehensive data.

Historically, the following countries are known to have been fishing in the SEAFO Area *viz*. Spain, Portugal, Russia, Cyprus, Mauritius, Japan, Korea, Poland, Norway, South Africa and Namibia. In 2009, the only countries that have provided landings data for the SEAFO Area were Japan and Korea. VMS data and catch reports suggest that these vessels were the only ones fishing for SEAFO species in the SEAFO CA.

Landings analyses were made on the most recent landings statistics provided to the Secretariat. The existence and extent of any Illegal, Unreported and Unregulated (IUU) fishing in the SEAFO CA is unknown.

SSC was again in a position to present a summary of available VMS data for vessels fishing for SEAFO species. These data are available from 2007, but only data for 2009 are presented in the SSC report (Figures 1 & 2 in the SSC Report). These data have been anonymised so that Contracting Parties and individual vessels cannot be identified.

Although it has not been possible to exclude VMS signals while vessels are steaming, the data related to vessels using static gear and from scrutinizing areas of intense VMS activity it is possible to identify likely fishing activity. There is no evidence of fishing activity in SEAFO closed areas during 2009 to date.

The only biological data available were length frequency distributions of toothfish landings from two Korean longline vessels fishing in different parts of Division D. These data suggest that fish caught in the western part of SEAFO Division D were larger than those caught in Sub-Division D1.

b. Evaluate trends in the total catches and where possible CPUE for the stocks as outlined under point (a), and undertake stock assessments when appropriate.

Currently the commercially most important species in the SEAFO CA are Patagonian toothfish and deep-sea red crabs. The SEAFO species list is given in Table 1. This list has been revised this year to include spiny dogfish (*Squalus acanthias*), rock lobster (*Jasus tristanti*) and a range of species of deep-sea sharks recorded in recent scientific investigations. It is likely that other species of deep-sea sharks are distributed in the SEAFO CA, however no information is available as yet for substantial areas of the CA.

SC expressed concern that the SEAFO species list, as revised in this report, is not extensive in so far it does not include many species may currently be by-catch species and which in future fisheries may be targeted. This is of particular importance because many conservation measures in the SEAFO CA refer explicitly to fishing for species on the SEAFO species list (e.g. Conservation Measure 06/06 regarding closed areas).

One option to resolve this issue would be to define the SEAFO species list as all those species encountered in commercial fishing operations currently not on the ICCAT species list.

Table 1. Revised SEAFO Species List.

FAO 3 Alfa Code	**Species**	**Latin Name**	**Transboundary**
TOP*	Patagonian toothfish	*Dissostichus eleginoides*	Yes
ORY*	Orange Roughy	*Hoplosthethus spp*	Unknown
ALF*	Alfonsino	*Family Berycidae*	Unknown
CGE*	Deep-sea Red Crab	*Chaceon maritae*	Unknown
MAC*	Mackerel	*Scomber scombrus*	Unknown
EDR*	Armourhead	*Pseudopentaceros spp.*	Unknown
BOC*	Boarfish	*Capros aper*	Unknown

ORD*	Oreo dories	*Family Oreosomatidae*	Unknown
CDL*	Cardinal Fish	*Epigonus spp.*	Unknown
OCZ*	Octopus	*Family Octopodidae*	Unknown
SQC*	Squid	*Family Loliginidae*	Unknown
WRF*	Wreckfish	*Polyprion americanus*	Unknown
SKA*	Skates	*Family Rajidae*	Unknown
DGS	Spiny Dogfish	*Squalus acanthias*	Unknown
ETB	Blurred smooth lanternshark	*Etmopterus bigelowi*	Unknown
ETH	Shorttail lanternshark	*Etmopterus brachyurus*	Unknown
ETR	Great lanternshark	*Etmopterus princeps*	Unknown
ETP	Smooth lanternshark	*Etmopterus pusillus*	Unknown
APA	Ghost catshark	*Apristurus manis*	Unknown
SSQ	Velvet dogfish	*Scymnodon squamulosus*	Unknown
CYO	Portuguese Dogfish	*Centroscymnus coelolepis*	Unknown
GUQ	Leafscale Gulper Shark	*Centrophorus squamosus*	Unknown
GUP	Gulper Shark	*Centrophorus granulosus*	Unknown
CFB	Black dogfish	*Centroscyllium fabricii*	Unknown
CYP	Longnose velvet dogfish	*Centroscymnus crepidater*	Unknown
CYY	Shortnose velvet dogfish	*Centroscymnus cryptacanthus*	Unknown
SCK	Kitefin shark	*Dalatias licha*	Unknown
ETE		*Etmopterus compagnoi*	Unknown
ETI	Broadbanded lanternshark	*Etmopterus gracilispinis*	Unknown
ETM	Southern lanternshark	*Etmopterus granulosus*	Unknown
ETF	Blackbelly lanternshark	*Etmopterus Lucifer*	Unknown
ETT	African lanternshark	*Etmopterus polli*	Unknown
ETX	Velvet belly lantern shark	*Etmopterus spinax*	Unknown

EUZ	Taillight shark	*Euprotomicroides zantedeschia*	Unknown
EUP	Pygmy shark	*Euprotomicrus bispinatus*	Unknown
HYY	Longnose pygmy shark	*Heteroscymnoides marleyi*	Unknown
ISB	Cookiecutter shark	*Isistius brasiliensis*	Unknown
OXY	Angular roughshark	*Oxynotus centrina*	Unknown
SYO	Smallmouth velvet dogfish	*Scymnodon obscurus*	Unknown
GSK	Greenland shark	*Somniosus microcephalus*	Unknown
SKH	Other sharks (deep-sea)	*Order Selachomorpha*	Unknown
LBT	Rock lobster	*Jasus tristanti*	Unknown

* *Species for which landings data have been recorded.*

 Source: From FishBase records for the SE Atlantic (Area 47)

Stock Assessments

In view of the lack of data, stock assessments cannot be attempted now and in the foreseeable future for any species of the SEAFO species list. Available LPUE data for orange roughy suggest that this species in Sub-division B1 remains at a low level compared to that seen at the start of the series (see Fig. 6 in the SSC report).

c. Evaluate and suggest reference points for deep-sea fish resources.

In 2007, SSC agreed to categorise the commercially most important species in the SEAFO Convention Area into two categories (A and B) on the basis of available information of life history characteristics, perceived vulnerability to fishing and the fishing gear used. In 2009, SSC has made a minor revision to the estimated longevity of deep-sea crab (see SSC report Table 11).

SEAFO SCR Doc 01/2009 (reviewed under ToR h in the SSC report) describes a method (Cheung et. al., 2005 and 2007; Musick, 1999) to identify the productivity and vulnerability of individual species using data currently available. The species profiles provide a useful basis to update and extract key information related to the target species that could be used in assessment models, management advice and ecosystem modelling.

SC agreed to nominate stock co-ordinators to develop species profiles for the majority of species in Table 11 in the SSC report.

In recent years SSC attempted to identify reference points for all species. The only data available for use were LPUE data and these were sparse for most species and were considered unreliable especially where species were taken as bycatch.

In the absence of reference points and available indicators of abundance and fishing mortality, SC again is of the view that the primary management tool should be precautionary catch limits (see ToRs 16i and 18 in the SC Report).

d. Review of sampling/reporting protocols and requirements including fish identification keys.

Last year SEAFO introduced mandatory sampling forms for catches and other fishing details (including discards/benthos/seabirds/mammals) to be recorded by observers and also an observer summary form. These forms were based on CCAMLR protocols.

In 2009 these protocols have been followed in the toothfish fishery however a number of issues need to be addressed in the red crab fishery. Vessels fishing in the crab fishery have changed the format of the crab fishery forms, have not included detailed spatial catch and effort data and have not provided biological sampling information. Some summarised biological and coarse spatial information were included in the observer summary report, however the required format for this report was not followed.

However, SC recognize that 2009 is the first year that these sampling forms have been in use, and acknowledges that Contracting and Fishing Parties have reaffirmed their commitment to fully comply.

Identification keys are not yet in place for fish. A coral and sponge ID key has been developed as part of the program for the SEAFO Bottom Fishing/VME Workshop (see ToR 7).

e. Complete FIRMS information fisheries sheets

SSC updated the FIRMS stock inventories in accordance with FAO request. SC has nothing further to add.

f. Examine where appropriate assessment and research done by neighbouring assessment and management organization (such as BCLME/BCC, CCAMLR, GCLME, ICCAT, SWIOFC)

No assessments and results were received during this year.

g. Reviewing the Distribution of Reported Catches of Benthic Organisms (corals, sponges etc.)

A second joint Spanish-Namibian survey was conducted in February/March 2009 on the Ewing seamount and Valdivia Bank to complete the work started in 2008. It is expected that the full results will be available in 2010.

h. Undertake review of Submitted SEAFO Research Documents

(i) SEAFO SCR Doc 01/2009 (reviewed under ToR h in the SSC report) describes a method (Cheung et. al., 2005 and 2007; Musick, 1999) to identify the productivity and vulnerability of individual species using data currently available. For SC comment please see Item c above.

(ii) The science plan of the MAR-ECO project "Patterns and processes of the Ecosystems of the Southern Mid-Atlantic" was reviewed at the SEAFO Bottom Fishing/VME Workshop where most members of SC were present.

(iii) The preliminary results from the Spanish-Namibian multi-disciplinary research cruise on the Walvis Ridge seamounts in 2009 was likewise reviewed at the SEAFO Bottom Fishing/VME Workshop.

i. Review of historical fisheries data

Historical data were reviewed by SSC and updates made where necessary. SSC is of the opinion that historical data are now updated up to 2008 with all data currently available. However, SC notes that additional historical data do exist for Ukraine and Russia (and other former Eastern-block nations), and **a** recommendation to obtain this data through the FAO is made under SC ToR 18.

j. Make recommendations on lost fishing gear

Much of the information presented below is a summary a *UNEP Regional Seas Reports and Studies,* No. 185; *FAO Fisheries and Aquaculture Technical Paper,* No. 523 (Macfadyen *et al*, 2009).

Abandoned, lost or otherwise discarded fishing gear (ALDFG) is a problem that is increasingly of concern. Various United Nations General Assembly resolutions now provide a mandate for and require action to reduce ALDFG and marine debris in general (FAO Tech. Paper No. 523).

The impacts of ALDFG include: continued catching of target and non-target species (such as turtles, seabirds and marine mammals); alterations to the benthic environment; navigational hazards; beach debris/litter; introduction of synthetic material into the marine food web; introduction of alien species transported by ALDFG; and a variety of costs related to clean-up operations and impacts on business activities. In general, gillnets and pots/traps are the fishing gears most likely to "ghost fish" while other gear, such as trawls and longlines, are more likely to cause entanglement of marine organisms, including protected species such as corals, and habitat damage.

The factors which cause fishing gear to be abandoned, lost or otherwise discarded are numerous and include: adverse weather; operational fishing factors including the cost of gear retrieval; gear conflicts; illegal, unregulated and unreported (IUU) fishing; vandalism/theft; and access to and cost and availability of shoreside collection facilities. Weather, operational fishing factors and gear conflicts are probably the most significant factors, but the causes of ALDFG accumulation are poorly documented and not well understood.

Gillnet/tangle nets

Gillnetting/tangle netting, defined as fishing with nets in which all or a substantial part of the catch is retained by becoming enmeshed in one or more meshes (Potter and Pawson, 1991), is a fishing method attractive to fishers because, as a passive gear, gillnet use is fuel-efficient (Millner, 1985) and has less impact on the seabed and benthic organisms than active fishing methods such as trawling (Morgan and Chuenpagdee, 2003). Also, and depending on the mesh size used, gillnets can be highly selective and have little impact on small and juvenile fish (Millner, 1985). However, if gillnets are lost, discarded or abandoned, they can have a harmful effect on the marine environment by continuing to "ghost fish", defined as causing mortality of fish and other taxa after all control of the fishing gear is lost by a fisher (Brown and Macfadyen, 2007).

Research into ghost fishing in European waters indicated that ghost fishing in water shallower than 200 m was not a significant problem because lost, discarded and abandoned nets have a limited fishing life owing to their high rate of biofouling and, in some areas, their tangling by tidal scouring (Carr *et al*., 1992; Erzini *et al*, 1997; Pawson, 2003; Revill and Dunlin, 2003). No notable long-term research has been conducted on the effect of ghost fishing in deeper water (Davies *et al*, 2007), but nets lost there are expected to stabilize to approximately 20% of the initial catch after 45 days (Humborstad *et al.*, 2003), though may continue to "fish" for periods of at least 2–3 years and perhaps even longer (Furevik and Fosseidengen, 2000), largely as a result of lower rates of biofouling and tidal scouring in deep water.

Other than damage to coral reefs, effects on habitat by gillnets are thought to be minimal (ICES, 1991, 1995; Stephan *et al.*, 2000). The impact of lost gillnets on coral reefs can be more severe. Al-Jufaili n*et al.* (1999) found that ALD nets affected coral reefs at 49 percent of sites surveyed throughout the Sultanate of Oman and accounted for 70 percent of all severe human impacts. Donohue *et al.* (2001) have confirmed the threat of ALDFG to the coral reefs of the northwestern Hawaiian Islands, where derelict fishing gear is threatening coral reef ecosystems by abrading and scouring living coral polyps and altering reef structure

Pots and traps

ALDFG pots and traps can also ghost fish. As they are usually baited when they are set, if the pot is lost, over time the bait attracts scavengers, some of which are commercially important species. These scavengers may become entrapped and subsequently die, forming new bait for other scavengers. Entrapped animals may escape over time. Animals captured in ALDFG traps die from starvation, cannibalism, infection, disease, or prolonged exposure to poor water quality (i.e. low dissolved oxygen) (Van Engel, 1982; Guillory, 1993). The continued fishing by ALDFG pots was evaluated experimentally by Bullimore *et al.* (2001). A fleet of 12 pots were set in a manner to simulate ghost fishing, off the coast of Wales, United Kingdom. The original bait was consumed within 28 days of deployment yet the pots continued to fish, mainly for spider crab (*M. squinado*) and brown crab (*Cancer pagurus*). The catch declined over time, reaching a minimum between nine and ten months. The actual mortality of crustaceans was difficult to estimate, as some were able to escape and the pots were not under continual observation.

In general, traps are often advocated on an environmental basis for having a lesser impact on habitat than mobile fishing gear such as trawls and dredges (Rogers *et al.*, 1998; Hamilton, 2000; Barnette, 2001). The potential physical impacts of ALD traps depend upon the type of habitat and the occurrence of these habitats relative to the distribution of traps (Guillory, 2001). In general, sand- and mud-bottom habitats are less affected by crab and lobster traps than sensitive bottom habitats such as submergent aquatic vegetation beds or non-vegetated live bottom (stony corals, gorgonians, sponges) (Barnette, 2001). ALD traps, while individually occupying a small area, may impact benthic flora because of their large number and potential smothering effect (Guillory, 2001). A study of the impact of ALD traps and other fishing gear on the Florida Keys (Chiappone *et al.*, 2002) indicated that 64% of the stony corals were impacted, 22% of the gorgonians impacted and 29% of the sponges impacted.

Trawls

For trawl gear, the larger diameter synthetic multifilament twine common to trawl nets is the key factor that reduces ghost fishing mortality in lost gear. The material has a larger diameter than gillnet monofilament and is visible or of such a size that it can be sensed by the fish. Although lost trawl gear will often be suspended by floats and form a curtain that rises well above the bottom, many of the losses form additional habitat for such organisms as ocean pout,

wolfish and cod, and substrate for attaching benthic invertebrates such as hydroids and sea anemone, again reducing their capacity to continue fishing (Carr and Harris, 1994).

Longlines

The mortality rate from lost demersal longlines is usually low (ICES, 2000; Huse *et al.*, 2002). Such lost gear may persist in the environment, however, when it is constructed of monofilament. Lost longline gear may continue to catch fish as long as bait exists on the hooks. Fish caught on the hooks may themselves become a form of bait for subsequent fish, both target and non-target. ALD longlines will not stop fishing until all of the hooks are bare. The extent to which this occurs and its effects on community structure have not been analysed (NOAA, 2004).

While it is an important commercial gear, hook and line is also used by a large number of recreational and subsistence fishers, and therefore losses, especially within shallow inshore waters, may be very high. This of relevance in the SEAFO area as some seamount peaks has water depths of < 50m. In the Florida Keys, Chiappone *et al.* (2002) reported that the debris type causing the greatest degree of damage was hook and line gear (68%), especially monofilament line (58%), and that it accounted for the majority of damage to branching gorgonians (69%), fire coral (83%), sponges (64 percent), and colonial zoanthids (77%).

In studies of the impact of fishing on the coldwater corals of the northeast Atlantic, although lost longlines were observed on video surveys of coral areas, no evidence of actual damage to reefs was found, although it was supposed that coral branches might be broken off during the retrieval of longlines (ICES, 2002).

Effects of ALDFG on the marine environment

The longer-term fate of lost fishing gear is unclear. Modern plastics can last up to 600 years in the marine environment, depending upon water conditions, ultraviolet light penetration and the level of physical abrasion. Furthermore, the impact of microscopic plastic fragments and fibers, the result of the degradation of larger items, is not known.

Review of measures to reduce ALDFG

Measures to address ALDFG can be broadly divided between measures that ***prevent*** (avoiding the occurrence of ALDFG in the environment); ***mitigate*** (reducing the impact of ALDFG in the nenvironment) and ***cure*** (removing ALDFG from the environment). The examples presented also illustrate that many of these measures can be applied at a variety of levels (internationally, nationally, regionally, locally) and through a variety of mechanisms from legal requirement through to voluntary schemes.

Preventative measures

Gear marking

FAO Guidelines set out the marking system and the responsibilities of owners of gear and fisheries authorities. They also cover the recovery of lost and abandoned gear, salvage and the role of gear manufacturers. In addition liabilities, penalties and control are discussed. (FAO Fisheries Report No. 485, 1991). Following the expert consultation, FAO produced a set of technical recommendations for the marking of fishing gear (FAO Fisheries Report No. 485 Supplement, 1993) with regard to a standardized system for the type and location of unique identifying marks on tags for each gear type as well as rules to be observed in marking gear so that its presence and extent is obvious to other seafarers. In 1994, at an expert consultation on the FAO Code of Conduct for Responsible Fishing. The experts offered, *inter alia,* the following solutions:

• reporting of all lost gear in terms of numbers and location to national management entities. Industry and government should consider efforts and means to recover ghost fishing gear; and

• Regulatory framework to deal with violators.

They recommended that:

• all fishing gear should be marked, as appropriate, in such a way so as to uniquely identify the ownership of the gear.

At the RFMO level, CCAMLR has an active programme to combat marine debris, including debris from fishing activities such as large-scale trawl fisheries for krill and longline fishing for Patagonian toothfish (NRC, 2008). Conservation Measure 10-01 on the Marking of Fishing Gear requires all fishing gear such as pots, marker buoys and floats to be marked with the vessel name, call sign and flag state. ICCAT does not have measures concerning ALD fishing gear, but Contracting Parties have to ensure that fishing gear is marked in accordance with generally accepted standards. Some nations have, however, already introduced gear marking requirements with explicit recognition of ALDFG issues. The Republic of Korea introduced a gear-marking initiative in 2006 as part of its National Integrated Management Strategy for Marine Litter. In 2006, the EC introduced regulations requiring the marking of passive gears (static longlines, gillnets and trammel nets) and beam trawls with the vessels' port licence number as a clear identifier. This applies to all vessels fishing this gear in Community waters outside of member state territorial waters (EC, 2006). However, worldwide there are few examples of requirements for gear marking intended to address the problem of ALDFG, i.e. marking to prohibit the deliberate abandonment of gear through enabling identification of ownership.

On-board technology to avoid or locate gear

The increasing use of GPS and sea-bed mapping technology by fishing vessels affords benefits in terms of both reducing initial loss and improving the location and subsequent recovery of lost gear. With improvements in sea-bed imaging technology, some mobile gear can be towed close to the sea bed or known obstacles, enabling reduced direct impact/contact with the sea bed or these obstacles, thereby reducing the risk of gear snagging and loss. For static gear, technology can also enable the more accurate setting and subsequent location and retrieval of gear.

The main determinant of successful recovery appears to be the reason for the initial loss of fishing gear; fishers report that where nets are trawled away, it is virtually impossible to recover them at sea.

Transponders are now a common feature in many large-scale fisheries with the satellite tracking of vessels for safety and MCS purposes, and the use of transponderson gear such as marker buoys or floats is becoming more readily available. The fitting of transponders to gear improves the ability to locate gear in the water.

Port State measures

Port State measures are seen to be critical in addressing IUU fishing, which is a significant contributor to ALDFG problems as illegal fishers are unlikely to comply with regulation including any measures to reduce ALDFG. Those engaged in IUU fishing are also assumed to be key contributors to abandoned gear prompted by MCS activity. In 2001, FAO Members, recognizing the threat of IUU fishing, developed within the framework of the 1995 FAO Code of Conduct for Responsible Fisheries, an International Plan of Action (IPOA) to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA-IUU).

A scheme was devised to address IUU fishing at the port state level. In addition to a reduction in IUU fishing having a positive influence on reducing ALDFG in general, the scheme proposes port inspections that will enable “examination of any areas of the fishing vessel that is required, including …the nets and any other gear, equipment…to verify compliance with relevant conservation and management measures”. FAO is encouraging the strengthening of port State measures in order to combat IUU. One of the inspection processes being proposed (relating to gear inspection and the marking of gear) is gear inventories for vessels in international waters.

Onshore collection/reception and/or payment for old/retrieved gear

The provision of appropriate collection facilities is a preventative measure, as it can reduce the likelihood that a fisher will discard unwanted gear at sea. MARPOL Annex V Regulation 7 requires that “the Government of each Party to the Convention undertakes to ensure the provision of facilities at ports and terminals for the reception of garbage, without causing undue delay to ships, and according to the needs of the ships using them.” (IMO, 2006). There has, however, been international recognition that there are scale and capacity issues that have

prevented the provision of adequate reception facilities at small ports and harbours, many of which are fishing harbours. While vessel crews docking at these berths well understand that such a service is not usually provided free of charge, vessel crews, ready and willing to pay for disposal services either directly from the facility or via independent entities, are not always able to secure these services. Although "rational" tariffs are recommended, any additional tariff for reception of waste such as fishing gear may be a disincentive to fishers compared to burning or dumping at no immediate direct cost. Numerous initiatives have since been developed that provide free waste reception facilities for solid waste such as fishing gear, or these costs are incorporated into general berthing charges or landing fees. In some circumstances where ALDFG gear is perceived to be a particular problem, authorities have created positive incentives through reward schemes for disposal of old and unwanted gear in appropriate facilities. The Korean Government Department, Ministry of Maritime Affairs and Fisheries (MOMAF), purchases waste fishing gear returned to port by fishers; this is reported to be highly effective in terms of recovery and disposal of gear.

Reduced fishing effort

Effort reduction measures can affect the causes and levels of ALDFG in different ways, depending on the type of input restriction. For static gear, the amount of gear in the water and the time it is left in the water (soak time), both influence the probability that gear will be lost or discarded, with greater gear use and longer soak times increasing the chances of lost gear.

Many fisheries already limit fishing efforts by monitoring use of pots or number of net hours where soak time is included as a key variable. The European Commission (EC) introduced an emergency temporary ban on gillnet fishing at depths >200 m in ICES Divisions VI and VIIb-k and Sub-area XII east of 27^{o}W (EC Regulation No 51/2005). These measures for deep-water gillnets were revised in 2006 and now include a permanent ban on all deep-water gillnet fisheries at depths >600 m and imposing maximum limits on the length of nets deployed (10 km) and the soak time (72 hrs) in the remaining fisheries at depths <600 m (EC Regulation No 41/2006).

Mitigating (reducing impacts) measures

Technology can be used to reduce the impacts of ALDFG, particularly through alterations to the gear itself to minimize the potential to ghost fish, but also through ways to better manage gear in the water.

Reduced ghost catches through the use of biodegradable nets and pots

A number of shellfish fisheries are required to use degradable escape panels in traps. For example, Florida's spiny lobster fishery has had such a requirement since 1982 (Matthews and Donahue, 1996). In Canada, recreational fishing traps require features "to ensure that if the trap is lost, the section secured by the cord will rot, allowing captive crabs to escape and to prevent the trap from continuing to fish". (DFO, 2007). Also in Canada, the Pacific Region Integrated Fisheries Management Plan for crab by traps, 2008, includes various requirements related to

biodegradable escape mechanisms. The use of biodegradable materials is less evident in net fisheries.

There have been some efforts to develop biodegradable and oxy-degradable plastics for use in the fishing industry. For example, the Australian and New Zealand Environment Conservation Council (ANZECC) was instrumental in promoting a national approach towards the use of biodegradable materials in bait bag manufacture (Kiessling, 2003).

Reduced ghost catches of incidental catch species

Fishing gears with the potential to capture significant bycatch of non-target species (cetaceans, pinnipeds, turtles, seabirds) when actively fishing, also have the potential to result in non-target species bycatch once gear is abandoned, lost or discarded. Mitigating against such ghost fishing of bycatch can be effected by using the same measures as in active fishery, such as acoustic beacons ("pingers"), reflectors in gillnet and set net fishing gears. But it should be recognized that the effectiveness of such measures can rapidly decrease when gear is no longer actively being fished and the pingers run out of power over time.

Of perhaps greater significance to ALDFG reduction are mitigation measures that are effective even when fishing gear is not being actively fished. Trials are progressing with substances that reflect sound, such as barium sulphate, with such substances being added to nylon net during production. The additive does not affect the performance or the look of the net in any way, but it reflects sound waves in ranges used by echo-locating animals (Schueller, 2001). Other developments supported by WWF's International Smart Gear Competition (www.smartgear.org) have produced weak ropes that are operationally sound, but break with the action of marine mammals, and magnets attached to longlines to repel sharks. Innovative solutions such as the passive pinger should retain effectiveness even when the gear is lost.

Clean-up/curative measures

Locating lost gear

Generally fishers will make every possible attempt to locate and recover their own gear as it has a significant economic cost in most fisheries. However in some circumstances, gear location surveys may be needed. Sea-based surveys can be used to locate lost fishing gear that may still be ghost fishing or damaging habitats. Where no accurate information on location of gear is available, the use of modeling techniques, local knowledge and anecdotal information to identify potential hotspots is essential in order to better target a survey intended for gear retrieval. Side scan sonar (SSS) is a sea-bed mapping technology that has become more accurate and more affordable in recent years. However, SSS is likely to be applicable where relatively large or readily distinguishable items such as pots or traps are to be located. Other possible sources of information might include skipper interviews and the interpretation of VMS plots.

Gear recovery programmes

Curative measures often take the form of gear retrieval programmes, which typically entail using a creeper or grapnel to snag nets. Gear retrieval programmes have been undertaken in net fisheries in Sweden and Poland (Brown and Macfadyen, 2007). Retrieval programmes are also routinely employed by Norway, which led to Norwegian, English and Irish collaborative projects to recover ALDFG from the Northeast deepwater Atlantic gillnet fishery (Large *et al*, 2009). However, the efficacy of such surveys is largely reliant on information on the position of ALDFG provided by and collected from fishers.

Implications for SEAFO

The only fisheries that currently pose potential ALDFG problems are longline fisheries for Patagonian toothfish and trap fisheries for deep-water red crab.

SC noted the work carried out on this subject by SSC and SC comments and recommendations can be found under SC ToR 18.

k. Complete TXOTX questionnaire

SSC completed the report with the assistance of the Secretariat. The questionnaire is addressed under SC ToR 11.

7. Feedback on the SEAFO Bottom Fishing/VME Workshop

SC held a bottom fishing VME Workshop on 28-29 September in preparation for the SC meeting. The workshop was attended by 15 scientists including a representative from the FAO and an expert from IEO (Spain) on benthos in African coastal regions. A brief report summarising the proceedings of the Workshop is currently in preparation and will be posted on the SEAFO website subject to signing off by the Workshop participants and agreement by the Commission.

The Workshop evaluated coral ID keys from CCAMLR, NAFO and African coastal regions. These were considered by SC and it was decided to adopt the ID key from IEO (Spain) for corals and sponges in south-western African shelf and slope waters.

The Workshop reviewed current reporting requirements for corals and sponges and made a number of recommendations which are described in SC ToRs 14 and 18.

VME composition was explored by the workshop using the limited information currently available for the SEAFO area. SC notes that more comprehensive information on the spatial distribution and extent of seamount areas and their associated fauna is required (see recommendations under SC ToR 18). Additionally there is a need to collate information of vents, carbonate mounds and seeps in the SEAFO CA. SC notes that the Workshop explored the possibility of using predictive methods to identify the possible areas where VMEs may exists. SC agreed to explore this approach.

Regarding developing a fishing footprint, SC notes that this was discussed at length within the Workshop but feels that the best way to progress this further should be explored by the Commission (see recommendations under SC ToR 18).

SC notes that the Workshop was aware of concern that the interim encounter threshold for VMEs set by most RFMOs, including SEAFO, may be too high. SC reviewed the alternate options for thresholds discussed in the workshop and recent developments regarding changes to encounter thresholds for VMEs used in the NAFO area and additional information made available from scientific investigations in progress. SC is aware that CCAMLR has developed specific thresholds for fixed gears and these and other thresholds will be reviewed by SC next year when the bottom fishing regulation is due to be reviewed by the Commission. In strong view of the concern that the interim encounter threshold for VMEs set by most RFMOs, including SEAFO, may be too high, SC suggests that the Commission give consideration to revising the thresholds downwards (see Tor 18).

8. Development of SEAFO Fishing Footprint

SC reviewed data supplied by CPs and FPs in response to SEAFO Conservation Measure 12/08 (Bottom Fishing Activity in the SEAFO CA). Data (a combination of JPEG maps and catch positions) are currently available for only two CPs and one FP. These account for only some of the fishing activity over the period 1987-2007, as indicated by landings tables and other sources (e.g. SEAFO SCR Doc 02/09). A further concern is that some of these data may relate to fishing activity for ICCAT species. The format of available data, although in compliance with Conservation Measure 12/08, were considered by SC to be unsuitable for developing a fishing footprint with similar precision to footprints developed by other RFMOs. (see recommendations under SC ToR 18).

9. The South Atlantic Mar-Eco Project

The SC appreciated that the MAR-ECO project, endorsed by SEAFO in 2008, submitted a science plan for the ocean-wide activity. There will be two cruises with MAR-ECO elements in 2009, one on a Russian (9 days) and one on a Brazilian vessel (two transatlantic transects). The Russian vessel will provide some information on benthic communities in a few locations. The cruises have as main objective to map biodiversity and distribution patterns, and exploratory fishing will not be conducted.

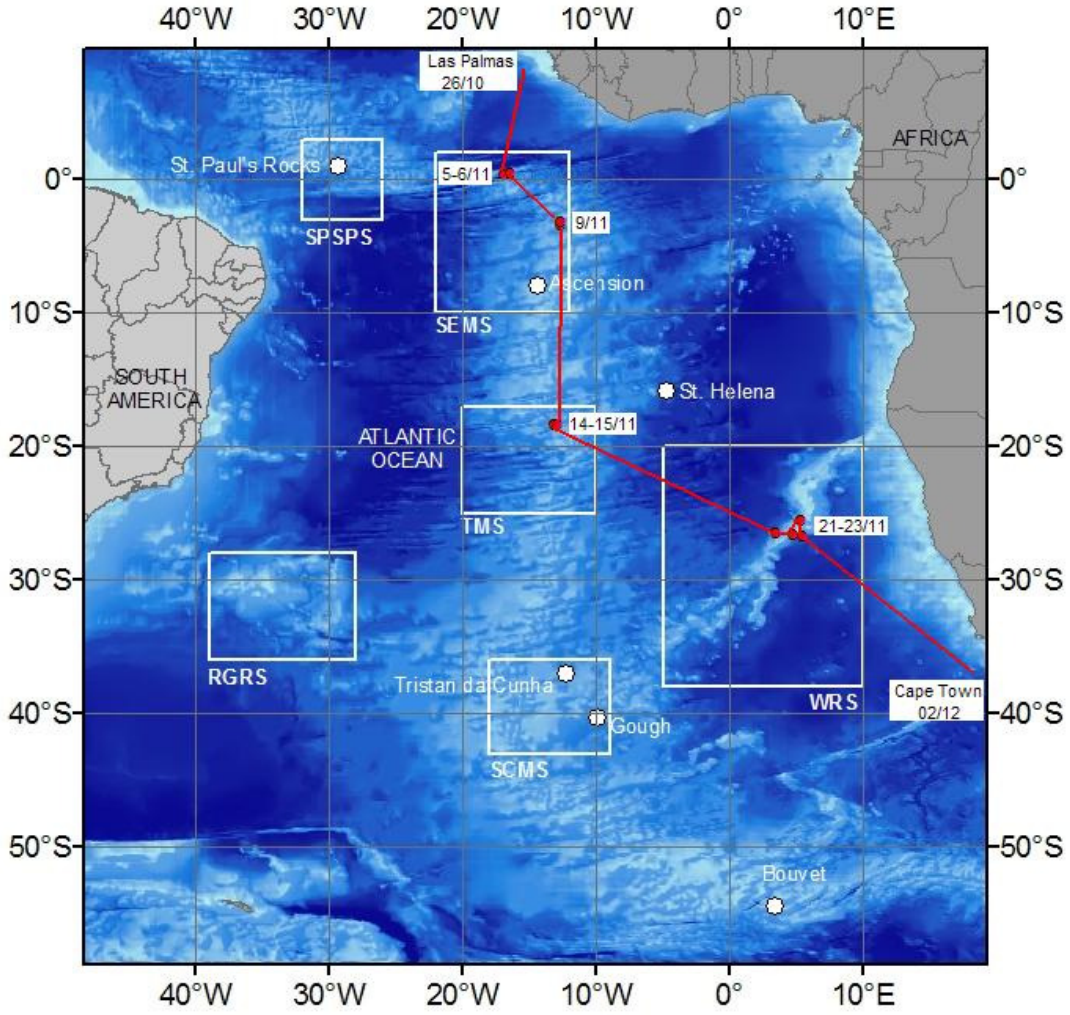

Figure 1: Cruise track and stations for the Russian MAR-ECO cruise on the RV Academic Ioffe in October-November 2009.

The participation from SEAFO is limited to one person from South Africa going on the Russian vessel. The MAR-ECO steering group has members from South Africa and maintains good communication with the SEAFO executive secretary. MAR-ECO is open to stronger African participation.

The SC recognised that there has been no decision made by African Coastal States party to SEAFO regarding participation in MAR-ECO, as envisaged last year. MAR-ECO is an opportunity for gaining new knowledge of the diversity and distribution patterns of marine life in the South Atlantic oceanic areas, including the SEAFO area, through a trans-Atlantic collaboration. To

develop activity at sea in the SEAFO area, specifically on the Walvis Ridge and the mid-Atlantic Ridge, the formation of a consortium should be encouraged with the aim to submit proposals to international funding agencies and the

FAO (regarding future ship-time). SEAFO CPs should endeavour to support this initiative and/or consider opportunities for own MAR-ECO activity, including work at sea and subsequent analyses.

The basic science activity as planned by MAR-ECO will potentially provide SEAFO with significant new information:

- Bathymetry and physical oceanography of the CA.
- Revised species lists for pelagic and benthic macro- and megafauna across a wide geographical area and depth range.
- Comprehensive occurrence records for species in the SEAFO area in relation to their overall biogeographical patterns.
- Distribution patterns of VME-indicator organisms and an improved basis for modelling the spatial distribution of candidate VMEs.
- New knowledge on the closed areas and their biota enabling a science-based evaluation of the appropriateness of the closures.
- Enhanced regional competence on deepwater studies and international networking.

10. The Spanish-Namibia Joint Survey

SC notes the progress update provided toSSC and will consider the final report summarizing the results from the 2008 and 2009 research cruises when it becomes available next year.

11. Review and endorsement of the TXOTX Questionnaire

SC reviewed the TXOTX questionnaire completed by the SSC with assistance from the SEAFO Secretariat and endorsed that this be the SC view.

12. Report back of Scientific Co-ordinators

SC reviewed the ToRs for Scientific Co-ordinators set by the Commission set in 2009 and is of the view that most of the tasks described are best dealt with by the relevant data management authorities within CPs and FPs. Also some of the ToRs are already addressed by mechanisms within the SEAFO Commission, CPs and FPs.

SC is of the view that the work of scientific co-ordinators should comprise:

1. To act as the scientific focal point between SEAFO and CPs and FPs.
2. Participation at SEAFO SSC and SC.

3. Ensure that all available fisheries and scientific data, including historical data, is available to SSC and SC via the SEAFO Secretariat using the prescribed format.
4. To encourage the provision of scientific analyses relevant to SEAFO scientific bodies.

SC is aware that not all CPs have nominated scientific co-ordinators. SC recommends that the Commission pursues this issue and includes the appointment of scientific co-ordinators by FPs (see recommendations under SC ToR 18)

13. Scientific Database

The organisation of data within the SEAFO Secretariat is problematic because of the lack of a functional database (see recommendations under SC ToR 18).

14. SEAFO Identification kit for Sponges and Corals

SC reviewed the coral and sponge key prepared by Ramos *et al.* (2009) and concluded that with minor modifications this should be adopted for use as the official SEAFO key by observers in the SEAFO CA. SC also agreed to modify the SEAFO sampling forms to include the names of major coral and sponge taxa.

15. Impact of lost gear on habitat and biodiversity

SC's response to this ToR refers solely to the impacts mitigation and curative measures relating to abandoned, lost or otherwise discarded fishing gear (ALDFG). SC does not have sufficient information available to evaluate the effects of lost gear on habitat and biodiversity. SC recommendations and advice based on the work carried out by SSC (SSC item j, above) are given under SC ToR 18.

16. Review of Conservation Measures

i Conservation Measure 10/07: Fixing catch limits for crabs and toothfish.

For Patagonian toothfish, the SC took into account the current CCAMLR Conservation Measure 41-04(2008) relating to toothfish in the northern component of CCAMLR Subarea 48.6 adjacent to SEAFO Division D. The current CCAMLR TAC for this area is 200 tonnes and SC agreed to reduce the precautionary catch limit for toothfish in SEAFO CA to 200 tonnes for 2010 and 2011.

For deep-sea red crab, SC agreed, in the absence of information on the current size of the resource and levels of fishing mortality, to recommend the current precautionary catch limits are maintained in 2010 and 2011 at 200 tonnes in Sub-Division B1 and 200 tonnes in the remainder of the SEAFO Area until such time as when additional information becomes available.

For orange roughy and alfonsino, SC is of the view that if substantial fisheries develop in the SEAFO CA it is likely that they will be for these species.

Experience from other orange roughy fisheries around the world (New Zealand, west of Ireland etc) suggests that sustainable catches are of the of order of 2-3% of virgin biomass. Annual landings from the Namibian orange roughy in Sub-Division B1 peaked in 2001 at around 90t and strongly declined thereafter to very low levels, which is reflected by available LPUE data. Additionally there is currently a moratorium on fishing for orange roughy in the Namibian EEZ adjacent to Sub-Division B1. The connectivity between the populations supporting these fisheries is unknown, but it is possible that these are from the same stock. Given this, SC recommends a zero catch limit for orange roughy in Sub-Division B1 for 2010 and 2011. In view of the unknown size of any orange roughy populations that may exist in the remainder of the SEAFO CA, SC recommends a precautionary annual catch limit for 2010 and 2011 of 50 tonnes until such time as when additional information becomes available to identify sustainable fishing levels. This catch limit would prevent a strong increase in activity but permit exploratory fishing.

Alfonsino is not a long-lived, slowing growing species but is vulnerable to fishing because fisheries mostly target aggregations. Experience in the NAFO region suggest that, as with orange roughy, fishing often takes the form of short-term "mining" which can lead to sequential depletion of populations which even for alfonsino may take 15-20 years to recover. SC recommends a precautionary annual catch limit for 2010 and 2011 of 200 tonnes for alfonsino in the SEAFO CA or until additional information becomes available to identify sustainable fishing levels.

A suggested revised text for Conservation Measure 10/07 for consideration by the Commission is given below:-

Conservation Measure ?/09: Fixing catch limits and related conditions for the Patagonian toothfish, red crab, orange roughy and alfonsino fisheries in the SEAFO Convention Area in 2010 and 2011.

1 Patagonian Toothfish

1.1 An annual catch limit of 200 tonnes is fixed for 2010 and 2011 in the SEAFO Convention area.

1.2 Each vessel shall report their catch including nil returns by electronic means to the SEAFO secretariat every 5 days of the fishing trip.

2. Deep sea red crab spp.

2.1 An annual catch limit of 200 tonnes is fixed for Sub Division B1 and 200 tonnes for the remainder of the SEAFO Convention area for 2010 and 2011.

2.2 Each vessel shall report their catch, including nil returns, by electronic means, to the SEAFO secretariat every 5 days of the fishing trip.

3. Orange roughy

3.1 An annual catch limit of zero tonnes is fixed for Sub-Division B1 and 50 tonnes for the remainder of the SEAFO CA for 2010 and 2011.

4. Alfonsino

4.1 An annual catch limit of 200 tonnes is fixed for the SEAFO CA in 2010 and 2011.

5. Each vessel shall report their catch (whole weight) for all of the above species on a set by set basis, including nil returns, by electronic means, to the SEAFO secretariat every 5 days of the fishing trip.

6. Closure of Fisheries

The Executive Secretary is mandated to close the fisheries when the catch limits referred to in paragraphs 1.1 or 2.1 are deemed to be exhausted.

7. CPUE Data

Flag States of vessels involved in these fisheries shall provide detailed catch and effort data no later than three months before the Scientific Committee Annual Meeting in 2010 and 2011, respectively.

8. Compliance

Vessels identified as not complying with these provisions, as well as other relevant SEAFO Conservation and Management measures 02/05, 03/06, 04/06, 05/06 and 07/06, shall be considered to be conducting IUU fishing and be subject to listing in accordance with Conservation Measure 08/06.

ii. Conservation Measure 05/06: On Reducing Incidental By-catch of Seabirds in the SEAFO Convention Area.

SC reviewed the current Conservation Measure 05/06 in the light of the latest CCAMLR regulations and information and advice provided by Birdlife International. The suggested revised text strengthens measures to address seabird losses in trawl gears. Recently, warp collisions (birds colliding with warp lines) have been recognised as a significant problem in trawl fisheries. Mitigation measures have been applied in South African trawl fisheries and in the CCAMLR area.

A suggested revised text for Conservation Measure 05/06 for consideration by the Commission is given below:-

Conservation Measure 05/06: On Reducing Incidental By-catch of Seabirds in the

SEAFO Convention Area.

The Parties to the SEAFO Convention:

RECOGNISING the need to strengthen mechanisms to protect seabirds in the South-East Atlantic Ocean;

TAKING INTO ACCOUNT the United Nations Food and Agriculture Organisation (FAO) International Plan of Action for Reducing the Incidental Catch of Seabirds in Longline Fisheries (IPOA-Seabirds);

ACKNOWLEDGING that to date some Contracting Parties have identified the need for, and have either completed or are near finalising their National Plan of Action on Seabirds;

RECOGNISING the concern that some species of seabirds, notably albatross and petrels, are threatened with global extinction;

NOTING that the Agreement on the Conservation of Albatrosses and Petrels, done at Canberra on 19 June 2001, has entered into force;

Have agreed as follows:

2. Contracting Parties shall collect and provide all available information to the Secretariat on interactions with seabirds, including incidental catches by fishing vessels, fishing for species covered by the SEAFO Convention, flagged to these Contracting Parties.

3. Each Contracting Party shall seek to achieve reductions in levels of seabird by-catch across all fishing areas, seasons, and fisheries through the use of effective mitigation measures.

Longlines

4. All longline vessels fishing south of the parallel of latitude 30 degrees South shall carry and use bird-scaring lines (tori poles):

- Tori poles shall be in accordance with agreed tori pole design and deployment guidelines (provided for in Appendix A);
- Tori poles shall be deployed prior to longlines entering the water at all times south of the parallel of latitude 30 degrees South;
- Where practical, vessels shall be encouraged to use a second tori pole and bird-scaring line at times of high bird abundance or activity;

- Back-up tori lines shall be carried by all vessels and be ready for immediate use.

5. The Commission shall, upon receipt of information from the Scientific Committee, consider, and if necessary, refine, the area of application of the mitigation measures specified in paragraph 4.

6. Longlines shall be set at night only (i.e. during the hours of darkness between the times of nautical twilight(1). During longline fishing at night, only the minimum ship's lights necessary for safety shall be used.

7. The dumping of offal is prohibited while gear is being shot or set. The dumping of offal during the hauling of gear shall be avoided. Any such discharge shall take place, where possible, on the opposite side of the vessel to that where the gear is being hauled. For vessels or fisheries where there is not a requirement to retain offal on board the vessel, a system shall be implemented to remove fish hooks from offal and fish heads prior to discharge.

8. Contracting Party shall not authorise vessels to fish in the Convention Area which are so configured that they lack on-board processing facilities or adequate capacity to retain offal on-board, or the ability to discharge offal on the opposite side of the vessel to that where gear is being hauled.

9. Every effort shall be made to ensure that birds captured alive during fishing operations are released alive and that whenever possible hooks are removed without jeopardising the life of the bird concerned.

Trawl gear

10. A streamer (or tori) line shall be deployed outside of both warp cables, the tori lines shall be attached to the stern at the maximum practical height above water line. Back-up tori lines shall be carried by all vessels and be ready for immediate use. Technical specifications for tori lines are given in Appendix B

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(1) The exact times of nautical twilight are set forth in the Nautical Almanac tables for the relevant latitude, local time and date. All times, whether for ship operations or observer reporting, shall be referenced to GMT

11. The dumping of offal is prohibited while gear is being shot or set. The dumping of offal during the hauling of gear shall be avoided.

12. Nets shall be cleaned prior to shooting to remove items that might attract seabirds.

13. Vessels shall adopt shooting and hauling procedures that minimise the time that the net is lying on the surface with the meshes slack. Net maintenance shall, to the extent possible, not be carried out with the net in the water.

14. Each Contracting Party shall encourage their vessels to develop gear configurations that will minimise the chance of birds encountering the part of the net to which they are most vulnerable. This could include increasing the weighting or decreasing the buoyancy of the net so that it sinks faster, or placing coloured streamer or other devices over particular areas of the net where the mesh sizes create a particular danger to birds.

Appendix A

Guidelines for Design and Deployment of Longline Tori Lines

Preamble

These guidelines are designed to assist in the preparation and implementation of tori line regulations for longline fishing vessels. While these guidelines are relatively explicit, improvement in tori line effectiveness through experimentation is encouraged. The guidelines take into account environmental and operational variables such as weather conditions, setting speed and ship size, all of which influence tori line performance and design in protecting baits from birds. Tori line design and use may change to take account of these variables provided that line performance is not compromised. Ongoing improvement in tori line design is envisaged and consequently review of these guidelines should be undertaken in the future.

Tori Line Design

1. The streamer line should be a minimum of 150 m in total length, be attached to the vessel at a point >7 m above the sea surface (using a pole if necessary) and tow an object (such as a length of heavy rope) at its seaward end, which creates drag and stability. These specifications are critical to achieve the desired aerial extent (100 m), the active portion of the streamer line and minimize fouling with hooklines, floats and other fishing gear.

2. The above water section of the line should be sufficiently light that its movement is unpredictable to avoid habituation by birds and sufficiently heavy to avoid deflection of the line by wind.

3. Swivels positioned at the attachment point to the vessel, the towed object and where streamers join the backbone help to avoid twisting and wear. These can also incorporate breakaway points, in the event of snags with the hook line.

4. Each branch streamer should consist of two or more strands and should be constructed from brightly coloured, UV-protected rubber tubing. Streamers should be spaced at intervals of less than 5 m along the streamer line backbone. Branch streamers should be long enough to reach the sea surface in calm conditions.

5. Each streamer pair should be detachable by means of a clip so that line stowage is more efficient.

6. The in-water portion of the tori line (that creates tension on the streamer line and thereby holds the aerial portion aloft) should be adjusted (e.g. increasing the length of rope) to account for slower setting speeds and to ensure the minimum aerial coverage of 100 m is maintained consistently.

Deployment of Tori Lines

1. The line should be suspended from a pole affixed to the vessel. The tori pole should be set as high as possible so that the line protects bait a good distance astern of the vessel and will not tangle with the fishing gear. Grater pole height provides greater bait protection. For example, a height of around 6 m above the water line can give about 100 m of bait protection.

2. The tori line should be set so that streamers pass over baited hooks in the water.

3. Deployment of multiple tori lines is encouraged to provide even greater protections of baits from birds.

4. Because there is the potential for line breakage and tangling, spare tori lines should be carried on board to replace damaged lines and to ensure fishing operations can continue uninterrupted.

5. When fishers use a bait casting machine (BCM) they must ensure co-ordination of the tori line and machine by:

a) ensuring the BCM throws directly under the tori line protection and

b) when using a BCM that allows throwing to port and starboard, ensure that two tori lines are used.

6. Fishers are encouraged to install manual, electric of hydraulic winches to improveease of deployment and retrieval of tori lines.

Line weighting

1.Vessels using autoline systems should add weights to the hookline or use integrated weight hooklines while deploying longlines. Integrated weight (IW) longlines of a minimum of 50 g/m or attachment to non-IW longlines of 5 kg weights at 50 to 60 m intervals are recommended.

2.Vessels using the Spanish method of longline fishing should release weights before line tension occurs; weights of at least 8.5 kg mass shall be used, spaced at intervals of no more than 40 m, or weights of at least 6 kg mass shall be used, spaced at intervals of no more than 20 m.

3. Further, SEAFO recommends that longline fisheries consider the Chilean system (equivalent to CCAMLR Trotline system), which is designed to eliminate cetacean predation on demersal longlines, but simultaneously eliminates virtually all seabird bycatch. In this system, 4-10 kg weights are deployed per hookline.

Appendix B

Guidelines for Design and Deployment of Trawl Tori Lines

1. The main line should consist of 50 m of 9 mm line.

2. Streamers should be attached at 5 m intervals and be long enough to reach the water in calm conditions.

3. It is essential that streamers are made from semi-flexible tubing of high visibility. The recommended material is UV-protected fluorescent red polythene tubing and alternatives such as fire hose; old waterproofs and dark coloured tubing are not acceptable.

4. The lines should be mounted two metres outboard of the trawl blocks on both the port and starboard sides. It may be necessary to weld short extension arms to the handrail in order to achieve this distance.

5. Streamer lines should be deployed once the trawl doors are submerged and retrieved as net hauling commences. It is important to retrieve the streamer lines before hauling as vessels often go astern during this process, which can suck the tori lines underwater and lead to problems.

6. A spare streamer line should be carried and deployed in the event of loss or damage of a line.

7. The tori lines should be deployed after shooting and retrieved prior to hauling to minimize entanglement, but should be flown during trawling.

iii. Resolution 01/06: To Reduce Sea Turtle Mortality in SEAFO Fishing Operations.

SC reviewed this resolution and updated it on the basis of information made available. A suggested revised text for consideration by the Commission is given below:-

Preamble:

Recognizing the cultural and ecological significance of sea turtles in the Southeast Atlantic Ocean;

Recognizing that the FAO Committee on Fisheries (COFI) endorsement "Guidelines to Reduce Sea Turtle Mortality in Fishing Operations" at its Twenty-sixth Session, held in March 2005, and that these guidelines are directed towards members and non-members of FAO, fishing entities, subregional, regional and global organizations, whether governmental or non-governmental concerned with fisheries management and sustainable use of aquatic ecosystems;

Further recognizing that implementation of these guidelines should be consistent with the Code of Conduct for Responsible Fisheries as well as with the Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystem with regard to ecosystem considerations and based on the use of the best available science;

Taking into account the importance placed by the guidelines on research, monitoring, the sharing of information, and public education on sea turtle;

The Contracting Parties of SEAFO resolve as follows:

1. Contracting Parties should, as appropriate, individually and collectively implement the FAO "Guidelines to Reduce Sea Turtle Mortality in Fishing Operations" to reduce the incidental catch of sea turtles and ensure the safe handling of all turtles that are captured.

2. Contracting Parties should continue to enhance the implementation of their existing turtle mitigation measures using best available scientific information on mitigation techniques.

3. Contracting Parties should collect and provide to the Secretariat, all available information on interactions with and by-catch of sea turtles in fisheries managed by SEAFO in the Convention area and foster collaboration with other Contracting Parties in the exchange of information in this area. The new SEAFO catch forms have provision for recording detailed by-catch data on a set-by-set basis, and these should be used at all times

4. SEAFO should cooperate with other regional, sub-regional and global organizations to share data on sea turtle by-catch and to develop and apply compatible by-catch reduction measures as appropriate.

5. Contracting Parties should continue to provide to the Secretariat a detailing of sea turtle fishery interaction/by-catch data (e.g. species identification, fate and condition at release, relevant biological information and gear configuration) collected by observers, in fisheries managed by SEAFO in the Convention Area. Observers should use the pictorial key in Appendix A (derived from the FAO field guide applying to fisheries in Namibian waters). This information shall be compiled by the Secretariat and reported to the Scientific Committee and to the Commission.

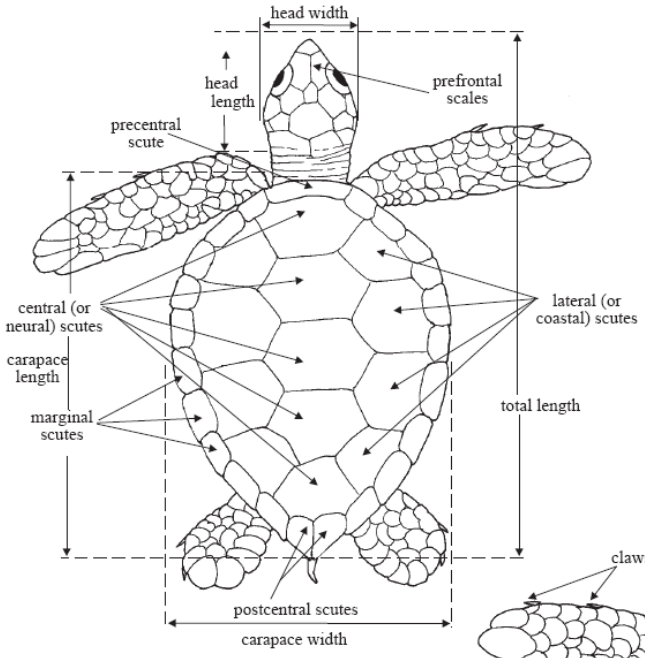
6. All information on sea turtles available to the SEAFO Secretariat will be forwarded to the FAO.

Appendix A

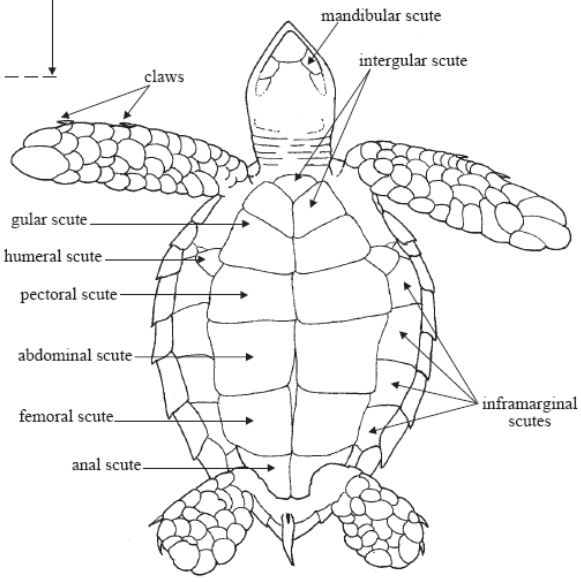
SEA TURTLES

Of the 8 species of sea turtles worldwide, 5 occur in Namibia. Most sea turtle species are considered endangered and are protected under an international agreement. All turtles receive total protection in Namibia. In the past they were incidentally exploited for their fresh meat, their eggs, for ornamental crafts made from their shell, and for leather from their skin. Today they are inadvertently caught in some fisheries. This guide is intended as an aid for conservationists in the management of this endangered group.

TECHNICAL TERMS AND MEASUREMENTS



dorsal view of a juvenile sea turtle (Family Chelonidae)



ventral view of a juvenile sea turtle (Family Chelonidae)

Caretta caretta (Linnaeus, 1758)

CHELONIIDAE

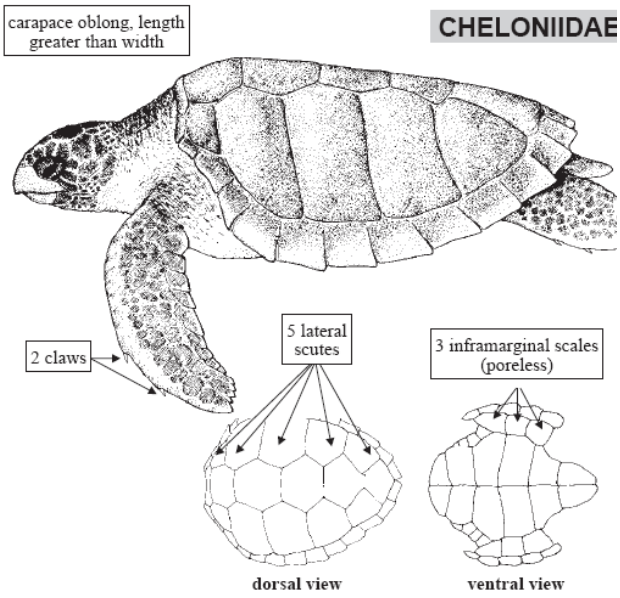
FAO names: **En** - Loggerhead turtle; **Fr** - Tortue caouanne; **Sp** - Caguama.

Local names:

Size: Mean straight carapace length of mature females between 80 and 105 cm.

Fisheries: Caught accidentally by trawlers.

Habitat and biology: Primarily in shallow waters of the continental shelf. Feeds on a wide variety of invertebrates as well as on bony fishes. It is preyed upon by sharks, at all age classes.



Chelonia mydas (Linnaeus, 1758)

CHELONIIDAE

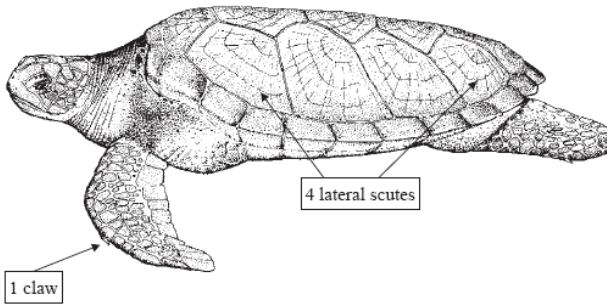
FAO names: **En** - Green sea turtle; **Fr** - Tortue verte; **Sp** - Tortuga blanca.

Local names:

Size: To 140 cm curved carapace length.

Fisheries: Caught inadvertently in trawls.

Habitat and biology: A solitary, nektonic species, sometimes forming feeding aggregations in shallow waters. Feeds, during daytime, on algae and sea grass. High predation on this species occurs at all its life stages, sharks being its worse enemies.



Eretmochelys imbricata (Linnaeus, 1766)

CHELONIIDAE

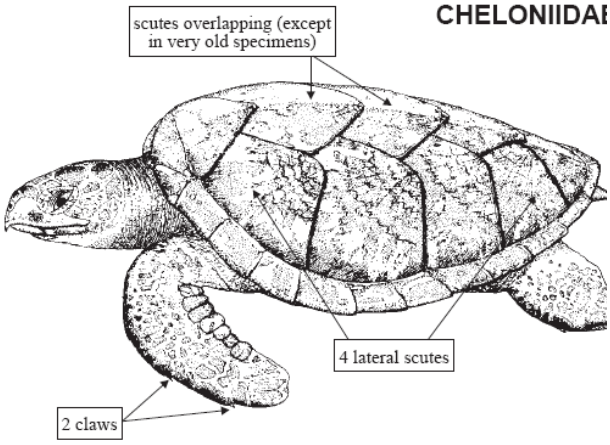
FAO names: **En** - Hawksbill sea turtle; **Fr** - Tortue caret; **Sp** - Tortuga de carey.

Local names:

Size: Adult females measure from 50 to 115 cm straight carapace length.

Fisheries: Elsewhere caught by turning the females while crawling on the beach, by spearing, entangling nets, and incidentally in trawls. This species is particularly valuable because of the scutes covering its carapace which are used in some countries in jewelry (tortoise shell), though not in Namibia.

Habitat and biology: Occur in clear littoral waters. Carnivorous, feeds on a wide variety of invertebrates. It is heavily preyed upon at all life stages.



CHELONIIDAE

Lepidochelys olivacea (Eschscholtz, 1829)

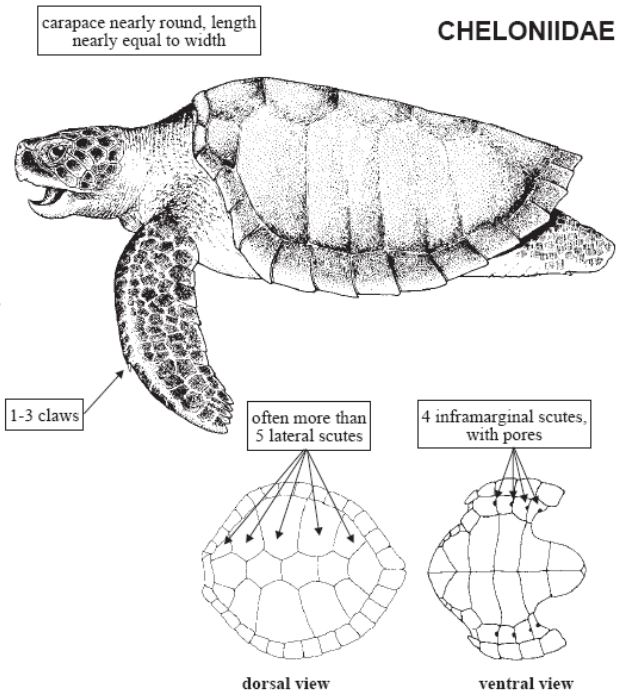
FAO names: **En** - Olive ridley turtle; **Fr** - Tortue olivâtre; **Sp** - Tortuga golfina.

Local names:

Size: Mature specimens between 50 and 75 cm straight carapace length.

Fisheries: Caught inadvertently in some fisheries.

Habitat and biology: Occurs in shallow coastal waters and offshore. Feeds on a wide variety of fishes and invertebrates. Juveniles and adults are preyed upon by sharks.



DERMOCHELYIDAE

Dermochelys coriacea (Vandelli, 1761)

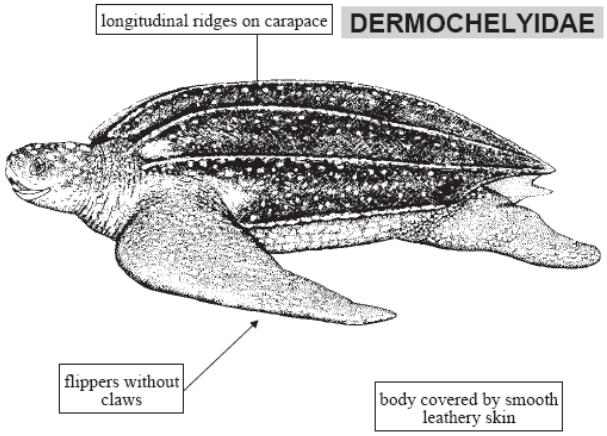
FAO names: **En** - Leatherback turtle; **Fr** - Tortue luth; **Sp** - Tortuga laud.

Local names:

Size: Maximum about 270 cm carapace length.

Fisheries: Caught accidentally with drift nets, longines, and in trawls.

Habitat and biology: Pelagic species, approaching the coast for spawning. It feeds on jellyfish, tunicates, and other soft-bodied invertebrates with highest concentrations in the upwelling regions. Preyed upon by sharks and killer whales. Adults are able to stand temperatures as low as 10°C.



17. Co-operation with other organisations/science programmes

• GESAMP

SC reviewed the annual report of the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) and supported the initiative of Working Group 35 on deep-water fisheries. However, SC is of the view that much of the information likely to be required by this Working Group is currently available in SEAFO documents on the SEAFO website.

• CWP

SC reviewed the report of the 22nd session of the FAO Co-ordinating Working Party on Fisheries Statistics (Feb-Mar 2007) and noted the involvement of SEAFO through the executive secretary and expressed the view that participation should be maintained.

• FAO Deep Sea Project

SC reviewed this program proposal and expressed a strong interest in participating and contributing to meetings and further development of the proposal.

18. Advice and recommendations to the Commission

As last year, the SC has identified the responsible entities to take action under each recommendation. These should not be interpreted as instructions, but are provided to facilitate responses and needs in a non-prescriptive manner.

a. SC recommends that Conservation Measure 10/07; Fixing catch limits of crabs and toothfish be revised as follows and to include orange roughy and alfonsino:

- For Patagonian toothfish, the SC took into account the current CCAMLR Conservation Measure 41-04(2008) relating to toothfish in the northern component of CCAMLR Subarea 48.6 adjacent to SEAFO Division D. The current CCAMLR TAC for this area is 200 tonnes and **SC agreed to recommend a reduction the precautionary catch limit for toothfish in SEAFO CA to 200 tonnes for 2010 and 2011.**

- For deep-sea red crab spp, SC, in the absence of information on the current size of the resource and levels of fishing mortality, **recommends the current precautionary catch limits be maintained in 2010 and 2011 at 200 tonnes in Sub-Division B1 and 200 tonnes in the remainder of the SEAFO CA until such time as when additional information becomes available.**

- For orange roughy and alfonsino, SC is of the view that if substantial fisheries develop in the SEAFO CA it is likely that they will be for these species. Experience from other orange roughy fisheries around the world (New Zealand, west of Ireland etc) suggests that sustainable catches are of the of order of 2-3% of virgin biomass. Annual landings

from the Namibian orange roughy in Sub-Division B1 peaked in 2001 at around 90t and strongly declined thereafter to very low levels, which is reflected by available LPUE data. Additionally there is currently a moratorium on fishing for orange roughy in the Namibian EEZ adjacent to Sub-Division B1. The connectivity between the populations supporting these fisheries is unknown, but it is possible that these are from the same stock. Given this, SC recommends a zero catch limit for orange roughy in Sub-Division B1 for 2010 and 2011. In view of the unknown size of any orange roughy populations that may exist in the remainder of the SEAFO CA, **SC recommends a precautionary annual catch limit for 2010 and 2011 of 50 tonnes until such time as when additional information becomes available to identify sustainable fishing levels.** This catch limit would prevent a strong increase in activity but permit exploratory fishing.

- Alfonsino is not a long-lived, slow-growing species but is vulnerable to fishing because fisheries mostly target aggregations. Experience in the NAFO region suggest that, as with orange roughy, fishing often takes the form of short-term "mining" which can lead to sequential depletion of populations which even for alfonsino may take 15-20 years to recover. **SC recommends a precautionary annual catch limit for 2010 and 2011 of 200 tonnes for alfonsino in the SEAFO CA or until additional information becomes available to identify sustainable fishing levels.**

SC has recommended changes to the text of the Conservation Measure in a

accordance with the above (see SC ToR 16i)

ACTION: Commission

b. Conservation Measure 05/06: On reducing incidental by-catch of seabirds in the SEAFO CA, has been revised in the light of the latest CCAMLR regulations and information and advice provided by Birdlife International. The revised text also introduces measures to address seabird losses in trawl gears. Warp collisions (birds colliding with warp lines) have been recognised as a significant problem in trawl fisheries. Mitigation measures have been applied in South African trawl fisheries and in the CCAMLR area. **SC recommends that the revised measure (see SC ToR 16ii) be adopted.**

ACTION: Commission

c. SC reviewed Resolution 01/06: To Reduce Sea Turtle Mortality in SEAFO Fishing Operations and made minor revisions to the text for consideration by the Commission (see TOR 16iii). **SC recommends that SEAFO catch forms be modified to record detailed by-catch data at a species level on a set-by-set basis, and these should be used at all times**. **SC recommends that the SEAFO Secretariat produce the Turtle identification key (see SC ToR 16iii Appendix A) in a form suitable for use at sea by observers.**

ACTION: Commission

d. Regarding the development of a fishing footprint, SC reviewed data supplied by CPs and fishing parties (FPs) and a combination of JPEG maps and catch positions are currently available for only two CPs and one FP. These account for only some of the fishing activity in the SEAFO CA over the period 1987-2007. A further concern is that some of these data may relate to fishing activity for ICCAT species. The format of available data, although in compliance with Conservation Measure 12/08, were considered by SC to be unsuitable for developing a fishing footprint with similar precision to footprints developed by other RFMOs. To permit graphical representation the **SC recommends the Commission consider revising the format of requested data. SC suggests that a way forward be to request actual catch position data in terms of latitude and longitude to the nearest minute.**

ACTION: Commission & Secretariat

e. SC expresses concern that the interim encounter threshold for VMEs set by some RFMOs, including SEAFO, may be too high. SC reviewed alternate options for thresholds taking into consideration changes to thresholds used in the NAFO area and additional information made available from scientific investigations in progress. SC is aware that CCAMLR has developed specific thresholds for fixed gears and these and other thresholds will be reviewed by SC next year when the bottom fishing regulation is due to be reviewed by the Commission. In view of the concern, as an interim measure, **SC suggests that the Commission give consideration to revising the thresholds downwards.**

ACTION: Commission

f. SC notes that more comprehensive information on the spatial distribution and extent of seamount areas and their associated fauna is required for the review of closed areas scheduled for 2010. Additionally there is a need to collate information of vents, carbonate mounds and seeps in the SEAFO CA**. SC recommends [1] that funds be made available to hire a consultant to compile the best available bathymetry data and to develop a detailed map of bottom topography of the SEAFO CA, and [2] SC explores the use of predictive methods to identify the possible areas where VMEs may exist.**

ACTION: Commission & Secretariat

g. Available coral and sponge keys were evaluated and SC recommends that SEAFO adopt the Spanish ID key based on observations on the south-western African shelf and slope waters**. SC recommends that the SEAFO Secretariat produce the key in a form suitable for use at sea by observers.**

ACTION: Secretariat

h. Regarding the impact of lost gear on habitat and biodiversity, SC's response to ToR 15 refers solely to the impacts mitigation and curative measures relating to abandoned, lost or otherwise discarded fishing gear (ALDFG). SC does not have sufficient information available to evaluate the effects of lost gear on habitat and biodiversity.

The only fisheries that currently pose potential ALDFG problems are longline fisheries for Patagonian toothfish and trap fisheries for deep-water red crab. It is important that fishers record the nature and location of ALDFG. **SC recommends that all SEAFO fishery forms include fields for ALDFG to include gear dimensions and geographical position.** In the absence of information from fishers, **SC recommends that the SEAFO Secretariat carries out a consultation with SEAFO fishing nations to determine the maximum limits on the length of individual fleets/sets, soak time, and vessel gear capacity, and reports back to SC.**

Gillnets are important contributors to ALDFG problems including ghost-fishing. This fishing method has been banned in the CCAMLR area and **SC recommends a similar ban be applied in the SEAFO CA.** However if a ban is not implemented **SC recommends introducing limitations on the length of fleets, soak-times and depth of fishing.** An example is those measures introduced in parts of the NE Atlantic such as the 10km limit on the maximum length of individual fleets, soak time to 72 hours**.**

Many of the preventative and mitigation measures regarding ALDFG problems (see SC ToR 6 item j), in the opinion of SC, are outside the Committee's expertise and **SC recommends that these be considered by the SEAFO Compliance Committee.**

ACTION: Commission

i. **SC recommends the development of species profiles (including information of productivity and vulnerability) for the main commercially exploited species in the SEAFO CA (see SC ToR 6 item c).** The profiles will be used in assessment models, management advice and ecosystem modeling.

ACTION: Scientific Committee

j. SC reviewed the ToRs for Scientific Co-ordinators set by the Commission in 2008 and is of the view that most of the tasks described are best dealt with by the relevant data management authorities within CPs and FPs. Also some of the ToRs are already addressed by mechanisms within the SEAFO Commission, CPs and FPs. **SC is of the view that the work of Scientific Co-ordinators should comprise:**

1. To act as the scientific focal point between SEAFO and CPs and FPs.
2. Participation at SEAFO SSC and SC.

3. Ensure that all available fisheries and scientific data, including historical data, is available to SSC and SC via the SEAFO Secretariat using the prescribed format.
4. To encourage the provision of scientific analyses relevant to SEAFO scientific bodies.

SC is aware that not all CPs have nominated scientific co-ordinators. **SC recommends that the Commission pursues this issue and includes the appointment of Scientific Co-ordinators by FPs.**

ACTION: Commission

k. SC recommends full compliance with agreed scientific reporting protocols. In addition **SC recommends that the Secretariat improve the SEAFO website to make catch, sampling and observer forms easily accessible**.

ACTION: Commission

l. SC recommends that the Secretariat invests in suitable database software that can accommodate all SEAFO data requirements. SC notes that the operation of such a database may require additional expertise in the SEAFO Secretariat.

ACTION: Commission

m. SC expressed concern that the SEAFO species list is not extensive insofar it does not include many species that may currently be by-catch species and which in the future fisheries may target. This is of importance because many conservation measures in the SEAFO CA refer explicitly to fishing for species on the SEAFO species list (e.g. Conservation Measure 06/06 regarding closed areas). One option to resolve this issue would be to define the SEAFO species list as all those species encountered in commercial fishing operations currently not on the ICCAT species list. **SC would welcome guidance on this issue from the Commission.**

ACTION: Commission

n. SC notes that additional historical fisheries data exist for Ukraine and Russia (and other former Eastern-block nations), and **recommends support of an offer by the FAO to collate this information.**

ACTION: Secretariat

o. SC recommends that SEAFO adopt a formal protocol for referencing scientific documents and working papers. SC recommends that scientific documents be available on the SEAFO website.

ACTION: Commission & Secretariat

19. 2010 work program

The 2010 work program will be developed in the remainder of 2009 and finalized in preparation for meetings in 2010.

20. Budget for 2010

The meeting recommended that the Commission approve an allocation to hire a consultant to compile the best available bathymetry data and to develop a detailed map of bottom topography of the SEAFO CA. SC wish that be noted that the funding allocation for the development of a coral and sponge ID was not used this year.

SC envisages a 3-day Scientific Sub-Committee meeting and a 5-day Scientific Committee meeting in 2010. The latter will be required to enable SC to provide advice and recommendations for the reviews of closed areas and bottom fishing conservation measures (required by the Commission in 2010).

21. Any other matters

There were no other matters.

22. Adoption of the report

The report was presented and adopted by the meeting.

23. Date and place of the next meeting

SC agreed not to set a date and await the agreed date for the 2010 Commission meeting. SC expressed the view that scientific meetings immediately precede the annual Commission meeting, as in this and previous years. SC expressed the view that if the Annual Commission meeting in 2010 is in Namibia, SC would wish to convene in Windhoek.

24. Closure of the meeting

On Friday 2nd October at 1750 hrs the Chairperson declared the closure of the meeting after all items had been concluded. In his closing remarks, the Chair expressed his satisfaction for the work accomplished and thanked all participants for their valuable contributions

ANNEX I

Agenda for the 5th Annual Meeting of the SEAFO Scientific Committee

1. Opening and welcome remarks by the Chairperson, Mr. Phil Large
2. Adoption of the agenda and arrangements
3. Appointment of rapporteur
4. Introduction of participants
5. Introduction of observers
6. Report by the Chair of the Scientific Sub-Committee and comments by SC
7. Feedback on the SEAFO Bottom fishing/VME Workshop
8. Development of SEAFO fishing footprint
9. The South Atlantic Mar-Eco Project
10. TheSpanish/Namibia joint survey
11. Review and endorsement of TXOTX questionnaire
12. Report back of Scientific Co-ordinators
13. Scientific database
14. SEAFO identification key for sponges and corals
15. Impact of lost gear on habitat and biodiversity
16. Review of Conservation Measures
    (i) Conservation Measure 10/07: Fixing catch limits of crabs and toothfish
    (ii) Conservation Measure 05/06: On reducing incidental by-catch of seabirds in the SEAFO Convention Area.
    (iii) Resolution 01/06: To reduce sea turtle mortality in SEAFO fishing operations.
17. Co-operation with other organisations/science programmes
    - GESAMP
    - CWP
    - FAO Deep-sea Project
18. Advice and recommendations to the Commission
19. 2010 work program
20. Budget for 2010
21. Any other matters
22. Adoption of the report
23. Date and place of the next meeting
24. Closure of the meeting

Annex II

List of Participants to the 5th Annual Meeting of SEAFO Scientific Committee

Angola

Kumbi KILONGO
Fisheries Scientist
Instituto Nacional de Investigação Pescas
Ministry of Fisheries
P.O. Box 2601
Ilha de Luanda,
Angola
Phone: +244-222309077
Fax: +244-222-309731
Email: kkilonga@gmail.com

European Union
Luis LOPEZ-ABELLAN
Instituto Español de Oceanografia
Centro Oceangrafico de Canarias
CTRA. San Andres N^{o} 45
38120 S/C de Tenerife
Islas Canarias
Tel: +34-922549400
Fax: +34-922549554
ESPAÑA
E-mail: Luis.lopez@ca.ieo.es

Phil LARGE (Chair)
Lowestoft Laboratory
Pakefield Road
Lowestoft
Suffolk NR 33 0HT
Tel : +44-1502-562244
Fax : +44-1502-513865
UNITED KINGDOM
E-mail : Phil.large@cefas.co.uk

Ivone FIGUEIREDO
INIAP/IPIMAR
Av. Brasilia
1449.006 Lisboa
PORTUGAL
Tel: +351-213027131
Fax : +351-213015948
E-mail: ivonefig@ipimar.pt

Namibia
Chris BARTHOLOMAE
Chief Oceanographer
Nat. Mar. Inform. and Research Centre
Directorate of Resources Management
Min. of Fish. and Mar. Resources
Private Bag 912
Swakopmund, Namibia
Phone: +264-64-4101000
Fax: +264-64-404385
Email: cbartholomae@mfmr.gov.na

Rudi CLOETE
Chief Fisheries Biologist
Nat. Mar. Inform. and Research Centre
Directorate of Resources Management
Min. of Fish. and Mar. Resources
Private Bag 912
Swakopmund, Namibia
Phone: +264-64-4101000
Fax: +264-64-404385
Email: rcloete@mfmr.gov.na

Graca D'Almeida
Chief Fisheries Biologist
Nat. Mar. Inform. and Research Centre
Directorate of Resources Management
Min. of Fish. and Mar. Resources
Private Bag 912
Swakopmund, Namibia
Phone: +264-64-4101000
Fax: +264-64-404385
Email: gdalmeida@mfmr.gov.na

Hannes HOLTZHAUSEN
Principal Fisheries Biologist

Nat. Mar. Inform. and Research Centre
Directorate of Resources Management
Min. of Fish. and Mar. Resources
Private Bag 912
Swakopmund, Namibia
Phone: +264-64-4101000
Fax: +264-64-404385
Email: hholtzhausen@mfmr.gov.na

Titus IILENDE
Deputy Director
Directorate of Resources Management
Min. of Fish. and Mar. Resources
Private Bag 13355
Windhoek, Namibia
Phone: +264-61-205-3911
Fax: +264-61-224566
Email: tiilende@mfmr.gov.na

Erich MALETZKY
Fisheries Biologist
Directorate of Resource Management
Min. of Fish. And Mar. Resources
Box 394
Luderitz, Namibia
Tel : + 264 63 202415
Email : emaletzky@mfmr.gov.na

Norway
Odd Aksel BERGSTAD
IMR, Flodevigen
N-4817 His, Norway
Tel: + 4737059010
Fax: + 47 37 059001
Email: **oddaksel@imr.no**

Benguela Current Commision (Observer)
Frikkie Botes
BCLME SAPIMP Project
Email: FrederickB@unops.org

Japan (Observer)
Tom NISHIDA
International Marine Fisheries Resources
National Research Institute for Seas Fisheries
Fisheries Research Agency
5-7-1 Orido, Shimzu-Ward
Shizuoka-City
Japan
Phone/Fax: +81-54-336-6052
Email: tnishida@affrc.go.jp

Yoshinobu NISHIKAWA
Industry Japan
Email : fwgdii@nifty.com

Brazil (Observer)
Jose Angel Perez
Centro de Ciencias Tecnologicas da Terra e do Mar-CTTMar
Univeridade do Vale do Itajai – UNIVALI
R. Uruguai, 457- Itajai
Santa Catarina – CEP 88302-202
Brazil
Phone: +55-47-33417714
Fax: +55-47-33417715
Email: angel.perez@univali.br

Birdlife International
Ross WANLESS

Supporting Staff: SEAFO Secretariat

Ben van ZYL
South East Atlantic Fisheries Organisation
P.O. Box 4296
Walvis Bay
Email: bvanzyl@seafo.org

Annie SNYDERS
Administrative Officer
South East Atlantic Fisheries Organisation
P.O. Box 4296
Walvis Bay
Email: asnyders@seafo.org

Annex III

REPORT OF THE SUB-COMMITTEE OF SEAFO SCIENTIFIC COMMITTEE

21 – 25 SEPTEMBER 2009

NATMIRC
SWAKOPMUND, NAMIBIA

1. INTRODUCTION

As recommended by the Scientific Committee (SC), the Commission decided during its 3rd Annual Meeting in 2006 to establish a Sub-Committee of the SC. The main objective of the Scientific Sub-Committee (SSC) is to carry out, among others, the analyses of existing fisheries data within the SEAFO Convention Area (CA).

The meeting in 2009 took place at NATMIRC in Swakopmund, Namibia from 21 to 25 September, and was chaired by Kumbi Kilongo (Angola). The meeting was attended by 8 scientists from Angola, EU (Spain and UK) and Namibia. One observer from Japan was also present. A list of participants is given in Annex II.

2. WORKING PROCEDURE

The Chairperson opened the meeting by welcoming all the participants. The agenda (Annex I) was adopted after the SSC decided to work as a single group. SSC agreed to work from 08:30hrs to 17:00hrs each day. The Chair presented terms of reference (listed below) after which the meeting agreed on the working procedure. The first two days were spent on reviewing the existing data, identifying gaps as well as addressing the terms of reference. Specific assignments on data review and analyses were allocated to participants and reported back to the Group.

Terms of Reference for the Scientific Sub-committee

a. Source, analyse and compile catch and CPUE data for the main fish stocks (e.g. orange roughy, alfonsino, armourhead, deep sea red crab, Patagonian toothfish) in terms of quantity and geographical positions for the SEAFO region using all existing information including observer and VMS data
b. Evaluate trends in the total catches and where possible CPUE for the stocks as outlined under point (a), and undertake stock assessments when appropriate.
c. Evaluate and suggest reference points for deep-sea fish resources.
d. Review of sampling/reporting protocols and requirements including fish identification keys.
e. Complete FIRMS information fisheries sheets.
f. Examine, where appropriate, assessments and research done by neighbouring assessment and management organisations (such as BCLME/BCC, CCAMLR, GCLME, ICCAT, SWIOFC).
g. Review the distribution of reported catches of benthic organisms (corals, sponges etc.).
h. Undertake review of submitted SEAFO research documents.
i. Review historical fisheries data
j. Make recommendations on lost fishing gear to SC
k. Complete TXOTX questionnaire

3. ADDRESSING THE TERMS OF REFERENCE

The terms of reference are addressed below in the same order as they appear above.

a.

b. Source, analyse and compile catch and CPUE data for the main fish stocks (e.g. orange roughy, alfonsino, armourhead, deep sea red crab, Patagonian toothfish) in terms of quantity and geographical positions for the SEAFO region using all existing information including observer and VMS data

The quality and quantity of data have improved in the last two years. Historically there was no distinction between landings and catches, however discard information was available for the two longline vessels fishing up to date in 2009. There is also a general lack of fishing effort and biological (length, sex ratio, and maturity) data.

For 2009, detailed catch positions for the crab fishery were not reported as specified in the new SEAFO logsheets and also no length frequency data were received. In contrast, the longline fishery provided relatively comprehensive data.

Historically, the following countries are known to have been fishing in the SEAFO Area viz. Spain, Portugal, Russia, Cyprus, Mauritius, Japan, Korea, Poland, Norway, South Africa and Namibia. In 2009, the only countries that have provided landings data for the SEAFO Area were Japan and Korea. VMS data suggest that these vessels were the only ones fishing for SEAFO species in the SEAFO CA.

Landings analyses were made on the most recent landings statistics provided to the Secretariat. The amount of Illegal, Unreported and Unregulated (IUU) fishing in the Area is unknown.

EU (Spain):

Landings data were provided for the years 2001-2007. No landings were made in 2008 and 2009. Apart from 2006, catch positions were not provided. The reported species composition changed from year to year. From 2001 to 2003, landings were small with the exception of around 100 tonnes of Patagonian toothfish (*Dissostichus eleginoides)*. In 2006, landings comprised 11 tonnes of toothfish, and, in 2005, 72 tonnes of alfonsino (*Beryx* spp.). In both years landings were by a single Spanish vessel. Fishing effort, discard and biological information (length data, sex ratios, maturity) was not available for all years.

EU (Portugal):

Landings data were provided for 2004 to 2007. No landings were made in 2008 and 2009. Data for 2007 includes landings from an exploratory trap survey, part of which was in the SEAFO Area. Catch positions, discard, fishing effort and biological data (length data, sex ratios, maturity) were not provided. Wreckfish (*Polyprion americanus*) landings of 0.5 tonnes were recorded in 2004, 6 tonnes in 2005 and 9 tonnes in 2007.

Japan:

Landings data were provided from 2005 to 2009 to date (Table 2&5). Crab landings for 2007 have been revised from 509 to 770 tonnes. The total landings for 2009 were 170 tonnes of red crab. Landings records for 2009 were not fully compliant with the new SEAFO format.

Republic of Korea:
Landings data were provided from 2005 to 2009 to date (Table 2). The total landings for 2009 were 62 tonnes of toothfish. Landings records for 2009 were compliant with the new SEAFO format.

Namibia:
Landings data were provided from 1995 to 2007. No landings were made in 2008 and 2009.

Other Countries:
Landings data for other countries are summarised in the various tables. No data for recent years are available. Whether this is the result of no fishing is unknown.

VMS data

The Scientific Sub-Committee was again in a position to present a summary of available VMS data for vessels fishing for SEAFO species. These data are available from 2007, but only data for 2009 are presented here (Figures 1&2) and have been anonymised so that Contracting Parties and individual vessels cannot be identified.

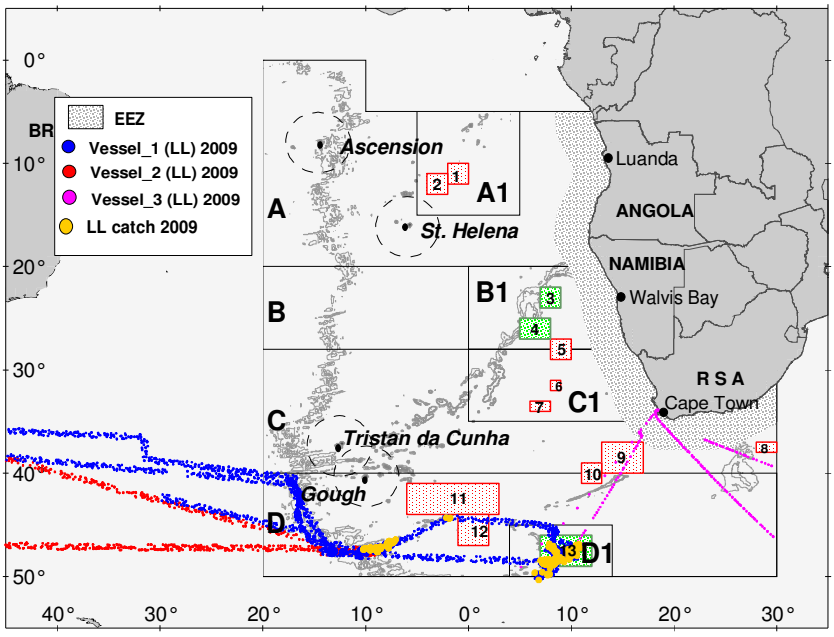


Figure 1. VMS tracks for longliners fishing for toothfish in 2009. Reported catch positions are indicated on the map.

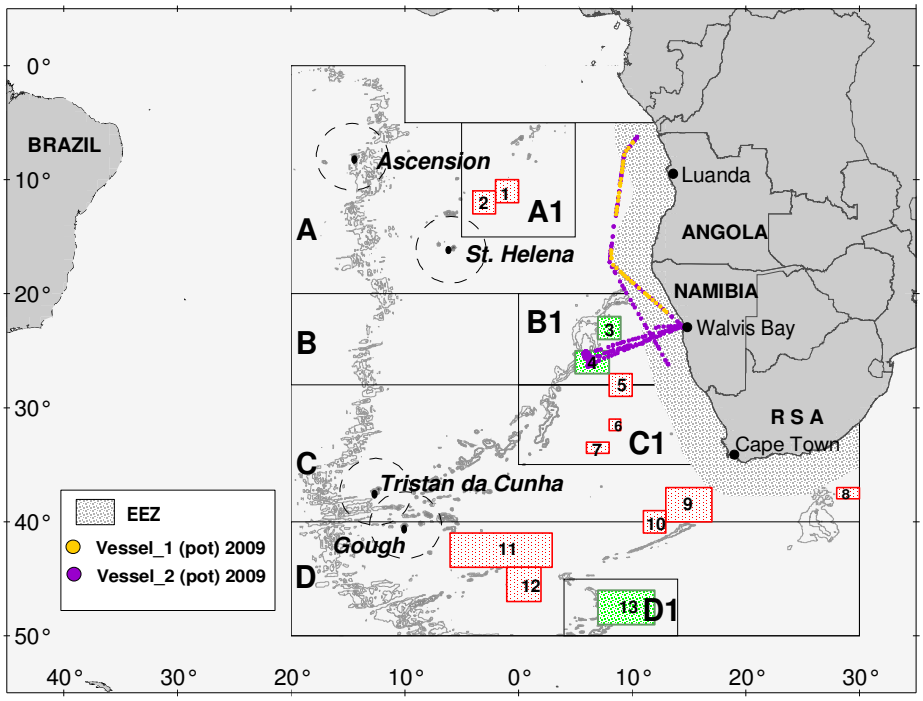


Figure 2. VMS tracks for vessels fishing for crab in 2009. No detailed catch positions were reported.

It has not been possible to exclude VMS signals when vessels are steaming so transit tracks are present in the plots. However, these vessels are using static gears and from scrutinising areas of intense VMS activity it is possible to identify likely fishing activity.

There was no evidence of fishing activity in closed areas during 2009 to date.

Biological data

Figures 3 & 4 present length frequency distributions of toothfish landings from Korean longline vessels fishing in the SEAFO area in 2009. The data suggest that the fish caught in the western part of area D were larger than those caught in D1.

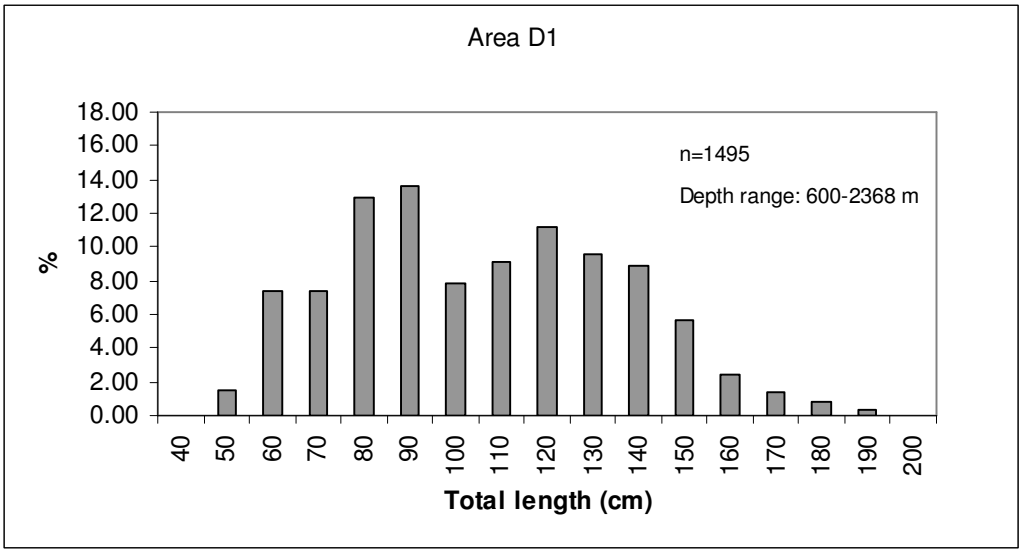


Figure 3. Aggregate length frequency distributions of sampled tooth fish from a Korean longline vessel fishing in area D1 in 2009.

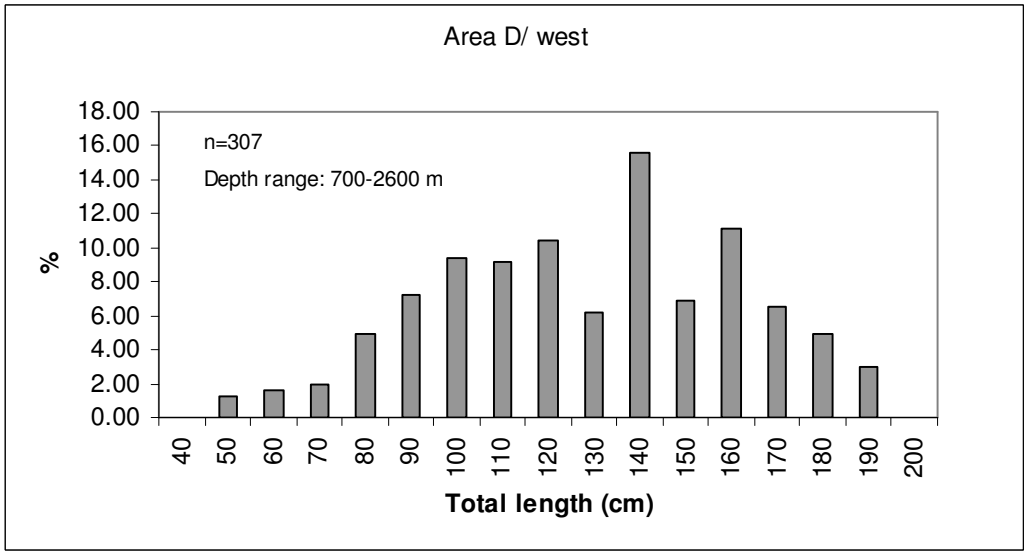


Figure 4. Aggregate length frequency distributions of sampled toothfish from two Korean longline vessels fishing in the western part of D in 2009.

There were no biological data available from the crab fishery.

b, Evaluate trends in the total catches and where possible CPUE for the stocks as outlined under point (a), and undertake stock assessments when appropriate.

Currently the commercially most important species in the SEAFO Area are Patagonian toothfish and deep-sea red crabs. The main species/groups in the SEAFO species list are given in Table 1. This list has been revised this year to include spiny dogfish (*Squalus acanthias*) and six named species of deep-sea sharks. It is likely that other species of deep-sea sharks are distributed in the SEAFO CA, however no information is available as yet for substantial areas of the CA.

Table 1. Some main species/groups in the revised SEAFO species List.

FAO 3 Alfa Code	Species	Latin Name	Transboundary
TOP	Patagonian toothfish	*Dissostichus eleginoides*	Yes
ORY	Orange Roughy	*Hoplosthethus spp*	Unknown
ALF	Alfonsino	*Family Berycidae*	Unknown
CGE	Deep-sea Red Crab	*Chaceon maritae*	Unknown
MAC	Mackerel	*Scomber scombrus*	Unknown
EDR	Armourhead	*Pseudopentaceros spp.*	Unknown
BOC	Boarfish	*Capros aper*	Unknown
ORD	Oreo dories	*Family Oreosomatidae*	Unknown
CDL	Cardinal Fish	*Epigonus spp.*	Unknown
OCZ	Octopus	*Family Octopodidae*	Unknown
SQC	Squid	*Family Loliginidae*	Unknown
WRF	Wreckfish	*Polyprion americanus*	Unknown
SKA	Skates	*Family Rajidae*	Unknown
DGS	Spiny Dogfish	*Squalus acanthias*	Unknown
ETB	Blurred smooth lanternshark	*Etmopterus bigelowi*	Unknown
ETH	Shorttail lanternshark	*Etmopterus brachyurus*	Unknown
ETR	Great lanternshark	*Etmopterus princeps*	Unknown
ETP	Smooth lanternshark	*Etmopterus pusillus*	Unknown
APA	Ghost catshark	*Apristurus manis*	Unknown
SSQ	Velvet dogfish	*Scymnodon squamulosus*	Unknown
SKH	Other sharks (deep-sea)	*Order Selachomorpha*	Unknown

Catch statistics for the SEAFO Area are incomplete. A table with the available data from 1995 to 1998 was listed in the report of the 1st annual meeting of the commission (2004), Appendix III (Table II). These data were based on a report by Japp (1999).

Landings for the four main species are listed by country in Tables 2-5, as well as fishing method and management Area in which the catch was taken. Tables 6-8, list the bycatch species.

Some data were derived from the "1975-2005 FAO Southeast Atlantic capture production database" and added to the tables on landings. These are printed in bold. Only data from the oceanic divisions and for SEAFO species were taken into consideration.

Table 2: Landings in tonnes of Patagonian toothfish by Spain, Japan and Rep. of Korea (values in bold are from FAO).

Main species	**Patagonian toothfish**						
Management Area	D		D		D		
Nations	Spain		Japan		Korea		
Fishing method	Longline		Longline		Longline		
	Catches (t) (whole weight)	Effort (1000 hooks)	Catches (t) (whole weight)	Effort (1000 hooks)	Catches (t) (whole weight)	Effort (1000 hooks)	
1976							
1977							
1978							
1993							
1994							
1995							
1996							

1997							
1998							
1999							
2000							
2001							
2002	18.28	213.96					
2003	100.54 (14.13)	(134.94)			245.19		
2004	6.12	313.12					
2005			72.65		10		
2006	11.08	204.48	157				
2007			15.76				
2008			83.79 (75.10)	(618.07)	75.65	1313.6	
2009 up to May					62.44	1036.6	

( ) Partial effort data refers to partial catch in brackets

Table 3: Landings (tonnes) of orange roughy made by Namibia, Norway and RSA. Values in italics are taken from the Japp (1999).

Main species	**Orange roughy**		
Management Area	B1	A1	B1?
Nations	Namibia	Norway	RSA
Fishing method	Bottom trawl	Bottom trawl	Bottom trawl
1976			

1977			
1978			
1993			
1994			
1995	40.3	No fishing	*1.18*
1996	7.9	No fishing	*0.04*
1997	5.2	22	*27.30**
1998	No fishing	12	
1999	0.3	No fishing	
2000	74.6	0	
2001	93.9	No fishing	
2002	9.0	No fishing	
2003	27.4	No fishing	
2004	14.7	No fishing	
2005	18.1	No fishing	
2006	No fishing	No fishing	
2007	No fishing	No fishing	
2008	No fishing	No fishing	
2009 up to May	No fishing	No fishing	

*Sum of landings from 1993 to 1997

Tables 4a, b (below): Landings (tonnes) of alfonsino made by various countries. Values in italics are taken from the Japp (1999). Values in bold are from FAO.

Main species	**Alfonsino (*Beryx* spp.)**				
Management Area	**B1**	**A1**	**Unknown**		
Nations	**Namibia**	**Norway**	**Russia**	**Portugal**	**Ukraine**
Fishing method	**Bottom trawl**	**Bottom trawl**	**Bottom trawl**		
1976			*252*		
1977			*2972*		
1978			*125*		
1993					**172**
1994					
1995	*1.2*	No fishing			
1996	*368*	No fishing			**747**
1997	*208*	836	*2800*		**392**
1998	No fishing	1066	**69**		
1999	0.60	No fishing		**3**	
2000	0.05	242		**1**	
2001	0.63	No fishing		**7**	
2002	0.00	No fishing		**1**	
2003	0.00	No fishing		**5**	
2004	6.45	No fishing	210.44		
2005	0.71	No fishing	54		

2006	No fishing	0.3
2007	No fishing	
2008	No fishing	
2009 up to May	No fishing	

Main species	**Alfonsino (contd)**					
Management Area			**Unknown**	**Unknown**	**Unknown**	**B1?**
Nations	**Spain**	**Poland**	**Cook Island**	**Mauritius**	**Cyprus**	**RSA**
Fishing method	**MWT /BLL**		**Bottom trawl**	**Bottom trawl**	**Bottom trawl**	**Bottom trawl**
Catches						
1976						
1977						
1978						
1993						
1994						
1995		**1964**				*59.705*
1996						*109.181*
1997	**186**					*124*
1998	**402**					
1999						
2000						

2001	1.96					
2002						
2003	2.34					
2004	4.16		141.55	114.88	436.97	
2005	72.34					
2006						
2007						
2008						
2009 up to May						

Table 5. Landings (tonnes) of deep-sea red crab made by Namibia and Japan.

Management Area	**Seafo CA**	**B1**		**A**
Nations	**Japan**	**Namibia**	**Spain**	**Portugal**
Fishing method	**Pots**	**Pots**	**Pots**	**Pots**
Landings				
1976				
1977				
1978				
1993				
1994				
1995				
1996				
1997				
1998				

1999				
2000				
2001			0.07	
2002				
2003			5.10	
2004			23.84	
2005	234.34	54.33		
2006	390			
2007	770.46	4.1		35
2008	38.99			
2009 (Jan-Mar)	169.87*			

*VMS data suggests catches were made in B1

Table 6. Landings (tonnes) of armourhead. Values in italics are taken from the Japp (1999). Values in bold are from FAO

Bycatch species	**Armourhead**					
Management Area	**B1**	**B1**	**Unknown**	**B1**	**B1**	**Unknown**
Nations	**Namibia**	**Russia**	**Ukraine**	**RSA**	**Spain**	**Cyprus**
Fishing method	**B. trawl**	**B. trawl**	**B. trawl**	**B. trawl**	**B. trawl & longline**	**B. trawl**
Catches						
1976		*108*				
1977		*1273*				
1978		*53*				

1993		*1000*	**435**			
1994						
1995	*3*		*49*	*529.581*		
1996	*212*		*281*	*201.184*		
1997	*546*		*18*	*12*		
1998						
1999						
2000						
2001						
2002						
2003						
2004						22
2005						
2006						
2007						
2008						
2009 up to May						

Table 7: Landings (tonnes) of boarfish and oreo dories.

By-catch species	**Boarfish**				**Oreo dories**
Management Area					
Nations	**Russia**	**Cyprus**	**Mauritius**	**Namibia**	**Namibia**
Fishing method				**Bottom trawling**	**Bottom trawling**

Landings					
1976					
1977					
1978					
1993					
1994					
1995				5.36	0.459
1996				71.67	0
1997				12.784	35.21
1998				No fishing	No fishing
1999				0	3.17
2000				79.19	32.853
2001				20.115	13.642
2002				0	0.5
2003				0	0.95
2004	0.081	21.312	25.164	4.4	0
2005				0	3.79
2006					
2007					
2008					
2009 up to May					

Table 8. Landings (tonnes) of wreckfish.

Management Area	A
Nations	Portugal
Fishing method	Longline
Landings (bycatch)	
1996	
1997	
1998	
1999	
2000	
2001	
2002	
2003	
2004	0.5
2005	
2006	6
2007	9
2008	
2009 up to May	

Orange roughy

The following text is unchanged from last year (there were no landings for orange roughy recorded during 2008 and 2009), and is included as Orange roughy is the only species in the SEAFO CA for which an abundance index is available.

To date, only the Namibian orange roughy dataset for Sub-Division B1 provided enough information to attempt to analyse trends. The fishery started in 1995, did not fish in 1998, but continued until 2005. During these 9 years, 7 Namibian vessels (Table 9) were fishing in the SEAFO Area for orange roughy and in total 1270 trawls were made and about 1000 tonnes of

deep-sea species were landed. A total of 290 tonnes of orange roughy and 303 tonnes of alfonsino were landed over this time period. The total annual effort in number of trawls and the total number of deep-sea fish (orange roughy, alfonsino, boarfish, oreo dory, and cardinal fish) landed is illustrated in Table 10. The LPUE was the highest in 1995 and thereafter decreased rapidly to reach the lowest LPUE in 1999. Since then the LPUE seems to have stabilized at a low level (Figures 5 and 6).

Table 9. Orange roughy/alfonsino: Fleet information, Sub-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

Table 10. Number of trawls made per year and the total landings of deep-sea species taken by the orange roughy fleet in Sub-Division B1.

	No of trawls	Landings (t)
1995	20	47
1996	223	340
1997	188	110
1999	16	4
2000	327	196
2001	295	130

2002	40	10
2003	63	32
2004	46	28
2005	61	40
2006	0	0
Total	1279	937

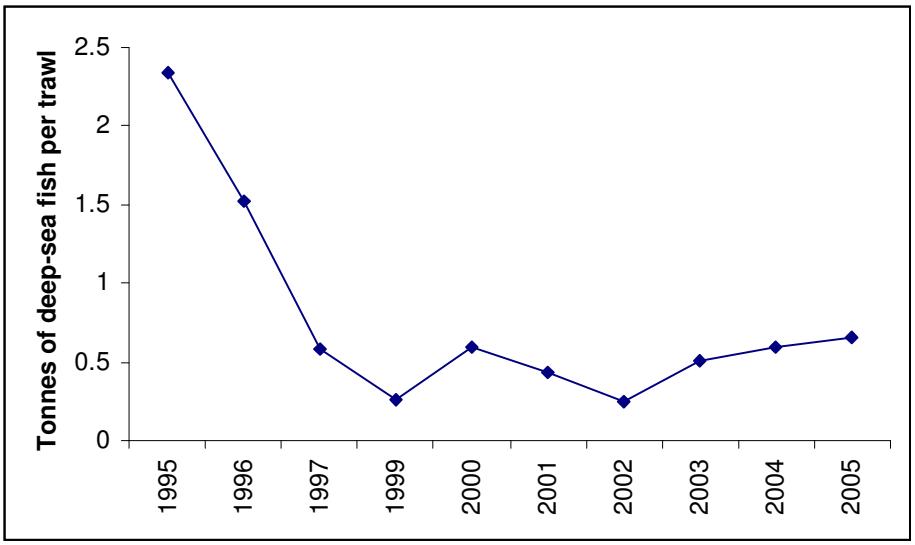


Figure 5. CPUE for the total deep-sea catch (all species) per trawl from 1995 to 2005 in Sub-Division B1.

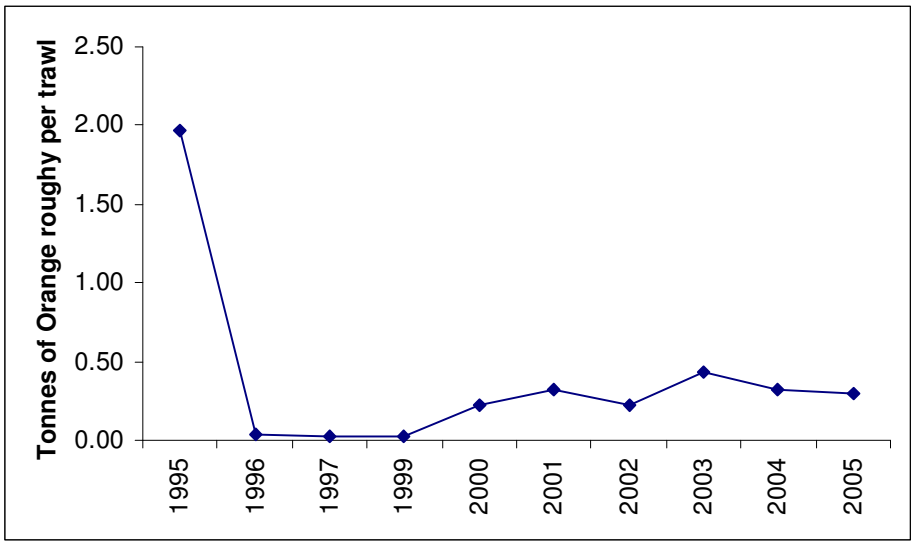


Figure 6. CPUE of orange roughy in tonnes per trawl in Sub-Division B1.

Stock Assessments

In view of the lack of data, stock assessments cannot be attempted now and in the foreseeable future.

c. Evaluate and suggest reference points for deep-sea fish resources.

In 2007 the SSC agreed to categorise the commercially most important species in the SEAFO Convention Area into two categories (A and B) on the basis of available information of life history characteristics, perceived vulnerability to fishing and the fishing gear used. SSC in 2008 reviewed this information and revised the vulnerability to fishing of toothfish, wreck fish and red crab from low to high. In 2009 the SSC has made a minor revision to the estimated longevity of deepsea crab. Table 11 shows life history characteristics and revised vulnerability to fishing of commercially important species.

Table 11. Major life history characteristics and vulnerability to fishing for commercially most important species in the SEAFO Area (mostly using data presented in SEAFO 2006 Scientific Committee Report).

Species	**Longevity (circa)**	**Growth rate**	**Aggregations**	**Vulnerability To fishing**	**Bottom fishing gears**
Orange roughy	150 years	Very slow	Yes	High	trawl
Oreo dories	150 years	Very slow	Yes	High	trawl
Alfonsino	17 years	Moderate	Yes	High	trawl/gill nets
Armourhead	14 years	Moderate	yes, in adult phase	High – but low fishing activity	trawl/gill nets
Patagonian toothfish	45 years	Slow	No	High	longline

Cardinal fish	100 years	Very slow	Yes	High – but low fishing activity	trawl
Wreckfish	80 years	Slow	No	High	longline
Deep-sea red crab spp.	15-20 years	Slow	Only sporadically	High	traps

Category A - considered to be long-lived, slow-growing and vulnerable to fishing

Orange roughy (*Hoplostethus atlanticus*)

Oreo dories (*Oreosomatidae* spp)

Alfonsino[1] (*Beryx splendens*)

Patagonian toothfish (*Dissostichus eleginoides*)

Wreckfish (*Polyprion americanus*)

Deep-sea red crab (*Chaceon* spp)

Cardinal fish (*Epigonus* spp)

Armourhead (*Pseudopentaceros richardsoni*)

Category B - considered to be moderate/short lived, faster-growing and less vulnerable to fishing.

No SEAFO species are currently classified in Category B.

SEAFO SCR Doc 01/2009 (reviewed under SSC ToR h) describes a method (Cheung et. al., 2005 and 2007; Musick, 1999) to identify the productivity and vulnerability of individual species using data currently available.

[1] Although not long-lived or slow growing, alfonsino was placed in category A because fisheries on this species are mainly on aggregations associated with seamounts and historical data suggests that large catches have been taken and that these aggregations may have been fished out.

Previously the Sub-Committee has attempted to identify reference points for all species. The only data available for use were LPUE data and these were sparse for most species and were considered unreliable especially where species were taken as bycatch. This situation remains unchanged.

Previously it was agreed that an alternative option was to set catch thresholds and this SSC recommended that this approach again be used this year.

d. Review of sampling/reporting protocols and requirements including fish identification keys.

Last year SEAFO introduced mandatory sampling forms for catches and other fishing details (including discards/benthos/seabirds/mammals) to be recorded by observers and also an observer summary form. These forms were based on CCAMLR protocols.

In 2009 these protocols have been followed in the toothfish fishery however a number of issues need to be addressed in the red crab fishery. Vessels fishing in the crab fishery have changed the format of the crab fishery forms, have not included detailed spatial catch and effort data and have not provided biological sampling information. Some summarised biological and coarse spatial information were included in the observer summary report, however the required format for this report was not followed.

Identification keys are not yet in place for both fish and benthos (e.g. corals, sponges etc.). The latter will be addressed at the forthcoming SEAFO VME workshop.

e. Complete FIRMS information fisheries sheets

The Sub-Committee updated the FIRMS stock inventories in accordance with FAO request.

f. Examine where appropriate assessment and research done by neighbouringassessment and management organization (such as BCLME/BCC, CCAMLR, GCLME, ICCAT, SWIOFC)

No assessments and results were received during this year.

g. Reviewing the Distribution of Reported Catches of Benthic Organisms (corals, sponges etc.)

A second joint Spanish-Namibian survey was conducted in February/March 2009 on the Ewing seamount and Valdivia Bank to complete the work developed in 2008. It is expected that the combined results will be available in 2010.

The preliminary results from the survey in 2008 were summarised by SSC in the 2008 SSC report.

h. Undertake review of the Submitted SEAFO Research Documents

SSC reviewed a working document (SEAFO WD 01/09) describing a part of the Portuguese fleet operating in the SEAFO area from 1998 to 2006 (Figueiredo and Moura, 2009). A summary of the abstract is given below.

"The SEAFO area has been commercially exploited by several countries but the information on the fisheries is sparse. Portugal has carried out commercial fishing activities in the SEAFO Convention Area and this paper summarizes the component of the fleet that fished mainly on the Vema Seamount (SEAFO Sub-Division C1). These fisheries are data poor and the information provided should be treated with caution".

SSC reviewed SRC Doc 01/09 entitled "Species profile proposal for the scientific bodies of SEAFO (López-Abellán , Figueiredo and Sarralde, 2009)".

"Some regional organisations similar to SEAFO have promoted and adopted the creation of templates for compiling and summarising the best information about fisheries and species within their management areas (e.g. CCAMLR, South Pacific RFMO). The aim of this species profile is to compile a document with the best available information about: i) the biology, ecology, productivity, vulnerability and population dynamics of the main species; ii) fisheries data; iii) factors or events affecting both the species and their environment; and iv) the evolution of their fisheries in the regional management area. The profiles provide a useful basis to update and extract key information related to the target species that could be used in assessment models, management advice and ecosystem modelling. Following the original model of standard template adopted by the South Pacific RFMO after several arrangements and simplifications, this paper presents a proposal to be analysed within SEAFO in order to consider its suitability and the possibility of adoption. This proposal includes a species profile template which contains explanatory text to help to complete it, and two incomplete species profiles as examples."

SSC also received (1) a draft of a proposed Census of Marine Life initiative entitled "Patterns and Processes of the Ecosystems of the Southern Mid-Atlantic" and (2) an activities report of the joint Spanish-Namibian multi-disciplinary research cruise on the Walvis Ridge seamounts. These documents will be addressed by the SC.

i. Review historical fisheries data

Historical data were reviewed by SSC and updates made where necessary (changes are indicated in the text). SSC is of the opinion that historical data are now updated up to 2008 with all data currently available. The organisation of data within the SEAFO Secretariat is problematic because of the lack of a functional database.

j. Make recommendations on lost fishing gear to SC.

Much of the information presented below is a summary a *UNEP Regional Seas Reports and Studies,* No. 185; *FAO Fisheries and Aquaculture Technical Paper,* No. 523 (Macfadyen *et al*, 2009).

Abandoned, lost or otherwise discarded fishing gear (ALDFG) is a problem that is increasingly of concern. Various United Nations General Assembly resolutions now provide a mandate for and require action to reduce ALDFG and marine debris in general (FAO Tech. Paper No. 523).

The impacts of ALDFG include: continued catching of target and non-target species (such as turtles, seabirds and marine mammals); alterations to the benthic environment; navigational hazards; beach debris/litter; introduction of synthetic material into the marine food web; introduction of alien species transported by ALDFG; and a variety of costs related to clean-up operations and impacts on business activities. In general, gillnets and pots/traps are the fishing gears most likely to "ghost fish" while other gear, such as trawls and longlines, are more likely to cause entanglement of marine organisms, including protected species such as corals, and habitat damage.

The factors which cause fishing gear to be abandoned, lost or otherwise discarded are numerous and include: adverse weather; operational fishing factors including the cost of gear retrieval; gear conflicts; illegal, unregulated and unreported (IUU) fishing; vandalism/theft; and access to and cost and availability of shoreside collection facilities. Weather, operational fishing factors and gear conflicts are probably the most significant factors, but the causes of ALDFG accumulation are poorly documented and not well understood.

Gillnet/tangle nets

Gillnetting/tangle netting, defined as fishing with nets in which all or a substantial part of the catch is retained by becoming enmeshed in one or more meshes (Potter and Pawson, 1991), is a fishing method attractive to fishers because, as a passive gear, gillnet use is fuel-efficient (Millner, 1985) and has less impact on the seabed and benthic organisms than active fishing methods such as trawling (Morgan and Chuenpagdee, 2003). Also, and depending on the mesh size used, gillnets can be highly selective and have little impact on small and juvenile fish (Millner, 1985). However, if gillnets are lost, discarded or abandoned, they can have a harmful effect on the marine environment by continuing to "ghost fish", defined as causing mortality of fish and other taxa after all control of the fishing gear is lost by a fisher (Brown and Macfadyen, 2007).

Research into ghost fishing in European waters indicated that ghost fishing in water shallower than 200 m was not a significant problem because lost, discarded and abandoned nets have a limited fishing life owing to their high rate of biofouling and, in some areas, their tangling by

tidal scouring (Carr *et al*., 1992; Erzini *et al*, 1997; Pawson, 2003; Revill and Dunlin, 2003). No notable long-term research has been conducted on the effect of ghost fishing in deeper water (Davies *et al*, 2007), but nets lost there are expected to stabilize to approximately 20% of the initial catch after 45 days (Humborstad *et al.*, 2003), though may continue to "fish" for periods of at least 2–3 years and perhaps even longer (Furevik and Fosseidengen, 2000), largely as a result of lower rates of biofouling and tidal scouring in deep water.

Other than damage to coral reefs, effects on habitat by gillnets are thought to be minimal (ICES, 1991, 1995; Stephan *et al.*, 2000). The impact of lost gillnets on coral reefs can be more severe. Al-Jufaili n*et al.* (1999) found that ALD nets affected coral reefs at 49 percent of sites surveyed throughout the Sultanate of Oman and accounted for 70 percent of all severe human impacts. Donohue *et al.* (2001) have confirmed the threat of ALDFG to the coral reefs

of the northwestern Hawaiian Islands, where derelict fishing gear is threatening coral reef ecosystems by abrading and scouring living coral polyps and altering reef structure

Pots and traps

ALDFG pots and traps can also ghost fish. As they are usually baited when they are set, if the pot is lost, over time the bait attracts scavengers, some of which are commercially important species. These scavengers may become entrapped and subsequently die, forming new bait for other scavengers. Entrapped animals may escape over time. Animals captured in ALDFG traps die from starvation, cannibalism, infection, disease, or prolonged exposure to poor water quality (i.e. low dissolved oxygen) (Van Engel, 1982; Guillory, 1993). The continued fishing by ALDFG pots was evaluated experimentally by Bullimore *et al.* (2001). A fleet of 12 pots were set in a manner to simulate ghost fishing, off the coast of Wales, United Kingdom. The original bait was consumed within 28 days of deployment yet the pots continued to fish, mainly for spider crab (*M. squinado*) and brown crab (*Cancer pagurus*). The catch declined over time, reaching a minimum between nine and ten months. The actual mortality of crustaceans was difficult to estimate, as some were able to escape and the pots were not under continual observation.

In general, traps are often advocated on an environmental basis for having a lesser impact on habitat than mobile fishing gear such as trawls and dredges (Rogers *et al.*, 1998; Hamilton, 2000; Barnette, 2001). The potential physical impacts of ALD traps depend upon the type of habitat and the occurrence of these habitats relative to the distribution of traps (Guillory, 2001). In general, sand- and mud-bottom habitats are less affected by crab and lobster traps than sensitive bottom habitats such as submergent aquatic vegetation beds or non-vegetated live bottom (stony corals, gorgonians, sponges) (Barnette, 2001). ALD traps, while individually occupying a small area, may impact benthic flora because of their large number and potential smothering effect (Guillory, 2001). A study of the impact of ALD traps and other fishing gear on the Florida Keys (Chiappone *et al.*, 2002) indicated that 64% of the stony corals were impacted, 22% of the gorgonians impacted and 29% of the sponges impacted.

Trawls

For trawl gear, the larger diameter synthetic multifilament twine common to trawl nets is the key factor that reduces ghost fishing mortality in lost gear. The material has a larger diameter than gillnet monofilament and is visible or of such a size that it can be sensed by the fish. Although lost trawl gear will often be suspended by floats and form a curtain that rises well above the bottom, many of the losses form additional habitat for such organisms as ocean pout, wolfish and cod, and substrate for attaching benthic invertebrates such as hydroids and sea anemone, again reducing their capacity to continue fishing (Carr and Harris, 1994).

Longlines

The mortality rate from lost demersal longlines is usually low (ICES, 2000; Huse *et al.*, 2002). Such lost gear may persist in the environment, however, when it is constructed

of monofilament. Lost longline gear may continue to catch fish as long as bait exists on the hooks. Fish caught on the hooks may themselves become a form of bait for subsequent fish, both target and non-target. ALD longlines will not stop fishing until all of the hooks are bare. The extent to which this occurs and its effects on community structure have not been analysed (NOAA, 2004).

While it is an important commercial gear, hook and line is also used by a large number of recreational and subsistence fishers, and therefore losses, especially within shallow inshore waters, may be very high. This of relevance in the SEAFO area as some seamount peaks has water depths of < 50m. In the Florida Keys, Chiappone *et al.* (2002) reported that the debris type causing the greatest degree of damage was hook and line gear (68%), especially monofilament line (58%), and that it accounted for the majority of damage to branching gorgonians (69%), fire coral (83%), sponges (64 percent), and colonial zoanthids (77%).

In studies of the impact of fishing on the coldwater corals of the northeast Atlantic, although lost longlines were observed on video surveys of coral areas, no evidence of actual damage to reefs was found, although it was supposed that coral branches might be broken off during the retrieval of longlines (ICES, 2002).

Effects of ALDFG on the marine environment

The longer-term fate of lost fishing gear is unclear. Modern plastics can last up to 600 years in the marine environment, depending upon water conditions, ultraviolet light penetration and the level of physical abrasion. Furthermore, the impact of microscopic plastic fragments and fibers, the result of the degradation of larger items, is not known.

Review of measures to reduce ALDFG

Measures to address ALDFG can be broadly divided between measures that ***prevent*** (avoiding the occurrence of ALDFG in the environment); ***mitigate*** (reducing the impact of ALDFG in the

nenvironment) and ***cure*** (removing ALDFG from the environment). The examples presented also illustrate that many of these measures can be applied at a variety of levels (internationally, nationally, regionally, locally) and through a variety of mechanisms from legal requirement through to voluntary schemes.

Preventative measures

Gear marking

FAO Guidelines set out the marking system and the responsibilities of owners of gear and fisheries authorities. They also cover the recovery of lost and abandoned gear, salvage and the role of gear manufacturers. In addition liabilities, penalties and control are discussed. (FAO Fisheries Report No. 485, 1991). Following the expert consultation, FAO produced a set of technical recommendations for the marking of fishing gear (FAO Fisheries Report No. 485 Supplement, 1993) with regard to a standardized system for the type and location of unique identifying marks on tags for each gear type as well as rules to be observed in marking gear so that its presence and extent is obvious to other seafarers. In 1994, at an expert consultation on the FAO Code of Conduct for Responsible Fishing. The experts offered, *inter alia,* the following solutions:

• reporting of all lost gear in terms of numbers and location to national management entities. Industry and government should consider efforts and means to recover ghost fishing gear; and

• Regulatory framework to deal with violators.

They recommended that:

• all fishing gear should be marked, as appropriate, in such a way so as to uniquely identify the ownership of the gear.

At the RFMO level, CCAMLR has an active programme to combat marine debris, including debris from fishing activities such as large-scale trawl fisheries for krill and longline fishing for Patagonian toothfish (NRC, 2008). Conservation Measure 10-01 on the Marking of Fishing Gear requires all fishing gear such as pots, marker buoys and floats to be marked with the vessel name, call sign and flag state. ICCAT does not have measures concerning ALD fishing gear, but Contracting Parties have to ensure that fishing gear is marked in accordance with generally accepted standards. Some nations have, however, already introduced gear marking requirements with explicit recognition of ALDFG issues. The Republic of Korea introduced a gear-marking initiative in 2006 as part of its National Integrated Management Strategy for Marine Litter. In 2006, the EC introduced regulations requiring the marking of passive gears (static longlines, gillnets and trammel nets) and beam trawls with the vessels' port licence number as a clear identifier. This applies to all vessels fishing this gear in Community waters outside of member state territorial waters (EC, 2006). However, worldwide there are few examples of requirements for gear marking intended to address the problem of ALDFG, i.e.

marking to prohibit the deliberate abandonment of gear through enabling identification of ownership.

On-board technology to avoid or locate gear

The increasing use of GPS and sea-bed mapping technology by fishing vessels affords benefits in terms of both reducing initial loss and improving the location and subsequent recovery of lost gear. With improvements in sea-bed imaging technology, some mobile gear can be towed close to the sea bed or known obstacles, enabling reduced direct impact/contact with the sea bed or these obstacles, thereby reducing the risk of gear snagging and loss. For static gear, technology can also enable the more accurate setting and subsequent location and retrieval of gear.

The main determinant of successful recovery appears to be the reason for the initial loss of fishing gear; fishers report that where nets are trawled away, it is virtually impossible to recover them at sea.

Transponders are now a common feature in many large-scale fisheries with the satellite tracking of vessels for safety and MCS purposes, and the use of transponderson gear such as marker buoys or floats is becoming more readily available. The fitting of transponders to gear improves the ability to locate gear in the water.

Port State measures

Port State measures are seen to be critical in addressing IUU fishing, which is a significant contributor to ALDFG problems as illegal fishers are unlikely to comply with regulation including any measures to reduce ALDFG. Those engaged in IUU fishing are also assumed to be key contributors to abandoned gear prompted by MCS activity. In 2001, FAO Members, recognizing the threat of IUU fishing, developed within the framework of the 1995 FAO Code of Conduct for Responsible Fisheries, an International Plan of Action (IPOA) to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA-IUU).

A scheme was devised to address IUU fishing at the port state level. In addition to a reduction in IUU fishing having a positive influence on reducing ALDFG in general, the scheme proposes port inspections that will enable “examination of any areas of the fishing vessel that is required, including …the nets and any other gear, equipment…to verify compliance with relevant conservation and management measures”. FAO is encouraging the strengthening of port State measures in order to combat IUU. One of the inspection processes being proposed (relating to gear inspection and the marking of gear) is gear inventories for vessels in international waters.

Onshore collection/reception and/or payment for old/retrieved gear

The provision of appropriate collection facilities is a preventative measure, as it can reduce the likelihood that a fisher will discard unwanted gear at sea. MARPOL Annex V Regulation 7 requires that “the Government of each Party to the Convention undertakes to ensure the provision of facilities at ports and terminals for the reception of garbage, without causing undue

delay to ships, and according to the needs of the ships using them." (IMO, 2006). There has, however, been international recognition that there are scale and capacity issues that have prevented the provision of adequate reception facilities at small ports and harbours, many of which are fishing harbours. While vessel crews docking at these berths well understand that such a service is not usually provided free of charge, vessel crews, ready and willing to pay for disposal services either directly from the facility or via independent entities, are not always able to secure these services. Although "rational" tariffs are recommended, any additional tariff for reception of waste such as fishing gear may be a disincentive to fishers compared to burning or dumping at no immediate direct cost. Numerous initiatives have since been developed that provide free waste reception facilities for solid waste such as fishing gear, or these costs are incorporated into general berthing charges or landing fees. In some circumstances where ALDFG gear is perceived to be a particular problem, authorities have created positive incentives through reward schemes for disposal of old and unwanted gear in appropriate facilities. The Korean Government Department, Ministry of Maritime Affairs and Fisheries (MOMAF), purchases waste fishing gear returned to port by fishers; this is reported to be highly effective in terms of recovery and disposal of gear.

Reduced fishing effort

Effort reduction measures can affect the causes and levels of ALDFG in different ways, depending on the type of input restriction. For static gear, the amount of gear in the water and the time it is left in the water (soak time), both influence the probability that gear will be lost or discarded, with greater gear use and longer soak times increasing the chances of lost gear.

Many fisheries already limit fishing efforts by monitoring use of pots or number of net hours where soak time is included as a key variable. The European Commission (EC) introduced an emergency temporary ban on gillnet fishing at depths >200 m in ICES Divisions VI and VIIb-k and Sub-area XII east of 27^{o}W (EC Regulation No 51/2005). These measures for deep-water gillnets were revised in 2006 and now include a permanent ban on all deep-water gillnet fisheries at depths >600 m and imposing maximum limits on the length of nets deployed (10 km) and the soak time (72 hrs) in the remaining fisheries at depths <600 m (EC Regulation No 41/2006).

Mitigating (reducing impacts) measures

Technology can be used to reduce the impacts of ALDFG, particularly through alterations to the gear itself to minimize the potential to ghost fish, but also through ways to better manage gear in the water.

Reduced ghost catches through the use of biodegradable nets and pots

A number of shellfish fisheries are required to use degradable escape panels in traps. For example, Florida's spiny lobster fishery has had such a requirement since 1982 (Matthews and Donahue, 1996). In Canada, recreational fishing traps require features "to ensure that if the trap is lost, the section secured by the cord will rot, allowing captive crabs to escape and to prevent

the trap from continuing to fish". (DFO, 2007). Also in Canada, the PacificRegion Integrated Fisheries Management Plan for crab by traps, 2008, includes various requirements related to biodegradable escape mechanisms. The use of biodegradable materials is less evident in net fisheries.

There have been some efforts to develop biodegradable and oxy-degradable plastics for use in the fishing industry. For example, the Australian and New Zealand Environment Conservation Council (ANZECC) was instrumental in promoting a national approach towards the use of biodegradable materials in bait bag manufacture (Kiessling, 2003).

Reduced ghost catches of incidental catch species

Fishing gears with the potential to capture significant bycatch of non-target species (cetaceans, pinnipeds, turtles, seabirds) when actively fishing, also have the potential to result in non-target species bycatch once gear is abandoned, lost or discarded. Mitigating against such ghost fishing of bycatch can be effected by using the same measures as in active fishery, such as acoustic beacons ("pingers"), reflectors in gillnet and set net fishing gears. But it should be recognized that the effectiveness of such measures can rapidly decrease when gear is no longer actively being fished and the pingers run out of power over time.

Of perhaps greater significance to ALDFG reduction are mitigation measures that are effective even when fishing gear is not being actively fished. Trials are progressing with substances that reflect sound, such as barium sulphate, with such substances being added to nylon net during production. The additive does not affect the performance or the look of the net in any way, but it reflects sound waves in ranges used by echo-locating animals (Schueller, 2001). Other developments supported by WWF's International Smart Gear Competition (www.smartgear.org) have produced weak ropes that are operationally sound, but break with the action of marine mammals, and magnets attached to longlines to repel sharks. Innovative solutions such as the passive pinger should retain effectiveness even when the gear is lost.

Clean-up/curative measures

Locating lost gear

Generally fishers will make every possible attempt to locate and recover their own gear as it has a significant economic cost in most fisheries. However in some circumstances, gear location surveys may be needed. Sea-based surveys can be used to locate lost fishing gear that may still be ghost fishing or damaging habitats. Where no accurate information on location of gear is available, the use of modeling techniques, local knowledge and anecdotal information to identify potential hotspots is essential in order to better target a survey intended for gear retrieval. Side scan sonar (SSS) is a sea-bed mapping technology that has become more accurate

and more affordable in recent years. However, SSS is likely to be applicable where relatively large or readily distinguishable items such as pots or traps are to be located. Other possible sources of information might include skipper interviews and the interpretation of VMS plots.

Gear recovery programmes

Curative measures often take the form of gear retrieval programmes, which typically entail using a creeper or grapnel to snag nets. Gear retrieval programmes have been undertaken in net fisheries in Sweden and Poland (Brown and Macfadyen, 2007). Retrieval programmes are also routinely employed by Norway, which led to Norwegian, English and Irish collaborative projects to recover ALDFG from the Northeast deepwater Atlantic gillnet fishery (Large *et al*, 2009). However, the efficacy of such surveys is largely reliant on information on the position of ALDFG provided by and collected from fishers.

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Implications for SEAFO

It is important that fishers record the nature and location of ALDFG. The SEAFO longline fishery form introduced last year has provision for this information, but this is not the case for the Crab or trawl fishery forms. **SSC recommends to SC that all SEAFO fishery forms include fields for ALDFG to include gear dimensions and geographical position.**

It is the view of the SSC that gillnets should be prohibited as is done in CCAMLR. There are currently no gillnet fisheries in the SEAFO CA and **SSC recommends to SC that gillnetting be banned in the SEAFO CA.** However if a ban is not implemented it seems sensible from a precautionary standpoint to introduce limitations on the length of fleets, soak-times and depth of fishing. As an interim measure **SSC recommends to SC that SEAFO adopts the current measures applied to EU fleets in the NE Atlantic (EC Regulation 41/2006) and limits the maximum length of individual fleets to 10 km, soak time to 72 hrs and prohibits gillnet fishing at depths greater than 600m. Vessels should not carry more than 100 km of nets at any one time.**

The only fisheries that currently pose potential ALDFG problems are longline fisheries for Patagonian toothfish and trap fisheries for deep-water red crab. In the absence of information from fishers, **SSC recommends to SC that the SEAFO Secretariat carries out a consultation with**

SEAFO fishing nations to determine the maximum limits on the length of individual fleets, soak time, and vessel gear capacity.

Many of the preventative and mitigation measures described above, in the opinion of SSC, are outside the Committee's expertise and **SSC recommends to SC Sethat these should be considered by the SEAFO Compliance Committee.**

k. Complete TXOTX questionnaire

SSC completed the report with the exception of issues relating to PET spp and Socio-economics section. These will be addressed by the SEAFO Secretary.

4. ANY OTHER MATTERS

There were no other matters raised.

5. ADOPTION OF THE REPORT

The report was presented and adopted by the meeting.

6. DATE AND PLACE FOR THE NEXT MEETING OF THE SUB-COMMITTEE

This was referred to the SC.

7. CLOSURE OF THE MEETING

On Friday at 17:30hrs October 1, the Chairperson declared the closure of the meeting after all items have been completed. In his closing remarks, the Chair expressed his satisfaction for the work accomplished and thanked all participants for their valuable contributions.