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DSCC paper for SPRFMO SC8

Deep Sea Conservation Coalition

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DSCC Paper for SC-8

Introduction

This paper for the Deep Sea Conservation Coalition (DSCC) focuses on issues (c), (d) and (e) of the Scientific Committee (SC-8) Deepwater agenda and introduces the paper by Professor Les Watling of the University of Hawaii and Emeritus Professor Peter J. Auster of the University of Connecticut and Mystic Aquarium, "Seamounts, VMEs and Spatial Management".

This paper recommends that SC-8:

(1) Advises that the encounter protocol thresholds should be reduced substantially from the current levels and instead be set to determine whether a VME has been encountered following the applicable United Nations General Assembly Resolutions (UNGA) and the International Guidelines for the Management of Deep-Sea Fisheries in the High Seas (FAO International Guidelines).

(2) Advises that the benthic fisheries impact assessment (BFIA) from New Zealand and Australia (SC8-DW07) should be re-written to comply with the UNGA resolutions and FAO International Guidelines, specifically to avoid significant adverse impacts (SAI) on vulnerable marine ecosystems (VMEs);

(3) Advises the Commission of the inadequate data underpinning the Zonation model put forward by New Zealand, the flaws in the model and the lack of scientific underpinning of the CMM 03-2020's spatial management approach; and

(4) Advises that the current bottom fisheries measure is not appropriate for managing benthic impacts and advises that it should be re-written to avoid SAIs on VMEs and to implement the UNGA resolutions, so that areas where VMEs are known or likely to occur –including seamounts and similar features– should be closed to bottom trawling, and that an encounter protocol be put into place which is designed to be triggered when a VME has been encountered.

Watling and Auster Paper

The Watling and Auster paper, "Seamounts, VMEs and Spatial Management":

1) Describes the vulnerable marine ecosystem (VME) indicator species as best as they are known from seamounts in the Pacific;

2) Examines the ecosystem concept and how it is applied in the context of VME indicator species and the distribution of VMEs[1] on seamounts and similar features, and the factors that might influence their local placement;

3) Assesses what we know, or can know, about VME indicator species distribution and abundance on seamounts as recorded from trawl bycatch;

4) Determines whether it is possible to model accurately for spatial management purposes the distribution of these species when trawl bycatch is the only information source; and

5) Examines the issue of potential recovery of VMEs following trawling based on what we know so far but also from the perspective of likely sources of larvae.

Watling and Auster explain the importance of vulnerable marine communities, as well as vulnerable marine ecosystems, which are connected through water flow, larval distribution, fish feeding, etc. The paper thus suggests the concept of the seamount as a series of functionally

interrelated communities making up part of an ecosystem which potentially comprises many seamounts, and that the communities that make up the ecosystem can range over very large distances.

The paper explains shortcomings of biogeographical papers, such as Costello et al. (2017) and Beger et al. (2020) including that:

1. Merely representing which squares in the ocean are most similar to each other does not provide information about the history and continuity of the biogeographical units. This continuity is manifested through larval dispersal by currents, as well as by larger organisms dispersing by swimming, all the while staying within some geographic boundaries which can be defined by water masses; and
2. These papers oversimplify for the purpose of classification: e.g. some cluster physical and chemical data, such as temperature, oxygen concentration, as well as nutrients and light, and those clusters are assumed to represent what the bathyal species are responding to. But the divisions are not likely to predict differences in species composition. For instance, the most important physical parameter is likely to be temperature, since it regulates metabolic rate.

It is more useful, for differentiating seamounts as VMEs, to try to determine which of the many seamounts in the ocean are similar to each other in some physical characteristic (i.e. summit depth, organic matter flux, distance to nearest seamount, and dissolved oxygen).

Watling and Auster address spatial management in their paper. They write that in order to determine the boundary of an ecosystem it is important to know the limits of the component communities, both horizontally (which are difficult to know) and vertically. Crucially, efforts to plot or model the distribution of the most abundant indicator species may not account for the whole ecosystem. Whole seamounts need to be treated as VMEs or as part of a larger ecosystem. Since so little is known about reproduction and recruitment of VME indicator species, predictions about the fate of the entire VMEs would seem to be difficult to make. While the VME indicator species are important for helping to delimit the VMEs, they are not the only species that might be impacted due to the fishery operating on a seamount. Since the ecosystem contains species that are both known as indicators as well as many others not so designated, it is possible that the VME could be impacted by the loss of those unknown species. They give a number of examples.

Relevant to the naturalness layer of the Zonation model, Watling and Auster write that recovery of communities on seamounts will rely on local larval production or delivery of larvae from afar, which will depend on factors such as the state of surviving colonies, whether the ecosystem can support the production of sufficient energy to allow the colony to generate viable reproductive products, and whether the surviving colonies are within reach of each other such that spawning and fertilization will be able to occur. Worse, it is possible that production of larvae will not occur due to various factors contributing to the Allee effect for the species. A lot depends on the vagaries of currents. But it seems likely that some colonies can begin to produce gonadal products when quite young, so it is possible for some larvae to be produced early in the life of the colony. Timelines of recovery are likely to be very long, perhaps from 40 years or so at 300-600 m depth, to many more decades in deeper water. Practical consequences of this for the naturalness layer are that continued destruction of VMEs will make recovery more difficult or impossible and that it is dangerous to continue to sanction destruction on the basis that they are probably already damaged.

On VME indicator species, Watling and Auster estimate that catch efficiency of taxa brought up in nets is as low as 10% or even 1%. Williams et al. (2010) estimated the catch efficiency for a deep-sea trawl net to be 0 to <0.01 for *Gorgonacea*. Further, several groups of corals overrun by trawls do not show up in the net at all, so that a catch of 35 kg may mean that more than 3500 corals were impacted during that single tow (the largest of the relevant corals ending up in the net weighing 1 to 1.5 kg). The precautionary approach would be to use a value far less than the 99th (or for stony corals 98th) percentile of trawl catches when setting limits for the move-on rule (see discussion of the encounter protocol below)

Watling and Auster conclude that identifying the presence, distribution, and abundance of an indicator species defines the state of that species at a moment (or period) in time: it does not define the composition of an associated community, the suite of species interactions that define and sustain the community, or the flows of materials and energy that define the bounds of the ecosystem. Habitat suitability models and related geo-spatial analyses give an impression of precision and quantitative certainty while implicitly ignoring critical but poorly known elements of the ecology of communities and ecosystem dynamics. Management decisions, especially given the known characteristics of VMEs, should be made with explicit admission of the limits to understanding and the consequences of errors in decision-making.

These observations and conclusions have obvious and have direct implications for the bottom fishing measure and its spatial approach. The precautionary approach, mandated by the Convention, should lead the SC to advise the Commission of the inadequate data, the flaws in the model and the lack of scientific underpinning of the CMM 03-2020's spatial management approach.

DW Agenda Item c) VME encounters and spatial management

In the 2020 workplan, the SC was asked to finalize the list of VME taxa and design approach for benthic bycatch review and review VME catch and other benthic sampling data, and to update and reassess the VME and habitat suitability modelling. There is also a Commission request from CMM03-2020 to review all reported VME encounters.

Spatial Management

In addition to the matters cited by Watling and Auster, it is abundantly clear that a single paper such as Costello et al. (2017) cannot form a basis for VME spatial management for orange roughy fisheries, and that such a simplistic approach must be rejected. The Costello paper is entitled "Marine biogeographic realms and species endemicity". Endemicity is at the core of the paper, yet the DSCC understands that NIWA have not factored endemism into their model or its application. It is also apparent from the supplemental materials that the Costello paper is heavily driven by the pelagic records. We have not seen a list of the taxa and of endemic species. A more recent paper, Beger et al. (2020) observes that the currently existing broad-scale bioregionalisations of marine environments (both coastal and offshore) are too coarse to inform most national planning processes: classifications are made despite known variability within and across the marine environment, and this level of assumed national and regional homogeneity is incorrect, and cannot differentiate marine assemblages at the spatial scales relevant for ocean management. Offshore environments are highly variable, but this variability decreases with depth, and are shaped by oceanographic and biophysical factors that drive open ocean population dynamics (such as temperature, as Watling and Auster note).

The use to which such spatial management approaches can be put is explained as, for example, designing ecologically representative systems of marine protected areas by ensuring representation of examples of every marine bioregion in the system. But this is a wholly different use than justifying the destruction of VMEs on the basis that there may be some more in the bioregion. The uses just cannot be assimilated. One is making the best use of the limited data to design MPAs; the other is to actually sanction marine destruction on the basis of an assumption that no endemic or otherwise vulnerable areas are being destroyed, with no notice taken of connectivity, and with the significant possibility of other (non-indicator) species being destroyed. It is no answer to state that this is the best scientific information available. The information, such as it is, is being used for a purpose – being management of damage to VMEs caused by bottom fishing, rather than, for instance, designing a system of marine protected areas - for which it was not designed, nor is it fit for that purpose. Fitness must be for the job at hand, which is preventing significant adverse impacts (SAIs) on VMEs – and, lest there be any doubt, that means on the VMEs impacted by the bottom trawlers. Using the bioregional models to justify allowing bottom trawlers to continue fishing in areas where VMEs are known to be found or likely to be found is clearly contrary to the UNGA resolutions and FAO International Guidelines.

Indicator Thresholds

As with SC-7, this SC needs to address the VME indicator thresholds. Both the UNGA resolutions, summarized in the Appendix to this paper, and the citation of the resolutions by CMM 03-2020 are important. Over 11 years, the UNGA resolutions not only repeat the importance of the encounter protocol but the importance of implementation of thresholds and move-on rules, to achieve the overall purpose, which is the avoidance of SAIs on VMEs. To this end, they note the FAO International Guidelines description of what constitutes SAIs, factors to be considered when determining the scale and significance of an impact, and what constitutes temporary impacts and factors to be considered in determining whether an impact is temporary.

The thresholds are set out in paragraph 28 of CMM 03-2020: they are triggered where VME indicator taxa are encountered in any one tow at or above the threshold limits in Annex 6A, or three or more different VME indicator taxa at or above the weight limits in Annex 6B. But what is not explicit is how those threshold limits were arrived upon.

Pitcher et al. (2019) identified significant deficiencies in what is now CMM 03-20: "The results of this work provide strong objective evidence that there are considerable and demonstrable uncertainties as to whether CMM 03-2019 is meeting (or will meet) the objective to manage and prevent SAIs on VMEs at local/site scales, population scales, and regional scales." The Pitcher et al. (2019) paper underlines that the objective of the CMM will not be achieved.[2] This has important implications for CMM 03-2020: not just on VME thresholds but for the basis of the whole measure.

The SC-7 catchability paper Geange et al. (2019) (1)[3] suggested a catch efficiency of taxa of 5%, and suggested that removing 5000 kg of coral could result in the mortality of many thousands of associated species.[4] The paper by Clark et al. (2019) shows that the resilience of deep-sea coral and sponge ecosystems is low, and recovery times are long, at least in the order of several decades. The Pitcher et al. (2019) paper[5] makes a similar point when it observes that a trawl catch of 250 kg of corals could scale to a seabed contact of more than 33–104 tonnes of corals on the seabed, or 27-85 tonnes using an estimated impact proportion of 0.82.[6] These conclusions, together with

the conclusions of Watling and Auster, shows that the advice of the SC-6 to set thresholds high needs to be reconsidered and updated.

Moreover, the exclusion of other taxa is explained as "[t]he ten taxa did not include some groups explicitly mentioned by the FAO guidelines as examples of VMEs because they had not been previously encountered as bycatch in the area (e.g., xenophyophores), were poorly retained by fishing gear (e.g. bryozoans), or were deemed difficult to identify in the field by observers (e.g. hydroids)."[7] (Geange et al.(2019) (2).) Being difficult to identify by observers or being poorly retained in fishing gear and not reported does not justify their exclusion: quite the reverse, it justifies a low precautionary threshold for them.

VME Thresholds: Choice of the percentile

In estimating the level of VME bycatch to trigger a move-on, Cryer et al. (2018)[8] estimated a percentile of bycatch caught per VME indicator taxon including sponges, a range of corals, and sea pens. The SC6-DW09 Table 4 included a range of options for percentage ratio that could be used from 0.8 to 0.995.[9] The choice of the 99% thresholds for the move-on rule is both arbitrary and extreme. The current CMM3-2020 uses those extreme values in calculating the thresholds for the move-on rule, rather than precautionary values, apart from the amendment made at the Commission this year. It is not fit for purpose in that it does not provide a definition of what constitutes evidence of an encounter with a VME. A 99% threshold level means that very few encounters will be considered to be potential VMEs and a taxa threshold was not set for *Stylasteridae* (hydrocorals), *Pennatulacea* (seapens), *Crinoidea* (sea lillies) or *Brisingida* ('armless' stars).

Table 1 includes the range of uncertainty that is presented in Table 4 from Cryer et al. (2018) for *Scleratinia* stony corals. The table shows that the percentile chosen is crucial: if the 80th percentile is chosen, 5 kg in the net represents between 0.7 to 2 tonnes destroyed on the slope, or 0.5 to 1.7 if it is assumed that 18% is not destroyed. But that figure swells to 33-104 and 27-85 tonnes for the 99th percentile, for 250 kg caught in the net.

Table 1:

Percentile	80	90	95	98	99
Stony Corals - threshold: kg[10]	5	10	20	60	250
Impact slope (tonnes)	0.7-2	1-4	2-8	8-25	33-104
- **Ratio 0.82[11] (tonnes)**	0.5-1.7	1-3	2-7	6-20	27-85
Impact UTF (tonnes)[12]	0.5-1.6	1-3	2-6	6-19	25-79
- **Ratio 0.24**	**0.1-0.4**	**0.2-0.8**	**0.5-1.5**	**1.5-4.5**	**6-19**

The choice of the 99th percentile was critical: for *Scleractinia* (stony corals), it resulted in a 250 kg threshold, whereas a 0.80 percentile would result in a 5 kg threshold (Table 6). This was amended in 2020 and 80 kg chosen by the Commission for a revised CMM03-2020 which is still higher than 98% and could result in well over 25 tonnes of corals impacted.

Penney's 2014 paper,[13] citing Parker (2008), explained the choice as follows:

> Parker (2008) used the cumulative weight frequency distributions from the analyses shown in Figure 3 to determine a range of threshold weights for each VME taxon, at 50%, 75%, 80% and 90% (see Table 2, e.g. 75% of the tows retained less than 100 kg of *Actiniaria*). He notes that the choice of which cumulative weight percentile to use to as a threshold weight indicating evidence of a VME encounter is a management choice somewhere between presence/absence (no weight threshold), and an excessively high weight threshold that would be triggered only by rare large bycatches of corals and sponges. He provides a rationale for the choice of the median (50%) cumulative weight level, largely based on the fact that fragile and habitat forming VM species such as corals and hydrozoans are poorly retained by bottom trawl nets, so that "a low weight in the catch indicates much higher densities on the seafloor".

The DSCC has already last year submitted to the SC that the 99th percentile is far from precautionary, as well as being arbitrary.[14] This approach specifically breaches the objective of the SPRFMO Convention, Article 2, in not applying a precautionary approach and not safeguarding the marine ecosystems.[15] Instead, we suggest that SC-8 should instead design and set the VME encounter protocol thresholds to determine whether a VME has been encountered.

DW Agenda Item d) Bottom fishery impact assessment

The SC will review an updated jointly presented bottom fishing impact assessment (BFIA) from New Zealand and Australia. This will include information relevant to the CMM 03 advice to the Commission on interactions with marine mammals, seabirds, reptiles and other species of concern.

The tabled BFIA SC8-DW07 is only partial, failing in particular to adequately address VMEs so it is not possible to comprehensively comment on it in time for the SC-8 deadline: the table on page 3 shows the section that have yet to be completed. But comments are made below on the sections that are included, in the hope that meaningful changes can be made which will correct the mis-reliance on predictive modelling and instead focus on preventing SAIs on VMEs.

4.6.1 General approach to avoiding Significant Adverse Impacts on VMEs. It is stated that "The measure was designed to provide an assurance that bottom fishing within the Evaluated Area would not have significant adverse impacts on VMEs, taking into account the spatial extent of the impact relative to the availability of VME indicator taxa within the Evaluated Area and at a range of finer spatial scales." It can only be assumed that the emphasis is on "taking into account the spatial extent of the impact" etc, since no efforts are made to close areas where VMEs are known or likely to occur (UNGA resolution 65/105 para. 83(c)) – or even refer to that requirement in the BFIA. Another statement is that "A VME encounter protocol was established as a complementary measure to spatial management within CMM03-2019." Whereas the UNGA resolutions require the encounter protocol as a complementary measure to closures, the BFIA has effectively re-written the resolutions, without expressly stating that it is doing so, to exchange the requirement to close areas where VMEs are known or likely to occur with a so-called 'spatial management' approach – effectively by stealth, since nowhere is this expressly stated. This is a 'hide the ball' approach which DSCC wishes to highlight. The misuse of the Zonation model to allow fishing in areas that VMEs are known or likely to occur is a direct breach of the UNGA requirements and permits bottom trawling vessels to destroy such VMEs with impunity – rather than identifying, and then closing, these areas.

This BFIA should therefore be rewritten to actually follow the UNGA requirements, and state how the approach needs to change to do so.

4.6.2 Design of VME encounter protocols

VME encounter thresholds are addressed in 4.6.2. However, even here, the 'spatial management' approach has fundamentally misunderstood, and therefore failed to implement, the UNGA requirements. It states that "The Scientific Committee is required by CMM03-2020 (paragraph 33) to review all encounters reported … **and determine whether any encounters were unexpected** based on the relevant VME habitat suitability models, and provide advice on management actions proposed by the [flag state] and any other management actions the Scientific Committee considers appropriate." The test to "determine whether any encounters were unexpected" is directly referable to the Zonation model, and rather than requirements to prevent SAIs on VMEs– thus relying on a subjective interpretation as to whether any encounter was 'expected'.

The UNGA requirement dates back to paragraph (d) of paragraph 83 of UNGA resolution 61/105: "(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." UNGA resolution 64/72 (2009) makes it clear in paragraph 119 what is expected: "(c) Establish and implement appropriate protocols for the implementation of paragraph 83 (d) of its resolution 61/105, including *definitions of what constitutes evidence of an encounter with a vulnerable marine ecosystem, in particular threshold levels and indicator species, based on the best available scientific information and consistent with the Guidelines*, and **taking into account any other conservation and management measures to prevent significant adverse impacts on vulnerable marine ecosystems, including those based on the results of assessments carried out pursuant to paragraph 83 (a) of its resolution 61/105 and paragraph 119 (a) of the present resolution;"** In other words, the protocol required is to prevent SAIs on VMEs, including those based on assessments: "(a) 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, 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."** (emphasis added)

The reliance on the Zonation model in the BFIA for deriving the encounter protocol is also seen in the statement that "This approach was also informed by the advice of the 6th Scientific Committee that the threshold for triggering the move-on rule should be high and triggered by rare and large catches of VME taxa, suggesting the models used to predict the distribution of VME taxa are misleading." This aim at only catching "rare and large catches of VME taxa" is fundamentally misguided: the italicized text above makes it clear that what the threshold should have aimed at is "definitions of what constitutes evidence of an encounter with a vulnerable marine ecosystem, in particular threshold levels and indicator species, based on the best available scientific information and consistent with the Guidelines". Instead, it was intentionally designed to ignore evidence of an encounter with the VME, and only designed to catch rare and large catches of VME taxa. This is despite the acknowledgement that "it is clear that bottom trawls are inefficient at sampling fragile organisms such as corals and retain only a small proportion of the benthos impacted". (p. 117) The Watling and Auster paper notes only 1% may be retained, and

that some species may not be retained at all. The resulting protocol "based on the 99th percentile of the distribution of historical positive catch weights" is both arbitrary and extreme, only being mitigated somewhat by the decision of the Commission to reduce stony corals to 80 kg (rather than a more precautionary 25 kg originally suggested by the EU COMM8-Prop07).

Section 4.6.3 describes the "Use of spatial decision support tools." The lack of data underpinning the Zonation tool is stated upfront: "Records of the location or density of VMEs or VME indicator taxa such as reef-forming corals within the SPRFMO Convention Area are sparse and inadequate to map the distribution of VMEs directly. This situation means that predictive models are required to map where VMEs are likely to occur." Exclusive reliance on a model, in the absence of data, will, it is obvious, result in VMEs being fished on and thus damaged or destroyed, since the fishing is relying on a model.

Another hidden assumption is alluded to: "to identify priority areas to close to fishing (to prevent SAIs on VMEs) and areas to be opened to fishing (to provide for a viable fishery). New Zealand has been using Zonation software (Moilanen 2009) for this purpose since 2014 because it provides a flexible and powerful tool for policy makers, scientists and stakeholders to explicitly consider the costs and benefits of opening or closing particular areas to bottom fishing." This assumes that a legitimate goal is to identify areas to be opened to fishing to provide for a viable fishery – without at the same time preventing SAI on VMEs inside that area. Maintaining a viable fishery is not permitted at the expense of preventing SAI on VMEs. The UNGA resolution 64/72 expressly calls on States "not to authorize bottom fishing activities until such measures have been adopted and implemented;" (para. 120).

Further, the BFIA states that "The key metric of the likely performance of spatial management areas used to advise the Scientific Committee in 2018 and the Commission in 2019 was the estimated proportion of each of a range of VME indicator taxa which was not exposed to fishing impacts". (emphasis added). It is clear from the UNGA resolutions that the key metric is not proportion of VMEs not exposed to fishing impacts – it is the VMEs that **are** exposed to fishing impacts. The so-called 'bioregional' analysis is thus completely inappropriate, and the conclusion – that "For the bioregional analysis conducted in 2018, the estimated proportion of VME indicator taxa not exposed to fishing was greater than 80% across all bioregions." – is fundamentally misguided, as well as based on inadequate bioregional data. The statement itself concerning the '80%' is misleading in the extreme. The issue to be analyzed is the VMEs that have been damaged by bottom trawling – not those that have not because there was no fishing.

The Pitcher et al. (2019) analysis showed that "the relationship [relationship between habitat suitability indices and the abundance of each modelled taxon] is quite uncertain, probably variable, and is much more complex than the simple linear assumption." This underpins the faulty reliance on a model, rather than the tried and tested UNGA resolution mitigation measures of assessment, identification, closures and a move-on rule. It is not acceptable that "Work is underway to develop empirical relationships between habitat suitability scores and the abundance of VME indicator taxa", and in the meantime fishing on VMEs continues.

Looking forward to the amended BFIA, the DSCC suggested that a checklist can be derived from the FAO International Guidelines and the UNGA resolutions. The impact assessment should set out:

(1) (a) identification, (b) description and (c) mapping of VMEs known or likely to occur in the tax

(2) *(a) data and (b) methods used to identify, describe and assess the impacts of the activity, (c) the identification of gaps in knowledge, and (d) an evaluation of uncertainties in the information presented in the assessment;*[16]
(3) *(a) identification, (b) description and (c) evaluation of the occurrence, scale and duration of likely impacts;* [17]
(4) *cumulative impacts of activities covered by the assessment on VMEs and low- productivity fishery resources in the fishing area;*[18]
(5) *assess individual and collective (as well as cumulative) impacts;*[19]
(6) *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;*[20] *and*
(7) *(a) the 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 (b) the measures to be used to monitor effects of the fishing operations* [21]

Specifically, the BFIA should quantify the overall assessment of risk - e.g. some BFIAs in the past have assessed risk as "low". It is not clear in such cases how low is related to significant. The FAO International Guidelines provide some helpful suggestions in this regard, spatial extent, intensity and severity of impacts (Para 18):

> When determining the scale and significance of an impact, the following six factors should be considered:
>
> i. the intensity or severity of the impact at the specific site being affected;
>
> ii. the spatial extent of the impact relative to the availability of the habitat type affected;
>
> iii. the sensitivity/vulnerability of the ecosystem to the impact;
>
> iv. the ability of an ecosystem to recover from harm, and the rate of such recovery;
>
> v. the extent to which ecosystem functions may be altered by the impact; and
>
> vi. the timing and duration of the impact relative to the period in which a species needs the habitat during one or more of its life-history stages.

DW Agenda Item e) Ongoing appropriateness of the management measure

The SC is asked to review available data and provide advice on the ongoing appropriateness of the management measures.

The paper by Watling and Auster has shown that biogeographical papers have limitations and may not account important factors for e.g. temperature. Further that efforts to plot or model the distribution of the most abundant indicator species may not account for the whole ecosystem. Whole seamounts need to be treated as VMEs or as part of a larger ecosystem. Since the ecosystem contains species that are both known as indicators as well as many others not so designated, it is possible that the VMEs could be impacted by the loss of those unknown species. Habitat suitability models and related geo-spatial analyses give an impression of precision and

quantitative certainty while implicitly ignoring critical but poorly known elements of the ecology of communities and ecosystem dynamics. Management decisions, especially given the known characteristics of VMEs, should be made with explicit admission of the limits to understanding and the consequences of errors in decision-making.

Moreover, the work by Dr Roland Pitcher et al (2019) has shown that the data underpinning the Zonation model and false assumptions made of a linear relationship have shown that the habitat suitability index (HSI) underpinning the Zonation model is deeply flawed: in some cases there is no relationship between the HSI and observed abundance. HSI predicted taxa which later was shown not to be present and it does not represent abundance. These are only models intended to show presence, are only HSI, and are limited by the paucity of data. This is symptomatic of the deeply flawed spatial management approach, and illustrates one reason the approach is not used in any other RFMO to avoid SAI on VMEs: we do not have enough data to give enough certainty to use it to sanction trawling in areas where VMEs are present or likely to occur. Instead, where VMEs are known or likely to occur, they should be closed to bottom trawling.

This is in addition to the Watling and Auster critique that geo-spatial analyses give an impression of precision and quantitative certainty while implicitly ignoring critical but poorly known elements of the ecology of communities and ecosystem dynamics.

Conclusions

DW Agenda Item c) VME Encounters and Threshold

The percentile chosen for the threshold, and the current 99th percentile choice, is the crucial issue that the SC now faces advising on. It is very clear from the above discussion that:

(1) the percentile choice needs to be precautionary;

(2) the 99% percentile is extreme and arbitrary and thus extremely non-precautionary and

(3) the ultimate choice is for the Commission, but SC-8 should revisit its approach to accepting a 'high' threshold to back up what we now know is a deeply flawed model, and instead derive thresholds which are aimed at determining whether a VME has been encountered.

The approach should be to set a threshold that will indicate when a VME has been encountered – not one designed to permit 99% of tows to take place.

Williams et al. (2010) has shown that catch efficiency for a deep-sea trawl net to be 0 to <0.01 for *Gorgonacea*. The precautionary approach would be to use a value far less than even the 80th percentile of trawl catches when setting limits for the move-on rule. A 5 kg catch of stony coral in the nets would indicate that potentially 500 kg of stony coral has been destroyed, and should trigger a move-on and temporary closure, pending investigation through methods such as video and photographic transects.

SC7 agreed that "The SC agreed that it would be useful to indicate to the Commission that the results show increased uncertainty about the predictions of the distribution of at least one important VME indicator taxon which may mean that the protection statistics of the measure might be lower than previously estimated"[22] and further that "The SC agreed that further work is needed to be more certain about the implications of the results presented in SC7-DW21, and that the Commission should also be advised that further work is underway to examine these issues".[23]

For these reasons, we suggest that the SC-8 should advise that the encounter protocol thresholds should be reduced substantially from the current levels and instead be set to determine whether a VME has been encountered following the applicable United Nations General Assembly Resolutions (UNGA) and the International Guidelines for the Management of Deep-Sea Fisheries in the High Seas (FAO International Guidelines).

DW Agenda Item d) Bottom fishery impact assessment

The BFIA from New Zealand and Australia is incomplete (SC8-DW07). The DSCC has commented on some aspects, but fundamentally it needs to be re-written to comply with the UNGA resolutions and the FAO International Guidelines and abandon the deeply flawed Zonation-focused management approach. The DSCC has supplied a checklist derived from the UNGA resolutions and FAO International Guidelines which is intended to assist that process.

DW Agenda Item e) Ongoing appropriateness

CMM 03-2020 is fatally flawed in its reliance on the discredited Zonation model, which in its reliance on inadequate data, and which in its misuse of a predictive modelling tool to be used as a - or even 'the' - management tool, allows fishing in areas that VMEs are known or likely to occur and sanctions ongoing damage to VMEs. Instead, SC-8 is encouraged to recommend, consistent with the precautionary approach, that the bottom fishing CMM be revised to require that areas where VMEs are known or likely to occur – which Watling and Auster have shown includes seamounts – should be closed to bottom trawling, and that an encounter protocol be put into place which is designed to be triggered when a VME has been encountered.

Appendix: UNGA Resolutions

CMM 03-2020 notes[24] UNGA resolution 61/105 (2006), which provides that to ensure that if it is assessed that these activities would have SAI, they are managed to prevent such impacts, or not authorized to proceed, and UNGA Resolution 64/72 (2009), which specifically called upon RFMOS[25] to establish and implement appropriate encounter protocols, including definitions of what constitutes evidence of an encounter with a VME, in particular threshold levels and indicator species; and to implement the FAO International Guidelines in order to sustainably manage fish stocks and protect VMEs. It then went on to note UNGA resolution 71/123 (2016), which called on RFMOs to use the full set of criteria in the FAO International Guidelines to identify where VMES occur or are likely to occur as well as for assessing SAI[26] and resolution 72/72 (2017) which noted the need to improve effective implementation of thresholds and move-on rules.[27]

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ENDNOTES

[1] Watling and Auster use the term 'VMEcosystem' to distinguish between the ecosystem and the indicator species usage of the acronym VME.
[2] "The results of this work provide strong objective evidence that there are considerable and demonstrable uncertainties as to whether CMM 03-2019 is meeting (or will meet) the objective to manage and prevent SAIs on VMEs at local/site scales, population scales, and regional scales." Pitcher et al. 2019, page 16.
[3] Geange et al. 2019 (1).
[4] "Using threshold values of 250 kg for stony corals and 50 kg for sponges that trigger an encounter protocol under CMM 03-2019, the biomass of impacted taxa can be predicted across a gradient of catch efficiencies. For example, at a catch efficiency of 5%, 5000 kg of coral and 1000 kg of sponges would be impacted. Further, strong positive relationships between the biomass of coral and the diversity of associated fauna (Jensen and Frederiksen 1992) suggest the impact of removing 5000 kg of coral could result in the mortality of many thousands of individual associating with the coral habitat." Geange et al. 2019 (1), page 5.
[5] Pitcher et al. 2019.
[6] "Based on the assumptions in Appendix 1, a trawl catch of 250 kg of corals could scale to a seabed contact of more than 33–104 t of corals on the seabed. Given the estimated impact proportion of 0.82 (Mormede et al. 2017), this contact range may translate to seabed impacts of more than 27–85 t." Simply stated, 250 kg of corals in a net can translate to 104 tonnes of corals destroyed on the seabed. This is borne out by sampling: "even when cover of Solenosmilia is very substantive (consistent with 'VME habitat' as defined by FAO 2009) the catches by the sled are small (only ~1–3 kg/Ha at 40–50% cover black fitted line and CIs) — even though sleds typically catch ~17–55× more coral than trawls."… "A trigger-level catch of 250 kg of corals …by a typical SPRFMO trawl… would correspond to very large biomass contacts and impacts on the seabed."
[7] Geange et al. 2019 (2). Page 4.
[8] Cryer et al. 2018. The ratio is an estimate of the area impacted within a footprint. As Mormede et al. 2017 noted, "fishing effort at repeatedly fished locations near the summit of preferred seamounts is still sufficiently concentrated that the cumulative impact approaches 100%".
[9] Cryer et al. 2018 and Mormede et al. 2017.
[10] From Table 4 in SC6-DW09.
[11] Assuming 0.82 is destroyed an 0.18 is not within a footprint: based on Mormede et al. 2017.
[12] Underwater topographical features – seamounts, guyots, hills and similar features.
[13] Penney 2014.
[14] The SC-6 Meeting Report noted that: (para 75) "The SC discussed which of the potential percentiles identified in the analysis would be appropriate to apply as a high threshold, as recommended by SC5. Although the selection of a particular threshold from the list of candidate thresholds identified by the analysis is **somewhat arbitrary**, there was agreement that the 99th percentile was more likely to indicate that the threshold represented evidence a VME had potentially been encountered than a lower threshold (particularly for longer duration tows). DSCC observed that other RFMOs use lower percentiles, for example in NAFO a percentage of 75% is used for bycatch in research trawl surveys." (emphasis added). 6th Scientific Committee Meeting Report. 9-14 September 2018. Puerto Varas, Chile. Para. 75. At https://www.sprfmo.int/assets/2018-SC6/SPRFMO-SC6-Report.pdf.
[15] Article 2: The objective of this Convention is, through the application of the precautionary approach and an ecosystem approach to fisheries management, to ensure the long-term conservation and sustainable use of fishery resources and, in so doing, to safeguard the marine ecosystems in which these resources occur.
[16] FAO International Guidelines para. 47 (iv).
[17] FAO International Guidelines para. 47 (v).
[18] FAO International Guidelines para. 47 (v).
[19] UNGA Resolution 66/68 para 129.
[20] FAO International Guidelines para. 47 (vi).

[21] FAO International Guidelines para. 47 (vii).
[22] SC-7 Report para. 141.
[23] SC-7 Report para. 142.
[24] NOTING United Nations General Assembly (UNGA) Resolution 61/105 which calls upon RFMOs 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 (VMEs), 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 authorised to proceed;
FURTHER NOTING UNGA Resolution 64/72 which calls upon RFMOs to establish and implement appropriate protocols for the implementation of UNGA Resolution 61/105, including definitions of what constitutes evidence of an encounter with a VME, in particular threshold levels and indicator species; and to implement the FAO International Guidelines for the Management of Deep-sea Fisheries in the High Seas (FAO, 2009; FAO Deep-sea Fisheries Guidelines) in order to sustainably manage fish stocks and protect VMEs; and
FURTHER NOTING UNGA Resolutions 71/123 and 72/72 which call upon RFMOs to use the full set of criteria in the FAO Deep-sea Fisheries Guidelines to identify where VMEs occur or are likely to occur as well as for assessing significant adverse impacts, to ensure that impact assessments, including for cumulative impacts of activities covered by the assessment, are conducted consistent with the FAO Deep-sea Fisheries Guidelines, are reviewed periodically and are revised whenever a substantial change in the fishery has occurred or there is relevant new information, and that, where such impact assessments have not been undertaken, they are carried out as a priority before authorising bottom fishing activities, and to ensure that CMMs are based on and updated on the basis of the best available scientific information, noting in particular the need to improve effective implementation of thresholds and move-on rules; and
BEARING IN MIND the description in the FAO Deep-sea Fisheries Guidelines of what constitutes significant adverse impacts, factors to be considered when determining the scale and significance of an impact, what constitutes temporary impacts and factors to be considered in determining whether an impact is temporary;
[25] Paragraph 119(d).
[26] Paragraph 180(a).
[27] Paragraph 184(c).