9TH MEETING OF THE SPRFMO COMMISSION

Held remotely, 25 January – 3 February 2021

COMM 9 – Obs 05

DSCC Briefing Paper for the 9th Meeting of the Commission of the SPRFMO

Deep Sea Conservation Coalition

Briefing Paper for the Ninth Meeting of the Commission of the South Pacific Regional Fisheries Management Organisation

Online

25 January – 3 February 2021

Contents

This paper addresses the issues arising in the Ninth Meeting of the Commission with respect to the scheduled review of the current bottom fishing measure CMM 03-2020.

Recommendations

The Deep Sea Conservation Coalition (DSCC) recommends that:

1. The full review scheduled in paragraph 44 of CMM 03-2020 should be postponed until the 10th meeting of the Commission in 2022.

   The review cannot meaningfully be undertaken in this year's virtual meeting and there are a number of scientific and policy issues to resolve, which the additional year would provide the opportunity to undertake.

2. Urgent matters arising from the SC-8 Review and the deepwater workshop need to be addressed to respond to the "great uncertainty" identified by SC-8 in translating model outputs to estimates of abundance of vulnerable marine ecosystem (VME) taxa on the seafloor, as well as issues of potential model over-prediction leading to over-optimistic estimates of protection for some taxa.

   These include:

   a. The quantity of taxa to trigger a move-on needs to be reduced to take account of the uncertainty shown by the workshop and Scientific Committee (SC) review. We suggest adopting the 80th percentile pending SC advice.

   b. The test to be applied by the SC needs to be changed significantly from whether the encounter was "unexpected" to one directed to prevent significant adverse impacts (SAIs) on VMEs.

   c. A power needs to be added to the measure to enable the Commission to close areas where VMEs have been identified as being in existence or likely to exist.

   d. The taxonomic changes to add Zoantharia, Hydrozoa (Hydroids) and Bryozoa should be made, consistent with the SC-8 advice, provided that gorgonian corals (Gorgonian Alcyonacea) are retained as a separate category. In addition, a broader list of VME taxa for the SPRFMO Convention area should be developed, and taxa threshold levels updated as discussed above.

   e. The proposed additions to paragraph 23 by Australia, New Zealand and the European Union to add the word "public" before "comment" and the by European Union to add "for at least 30 days before review by the Scientific Committee" should be adopted, and in addition, it should be stated that the Scientific Committee should assess the comments and respond to them. The paragraph could read as follows:

      > *23. The Secretariat shall make publicly available on the SPRFMO website all submitted assessments for at least 30 days before review by the Scientific Committee, as well as the Scientific Committee's review of such assessments in accordance with its usual procedures, and shall invite public comment on assessments. The Scientific Committee shall assess comments and make appropriate changes*

   f. There should be no increase in any catch limits in CMM 03a-2020 (Deepwater Species) until the review is undertaken.

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The Bottom Fishing Review

The context of that review is stated in paragraph 44:

> The Commission shall review this CMM in 2021 and at least every 3 years thereafter, and in doing so, take appropriate action to meet the objectives of this CMM and the Convention, in view of the advice and recommendations of the Scientific Committee. Each such review shall consider the protocol for encounters with VME indicator taxa and the appropriateness of applied management measures.

The review is to ensure it meets the objectives of (1) the CMM and (2) the Convention, in view of the advice and recommendations of the SC. Each such review shall consider (1) the protocol for encounters with VME indicator taxa and (2) the appropriateness of applied management measures (para. 44).

The CMM Objective

The objective of the measure is stated in paragraph 1:

> The objective of the CMM together with CMM 03a-2020 (Deepwater Species) 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 deep sea fishery resources, including target fish stocks as well as nontarget or associated and dependent species, and, in doing so, to safeguard the marine ecosystems in which these resources occur, including inter alia the prevention of significant adverse impacts on vulnerable marine ecosystems.

That is, it is (1) to ensure the long-term conservation and sustainable use of deep sea fishery resources, including target fish stocks as well as non-target or associated and dependent species, and, (2) in doing so, to safeguard the marine ecosystems in which these resources occur, including *inter alia* the prevention of SAIs on VMEs: that is the objective.

This in turn, as stated in the preamble, reflects Article 2 of the SPRFMO Convention, but specifically adds "including *inter alia* the prevention of significant adverse impacts on vulnerable marine ecosystems." This reflects the wording in Article 20(1)(d) of the Convention: Measures are to:

> protect the habitats and marine ecosystems in which fishery resources and non-target and associated or dependent species occur from the impacts of fishing, including measures to prevent significant adverse impacts on vulnerable marine ecosystems and precautionary measures where it cannot adequately be determined whether vulnerable marine ecosystems are present or whether fishing would cause significant adverse impacts on vulnerable marine ecosystems.

Article 20(1)(d) therefore goes further than Article 2 in that it specifically requires "precautionary measures where it cannot adequately be determined whether vulnerable marine ecosystems are present or whether fishing would cause significant adverse impacts on vulnerable marine ecosystems."

The objective also reflects the United Nations General Assembly (UNGA) resolutions, which all States have committed to implement, which are cited in the preamble to the measure; specifically UNGA resolutions 61/105, 64/72, 66/68, 71/123 and 72/72.[1]

Scientific Committee Advice

SC-8, which met virtually immediately following the third (also remotely held) Deepwater Workshop, in its report[2] recommended as follows:

> The SC recommended that, in its review of CMM 03-2020 (Bottom fishing), the Commission may wish to consider additional precautionary management measures for areas and taxa at higher risk from bottom trawl fisheries to address uncertainty and provide additional

> confidence that the CMM will meet its objective. Further, the SC recommended that the Commission provides guidance to the SC on the level of protection, structure, or function of VMEs it requires to assure that Significant Adverse Impacts on VMEs are prevented, or requests advice on this in the multi-annual workplan.

These two recommendations – to consider additional precautionary management measures and provide guidance to the SC on measures to assure that SAIs on VMEs are prevented are key outputs from the SC-8 Report. The BFIA, SC8-DW07_rev1, discusses the over-prediction problems (page 146), difficulties in estimating the catchability of VME indicator or taxa (page 149), and the many uncertainties in page 152 – 153. These uncertainties and newly discovered problems with the habitat suitability index model underline the very high uncertainties inherent in the 03-2020 measure and the urgent need for SPRFMO to revert to compliance with the UNGA resolutions and FAO International Guidelines. In the meantime, pending a 2022 full review, DSCC details below proposed short term precautionary measures. Firstly, we outline responses that have been proposed by Members.

Proposed Responses by Member States

New Zealand's proposed measure Comm9-Prop04 would:

1. Increase the Tasman sea orange roughy catch from 346 to 711 tonnes (Comm9-Prop05). A higher TAC would mean more bottom trawling, resulting in more VME damage. The SC "also noted that the Commission may set lower catch limits in consideration of the potential impacts of increased fishing effort on VME status";[3]
2. Limit bottom trawl ground ropes to being no deeper than 1400m in the bottom trawl management area locality of "Louisville" (para. 16(a *bis*)).

   > The 1400m limit would not meet the SC recommendation. Even on its face, it is ineffective as fishing essentially ceases at 1250m. As the SC specifically said in SC-8,[4]
   >
   > "Suitable habitat for VME indicator taxa deeper than 1400 m is unlikely to be impacted by fishing (which essentially ceases at 1250 m). If a depth cut-off of 1400 m is applied, the proportion of suitable habitat for a subset of VME indicator taxa including stony corals unlikely to be impacted increases on the Central and Southern Louisville Ridge and becomes qualitatively favourable, but the core depth distribution of many other VME indicator taxa likely overlaps with fishable depths in these areas."

3. Reduce the NW Challenger area open to fishing by removing an area which has had little fishing since 2010.[5] Further, this does little to protect the 21 seamounts and hills identified within the fishing area.[6]

Most of this deleted area is not part of the core NW Challenger fishery (166–170°E and 36.8–38°S).[7]

Australia's proposed measure Comm9-Prop02 suggests deleting the "unexpected" test (paras. 33, 34); ensuring bycatch is reported as part of annual reports (para. 35); and asking for SC advice on VME thresholds for all areas, boundaries of Management Areas, and the relationship between benthic bycatch from fishing vessels (including encounter events) and the habitat suitability models. Australia also suggests a review in 2022.

These proposed changes are helpful, particularly the 2022 review, since this year's review cannot be a substantive review due to the virtual format. The deletion of the "unexpected" test is essential, but needs to be accompanied with a reduction in the Appendix 6A taxa quantities to adequately respond to the SC call.

The **European Union**'s proposed measure Comm9-Prop03 would task the SC with scenarios for consideration by the Commission regarding the level of protection of VMEs required in the Bottom Trawl Management Area to assure that SAIs on VMEs are prevented in that area. This is discussed below in the context of Relative Benthic Status (RBS).

The **DSCC** recommends:

1. Reducing the quantity of taxa to trigger a move-on to take account of the uncertainty shown by the third Deepwater Workshop (SCW10) and SC review. We suggest adopting the 80th percentile pending SC advice.
2. Changing the test to be applied by the SC following an encounter from whether the encounter was "unexpected" to one directed to prevent SAIs on VMEs.
3. Adding a power to the measure to enable the Commission to close areas where VMEs have been identified as being in existence or likely to exist.
4. Rescheduling the review of measure CMM 2020-03 to 2022. This would still be ahead of the UNGA bottom trawling workshop/review, which itself has been delayed to 2022 due to covid-19.

The "Unexpected" Encounter Protocol Test

There was considerable discussion of the current requirement in paragraph 33 that the SC determine whether any encounters were "unexpected". In the Deepwater Workshop prior to SC-8, Australia noted that "the large uncertainties identified in the Benthic Fisheries Impact Assessment (BFIA) and throughout this workshop suggests that our confidence in HSI models of VME taxa is diminished substantially…. This raises the question of whether it is fit for purpose in the context of the spatial management approach embodied in CMM 03. Further we also note that the broad uncertainties in the HSI modelling bring into question the process of reviewing the 'expectedness' of encounters in accordance with the [bycatch] thresholds identified in CMM 03."[8]

The "unexpected" test in SC-8

The European Union noted concerns with the process being dependent on whether encounters are considered expected.[9] Australia considered that it would be very difficult to determine whether or not encounters were expected, because such a process essentially requires a decision on the significance of a measure of abundance (i.e. the thresholds) against Habitat Suitability Index (HSI) models that provide an indication of a broadly suitable environmental envelope. Australia also cited uncertainties in the HSI models and HSI-abundance relationships noted in the BFIA.[10]

Australia further stated that an encounter review process should be based around determining whether all interactions with VME indicator taxa, including encounters over particular thresholds, constitute evidence of a VME and SAIs on VMEs, not just their expectedness in the context of the HSI models. Australia said that in accordance with the relevant UNGA Resolutions, such evidence of VMEs should require consideration of whether these areas should be closed.[11]

New Zealand responded that in their view the uncertainty in the science is overstated and that the habitat suitability models have been tested recently and found to be robust, but accepted that the test suggested a qualitative rather than quantitative process.[12] New Zealand noted that in their view, the measure is predicated on the spatial regime being the primary mechanism to avoid SAIs on VMEs at relatively broad scales, and in that context, the encounter protocol is consistent with the guidelines. New Zealand said that if we want to change the measure and the context, that is for the Commission to decide, although the SC can provide some recommendations to the Commission.[13]

Australia, for its part, expressed the view that advice should be formulated that reflects a need for additional thinking on how to review encounters and benthic bycatch data more generally

pending review of the CMM.[14] After the robust debate, a process proposed by New Zealand for reviewing the encounter was not adopted.[15] New Zealand's paper, SC-8 DW12,[16] had suggested that a hypothetical bottom trawl tow which caught 260 kg of the stony coral *Solenosmilia variabilis* should be assessed as not unexpected, given that some cells close to the reported location were predicted to have a high habitat suitability for S. variabilis even though such cells lie within an area open to fishing.[17]

The DSCC suggests this illustrates why the "unexpected" test in para. 33 of the Measure is at best misplaced. It is a poor and inappropriate test and should be replaced: the UNGA resolution 61/105 in para. 83 calls on States in paragraph (c) where VMEs 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 it has established conservation and management measures to prevent SAIs on VMEs, and in paragraph (d) calls on States to require members to cease bottom fishing activities in areas where, in the course of fishing operations, VMEs are encountered, and to report the encounter so that appropriate measures can be adopted in respect of the relevant site.[18]

CMM 03-2020 para. 33, contrary to this, would allow fishing on the presumed VME to continue unabated, even though VMEs "are known to occur or are likely to occur".

In conclusion, DSCC submits that paragraph 33 should reflect the test laid down in paragraph 83(c) of UNGA resolution 61/105 and so that "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 it has established conservation and management measures to prevent significant adverse impacts on vulnerable marine ecosystems." Accordingly, paragraph 33 could simply read that:

> The Scientific Committee, at its next annual meeting, shall review all encounters reported pursuant to paragraph 28(b), and provide advice such management actions the Scientific Committee considers appropriate **to prevent significant adverse impacts on VMEs**. This review should include consideration of:
>
> a) any detailed analyses provided by a Member or CNCP pursuant to paragraph 32;
>
> b) historical fishing events within 5nm of the encounter tow, in particular, any previous encounters, and all information on benthic bycatch;
>
> c) model predictions for all VME indicator taxa;
>
> **d) observations of all VMEs;**
>
> **e) any other scientific information;**
>
> f) details of the relevant fishing activity, including the bioregion; and
>
> g) any other information the Scientific Committee considers relevant.

"Relative Benthic Status" (RBS)

This issue arises in the context of the EU proposal Comm9-Prop03.[19] DSCC considers that the Bottom Trawl Workshop discussion shows that there is insufficient data to be able to use any RBS method for management, and that management should instead simply implement the UNGA resolutions. While RBS may be a useful tool for analysis of current state, particularly in degraded areas, that does not qualify it as a management tool which would be used to destroy VMEs through bottom trawling.

The Workshop observed that "Large uncertainties in taxa distributions and taxa sensitivities leads to low confidence in estimates of actual status of VMEs. The biologically/ecologically relevant scales for assessments of VMEs are not currently known."[20]

In response to a European Union suggestion that the catchability information and the habitat suitability information, combined with observed presence of benthic species vs habitat suitability, could be used as a way to determine encounter threshold values:[21]

> The workshop noted that it could be very complicated to implement given the variability across grid cells, and that while there is some work underway looking at this, these types of analyses require abundance information. The workshop has previously discussed the high uncertainty in information about the abundance distribution of VME taxa and the uncertainty in the catchability of these taxa that would be propagated into the estimates. It was noted that it is feasible to start building the kind of MSE tools that would be needed, but an operational approach to the encounter thresholds would still require empirical data.

Of course, the necessary empirical data across the entire bottom trawling management zone is not available. The DSCC considers that these key uncertainties underpin the inappropriateness of relying on RBS for management. Even if, as the report stated, "RBS is the best approach available to assess current status", that does not make it fit for purpose for management of VMEs – by contrast, the approach sanctioned by the UNGA resolutions is both fit for purpose for management of VMEs and is applied by all the other bottom fishing RFMOs.[22] As was noted in the Workshop, RBS is not intended to be a stock assessment, but to provide a status indicator.[23]

The encounter protocol

At the bottom trawling Workshop, Australian scientist Roland Pitcher observed that "previous analyses (SC07-DW21-rev1 and SC07-DW14) showed that fish-trawls typically catch (into the net) and retain only very small proportions of VME taxa abundance on the seabed, suggesting that the VME move-on thresholds likely corresponded to very high covers/biomasses of VME taxa on the seabed".[24] New Zealand agreed that catchability of fishing gear is low.[25]

SC-8 advised that "there is great uncertainty in translating model outputs to estimates of abundance of VME taxa on the seafloor, as well as issues of potential model over-prediction leading to over-optimistic estimates of protection for some taxa." In other words, the output of the model cannot be accurately translated into abundance of actual VME taxa on the seafloor, and the model over-predicts, leading to over-optimistic estimates of protection for some taxa. In addition, the HSI model, apart from four stony coral species, lumps individual species into a broad taxa groups so changes in habitat suitability for most individual VME indicator species is not modelled.

SC-8 also advised that "there are a number of areas at smaller scales (Fishery Management Areas) where the level of suitable habitat protected for some VME taxa is less favourable including North-west Challenger, Central Louisville and Southern Louisville."

These findings underlined an alarm first sounded in 2019 when SC-7:[26]

> Agreed that work in progress suggests that uncertainty in the predictions of the habitat suitability models for VME taxa may be higher than previously thought and this leads to increased uncertainty in estimates of the proportion of stony coral protected across the modelled region. Specifically, the new results might indicate that CMM 03-2019 may provide less protection than previously thought; and
>
> Agreed that presence of areas of high habitat suitability for VME indicator taxa within the current Bottom Trawl Management Areas contributes to the uncertainty in the estimates of the proportion of VME taxa protected under CMM 03-2019;
>
> Agreed that the VME indicator taxa thresholds outlined in CMM 03-2019 are likely to correspond to high coverage and biomass of VME taxa on the seabed and further work is required to establish whether current thresholds are consistent with the objectives of CMM 03-

> 2019 to prevent significant adverse impacts on VMEs, and that it is important to evaluate whether bycatch of VME indicator taxa that correspond to these thresholds would result in significant adverse impacts;
>
> Agreed that given these increased uncertainties, lower encounter thresholds for VME indicator taxa would help to mitigate risks of significant adverse impacts on VMEs until key uncertainties with the performance of the spatial management measures can be resolved; and urged
>
> all members to continue working collaboratively to reduce key uncertainties as part of the cumulative bottom fishery impact assessment.

This advice resulted in COMM8[27] lowering the threshold for stony corals from 250 kg to 80 kg but not taking any other action. Yet even with that threshold, no encounters reaching the threshold have been reported to date.[28]

This review needs to extend beyond such ineffective action and ensure the development of an overall threshold that is designed to be triggered when "vulnerable marine ecosystems are encountered" according to para. 83(C) of UNGA resolution 61/105. UNGA resolution 64/72 gave specific directives in para. 119(c) when it called on States and RMFOs to:

> "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; [emphasis added]

UNGA resolution 72/72 (2017) noted the need to improve effective implementation of thresholds and move-on rules[29] and the 2019 Sustainable Fisheries resolution 74/18 called on States and RFMOs to "To use, as applicable, the full set of criteria in the Guidelines to identify where vulnerable marine ecosystems occur or are likely to occur as well as for assessing significant adverse impacts."[30]

Both the resolutions and the citation of the resolutions are important: for over a decade, the resolutions repeat not only the importance of the encounter protocol but also 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 Deep-sea Fisheries Guidelines description of what constitutes SAIs, 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.

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.

It is crucial to bear in mind the broader implications of destroying coral habitat and associated taxa. Professors Watling and Auster[31] 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 *Gorgoneia* (now Gorgonian Alcyonacea). Further, several groups of corals impacted 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 extreme 99th (or for stony corals 98th) percentile of past trawl catches when setting limits for the move-on rule (see discussion of the encounter protocol below).

The Pitcher et al paper SC7-DW21[32] observed that:

> "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."

Use and Choice of the percentile

In estimating the level of VME bycatch to trigger a move-on, Cryer et al. (2018)[33] estimated a percentile from observed bycatch caught by trawlers per VME indicator taxon including sponges, a range of corals, and sea pens. Table 4 in paper SC6-DW09 included a range of options for percentage ratio that could be used from 0.8 to 0.995.[34] The choice of the 99% thresholds for the move-on rule is both arbitrary and extreme, and has a very low chance of being triggered and is not precautionary. 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 in 2019. 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) in part because it was not possible to calculate a threshold for these taxa to the 99% value but it was possible to the 80% level used in the biodiversity threshold.

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 tonnes if it is assumed that 18% is not destroyed. But that figure swells to 33-104 tonnes and 27-85 tonnes respectively for the 99th percentile, for 250 kg caught in the net.

Table 1:

Percentile	80	90	95	98	99
Stony Corals - threshold: kg[35]	5	10	20	60	250
Impact slope (tonnes)	0.7-2	1-4	2-8	8-25	33-104
- **Ratio 0.82[36] (tonnes)**	0.5-1.7	1-3	2-7	6-20	27-85
Impact UTF (tonnes)[37]	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 80th 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 98th percentile and could result in well over 25 tonnes of corals impacted.

Penney's 2014 paper,[38] 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 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".

Conclusion on the Threshold

The approach taken by the current measure specifically breaches the objective of the SPRFMO Convention, Article 2, in not applying a precautionary approach and not safeguarding the marine ecosystems.[39]

The percentile chosen for the threshold, and the current 99th percentile choice, is a crucial issue. Other RFMOs use lower percentiles: for example in NAFO a percentage of 75% is used for bycatch in research trawl surveys. The justification for the 99th percentile is not borne out by the two New Zealand papers, and in fact the companion paper shows that the reverse is true and a much lower (even lower than 80%) is justified. It is very clear from the above discussion that

(1) the percentile threshold choice needs to be truly precautionary;

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

(3) the ultimate choice is for the Commission.

Instead, we suggest that SC-9 should instead be tasked to design and set the VME encounter protocol thresholds to determine whether a VME has been encountered, and in the meantime adopt an 80th percentile choice.

So for **Annex 6A and B:** we suggest to significantly reduce thresholds and delete Annex 6B. Annex 6B appears to be based on the 80% threshold, but requires three of the specified weights of each taxa be brought up.

We have suggested, (pending a recommendation of the SC, which should, we submit, be tasked to calculate thresholds based on a level that will indicate when a VME has been encountered, rather than be based on a percentage of taxa recovered,) for Annex 6A using the 80% thresholds which are the last calculations we aware of, in SC7-DW13 Table 5 (reproduced below). This was an update of Table 4 in in SC6-DW9.

We suggest deleting Annex 6B since 80% would be used for Annex 6A, rendering Annex 6B redundant. An alternative, and probably preferable, approach would be to re-calculate Annex 6B with much lower e.g. based on 50% thresholds. Of course, to be clear, Annex 6B should not be deleted if any figure higher than 80% threshold is used.

Table 5: Percentiles in bycatch weight (kg) per VME indicator taxon as calculated in SC DW-09, and this study, and encounter thresholds as specified in CMM 03-2019. **** Indicates sample sizes were too small to calculate the 80th percentile from ordered values; therefore, a nominal threshold of 1 kg was selected.***

Taxon	**Percentiles calculated in SC6 DW-09**		**Percentiles calculated in this study**		**Thresholds specified in CMM 03-2019**	
	0.8	0.99	0.8	0.99	Biodiversity	Weight
Porifera (Sponges)	3.0	50.0	3.1	50.0	5	50
Gorgonian Alcyonacea (Treelike forms, sea fans, sea whips, bottlebrush)	0.6	15.0	1.0	32.0	1	15
Alcyonacea (Soft corals)	1.0	60.0	1.0*	NA	1	60
Stylasteridae (Hydrocorals)	1.0	NA	1.0	NA	1	NA
Scleractinia (Stony corals)	5.0	250.0	5.0	250.0	5	250
Antipatharia (Black corals)	1.0	5.5	1.0	5.8	1	5
Actiniaria (Anemones)	7.3	38.0	7.4	35.3	5	40
Pennatulacea (Sea pens)	1.0	NA	1.0	NA	1	NA
Zoantharia (Hexacorals)	NA	NA	1.0	12.2	NA	NA
Hydrozoa (Hydroids)	NA	NA	1.7	NA	NA	NA
Brisingida (‘Armless’ stars)	1.0	NA	1.0	NA	1	NA
Crinoidea (Sea lillies)	0.2	NA	1.0	NA	1	NA
Bryozoa	NA	NA	1.0*	NA	NA	NA

Spatial Management

So-called spatial management is a core issue for the Commission to determine this year. SC-8 advised that it:

> •Agrees that, although the appropriate scale to assess and manage impacts on VMEs has not been defined in SPRFMO, the smaller scale of the Fishery Management Areas is likely to be a more biologically appropriate scale at which to assess and manage these impacts than larger scales.

> •Notes that there is currently a lack of a scientific underpinning for defining ecologically appropriate reference points for VME status or protection.
>
> •Notes that, in the absence of SPRFMO-agreed reference points for assessment and management of VME status and/or the proportion of suitable habitat protected, it is not possible for the SC to provide a quantitative interpretation of the BFIA results against such reference points.

The UNGA resolutions already provide for a spatial management approach: assess individual bottom fishing activities; identify VMEs and determine whether bottom fishing will have SAIs on the VMEs, close such areas to bottom fishing and ensure that such activities do not proceed unless the RFMO has established measures to prevent SAIs on VMES, and cease bottom fishing activities in areas where, in the course of fishing operations, VMEs are encountered, and to report the encounter so that appropriate measures can be adopted in respect of the relevant site.

The last word is important: "the relevant site". Nowhere do the UNGA resolutions contemplate allowing the destruction of VMEs by bottom trawlers. They are aimed at preventing them from happening – at the impact site. SPRFMO has, for a number of years, attempted a different 'spatial management' approach. Speaking frankly, it has failed. As the European Union observed in the introduction of its measure Comm9-Prop03, "there is still a lot of uncertainty with regard to the spatial management approach adopted under CMM 03-2020, which may offer less protection than previously thought, in particular due to on-going uncertainties in the predictions of the habitat suitability models for VMEs." And as SC-8 reported, "there is great uncertainty in translating model outputs to estimates of abundance of VME taxa on the seafloor, as well as issues of potential model over-prediction leading to over-optimistic estimates of protection for some taxa."

It is time to stop relying on the spatial management approach and habitat suitability index, and return to the implementation of the UNGA resolutions.

Area Closures

CMM 03-2020 provides for closures only in paragraph 19(b), and then only for advice by the SC for "species of concern,"[40] not VMEs. This is a major omission by CMM 03-2020.

The spatial management approach has been strongly promoted by New Zealand. New Zealand in 2019 described the spatial management approach as follows:[41]

> The issue of the spatial scale at which significant adverse impacts on VMEs must or should be prevented is not specified quantitatively in the objectives of the Convention or CMM-03-2019, nor in UNGA resolutions or FAO's 2009 Guidelines. In adopting CMM-03-2019, the Commission accepted that preventing significant adverse impacts on VMEs at a fairly broad bioregional scale was appropriate. However, VMEs are variously considered to occur at spatial scales ranging from site/local scales (e.g., such as associated with a move-on event), through VME population or "stock" scales (e.g., similar to the management scale of the management areas agreed for orange roughy stocks), to bioregional and regional (ocean) scales. Given the lack of concrete guidance, these are essentially policy determinations, but it would be very helpful to have the issue resolved because the required scale of management will drive the design of appropriate approaches and the assessment of likely performance (e.g., of spatial management measures). In their paper on the BFIAS (SC-07-DW-19), Georgeson & Cryer recommend that the SC requests the Commission to work with other RFMOs to progress the issue. Accepting that rapid progress and agreement among RFMOs is unlikely, New Zealand and Australia will work collaboratively with other interested Members in the meantime to reconfirm the existing "bioregional" scale or develop and agree an alternative.

Since then, the SC-8 recommended the "Fishery Management Areas" as a "more biologically appropriate scale at which to assess and manage these impacts than larger scales"[42] – that is, instead of the much larger bioregional scale. This presumably means the "Bottom Trawl Management Area" described in para. 13 of CMM 03-2020, the co-ordinates of which are given in Annex 4.

SC-8 then went on to advise that it:

> •Notes that there is currently a lack of a scientific underpinning for defining ecologically appropriate reference points for VME status or protection.
>
> •Notes that, in the absence of SPRFMO-agreed reference points for assessment and management of VME status and/or the proportion of suitable habitat protected, it is not possible for the SC to provide a quantitative interpretation of the BFIA results against such reference points.

Presumably, the "reference points" referred to were ones discussed in SC-8 such as Marine Stewardship Council (MSC)[43] and a Canadian DFO report cited in the BFIA.[44] DSCC strongly submits that both propositions are not appropriate: MSC is referring to its own standard "serious or irreversible harm", a different and much higher standard than "significant adverse impact," and the DFO report[45] is a single scientific paper (not even accepted policy), relating to national not international waters (Newfoundland and Labrador), mainly on the continental shelf and slope. There has been no wider review of this approach and it is inconsistent with the FAO Guidelines.

DSCC submits that this inquiry would lead the SPRFMO down a slippery slope in a quest to quantify a fundamentally flawed proposal: that SPRFMO can prevent VMEs at some scale other than at the site. All the UNGA resolutions addressing bottom trawling, the FAO Guidelines and the Convention itself make it clear that the impacted site is the "scale" that must be assessed. SPRFMO should not depart on a quest for a Holy Grail of some other scale.

FAO Guidelines:[46] *e*.g. Para 14 refers to "structural" aspects and states that "VME features may be physically or functionally fragile. The most vulnerable ecosystems are those that are both easily disturbed and very slow to recover, or may never recover." Paragraphs 25 and 15 refer to the "threat" – that must be bottom fishing. Similarly, "significant adverse impacts" must refer to the VMEs themselves. Paras. 17 and 18 refer to ecosystem integrity, ecosystem structure and function and affected populations. Scale and significance are referred to: in the context of scale and significance "of an impact" and "the specific site" being affected". "Recovery" can only be recovery of the impacted site, and "impact" can only be impact to the site.

Convention: Article 20(1)(d) describes measures to "protect the habitats and marine ecosystems in which fishery resources and non-target and associated or dependent species occur from the impacts of fishing, including measures to prevent significant adverse impacts on vulnerable marine ecosystems and precautionary measures where it cannot adequately be determined whether vulnerable marine ecosystems are present or whether fishing would cause significant adverse impacts on vulnerable marine ecosystems." The references to "habitats", and ecosystems "in which fishery resources" etc "occur" clearly refer to the place the fishing is happening. "Significant adverse impacts" are clearly on "them" being the VMEs: Article 10(2)(c), and SAIs on VMEs: Article 20(1)(d).

UNGA Resolutions: UNGA resolution 61/105 para. 83(c) speaks of closing "such areas", being areas here VMEs are known or likely to occur. Even more specifically, para (d) on the encounter protocol makes it clear that the report of an impact is in respect of "the relevant site". UNGA resolution 74/17 also makes this clear in addressing "such ecosystems", being the area where VMEs "are known or likely to occur".[47]

Other RFMOs

Not one single RFMO follows the 'spatial management' approach that New Zealand has advocated. SPRFMO has prepared a detailed account of approaches taken by RFMOs.[48]

CCAMLR bans bottom trawling altogether and NAFO has just closed the last seamount trawl fishery in the Northwest Atlantic, and CCAMLR, NAFO, GFCM, NPFC, SEAFO, and NEAFC

have measures generally following the UNGA requirements, while SIOFA to date only an interim measure which largely reflects the UNGA requirements.

Spatial Management - Conclusion

In conclusion, DSCC strongly urges SPRFMO to amend CMM 03-2019 to implement the UNGA resolutions. SPRFMO is on its own in trying to devise a spatial management approach. The scientific basis for its HSI model on which it is based, has been shown wanting, but more importantly, SPRFMO for too long has searched for a pathway to allow bottom trawling while preventing SAIs on VMEs. That pathway, internationally sanctioned, is to implement UNGA resolutions following the FAO Guidelines. The current measure based around a model, which has now been shown wanting, is misguided and should be amended to:

1. Provide for closure of VMEs where identified;

2. Provide an encounter protocol designed to identify when VMEs have been encountered;

3. Task the Scientific Committee to (1) identify and advise on closures of VMEs and (2) assess encounters with a view to providing advice on avoiding SAIs on VMEs.

These recommendations are not revolutionary. They are based firmly in international law and practice and have stood the test of time, whereas the model has been shown wanting – which is not a criticism of the scientists who developed the model: all models are wrong, but some are useful, as George Box[49] once observed. They are useful, but not appropriate to be used for management to the extent they have been used.

The Bottom Fishery Impact Assessment

Paragraph 20 of CMM 03-2020 addresses the need for bottom fishery impact assessments (BFIA). Currently it requires that "23. The Secretariat shall make publicly available on the SPRFMO website all submitted assessments as well as the Scientific Committee's review of such assessments in accordance with its usual procedures."

However, the review process did not appear to take place this year. While DSCC made comments to the authors of the BFIA, there was no review undertaken as far as DSCC can tell A requirement which allowed wider review was in earlier measures has been lost: that being requiring the Secretariat to place the BFIA and to invite members of the public to comment within 30 days. The member or CNCP should then assess the comments and submit a version which has taken into account the comments to the Secretariat.

We therefore welcome the proposed additions by Australia (in paragraph 23, to add the word "public" before "comment"), New Zealand and the European Union (making the same addition, as well as adding "for at least 30 days before review by the Scientific Committee": a welcome addition).[50]

DSCC suggests adding explicitly that Scientific Committee should assess the comments and respond to them, as is consistent with modern practice.

Bycatch

SC-8 advised "for other target species caught in SPRFMO demersal fisheries, workplans are being developed for stock structure delineation studies, which may inform future assessment and management". This is not adequate. SC-8 is in its 8th year. UNGA resolution 74/72 in 2009 called on States and RFMOs to:

> 119(d) Adopt conservation and management measures, including monitoring, control and measures, on the basis of stock assessments and the best available scientific information, to

> ensure the long-term sustainability of deep sea fish stocks **and non-target species, and the rebuilding of depleted stocks,** consistent with the Guidelines; and, where scientific information is uncertain, unreliable, or inadequate, ensure that conservation and management measures be established consistent with the precautionary approach, **including measures to ensure that fishing effort, fishing capacity and catch limits, as appropriate, are at levels commensurate with the long-term sustainability of such stocks;**
>
> 120. Calls upon flag States, members of regional fisheries management organizations or arrangements with the competence to regulate bottom fisheries and States participating in negotiations to establish such organizations or arrangements to adopt and implement measures in accordance with paragraphs 83, 85 and 86 of its resolution 61/105, paragraph 119 of the present resolution, and international law, and consistent with the Guidelines, **and not to authorize bottom fishing activities until such measures have been adopted and implemented;**

Accordingly, fishing on orange roughy and other target stocks should stop until SPRFMO has adopted conservation and management measures, including monitoring, control and surveillance measures, on the basis of stock assessments and the best available scientific information, to ensure the long-term sustainability non-target species, and the rebuilding of depleted stocks, consistent with the Guidelines.

Endnotes

[1] The Preamble to CMM03-2020 includes:
"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;
FURTHER NOTING UNGA Resolution 66/68 which encourages RFMOs to consider the results available from marine scientific research, including those obtained from seabed mapping programmes concerning the identification of areas containing VMEs, and to adopt CMMs to prevent significant adverse impacts from bottom fishing on such ecosystems, consistent with the FAO Deep-sea Fisheries Guidelines, or to close such areas to bottom fishing until such CMMs are adopted, as well as to continue to undertake further marine scientific research, in accordance with international law as reflected in Part XIII of the 1982 Convention;
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."

[2] SPRFMO (2020). 8th Scientific Committee meeting report. 76 p. Wellington, New Zealand 2020. At https://www.sprfmo.int/assets/2020-SC8/Report/SPRFMO-SC8-Report-2020.pdf.

[3] SC-8 Report Page 2 and para. 29.

[4] SC-8 Report, para. 73.

[5] Clark, M.R.; McMillan, P.J.; Anderson, O.F.; Roux, M-J. (2016). Stock management areas for orange roughy (Hoplostethus atlanticus) in the Tasman Sea and western South Pacific Ocean. New Zealand Fisheries Assessment Report 2016/19. 27 p. At https://docs.niwa.co.nz/library/public/FAR2016-19.pdf.

[6] See fig 18 in Clark, M.R.; Dunn, M.R.; Anderson, O.F. (2010). Development of estimates of biomass and sustainable catches for orange roughy fisheries in the New Zealand region outside the EEZ: CPUE analyses, and application of the "seamount meta-analysis" approach. New Zealand Fisheries Assessment Report 2010/19. At https://fs.fish.govt.nz/Doc/22296/10_19_FAR.pdf.ashx.

[7] Op cit.

[8] SPRFMO SC 3rd Deepwater Workshop Report. Virtual meeting, 29 September – 2 October 2020. At https://www.sprfmo.int/assets/2020-SC8/Report/SPRFMO-SCW10-Report-Third-Deepwater-Workshop.pdf. ("Workshop Report"). para. 148.

[9] 8th Scientific Committee Meeting Report 3-8 October 2020. New Zealand – Held remotely. At https://www.sprfmo.int/assets/2020-SC8/Report/SPRFMO-SC8-Report-2020.pdf ("SC-8 Report") para. 48.

[10] SC-8 Report para. 52.

[11] SC-8 Report para. 53.

[12] SC-8 Report para. 54.

[13] SC-8 Report para. 61.

[14] SC-8 Report para. 63.

[15] SC-8 Report para. 64.

[16] SC8-DW12. Process for reviewing VME encounters. New Zealand. At https://www.sprfmo.int/assets/2020-SC8/SC8-DW12-Process-for-reviewing-VME-encounters.pdf.

[17] SC8-DW12 page 14.

[18] UNGA resolution 61/105 (2006) para. 83. *(*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 it has established conservation and management measures to prevent significant adverse impacts on vulnerable marine ecosystems"

(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.

[19] "17bis. At its next annual meeting, the Scientific Committee shall develop scenarios for consideration by the Commission regarding the level of protection of VMEs required in the Bottom Trawl Management Area to assure that Significant Adverse Impacts on VMEs are prevented in that area. These scenarios shall include at least those in which all VME indicator taxa can remain at or rebuild to 80%, 85%, 90% or 95% of their relative benthic state (RBS), whereby RBS shall be evaluated against these levels within each of the Bottom Trawl Management Areas separately."
"17ter. No later than at its 2022 annual meeting, the Commission shall decide on the level of protection required for VMEs, taking into account the scenarios developed by the Scientific Committee."
[20] Workshop Report para. 74.
[21] Workshop Report para. 144.
[22] See DSCC Review of RFMOS, Preventing Biodiversity Loss in the Deep Sea — A Critique of Compliance by High Seas Fishing Nations and RFMOS With Global Environmental Commitments. 2020.
at http://www.savethehighseas.org/resources/publications/preventing-biodiversity-loss-in-the-deep-sea-a-critique-of-compliance-by-high-seas-fishing-nations-and-rfmos-with-global-environmental-commitments/.
[23] Workshop Report para. 143.
[24] Workshop Report para. 134.
[25] Workshop Report para. 142.
[26] SPRFMO (2019). 7th Scientific Committee meeting report. 98 p. Wellington, New Zealand 2019. At https://www.sprfmo.int/assets/2019-SC7/Reports/SPRFMO-SC7-Report-2019-V2.pdf. Page 23.
[27] SPRFMO (2020). 8th SPRFMO Commission Meeting Report. 20 p. Wellington, New Zealand 2020. At https://www.sprfmo.int/assets/2020-Annual-Meeting/Reports/COMM8-Meeting-Report-Final-10Mar2020.pdf.
[28] SC8-DW13 New Zealand Summary of recent benthic bycatch data. New Zealand. At https://www.sprfmo.int/assets/2020-SC8/SC8-DW13-New-Zealand-Summary-of-recent-benthic-bycatch-data.pdf.
[29] Paragraph 184(c).
[30] 2019 Resolution 74/18 (2019).19 December 2019. Para. 200)(a). At https://undocs.org/en/A/RES/74/18.
[31] Les Watling and Peter J. Auster. Seamounts, VMEs And Spatial Management. 2020. At https://www.sprfmo.int/assets/2020-SC8/SC8-Obs03-DSCC-Seamounts-VMEs-and-Spatial-management.pdf.
[32] Roland Pitcher, Alan Williams, Lee Georgeson. "Progress with investigating uncertainty in the habitat suitability model predictions and VME indicator taxa thresholds underpinning CMM 03-2019". September 2019.
[33] Martin Cryer, Shane Geange, Simon Nicol. Methods for deriving thresholds for VME encounter protocols for SPRFMO bottom fisheries. SC6-DW09. 10 August 2018. At https://www.sprfmo.int/assets/2018-SC6/Meeting-Documents/SC6-DW09-Methods-deriving-VME-thresholds.pdf (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%". Sophie Mormede, Ben Sharp,, Marie-Julie Rou, & Steve Parker.Methods development for spatially-explicit bottom fishing impact evaluation within SPRFMO. SC5-DW06. 2017. At https://www.sprfmo.int/assets/SC5-2017/SC5-DW06-Spatial-impact-assessment-method.pdf.
[34] Cryer et al. 2018 and Mormede et al. 2017.
[35] From Table 4 in Cryer *et al* 2018.
[36] Assuming 0.82 is destroyed and 0.18 is not within a footprint: based on Mormede et al. 2017.
[37] Underwater topographical features – seamounts, guyots, hills and similar features.
[38] A. J. Penney. Review of the biodiversity component of the New Zealand Vulnerable Marine Ecosystem Evidence Process. September 2014. At https://www.mpi.govt.nz/dmsdocument/4723/direct (Penney 2014.)
[39] 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.
[40] Marine Mammals, Seabirds, Reptiles and "Other Species of Concern", which are those designated in Appendix 14 of SC2-2020 being various species of sharks, manta rays, mobula nei.
[41] C7-DW16_rev1. Progress toward a review of spatial and other management measures required by CMM-03-2019. 7 September 2019. At https://www.sprfmo.int/assets/2019-SC7/Meeting-Docs/SC7-DW17-rev1-Progress-toward-a-review-of-spatial-and-other-management-measures-required-by-CMM-03-2019.pdf
[42] SC-8 Report, para. 73.
[43] MSC Fisheries Standard and Guidance v2.0 (Extracted from Annexes SA, SB, SC and SD of the Fisheries Certification Requirements v2.0). Para. SA3.13.4. At https://www.msc.org/docs/default-source/default-document-library/for-business/program-documents/fisheries-program-documents/fisheries_standard_v2-0.pdf
[44] See SC-8 Report para. 273.

[45] Fisheries and Oceans Canada. Guidance on the Level of Protection of Significant Areas of Coldwater Corals and Sponge-Dominated Communities in Newfoundland and Labrador Waters. Science Response 2017/03.2017. At https://waves-vagues.dfo-mpo.gc.ca/Library/40625722.pdf.

[46] The FAO Guidelines describe VMEs and SAIs. The Guidelines describe "VME features" as being "physically or functionally fragile". In no sense can this be interpreted to refer to anything other than the physical VMEs themselves which are impacted by bottom fishing. In addition, in discussing vulnerability in paragraphs 15 and 15 the Guidelines state that 'The most vulnerable ecosystems are those that are both easily disturbed and very slow to recover, or may never recover." It is obviously referring to the VMEs themselves which have been disturbed by the bottom fishing, and which may or may not recover. The Guidelines also refer to 'specific threats' and "the type of fishing gear used". It is absolutely crystal clear that the Guidelines are here referring to the physical VMEs impacted by the fishing themselves. See paragraphs 14 – 18 (emphasis added):

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

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

16. 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.**

Nor can the Guidelines be interpreted to refer to 'significant adverse impacts' in anything other than referring to the VMEs themselves. It is described in terms of ecosystem integrity "i.e. ecosystem structure or function" and referred to "the affected populations". Scale and significance is referred to – but it is the scale and significance "of an impact" and refers to "the specific site being affected", as well as to the habitat, "the ability of an ecosystem to recover from harm, and the rate of such recover" – obviously that is the impacted ecosystem, not some other remote ecosystem – and "the extent to which ecosystem functions may be altered by the impact." Again, a clear referral to the "impact".

Significant adverse impacts

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

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.

[47] UNGA resolution 74/18. 019. Paragraph 202. At https://undocs.org/en/A/RES/74/18

[48] Susanna Fuller, Duncan Currie, Matthew Gianni, Lyn Goldsworthy, Cassandra Rigby, Kathryn Schleit, Colin Simpfendorfer, Les Watling, Barry Weeber. Preventing Biodiversity Loss in the Deep Sea — A Critique of Compliance by High Seas Fishing Nations and RFMOS with Global Environmental Commitments. 2020. At http://www.savethehighseas.org/resources/publications/preventing-biodiversity-loss-in-the-deep-sea-a-critique-of-compliance-by-high-seas-fishing-nations-and-rfmos-with-global-environmental-commitments/

[49] Box, G. E. P. (1976), "Science and statistics", Journal of the American Statistical Association, 71 (356): 791–799, doi:10.1080/01621459.1976.10480949.

[50] There was a requirement in the Benthic Fishery Impact Assessment Standard that a BFIA be placed on the website for 30 days has been lost: the 2011 version of the Bottom Fishery Impact Assessment Standard was revised in 2019 and the 7th meeting of the Scientific Committee approved a new Bottom Fishery Impact Assessment Standard in October 2019. The 2011 version read "All bottom fishery impact assessments are to be posted on the

SPRFMO website for public comment for a period of 30 days, and forwarded to the SWG for comment." (page 5). The last version simply reads "SPRFMO bottom fishery impact assessments and the Scientific Committee's review of such assessments are to be made publicly available on the SPRFMO website."