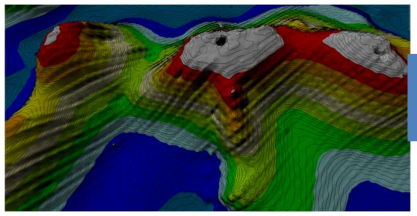


TO: The SPRFMO Scientific Committee

High Seas Fishing Group - science statement

- Delivered in summary form to DWG subgroup, 28 September 2022

Introduction.

Having reviewed the various science outputs and tools that SPRFMO is relying on in addressing bottom fishing impacts on VMEs, we thought it would be useful, to assist the deliberations of Scientific Committee, to highlight some concerns and draw attention to our recommendations in paper SC10-DW-Obs1 constructively detailing how these might be most productively addressed

These are summarised below with a more detailed explanation later in this paper.

Executive Summary.

1. **Clarifying the risk management framework**: The current work plan calls for work to progress a VME risk assessment. But currently the necessary components of a risk assessment do not exist and the work plan does not provide confidence that they are being progressed. *A VME risk assessment requires first a VME status assessment, then an assessment of whether that status fails to meet a clearly defined management objective.*

2. **Ambiguous and ill-defined management goals**: SPRFMO implicitly (without making it explicit) seems to be moving toward the definition of a management objective based on the proportion of VME habitat 'protected' rather than an assessment of current *intact status.* This is contrary to established and defensible practice.

3. **Concerns regarding the potential misuse of data and analyses across incompatible spatial scales**: Problems with the available science used to evaluate bottom fishing in SPRFMO arise from uncritical application of data and analyses at spatial scales where their use may be inappropriate. Validation is required to demonstrate the utility of spatial models *at the same spatial scale at which they are being applied for management.*

4. **Move On rule**: A move on rule is only useful if it successfully shifts fishing effort away from a location with high VME abundance and into an area with lower VME abundance. If not designed appropriately, *it is highly likely that move on rules will have the perverse effect of increasing rather than decreasing actual impact.*

Overview

We emphasise that in many instances the problem is not with the science or the scientific methods 'per se', because the 'best available science' often reflects the true limitations of the available data. Rather, the problems we see are:

- Science tools and analyses are being built and utilised without any clearly articulated management framework with empirically measurable objectives regarding VMEs
    - E.g. in fisheries we manage to MSY, but in SPRFMO there is no operational definition of SAI (significant adverse impact)

- Science outputs are often not matched to the what the management approach requires in terms of inputs. But instead of assessing what the science can *and cannot* tell us, it seems that SPRFMO tends to observe that the science is the 'best available' and then assume that the science says what we wish it could say, but in fact perhaps cannot.
    - E.g. we build presence only models at the scale of ocean basins then propose to utilise them as if they represent patterns of abundance at the scale of FMAs; this assumption needs to be tested.

Our intention is not to criticise the adequacy of the available science without offering solutions. The proposed work plan in Section 4 of paper SC10-DW-Obs1 offers concrete recommendations for how SPRFMO can make real progress without the need to wait for additional data collection.

Clarifying the risk management framework:

The work plan calls for work to progress a VME risk assessment. In technical terms a risk assessment requires: 1) a VME status assessment; 2) clearly defined management objectives defining what is the minimum acceptable status (maximum acceptable impact); and 3) an assessment of the probability that the objective is not being achieved.

Impact assessment

Nearly all of the necessary science components to produce a VME status assessment are already available and have been reviewed (in the BFIA). Completing a status assessment as described in our proposed paper #1 (in Section 4 of SC10-DW-Obs1) should be the highest priority. The outputs can then be used to prioritise future work, for example focusing on those taxa where the risk of failing to achieve the objective is the highest.

Spatial scale for status assessment

Decisions about what spatial units are used to summarise the impacts (to estimate status relative to the management objective) may be subjective but they are not completely arbitrary. Current advice is that they should be biologically meaningful and at the scale of the FMAs. 'Biologically meaningful' implies that the areas should correspond to VME 'stocks' i.e. reflecting population connectivity and dispersal. It is not defensible to arbitrarily limit the analysis to management boundaries drawn with reference to fish stocks, because the biological factors affecting their population structures and distributions are not the same, and VME stocks are likely to exist both inside and outside those boundaries.

Whatever spatial units are defined, they should be spatially contiguous (i.e. without gaps) in the assessed domain and should incorporate the full depth range of the VME taxa. Even if the decision were made to assess fishable areas separately from unfished areas (which would not be biologically justified) the status of VMEs in the remaining un-fished areas (100%, by definition) should still be summarised and reported alongside the results for fished areas. A myopic focus on impacted areas while ignoring the proportion of VME habitat that exists in unimpacted areas is not biologically justified, and undermines the credibility of the science.

Minimum acceptable status

Defining a clear management objective in terms of minimum acceptable status is likewise subjective, and involves Commission-level value judgements, but requires science advice for which precedents exist. For example the Marine Stewardship Council define 'serious or irreversible harm' as a reduction in the habitat structure and function (i.e., 'status') below 80% of the unimpacted level.

Concerns with current available science outputs

Vaguely or improperly defined metrics proposed as management objectives

1. SPRFMO implicitly (without making it explicit) seems to be moving toward the definition of a management objective based on the proportion of VME habitat 'protected' rather than the proportion *intact.* This is inconsistent with SPRFMO's own processes, with international best practice, and with common sense. Any reasonable management objective for VME's needs to refer to minimum acceptable *'percent intact status'* at a biologically meaningful scale. Referring to 'percent protected' rather than intact status implies that fishing is spatially uniform within the open areas, and that fishing effort is infinite. Both premises are of course indefensible.

   Fortunately this is not a difficult problem to solve. Spatially resolved estimates of intact status are easily extracted from the impact layer used in the BFIA (later used in the Zonation analysis as a 'naturalness' layer). There is no reason these estimates should not be generated and used.

2. Recent papers and presentations (especially with reference to the question of assessing VME catchability) mistakenly conflate *impact* with *bycatch* when in reality these are two distinct concepts.
    - **Impact** is the *proportion* (not the weight) of a taxon that is damaged by the fishing gear, whether or not that material is retained in the net; it is primarily a function of the swept area of the gear, and is by necessity less than the footprint.
    - **Bycatch** is a function of catchability *within the footprint*, which can range from 0 to 1.

    Witnessing a higher bycatch in a trawl does not imply a higher impact, rather it implies a higher initial abundance of VME taxa in the location of the trawl.

Misuse of data and analyses across incompatible spatial scales

Most problems with the available science used to evaluate bottom fishing in SPRFMO arise from uncritical application of data and analyses at spatial scales where their use may be inappropriate. Analyses may be 'right' at one spatial scale and simultaneously 'wrong' at a larger and/or smaller scale.

3. The presence-only habitat suitability models uncritically pool data without reference to spatial scale or sampling tool.

    a. 'Probability of presence' is meaningless without reference to spatial scale; it approaches 1 at very large cell sizes and 0 at very small cell sizes; but no cell size is specified. In effect the analysis estimates 'probability of ~~presence~~ detection in the sampled area' but the HSI models mix data from dredges, cameras, research trawls, and commercial trawls of all different lengths, as if the area of each sampling event were the same.

    b. HSI models refer to presence but what they actually represent is a product of 'presence' multiplied by *probability of detection*. But detectability will be different for each sampling method, and will vary widely between different VME taxa. In papers currently before the SC, the acknowledged uncertainty about 'catchability' is referred to as if it just represents a multiplier on the weight of material retained, but it actually affects the reliability of data to model VME distributions in the first place. Where catchability is very low, there may be almost no relationship between what exists on the sea floor and what is seen in the trawl net.

4. HSI models are built and (perhaps) 'validated' with reference to data collected at very large scales and across a large latitudinal gradient (i.e. including the entire NZ EEZ) but then applied at much smaller scales (to be determined, but a recommendation exists to use individual FMAs). *But it is often not valid to apply spatial model predictions at spatial and temporal scales different from the datasets/ analyses at which they were built.* This is because:

a. *It is possible for a spatial model to be 'right' (i.e. with high or even perfect predictive power) at the larger scale of the analytical domain and simultaneously 'wrong' (i.e. low or even zero predictive power) at smaller scales within that domain.*

b. This problem is not just a consequence of total data availability or the spatial resolution of the predicted patterns. Usually, *there are entirely different ecological variables responsible for observed spatial patterns at large scales vs. smaller scales.*

c. There is no easy fix for this problem: *the only solution is to test the predictive power of the model at the same scale at which it is to be applied for management.* This still has not been done in SPRFMO. We identify the need to test the predictive power of HSI models among as the second highest priority items in the proposed work plan (SC10-DWG-Obs1, section 4, paper #2), before the HSI models are used. HSI model outputs should not be used for management at spatial scales where they have no predictive power.

d. Generally these problems apply to considerations of both spatial and temporal scale. Fortunately in SPRFMO the data collection is all at scales comparable to the management application (i.e. years to decades) and the benthic environment is sufficiently stable that we can safely ignore temporal dynamics for this purpose.

e. If we find that the HSI models do not have predictive power at smaller scales, it is still possible to manage bottom fishing impacts effectively at those scales, because impact is a function of fishery footprint, and the locations of fishery trawls are known. This approach is used effectively in CCAMLR and other jurisdictions.

Move on rules

5. A move on rule is only useful if it successfully shifts fishing effort away from a location with high VME abundance and into an area with lower VME abundance. Whether or not this is possible depends on the patch size and spatial pattern of the VME patches, the size and shape of the gear footprint, and the detectability of the VME taxa in trawl gear. Move on rules cannot be useful for taxa with very low catchability (hence detectability) because what is seen in the net may have almost no relationship to what actually occurs on the ocean floor.

6. If not designed appropriately, it is highly likely that move on rules will increase rather than decrease actual impact. Because trawls are such a coarse sampling tool, and camera analyses are so spatially restricted and expensive, it is likely that no feasible data collection programme in the SPRFMO area can ever provide us with data at sufficient spatial resolution to prove the effectiveness of a move on rule (noting also that spatial

patterns of VME distribution will be different for every VME taxon… which VME taxon is the move on rule meant to prioritise?).

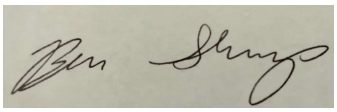
7. Move on rules should not be triggered by taxa for which catchability within the trawl is very close to zero, because for these taxa there will be almost no relationship between what is seen in the net and what exists on the ocean floor. Triggering a move on rule in this instance is effectively no different than imposing spatial management by rolling dice on every trawl.

8. We propose in SC10-DW-Obs1 (section 4 paper #3) a simulation analysis to test the effects of different move on rules under a range of spatial scenarios. We feel this work is essential before further modifying CMM-03, to avoid a move on rule having the perverse effect of actually increasing impact.

9. If further data collection is proposed to improve our knowledge of fine scale VME spatial patterns affecting the estimation of catchability and the effectiveness of move on rules, then we describe a power analysis and additional considerations that should guide the design of this work before it is funded, described in SC10-DW-Obs1 (section 4 paper #4).

We look forward to working collaboratively with other Members of SPRFMO to develop a science and management framework for bottom fishing in SPRFMO that is rigorous, transparent, logical, effective, and fair.

Regards



DR BEN R SHARP, MSc, PhD
Consulting scientist

High Seas Fisheries Group Incorporated.