

**8<sup>th</sup> MEETING OF THE SCIENTIFIC COMMITTEE**

*New Zealand, 3 to 8 October 2020*

**SC8-DW12**

**Process for reviewing VME encounters**

*New Zealand*

South Pacific Regional Fisheries Management Organisation

8th Meeting of the Scientific Committee

Online meeting hosted by New Zealand, 3–8 October 2020

**Proposed review process for VME encounters in bottom fisheries in the  
SPRFMO Area**

Martin Cryer, Shane W. Geange, Ashley A. Rowden, Tiffany D. Bock

3 September 2020

## Table of Contents

1. Purpose .....	2
2. Requirements of the bottom fishing measure.....	2
Objectives.....	2
Relevant paragraphs from CMM-03-2020 .....	2
3. Components of a review process.....	3
4. Proposed review process .....	5
Step 1: Member provides a detailed description of each encounter .....	5
Step 2: Member provides a comparison of the encounter with model predictions .....	6
Step 3: Member suggests management actions to prevent SAIs on VMEs .....	7
Step 4: SC reviews encounters and determines whether any were unexpected .....	8
Step 5: SC advises management actions it considers appropriate .....	9
Steps 6 and 7: SC reviews all encounters and new information and advises Commission on whether the CMM is working as anticipated .....	10
5. Recommendations .....	11
6. References .....	12
Appendix 1: proposed checklist .....	13
Appendix 2: Hypothetical examples of expected and unexpected encounter events .....	14

## 1. Purpose

This paper proposes a process for the Scientific Committee (SC) to implement when it reviews encounters<sup>1</sup> with potential vulnerable marine ecosystems (VMEs) in bottom fisheries at its annual meeting each year. It does not go into detail on all matters that the SC might consider relevant in reviewing encounters or the likely effectiveness of management measures but, rather, focuses on the requirements specified in CMM 03-2020.

## 2. Requirements of the bottom fishing measure

### Objectives

In February 2019, the SPRFMO Commission approved a new CMM for the management of bottom fisheries, [CMM-03-2019](#). The objective of that CMM was (and remains under the updated CMM-03-2020):

1. *The objective of the CMM together with CMM 03a-2019 (Deepwater Species) is, through the application of the precautionary approach and an ecosystem approach to fisheries management, to ensure the longterm conservation and sustainable use of deep sea fishery resources, including target fish stocks as well as non-target 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.*

This objective uses much of the text from the Objective of the [SPRFMO Convention](#) but is tailored to bottom fisheries and is more specific about the requirement to prevent significant adverse impacts on VMEs than the objective of the Convention text. Both objectives are considered further in later sections on developing advice to the Commission.

### Relevant paragraphs from CMM-03-2020

The updated [CMM-03-2020](#) provides a detailed description of procedures following encounters that are to be undertaken by flag states, the Scientific Committee (SC) and Commission.

32. *Members and CNCPs shall submit to the Scientific Committee a detailed description of each encounter by vessels flying their flag that resulted in a temporary suspension pursuant to paragraph 28, a comparison of the encounter with the existing model prediction, and suggested management actions to prevent significant adverse impacts on VMEs.*
33. *The Scientific Committee, at its next annual meeting, shall review all encounters reported pursuant to paragraph 28(b) and determine whether any encounters were unexpected based on the relevant VME habitat suitability models, and provide advice on management actions proposed by the Member or CNCP under paragraph 32 and any other management actions the Scientific Committee considers appropriate. This review should include consideration of:*
  - a) *the detailed analyses provided by a Member or CNCP pursuant to paragraph 32;*

---

<sup>1</sup> "Encounter" means catch of one or more VME indicator taxa above threshold levels as set out in paragraph 28 of CMM-03-2019

- 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) *details of the relevant fishing activity, including the bioregion; and*
- e) *any other information the Scientific Committee considers relevant.*

34. *Taking into account the Scientific Committee's determination of whether the encounter was unexpected based on the relevant VME habitat suitability models, and advice on management actions, at its next annual meeting, the Commission shall determine management actions for each encounter area. Management actions determined by the Commission will apply as appropriate, unless otherwise determined, from the conclusion of the relevant Commission meeting.*

35. *Members and CNCPs shall submit to the Secretariat annual reports of all benthic bycatch data from vessels flying their flag, consistent with CMM 02-2018 (Data Standards), to enable an ongoing review of the effectiveness of the spatial management arrangements. By no later than its annual meeting in 2019, the Scientific Committee shall develop a review process to provide for ongoing monitoring and feedback.*

36. *At its annual meetings in 2019 and 2020, the Scientific Committee shall review and provide advice on the effectiveness of the applied management measures, including:*

- *VME indicator thresholds;*
- *The number of encounters;*
- *The number of encounters that were expected based on habitat suitability models;*
- *The appropriateness of the management approach (e.g. scale);*
- *Additional relevant VME indicator species that have not been modelled, assessed or for which thresholds have not been established;*
- *Refinement of the encounter protocol;*
- *Measures to prevent the catch and/or impacts on rare species; and*
- *Anything else the SC considers relevant*

*... to ensure the measure is achieving its objective and the objectives of the Convention.*

37. *From 2020, the Scientific Committee shall review all available data and provide advice on the ongoing appropriateness of the management measures in this CMM to ensure the measure continues to achieve its objective and the objectives of the Convention.*

### 3. Components of a review process

Based on the specifications in the CMM, Cryer et al (2019, [SC-07-DW-16](#)) identified the following components of a review process for discussion by the 7<sup>th</sup> meeting of the SC:

- The Member whose vessel triggers an encounter provides a detailed description of each encounter;

- All Members provide information on all benthic bycatch, including, but not limited to, bycatch from the fishing event that led to the encounter and all previous encounters and historical fishing events within at least 5 nm of the encounter event;
- The Member provides a comparison of the encounter and all historical fishing events within at least 5 nm of the encounter tow with the existing model predictions, including consideration of both the habitat suitability layers and the associated uncertainty layers;
- The Member suggests management actions to prevent SAIs on VMEs;
- SC reviews encounters and determines whether any encounters were unexpected based on the relevant VME habitat suitability models and associated uncertainty layers, taking into account:
  - the detailed analyses provided by the Member;
  - all historical fishing events within at least 5 nm of the encounter tow, in particular, any previous encounters, and all information on benthic bycatch;
  - available model predictions for VME indicator taxa;
  - its view of which bioregion<sup>2</sup> the encounter occurred within and, therefore, what types and amounts of bycatch might be expected;
  - details of other relevant fishing activity; and
  - any other information it considers relevant.
- SC reviews advice on management actions proposed by the Member and develops recommendations for the Commission on the management actions that it considers appropriate for each encounter area;
- SC reviews all encounters and any other new information and highlights for Commission any information that may suggest the CMM is not working as anticipated;
- From 2020 onwards, SC provides advice to the Commission on the ongoing appropriateness of the CMM, including the appropriateness of the spatial management measures in preventing significant adverse impacts on VMEs and the effectiveness of the selected thresholds for VME indicator taxa included in the encounter protocol to complement the spatial management measures.

In [SC7's report](#), the Scientific Committee adopted the proposed components and agreed to some technical details as follows (paragraph 154):

After consideration of SC7-DW16, the SC:

- **Noted** that up to 18 August 2019, there have been no encounters since CMM 03-2019 came into force, so no reviews of temporary closures are required this year;
- **Agreed** to the draft components of a review process identified in this paper for application and revision in future years and develops a protocol or terms of reference for the review process, using an intersessional working group;
- **Agreed** that a geodatabase of standardised and approved GIS layers should be developed including habitat suitability predictions for the 10 VME indicator species at a 1 km spatial resolution, including corresponding naturalness and uncertainty layers;
- **Agreed** that the geodatabase will be held by the Secretariat and can be provided to Members and CNCs to aid in the evaluation of encounters each year;

---

<sup>2</sup> The SC has discretion to use any bioregions it considers appropriate whether these be formal, published bioregions based on data analyses or more pragmatic spatial divisions

- **Noted** that Members will work collaboratively on the suite of VME indicator taxa appropriate for SPRFMO, the thresholds for VME encounter protocols, habitat suitability models for VME indicator taxa, and estimating the performance of the spatial management regime to be completed before SC8 meets in 2020 to support advice to the Commission on the ongoing effectiveness of CMM 03-2019.

#### 4. Proposed review process

As suggested by the 7<sup>th</sup> meeting of the SC (at paragraph 153 of its [report](#)) New Zealand consulted Australia and stakeholders on the details of this proposed process, starting with a working group meeting on 6 April 2020 involving scientists and officials from both New Zealand and Australia, technical experts, and stakeholders. Many of the details and information requirements for the process were agreed and there was consensus that a “checklist” could be developed, like that used by the SC to assess proposals for exploratory fisheries (see Appendix 1). Following that meeting, drafts were exchanged with Australia in developing this paper, although full agreement on all aspects could not be reached.

##### Step 1: Member provides a detailed description of each encounter

A Member or CNCP must provide for the consideration of the SC, the following information for bottom fishing events on vessels flying their flag that resulted in a temporary suspension pursuant to paragraph 28: of CMM-03-2019:

- The date that the event was completed;
- The start and finish locations of the event;
- The start and finish depths of the event;
- The target species for the event and the gear used (i.e., bottom trawl or midwater trawl for benthic-pelagic species);
- The location of the event relative to all historical fishing events (all methods and Members) within at least 5 nm. of the encounter tow (to the extent that these data are available to the Member);
- The catch weight of all benthic invertebrate species, including but not limited to, VME indicator taxa<sup>3</sup>, in that event and all historical fishing events within 5 nm (to the extent that these data are available to the Member);
- Any photographs of the benthic invertebrates that triggered the encounter that can be legally released by the Member or CNCP.

The weight of catch of fish or other target species are not relevant to the review of encounters and need not be submitted. A Member or CNCP whose vessel triggers an encounter will need to contact other bottom fishing Members and CNCPs to compile information related to historical fishing events in the area once an encounter occurs. If data cannot be provided by other bottom fishing Members or CNCPs in a timely manner, for example because of confidentiality concerns or legal issues, the SC has the discretion to conduct a review with the information that is available to it.

---

<sup>3</sup> Including the respective trigger amounts specified in Annex 6A and Annex 6B of [CMM-03-2020](#)

## Step 2: Member provides a comparison of the encounter with model predictions

Before the 8<sup>th</sup> meeting of the Scientific Committee, New Zealand and Australia will compile the following spatial data layers which will be held by the Secretariat for distribution to Members or CNCs requiring access to them:

- the predicted habitat suitability for each of the taxa modelled by [Georgian et al. \(2019\)](#) to underpin the original design of the spatial management areas (Table 1);
- new model predictions of habitat suitability and estimated abundance for the taxa modelled in 2020 (Table 1);
- in subsequent years, any new model predictions of habitat suitability or abundance;
- estimates of uncertainty for model predictions;
- predictions discounted for the estimated impact of historical bottom fishing using the discounting method used in the Bottom Fishery Impact Assessment.

**Table 1: Taxonomic groups for which GIS layers of model predictions of habitat suitability and abundance are required to support SC's annual review of VME encounters compared with taxa and thresholds specified in CMM-03-2020**

Taxonomic group	Modelled taxa (as at 2020)	Single taxon encounter threshold (Annex 6A of CMM-03-2020)
Framework-forming stony corals	<i>Enallopsammia rostrata</i>	80 kg, all species combined*
	<i>Goniocorella dumosa</i>	
	<i>Madrepora oculata</i>	
	<i>Solenosmilia variabilis</i>	
Sponges	Demospongiae (demosponges)	50 kg, all species of sponges combined
	Hexactinellida (glass sponges)	
Other modelled groups	Gorgonian Alcyonacea (restricted to Gorgonian soft corals in 2020 models)	15 kg, all species of gorgonians combined**
	Antipatharia (black corals)	5 kg, all species combined
	Pennatulacea (sea pens)	No single-taxon threshold (but 1 kg threshold for all species of sea pens combined in multi-taxon trigger)
	Stylasteridae (hydrocorals)	No single-taxon threshold (but 1 kg threshold for all species of hydrocoral combined in multi-taxon trigger)
Groups without models as at 2020	(Alcyonacea (soft corals), not modelled)	60 kg, all species of true soft corals combined
	(Actinaria, not modelled)	40 kg, all species of anemone combined
	(Brisingida, not modelled)	No single-taxon threshold (but 1 kg threshold for all species of armless stars in multi-taxon trigger)
	(Crinoidea, not modelled)	No single-taxon threshold (but 1 kg threshold for all species of sea lillies in multi-taxon trigger)

\* All species within the genera *Solenosmilia*, *Goniocorella*, *Oculina*, *Enallopsammia*, *Madrepora*, *Lophelia* (now *Desmophyllum*). \*\*All species within the suborders Holaxonia, Calaxonia, Scleraxonia.



Any Member or CNCP whose vessels trigger an encounter must, for each such event, provide a series of maps<sup>4</sup> of the encounter and the environs having the following characteristics:

- Spatial coverage of approximately 5–10 nm around the entire event;
- Predictions of habitat suitability or abundance of VME taxa at a scale (granularity) of 1 km;
- A colour scale indicating the predicted habitat suitability (range 0–1.0) or the predicted abundance of each taxon;
- Predictions discounted and not discounted for estimated “naturalness”;
- Estimates of the uncertainty of habitat suitability or abundance predictions for each taxon;
- Overlay of the encounter event corrected, to the extent practicable, for differences between the location of the vessel and the gear;
- Overlay of the boundaries of all spatial management areas in the vicinity and the temporary closure established following the encounter;
- To the extent practicable, overlay of all historical fishing events and their relevant benthic bycatch records, if any, within at least 5 nm of the encounter, corrected for differences between the location of the vessel and the gear;
- Any other information that will assist the SC to interpret the maps (e.g., bathymetry)

Additional analyses or plots may be provided by the Member or CNCP whose vessels trigger an encounter to assist the SC to assess whether the encounter was expected or unexpected based on the predictions of the models and any historical fishing in the area. In particular, where an encounter is caused by bycatch above the threshold of one or more VME indicator taxa for which there are no predictions of habitat suitability or abundance (i.e., no modelling has been conducted), then the Member must provide background information on previous location records and bycatch weights for that taxon.

The Member or CNCP whose vessels triggered an encounter must produce, for each encounter, a one-page summary of the information that it considers most pertinent to the SC’s task of assessing whether the encounter was expected or unexpected based on the predictions of the models and any historical fishing in the area.

### Step 3: Member suggests management actions to prevent SAIs on VMEs

For each encounter event, and for all encounters and historical fishing events combined, any Member or CNCP whose vessels triggered one or more encounters must provide (with supporting rationale for each):

- Their assessment of whether each encounter event and patterns in historic bycatch within the vicinity of that encounter were unexpected based on the predictions of relevant VME habitat suitability models or (where no such models exist) other data (and, therefore, whether the SC should advise the Commission to maintain the temporary closure of that particular encounter area);
- If there were multiple encounters, their assessment of whether all encounter events combined were unexpected based on the predictions of relevant VME habitat suitability models and any assessment of the likely number of encounters in a year, including;

---

<sup>4</sup> It is expected that a large number of maps, probably at least 30, will be required for each encounter

- Any series of encounters or bycatch events that appears to suggest a higher habitat suitability or abundance of one or more VME indicator taxa in an area compared with the model predictions;
- Consideration of the number of encounters compared with the number that might have been expected in a given area, considering the unexpectedness of each relative to the model predictions;
- A description of the changes, if any, in the measures specified in [CMM-03-2020](#) that they consider to be necessary to prevent significant adverse impacts on VMEs (for example, continuation of some temporary closures, changes to the boundaries of spatial management areas, etc.);
- If a Member or CNCP whose vessels triggered one or more encounters does not consider that any changes to the measures specified in [CMM-03-2019](#) are required to address the impacts of vessels flying their flag, a rationale must be provided.

#### Step 4: SC reviews encounters and determines whether any were unexpected

The Scientific Committee is required by paragraph 33 of [CMM-03-2020](#) to compile and consider the following information and determine (form an opinion) whether the benthic invertebrate catch of each encounter that led to a temporary closure was surprising in the context of [CMM-03-2020](#). Paragraph 33 also requires the committee to provide advice on the Member's suggestions on additional measures, if any, that are required to prevent significant adverse impacts on VMEs:

- the detailed maps and analyses provided by the Member or CNCP;
- the one-page summary provided by the Member or CNCP;
- historical fishing events within at least 5 nm. of the encounter tow, in particular, any previous encounters, and all information on benthic bycatch;
- original and updated model predictions for all VME indicator taxa and associated uncertainty layers;
- details of the relevant fishing activity, including any bioregional or other spatial divisions that it considers appropriate (noting that different regions have different compositions of benthic bycatch, for example stony coral are more commonly caught on the Louisville than elsewhere);
- the Member's suggested management actions to prevent significant adverse impacts on VMEs; and
- any other information it considers relevant.

It is anticipated that assessments of "expectedness" presented by the Member or CNCP, and those developed by the SC, will be largely qualitative (albeit supported by numerical analysis) because no formal statistical hypothesis tests have yet been developed. Some hypothetical examples are shown in Appendix 2.

The SC should conduct this review of encounters with a focus on detecting "false negatives" in the VME indicator taxa models. That is, a key task for Members and CNCPs whose vessels trigger an encounter and for SC is to identify any areas of likely high habitat suitability or abundance of VME indicator taxa within the areas open to fishing that the models (combined with discounting for

naturalness) did not predict<sup>5</sup>. Detecting “false positives” (areas of consistently low bycatch or low observed abundance where models predict a relatively high habitat suitability) is a separate issue and will be conducted as part of the deliberative review of models as part of the cumulative bottom fishery impact assessment (cBFIA) mandated by paragraph 25 of [CMM-03-2020](#).

Other information that the SC considers relevant could come from the Members or CNCPs whose vessels triggered the encounters that were reviewed, or from other Members or sources. The SC has broad discretion to consider the information it collectively considers relevant to the objectives of [CMM-03-2020](#) and the Convention.

### Step 5: SC advises management actions it considers appropriate

The default settings of the CMM are that temporary closures remain in place until the Member provides at least its own data and analyses, SC has reviewed the information, and Commission has made a decision on management settings.

Using the management actions proposed by the Member or CNCP whose vessels triggered one or more encounters as a starting point, if appropriate, SC is required by paragraph 33 of CMM-03-2020 to advise the Commission on the management actions it considers appropriate for the Commission to consider to respond to the encounters and to prevent significant adverse impacts on VMEs. These could include some or all of:

- Re-opening for fishing some or all of the areas that were closed as a result of the encounter protocol when the SC’s assessment is that the benthic bycatch recorded during individual events were not unexpected and lifting the temporary closure would not allow significant adverse impacts on a VME;
- Maintaining closure of all areas that were closed as a result of the encounter protocol when the SC’s assessment is that the benthic bycatch recorded during individual encounter events was unexpected or if insufficient evidence to review the temporary closure has been provided;
- Maintaining closure of some or all of the areas that were closed as a result of the encounter protocol when the SC’s assessment is that the pattern of benthic bycatch recorded during a series of encounters in the same general area was unexpected;
- Where one or more temporary closures caused by encounters occur close to the boundary of an area open to fishing, simplifying the boundaries of those open areas to exclude the temporary closure and avoid unreasonable complexity in boundaries;
- Any other changes the SC considers appropriate to prevent significant adverse impacts on VMEs and meet the objectives of [CMM-03-2020](#) and the [Convention](#);

To negate any requirement for additional work or development of papers between the SC meeting and the following Commission meeting, the SC’s report will include specific recommendations to the Commission on a management response for each encounter area and, as appropriate, all encounter areas combined. Where consensus cannot be reached, individual views shall be recorded and

---

<sup>5</sup> Noting that the FAO’s deepsea guidelines (2009) specify that “*merely detecting the presence of an element [such as a VME indicator taxon] itself is not sufficient to identify a VME*”

presented to the Commission as part of the SC's report in accordance with Regulation 7 of SPRFMO's [Rules of Procedure](#).

## Steps 6 and 7: SC reviews all encounters and new information and advises Commission on whether the CMM is working as anticipated

We believe these final steps are separate, and more holistic, than SC's review of individual encounters (and possible clusters of encounters) with potential VMEs and should not be driven by a pre-defined process.

Paragraph 36 of CMM-03-2020 states:

*At its annual meetings in 2019 and 2020, the Scientific Committee shall review and provide advice on the effectiveness of the applied management measures, including:*

- *VME indicator thresholds;*
- *The number of encounters;*
- *The number of encounters that were expected based on habitat suitability models;*
- *The appropriateness of the management approach (e.g. scale);*
- *Additional relevant VME indicator species that have not been modelled, assessed or for which thresholds have not been established;*
- *Refinement of the encounter protocol;*
- *Measures to prevent the catch and/or impacts on rare species; and*
- *Anything else the SC considers relevant*

Given that there had been relatively little fishing and no encounters between the time when CMM-03-2019 was implemented and the time SC-07 met (see Geange et al. 2019, paper [SC-07-DW-15](#)) and that detailed observer data on benthic bycatch (including VME indicator taxa) taken during fishing in the revised spatial management areas was not due with the Secretariat until the end of September 2019, there was insufficient new data for SC to advise the Commission of information that may suggest the CMM is not working as anticipated at its meeting in 2019.

However, significant work to address the points above has been done since SC-07 met, including:

- collating new and all historical information on benthic bycatch in bottom fisheries;
- refining the suite of VME indicator taxa for SPRFMO;
- collating new information on the presence, absence, and abundance of key VME indicator taxa;
- testing and improvement of models used to predict habitat suitability of VME indicator taxa, including developing new models;
- reviewing and revising the "naturalness" layer used to discount predicted habitat suitability when assessing priority for protection;
- assessing the relationship between model predictions of habitat suitability for a taxon in an area and its observed abundance;
- reassessment of the performance of the spatial management measures, including sensitivity to issues of scale and any relationships between habitat suitability and abundance.

This work will be reported in separate papers to SC-08 and most will be components of the cumulative bottom fishery impact assessment that Australia and New Zealand submitted for the SC's consideration on 4 August 2020.

At its 8<sup>th</sup> meeting in 2020, SC should be in a better position to judge the effectiveness of the management measures and advise Commission of any changes it considers necessary. The SC is required by paragraph 37 of [CMM-03-2020](#) to review all available data and provide advice on the ongoing appropriateness of the management measures to ensure the measure continues to achieve its objective and the objectives of the Convention. We do not believe this final step is one for which a process should be pre-defined for the SC to follow. Rather, the cumulative bottom fishery impact assessment and other papers will be available for SC to consider and to form a collective opinion on how to ensure the measure continues to meet its objectives (and those of the Convention) in the future.

### Objectives of the CMM and the Convention

1. *The objective of the CMM together with CMM 03a-2019 (Deepwater Species) is, through the application of the precautionary approach and an ecosystem approach to fisheries management, to ensure the longterm conservation and sustainable use of deep sea fishery resources, including target fish stocks as well as non-target 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.*

*Article 2, Objective: 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.*

## 5. Recommendations

It is recommended that the Scientific Committee:

- **Notes** that a geodatabase of standardized and approved GIS layers has been developed and will be deposited with the Secretariat including habitat suitability predictions for the 10 modelled VME indicator taxa at a 1 km spatial resolution, including corresponding naturalness and uncertainty layers;
- **Agrees** that the geodatabase can be provided to Members and CNCs on request to aid in the evaluation of encounters each year;
- **Adopts** the protocol for the review of VME encounters detailed in steps 1–5 of this paper for application in future years, subject to re-evaluation by the SC based on the performance of the process once it is implemented;
- **Adopts** the checklist at Appendix 1 to assist in SC's review (it is anticipated that the checklist can facilitate a quick check that sufficient information has been provided to permit the SC to move to a formal review of the encounter);

## 6. References

- Cryer, M.; Geange, S.W.; Rowden, A.A. (2019). Design of a review process for VME encounters in bottom fisheries in the SPRFMO Area. Paper DW-16 (rev1) for the 7th Meeting of the SPRFMO Scientific Committee, Havana, Cuba 7–12 October 2019. 13 p.
- Geange, S.W.; Cryer, M.; Bock, T.D. (2019). Summary of recent NZ benthic bycatch data. Paper DW-15 for the 7th Meeting of the SPRFMO Scientific Committee, Havana, Cuba 7–12 October 2019. 7 p.

## Appendix 1: proposed checklist

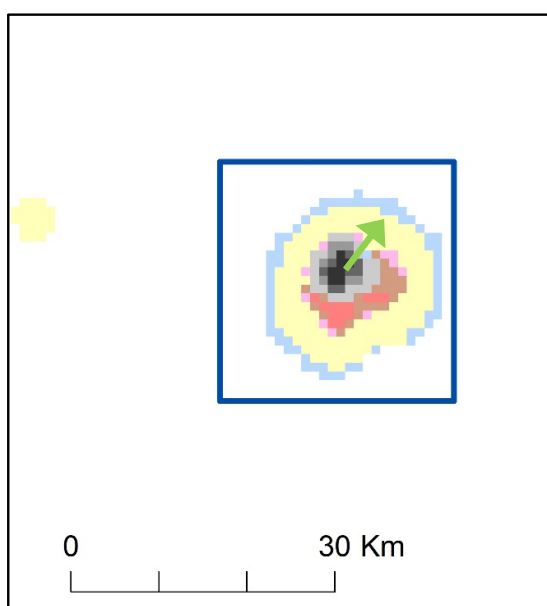
### CHECK LIST FOR SCIENTIFIC COMMITTEE TO ASSESS WHETHER A MEMBER OR CNCP WHOSE VESSEL TRIGGERS A POTENTIAL VME ENCOUNTER HAS PROVIDED THE REQUIRED INFORMATION FOR THE COMMITTEE TO CONDUCT A REVIEW OF EXPECTEDNESS

Process step	Component	Outcome, comments
Information required of flag state for each encounter	Date of encounter, gear, start and finish locations and depths, target species	
	Locations of all historical fishing events (all methods) within at least 5 nm of the encounter tow	
	Catch weight of all benthic invertebrate species in that encounter and all historical fishing events within 5 nm	
Model predictions of habitat suitability and abundance available from Secretariat	<ul style="list-style-type: none"> <li>• Predictions of habitat suitability and abundance based on Georgian et al (2019) and most recent models for the 10 modelled VME indicator taxa;</li> <li>• Uncertainty layers for all predictions;</li> <li>• Maps with and without discounting for historical impacts</li> </ul>	
Analyses required of flag state for each encounter	Maps of the encounter and the environs: <ul style="list-style-type: none"> <li>• Coverage of ~5–10 nm around event;</li> <li>• Pixel size ~1 km;</li> <li>• Colour scale indicating habitat suitability or predicted abundance of each taxon;</li> <li>• Discounted and not discounted for “naturalness”;</li> <li>• Estimates of uncertainty;</li> <li>• Location of encounter event, corrected for offset of net from vessel, and boundaries of temporary closure;</li> <li>• Overlay of all historical fishing events and bycatch within at least 5 nm of the encounter, corrected for offset of net from vessel;</li> <li>• Overlay of spatial management measures in place within the vicinity of the encounter;</li> <li>• Other information to assist SC to interpret the maps (e.g., bathymetry, bioregion, etc)</li> </ul>	
	Additional analyses or plots that may assist SC to assess “expectedness”, especially for taxa that trigger the encounter but for which no habitat suitability models exist	
	One-page summary of the Member’s view of the key points for SC to consider	
	Member’s assessment of whether each encounter event and any surrounding events was unexpected	
	Member’s assessment of whether all encounter events and new benthic bycatch data combined were unexpected	
	Member’s suggested changes to CMM to prevent SAIs on VMEs (or rationale, if no changes are suggested)	

## Appendix 2: Hypothetical examples of expected and unexpected encounter events

Paper [SC-07-DW-16-rev1](#) included some hypothetical examples as a starting point for SC's discussion of what may or may not be considered an unexpected encounter relative to the predictions of habitat suitability models. Those examples are reproduced here with the commentary from that paper. Each graphic shows the hypothetical encounter tow as a green arrow, the area open to fishing as a blue polygon, the intensity of historical fishing as shades of grey and black, and the hypothetical modelled habitat suitability for the taxon that triggered the encounter event on a colour scale ranging from blues, through yellow to pink and red. The plots available to the Scientific Committee to review actual encounters will look different and will be more numerous (model predictions, with uncertainty, for all 10 modelled VME indicator taxa, with and without discounting for historical impacts of fishing). White areas in the plots are outside the modelled domain because they are within areas of national jurisdiction or are deeper than 3000 m.

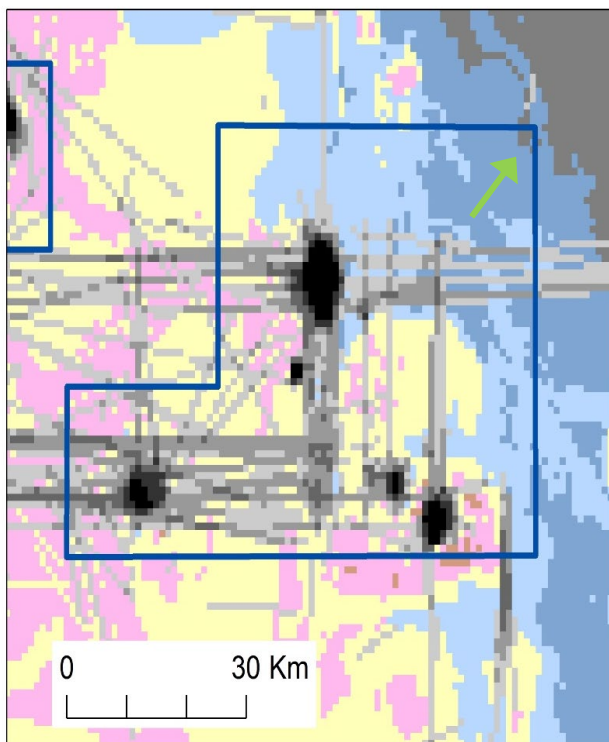
**Hypothetical Example 1:** A very short bottom trawl tow (less than 5 minutes on the bottom) targeting orange roughy at a depth of 900 m caught 260 kg of the stony coral *Solenosmilia variabilis*. The tow (green arrow) was within a small open area covering a single feature (blue box) that had been heavily fished. Habitat suitability models suggested that parts of the feature were originally quite suitable for *S. variabilis* (red and pink cells) with high certainty, but the benthic community was estimated to have low naturalness in most parts of the feature (grey cells). Noting the inherent uncertainty in the position of the gear on the bottom, the estimated position of the tow was close to, possibly on top of, parts of the open area that had not been heavily fished and were estimated to be quite suitable for *S. variabilis*. About 40% of historical tows on the feature had caught *S. variabilis*, and a few of these "positive" tows had bycatch weights of between 200 and 500 kg of stony corals (usually but not always recorded as *S. variabilis*).



We suggest an encounter of this type might reasonably be expected 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. Historical tows in the general area also have occasional catches of *S. variabilis*.

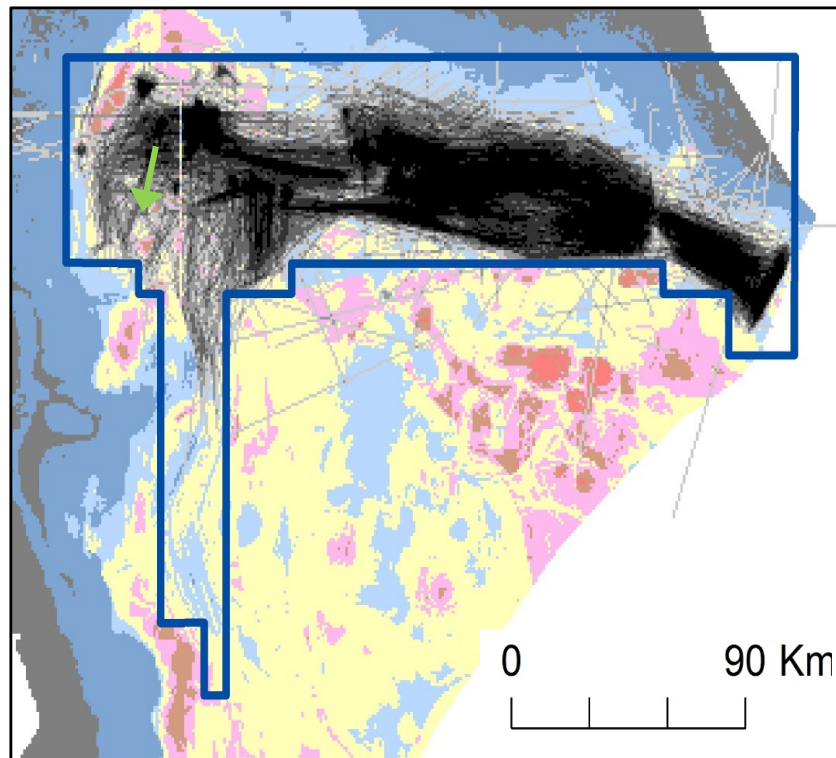


**Hypothetical Example 2:** A short bottom trawl tow targeting orange roughy at a depth of 1000 m caught 260 kg of the stony coral *Solenosmilia variabilis*. The tow (green arrow) was within a moderately small open area covering a complex of features (blue box) that had been heavily fished. Habitat suitability models suggested that parts of the feature were originally quite suitable for *S. variabilis* (red and pink cells) with high certainty, but the benthic community was estimated to have low naturalness in most parts of the feature (grey cells). Noting the inherent uncertainty in the position of the gear on the bottom, the estimated position of the tow was many kilometres away from areas predicted to be suitable for *S. variabilis*. There were few historical tows close to the encounter event, although more than 20% of these had caught *S. variabilis*, generally over 50 kg.



We suggest an encounter of this type should be classified as unexpected with respect to the habitat suitability model predictions given that few cells close to the reported location were predicted to have a high habitat suitability for *S. variabilis* and some historical tows in the general area had significant catches of *S. variabilis*.

**Hypothetical Example 3:** A long bottom trawl tow of about 14 km targeting orange roughy at a depth of 800 m on the slope caught 80 kg of demosponges. The tow (green arrow) was within a large open area covering the outer parts of a plateau (blue box) that had been heavily fished. Habitat suitability models suggested that most of the plateau was only moderately suitable for demosponges (yellow cells) but with high uncertainty. The benthic community was estimated to have low naturalness in most parts of the feature (grey cells) but, because of the patchy distribution of fishing, small areas of less impacted benthic communities were predicted to occur along and around the encounter tow. Noting the inherent uncertainty in the position of the gear on the bottom, the estimated track of the tow traversed an area with heterogeneous and uncertain predictions of suitability for demosponges. About 10% of the historical tows close to the encounter event (spread over a very large area given the length of the encounter tow) had caught demosponges with catch weights mostly 1-10 kg but with one very large catch of > 250 kg (estimated by eye).



An encounter of this type would be difficult to classify definitively because of the heterogeneous and uncertain predictions of habitat suitability for demosponges and the length of the tow across many predictive cells. However, we suggest that a single encounter of this type might be expected occasionally given that some cells close to the tow were predicted to have a moderate (but uncertain) suitability for demosponges. We would consider multiple encounters and/or frequent bycatch events just below the thresholds to be more surprising and the weight of evidence would indicate the habitat suitability models were potentially misleading.

The predictions of habitat suitability models could be misleading in terms of both false positive (predicting VME indicator taxa where they do not occur) and false negatives negative (failing to predict VME indicator taxa where they do occur). Review of encounters, as described in this paper, is designed to detect false negatives by identifying potential areas of high abundance of VME indicator taxa that the models (combined with discounting for naturalness) did not predict. Detecting false positives using fishing information would require an assessment of the bycatch records of all past trawling and comparing them with model predictions. This is anticipated in paper SC-07-DW-12 which identifies that 46% of the new records of VME indicator taxa that could be used to test and update habitat suitability models have come from observers on board fishing vessels. False positives would have important implications for assessing the performance of spatial management measures. However, we think the testing and updating of models using broad-scale assessment of false positives and negatives together should not be confused with the process required by CMM-03-2019 for assessing individual encounter events.