PrepCon-03-OBS-04

MANAGEMENT OF DEEPWATER FISHERIES BY SEAFLOOR FEATURE IN THE SOUTH PACIFIC OCEAN

High Seas Fisheries Group[1]
(*HSFG*)

November 2010

Preface

This proposal by the HSFG reflects their view that high-seas deepwater fisheries should contribute to food security and employment and create wealth as is consistent with most fishery management and international conservation declarations. To do this, the HSFG is committed to the sustainable and responsible harvesting of fisheries and conservation of bio-diversity to protect both dependent and associated species to the greatest extent possible within the constraints of sustainable utilisation.

This paper reviews current management practices of concern: including the use of best available scientific information, the Ministry of Fisheries *Total VME Indicator Score*, the 20′ by 20′ block management process, the 5-mile move-on requirement and catch limits/quotas. This raises concerns regarding management measures relating to

i. protection of benthic fauna;
ii. where fishing is or is not permitted; and
iii. under what conditions.

Because of serious concerns with the present management structure being a management of discrete rectangular area / block areas the HSFG proposes that a feature-by-feature management policy be implemented instead.

As a consequence of this analysis of the New Zealand-supported interim measures being implemented for Southwest Pacific Ocean Deepwater Fisheries the HSFG proposes that the Ministry of Fisheries amend its approach to the management of these fisheries and request the Deepwater Scientific Group and Scientific Committee of the SPRFMO proceed to review the methods proposed here for adoption. The HSFG is willing to work with relevant people and committees as appropriate to facilitate this.

Cite this document as:

HSFG 2010. Management of Deepwater Fisheries by Seafloor Feature in the Southern hemisphere South Pacific Oceans. High Seas Fisheries Group, Nelson, New Zealand. 20pp.

[1] Talley's Group Limited, Sealord Group Ltd, Richardson Fishing Limited, Endurance Fishing Limited, Pescatore Fishing Limited and Anton's Trawling Limited

Contents

1. PURPOSE OF THIS DOCUMENT

The New Zealand High Seas Fisheries Group (HSFG) has prepared this document to propose an alternative and, in their view, improved management method to the current 'interim' management measures imposed on HSFG members by the Ministry of Fisheries for Deepwater Fisheries in the High Seas of the Southwest Pacific Ocean. These measures are to come under the aegis of the South Pacific Regional Fisheries Management Organization (SPRFMO). Thus this document:

i. Summarizes the current management regime and identifies shortfalls;
ii. Outlines the proposed management regime;
iii. Identifies the benefits and costs that would be involved in the implementation of this management approach;
iv. Documents the role that the HSFG is prepared to undertake in support of this management approach;
v. Raises relevant negotiating issues
vi. Identifies issues related to the setting of catch quotas and
vii. Details actions the HSFG requests the Ministry of Fisheries to take in upcoming SPRFMO negotiations

2. BACKGROUND

On 23 April 2008 the Chief Executive addressed letters to HSFG members setting out the final fishing permit conditions relating to bottom trawling in the South Pacific Ocean. The dissatisfaction of the HSFG with the current management protocols along with the further proposals that it understands the Ministry of Fisheries will present in forthcoming negotiations over interim (but to become permanent?) management arrangements for the fisheries to come under the aegis of SPRFMO have been documented in separate correspondence.[2]

In summary, the HSFG has noted, among other concerns, the following:

The manner and policy direction in which New Zealand Government has been driving the implementation of the interim measures;

i. The continued reliance on ill-defined concepts that are scientifically weak and essentially impossible to operate under in a consistently rational manner (VMEs and SAIs);

ii. The proposed management of the High Seas fishery on the basis of science that has been based on partial information and predictive modelling whose assumptions do not reflect the actual history of the fishery.

iii. The use of spatial closures as an effective method of mitigating adverse impacts.

[2] (a) Letter of 11 October 2010 to Mr James Brown, Ministry of Fisheries, Wellington regarding SPRFMO Interim Measures: Review Process; (b) E-mail of 20 October 2010 to Jane Willing and James Brown, Ministry of Fisheries, Wellington regarding Benthic Assessment Framework.

iv. The categorisation of certain areas of heavily trawled, lightly trawled and medium trawled blocks.

v. The proposed implementation of the particular catch limits on the High Seas in the SPRFMO area based on the Penney review;

vi. The proposed thresholds for bottom fauna (VME indicator scores).

In addressing these issues, the HSFG is of the view that management measures should be:

i. Consistent with relevant national and international obligations;
ii. Effective in achieving policy objectives and programme goals;
iii. Conducive to efficient fishing operations;
iv. As simple as the operational setting will allow to maximize the ability to comply with conservation measures;
v. Unambiguous and not liable to subjective and/or arbitrary interpretation;
vi. Based on analyses that use all data relevant to the fishery;
vii. Where management decisions unavoidably depend on predictive modelling, the assumptions that are used should be discussed with those with first-hand experience in the fishery to ensure they are correct and so minimize the chance of erroneous conclusions.

This note has as it basis three assumptions that re-occur throughout the document.

- The purpose of the fishery is to produce food, provide employment and create economic benefits. Thus, the objective of management should be to create maximum sustainable (welfare) benefits. This requires (a) ensuring that fishery yields are sustained at high levels, i.e. stock biomasses must be maintained at productive levels *while* (b), simultaneously ensuring the protection and healthy survival of 'ecosystems' that occur in the region of the fisheries (i.e. on the seafloor features).[3] This reflects the objectives of the Fisheries Act 1996.

- ***All*** useful and available information, current and historical, should be used in management decision-making on the fishery: this is required by the much - quoted requirement "to use the best available scientific data". Thus, there seems no reason why time restrictions or 'windows' should be placed on the data that are used in preparing the management protocol – knowingly avoiding the use of relevant and obtainable data is unscientific and counter-productive. Likewise, all relevant area information should be used while remaining aware that some past operating practices have misreported where fishing occurred and thus the need for appropriately resolving such distortions (i.e. grooming) in the data record.

[3] Note: The extent fish stocks targeted on the seafloor features are dependent on (other) biological aspects of the ecosystems associated with the seafloor features remains undetermined.

- The use of highly advanced acoustic and navigational technology in this fishery fundamentally distinguishes it from many of the (mainly boreal) deepwater fisheries that appear to have prompted many environmental lobbyists to have labelled "bottom trawling" as destructive. HSFG's vessels undertake precision fishing operations: the relevant HSFG vessels use 'leading-edge' technology both in the aimed or directed trawling and positional recording of where fishing occurs: positioning errors are trivial. Usually only a small (tiny?) fraction of the habitat of benthic ecosystems on any one bottom feature is contacted by the fishing gear (indeed, HSFG vessels exclusively use pelagic-gear trawl doors – they are a requirement of aimed trawling!).

The Current Management Measures

A variety of documents exist that outline in detail the current interim management measures. In some cases these are perplexing. For example, in the SPRFMO paper[4] titled "Interim Measures Adopted by Participants in Negotiations to Establish South Pacific Regional Fisheries Management Organization" it is noted:

7. *Require that vessels flying their flag cease bottom fishing activities within five (5) nautical miles of any site in the Area where, in the course of fishing operations, evidence of vulnerable marine ecosystems is encountered, and report the encounter, including the location, and the type[5] of ecosystem in question, to the interim Secretariat so that appropriate measures can be adopted in respect of the relevant site. Such sites will then be treated in accordance with paragraph 6 above.*

The paper then goes on to record in Footnote 3 that:

'For the purposes of these interim measures, **"vulnerable marine ecosystems includes** s**eamounts**, hydrothermal vents, cold water corals and sponge fields.'

In the preceding paragraph (6) it notes:

6. *In respect of areas where vulnerable marine ecosystems are known to occur or are likely to occur based on the best available scientific information, close such areas to bottom fishing unless, based on an assessment undertaken in accordance with paragraphs 11 and 12 below, conservation and management measures have been established to prevent significant adverse impacts on vulnerable marine ecosystems and the long-term sustainability of deep sea fish stocks or it has been determined that such bottom fishing will not have significant adverse impacts on vulnerable marine ecosystems or the long term sustainability of deep sea fish stocks.*

Paragraphs 11 and 12 note as follow:

11. *"Assess, on the basis of the best available scientific information, whether individual bottom fishing activities would have significant adverse impacts on vulnerable marine*

[4] < http://www.southpacificrfmo.org/interim-measures/>
[5] Always a benthic fauna ecosystem?

ecosystems[6], and to ensure that if it is assessed that these activities would have significant adverse impacts, they are managed to prevent such impacts, or not authorized to proceed.

12. Apply the following procedures regarding the assessment described in paragraph 11 above:

a) Participants are to submit to the Interim Science Working Group their assessments of whether individual bottom fishing activities would have significant adverse impacts on vulnerable marine ecosystems, including the proposed management measures to prevent such impacts, and make these assessments publicly available.

b) The Interim Scientific Working Group will review the assessments and proposed management measures and provide comments to the submitting Participant. For the purposes of carrying out such reviews, the Interim Scientific Working Group will 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 within two months. In the meantime[7], the submitting Participant may provisionally apply their proposed management measures.

c) Participants may, on the basis of the assessments submitted under sub-paragraph (a) above and the comments provided under sub-paragraph (b) above, authorize vessels flying their flag to undertake bottom fishing activities in the region of the Area for which the assessment was conducted and require such vessels to implement conservation and management measures to prevent significant adverse impacts."

Briefly, through the conditioning of High Seas Permits, the Ministry of Fishery applies the following 'interim' management measures to New Zealand flagged vessels operating on the high seas.

Areas of some past deepwater trawling fishing activities by New Zealand flagged vessels are assigned to one of four categories:

i. *Areas that analyses indicate most fishing and catches have been taken in the past by New Zealand flagged vessels*: fishing is to be permitted to continue in these areas subject to the setting aside of part of these areas for conservation purposes.
ii. *Areas where past fishing has been judged to have been moderate*: In these 'medium' areas if the bycatch from a single trawl contains more than a specified threshold level of certain benthic species the vessel must stop fishing operations at that location and is not permitted to continue fishing within five nautical miles of that location. However, other vessels may fish at the location and the vessel may resume fishing activities at

[6] If the fishing activities do not have significant adverse impacts, can the marine ecosystem be vulnerable?
[7] Is this to imply that the Interim Scientific Working Group will determine the ultimate management measures?

that location on a subsequent voyage. No rational justification is known (at least to the HSFG) for the required vessel movement distance of five nautical miles, for the benthic threshold value weights that would required the vessel to 'move-on' or for the 'bio-diversity' multiplier factor that is used.

iii. *Areas where little past fishing has been undertaken*: these areas are to be closed to fishing as a protection measure.
iv. *Areas the Ministry of Fisheries assumes have not been fished by New Zealand flagged vessels in the past*: future fishing in these is to be subject to yet-to-be-established 'new fishing'/ 'exploratory fishing' protocols.

The HSFG concludes from the above that:

i. The Ministry of Fisheries accepts that seamounts are, *a priori*, *vulnerable marine ecosystems* not withstanding that:

    a. HSFG vessels fish a wide range of seafloor features of which seamounts are only one and indeed, are a minority of the fished features: this implies either a lack of understanding by those developing the management guidelines or a perception that the concepts needed simplification.
    b. There is no indication as to what the Ministry of Fisheries understands to comprise the 'ecosystem' in this context – perhaps the most fundamental biological concern.

ii. In areas where fishing is permitted to continue (heavily fished areas) there is little probability of fishing having significant adverse impacts to vulnerable marine ecosystems ***or*** the long-term sustainability of deep sea fish stocks – subject to catches remaining within those established collectively for the entire SPRFMO area for 2002 - 2006.
iii. In areas subject to the 'move-on' rule (the medium-fished areas), specified levels of particular benthos bycatch that trigger the vessel movement requirement will result in further, as yet not articulated and documented, measures that will prevent significant adverse impacts on vulnerable marine ecosystems.
iv. The long-term sustainability of targeted fish stocks will be protected, at least in the interim, by capping catches/effort (?) to that observed during 2002 – 2006.

In summary, the HSFG finds the interim measures to be complex, subjective, and at times apparently incoherent, given that the Parties seek two prime utilization objectives:

i. the use outcome - fisheries resources are used in a manner that provides greatest overall economic, social and cultural benefit - and
ii. the environment outcome - the capacity and integrity of the aquatic environment, habitats and species are sustained at levels that provide for current and future use
    The HSFG notes further that all fisheries affect the ecosystems within which they operate and that excessive harvests will have significant adverse impacts on the ecosystems of which the fish are part. But, if fishing potentially or in reality only ever affects a small or minor part of the habitat of vulnerable species, then it is unclear how an incidental bycatch can constitute a 'significant adverse impact.

3. CONCERNS WITH CURRENT MANAGEMENT PRACTICES

3.1 Use of Best Available Scientific Information

It is almost a mantra that fisheries managers should use 'the best available scientific information'. The HSFG takes this to mean that all useful information should be used in the analysis of policy options and in the making of management decisions. It is evident that the interim management measures for the deepwater fisheries to come under the aegis of the South Pacific Regional Fisheries Management Commission (SPRFMO) are not always consistent with this important principle. In particular:

i. The arbitrary restriction of the baseline data period to 2002 – 2006 for catch, effort and fishing data may result in distorted management practices. New Zealand vessels have exploited this fishery from the 1980s and while all data may not be readily available, much data is. At a minimum, comparative analyses should be undertaken using all data that can be obtained.
ii. Information that is in part undocumented, but which the HSFG considers reliable, indicates that fishing has occurred more widely that is currently described as during earlier periods fishing effort locations were sometimes misreported to maintain vessel competitivity. Consultations with informed skippers and reconsideration of the procedure for assigning areas as lightly, moderately and heavily fished should be revisited (if use of this method is unavoidable).
iii. Some vessels are now avoiding fishing in the 'moderately' fished blocks where a move-on requirement may be imposed. This may bias assumptions as to how fishing effort is rationally distributed.
iv. Fishing techniques and technology have evolved during the period of the New Zealand South Pacific deepwater fishery: thus greater emphasis should be placed on the most recent practices as it will more accurately describe the fishing relationships of the future. The practice of extensive wide-area extended-period bottom trawling undertaken by smaller vessels in the past is not longer part of this fishery. The HSFG would like confirmation that these data, which represent fishing practices that are no longer part of the fishery, are not being used in a manner that would bias estimates and thus conclusions as to how the fishery operates.

3.2 The 20' by 20' Management Blocks

The interim measures implemented by the Ministry of Fisheries use rectangular areal management units of 20' of latitude (20 nautical miles in the case of latitude) and 20' of longitude. The use of marine rectangular areas defined by convenient numbers of degrees and/or minutes for fisheries reporting is a long standing practice, dating from, at the latest, the post WWII years. In these earlier times, such areas were sensible: they often applied to fisheries that were prosecuted over fairly extensive areas, precise navigational aids that would have permitted more accurate position fixing were unavailable and the extended areas from which data was reported provided a convenient means of obscuring exact fishing locations (despite this, area-misreporting was wide spread).

While the proposal of the Ministry of Fisheries to adopt rectangular summary areas for management purposes is consistent with the area-based management practices of the last century, the HSFG believes that such a practice forgoes many benefits. The use of rectangular reporting areas may mean that a single rectangle may contain several seafloor features that are/can be fished and which differ in their characteristics in providing habitat for benthic fauna and their fisheries productivity. Or, they may define areas of no management interest or relevance. Further, block-based management is not consistent with HSFG fishing practice that has been followed for over two decades, the distribution of the fishery populations, or the assessment methods that the Ministry itself has commissioned and accepts.[8]

The HSFG has further concerns about the method used to classify the types of areas to produce closed areas, open fishing areas and conditionally open fishing areas. These concerns arise from uncertainties as to the suitability of the data that were used in making the classifications and the arbitrary nature of the basis for decisions regarding what areas should be unconditionally open to fishing and what areas should be subject to move-on requirements if there was 'evidence' of a vulnerable marine ecosystem. Further, the HSFG believes that this method is not the most effective for ensuring conservation of fragile emergent benthic fauna. Fishing may be permitted in areas that provide good habitat for fragile emergent benthic fauna and efforts to control it may be desirable (and would be encouraged by the HSFG). Further, the control on fishing in the 'medium' areas is such that expert decision makers are unlikely to have the information they need to determine if that area should be protected from fishing in the future – in which case the decision, which is implicitly scientific, may be made on subjective or political grounds.

For these reasons, the HSFG believe that management on a sea-floor-feature by sea-floor-feature basis is more rational and will make for better fisheries management (see Section 4.2).

3.3 The Ministry of Fisheries "*Total VME Indicator Score*"

Annex C, appended to Schedule X, Conditions relating to Bottom Trawling, issued by the Ministry of Fisheries (Anon undated) specifies the Vulnerable Marine Ecosystem Evidence Process. Eleven faunal groups are listed, of which any presence in the catch, no matter how small, of any one of six categories [9]contributes to the 'trigger' point score. A score of three is defined as "evidence of a vulnerable marine ecosystem". Even if the faunal item is 'stone dead', e.g. a piece of coral rubble, it is still to be taken as "evidence of a vulnerable marine ecosystem". It is unclear to the HSFG if this scoring system is the result of an unexplained scientific process or is simply a bureaucratic algorithm whose function is to result in a management action and operational response.

Item 3 of the SPRFMO "Interim Measures Adopted by Participants in Negotiations to Establish South Pacific Regional Fisheries Management Organisation" (SPRFMO Undated) relating to Bottom Fisheries requires Participants to prevent significant adverse impacts on vulnerable marine ecosystems … or determine that such activities will not have adverse impacts, based on an assessment undertaken in accordance with paragraphs 11 and 12.

[8] For example: Clark, M., M. Dunn and O. Anderson (2010).
[9] Porifera, Scerlractinia, Antipatharia, Alcyonacea, Gorgonacea and Hydrozoa.

Notwithstanding the logical impossibility of proving a negative, the HSFG wonders if it is the view of the Ministry of Fisheries that there would be a 'significant adverse impact' in the absence of the procedure described in Annex C. The HSFG is unaware of any scientific evidence that the presence of three pieces of rubble from three of the faunal groups listed in Annex C indicates that the bottom trawl threatens the undefined 'ecosystem' in question. Indeed, in the absence of any definition (or even thoughtful or reasonable consideration) of what constitutes the ecosystem, the HSFG concludes that this conservation measure has become victim to flaws in the process referred to by Penny (Undated) - "which culminated in calls in 2006 for high seas bottom fishing controls by the United Nations General Assembly (UNGA) Resolution 61/105." When there has been only limited data available to inform estimates of trawl impact how does one conclude that it may be significantly adverse? While the relationship between trawl impact and ecological consequence is currently unknown sufficient knowledge should exist to enable at least a subjective assessment of the risk.

The direction to observers ("3. Instructions. Assess the total weight of all organisms ***whether dead*** or alive…") of the New Zealand Vulnerable Marine Ecosystem Process (Version 1.0 - Apr 06) raises the doubt in the view of the HSFG as to what a piece of dead coral (i.e. coral rubble) can be vulnerable to. The HSFG has been unable to find any documentation that indicates that a dead animal can be vulnerable to bottom-contact fishing. Conceivably it could be claimed that a dead piece of scleractinian coral *might* provide habitat for organisms but still, that they should be considered vulnerable, should be at least discussed and, ideally, demonstrated.

The UNGA resolution describes 'seamounts' as a "vulnerable marine ecosystem" when clearly in the usual fishing situation of the HSFG they are not. The 'evidence' is that the (unavoidably) politically compromised process that resulted in UNGA Resolution 61/105 failed to reflect the diversity in deep-sea bottom fishing practices that exist in the different deepwater fisheries around the world. Aimed-trawling as practiced by the HSFG with its short, highly defined bottom contact, usually restricted to well defined areas of seafloor features, is ostensibly different to the extensive bottom-dragging practices of, e.g. the Northeast Atlantic where deepwater tows of 5 – 6 hours are common – a reality recognized in the Ministry of Fisheries Bottom Fishery Impact Assessment (MF 2008). Because much, if not most, deep-sea fishing, such as that practiced by the HSFG, is restricted to well defined (and well definable) areas of seafloor features, survival of an 'ecosystem' cannot be threatened even if some members of the benthic ecosystem are damaged or destroyed. Chronic bottom contact is, with accidental exceptions, restricted to usually well-defined fishable tow paths. With possible exceptions, once damage to individuals of ecosystems has been done: it cannot be repeated.

The HSFG finds that the management basis deriving from the United Nations General Assembly of denoting seamounts as vulnerable marine ecosystems (VMEs) does not reflect our factual understanding of the nature of these seafloor features. The HSFG readily acknowledges that a fragile emergent coral in the path of a trawl in contact with the bottom will be knocked over. However, it is stressed that:

i. Seamounts (and by implicit extension, seafloor features supporting deepwater fisheries[10]) do not necessarily constitute vulnerable marine ecosystems
ii. Many seafloor features are explicitly not vulnerable marine ecosystems

[10] Gouyots, knolls, hills, ridges, etc.

iii. Conceivably all seafloor features have at least some benthos that, if in the path of a trawl in contact with the bottom, would be destroyed. But not all seafloor features are usually fished and not all of the area of a seafloor feature is, or can be fished using bottom-contact trawling.
iv. For most (but not all) seafloor features that are fished, much of the features' areas are unavailable for bottom-contact trawl fishing because of rough topography, presence of boulders or gear-snagging ridges, or having areas with gradients that are too steep for trawling requiring bottom contact.
v. Many sea floor features do not have associated commercially attractive aggregations of fish.

The HSFG finds the operational reaction required of the vessel in response to the definition(s) of 'evidence' of a vulnerable marine, to be contrived. It is difficult to conceive of a seafloor feature that would be devoid of all of the fauna that are considered by the Ministry of Fisheries to be evidence of a vulnerable marine ecosystem no matter how sparsely populated the relevant fauna on the seafloor feature may be. If such seafloor features are fished there is always a chance that such fauna will be retained in the catch and the vessel is required to 'move on' despite there being no significant adverse impact or even a reasonable possibility of one. There are many operational responses that should be considered and implemented in such situations.

3.4 The 5-Mile Move-on Rule

The SPRFMO Interim Measures for bottom fisheries "*Require that vessels flying their flag cease bottom fishing activities within five (5) nautical miles of any site in the Area where, in the course of fishing operations, evidence of vulnerable marine ecosystems is encountered"* (SPRFMO Bottom Fishing Interim Measure 7). The Ministry of Fisheries requires that vessels bringing up evidence of a VME are required to move 5 nm away from the position that hauling of the gear commenced for any particular tow, and not fish within 5 nm of that position for the remainder of that fishing trip.

The HSFG finds the 5-mile 'move-on' rule to be particularly problematic. The primary purpose of this regulation appears to be to reduce fishing effort at the location where a threshold value has been triggered until subsequent scientific consideration of the consequences of the evidence of a VME has been undertaken. But, it is unclear neither what such consideration may achieve nor, how it can be done. Given the highly limited period of the fishery and the few boats that are involved (≤ 8); each may take its turn on the site/fish aggregation. Some (or none) may then have to move-on, others (or all) may continue to fish depending on the highly unpredictable presence of VME faunal evidence in the trawl – with particular cognizance to the much-asserted uncertain relation between benthic bycatch and likely benthos presence in the trawl's bottom-contact tow path.

Five miles is a subjective distance that defies justification on any ecological grounds. Further, the navigational capability of the vessels involved enables them to manoeuvre their trawls with a far greater accuracy and precision than a 5-mile distance implies. The HSFG is concerned that at no point is there any explanation or justification for the choice of a 5-mile move. Inevitably this regulation requires the vessel to move off a fish aggregation it was harvesting when the 'evidence' was encountered. As is recognized by the Ministry of Fisheries, the amount, even the existence of evidence of a vulnerable marine ecosystem has elements of a stochastic process

and is not deterministically predictable. Fishing on deepwater features is usually confined to well-specified tow paths whose positions are accurately recorded and which may be considered the intellectual property of the skipper or the vessel's operators. In such cases, small deviations in the course or unusual currents may place the trawl to one side of the intended tow path and result in a bycatch of e.g., coldwater corals. A vessel may repeatedly fish a tow line for several seasons without encountering 'evidence of a vulnerable marine ecosystem'. Then, because of changes in currents, or even happenstance (the stochastic event), a large piece of dead coral rubble may be retrieved. Depending on when and where this happens it may mean the end of that voyage for the vessel with significant financial implications for all involved – the vessel operators and its crew, though other vessels may continue fishing the same tow line, as indeed so could the penalized vessel on the next voyage. As Penny (2010) notes "Access to high-resolution swath bathymetry and seabed photographic images is increasingly confirming that habitat suitability, and benthic community composition, can change substantially over relatively short distances." (Implying the uselessness of the modelling to date and on which the presence of vulnerable marine ecosystems are to be predicted?)

If the bycatch from a tow triggers a 'move-on' from an area where no other information exists, it would be impossible to gather additional information that may be needed to assess the possible nature of the benthos. Allowing a subsequent tow would seem to be a rational and desirable action.

If every tow at a location has triggered a threshold, then the area may indeed provide habitat for larger numbers of fragile benthos and it should be permanently protected. It is assumed that sufficient information exists in the Ministry of Fisheries High Seas Catch and Effort database to inform what past consequences would be notwithstanding the lack of disaggregation of coral catch species identification to family level in the bycatch record. Bottom-swath mapping and even echo sounding can show the existence of cold-water corals. In these cases skippers have no problems in fishing around such sites or choosing another tow path or seafloor feature.

A question that is posed is whether the move-on, i.e. the location closure, should apply to all vessels, i.e. that feature becomes closed to all fishing. In this case, the further question posed is should the closure be indefinite and if not, for how long should the area be closed – to the offending vessel or to all vessels? How long would it take appropriate experts to draw conclusions about the catch of 31kg of stony coral rubble (which may be all the information they have) and its indication of the presence of a vulnerable marine ecosystem? And what could their possible conclusion be? 'We need more information'?

The HSFG is aware that 5-mile move-on 'conservation' processes have been adopted in the convention areas of other RFMOs, and in some of New Zealand's domestic fisheries. The objectives in adopting such a rule have been various (Shotton & Patchell 2008, Kenchington 2009). These have included the desire to spread fishing over as large a geographical and bathymetric range as possible, e.g. as in the case of at least one CCAMLR fishery. In the case of the New Zealand Hoki Fishery Company when more than 10% of fish caught are small the vessel cannot return to the towline where the threshold was exceeded for at least five days. But this regulation refers to a mobile fauna.

The HSGF has difficulty in understanding how the 'move-on rule' constitutes effective fisheries management: in one area, the heavily fished blocks, fishing may continue in the case of

evidence of vulnerable marine ecosystems but not in moderately fished blocks. If the objective is to delimit areas that should be protected for conservation purposes, tapping and formalizing skippers' experience may be more useful than stopping a vessel from potentially collecting more data from a site whose status is unknown or uncertain.

While HSFG reject the concept and practice of the move-on rule as a meaningful and useful management practice, in this context, if occurrences of 'evidence of a vulnerable marine ecosystem are to be used to characterize the fauna of a location, then it would seem sensible to undertake a further tow to provide verification or supplementary information of the populations that have been sampled. HSFG concludes that the use of a 5-mile move-on-rule is not based on analysis of the actual situation, nor has there been any discussion with the operators in this area, even though they are a good source of 'scientific information' that would inform how vessels should react when encountering 'evidence of a vulnerable marine ecosystem'.

HSFG conclude that the choice of 5 nm for the move-on distance has been determined by its use in other fisheries that fundamentally differ in their characteristics, and the conservation issues to be addressed: the 'five–mile move-on-distance' distance appears to have migrated to the South Pacific Ocean by default to become part of the interim management measures.

4. SEAFLOOR BOTTOM FEATURES AS THE MANAGEMENT UNIT

4.1 Existing Fishing Operations

Fishing by the HSFG is exclusively prosecuted on specific identifiable bottom features. If there is no indication of fish on the echo sounders above a feature that is being targeted or catch rates are uneconomic, the vessel proceeds to another feature. Catch and effort details are recorded by the feature name (different companies may use different names) and the geographical coordinates – a condition of the fishing licence. The coordinates of the start of the tow (net touching bottom) are recorded and when haul back (net off the bottom) commences. Depth is recorded when the tow is started and finished. Of course, this situation is well known and a large amount of detailed information exists in the Ministry of Fisheries high seas deepwater fisheries database on a feature-by-feature basis in an easily accessible form.

It remains uncertain how many seafloor features are fished and have been fished by HSFG vessels in the Area though Clark *et al.* (2010) list 59 – see Appendix I. But, this information can be ascertained – it would be necessary to do so for feature-based management. (Table 6.1 lists the numbers of features given in Ministry of Fisheries reports).

Table 6.1
Number of seafloor features by major fishing area
[1]Table 2 of Penny (undated) and [2]Table 16 of MoF (2008). Appendix I lists 59 sea floor feature given by Clark *et al.* (2010)

Fishing Area	**[1]No. of seafloor features fished**	**[2]No. of blocks**		
		Light	Medium	Heavy
South Tasman Rise	-			
Lord Howe North	3	8	9	5
Lord Howe South		12	5	6
Northwest Challenger Plateau	14	9	20	29
West Norfolk Ridge	10	6	7	4
Three Kings Ridge		6	7	4
Louisville North	11	7	7	10
Louisville Central	10	6	13	7
Louisville South	6	6	3	7
Total fished features	**54**			

Allain, Kerandel & Clark (2010) have reviewed the number of seamounts in the SPRFMO area. They refer to 1451 features being higher than 1000 m in the SPRFMO area. Of these they note 205 seamount peaks are between 500 and 1500 m, the depth range that would provide potential habitat for some of the demersal commercial species. They also note that the list could be augmented by the inclusion of 1611 remaining Wessel (2001) potential seamounts and by the addition of 756 Hillier and Watts (2007) underwater features higher than 1000 m in height. In addition, they note that 34,256 Hillier and Watts (2007) underwater features smaller than 1000 m in height should also be considered. While there is little doubt that these additional seafloor features are unlikely to attract fish aggregations, no comment is made as to whether these additional features are expected to provide habitat for cold water corals.

4.2 Seafloor Bottom Features as the Management Unit

Given the deficiencies in the current management approach, the HSFG believes a new management protocol is required for the deepwater fisheries traditionally fished by HSFG vessels in the south-west Pacific Ocean. It is proposed that management of fishery be undertaken on a feature-by-feature basis. In this is noted that:

- Resources, particularly orange roughy, can be highly mobile with potentially large year-to-year variation in their location: the absence of fish in an area in one year does not necessarily mean that the stock has been depleted or has crashed: likewise, the presence of large aggregations of fish in an area may be the result of fish migrations from other sea floor features. Some uncertainty exists regarding this behaviour.
- At times orange roughy can be acoustically invisible
- Orange roughy may respond to fishing activity by moving – to where is often unknown.

The HSFG believes that sufficient information and the analytical capability exists to enable the fishery to be managed on a feature-specific basis. Catches and tow location data (start and end of bottom contact (20 m accuracy) by the trawl) are recorded on a feature-specific basis (as a licence condition) and can be verified by Ministry of Fisheries observers. This detail of information permits accurate mapping of benthic bycatch, especially as usually highly-detailed acoustic observations of seafloor topography are also recorded. On a feature-by feature basis, areas that can be fished (or may be permitted as fishing locations), or are known to be important coral/sponge habitat, perhaps because of local current conditions or bottom topography, etc. can be defined. Fishing in areas that are habitat for fragile benthos can be prohibited thus effectively achieving conservation management objectives.

Thus, management measures may be specific for particular seafloor features. Where it is appropriate, seafloor features may be aggregated into management clusters for resource assessment and TAC management purposes either because it is known that the range of a stock encompasses several seafloor features or because insufficient information exists to confidently permit seafloor-specific management measures in a particular area.

Seafloor-specific measures would encompass those traditionally used:

- Dates of opening and closing of the fishing season
- Species-specific total allowable catches
- Defined/permitted areas of fishing operations, perhaps even specified tow lines
- Requirements for special data collection, e.g. video recordings (along specified tracks), biological sampling needs, etc.
- Type of fishing gear to be used – within an appropriate management structure that provides secure fishing entitlements, HSFG members would share their extensive knowledge on best gear and rigging specifications for specific seafloor features
- Best times and conditions to fish certain areas to obtain most efficient fishing operations.

This proposal is necessarily incomplete and further development of some, if not many, of the elements is desirable: collaboration towards this end is welcome.

4.3 Protection of Fragile Benthos

Characteristically, only a part of the area of a seafloor feature is usually suitable for trawling, either because of the bottom gradient or the presence of bottom irregularities. The fraction of fishable area is highly variable – industry estimates range from 5% to 40%, but this information needs to be confirmed on a feature-by-feature basis. This has been done for the immediate areas affected under New Zealand's SPRFMO footprint. Commonly, vessels fish along specific tow paths. It is expected that in such cases, if these areas were inhabited by fragile benthos (e.g. emergent cold water corals) they would by now have been destroyed. Two issues accompany this reality.

First, videos of the surfaces of seafloor features show that they are not uniformly covered with 'coral forests' or 'coral gardens' or other characteristic benthic fauna. This is not unsurprising as it would be expected that different areas of seafloor features would vary in their habitat

characteristics and thus their quality as a benthic habitat. Corals are passive feeders: they rely on currents to bring their food to them. Areas of enhanced currents, e.g. seafloor ridges could be expected to provide more desirable habitat than e.g., flatter areas with lower current flows.

Second, it is difficult to conceive that the removal/destruction of a small fraction of the benthos (even as great as 40% should it, undesirable as this is, have happened) threatens the 'ecosystem' that the corals comprise or the ecosystem(s) in general associated with the seafloor feature. Further, in many cases where there are large emergent corals they can be seen with the acoustic system of the boat an appropriate 'no-fishing in that area' strategy can be implemented. This can be institutionalized across the HSFG fleet. Skippers have every reason to avoid catching fish-damaging and/or gear-damaging benthos. We note that the *Fisheries Act* (1996) is a use-based statute as opposed to a conservation-based statute. As part of the proposed management protocol, prior to each fishing expedition, fishing plans should be carefully reviewed and information on the presence/absence of coldwater corals noted to ensure that fishing operations will avoid areas fished in the past where they are known to occur. Skippers involved in the HSFG are among the most experienced deepwater skippers in the world having fished on the high seas in all parts of the globe. They are committed to sharing their experience with other member of the group and other parties that fish on the high seas (subject to clearly defined protocols regarding the dissemination of sensitive data), especially in the context of a management structure that provides appropriate incentives for responsible fishing.

4.4 Video Recording of the Seafloor in Fished Areas with Potential Coldwater Coral Populations

A reasonable number of videos of seafloor bottom features is developing and some fishing companies are investigating the use of videos to determine the nature of the seafloor, before, during or after fishing. In some cases, it has been shown that benthic organisms are remarkably absent in fished areas and that the presence of targeted species is not associated with abundant areas of coral growth when they do occur on the same sea floor feature. The use of such video recorders by HSFG vessels offers an interesting possibility to demonstrate if it is likely that the gear is causing significant adverse impacts when small amounts of coral are returned in the trawl catch. This is of particular concern where it is believed that the coral in the gear represents only a small fraction of the coral hit by the trawl. The HSFG believes that this potential area of research should be formally investigated.

4.5 HSFG Participation on Resource Assessment

Members of the HSFG often have extensive, experience in participating in resource management through involvement with orange roughy fisheries in the New Zealand EEZ. In a management context that controlled 'free riders' and new entrants to the fishery, HSFG operators would agree to undertake commercial-vessel aggregation-based acoustic stock assessment surveys on a basis negotiated with stock assessment scientists. While this may require stopping fishing operations it may also be the most cost-effective manner and indeed only way of stock assessment in this distant water fishery.

The extent of post-cruise involvement and funding in data analysis would be a matter for future negotiation. An important consideration would be the degree of exclusivity, security, duration and transferability of fishing licences and catch entitlements.

5. CATCHES AND CATCH LIMITS

5.1 Uncertainties and Baselines

The HSFG acknowledges that the issue of appropriate catch limits is difficult. As Clark *et al.* (2010) notes, for a range of difficult-to-resolve reasons CPUE does not provide an indication of stock status in which there can be much confidence. The HSFG recognizes that the use of a meta-analysis model Clark *et al.* is subject to all of the assumptions required in predictive modelling and that the actual productivity of individual features will depend on factors in addition to those that are, or could be, included in the model. The HSFG further recognizes that catch limits must be defensible in an international assessment environment but is also strongly of the view that risk assessments must appropriately reflect the objective of maintaining a viable and sustainable commercial fishery.

It has been noted that the use of the period 2002 – 2006 as the baseline period for setting catch limits is arbitrary and appears to be have been a consequence of the need for agreement on a time period for the much larger Chilean jack mackerel fishery. The HSFG wonders why this has not been challenged by the scientists involved. There seems to be no reason why the treatment of catch should not formally address the entire period with recognition of all features that have been fished in the past including those to the east of the area now usually fished. This assessment work should be done in any case and it is probably more a matter of 'when' rather than 'if'.

HSFG notes that several factors have determined whether many New Zealand-flagged vessels have participated in every year in which the fishery has been active. Market conditions, fuel oil prices and availability of other fishing opportunities within the New Zealand EEZ have been among factors that have determined whether HSFG vessels would prosecute the fishery in the different fishing seasons.

HSFG notes that there is a continuing evolution, both technically and operationally, in how the fishery has been fished. Now, the fishery is highly focused on a well-defined period when catch rates will be highest and operations can be undertaken in the most cost-effective manner. Orange roughy are known to react to vessel activity and this also minimizes any effects on the behavioural biology of the fish that result from fishing activity.

5.2 Fishing on known features currently excluded under interim measures

HSFG stresses that in the past New Zealand flagged vessels have fished features across the Southern Pacific Ocean and wish to stress that this reality be recognized in any process of deciding what have been historical fishing practices. These areas were primarily fished by New Zealand vessels starting during the mid 1980s and onwards . HSFG supports a formal analysis of the likely sustainable yield from the areas fished during this period, The HSFG has evidence that documents these past fishing practices and past catches and can verify any proposed catch limit.

5.3 Impact Assessments

The HSFG notes that impact assessments in relation to fishing in new areas will be required, but stresses that some realism needs to accompany these demands. Description of vessels and gears is almost a standard practice along with the requirement for vessel location monitoring. As the objective of the exercise is to remove biomass from the marine ecosystem this aspect of the hoped-for impact should be self-evident. In this context, a policy that limits the amount of fishing effort in a new fishing area (at least 'new' to the regulators) should be controlled. Disincentives should exist to deter non-serious applications for permission to fish in new areas if they are not going to be exercised.

In terms of the affects on bottom fauna, there is no other way of undertaking the exploratory fishing and observing the results other than by fishing operations. It is stressed again that given the stochastic nature of the distribution of fragile benthic fauna and thus 'evidence' in the catch of VMEs and the nature of the forces that act on fishing gear, then requiring a vessel to 'move-on' is, we feel, irrational. This policy may move the vessel off the bottom feature and may be triggered by the first tow or the twenty-first tow. One might expect on average, one trawl in five (or ten ...) to exceed one of the VME trigger levels. Should this happen on the first tow then a potentially valuable fishery will be forgone.

5.4 Dealing with Annual Quotas

A number of factors influence the HSFG's view on setting of annual quotas. A primary objective of the Group is the undertaking of the fishery in the most efficient way possible. Operations in the high seas of the South Pacific Ocean are integrated with those in the New Zealand zone while being subjected to constantly varying product prices and costs of inputs. Further, past experience is that availability of fish can vary from year-to-year in a way that appears to be independent to their longer-term abundance. For these reasons, the HSFG proposes that annual catch quotas be set on a multi-annual basis. Catch not taken in one year, especially because an operator may have a better use for the vessel in that period, would be carried over to a following year, subject to a rather punitive catch-or-lose principle. For example, unfished catch may be accumulated for only one or two years before being lost. Care would be necessary that lack of success in taking the quota was not because of a decline in biomass and an appropriate management process would need to be in place to deal with this situation. (The HSFG is cognizant of the situation of the Chilean jack mackerel fishery that has arisen under the interim management arrangements.) It is noted that any policy that defers catch, with the possibility that it might not be fished, should be encouraged from a conservation perspective. Such a policy should not prejudice the possibility of one operator transferring to another any catch entitlement should harvesting policy, national or international, develop in this direction.

Thus in summary the HSFG says that to meaningfully discuss catch limits/quotas then:

- A review of all catches by all the vessels of all participating states be undertaken (has this been done?)
- Identification of past catches by seafloor feature be undertaken;
- Identification of past bycatch of fragile benthos by seafloor feature be undertaken;
- Review for implementation a multi-annual catch/quota process but
- Subject to appropriate conservation safeguards.

6. FURTHER REMARKS ON CURRENT MEASURES

It is widely accepted, both at national and international levels, that conservation regulations have the greatest chance of being effective and achieve compliance when they are simple, and thus easily understood, and when they have a clear relation to the declared conservation objective. Alas, the HSFG believes that there are few grounds for confidence that existing 'conservation measures' satisfy this requirement. This is a matter of considerable regret given the commitment of the HSFG to conservation of 'bio-diversity' in the SPRFMO area. A different, much simpler method of management is possible that will be more successful in achieving the objectives and goals that both the Ministry of Fisheries and the HSFG seek.

One impression of the HSFG of the management process being implemented through the SPRFMO negotiating process is of institutional confusion. On the one hand, considerable emphasis is being placed on the need to undertake predictive modelling of the suitability of areas in the Southwest Pacific as habitat for vulnerable marine ecosystems (notwithstanding the as-yet absence of a reasonable consideration as to what such an ecosystem might be). Yet the results quoted are so general and intuitive that it is hard to conceive that they offer any information of value (e.g., in terms of the Tittensor *et al*. (2009, 2010) *Maxent* predictive models, the most suitable predicted habitat for scleractinian corals in the western SPRFMO area *occurs in the depth range of 250m to 1,500m*, which closely corresponds to the targeted bottom-trawl fishing depth range in these areas, which is 500m to 1,500 m."). Such self-evident comment is compounded by inferential error, e.g. "If the usually fished depth range of 500m - 1,500m is considered to be the 'fishable depth' for this fishery, then the proportion of fishable depth in a particular area is, in fact, an accurate indicator of the predicted coral habitat suitability."[11]

Considerable note is made of the efforts and constraints of recent and current efforts at predictive habitat modelling. Yet it is claimed that "predictive modelling provides the most cost-effective option for evaluating the likelihood of occurrence of VMEs in areas of concern. The HSFG is of the view that simple inspection of observers' reports on 'VME' bycatch by deepwater trawlers would provide direct low-cost indications as to the presence of VMEs. Self-evidently, fishing only occurs in fishable depths, and Penny's (2010) conclusion is that the best indicator of VMEs, at least in the form of scleractinians, is fishable depth. Yet MF (2010) notes that in 2009 and 2010 48 tows were undertaken in the 'move-on' blocks. Of these 31 reported no benthic bycatch taxa, i.e. 70.5% of the tows, a fraction that is difficult for the HSFG to reconcile with the prediction of the habitat modelling exercises that these tows would be in areas that would be 'VME' habitats. No information is given for the heavily fished areas. Could it be that this approach has nothing to offer? This is a question that the HSFG believes needs careful independent consideration.

The incoherence between the assertion as to the potential usefulness of habitat predictive modelling is further underlined by the comment of Penny (2010): "Access to high-resolution swath bathymetry and seabed photographic images is increasingly confirming that habitat suitability, and benthic community composition can change substantially over relatively short

[11] It would be the presence of 'fishable area' not the proportion that should indicate the presence of habitat suitable for coral.

distances." This is in accord with longstanding experience of vessel officers who monitor, in real-time, bottom echo returns. Rather than undertaking modelling exercises, the HSFG is perplexed as to why this information is not simply directly observed. Further, there is the added benefit that observations would be made directly on the areas fished. Little comment is made as to the possibility of Type II error, i.e. assuming that vulnerable marine ecosystems exist where they do not, despite acknowledgements in the literature that this happens.

The Ministry of Fisheries (2008) Bottom Fishery Impact Assessment refers to damage to vulnerable marine ecosystems by trawls but notes in several places that trawls are poor indicators of the presence of VMEs:

- P48: In particular, trawls are very poor sampling tools of VME evidence, and trawling may have a significant adverse impact on VMEs while providing very little evidence thereof in a specific tow.
- P61: However, poor retention by trawl gear means that low weight thresholds can still indicate higher benthic impacts.
- P64: It is known that bottom trawls do not retain these taxa efficiently, and trawls on seamounts known from research surveys to support dense and diverse structural fauna have been observed to arrive on deck with little or no coral bycatch.
- P65: In the absence of any specified definition, or management objective, for 'evidence of a VME', and in recognition of the generally poor performance of trawl nets in sampling corals, …corals,
- P69: Although catch weights may appear small, trawl selectivity for many taxa is poor, so small individuals are not retained and large individuals are broken and not well retained. Comparisons of video with sled and trawl tows demonstrate the low selectivity and the small weights typically encountered.
- P77: However, trawl nets remain poor tools to sample benthic materials, and much of the benthic material damaged, and **perhaps** even initially caught, by trawl nets is lost through the meshes, particularly the fragile and vulnerable cold water corals.

But in the same document it is also noted that:

- P68: Few datasets exist to investigate the relationship between what benthic invertebrates are actually on the bottom and what comes up in a trawl.
- P71: However, when combined, only one tow from research cruise AEX9901 in overlapping areas with sled tows and camera tows caught coral, and this was on Graveyard, a highly fished area. The other 8 tows did not return corals, highlighting the poor ability of these trawls to retain benthic materials, assuming the same areas were fished.
- P71: Few datasets exist to investigate the relationship between what benthic invertebrates are actually on the bottom and what comes up in a trawl.
- P77: Dedicated before/after or control/impact scientific surveys are probably the only way to reliably and quantitatively evaluate benthic impacts of deepwater trawling operations. Dedicated before/after or control/impact scientific surveys are probably the only way to reliably and quantitatively evaluate benthic impacts of deepwater trawling operations.

The conclusion of the HSFG is that the relation between trawl bycatch of coldwater corals and other benthic fauna is complex and poorly understood and probably is dependent of the

particular seafloor feature, its topography and the nature of the attendant benthic fauna. In such cases, 'blanket statements' about the destructive affect of trawls are unwise and unhelpful and should only be in the context of their associated uncertainty. The HSFG are puzzled that greater, more formal, efforts do not appear to have been made to research the relation between bottom trawl fishing in deepwater and its affect on available living benthic fauna. There is substantial video and photographic evidence of seamounts that are devoid of any benthos or benthic material.

The HSFG acknowledges that changing management direction involves risk as does failing to do so. However, the existing 'management by block' method has severe limitations, which, to review, are:

i. They imply 'macro-scale' management that fails to protect fragile benthos on features in heavily fished areas – even though this may readily achievable
ii. The vessel-specific move-on procedure as the means of initiating an assessment of the 'evidence' of a vulnerable marine ecosystem will result in delays in protecting fragile benthic fauna from multi-vessel fishing operations when 'evidence' of vulnerable marine ecosystems has not been assessed or when insufficient information exists to enable an accurate assessment – a likely scenario.
iii. Incoherence between a feature-stock association model for management and a 20′ block basis for regulations and fishing measures. This leads to an inability to tie quotas to specific seafloor features when more than one feature exists within a fished 20′ block and may cause complications if the same stocks exist in several 20′ blocks.
iv. *The-seamount-is-a-vulnerable-marine-ecosystem* paradyne is implicitly a feature-based concept though the HSFG considers it deficient for numerous reasons and should be discarded. Marine protected areas, when evaluated and implemented should focus on the seafloor feature: variability in seafloor characteristics will require consideration of the suitability of seafloor features as protected areas to be done on a feature-specific basis.

Further, the HSFG believes that there is a danger of treating this issue as one of legal interpretation of bygone resolutions by intergovernmental bodies that often appear to be without the technical competence to judge biological issues. Decisions have been compromises that appear to have been the result of politically-prompted debate with resulting parallel and/or mutually exclusive aspirations. Fishing unavoidably affects the marine environment! The HSFG believes there is an urgent requirement to refocus on the basic requirements that recognize this.

There is great variation in fishing methods and effects in deepwater fishing operations – as the Ministry of Fisheries assessment notes, aimed trawling – as exclusively practiced by HSFG operators - differs fundamentally in its affects to wide-area extensive trawling that relies on continuous bottom contact. The consequences of detecting 'evidence of vulnerable marine ecosystems must reflect the extent to which seafloor features are available for bottom-contact trawling.

What is an Ecosystem?
The HSFG notes the complete absence of consideration as to what exactly is the ecosystem that is deemed to be vulnerable. Indeed, there seems little agreement among ecologists as to what is an ecosystem. Comments that an ecosystem may range in scale from the bacteria in the gut of a single fish up to the entire Earth are not helpful. While conceptually it is possible to conceive of a single animal comprising an ecosystem on a seafloor, conventionally ecosystems consist of populations. Here, the populations of concern are fragile emergent benthic fauna that could be crushed through contact with a trawl. Experience, most notably on the South Tasman Rise, but also elsewhere, shows that when high densities of coldwater corals are present in areas being fished, coral bycatch retained in a trawl tow has been in the order of tonnes or tens of tonnes. In the SPRFMO Area, threshold levels deemed to be 'evidence of vulnerable marine ecosystems' are in the range of 'presence' and 1 kg to 50 kg. If 49 kg of porifera and 29 kg of scleractinia were retrieved in the trawl, it would be deemed that there was no evidence of a vulnerable marine ecosystem. However, simply the presence of 31 kg of scleractinia would result in evidence of a vulnerable marine ecosystem and the vessel would have to stop fishing at that location. One kilogramme of porifera, one kilogramme of scleractinia and the presence of some unidentified coral would, again, require the vessel to stop fishing. There is clearly a major incentive to train observers to identify corals – if a coral was unidentified and it was a scleractinian, a correct identification may allow the vessel to continue fishing. The HSFG does not believe that past analyses of coral bycatch accurately reflect how observers would have scored even traces of coral in the net. Indeed, this is a major reason HSFG skippers have fished so little in 'medium' blocks during the last fishing season - to avoid the costs of searching and locating fish aggregations and then have to move off the fish because of traces of coral in the bycatch, unidentified or not.

Complicated conservations systems, such as the Ministry of Fisheries' Vulnerable Marine Ecosystem Evidence Process, where the outcome appears to depend to a considerable extent on happenstance and/or the nature of the bycatch and which seem biologically counterintuitive (coral rubble is direct evidence of a vulnerable marine ecosystem?) do not gain the confidence of those who must implement it and abide by it. That is the situation of the HSFG and the vulnerable marine ecosystem evidence process. Further evaluation of the process, while important and necessary, remains impossible, because the subsequent assessment and decision process has not yet progressed to the position when it can be explained. How the process of deciding if 'evidence', arbitrarily decided it may be, implies or does not, the existence of an area where fishing will not be permitted is a critical issue for the vessel operators. No indications appear documented as to how this judgemental process will work. This should explain the major concerns of the HSFG about an interim process becoming permanent *before* all necessary elements of the process have been tried and evaluated.

7. FEATURE-SPECIFIC MANAGEMENT

The HSFG believes that the alternative of feature-based management has a logical basis and offers several advantages to management using the arbitrary Vulnerable Marine Ecosystem Evidence Process, a process that remains untested and uncertain as to how it will function in its entirety. The basis of Feature-Specific Management (FMS) is, by contrast simple: *areas are open or closed to fishing*. Closed areas may consist of entire features but it is the expectation of the HSFG that closed areas would primarily encompass:

i. areas that cannot be fished because of the bottom topography and
ii. areas known to provide important habitat for fragile emergent benthos.

The second type of area closure category would be subject to ongoing review. This would consider e.g., observers' reports and/or whether an area was known to have been subject to considerable fishing in the past. FBM will require far greater collaboration between the fishing operators, especially the skippers and those responsible for management. Fishing areas and 'no-go' areas will need to be mapped though to a large extent this only means making use of existing data in companies' confidential records. An accurate survey of past fishing activities is needed and the information would helpfully be available in geographical information systems. Targeted catch and bycatch analyses would be on a feature basis.

FSM will involve considerable investment by HSFG in management costs: these must be protected through some form of exclusive quota agreement. To the extent that non-HSFG operators participate in the fishery, a joint approach must be negotiated with equitable sharing of management costs and fishery benefits.

It is noted that developments along these lines in an international context are not entirely revolutionary: use of national quotas are used by several RFMOs and these with the possibility of transfer between Parties. It is the logical next-step in management of feature-based deep-sea fisheries, not least those on the high seas. We believe that an opportunity exists for the Ministry of Fisheries to show to the international community its embrace of leading-edge management strategies that make use of evolving leading technology in fishing and related documentation of fishing practices. New Zealand's quota management system is widely recognized internationally and justly acclaimed: it is a precedent in this regard.

8. PROGRAMME ELEMENTS

In implementing a feature-based management regime for the deepwater fishes of the Southwest Pacific Ocean, the HSFG envisions the following programme elements.

i. A review of the catch and effort data for the entire history of the fishery with Ministry of Fisheries officials and past and present vessel skippers and operators to determine if the existing catch record accurately reflects the history of the fishery. Where this is not the case, joint-grooming of the data would be undertaken to provide a record that best describes past catch and effort.
ii. A review should be undertaken of past trawl fishing effort that has used extensive rather than aimed-trawling. These two groups of data should be expected to have fundamental characteristics in terms of the CPUE characteristics: it may be appropriate that the two groups are analyzed separately.
iii. A review of possible past misreporting, primarily by area or position, should be undertaken to improve data 'grooming'. This exercise may also assist in relating past catches to specific seafloor features in addition to identifying areas whose catch history has been wrongly characterized.
iv. A feature-by-feature database should be developed that will permit feature-based identification of catch (weights and species), effort and seafloor feature information. In

particular such a database should record areas where fishing is not possible and/or areas that might be closed to fishing for conservation purposes.

v. An interactive exercise with relevant vessel officers:

   a. to determine which areas have been known to be characterized by bycatch of fragile emergent benthic fauna and associated details and
   b. to document relevant knowledge and experience relating to targeted fish behaviour and distribution.

vi. Discussions and agreement on what information should be collected during future fishing campaigns to enable better management of these fisheries.

This type of informed fisheries management is best undertaken in a context of secure fishing entitlements and the HSFG would like to explore with the Ministry of Fisheries how this objective may be achieved. This should be done on a priority basis.

vii. Further, Protocols regarding the handling and dissemination of data at SWG meetings should be agreed prior to commencement of data exchange.

viii. Agreement on scientific methodology around how data should be groomed should be reached.

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Appendix I: Southwest Pacific Ocean Physical Characteristics of Seamounts
(Clark, Dunn & Anderson 2010)

IFA No.	Region	Latitude	Longitude	Summit (m)	Elevation (m)	Area (km2)
1	West Norfolk	-33.98	167.50	915	335	15.0
2	West Norfolk	-33.60	167.80	830	370	4.9
3	West Norfolk	-33.83	167.84	966	534	40.0
4	West Norfolk	-33.23	167.54	450	1050	50.0
5	West Norfolk	-33.75	167.27	250	450	50.0
6	West Norfolk	-33.78	167.38	480	270	10.0
7	West Norfolk	-33.27	166.96	540	210	7.5
8	West Norfolk	-33.09	167.04	450	250	25.0
9	West Norfolk	-32.74	166.94	230	470	55.0
10	West Norfolk	-32.57	166.83	480	270	27.0
11	NW Challenger	-37.34	168.05	695	255	4.2
12	NW Challenger	-37.48	167.68	595	365	4.0
13	NW Challenger	-37.47	168.64	899	101	1.0
14	NW Challenger	-37.81	168.14	609	191	1.0
15	NW Challenger	-37.19	167.23	606	394	4.0
16	NW Challenger	-37.25	167.29	822	178	1.5
17	NW Challenger	-37.31	167.27	578	322	4.0
18	NW Challenger	-37.36	167.57	874	126	1.0
19	NW Challenger	-37.60	168.47	752	148	1.5
20	NW Challenger	-37.89	166.97	1187	163	16.0
21	NW Challenger	-37.86	166.99	1242	108	1.5
22	NW Challenger	-37.35	168.14	940	80	1.3
23	NW Challenger	-37.33	168.02	898	77	1.1
24	NW Challenger	-37.32	168.01	923	52	0.6
25	Lord Howe	-35.65	165.97	772	428	5.0
26	Lord Howe	-35.61	165.96	807	393	3.0
27	Lord Howe	-35.97	166.18	920	280	11.8
28	Louisville (S.S)	-50.50	220.80	540	3660	1331.5
29	Louisville (S)	-48.20	211.20	490	4310	1739.1
30	Louisville (S)	-47.90	210.30	1090	3710	550.3
31	Louisville (S)	-46.10	205.70	590	4110	1148.1
32	Louisville (S)	-46.20	204.10	590	4210	1739.1
33	Louisville (S)	-45.40	202.40	540	3860	2201.0
34	Louisville (C)	-44.00	199.30	740	3260	1148.1
35	Louisville (C)	-43.70	199.00	1010	2690	434.8
36	Louisville (C)	-43.50	198.50	690	3310	1331.5
37	Louisville (C)	-42.80	198.00	810	3690	679.3
38	Louisville (C)	-42.30	197.20	655	3845	2717.3
39	Louisville (C)	-41.90	196.40	918	3082	679.3
40	Louisville (C)	-41.50	195.70	785	3216	3912.9
41	Louisville (C)	-40.90	195.00	662	3338	244.6
42	Louisville (C)	-40.70	194.60	620	3380	332.9
43	Louisville (C)	-40.40	194.30	1070	3080	332.9
44	Louisville (N)	-39.90	193.90	1410	2580	679.3
45	Louisville (N)	-39.70	193.70	1375	1625	169.8
46	Louisville (N)	-39.60	193.40	1385	2415	332.9
47	Louisville (N)	-39.10	192.60	880	3652	2717.3
48	Louisville (N)	-38.40	192.00	274	4507	3288.0
49	Louisville (N)	-37.70	191.00	1085	-1085	434.8
50	Louisville (N)	-37.50	190.70	1035	3613	332.9
51	Louisville (N)	-36.90	190.20	955	3868	1148.1
52	Louisville (N)	-35.60	189.80	1210	4076	434.8
53	Louisville (N)	-35.40	189.60	980	3920	679.3
54	Louisville (N)	-35.00	189.20	1390	4052	244.6

55	Louisville (N.N)	-34.70	189.40	1150	3950	244.6
56	Louisville (N.N)	-33.70	188.60	1250	5070	978.2
57	Louisville (N.N)	-33.40	188.60	1430	3670	550.3
58	Louisville (N.N)	-32.50	188.20	1490	3500	679.3
59	Louisville (N.N)	-31.40	187.80	1135	4390	3912.9