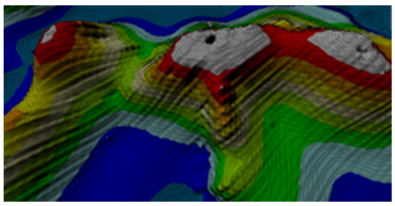
New Zealand High Seas Fisheries Group Incorporated



3RD Meeting, Scientific Committee
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October 2015

COMPETING NARRATIVES

GETTING YOUR VME STORY HEARD ABOVE THE REST

A. Smith, R. Shotton & G. Patchell
High Seas Fishery Group
Richmond, New Zealand

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1. INTRODUCTION

The development of the issue, and practices, of conservation of marine animals, in particular deepsea benthos, has not yet been comprehensively documented and the HSFG is aware that its efforts here are almost certainly incomplete. But in examining this issue it becomes clear that there have been a number of interest groups – commonly, but perhaps erroneously, referred to as `stakeholders' but may be better described as protagonists. Unsurprisingly, these protagonists have different mandates and interests which have moulded and flavoured the debate, not least what has been influential in setting the agenda of the issue of deepsea benthic conservation.

From the Seafood Industry's perspective and that of fishermen, the challenge here is to read this paper with an open mind. We believe there have been several decades of political meddling fused with dubiously-founded science and lobbying woven into a scientific and political narrative that casts all deep-sea trawling and bottom fishing in a negative light. The common thread is the push to ban trawling and even "bottom fishing" on the high-seas, something some wish to see also within EEZs. This paper attempts to carefully examine the formation of the new vocabulary, regulations and definitions that are now commonly used in and scientific papers science, UN agencies and RFMOs as well as in governments.

The stimulus for these issues has been the development of deep-sea trawling, first and most importantly in the Northeast Atlantic Ocean and then in places as distant as the North and South-west Pacific as species such as armourhead and orange roughy became targeted. While some have claimed that the impetus for this development was overfishing of inshore resources, this has not been demonstrated and was more likely a consequence of the nexus of the increase in demand for marine fishery products towards the end of the 1970s, the expansion of the globalization of trade in fishery products, the development of technology that enabled deepsea fisheries to be prosecuted and perhaps, but to a lesser degree, the extension of sovereign control of greatly expanded coastal areas – the 200 nm EEZ.

While discussions of the issue of protection of the marine environment must have begun much earlier, the first formal move by an international governmental agency could be attributed to that of the International Maritime Organization (IMO), who, ten years after the signing of the Law of the Sea Convention in 1982, addressed this issue through the introduction of formal guidelines, in 1992. Most of the criteria identified at that time have persevered - an indication of the thoroughness of their early efforts?

Following the expression of the formal concern of the IMO with marine conservation and protection a number of narratives have emerged, in parallel with a vocabulary that mixes common and technical concepts with two important consequences:

- Non-technical interlocutors have adopted used terms that on-the-one-hand have a specific scientific meaning and then
- These terms have become widely used by the scientific community so that it is no longer clear if the terminology is being used in a general or specific sense.

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This confusion has been widely exploited to promote programmes by those who should know better but show no evidence of this. We believe that at times this has resulted in programmes that were not well conceived in terms of the new use of terminology, or more accurately, in our view were misleading with the consequence that a `cart-before-the-horse' approach has developed.

Who have been, or become, the protagonists?

- The environmental NGOs have been early participants in the development of this discourse. We find their approach rather myopic, but then their raison d'être is the conservation/protection of animal species.

- International institutions: first the IMO, then three offices of the United Nations in New York, the FAOs
- The fishing industry
- Implementing agencies such as RFMOs, the Marine Stewardship Council and national departments of fisheries and
- Service agencies such as marine research institutions – agencies that undertake contestable funded-research.

HSFG has found that each protagonist attempts to develop and champion a particular *narrative* and it is these narratives, through our lens, that this note attempts to review.

2. THE INDUSTRY PERSPECTIVE

Each protagonist has its own objectives – their agendas, on and perhaps off the table. Some of these objectives will be shared and some not, e.g. some environmentalists would like to see a ban on trawling. This paper provides the industry's perspective on these. The issues are, in our view, serious – existential in our case - and we believe that there is now ample information to review. These issues relate to regulation of the deepwater fishing industry in relation to conservation of the benthos. As would be expected, the roles of the agencies involved in this process, the protagonists above and their institutional objectives and agendas have influenced, if not controlled this process.

What does the Industry see as (the) issues?

- Confounding of institutional interests with objective/accurate framing of the problem and thus the questions that should be posed and examined – how the problem is framed is critical as the questions posed determine the answers that are provided
- Objectivity of the information process, often rightly and often wrongly, described as 'Science'
- Institutional functionality, or more important its consequences
- Failure of institutions to fulfil their mandate, often for reasons that are common in our society: appropriate responses require an appropriate knowledge base
- Naïve and ecologically simple minded implementation of predictive modelling that has failed to use all existing information on the distribution of benthic fauna.
- The role of industry –understanding its dynamics is critical to identifying management options that will provide acceptable solutions.

3. WHAT HAVE BECOME THE NARRATIVES OF CONCERN

3.1 Destructive Fishing and Appropriate Responses

The Destructive Fishing Paradigm, or paradigms, has had various progenitors. Traditionally, in an international context at least, destructive fishing has meant fishing with chemicals or explosives. With the development of the issue of the effect of deepwater bottom fishing on benthos it has come include changes occurring to the benthic, usually sessile/immobile fauna, commonly corals and sponges but also including crinoids and asteroids. Different organizations have developed different definitions of what is *destructive fishing* quite naturally reflecting the particular perspective embraced by that organization. In this narrative, destructive fishing as defined in terms of the organization's perspective of what is to be regulated, controlled as banned as the case may be. Needless to say, the pejorative sense of the word 'destructive' is in no doubt – ecosystem-, or better still, `benthic-modifying' anyone?

3.2 Saving the Beauty/Wonder of the Oceans' (Benthic) Biodiversity – it's Ecosystem Services

The Development of the Threatened Oceans Paradigm has seen protagonists vigorously promoting perceptions of the deepsea's benthos in a way that endorses their view whereas a more scientific or rational

approach would have recognized not only the diversity within benthic ecosystems but also the range in biomass and species densities (= biodiversity?) that exist. An early media-catching sound bite was that trawling the deep sea was like "clear cutting the forests to harvest the squirrels" – Dr Alex Rose[1], the Deepsea Conservation Coalition[2] and popularisers of the wonders of the ocean such as highly-lauded Sylvia Earle, Explorer-in-Residence of the (U.S) National Geographic have all explicitly articulated this particular theme[3].

The narrative here is unambiguous: the sea floor is a treasure of biodiversity threated by destructive trawling practices, = deepwater bottom trawling. This paradigm has been helped by the exquisite beauty of some species of deepwater corals, which may possess radiant and luminescent colours and eye-catching symmetry. Photographs of `coral gardens', notwithstanding that the corals are animals, not plants show dense multispecies stands that, with luck, have an orange roughy or similar targeted species gliding over them. What report on saving deep-sea biodiversity lacks such photos? It would be naïve to assume that such beautiful photos do not influence attitudes of at least the public and thus indirectly, if not directly, the policies and decisions of those responsible for the governance of such matters. Or, that the seafloors were carpeted so.

Figure 3.1 shows the cover picture of the Voyage Report of a Survey of Deep-sea Habitats of the Louisville Seamount Chain (TAN1402) (Clark *et al*. 2015) though there are many examples that could be used. Unsurprisingly, this picture became included in other related presentations. Figure 3.2 shows the cover of MIF (2008) a New Zealand Bottom Fishery Impact Assessment. Figures 3.3 and 3.4 show images from the same voyage as that recorded Figure 3.1. The images 3.3 and 3.4 by a large order show a more typical bottom situation for at least one of the sea floor features that this cruise examined.

The point is not that one type of picture represents reality while another doesn't. And indeed, we don't believe that the images were deliberately chosen to mislead. Rather, what these images do show is our fascination with the beauty and mysteries of the deep. Here, the issue is the narrative that is developed and portrayed by the use of such images. Is the sea floor best represented by images of coral `gardens'/ `thickets', etc. as shown? Or is it essentially typically bare and more appropriately shown as such? Does the answer matter? We believe it does. We believe that our point is unambiguous and clear. Narratives and how to frame the issues becomes important when there are other objectives at stake.

Figure 3.5 shows an image type that is bottom usually encountered during fishing operations (this is from a similar fishery in the Southern Indian Ocean). These images are clearly bereft of any `vulnerable marine ecosystem'. Figure 3.5 shows a frame from a video taken during commercial deepwater fishing operations that is characteristic of the sequence. Nothing there remotely resembles that shown in Clark (2015) of MIF 2008) occurs.

3.3 Feeding the World

International forums have at times indicated that they "want their cake and eat it too".[4] People must be fed and poverty reduced/eradicated. But this must be done in a sustainable manner, though usually what is to be sustained is not always made explicit. The Johannesburg Declaration on Sustainable Development is

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[1] Now an academic at Oxford University.

[2] Mathew Gianni, cofounder of DSSC and now its policy advisor quotes as follows ""Clearly we are in the midst of one of the great extinction spasms of geological history… " Research into the impacts of fishing in the marine environment suggests that a similar trend involving a threat to marine biodiversity and ecosystems in the deep ocean may also be underway".

[3] "They're mining the ocean, clear-cutting the ocean of fish that are sold not, again, for food security, but for corporate bank accounts. And when people understand that, they should just say, 'wait a minute, we want a healthy ocean.'" <http://www.earthisland.org/journal/index.php/eij/article/sylvia_earle/>

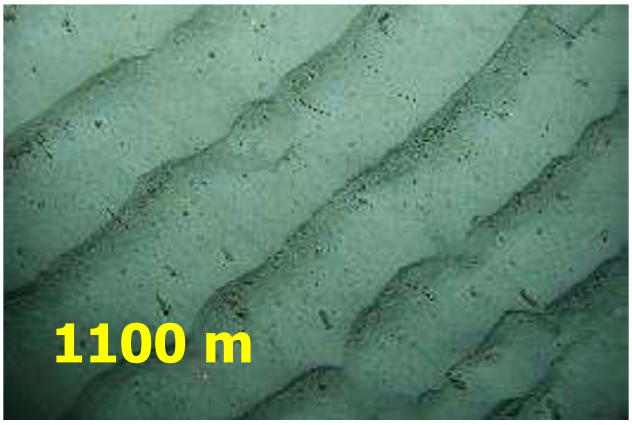
[4] Wolde ye bothe eate your cake, and have your cake? Heywood, 1546.

usually the forum that is cited in this regard.[5] How many balanced accounts of the benefits of provision of food – *Food Security* - from deepwater fisheries and the parallel costs to ecosystem services are referenced in UN documents?

Figure 3.1
Copy of cover of Clark *at al.* (2015)

Figure 3.2
Cover of MIF (2008) NZ Bottom Fishery Impact Assessment

Figures 3.3 and 3.4
Seabed Images also recorded during the trip TAN1402.



3.4 Livelihoods

Providing employment and banning a fishery are two sides of the same coin. Societies, at many levels, express commitment to the provision of jobs. But who is the stakeholder championing this objective in relation to fishing as an economic activity? Is any relatively small source of employment to be endangered because it is a small source of national/global activity? This is the view of some environmental lobbyists. But is it an appropriate and/or balanced one?

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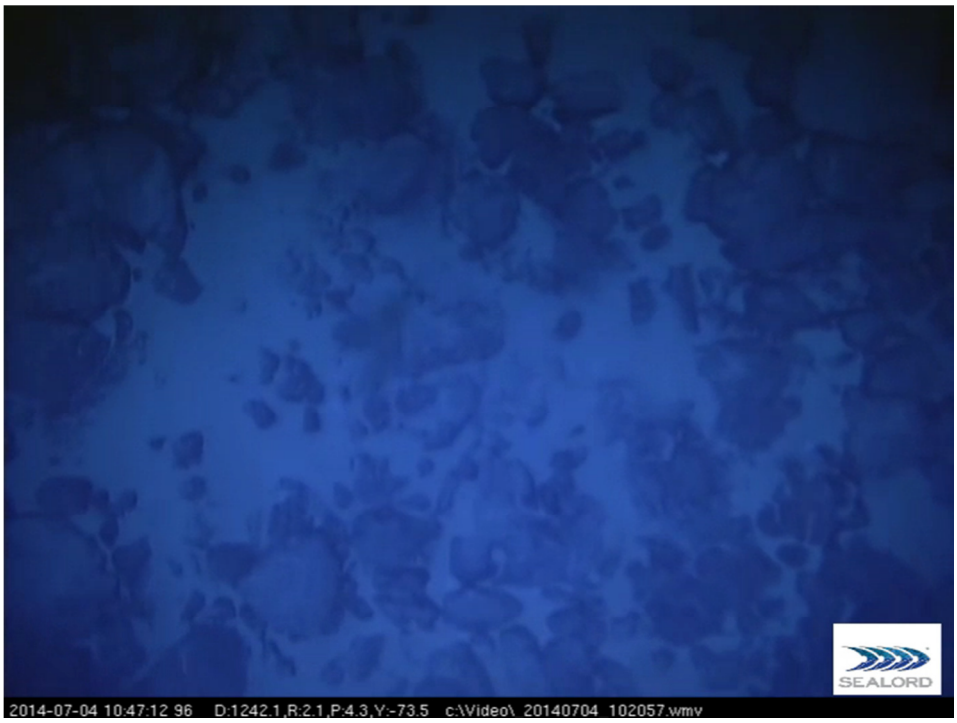
[5] 6. From this continent, the cradle of humanity, we declare, through the Plan of Implementation of the World Summit on Sustainable Development and the present Declaration, our responsibility to one another, to the greater community of life and to our children.

7. Recognizing that humankind is at a crossroads, we have united in a common resolve to make a determined effort to respond positively to the need to produce a practical and visible plan to bring about poverty eradication and human development.

Paragraphs from the Johannesburg Declaration.

Figure 3.5

Sea floor image taken during commercial fishing operations



3.5 The Views of the General Assembly United Nations

The General Assembly of the United Nations is the world's highest-level political forum. Countries are represented at the United Nations through their departments of external/foreign affairs and these ministries are usually either at the highest level in the ranking of ministerial influence or, perhaps, joint co-holders with that of the Ministry of Finance.[6] Countries are represented in New York by the highest-level senior diplomats, North Korea notwithstanding. Countries are loath to be perceived as acting inconsistently with positions negotiated in General Assembly. Indeed national positions on international issues are often the result of horse trading among members of coalitions often whose preferred positions are forgone for the sake of ensuring coalition unanimity. Thus it has always been so and is neither an issue for our concern or surprise – it's how the system works.

Delegations to RFMOs are usually led by civil servants based in national departments of foreign/external affairs. National positions that are expressed understandably are presented through the respective heads of delegations. This is normal and HSFG understands better than most that a ship should only have one captain. But the consequence is that preferable positions on fisheries affairs may not be consistent with other items on the political agenda and be passed over: being seen to support the outcome of deliberations of the UNGA is one, no matter that the `Paulaus' of the system share the floor in the same manner as the major global powers – of this environmental strategists are fully aware in planning lobbying campaigns.

[6] John Crosby, the Newfoundlander and outspoken and controversial past Minister of Fisheries and Oceans in Canada, once famously remarked that the portfolio of Fisheries had all of the problems as that of Finance but none of the prestige or glamour.

3.6 We need more Information

Good decisions depend on good information, and uncertainty (as opposed to ignorance as to the outcome of a probabilistic event) is ever present and unavoidable. Thus, the basis is self-evident for claiming the need for further research and the enabling funding. Who provides this information is relevant and is something that decision makers do not usually acknowledge, as least as part of a public discourse. The term 'capturing the agenda' is not a lexicological happenstance. Answering the questions of applied management may be congruent with those posed by undertaking basic research and the benefits of serendipity should never be dismissed. But, these are two, yes closely related, narratives, but narratives that often are not driven by the same incentives. Decision makers need to remain cognisant of this reality.

3.7 Predicting Modelling will do it for us

One of the emerging narratives that have been, in our view, uncritically promoted, is that Science, in the form of predictive modelling will solve this problem. Of course if confidence was not expressed in regard to achieving this outcome, it is unlikely that the funding required to pursue this objective would not be forthcoming. HSFG has been, and remains so, sceptical of the claims made for this activity. We remain to be proven wrong of the benefits claimed possible for this activity.

3.8 Midwater Trawling is (not) Bottom Trawling

Words are important! Even if you can force a preference for a particular usage onto a sector by bureaucratic fiat there is a danger that insisting upon a practice that is contrary to convention will cause challenges to one's credibility and certainly make for confusion. Bottom Trawling has a well-established meaning in fisheries: it means fishing by towing a trawl along the bottom. The trawls that are used for this are designed for continuing contact with the bottom and usually the trawl doors are designed and hung so that they travel in contact with the sea floor. This is a well-established widely-accepted convention. Promoting the narrative that Midwater trawling in which the gear may (or may not) make contact with the sea floor is Bottom Fishing/Trawling, is to equate the effects of these two radically different methods of fishing. At best this is unhelpful for solving problems even if it facilitates the task of drafting conservation texts. HSFG believes that these issues (Bottom Trawling vs Midwater Trawling) should not be confounded into a single narrative – separation of different operational issues should be respected if other future potential problems of text drafting are to be avoided.

4. THE HISTORICAL DEVELOPMENT

4.1 The International Maritime Organization (IMO)

The guiding text for the IMO is the International Convention for the Prevention of Pollution from Ships (MARPOL) that was adopted in 1973 and entered into force in October 1983. Through this the IMO assumed responsibility for investigating "areas which need special protection through actions by IMO because of their significance for recognized ecological or socio-economic or scientific reasons and which may be vulnerable to damage by maritime activities". This concept of particularly sensitive sea areas was further discussed by IMO's Marine Environment Protection Committee (MEPC) from 1986 to 1991. This appears to be a seminal work on this issue. This work was financed by NOAA (USA), NAMNF (The Netherlands) and WWF. The assistance of the environmental group *Friends of the Earth International* in preparing the material was explicitly acknowledged. The Guidelines were to assist the IMO and governments in identifying, managing and protecting sensitive sea areas. As would be expected, the emphasis of this work was shipping-related affects and although the text refers to seamounts, this was only one of many marine candidate areas that were mentioned.

IMO texts note that a wide range of objectives in terms of the protection were considered:

- ecologically or biologically important areas
- specific marine organisms

- important geological or geomorphological processes
- beautiful seascapes
- cultural or historic sites and
- certain forms of recreational fishing.

The IMO resolution specifies the criteria for designation of `special areas' and `particularly sensitive sea areas':

(a) Ecological conditions
  - Endangered species
  - Productivity
  - Spawning/breeding/nursery areas
  - Fragile/rare ecosystem
  - Critical habitats.

For a particularly sensitive sea area one of the following categories should be satisfied:

  - Uniqueness
  - Dependency
  - Representativeness
  - Diversity
  - Productivity
  - Naturalness
  - Integrity
  - Vulnerability

(b) Social, cultural and economic criteria
  - Economic benefit
  - Recreation
  - Human dependency

(c) Scientific and educational criteria
  - Research and baseline monitoring studies
  - Education
  - Historical value.

MARPOL 73/78 is concerned with 'special areas'- "a sea area where for recognised technical reasons in relation to its oceanographic and ecological condition …" in the context of (allowable) pollution. The relevant criteria are:

- Oceanographic conditions
- Ecological conditions and
- Vessel traffic conditions.

It is the second of these that is relevant here. This includes:

1. Depleted, threatened or endangered marine species
2. Areas of high natural productivity (such as fronts, upwelling areas, gyres)
3. Spawning, breeding and nursery areas for important marine species and areas representing migratory routes for sea-birds and marine mammals

4. Rare or fragile ecosystems (such as coral reefs, mangroves, sea-grass beds and wetlands)
5. Critical habitats for marine resources including fish stocks and/or areas of critical importance for the support of large marine ecosystems.

The MEPC defined a particularly sensitive sea area as one that needs special protection … because of its significance for recognized ecological or socio-economic or scientific reasons and which may be vulnerable to environmental damage by maritime activities. It would need to meet one of the following criteria:

1. ??
2. *Dependency* – ecosystems highly dependent on existing biologically structured systems
3. *Representativeness* – areas that have a highly representative ecological process, community or habitat types. It is then defined as the degree to which an area represents a habitat type, ecological process, biological community, physiological features or other natural characteristic.
4. *Diversity* – dependent on a high variety of species or including varied ecosystems, habitats, communities or areas subject to disruptive forces such as sea shores exposed to high energy wave action
5. *Productivity* – a large increase in biomass characteristic of oceanic fronts, upwelling areas and some gyres
6. *Naturalness* – lack of human-induced disturbance or degradation
7. *Integrity* – the area is a biologically functional unit, an effective self-sustaining ecological unit
8. *Vulnerability* - the area is highly susceptible to degradation by natural events or the activities of people though in the IMO text the emphasis is on coastal areas and the consequences of pollution.

Second, in regard to social, cultural and economic criteria, note is made to:

1. *Economic benefit* – if the area is of particular important to utilization of living marine resources
2. *Recreation* – the area has special significance for recreation and tourism and
3. *Human dependency* – provides for the support of subsistence and/or cultural needs of a local population.

Third, IMO refers to scientific and educational criteria:

1. *Research* – an area is of high scientific interest
2. *Baseline and monitoring studies*
3. *Education* – the area provides an opportunity to demonstrate particular natural phenomena and
4. *Historical value* – the area has historical and/or archaeological significance.

Appropriately, the emphasis of the IMO deliberations is on the direct consequences of maritime activity – discharges from ships and the physical effects of vessel handling and movement. The remedies considered revolve round regulations affecting maritime control, i.e. commercial shipping affairs. However, the IMO Resolution A,720 (17) is important in that it appears to have been seminal in influencing subsequent more general considerations of marine environmental concerns.

The concept of the 'ecosystem' is noted by the IMO work. Although this concept is not explicitly treated, parts of the text deal with characteristics commonly attributed to ecosystems, e.g. dependence and integrity. Reference is made to the concept of 'vulnerability' though the Resolution uses the near-synonymous term 'sensitive' – the implication being the need for protection. A reference is made to vulnerability to damage caused by maritime activities and ecological vulnerability (p15). Vulnerability is specifically referred to as "highly susceptible to degradation by natural events or the activities of people. But, as of 1992 the conjunction of 'vulnerable' and 'ecosystem' to form the new neologism was still in the future. And, characteristically of subsequent resolutions on these matters, the Resolution, in its preambular

text anticipates the need for compromise with other views on how these issues should be handled – i.e. "taking into account other legitimate uses of the sea."

To what extent did the assistance of *Friends of the Earth International* determine the final form of text relating to the marine environment in the IMO Resolution? This question, at least for us, remains unanswerable – we weren't there. But, in a trend that was to continue numerous adjectives and adverbs were introduced that would have to be quantified or at least operationalized if the Resolution were to go beyond being a desideratum to being a functional management tool. These include *important*, *sensitive*, *vulnerable*, *natural*, *rare*, *critical* and *depleted*.

4.2 The Report of the United Nations Secretary-General, 3 March 2003

The Secretary General's report of 3 March 2003 is an omnibus that covers eight sections of which one part deals with 'marine resources, the marine environment'. We conclude that a large number of contributors would have been involved in its preparation. This report (UNSG 2003) is both important as a seminal document and in making (a rare) explicit reference to the concept of a vulnerable marine ecosystem. The report is further unusual in that it provides definitions of terms that usually fail to appear in subsequent relevant reports thus emphasizing the importance of doing so.

A marine ecosystem may be defined (para. 172) as *the sum total of marine organisms living in a particular sea area, the interactions between those organisms and the physical environment in which they interact*. A vulnerable marine ecosystem could be defined as one that is particularly susceptible to disruption, to damage or even to destruction due to its physical characteristics, the activities and interactions of the organisms therein and the impacts they suffer from human activities and the surrounding environment. Paragraph 173 notes that the term 'vulnerable marine ecosystem' is to be used to refer to rare or fragile ecosystems, as well as the habitat of depleted, threatened or endangered species and other forms of marine life. So, within two paragraphs, the confounding/confusing of the concept of 'ecosystem' and habitat begins: para. 172 clearly indicates that for this report habitat is part of the ecosystem. For our purposes the important terms are:

i. Rare ecosystems
ii. Fragile ecosystems
iii. The habitat of depleted, threatened or endangered species and
iv. Other forms of marine life.

UNSG (2003) refers (para. 173) to "other forms of marine life" and "depleted, threatened or endangered species and other forms of marine life", echoing earlier IMO use – "depleted, threatened or endangered marine species" (IMO 2002). How such an open-ended grab-bag made it through the UNSG's editing process remains a mystery.

UNSG (2003) para. 175 cites subsequent IMO text: (para. 175). In the IMO guidelines, "'uniqueness or rarity' and 'critical habitats' are criteria for the identification of particular sensitive areas. Unique or rare ecosystems are defined as habitats of rare, threatened or endangered species that occur only in one area or ecosystems that occur in few locations or have been depleted across their range. Critical habitats include sea areas that may be critical habitats for fish stocks or rare or endangered marine species."

UNSG (2003) continues to give the following "non-exhaustive list of particular ecosystems generally considered to be vulnerable":

- Mangroves
- Sea-grasses
- Warm-water coral reefs

- Seamounts
- Hydrothermal vents and
- Polar Regions.

Seamounts (the one item of the six relevant to us) are described as generally isolated elevations … which do not rise above the sea surface. The report goes on to note that existing assessments show that they have high levels of endemic species, together with certain other high seas underwater features, such as deep-sea ridges and plateaus. Of 921 species of fish and benthic macro fauna collected on 24 seamounts in the Tasman and South Coral Sea, between 16 per cent and 36 per cent were new to science and many, if not most, were potentially endemic to the individual seamounts or seamount clusters on which they were collected. Information currently available indicates that the total number of species endemic to deep-sea seamounts may range to tens of thousands or more, thus potentially making these ecosystems the most prolific and diverse on the planet.

UNSG (2003) cites to a discussion paper prepared for the IUCN/World Wildlife Fund (WWF) High Sea Marine Protected Areas Workshop held during 15-17 January 2003 in Malaga, Spain written by Mathew Gianni, co-founder and policy advisor to the environmental NGO the *Deep Sea Conservation Coalition*. This would have been just six weeks before the release of the 80-page Secretary General's report and thus is testament to their great efficiency of this office in accessing most relevant literature.

The Secretary General's report notes "the international community has yet to devote sufficient attention to the protection of vulnerable marine ecosystems from the adverse impact of fishing"…" and that such initiatives should include "ultimately a global moratorium on commercial fishing around high seas seamounts."

The report notes (para. 184) that "For the purpose of fisheries conservation, *vulnerable marine ecosystems* could be identified as particular regions of ocean space characterized by distinct bathymetry, hydrography, productivity and trophically dependent populations which function as critical habitats to certain fish species and other marine species that breed, rest, shelter or feed in such areas."… "These ecosystems encompass mangroves, reefs and high seas seamounts."
The Secretary General's report (para. 192) notes that "In the case of seamounts, the fauna and flora[7] of such ecosystems as well as other underwater features, particularly those that are not migratory, are also threatened by human activities. Bottom Trawl Fishing is considered to be the greatest danger to seamount ecosystems due to the impact of fishing gear on fish habitat structure. Trawls are non-selective gears which can take in considerable by-catch, and their interactions with the sea bottom may lead to irreversible modifications of bottom ecosystems. The expertise, technology and markets are improving for these fisheries and, given the current trend of increasing demand for and restricted supply of fisheries products worldwide, the scale of fishing on seamounts and other deep-sea areas is likely to grow in coming years, at the expense of the unique and endemic species inhabiting those areas." The citation in support of these contentions is again that of Gianni (2003).

In this report on discussion of the Ecosystem approach to fisheries management, the Secretary General again returns to the issue of preventing fishing, (para. 230) " In order to protect high seas marine living resources, some NGOs have recently suggested that the General Assembly adopt a resolution imposing a global moratorium on fishing around high seas seamounts to prevent the further loss of biodiversity in deep sea areas pending the negotiation of a regime for the conservation of these fragile ecosystems. They consider such preventative action to be in conformity with concerns raised by marine scientists and the application of the precautionary approach to fisheries. Again, the citation provided in support of this text is the report of Gianni (2003); indeed (and lamentably) this report seems to be the only document used as a source in the preparation of this part of the Secretary General's report.

[7] Presumably in the case of seamounts that rise into the photic zone.

Points for Consideration
It does not appear to be the practice to indicate the identities of those responsible for preparing Secretary General's reports. This is understandable, but such knowledge would help interpret the reasons for adopting particular narrative themes. For example, if text dealing with technical issues had been drafted by a lawyer or environmental lobbyist, it would be interpreted differently than if it was drafted by a scientist active in the relevant field. And, this document was important as it would have been a major source briefing for the UN Informal Consultation Process meeting that met later, in June 2003. The treatment of almost all of the issues raised would better have been considered preliminary and the need for further technical consultation identified. Of greater concern here is how a United Nations Secretary General's report, which was presumably intended to be a technical document, could make not one, but two references to banning high seas fishing in the region of seamounts! It seems clear to the HSFG that considerable lobbying and distortion of the UN system must have occurred, based on contestable narratives.

The additional concern is the apparent reliance of the SG's report of the document of Gianni, co-founder of the Deep Sea Conservation Coalition. This document was presented at an IUCN/WWF Workshop during 15-17 January 2003: how did it come to be used as the source document for the UNSG's report published about six weeks later?

4.3 The fourth meeting of the Informal Consultative Process, United Nations, 2 to 6 June 2003

The fourth meeting of the Consultative Process was held at the United Nations Headquarters in New York from 2 to 6 June 2003 and discussions focused around the issue of protecting vulnerable marine ecosystems: it was the next United Nations forum relating to vulnerable marine ecosystems. This meeting proposed that the General Assembly reiterate its call for urgent consideration of ways to integrate and improve, on a scientific basis, the management of risks to marine biodiversity of seamounts, cold water coral reefs and certain other underwater features and reaffirm the efforts of States to develop and facilitate the use of diverse approaches and tools for conserving and managing vulnerable marine ecosystems, including the establishment of marine protected areas (MPAs), consistent with international law and based on the best scientific information available, and the development of representative networks of such marine protected areas by 2012.

The discussion panel associated with the Consultation noted that *marine ecosystems are generally defined as the sum total of marine organisms living in particular sea areas and the interactions between those organisms and the physical environment in which they interact*. Vulnerable marine ecosystems could be defined as those particularly susceptible to disruption or damage by adverse impacts of human activities, such as marine pollution, overutilization of living marine resources or use of destructive fishing practices. While some ecosystems may be fairly resilient and recover quickly from external shocks, others may collapse under either slight or repeated stress. Vulnerable marine ecosystems include, but are not limited to, mangroves, sea grasses, coral reefs, seamounts, polar regions and hydrothermal vents.

Matthew Gianni (this time Consultant, World Conservation Union) noted "the serious and increasing risk to marine biodiversity in areas beyond national jurisdiction, with particular emphasis on seamounts, noting their productivity and high endemism." He discussed the "particularly destructive impacts of Bottom Trawl Fishing", and pointed out that fishing activities around seamounts were unsustainable … He urged the international community to improve the management of risks to the marine biodiversity of seamounts based on scientific evidence and international law [but is not quoted as to what these were] and suggested that: (i) RFMOs should put in place measures to manage seamount fisheries; (ii) regional organizations should impose a moratorium on seamount fishing within their areas of competence until such effective measures were in place; (iii) management in high sea areas outside the competence of regional fishery bodies should be established where unregulated fishing on seamounts took place; (iv) the imposition of a moratorium on seamount fishing until such measures were in place. He proposed that the General Assembly play a leading role in addressing the question of the conservation of marine biodiversity of seamounts.

It was reported that delegations (it remains unknown how many were specialists in the relevant issues – the Consultation's chairmen were respectively an international lawyer and international government officer) made numerous assertions – none of which appear to have been qualified:

i. There was a need to protect vulnerable marine ecosystems and to raise awareness of such vulnerability
ii. Many of these ecosystems were known to be rich in biodiversity and endemic species and
iii. Play an important role in global food webs
iv. Maritime areas were extremely sensitive to anthropogenic impacts and had undergone enormous degradation - as a result of human activities, because of natural phenomena or both
v. Among human activities, fishing activities had the biggest impacts on marine ecosystems, since many fishing operations were unsustainable with
vi. Adverse impacts, not only on target stocks, but also on dependent and associated species.
vii. A number of delegations indicated that, since there was still insufficient knowledge of the functioning of marine ecosystems, priority should be given to the study of the status of vulnerable marine ecosystems, as well as the study of the patterns and causes of their transformation, in order to allow the formulation of criteria for sustainable management approaches.
viii. To understand the threats to vulnerable marine ecosystems it was critical for the international community to continue to support both marine scientific research and monitoring and reporting mechanisms

All of these assertions appear reported as uncontested fact with no evaluation or qualification and without citations in their support. Needless to say, almost all of the above assertions warranted critical comment and evaluation. It is a concern that an international consultation process that was to bring to the attention of the General Assembly issues for consideration could proceed in a manner reminiscent of a high school student council. To be fair to those responsible for reporting such meetings, it is accepted that what delegates say, no matter how general, as long as it is sufficiently coherent to be expressed in text may be included in some manner in the meeting report.

While a technical definition of a marine ecosystem is given, terms such as vulnerable, important, biodiversity and adverse impact (significant or otherwise) remain unconsidered/undefined and therefore while useful and common conference language, are of uncertain benefit in preparing conservation regulations or even providing useful quantitative assessments as to what the actual level of threats/risks were. For the Decision Makers, such terms provide the basis of their negotiations and are tools used comfortably in their trade.

More importantly, Can any narratives be identified here? The need for funding for studies, i.e. the need to support marine research? The need for publicity about the issue? Global food webs were at imminent risk? Trawling was destructive and unselective? Vulnerable marine ecosystems can range from either one of the polar regions (or both) to a patch of mangroves. These were the issues that would be formally presented at the United Nations General Assembly and thus set the scene for the next stage of debate.

4.4 The UNSG Report 2004

This Secretary General's report (A/59/298) was prepared in response to paragraph 57 of General Assembly resolution 58/14 and represented a quantum advance in the quality of its considerations relative to the reports that preceded it. The report specifically considered risks to the marine biodiversity of vulnerable marine ecosystems related to fishing activities and recognized that all fishing has some impact on marine ecosystems and that such impacts generally fall one of four categories and that these may occur at the same time. Relevant to this discussion is the impact on the habitat as a result of the use of destructive fishing gear and reduction of habitat complexity and disturbance of seabed (benthic) communities.

In addressing the issue of the impact on the habitat as a result of the use of destructive fishing gear it notes that much attention has been given to the destructive effects of various types of fishing gear through contact with the seabed and associated ecosystem features. It is widely recognized that all forms of Bottom Trawl are among the most destructive sort of gear because of the damage caused by dragging them across the seabed. Deep-sea trawls can operate to depths of 1,900 metres. However, the report's view that "A typical day's drag with a 55-metre trawl net might cover 33 km^2 of sea floor is somewhat fanciful as it would require the vessel to fish at a speed of around 13.5 knots for 24 hours/day. Phew! Such a speed would be above the steaming speed for many deepwater trawlers! For areas in which deepwater fishing using aimed trawling, as in the SW Pacific and Southern Indian, the gear may be on the ground for minutes (commonly 2 – 20 minutes). While trawlers deepwater fishing in the Northeast Atlantic do use trawls with relatively long footropes- up to 65 m -, but more commonly in this area it is 35 – 40 m. In the Southern Indian Ocean and South West Pacific Ocean, the trawl wing-to-wing spread and footrope length is of the order of 22 – 25 m. Does the text in the same paragraph "A typical day's drag with a 55-metre trawl" refer to the opening of the trawl? Its length? Circumference? Or what? Such sloppy reporting and associated howlers should be unacceptable in a formal United Nations report. The report notes, scarcely usefully, that all fishing has some impact on marine ecosystems.

Other text in this report of the Secretary General raises serious concerns too if not about the experience of those responsible for producing the report then possible biased reporting that supports a particular narrative. Para. 121 notes that bottom trawls have been shown to dig 10 to 25 centimetres into the sea floor, depending on the hardness of the bottom surface. Is the report implying that all trawls on soft bottoms dig up the top 10 – 25 cm of the sea floor? If this is the case it shows lamentable inexperience. However the very next sentence notes " … fishers seek techniques to reduce bottom contact, as this slows fishing and may damage gear." Was the 10 – 25 cm dig a one-off event or was it considered a typical phenomenon? Or just a possibility along the lines that anything is possible?

Despite the realism of some of the generalizations (was there an absence of ENGOs among the consultation's members?) no detail is provided as to how to assess or quantify the critical term 'vulnerability' a deficiency that remains to be addressed. Further to this, HSFG recognizes the need to ensure that future relevant UN deliberations include appropriate skippers and vessel officers, who can comment from a perspective of on-the-grounds experience.

Figure 4.1
Pelagic-style trawl doors as used in aimed bentho-pelagic trawling. These doors are not designed for demersal trawling.

4.5 The United Nations General Assembly Resolution 59/25 of 2005

It is the UNGA Resolution 59/25 that sees the emergence of the important flaws in how the UN system was handling the issue of 'vulnerable marine ecosystems'. Perversely, the Secretary General's Report was probably the most realistic and helpful that had to then been produced by that office, which the General Assembly duly notes (*Taking note with appreciation* of the report of the Secretary-General). Clearly there was a chance in the dynamics of the debate that was happening in 2005 around this topic.

Para 66 notes:

Calls upon States, either by themselves or through regional fisheries management organizations or arrangements, where these are competent to do so, to take action

urgently, and consider on a case-by-case basis and on a scientific basis, including the application of the precautionary approach, the interim prohibition of destructive fishing practices, including bottom trawling that has adverse impacts on vulnerable marine ecosystems, including seamounts, hydrothermal vents and cold water corals located beyond national jurisdiction, until such time as appropriate conservation and management measures have been adopted in accordance with international law.

Here the concept of an "interim prohibition of destructive fishing practices ***including*** Bottom Trawling ***that*** has adverse impacts on vulnerable marine ecosystems, including seamounts" … raises numerous questions.

Presumably use of the pronoun '***that***' would exclude Bottom Trawling that does not have an adverse impact and thus the issue becomes determination as to whether an impact is 'adverse'. Could it be, for example, trawling in areas where there were no 'vulnerable marine ecosystems' including seamounts, etc. But then there would be no impact. Is that what the delegates meant? Or was it intended to be construction ambiguity?

Is the text ", including seamounts" intended to clarify or emphasize what a vulnerable marine ecosystem is? I.e. vulnerable marine ecosystems includes the collective noun 'seamounts'. Or does it extend the range of what are considered to be vulnerable marine ecosystems, i.e. vulnerable marine ecosystems *plus* seamounts? I suspect that because seamounts are generally referred to in UN reports as vulnerable marine ecosystems we presume that the phrase is to provide emphasis.

This weak, if not misleading then explicitly ambiguous, is the assembly reporting that further confounds the term 'destructive fishing'. Conventionally this has referred to as fishing with explosives or chemicals. Here the context can only mean that "destructive fishing practices" = "Bottom Trawling". This appears to directly beg the question! We wonder how this came to pass in what is the forum that is supposed to be the highest level of political debate in the world.

So what happened? It is widely reported that the positions of almost all countries on matters that are before the General Assembly are not decided on the floor of the Assembly but during discussions, either before in home capitals or between coalitions of nations whose policy is to present a coherent position on matters of coalition interest. (The usually common international positions of New Zealand and Australia illustrate this). Trade-offs, not doubt, occur but these are made 'in the corridors'. What has gone forward (in 2005) is that Bottom Trawling is "destructive" and seamounts are vulnerable marine ecosystems. Without appropriate qualification, both assertions are nonsense and are assertions that stakeholders have had to struggle to live with and address.

Paragraph 67 reinforces this view. It notes:
"Calls upon regional fisheries management organizations or arrangements with the competence to regulate bottom fisheries urgently to adopt, in their regulatory areas, appropriate conservation and management measures, in accordance with international law, ***to address the impact of destructive fishing practices, including Bottom Trawling that has adverse impacts on vulnerable marine ecosystems***, and to ensure compliance with such measures;

The narratives that emerge here are:

- Bottom Trawling is destructive and
- Seamounts are vulnerable marine ecosystems.

4.6 The Informal Consultation Process 2005

Once again, in 2005, at the Informal Consultation Process meeting in June 2005, some delegations proposed to include a subparagraph that called upon States to immediately establish interim targeted protection measures, ***including interim bans on Bottom Trawling in vulnerable marine ecosystems***, until such time as

regional agreements or arrangements had been established. Other delegations proposed to call upon States to urgently agree on an open mechanism to cooperate in the protection of vulnerable marine ecosystems. But now there was complication as some delegations held the view that as Bottom Trawling affected the resources on the seabed, including sedentary species, the competency of the International Seabed Authority should be respected. Not surprisingly the issue of what is a vulnerable marine ecosystem became an issue no longer for discussion.

4.7 United Nations Resolution A/RES/60/31, 10 March 2006

This UNGA resolution notes:

69. *Reaffirms* the importance it attaches to paragraphs 66 to 71 of resolution 59/25 concerning the impacts of fishing on vulnerable marine ecosystems,

70. *Requests* regional fisheries management organizations and arrangements with the competence to regulate Bottom Fisheries to adopt, in accordance with paragraph 67 of resolution 59/25, and implement appropriate conservation and management measures, including spatial and temporal measures, to protect vulnerable marine ecosystems as a matter of urgency;

However, Resolution 59/25 *only* refers to "address the impact of destructive fishing practices, including Bottom Trawling *that* [my emphasis] has adverse impacts on vulnerable marine ecosystems. Here, again, there is the subtle shift from something that may happen, i.e. that bottom trawling *that has* adverse impacts. There is no description of the impacts of fishing on vulnerable marine ecosystems, tautology notwithstanding. What if there are no impacts? That protection is considered needed "as a matter of urgency" indicates the evolution of this narrative.

4.8 UNSG 2006. A/61/154

This Secretary General's report would have been the main preparatory document for the December meeting of the UNGA that resulted in the Resolution 61/105. The report was prepared in response to General Assembly resolution 60/31, paragraphs 73 and 74 that requested information regarding actions taken to give effect to paragraphs 66 to 69 of resolution 59/25, to address the impacts of fishing on vulnerable marine ecosystems.

The report begins by citing paragraphs 66 – 71 of UNGA Resolution 59/25. Important aspects of the paragraphs 66 – 68 are:

66. … the interim prohibition of destructive fishing practices, including Bottom Trawling that has adverse impacts on vulnerable marine ecosystems, including seamounts, hydrothermal vents and cold water corals located beyond national jurisdiction …

67. … to address the impact of destructive fishing practices, including Bottom Trawling that has adverse impacts on vulnerable marine ecosystems …

68. … to regulate bottom fisheries and the impacts of fishing on vulnerable marine ecosystems …

It is true that these paragraphs condition their text with the phrase "including Bottom Trawling that has adverse impacts", i.e. it does not refer to bottom trawling that *does not* have adverse impacts – though I find no mention of this distinction in any reports or texts. And para. 66 does end with the text "until such time as appropriate conservation and management measures have been adopted in accordance with international law;"

In the section addressing vulnerable marine ecosystems and destructive fishing practices, reference is made to the FAO Code of Conduct for Responsible Fisheries:

(c) Prevention of habitat degradation through protected areas, gear modifications and restrictions;

which is not the same as protecting VMEs.

The related concept of sensitive habitats has recently been defined as those habitats that are easily adversely affected by a human activity, and/or those where an affected area is expected to recover only over a very long period, or not at all.

Paragraphs 8 – 17 describe either in general or in particular deepwater benthic ecosystems, habitats, endemism, fragility, importance of seamounts to speciation, and general lack of knowledge of these ecosystems and potential impacts of fishing upon them.

The assessment of destructive fishing practices starts with the canard (or is it just a *non sequitur*) that deepwater fishing began because of declines in abundance of fisheries for, e.g. roundfish, flat fish, shrimp, scallops and lobster and more reasonably, technological development. It notes that "new technology allows a high yield per unit effort, potentially depleting target stocks and associated species". In the description of "Bottom-trawling and dredging" it is noted that "nets can be as large as 55 m across and 12 m high. Then follows a particularly academic section that notes that fishing affects the marine environment/ecosystems by removing fish.

It notes that "particular concern has been raised over the adverse impacts of Bottom Trawling on vulnerable marine ecosystems and their associated biodiversity. Among several concerns listed, the most relevant to this paper is: "their physical impact on the bottom, and its fauna and the resulting damage to vulnerable ecosystems as critical habitats for marine biodiversity".

The detrimental effects of Bottom Trawling and dredging on benthos is noted for a dozen locations some of wide geographical area and in various parts of the world's oceans. But then the report notes "The actual impact of these fisheries on sensitive deepsea habitats and the species that occupy them is unknown, … It has been suggested that, in parts of the European continental slope, the distribution of *Lophelia pertusa* and associated reefs has been reduced by intensive trawling. The impact from Bottom Trawling on fragile deep-sea habitats results when the trawl doors and the net sweep scrape along the seabed, removing epibenthic organisms and disturbing otherwise stable substrate.

The report notes that "By-catch and discarding are a common problem in all deepwater fisheries." But without further qualification. In discussing Impacts on benthic ecosystems the report notes that deepsea habitats are particularly sensitive to anthropogenic disturbance due to the longevity, slow growth, low reproductive rates and endemism of the individuals that structure the habitat, their susceptibility to increased sedimentation, their fragility and limited ability to recover from physical fragmentation. A large number of studies have documented the effects of mobile fishing gear on benthic habitat, including the loss of habitat complexity, shifts in community structure and changes in ecosystem processes. No mention is made of studies that show no such thing.

The report notes as "a general comment, it may be observed that although trawls have immediate and short-term visual effects on the physical structure and the biodiversity of many highly structured vulnerable habitats (e.g. coral reefs, sea-grass beds), the long-term effects of Bottom Trawling on the less structured habitats that cover the vast majority of the oceans seabed (e.g. soft substrates) are very poorly documented, although they might be considerable. Overall knowledge on the subject is far from conclusive."

The report notes (para. 56) that "the impact of Bottom Trawling could be reduced by requiring a maximum size of discs or roller gear on the trawl footrope, which would *de facto* impede the work of trawlers on most vulnerable fishing grounds.", by which it is probably meant vulnerable to habitat degradation.

UNSG (2006) A/61/154 is without doubt the most comprehensive technical report produced by the United Nations on fisheries issues. It appears to have had considerable scientific support and input though it is unclear if the representation among those preparing this report included any from the fishing industry – a concern that this is a major source of information and expertise. Now, at least some of the information reported is becoming dated, in particular that claiming high levels of endemism among seamount benthos. It appears that such early accounts simply represented the scarcity of sampling that had taken place until then.

Much relevant literature is reviewed. However, in retrospect there are serious misgivings regarding the report, not least because of its probably influence on subsequent United Nations General Assembly business. Above all is the absence in the report as to what is meant by a vulnerable marine ecosystem. Vulnerable to what? Total extinction? Local extinction? Population change? Habitat destruction? Habitat modification? What should be the reaction if there is an increase in the numbers of a particular species relative to that previously present? What is the ecosystem to be considered? A community? Biome? Local populations?

Again, no interpretation of the term 'habitat' is given. Habitat for everything? Or select species? Are all forms of habitat modification (i.e. destruction) to be avoided/condemned? Are there degrees of concern relating to degrees of habitat change? Is this an issue? Has it be evaluated elsewhere?

Is all modification bad? Is necessary that the report notes (para. 25) "… There is conclusive evidence that stock biomass and abundance have been reduced by fishing. A significant reduction of biomass is unavoidable ***and even necessary*** [my emphasis] to obtain food and livelihood".

What is not even suggested as a possibility is that deepwater trawling can be, and is, undertaken in what the United Nations process would deem a non-destructive way. This reflects the nature of the narrative that is established by this Secretary General's report.

4.9 General Assembly Resolution 61/105, 6 March 2007

UNGA (2007) 61/105 Concerning Sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks became somewhat of a standard bearer for the issue of 'vulnerable marine ecosystems'.

UNGA resolution 61/105 was passed on 6 March 2007. As was common in the history of these resolutions, it addressed a wide range of issues. Paragraph 1 starts "1. *Reaffirms* the importance it attaches to the long-term conservation, management and sustainable use of the marine living resources of the world's oceans and seas and the obligations of States to cooperate to this end, in accordance with international law …". This presumably is to record the meeting's view that the world's fisheries are to be exploited and no matter what else was decided, delegates from fishing nations could return to their state capitals with this message.

Once again, text contains old friends – para. 80 notes "*Calls upon* States to take action immediately, individually and through regional fisheries management organizations and arrangements, and consistent with the precautionary approach and ecosystem approaches, to sustainably manage fish stocks and protect vulnerable marine ecosystems, including seamounts, hydrothermal vents and cold water corals, from destructive fishing practices, recognizing the immense importance and value of deepsea ecosystems and the biodiversity they contain".

The importance it attaches to paragraphs 66 to 69 of its resolution 59/25 concerning the impacts of fishing on vulnerable marine ecosystems is reaffirmed though again what these impacts are is democratically left to the delegations to form their own views. The 'vulnerable marine ecosystems' of mangroves, sea-grasses, warm-water coral reefs and polar regions had become extinct in the UN lexicon as to VMEs. The immense importance and value of deepsea ecosystems is noted but again, is democratically left the reader to decide why or how they are important and why they are valuable, notwithstanding the interests of big pharma.

The concept of the *significant adverse impact* is introduced into UN lexicology in para. 83:

(*a*) To assess, on the basis of the best available scientific information[8], whether individual bottom fishing activities would have *significant adverse impacts* on vulnerable marine ecosystems, 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;

(*b*) To identify vulnerable marine ecosystems and determine whether bottom fishing activities would cause *significant adverse impacts* to such ecosystems and the long-term sustainability of deep sea fish stocks, inter alia, by improving scientific research and data collection and sharing, and through new and exploratory fisheries;

Again, the call to close fisheries in unregulated situation is repeated:

(*c*) "In respect of areas where vulnerable marine ecosystems, including seamounts, hydrothermal vents and cold water corals, are known to occur or are likely to occur based on the best available scientific information, *to close such areas to bottom fishing* and ensure that such activities do not proceed unless conservation and management measures have been established to prevent significant adverse impacts on vulnerable marine ecosystems". And again, the reader is left wondering why particular emphasis is repeated as to seamounts, etc.

There is a request to close 'areas':

(d) In respect of areas where vulnerable marine ecosystems, including seamounts, hydrothermal vents and cold water corals, are known to occur or are likely to occur based on the best available scientific information, to close such areas to bottom fishing and ensure that such activities do not proceed unless conservation and management measures have been established to prevent significant adverse impacts on vulnerable marine ecosystems. Again all rides on what is meant by "significant adverse impact".

There is a request for 'appropriate measures':

(e) To require members of the regional fisheries management organizations or arrangements to require vessels flying their flag to cease bottom fishing activities in areas where, in the course of fishing operations, vulnerable marine ecosystems are encountered, and to report the encounter so that *appropriate measures* can be adopted in respect of the relevant site;"

Paragraph 88 *Emphasizes* the critical role played by the Food and Agriculture Organization of the United Nations in providing expert technical advice, in assisting with international fisheries policy development and management standards, and in the collection and dissemination of information on fisheries-related issues, including the protection of vulnerable marine ecosystems from the impacts of fishing. The resolution further invites the FAO to continue promoting information exchange and increased knowledge on deepsea fishing activities, e.g. through convening a meeting of States engaged in such fisheries, developing standards and criteria for use by States and regional fisheries management organizations or arrangements in identifying

[8] A reader is left wondering how else it might be done.

vulnerable marine ecosystems and the impacts of fishing on such ecosystems, and establishing standards for the management of deepsea fisheries, such as through the development of an international plan of action;

Paragraph 88 has a further fundamental importance as it appears to be the first recognition by the UN system of the need for "standards and criteria" … "in identifying vulnerable marine ecosystems and the impacts of fishing on such ecosystems" despite on-going resolutions, Secretary General's Reports and Informal Consultations making frequent reference to the term 'vulnerable marine ecosystem' and impact. Put another way, for the first time the question is raised 'what are we talking about?' From here, the attention switches to the Food and Agriculture Organization.

4.10 The Food and Agriculture Organization Involvement

4.10.1 Introduction

The FAO, through its Department of Fisheries is the lead technical agency for fisheries matters in the United Nations System and as such is the default institution to which the United Nations in New York turns for advice on such technical issues. In response to the request of the UN the 27th FAO Committee on Fisheries instructed the Fisheries Department to organize a meeting termed by FAO as an "Expert Consultation" to address deepsea fisheries issues (FAO 2007).

Many COFO members referred to UNGA Resolution A/RES/61/105, especially paragraphs 80 to 91, and the need for FAO to act on the requests in the Resolution. COFI agreed that FAO should convene an expert consultation no later than August 2007 to prepare draft technical guidelines including standards for the management of deepsea fisheries in the high seas. The technical guidelines should include standards and criteria for identifying vulnerable marine ecosystems beyond areas under national jurisdiction and the impacts of fishing activities on such ecosystems to facilitate the adoption and the implementation of conservation and management measures by RFMO/As and Flag States (pursuant to paragraphs 83 and 86 of the Resolution). FAO (2007) reports that some members called for a moratorium on high seas deep-sea fisheries until the impacts of fishing activities on these ecosystems could be assessed, but the identities of the countries were not recorded.

4.10.2 Report of the Consultation on International Guidelines for the Management of Deep-sea Fisheries in the High Seas, Bangkok, 11–14 September 2007

The Expert Consultation was to develop international guidelines including standards and criteria for identifying vulnerable marine ecosystems in areas beyond national jurisdiction and to identify the potential impacts of fishing activities on such ecosystems, in order to facilitate the adoption and the implementation of conservation and management measures by RFMO/As and Flag States.

This meeting followed a previous Expert Consultation on Deepsea Fisheries in the High Seas (Bangkok, 21–24 November 2006), which sought to further develop understanding of the management of deep-sea fisheries but the context of this meeting was the request by COFI to respond the UNGA Resolution 61/105. Draft guidelines were prepared and presented to the expert consultation which then reviewed the document, made specific recommendations and adopted a new draft that was to be presented to a subsequent FAO Technical Consultation for review. Usefully, the participants are identified in the meeting report (FAO 2008) and consisted (generally) of 3 academics, 6 marine scientists, 8 representatives of IGOs or NGOs, one member from the fishing industry and 6 government officers in addition to FAO staff.

Once again, the report of the meeting (FAO 2008) contained text "Recognizing the immense importance and value of deepsea ecosystems and the biodiversity they contain." The higher order objectives of management of deepsea fisheries were to:

a) ensure the long-term sustainability of deepsea living resources;
b) prevent significant adverse impacts on vulnerable marine ecosystems (VMEs) and

c) protect biodiversity in the marine environment.

To do this would require identifying areas where VMEs are known or ***likely*** to occur; and take action using the best information available, including through the closure of areas to bottom fishing.

FAO (2008) noted particular concerns that included:

a) the sensitivity and vulnerability of some species, communities and habitats to direct and indirect impacts of fishing –i.e. easily perturbed
b) extreme longevity (100s to >1000 years) of some organisms or the long times over which some habitats develop – i.e. slow recovery
c) the low resilience of species, communities and habitats as a result of low productivity, great longevity, unpredictable and usually low recruitment, and low growth rates, - unpredictable recovery
d) a high proportion of endemic species - high risk of loss of biodiversity, including extinctions
e) those vulnerable seafloor communities distributed as spatially discrete units within a relatively small area - small perturbations may have significant consequences
f) connectivity between populations within regions may be critical to the long term sustainability of biodiversity - fragmentation and risk of loss of populations and
g) knowledge of the ecosystem components and their relationships is poorly known (managing under greater uncertainty).

This consultation explicitly considered the issue of vulnerability and concluded that it included considerations of both the likelihood that a population, community, or habitat will experience substantial alteration from short-term or chronic disturbance, and the length of time required to recover to its prior state, after a disturbance. The most vulnerable marine ecosystems were deemed to those that are easily disturbed and slow to recover, or may never recover. Vulnerable ecosystem features may be physically fragile, but some may be functionally fragile even if physically robust, though no examples of this were provided.

The Consultation (FAO 2008) noted that vulnerabilities of populations, communities and habitats must be assessed relative to specific threats but did not explicitly define what there were. However, examples of vulnerable species and habitats forming species were tables that are considered to be sensitive and potentially vulnerable to deepsea fisheries.

The Consultation (FAO 2008) defined 'Adverse impacts' caused by fishing gears as impacts on populations, communities, or habitats that are more than minimal and not temporary in nature. In the view of this report, if the consequences of an impact spread more widely in space or through ecosystem interactions and are not temporary, the impact is adverse even if the ecosystem feature impacted directly shows rapid recovery (!).

The Consultation (FAO 2008) noted that adverse impacts become significant when the harm is serious or irreversible, e.g. impacts that are likely to take several generations or decades to reverse are considered irreversible – whatever is the shorter (?). Impacts that are likely to reduce the *productivity* of any population impacted by the fishery or the productivity, species richness, or resilience of an impacted community or ecosystem, or the structural complexity of a habitat are considered serious. In this context *productivity* covers all aspects of a population's capacity to maintain itself. In circumstances of limited information the assumption should be that impacts will be difficult to reverse or likely to affect productivity or resilience unless there is evidence to the contrary.

In addressing general management considerations, the Consultation (FAO 2008) noted the need:

a) to identify areas where VMEs are known to likely to occur and the location of fisheries in relation to VMEs or features likely to contain such ecosystems and
b) to adopt plans to ensure the … the prevention of significant adverse impacts on VMEs and the protection of marine biodiversity.

VMEs should be designated if areas exhibit one or more of the following characteristics:

a) Contain unique or intrinsically rare species, communities or habitats – An area or ecosystem that is unique or that contains rare species should be considered vulnerable, since its loss could not be compensated for by other areas.
b) Contain habitats that support endemic species – An area/ecosystem that has significant rates of endemism should be considered vulnerable.
c) Support the presence of depleted, threatened, or endangered species – Areas that contain depleted, threatened or endangered species for all or part of their life histories should be considered vulnerable.[9]

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[9] This usage appears to confound how these terms are used by the IUCN. These may generally be taken as:
Endangered: when a taxon is facing a very high risk of extinction in the wild in the near future and
A) Population reduction in the form of either of the following:
1) An observed, estimated, inferred or suspected reduction of at least 50% over the last 10 years or three generations, whichever is the longer, based on (and specifying) any of the following:
a) direct observation
b) an index of abundance appropriate for the taxon
c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
d) actual or potential levels of exploitation
e) the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.
2) A reduction of at least 50%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer, based on (and specifying) any of (b), (c), (d), or (e) above.
B) Extent of occurrence estimated to be less than 5000 km^2 or area of occupancy estimated to be less than 500 km^2, and estimates indicating any two of the following:
1) Severely fragmented or known to exist at no more than five locations.
2) Continuing decline, inferred, observed or projected, in any of the following:
a) extent of occurrence
b) area of occupancy
c) area, extent and/or quality of habitat
d) number of locations or subpopulations
e) number of mature individuals
3) Extreme fluctuations in any of the following:
a) extent of occurrence
b) area of occupancy
c) number of locations or subpopulations
d) number of mature individuals
C) Population estimated to number less than 2500 mature individuals and either:
1) An estimated continuing decline of at least 20% within five years or two generations, whichever is longer, or
2) A continuing decline, observed, projected, or inferred, in numbers of mature individuals and population structure in the form of either:
a) severely fragmented (i.e. no subpopulation estimated to contain more than 250 mature individuals)
b) all individuals are in a single subpopulation.
c) population estimated to number less than 250 mature individuals.
d) quantitative analysis showing the probability of extinction in the wild is at least 20% within 20 years or five generations, whichever is the longer.

Vulnerable: When a taxon is facing a high risk of extinction in the wild in the medium-term future, as defined by similar criteria.

e) contain important habitat for populations and for which alternative habitats are not known to exist or are uncommon – A discrete area or habitat *that may be essential* for the survival, spawning/reproduction, or recovery of a species (target or non-target species) should be considered vulnerable, whether or not the actual functional relationship between species and habitats are known.
f) are fragile – An area that contains populations, communities, or habitats that are easily damaged by … fishing, should be considered vulnerable particularly if the features that are damaged have long recovery times or where recovery may not be to the original state.
g) are structurally complex – An area or habitat that is *characterized* by complex physical structures created by e.g., corals, sponges, bryozoans or by abiotic features (e.g. boulder fields, clay levees). In these areas, *ecological processes* are usually highly dependent on these structured systems. Further, such ecosystems often have high diversity, which is dependent on the structuring organisms or physical features. Such areas have been shown to be vulnerable to physical disturbance.
h) support species whose life-history traits make recovery long or unlikely if impacted – Areas that support species with one or more of the characteristics listed in para. 16 are vulnerable.

66. States should conduct assessments to establish if fishing activities are likely to produce significant adverse impacts. The assessments should address*, inter alia:*

a) the population, communities and habitats that are present or are considered likely to be or to have been present in the area
b) the risk that the area being impacted by fishing contains VMEs
c) the proportion of the populations, communities, and habitats at risk of being impacted by the fishing and
d) whether the activities involved in fishing will affect the properties that make the area a VME.

Identification of VMEs should use direct ecological criteria such as:

a) the presence of known types of vulnerable species, communities, or habitats, which were tabulated by the consultancy (their Table 2)
b) the presence of structurally complex and fragile habitats or species and
c) the presence of species of concern that perform important life history functions at discrete sites determined to be or likely to be sensitive to adverse impacts.

Where site-specific information is lacking to apply direct ecological criteria, then information that may allow the potential presence of such species, communities or habitats to be inferred should be used (e.g., areas of steep topography that may be the basis to infer presence of suspension feeding communities dominated by corals, sponges, etc.).

The Consultation (FAO 2008) dealt with the issue of biodiversity. The Consultation noted that spatial management tools can protect components of ecosystems: areas that are closed to fishing will gain from protection of species abundance and richness, population structure, and genetic and habitat diversity[10]. Given the paucity of species-specific information for most deepseas fishery habitats, spatial management measures may be necessary to protect all biodiversity in a region.

The IUCN defines Endangered and Vulnerable species as *Threatened*. The FAO defines *Depleted* as where "Catches are well below historical levels, irrespective of the amount of fishing effort exerted". (What if fishing effort is near zero for market reasons? A more useful definition might be fisheries where $B < B_{lim}$.)

[10] I myself counter the daily demands from my wife that I weed the garden by protesting that I am protecting biodiversity.

When deciding if a VME is present the criteria in paragraph 64 should be applied as the starting point for the decision, but the decision should include all the information available, whether directly applicable to the criteria or complementary to them. It should be concluded that an area contains a VME if even [only] one of the criterion is met and in data-poor situations, it may not be possible to have an evidence-based application of the criteria. In such situations the best information available should be used as a basis for the decision, and consistent with the Precautionary Approach, if the information leaves substantial uncertainty about the presence of a VME, it should be concluded that a VME is present until there is sufficient information to change that decision. Interestingly, this is not qualified in any way. When deciding if fishing will cause significant adverse impacts, the same process as in para. 119 should be followed, applying the standards in paragraphs 27 and 28.

The Consultation (FAO 2008) notes that the spatial scale at which these decisions will be made needs to be established on a case-by-case basis, appropriate for the fishery and the likely scale of the VMEs and that decision–making to identify VMEs using the criteria in Section 6C should be precautionary.

The Consultation noted that when a vessel unexpectedly encounters features likely to be associated with VMEs (a seamount?), fishing should cease at the site and the encounter should be recorded and immediately reported. RFMOs/As and Flag States should have an appropriate protocol identified in advance for how vessels in deepsea fisheries should respond to unexpected encounters with a VME or features associated with a VME, ensuring as a minimum that the provision 83d[11] of the UNGA resolution 61/105 is met. When a vessel encounters a VME or features likely to be associated with a VME is reported, the RFMO/A or flag State should consider the report and adapt management of fisheries in that area appropriately to ensure the necessary protection of the VME.

The consultation was of the view that a mix of measures has to be developed on a case-by-case basis and would include:

a) closed areas;
b) closed areas to bottom-contact fisheries or other specific gears;
c) changes in gear design and/or deployment to prevent or reduce adverse impacts, including and
d) eliminate or minimize the contact between the fishing gear and the seabed.

4.10.3 Discussion

With the benefit of seven years hindsight, the flaws embedded in the recommendations that were the results of the Expert Consultation have become clearly evident. These flaws may be grouped as follows:

i. Failure to critically review the technical basis of the request from the United Nations General Assembly
ii. Circular reasoning
iii. Non sequiturs
iv. Introduction of new terminology without definition, explanation or explicit linking to the original text
v. Use of terms that have difficult-to-define within a regulatory context
vi. Use of terms that may have either a general common usage or a specific technical sense without making it clear what is intended and
vii. Use of undefined technical/biological terms.

[11] (*d*) To require members of the regional fisheries management organizations or arrangements to require vessels flying their flag to cease bottom fishing activities in areas where, in the course of fishing operations, vulnerable marine ecosystems are encountered, and to report the encounter so that appropriate measures can be adopted in respect of the relevant site;

Vague Terminology

- *Longevity*

Longevity of a benthic species that may be damaged or destroyed is listed as a criterion of concern. However a distinction should be made between those that have great longevity but are rapid colonizers and those that don't. Long-living species that can rapidly re-establish themselves deserve different consideration to those that are slow to re-populate benthic areas from where their numbers have been reduced or they have been extirpated.

- *A high proportion of endemic species*

This concept is troubling for two reasons. An endemic species that is vulnerable to extinction may be 'rare', in fact one would expect it as it isn't found anywhere else. Thus, the question is posed as to why there should be different treatment between areas that have high or low proportions of endemic species.

The second issue is perhaps more important. The issue of endemicity appears to have arisen following the exploration of deepwater sea floor features in the 1990s. Hardly surprisingly, new species were discovered and, axiomatically, could be described as endemic – they could not be recorded as occurring elsewhere – otherwise they would not be a new species. But, to describe them as endemic would require demonstrating that they do not occur elsewhere and this has not been the case. In fact, attributing endemicity in such cases would be poor, if not deficient, scientific practice. Yet this seems to have been what happened. What should be done now by those wishing to use the endemicity argument is an analysis of subsequent records of benthic 'VME' species after their first record. This should be easy and would give insights as to whether endemicity is a non-issue. For example, how many new benthic species was been subsequently discovered to occur elsewhere? It is noted that many important benthic species deemed to be 'VMEs' have circumglobal distributions, something that would be expected by many marine biologists.

- *Important Life History Functions*

The consultancy notes that identification of VMEs should consider the presence of species of concern that perform important life history functions at discrete sites determined to be or likely to be sensitive to adverse impacts. But, it is difficult to conceive what life history functions of a species are not important!

- *Encountering Features likely to be Associated with VMEs*

The consultancy notes in para. 123 – 125 the possibility of encountering features associated with VMEs and the need to stop fishing. This may be the origin of the concept of the 'move-on-rule' whereby vessels cannot continue fishing unless they move a certain distance (usually 5 nautical miles, a number apparently borrowed from other fishery conservation practices) from where it was deemed that there was 'evidence of a potential VME'. By the term 'features' the Consultancy may have had in mind:

- physically fragility
- inherent rareness
- a single seamount or ridge feature
- features likely to be associated with VMEs that are likely to occur in the region
- structurally complex areas or habitats
- abiotic features e.g. boulder fields/clay levees
- biodiversity (undefined in FAO 2008) and
- sensitive habitat.

Table 2, "Examples of areas (mega-habitats) which are topographical, hydrophysical or geological features (including fragile geologic structures) known to support vulnerable species, communities or Habitats" includes " Summits and flanks of seamounts, guyots, banks, knolls, and hills (e.g., corals, sponges, xenophyphores)". With such a grab bag of criteria it is unsurprising that management agencies have such

difficulty in effectively managing deepwater fisheries to the satisfaction of the stakeholders. It is difficult to conceive of any fishing area that would not be included in the criteria listed above.

Misuse of Terminology

- 'Likely'

This consultation introduced the use of the term 'likely', as in "require identifying areas where VMEs are known or ***likely*** to occur" but offered no guidance as how to decide if something is 'likely'- or not. The occurrence of an unknown event (i.e. possibility of the existence of a VME) may be likely, unlikely or, as there are only three possible outcomes in exclusive probabilistic situations, equally likely. Thus, logically, a 'likely' event must be one in for which the possibility is > 0.5. But, in the absence of any frequentist data, assigning probabilities is impossible. A Bayesian approach perhaps? Is the correct word to use '***may***' as in: "a VME may occur in the area", but of course that simply emphasizes the uncertainty of the situation that is begin dealt with.

- *Non sequiturs*

The FAO expert consultancy noted as an indication of a VME, "the low resilience of species, communities and habitats as a result of low productivity, great longevity, unpredictable and usually low recruitment, and low growth rates" that would result in unpredictable recovery. However, it does not necessarily follow that low productivity (rate of increase of biomass?), great longevity and low growth rates necessarily mean that a species has low resiliency. It is agreed that unpredictable and usually low recruitment may result in low resilience, but high or low, if a spawning population is removed there will not be recruitment. Certainly what constitutes the population needs evaluation and comment.

- *Use of undefined technical/biological terms*

When guidelines must be operationalized through articulation into conservation regulations, the meaning intended, implicitly or explicitly, by a word is critical to whether the exercise is potentially effective or is merely, in reality, posturing. Just as ecosystems can undergo regime changes, so UN initiatives, in response to the pressures of realities also have changed in the vocabulary that has been used. When this is recognized explicitly, there may be a constructive process contributing to a regulatory effort achieving its goal. When this change is implicit or accidental the results is more probably confusion and obfuscation.

Initially the two key issues were 'vulnerability' and 'ecosystems'. In concise terms, the issue was the potential for trawls towed in contact with the seafloor to damage or destroy benthos, i.e. benthos that was 'vulnerable' to the action of trawling. This concept of 'vulnerability' was then expanded to include 'habitat' with the implicit view that habitat would be destroyed or damaged. It has never been explicitly discussed whose habitat was at issue (a strange deficiency?), nor the reality that the phenomenon was in fact the modifying of habitat from one form to another.

FAO (2008, para. 25) is of the view that "Vulnerability includes considerations of both the likelihood that a population, community, or habitat will experience substantial alteration from short-term or chronic disturbance, and the length of time required to recover to its prior state, after a disturbance. The most vulnerable marine ecosystems are ones that are both easily disturbed and are very slow to recover, or may never recover". The concept of probability is introduced (likelihood) and, for the first time, it appears that the terms population, community, or habitat are used as synonyms for an ecosystem. Despite this, we are unaware of the existence of any attempt to determine the probability of a substantial alteration.

In early discussion, definitions of what was meant by 'ecosystem' were given but these definitions, while accurate did not inform the debate at hand and despite the continued reference to 'ecosystems' the discussion has never returned to the meaning of this term. Rather it was proposed to redefine the terms so creating the neologism of the 'vulnerable marine ecosystem' as benthos that is damaged or destroyed by

trawl action on the sea floor. A number of conditional factors, which were usually considered to be independent, were identified and qualified, though as will be discussed below, there has been scarce reference to them in subsequent work.

The definition of marine ecosystem given in UNSG (2003, para. 172) "*the sum total of marine organisms living in a particular sea area, the interactions between those organisms and the physical environment in which they interact*" is not helpful without further qualification. Should it include the fish and plankton in the water column? They are in the particular sea area. But, as the purpose of the fishing is to reduce the biomass of at least the targeted species, clearly it will have an effect on other elements of the ecosystem and the precautionary principle may be invoked to claim that unless this is well understood, there should be no fishing.

The 2007 Consultation implicitly made some critical assumptions. It introduced the concepts of 'population', 'community' and 'habitat'. This was the first inclusion of the concept of *scale*. Could the ecosystem have a greater extent than the population (and *vice versa*)? These three terms imply a functional connectivity; the definition of ecosystem is defined in terms of area. Clearly, ecosystem must be qualified, e.g. a seamount can be considered an area. But what if the population or community extends beyond the seamount in question? Or more pertinently, what if the significant adverse impact is only upon a part (minor or major as the case may be) of the population or community? This would happen if there is fishing on only part of the seamount or the area of relevance. According to the 2007 FAO consultation, (para. 64), a VME should be designated if an area exhibits any one of seven characteristics - though there may be a need for additional criteria. Then para. 70 adds a further three criteria. In all, the usefulness of this guidance must be questioned for if it were to be implemented it would be difficult to conceive of fishing, deepwater or otherwise, occurring anywhere, either on the high seas or within EEZs. Para. 119 notes that a VME should be considered present if even one of the criterion listed by FAO (2008) is met. Para. 121 notes that the spatial scale at which these decisions will be made needs to be established on a case-by case basis as appropriate for the fishery and the likely scale of the VMEs, but no guidance is given as to how that could be achieved.

4.12 The International Guidelines for the Management of Deepsea Fisheries in the High Seas

4.12.1 The General Text

Following on from the 2007 Bangkok a Technical Consultation on International Guidelines for the Management of Deepsea Fisheries in the High Seas was convened by FAO. This consultation reviewed and negotiated the draft FAO International Guidelines that were to guide States and RFMOs in their implementation of the UNGA Resolution 61/105. Delegations to FAO Technical Consultations are usually not lead by technical experts, e.g. in the case of New Zealand, the delegation was led by the Director of International Fisheries, Ministry of Fisheries (who was elected to chair the meeting). The other members of the New Zealand delegation were Andrew Penney, Ministry of Fisheries, and Cathie McGregor of the New Zealand Embassy in Rome, and Richard Wells, Seafood Industry Council. In the case of Australia the mission was headed by John Kalish, General Fisheries & Aquaculture Department of Agriculture, Canberra and in the case of Canada, by Lorraine Ridgeway, Director-General for International Policy and Integration, Fisheries and Oceans Canada , Ottawa. The consultation met in February and August 2008 for nine days: the report of the meeting is given in FAO (2009). The Consultation was attended by 70 Members of FAO, one representative of the United Nations, and by observers from 12 intergovernmental and international non-governmental organizations.[12]

The purpose of this Technical Consultation was to consider the FAO International Guidelines reviewed by the Expert Consultation and to finalize them, as requested at the twenty-seventh session of COFI. The meeting noted that the main objectives of the management of deepsea fisheries was to promote responsible fisheries that provide economic opportunities while ensuring the conservation of marine living resources and

[12] Two representatives of SIODFA were unofficially permitted to sit in the conference room but could not be official observers of the meeting or participate in any way as SIODFA had not been formally recognized by the FAO.

the protection of marine biodiversity, by ensuring the long-term conservation and sustainable use of marine living resources in the deep seas; and preventing significant adverse impacts on VMEs.

Although the guidelines that were produced by the meeting essentially followed those recommended by the Bangkok meeting, it should be noted that it took seven days of meetings (with additional in-the-margin and friends-of-the-chairman meetings) to produce the meeting document. Subtle changes in text occurred but no substantial change in content or objectives. Most of the bugbears that were present in the Bangkok text remained in the Rome report.

The FAO Guidelines (FAO 2009a, 2009b) reaffirm that 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*.

Here there seems to be exact equivalence in use between the term ecosystem and population, community and habitat as the terms are used interchangeably. No definition of the terms population, community and habitat, though this would have been useful. The guidelines assert that physical fragility or inherent rareness may be vulnerable to most forms of disturbance. The consultation agreed 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. Here the concepts of agent (fishing gear), to which the ecosystem/population/ community/habitat is deemed vulnerable and probability of that happening have been separated.

Significant adverse impacts are considered those that compromise ecosystem structure or function such that it (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. These topics are discussed in Section 4.12.3.1.

When designating an ecosystem as vulnerable, habitats and ecosystems should be evaluated against the individual criterion or in combination and the characteristics weighted according to their relative contribution to an ecosystem's vulnerability – though, no doubt, guidance would be needed to do this. Flag States and RFMO/As should conduct assessments to establish if deepsea fishing activities are likely to produce significant adverse impacts in a given area that addresses, inter alia:

i. type(s) of fishing conducted or contemplated, including vessels and gear types, fishing areas, target and potential bycatch species, fishing effort levels and duration of fishing (harvesting plan)
ii. best available scientific and technical information on the current state of fishery resources and baseline information on the ecosystems, habitats and communities in the fishing area, against which future changes are to be compared
iii. identification, description and mapping of VMEs known or likely to occur in the fishing area
iv. data and methods used to identify, describe and assess the impacts of the activity, the identification of gaps in knowledge, and an evaluation of uncertainties in the information presented in the assessment
v. identification, description and evaluation of the occurrence, scale and duration of likely impacts, including cumulative impacts of activities covered by the assessment on VMEs and low-productivity fishery resources in the fishing area
vi. risk assessment of likely impacts by the fishing operations to determine which impacts are likely to be significant adverse impacts, particularly impacts on VMEs and low productivity fishery resources and
vii. proposed mitigation and management measures to be used to prevent significant adverse impacts on VMEs and ensure long-term conservation and sustainable utilization of low-

productivity fishery resources, and the measures to be used to monitor effects of the fishing operations

Risk assessments referred to in para. 47 (vi) should take into account, as appropriate, differing conditions prevailing in areas where DSFs are well established and in areas where DSFs have not taken place or only occur occasionally. In conducting impact assessments, States and RFMO/As should consider, as appropriate, the information referred to in these Guidelines, as well as relevant information from similar or related fisheries, species and ecosystems. Notwithstanding paragraph 34, it should be recognised that there may be circumstances in which States may have to rely on information and data obtained from only the 46 vessels flying their flags or their own research activities when assessing deep-sea fisheries that take place in areas where no competent RFMO/A is in place.

4.12.2 Table 2 and the VME Criteria

FAO (2008a&b) provides an annex of examples of species groups, communities and habitat forming species that are considered sensitive and potentially vulnerable to deepsea fisheries (in the high-seas), and which may contribute to forming VMEs:

i. certain coldwater corals and hydroids, e.g. reef builders and coral forests including: stony corals (Scleractinia), alcyonaceans and gorgonians (Octocorallia), black corals (Antipatharia) and hydrocorals (Stylasteridae)
ii. some types of sponge dominated communities
iii. communities composed of dense emergent fauna where large sessile protozoans (xenophyophores) and invertebrates (e.g. hydroids and bryozoans) form an important structural component of habitat and
iv. seep and vent communities comprised of invertebrate and microbial species found nowhere else (i.e. endemic)

Examples of topographical, hydrophysical or geological features, including fragile geological structures, that potentially support the species groups or communities, referred to above:

i. submerged (!) edges and slopes (e.g. corals and sponges);
ii. summits and flanks of seamounts, guyots, banks, knolls, and hills (e.g. corals, sponges, xenophyphores);
iii. canyons and trenches (e.g. burrowed clay outcrops, corals);
iv. hydrothermal vents (e.g. microbial communities and endemic invertebrates); and
v. cold seeps (e.g. mud volcanoes for microbes, hard substrates for sessile invertebrates).

The biological criteria of concern that are referred to here are:

- Benthos that results in structure, presumably because it has been shown or it is assumed this provides habitat to other animals
- Benthos that is fragile.

To this list of concerns should be added that of endemicity, but we have no knowledge of any evidence that shows deepwater fishing is endangering endemic benthos.

That leaves essentially 'fragility' and structure as concerns. In terms of topographical, hydrophysical or geological features, item ii. is all inclusive as essentially all deepwater fishing occurs in relation to "summits and flanks of seamounts, guyots, banks, knolls, and hills". This all-encompassing criterion would appear then, to be decidedly unhelpful. Of course, all edges and slopes are submerged, and presumably with better editing, this criterion would have disappeared. Benthos that is fragile is usually fragile because it has three-dimensional structure, so it is not unsurprising that species identification guides for VME taxa tend to consist

of all deepwater invertebrate benthos attached to the seafloor. One might conclude then everywhere deepwater fishing occurs plus where ever there is benthos is potentially a vulnerable marine ecosystem.

5. SO, WHAT ABOUT THE CONCEPTS?

5.1 Introduction

The criteria and concepts that are raised, either explicitly or implicitly in the FAO Deepsea Guidelines at first glance appear potentially problematic. Several important concepts are not mentioned at all, though one might assert some logical connection albeit well-disguised by 'conference talk'. These concerns are scientific and operational.

5.2 The Vulnerable Marine Ecosystem Neologism

A question rarely raised, and indeed usually ignored is 'What is that is being considered vulnerable'? Members of a taxon may be vulnerable to physical damage, which may result in the death of the organism, by being knocked over, crushed or retained as bycatch and discarded elsewhere. It is inevitable that there will be instances when this will happen. Where sea floor features have not been fished before, commercially attractive aggregations of fish occur and fishing involves gear-hard-on-the-bottom techniques, benthos will be destroyed. This appears to have happen during the early years of the South Tasman Rise fishery and at particular locations elsewhere. Sea floor features with no commercial fish aggregations – there appear to be many that never attract commercially viable concentrations of fish - are not be fished, not least using the method of preference – aimed trawling. Sea floor features with essentially no emergent benthos (I.e. sandy or hard-rock bottoms) will suffer little or no damage should they be fished. Current fishing practices where trawl doors are kept of the sea floor and contact between the footrope and the sea floor is short (characteristically 2 – 20 minutes) will minimize impacts on benthos. Clearly there will be chronic effects where fishing is sustainable in terms of the target species and there are at least some fragile benthic fauna. Any benthos so crushed or destroyed will suffer what is defined as 'significant adverse impacts'. ***BUT***, when this happens is it synonymous with causing the depletion or extinction of the fragile taxon of concern? I.e. is the destruction of any specimen that is a member of a VME taxon to be an event that should prevent the continuation of the fishery in any area? This is a critical scientific and operational question that more than deserves answering.

The FAO Guidelines (2008a,b) make an implicit and partial shift to deal with this dilemma. These document s introduces the concepts of "population, community, or habitat" (para. 14) while in parallel continuing with the use of the term 'ecosystem' and presumably the concept, e.g. (again para. 14) "These are, in turn, related to the characteristics of the ecosystems themselves". Was it intended that "population, community, or habitat" = "ecosystem"? Who knows? But certainly this text runs the risk of being accused of sloppy drafting.

5.3 Rarity, Diversity and the Ecosystem

From the IMO resolution of 1992 to the 2007 FAO Guidelines, which have become the standard of preference relating to governance of high-seas deepsea fisheries, the concept of rarity has been a fundamental criterion. For example, FAO (2008b, para. 15): "Some features, particularly those that are physically fragile or inherently ***rare***, may be vulnerable to most forms of disturbance ".

There is no indication of any distinction between relative rarity and absolute rarity or other factors that affect the abundance of a taxon. A species/taxon may be rare in an area because it is at the extreme limit of its range, geographically or vertically. These limits will move in relation to shifts in water mass regimes or the other factors determining the species abundance. A species may be rare in an area for reasons unknown, but common elsewhere. Or a species may be rare because normally there are only few of them. Ecologists know that the frequency distribution of the number of individuals of a species in an area is characteristically logarithmically and log-normally distributed, i.e. there usually always are species that have

few individuals present in an area. But, no matter the cause, the result is that the ecosystem or at least some of its components will have elements that can be defined as rare and thus in terms of the FAO guidelines, fragile and therefore a VME must exist. Indeed, one could argue that it is precisely when threshold levels of benthos bycatch *are not triggered* that the circumstances for a VME are the most probable as there will be some rare species around.

But, no matter the variety of causes of rarity, and thus the population/community/VME's fragility, clearly the consequences are not the same. Rarity because of range limits or simply because few specimens are present but the species/taxon's adundance is, e.g., greater on the other side of a sea floor feature or an adjacent sea floor should not raise the same concern as when there are few individuals in existence anywhere. So far, there is no apparent consideration of this reality in the lists of 'taxon that are evidence of potential VMEs' or some similar contrived construction even though it would seem that the response should be fundamentally different. Does this issue deserve attention?

5.4 Conundrum of the Significant Adverse Impact

As is noted above, the FAO Guidelines provides a definition of a 'significant adverse impact'. Paragraph 17 notes that significant adverse impacts compromise ecosystem integrity (i.e. ecosystem structure or function) by (i) impairing the ability of affected populations to replace themselves; (ii) degrading the long-term natural productivity of habitats; or (iii) causing on more than a temporary basis, significant loss of species richness, habitat or community types. These impacts should be evaluated individually, in combination and cumulatively.

When determining the scale and significance of an impact, FAO notes that the following 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 of its life history stages (para. 18)

Temporary impacts are of limited duration such that the affected ecosystem can 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.

A reasonable case can be argued that none of the criteria listed in para. 17 apply to the deepwater fisheries of the Southwest Indian Ocean, or at least not without significant conditionality. And that even that such a claim can be made it emphasizes the deficiency of the governance process that none of the para. 17 conditions have apparently not been explicitly evaluated. The same comment applies to the criteria i., ii. and iii. in para. 18. Being able to intelligently respond to the criteria iv., v. and vi. will require a level of information that is highly unlikely to exist, though a focus on large sponges and large erectile corals would make common sense. It would have helped to have some examples of the ecosystem functions that were in mind when this criterion was drafted. As the entire (?) focus on VME taxon appears to be immobile, if not sessile, invertebrates, again, having a constructive and operational understanding of what was intended by criterion vi. would have been useful.

Clearly (sorry to keep using that adverb), Significant Adverse Impacts are important – if not critical in assessing the evidence of the potential for a VME. But how often have such assessments been undertaken that systematically examine each of the criteria enumerated above? Rarely? Or not at all?

5.5 And what about Biodiversity?

Biodiversity is a concept that is most remarkable for the inverse relation between the frequency of its use and the infrequency of any explanation as to what is meant by the term. The UNSG (2006) notes (para. 9) sensitive habitats also lie within deepsea areas, which support a wide variety of species and populations, and in which research over the past decade has revealed remarkably high levels of *biodiversity* and endemism associated with many deepsea ecosystems. It then provides two references neither of which defines what they mean by diversity. UNGA (2007) notes that it is concerned that marine pollution … endangers … marine biodiversity; *Urges …* application of the precautionary approach … to … biodiversity considerations; recognizes the immense importance and value of … the biodiversity of the oceans. You get the picture. FAO (2008a, b) note that the role of the Guidelines is to provide tools, including guidance on their application, for … the protection of marine biodiversity that these [VMEs] … contain. FAO (2008a) makes five references to the biodiversity contained in VMEs almost matched for frequency by FAO (2008b).

Perhaps this general reference to biodiversity is an indication that the word successfully satisfies the need to express something that all feel they have an intuitive understanding without having to waste time clarifying what it is. Publications abound that explicitly mention the concept in their titles and then proceed to ignore this need completely in the view that this is a term that needs no explanation. The reports from the United Nations and subsequently the FAO make frequent use of the term also, apparently, in the view that the term needs no explanation.

Wikipedia, in reference to a search on biodiversity gives "'"totality of genes, species, and ecosystems of a region" and that there are three levels at which the concept can be considered: species diversity, ecosystem diversity and genetic diversity. Stocks and Hart (2010) in their treatment of the *Biogeography and biodiversity of seamounts* note that the concept in practice, at least for seamounts, is examined by looking at the diversity of species. Other definitions refer to the *number of individuals in a specified area.* The WWF gives us "*biodiversity – is the term given to the variety of life on Earth. It is the variety within and between all species of plants, animals and micro-organisms and the ecosystems within which they live and interact.* "Again here no reference to either number of individuals of a single species (or indeed their biomass). Morato & Pauly (2004) in a compilation dealing with seamount biodiversity manage to go 82 pages without definition of the term.

So, is biodiversity with numbers of individuals of species (previously referred to species abundance)? Does it refer to the numbers of different species in an area? Should it consider concerns of biomass, i.e. does a small animal score the same as a large animal of the same species? Or should the whole concept be left undefined and we rely on those drafting conservation regulations to sort it all out? We pass around the issue of species we feel are beautify/pretty and those we consider ugly.

5.6 Can one have Fisheries without Significant Adverse Impacts?

It would appear that United Nations resolutions and reports (so as to achieve workable agreements?) have handled the need to finish meetings with an agreement by keeping the concepts of sustainable fisheries and significant adverse impacts well separated. The dilemma is that fishing is a socio-economically desirable activity. It provides food and livelihoods and often creates wealth that can be used to fund social welfare programmes – for education, health, transportation, etc. But, there are two critical concerns that are only rarely acknowledged. Firstly, fishing results in the removal of enormous amounts of biomass from the world's oceans – this is an unequivocal reality. In the case of sustainable fisheries, this should be (more-or-less) around half of the initial biomass of the targeted taxon. Between catch and discards, around 100 million tonnes of fish are removed from the world's oceans annually. Though the detail is usually unknown this must have enormous impacts upon the nature and functioning of the oceans ecosystems. But, society continues to do this and fish remains, with some caveats, perceived as a healthy, nutritious, preferred and recommended dietary item. For many, especially subsistence fishermen, fishing is an obligatory lifestyle that relieves them of potentially the most severe poverty.

A corollary to this, which Dr Ray Hilborn (University of Washington) and colleagues have been noting in recent years, is that if these 100 million tonnes of fish were not harvested, presumably an equivalent amount of food (proteins and fats) would have to be obtained from terrestrial sources unless world hunger statistics were not to show a major and unacceptable increase. The example that springs to mind is that of the destruction of Amazonian forest to grow soya bean for international beef-raising markets – hamburger anyone? This reality has yet to appear in any practical form in the policies of environmental lobbyists. In New Zealand we have seen the conversion of high country tussock country to irrigated pasture and the wide-spread drainage of coastal wetlands and destruction of climax forests (Manawatu, the Bay of Plenty and more) for dairy and other forms of farming or plantation forestry. Think para. 17 of FAO 2008b: "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."

United Nation agencies deal with this issue through text such as that of the UNGA Resolution 61/105:

"*Recognizing* the significant contribution of sustainable fisheries to food security, income and wealth for present and future generations,

…

1. *Reaffirms* the importance it attaches to the long-term conservation, management and sustainable use of the marine living resources of the world's oceans and seas and the obligations of States to cooperate to this end, in accordance with international law, as reflected in the relevant provisions of the Convention,2 in particular the provisions on cooperation set out in Part V and Part VII, section 2, of the Convention, and where applicable, the Agreement".

Or paras 11 of FAO (2008a, b) "The main objectives of the management of DSFs are to promote responsible fisheries that provide economic opportunities while ensuring the conservation of marine living resources and the protection of marine biodiversity, by:

> i. ensuring the long-term conservation and sustainable use of marine living resources in the deep seas and
> ii. preventing significant adverse impacts on VMEs."

The closest such bodies come to dealing with the reality of the need for trade-offs and compromises between ecological virginity and social/commercial (and political) realities and the need for human survival might be reference to the "ecosystem approaches to oceans management and the need to integrate such approaches into fisheries conservation and management." This is a narrative that should not be pushed under the surface as it conditions the entire debate. Retreating to live in caves is not an option![13]

6 The Scientific Narrative – What has been its Role?

6.1 Introduction

One of the most active and influential groups in developing the discourse relating to destructive fishing and in public advocacy as to the importance of deepwater ecosystems and biodiversity have been marine biologists - scientists whose careers have been intimately related with deepwater biological research, or at least marine biology in a more general sense. This is unsurprising. Outside of the fishing industry, no other stakeholder group has the same direct exposure to, or insights into, the effects that can result from deepwater trawling on fragile emergent benthos. And, of course, who else has the understanding of the biology and ecology of deepwater benthos – for some (many?) it has been a career-long occupation. It is they who undertook the first deepwater marine surveys and analyzed the results. One can argue that as a consequence it is they that have a responsibility to communicate their findings to the wider public. This can

[13] What about the bats

happen through the normal scientific process. Research results are published in, usually internally reviewed, technical reports or in the primary scientific literature where one hopes independent and usually anonymous reviewers ensure that adequate scientific standards are observed. For obvious reasons, peer reviews may benefit when it is undertaken by members of the same scientific community as authors of papers otherwise specialist knowledge will not be bought to bear on the research that is being undertaken. The occasional bloopers that make it into primary science journals underlines that this process is not always perfect, though it is argued that it is the best we have.

This is not the place for a journey into the debate between what constitutes science and what constitutes advocacy and the merits of keeping these tasks identifiably separate. Nor has this task, in the case of the discourse relating to vulnerable marine ecosystems, yet been undertaken. But clearly it is a critical issue. The output of scientists influences the political process. This may be done directly, as when a report is commissioned or submissions are invited. Relevant examples are the Reports of the Secretary General of the United Nations. Alas, in this case it is not readily apparent who has written the report, though the use of certain citations in support of the reports can raise concerns as to the quality of the outcome. But critically, such reports will influence the debate in the General Assembly, and especially the positions of countries that are not in a position to undertake their technical analyses. Fundamental to good science is transparency and visibility indeed as much as skepticism and criticality.

The more problematic arena is where results are reported or when research undertaken when there has not been an appropriate objective and robust analysis and reporting of the assumptions on which the proposal for the research (and funding) has been based. This may be reflected in texts that projects a particular narrative. When a particular narrative is pursued lack of critical appraisal is endangered. This paper is certainly not a comprehensive review of these phenomena but two examples are offered as HSFG believes they illustrate the process.

6.2 Jones[14] & Lockhart (2011)

This paper was encountered as a consequence of happenstance so its examination here is not intended to imply that it has particular significance, i.e. that it is typical, a worst case, etc. Rather it usefully demonstrates points we wish to make.

The title of Jones & Lockhart's paper is "Detecting Vulnerable Marine Ecosystems in the Southern Ocean Using Research Trawls and Underwater Imagery". The abstract starts with the text "To ensure that destructive bottom fishing activities do not have significant adverse impacts on Vulnerable Marine Ecosystems (VMEs) in high seas areas of the World Ocean, as required by United Nations General Assembly Resolution 61–105, knowledge of the locations of VMEs is required." No further direct reference or explanation is made as to what is considered to be destructive fishing. The authors refer to the United Nations General Assembly Resolution 61/105 as the apparent source of the definition a vulnerable marine ecosystem: "In UNGA Resolution 61/105, VMEs are obliquely defined, and can includes the conventional seamounts, hydrothermal vents, coldwater corals and sponge fields." Jones and Lockhart note that "CCAMLR has interpreted a VME to be consistent with an area that includes the presence of benthic invertebrates that significantly contribute to the creation of complex three-dimensional structure, cluster in high densities, change the structure of the substratum, provide substrata for other organisms or are rare or unique. This interpretation was presumably the result of a workshop that reported to the Scientific Committee of CCAMLR their views that would then, presumably have been adopted by the plenary of CCAMLR. No mention is made to CCAMLR in the abstract but it appears it is the CCAMLR definition that is used in the paper.

What is not mentioned in the Short Communication is that the resolution 61/105 "*Calls upon* regional fisheries management organizations or arrangements with the competence to regulate bottom fisheries"

[14] Dr D. Jones is Chairman of the CCMALR Scientific Committee and an employee of the United States Government.

(para. 83), i.e. such as CCAMLR, and "to assess, on the basis of the best available scientific information, whether individual bottom fishing activities would have significant adverse impacts on vulnerable marine ecosystems,". Jones & Lockhart do not address the issue of what is a significant adverse impact but by following paper citations a definition is given in SC-CAMLR-XXVI/10.

Thus the points relating to establishing a narrative are:

- Destructive fishing and benthos
- The United Nations is against it
- This is a policy issue (the paper was published in *Marine Policy*), as the results influence management of fisheries in the Southern Ocean.

What is not discussed in the paper are the concepts introduced in the FAO Guidelines of populations and communities though note is made that some species that were examined are rare, i.e. dense populations of single species or communities (e.g. aggregations of stalked crinoids) could be significantly impacted by a single fishing event, and the effect exacerbated by limited potential for recovery because of isolation from recruitment sources.

6.3 The Role of NIWA in the Issue of Vulnerable Marine Ecosystems

6.3.1 What is NIWA?

NIWA, the National Institute of Water and Atmospheric Research, is a Crown Research Institute established in 1992. It operates as a stand-alone company with its own Board of Directors and Executive whose mission is to conduct leading environmental science to enable the sustainable management of natural resources for New Zealand. Among its thirteen praiseworthy operating principles, is that of remaining financially viable and delivering an appropriate rate of return on equity.[15] There is no denying that NIWA, by global standards - is a prestigious research institution that makes crucially important national contributions to science and indeed many aspects of New Zealanders' lives. However, it is also an enterprise that is 'open for business' and fair enough.

6.3.2 What are our NIWA Concerns?

NIWA, through its involvement in deep-sea benthos research has adopted the issue of benthic research through the lens of vulnerable marine ecosystems. Traditionally, biological research has been undertaken because of the values our society attributes to scientific knowledge and the desire to know about our natural environment and how it works. This is a narrative with a centuries-old tradition. The United Nations perspective (predated by the work of the IMO) was prompted by concerns of the effects on high seas fish stocks and in the case of fisheries for bentho-pelagic species, the impacts of trawl gear on fragile benthos.

Even though initial concerns were in terms of quite general taxon, research institutions (and others?) have chosen to interpret the vulnerable marine ecosystem paradigm exclusively in terms of deepwater benthos. For example, Rowden *et al.* (2013) refer to vulnerable marine ecosystems (VMEs) as "any deepsea ecosystems that are highly vulnerable to one or more kinds of fishing activity, and are identified by the vulnerability of their components (e.g. habitats, communities or species)." As is usual, the issue of scale is not addressed, e.g. if the fishing activity renders say 5% or 10% of the ecosystem 'vulnerable', is it appropriate to consider the area potentially affected as a vulnerable marine ecosystem or just those individuals that will be effected?

6.3.3 The NIWA Programme and Vulnerable Predictive Modelling of Marine Ecosystems

NIWA have become committed to the concept that the location of vulnerable marine ecosystems can be usefully predicted. Indeed this conviction has instrumental in the Ministry of Business, Innovation and Employment and the Ministry for Primary Industries funding a $NZ 3.5 million research voyage, a major

[15] This information taken from the NIWA Web Site <https://www.niwa.co.nz>

objective of which was to validate the use of computer models that would allow areas of vulnerable marine ecosystems to be predicted and thus through the use of appropriate conservation regulations, be safeguarded. The view of the fishing industry towards this programme has always been askance. HSFG had made clear that the NIWA predictive model appeared flawed and the Group offered actual baseline information that was not used. The results of this cruise, undertaken in 31 January – 6 March 2014, have yet to be made available in a form that will enable appropriate third-party assessment. However, it is clear that the misgivings of the fishing industry in relation to predictive modelling were fully justified. It is perhaps relevant to refer to some of the HSFG's technical concerns, but first a response to the general programme results. The following table lists the general objectives to the entire programme. We have added, in restricted terms, our view of the results so far of elements of the programme.

Objectives for the trip TAN1402 (referred to by NIWA as a "Vision Statement"

Objective	Apparent Cruise Result
The predicted location of vulnerable marine ecosystems in New Zealand's EEZ and adjacent areas will be known. These prediction models will have been ground-truthed, and confidence in their accuracy assessed.	This cruise was restricted to the Louisville Ridge system. Our experience is that different ridge systems have different bottom characteristics, - sand, basaltic rock, depth profiles, etc. and thus would be expected to have diver benthic faunal characteristics.
These prediction models will have been ground-truthed, and confidence in their accuracy assessed.	The prediction models failed miserably and there is no confidence in their accuracy, at least as they exist at present.
Management agencies, as well as industry, and the general public, will have confidence in application of the model results, and they will have been used to inform New Zealand initiatives on marine spatial planning in the South Pacific region and potentially the EEZ.	Industry have yet to see any reason to change their pessimistic view that such prediction models will work (or indeed that this is potentially the most effective way of protecting communities consisting of fragile benthos (CCFBs).
Such conservation and management measures will protect vulnerable marine ecosystems from the adverse effects of fishing, or other human activities.	No indication is given of any conservation or management measures.

HSFG was particularly concerned by manner of survey design in relation to the predictive modelling: this is reflected in the lack of appropriate detail in Section 2.2 of Clark *et al.* (2104) "Survey Design". We found an absence of a clear explanation as to how the survey area was stratified and how the sizes of sampling cells were chosen troubling. Clearly any probability estimate will depend on the size of the sampling cell – near certainty of evidence of a vulnerable marine ecosystem can be obtained from a predictive model just be increasing the size of the sample element – something that is not particularly helpful – or worth paying for. Thus we were of the view (as yet unchanged) that any results must be subjective in the sense that they will change if the size of the sample element is changed. This has been a known ecological challenge since the beginning of the last century.

The report does refer to strata based on estimated probabilities of suitable habitat for corals but it is unclear if the probabilities refer to the expectation of finding corals or just to 'suitable habitat'? And, if there were no corals does that mean the habitat is unsuitable? Surely there should be no need to be asking such questions at this point in the programme.

At a minimum one would expect to see in the report for each guyot that was surveyed a table with a list of the number of sampling elements (= their cells?) in each class, i.e. probabilities > 0.8, 0.2 - 0.8, <0.2, etc. and

how these assignments were obtained. But, the report gives only a partial diagram for one guyot to convey this information. One would assume that the probabilities referred to, e.g., > 0.8, refer to the probability of finding a hard coral. But, is this the same as finding a 'VME', which appears to be equated to a 'coral thicket', i.e. >15% of the picture frame occupied by a coral?

For Forde Guyot (the only one for which information is provided in the form of a diagram, there appear to be 48 high probability squares (green). Here the prediction models indicate a probability of >0.8 of 'suitable habitat'. If 'suitable habitat' = existence of hard corals, then one would have expected to have found 48 * 0.8 = 38.4 suitable habitats (= hard corals?). It seems this didn't happen. In this case, an explanation (and details) in the trip reporting process would have been most useful.

7. WHERE SHOULD WE GO NOW

It is our view that the right answer to this question is not in reference to, or scrutiny of, the relevant United Nations/FAO record, although this we have done, but the need to reframe the task and ask again 'what is the central question'. So what is this central proposition? We believe that at its core is the issue of environmental use and environmental protection and the balance between them. We see no reason why this question is better answered by a benthic biologist/ecologist though undoubtedly they can inform on the required discourse.

We believe that the discourse must have as its basis a number of fundamental axioms:

- Society uses the resources of the world – this is undisputed, inevitable and unavoidable. Fisheries, as a societal activity will modify marine ecosystems by removing biomass and where it has impacts, e.g. the benthos, modify other aspects of the marine environment.
- Much of the world's benthic areas have been modified by fishing activity – and in cases destruction is an appropriate description: some of this modification has been severe with the destruction and removal of fragile benthos but this has not been, and is not always, the case. Indeed our experience is that often, targeted fish aggregations seem to avoid areas with corals.
- If fisheries are restricted, the food they would provide will be replaced by food production that causes its own impacts on the terrestrial environment; extra costs that are created will have consequential costs to society – increased carbon foot print and/or forgone social welfare benefits. Hilborn, from quantitative assessment of this issue, is of the view that fish production, at least for certain fisheries, is benign relative to other food production options.
- Much (most?) of the ecosystem services provided by deepwater benthos cannot be assessed quantitatively (at least by any models we are aware of) whether we deem them important or make no pertinent prognoses. That is, the VME ecological services generally have no direct human value and the issue is that of their existence value, i.e. the value society attributes to the fact that those animals exist even though there is no direct usage. (We are aware of a limited number of studies showing a relation between some benthos and life-history stages of some commercial exploited species.)
- The fishing industry (at least this industry association) subscribes to the view that species should not be gratuitously driven to extinction and that fishery operations should be conducted in a manner that avoids this and, indeed, minimizes or removes the possibility of the depletion or extinction of benthic species, populations or communities. There is no equivocality about that.
- The concept of the ecosystem is problematic in the circumstances of this discourse. In fact, it seems reasonable to conclude that what is at issue is the, usually sessile, fragile erect benthos. Words are important and we believe that this discourse would be facilitated if the neologism 'vulnerable marine ecosystem' was dropped. The adjective 'marine' is superfluous. What constitutes the ecosystem is contentious. And, what it is that vulnerable refers to is variable? Vulnerable to impact by fishing gear? Vulnerable to significant adverse impacts, where this is a subjective construction whose projection is uncertain and certainly imprecisely documented. Twenty to thirty years? Fifty to one hundred? New

definitions can create neologisms and new interpretations but that doesn't mean that the newly-minted concepts are clear, correct or appropriate.

Implicit though it has been, there is a need for acceptance that areas that are fished will be impacted and much sea floor has already been modified. This is an unavoidable cost generated by our society. But, this reality should be complemented by provisions that ensure that there is protection and conservation of a healthy representation of benthic communities. By its very nature, fishing is a stochastic activity; one is never sure what will be in the catch until the net is emptied–in our case - factory deck. Our experience is that the occasional presence of corals, sponges, etc. in the catch will happen no matter what (rare exceptions can always be imagined). Further, implementation of ever more tortuous threshold criteria (is that one species or two?) requiring a vessel to repeat the draw somewhere else will not solve the problem, unless the objective is to slowly stop all fishing in a region.

There is a further change required to the narrative that we believe is most commonly perceived and that is that the fishing grounds are a bed of coral gardens, coral forests, coral thickets etc. Not only do we believe that the evidence clearly shows that most fishing occurs over grounds that have little or no fragile benthos and it seems that this has been its natural condition since prior to the start of fishing operations but our collection of evidence to show this is well advanced. Of course there are areas of high species richness and biomass of fragile benthos (= diversity?): this we recognize and we fully endorse the need to fully protect these types of ecosystems from damage by fishing. We believe the debate about how best to ensure this has been unsatisfactory with perverse consequences in terms of achieving the objectives that most stakeholders seek. The global fishing industry is one of the most important providers of food and economic well-being to a growing population. Food security is at the forefront of many governments objectives but compartmentalization of governance appears to have resulted in a failure of appropriate policy evaluation, an evaluation that should be comprehensive based on the views of all stakeholders.

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