# Interim Deep-Sea Fisheries Impact Assessment Framework

## 1. Introduction

The SPRFMO Interim Measures adopted at the 4th meeting in Reñaca, Chile, in May 2007, in relation to assessments for Deep-Sea Fisheries[1] (DSF), require the Science Working Group (SWG) to "*design a preliminary interim standard for reviewing the assessments and develop a process to ensure comments are provided to the submitting Participant and all other Participants*". The SPRFMO Interim Deep-Sea Fisheries Impact Assessment Standard (DSF-IAS) is intended to guide the SWG in evaluating and commenting on assessments submitted by flag States that wish to participate in DSF in any of their development stages in the SPRFMO Area after the interim measures implementation date of 30 September 2007.

Work is currently underway to develop a detailed SPRFMO DSF-IAS. Pending the development and adoption of the detailed DSF-IAS, an initial framework and guideline is required to guide flag States in preparation of assessments, and the SWG in evaluating those assessments. This document contains the proposed draft interim SPRFMO DSF Impact Assessment Framework, and is intended to serve as the interim guideline pending development of the full standard.

## 2. Purpose

The purpose of this framework is to provide initial guidelines for flag States in preparing impact assessments and management measures to prevent or mitigate significant adverse impacts on VMEs for proposed Deep-Sea Fisheries in the SPRFMO area, and to guide the SPRFMO SWG in evaluating and commenting on submitted assessments. This framework provides contextual information to be considered in preparing assessments, including relevant definitions (Section 3new), key concepts (Section 4new). Section 6 then lists the sub-sections that are expected to be included in impact assessments on VMEs from DSF, with broad descriptions of the expected contents of each section.

It is intended that the full SPRFMO DSF Impact Assessment Standard will replace this framework and provide guidelines to conduct this assessments, according to international practices.

[1] As defined in the International Guidelines for the Management of Deep-Sea Fisheries in the High Seas (FAO, august 2008).

## 3.new Deep-Sea Fisheries

### 3.1new Definition

For the purpose of this framework, the fisheries that shall be referred as "Deep-Sea Fisheries" (DSF), are those that occur in areas beyond national jurisdiction and have the following characteristics:

i. the total catch (everything brought up by the gear) includes species that can only sustain low exploitation rates; and

ii. the fishing gear is likely to contact the seafloor during the normal course of fishing operations.

### 3.2new Mapping of the SPRFMO Footprint

The SWG, working in cooperation with the SPRFMO Secretariat, shall develop and maintain an electronic geo-spatial map of a 'joint footprint' for all participants in DSF in the SPRFMO area. The Secretariat should include seabed bathymetry and the SPRFMO maps of VMEs in this geospatial database.

This joint footprint map should be developed at the finest resolution practicable, to prevent inclusion of unnecessarily large un-fished areas into the defined 'joint footprint'. It is proposed that this footprint be expressed as grid blocks of 10 minute resolution, with a 'fished' block being defined as any grid block partially intersected or crossed by at least one track or plot of the hauled or settled gear[2].

The Secretariat shall be responsible for requesting these data, and for developing and maintaining the SPRFMO joint footprint geospatial database and map, at the agreed resolution.

The SWG will take this into consideration when evaluating the harvesting plan component of the impact assessments proposed for flag States in the interim period.

Efforts to map footprint areas, at least during the interim period, should focus on trawling. Trawling (bottom and midwater trawling) is currently the main deep-sea fishing activity in the SPRFMO area. In terms of the hierarchy in Table 1, these methods are expected to have potentially significant impacts on VMEs.

### 3.3new Proposed Ranking for Expected Fishing Gear Impact

The provisions of the SPRFMO interim measures for DSF apply to fishing gears, which are likely to contact seafloor. However, not all fishing gears involved have the same expected severity, magnitude or extent of impact on seabed communities. VMEs are therefore differentially 'vulnerable' to the impacts of different fishing gears.

The intent of UNGA Resolution 61/105 and the SPRFMO Interim Measures is clearly to minimize adverse impacts on the VMEs. Concerns are mainly focused on the impact of moving fishing gears that are designed to, or are likely to, be dragged across the seabed during fishing, causing direct physical damage to habitat forming benthic species. Table 1 shows the hierarchy of expected impact (magnitude, extent and duration) ranking of the various fishing gears.

[2] See Penney et al 2007 for an evaluation of the effect of adopting different resolutions for trawl footprint mapping.

Table 1. Hierarchy of expected extent and magnitude of impacts of various fishing gears on VMEs.

| Fishing Gear | Expected Impact |
|---|---|
| Bottom Dredging | High |
| Bottom Trawling | High |
| Midwater Trawling | Med – High |
| Settled Gill or Tangle Nets | Med – High |
| Trap and Pot Fishing | Med |
| Bottom Longlining | Low – Med |
| Drop Lining | Low |

The flag States should consider this hierarchy of expected impact into account when assess the proposed harvesting plan and SWG will explicitly take this hierarchy of expected impact into account when evaluating and commenting on impact assessments submitted by flag States in the SPRFMO area.

## 4new Key Concepts

### 4.1new Vulnerability of Marine Ecosystems

Vulnerability is related to the likelihood that a population, community, or habitat will experience substantial alteration from short-term or chronic disturbance, and the likelihood that it would recover and in what time frame. These are, in turn, related to the characteristics of the ecosystems themselves, especially biological and structural aspects. VME features may be physically or functionally fragile. The most vulnerable ecosystems are those both easily disturbed and very slow to recover, or may never recover.

The vulnerabilities of populations, communities and habitats must be assessed relative to specific threats. Some features, particularly the ones that are physically fragile or inherently rare, may be vulnerable to most forms of disturbance, but the vulnerability of some populations, communities and habitats, may vary greatly depending on the type of fishing gear used or the kind of disturbance experienced.

The risks to a marine ecosystem are determined by its vulnerability, the probability of a threat occurring and the mitigation means applied to the threat.

### 4.2new Significant Adverse Impacts

Significant adverse impacts are those that compromise ecosystem integrity (i. e. ecosystem structure or function) in a manner that: (i) impairs the ability of affected populations to replace themselves; (ii) degrades the long-term natural productivity of habitats; or (iii) causes, on more than a temporary basis, significant loss of species richness, habitat or community types. Impacts should be evaluated individually, in combination and cumulatively.

When determining the scale and significance of an impact, the following six factors should be considered:

i. the intensity or severity of the impact at the specific site being affected;
ii. the spatial extent of the impact relative to the availability of the habitat type affected;
iii. the sensitivity/vulnerability of the ecosystem to the impact;

iv. the ability of an ecosystem to recover from harm, and the rate of such recovery;

v. the extent to which ecosystem functions may be altered by the impact; and

vi. the timing and duration of the impact relative to the period in which a species needs the habitat during one or more life-history stages.

Temporary impacts are those that are limited in duration and that allow the particular ecosystem to recover over an acceptable time frame. Such time frames should be decided on a case-by-case basis and should be in the order of 5-20 years, taking into account the specific features of the populations and ecosystems.

In determining whether an impact is temporary, both the duration and the frequency with which an impact is repeated should be considered. If the interval between the expected disturbance of a habitat is shorter than the recovery time, the impact should be considered more than temporary. In circumstances of limited information, States should apply the precautionary approach in their determinations regarding the nature and duration of impacts.

## 5new Vulnerable Marine Ecosystems

### 5.1new Definition

VMEs has been formally defined in the context of DSF on the FAO International Guidelines for the Management of Deep-Sea Fisheries in the High Seas[3], as follows:

A marine ecosystem should be classified as vulnerable based on the characteristics that it possesses. The following list of characteristics should be used as criteria in the identification of VMEs.

i. Uniqueness or rarity - an area or ecosystem that is unique or that contains rare species whose loss could not be compensated for by similar areas. These include:

• habitats that contain endemic species;

• habitats of rare, threatened or endangered species that occur only in discrete areas; or

• nurseries or discrete feeding, breeding, or spawning areas.

ii. Functional significance of the habitat – discrete areas or habitats that are necessary for the survival, function, spawning/reproduction or recovery of fish stocks, particular life-history stages (e.g. nursery grounds or rearing areas), or of rare, threatened or endangered marine species.

iii. Fragility – an ecosystem that is highly susceptible to degradation by anthropogenic activities.

iv. Life-history traits of component species that make recovery difficult – ecosystems that are characterized by populations or assemblages of species with one or more of the following characteristics:

• slow growth rates;

• late age of maturity;

[3] Paragraph 42 of the Guidelines, which include Annex 1 containing examples of potencially vulnerable species groups, communities, and habitats, as well as features that potencially support them.

- low or unpredictable recruitment; or
- long-lived.

v. Structural complexity – an ecosystem that is characterized by complex physical structures created by significant concentrations of biotic and abiotic features. In these ecosystems, ecological processes are usually highly dependent on these structured systems. Further, such ecosystems often have high diversity, which is dependent on the structuring organisms.

## 5.2 Mapping of Vulnerable Marine Ecosystems

At this stage, given the limited knowledge of the distribution of deepwater benthic species, seamounts will have to be the main focus for mapping the distribution of potential VMEs. This focus is justified, given the known association of complex deepwater benthic communities with seamounts. Initially, will necessarily amount to mapping of seamounts and other topographic features that have a high probability of supporting VMEs.

Current maps of seamounts only show the distributions of large seamounts (> 1500m), notably that by Kitchingman & Lai (2004) (Figure 1). Further work in more fine spatial scale is required to identify smaller seamounts, in accordance with the characteristics proposed in VMEs definition in Section 5.1 new.

Contextual information also needs to be added to GIS VME maps to identify vulnerable or diverse systems, and to provide a scientific basis for moves towards higher levels of protection for the more vulnerable systems, or development of proposals to protect certain proportions of each significant habitat type.

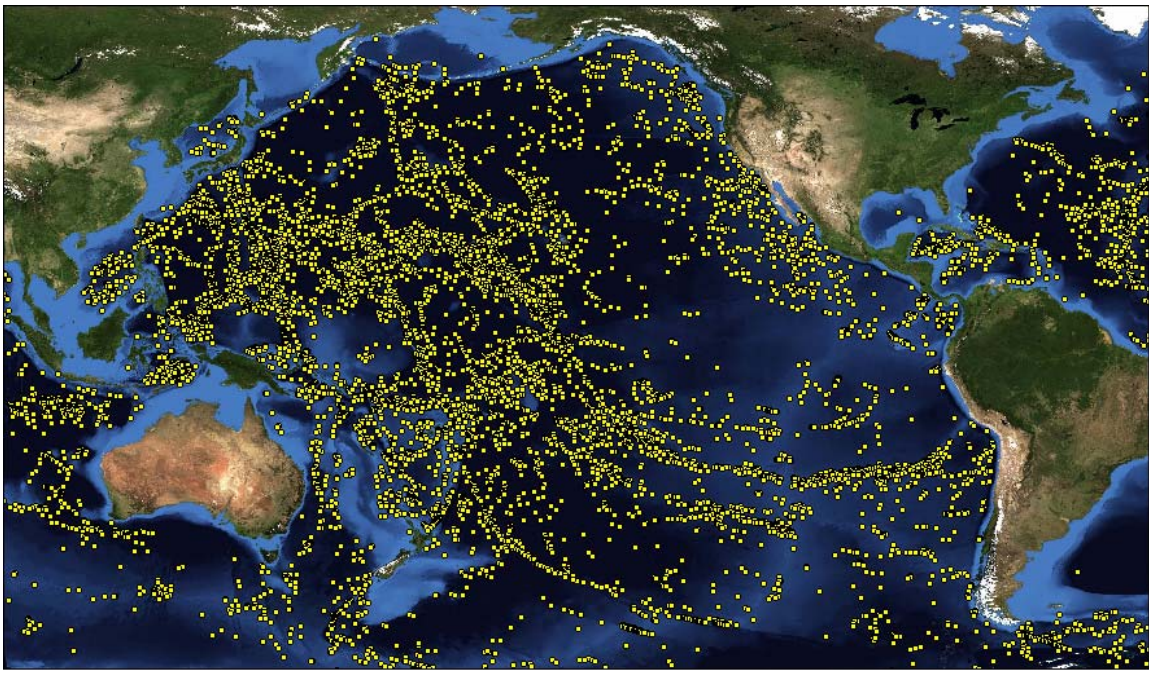

**Figure 1**. Distribution of potential seamounts predicted by satellite altimetry analyses (from Kitchingman & Lai 2004). This technique is thought able to detect seamount features with an elevation of 1,500m or greater.

## 6. Impact Assessment

Impact assessments submitted by flag States for evaluation and comment by the SWG will be expected to contain the following sub-sections:

### 6.1 Description of the Proposed Harvesting Plan

Impact assessments submitted by flag States to the SPRFMO Secretariat shall contain a detailed harvesting plan, providing a quantified description of the conducted or planned fishing operations, including:

i) Type of fishing gears to be used, including description of relevant aspects of the gear needed to evaluate potential impacts.

ii) Fishing areas, depth range to be fished and intended period and duration of fishing.

iii) Target species, and likely or potential by-catch species.

iv) Effort levels in terms of number of vessels, number of tows, estimated tow durations or distance (ranges).

v) Estimated catch and discard quantities, as appropriate.

vi) Information on vessels to be used: Vessel sizes, GRT, horsepower, names, confirmation that they appear on the list of approved SPRFMO vessels, flags and callsigns. These vessels should appear on the list of approved vessels submitted by flag States to the SPRFMO Secretariat.

### 6.2 Baseline Information on VMEs in Fishing Areas

This section should contain scientific and technical information available to be provided by flag States:

i) The ecosystem, habitat and communities in the fishing areas, against which future changes are to be compared.

ii) Identification, description and mapping of VMEs or topographic features, known or likely to occur in the fishing area.

iii) Historic fishing patterns in terms of catches and fishing effort.

iv) Status of the target fisheries resource.

In conducting impact assessments, States should consider other relevant baseline information from similar or related DSF, species and ecosystems in other areas of the high seas. States which have information should provide it to the Secretariat of SPRFMO in order to make it available to design impact assessment proposals by other flag States.

The SPRFMO Secretariat will make the SPRFMO geospatial maps of VMEs, bathymetry and joint footprint available to facilitate mapping of proposed harvesting plan in context with this baseline geo-spatial information.

To facilitate evaluation of the relationship between proposed fishing areas, the joint footprint and existing VME maps, flag States should provide their maps for proposed harvesting plans to the Secretariat in a compatible GIS format, for inclusion in the SPRFMO geospatial database.

### 6.3 Impact Assessment Methods

This section should specifically address:

i) The data and methods used to identify, describe and assess the impact of the fishing activity occurred or expected to occur in the fishing areas.

ii) The procedure for scoring and weighting characteristics of VMEs, according to their relative contribution to vulnerability, indicated in section 5.1new.

iii) Risk assessment methods to identify impacts by fishing operations to determine which impacts are significant, particularly impacts on VMEs and/or low productivity fisheries resource.

SWG of the SPRFMO should consider gradualism in the development and application of the Impact Assessment Methods, regarding the process of accumulation of knowledge and information according with the stages on the development of the DSF, for evaluation of the likely fishing impacts on ecological systems.

In the initial stages -as exploratory or experimental fisheries- qualitative or semi-quantitative methods will be privileged. On established fisheries, which have time-series and enough knowledge, quantitative methods should be applied.

Approaches developed for Environmental Impact Assessment (EIA) are listed in Annex 1, in a non neither exhaustive nor prescriptive manner.

### 6.4 Management and Mitigation Measures

This section should detail proposals for how the harvesting plan will be conducted to avoid or minimize significant adverse impacts on VMEs[4], including:

i) Description of gear selection, design, modification or deployment to prevent or reduce adverse impacts.

ii) The process to be used to detect evidence of fishing on VMEs, and the procedure to adhere to the SPRFMO requirement to move 5 nautical miles away from any VME detected while fishing. If this will be monitored by observers, then this should be cross-referenced in the section on monitoring, and details provided on the information to be recorded by observers to document the presence of VMEs.

### 6.5 Monitoring and Data Reporting

This section should detail all data and information gathering and reporting systems that will be used to monitor the proposed harvesting plan, catches and interactions with VMEs, including:

i) Details of VMS systems to be operated on vessels, including who these will report to, reporting frequency and reporting accuracy (as required in terms of the SPRFMO VMS Standard).

ii) Catch and effort monitoring systems to be used, including catch and effort reporting systems to the flag States concerned, and additional systems to be implemented specifically for the proposed operation. These monitoring systems should specifically address how retained and discarded by-catches are to be monitored and

[4] See Shotton *et al.* (2006), Management of Demersal Fisheries Resources of the Southern Indian Ocean.

reported. There should also be reporting systems in place to record whether a VME has been encountered during fishing.

iii) Details of the scientific observer coverage planned for the proposed fishing operation, including levels of coverage, how deployments will be designed to achieve statistically representative coverage of the proposed harvesting plan, and what information observers will be collecting. Monitoring system should be designed according to the stage of development of the DSF and should ensure that DSFs fishing operation achieve appropriate coverage.

iv) Description of the data that will be provided to the SPRFMO Secretariat for the fishing operation including, as a minimum, the data required in terms of the SPRFMO Data Standards and Observer Programme Standard, but also describing any other information (seabed bathymetry or mapping, VME identification and characterization) that may be provided.

### 6.6 Impact Assessment Report

A concluding Environmental Impact Assessment (EIA) section should be presented for all participants, which conduct fishing activities on DSFs in the SPRFMO area, according with the stage of development of the fishery.

i) In the case of initial stages of DSFs -exploratory or experimental- flag States should submit to SWG of SPRFMO an overview and summary EIA, identifying main likely impacts according with the hierarchy of the expected impact of the specific fishing gear, the scale and significance of the likely impacts and the probability to encounter a VMEs in the fishing areas of the proposed harvesting plan and degree of vulnerability.

ii) In the case of an established DSF, flag States should submit a proper EIA, considering baseline information of the ecosystem in early stages, based on the best scientific and technical information available, including the assessment of the targeted fishery resource.

In the first case, all impacts ranked as being above moderate, report should include the proposed monitoring framework, and the management measures to detect, prevent or minimize significant adverse impacts should be described.

In the second case, report should describe detailed information about the management measures implemented and applied at the DSF, on resource conservation and/or ecosystem restoration during all the fishery period.

## 7. References

Chuenpagdee, R., L.E. Morgan, S.M. Maxwell, E.A. Norse & D. Pauly, 2003. Shifting gears: assessing collateral impacts of fishing methods in US waters. *Front. Ecol. Environ.*, 1(10): 517–524.

Clark, M.R., D. Tittensor, A.D. Rogers, P. Brewin, T. Schlacher, A. Rowden, K. Stocks & M. Consalvey, 2006. Seamounts, deep-sea corals and fisheries: vulnerability of deep-sea corals to fishing on seamounts beyond areas of national jurisdiction. UNEP-WCMC, Cambridge, U.K.

DEFRA 2002. Guidelines for Environmental Risk Assessment and Management. UK Department for Environment, Food & Rural Affairs. (http://www.defra.gov.uk/ENVIRONMENT/risk/eramguide/index.htm).

FAO 2008. International Guidelines for the Management of Deep-Sea Fisheries in the High Seas. . FAO, 16 pp.

Hobday, A. J., A. Smith, H. Webb, R. Daley, S. Wayte, C. Bulman, J. Dowdney, A. Williams, M. Sporcic, J. Dambacher, M. Fuller & T. Walker., 2007. Ecological Risk Assessment for Effects of Fishing: Methodology Report R04/1072 for the Australian Fisheries Management Authority, Canberra.

Kitchingman, A. & S. Lai, 2004. Inferences on potential seamount locations from mid-resolution bathymetric data. In: Seamounts: Biodiversity and Fisheries (eds. T. Morato, D. Pauly). UBC Fisheries Centre, 78. 261 pp. Vancouver. B.C.

MacDonald, D.S., M. Little, N.C. Eno, & K. Hiscock, 1996. Disturbance of benthic species by fishing activities: a sensitivity index. *Aquatic Conservation: Marine and Freshwater Ecosystems,* 6, 257-268.

Penney, A.J., M.R. Clark, M. Dunn, S. Ballara & M. Consalvey, 2007. A descriptive analysis of New Zealand bottom trawl catch & effort in the proposed convention area of the South Pacific Regional Fisheries Management Organization. *Report to the 4th meeting of the SPRFMO Science Working Group*, 31pp. (SPRFMO-IV-SWG-05).

Pitcher, T., T. Morato, P. Hart, M. Clark, N. Haggan & and R. Santos, 2007 (in press). Seamounts: Ecology, Conservation and Management. Blackwell Publishing.

Shotton, R. (comp.), 2006. Management of Demersal Fisheries Resources of the Southern Indian Ocean. Report of the 4th and 5th *ad hoc* Meetings on Management of Demersal Fisheries Resources of the Southern Indian Ocean. *FAO Fisheries Circular No. 1020*, Rome, FAO. 90pp.

Tyler-Walters, H., K. Hiscock, D.B. Lear, & A. Jackson, 2001. Identifying species and ecosystem sensitivities. Report to the Department for Environment, Food and Rural Affairs from the Marine Life Information Network (MarLIN), Marine Biological Association of the United Kingdom, Plymouth. (http://www.marlin.ac.uk/pap/defrareport.php).

## 8. ANNEX 1 Environmental Assessment Approaches

The SPRFMO Impact Assessment Standard will provide recommendations on specific environmental assessment approaches and best practices to use in developing EIA6. In the interim, participants should refer to the following of EIA approaches, noting that this list is neither prescriptive nor exhaustive:

ICES: There have been two main approaches to assessing the sensitivity of habitat to fishing: i) ranking sensitivity of habitat units (physical and biological) to disturbance; and ii) ranking the impacts of the gear. ICES conclude that these should be combined.

NOAA EIS: Spatial and temporal analysis of the distribution of habitat type, distribution of biota, habitat use, habitat sensitivity, dynamics of fishing effort.

MarLin: Approach consists of i) Identify "key / important" species in habitat/biotype; ii) Assess biotype sensitivity based on key species; iii) Assess recoverability of key/important species (Tyler-Walters et al. 2001).

Sensmap: A sensitivity index for benthic species or habitat to physical disturbance from fishing has been adapted to include chemical contamination and other environmental disturbance. Sensitivity is assessed based on intolerance to the disturbance (fragility of biota and intensity of fishing) as well as ability to recover. Sensmap uses the UK Marine Habitat Classification (MacDonald et al. 1996). Similar to MarLin.

Canadian and US Framework: Damage schedule approach which ranks the severity of fishing gear impacts on a binary questionnaire (Chuenpagdee et al. 2003).

CSIRO Ecological Risk Assessment for Effects of Fishing: ERAEF is a hierarchical framework that moves from a Level 1 qualitative analysis through to a more focussed semi-quantitative Level 2 to Level 3 which is model based and fully quantitative. This approach leads to a rapid identification of high risk activities, and evaluation of how fishing impacts on ecological systems (Hobday et al. 2007).

UK Department for Environment, Food & Rural Affairs (DEFRA) Guidelines for Environmental Risk Assessment and Management.

[6] The primary role of the SWG will be to critically evaluate this impact assessment against the standard, and to comment on whether the indicated impact rankings are appropriate or not. The SWG will need to work towards adopting an appropriate ranking system for these EIAs, and to identify the best risk management technique.