

Peer-review of ESS technical Paper

Environmental Standards Scotland (ESS) Technical Analysis Paper “How much could marine protected areas contribute to Good Environmental Status (GES)?” was peer-reviewed by members of the Marine Alliance for Science and Technology Scotland. The reviewers’ comments included feedback on data limitations in the underlying indicator, justification of methodological choices (including fishing pressure scores) and broader factors influencing the likelihood of achieving GES. We have addressed these comments by clarifying and strengthening the explanation of methodological choices and by expanding discussion of additional factors influencing GES that are not captured in the proposed approach. This document sets out our responses to the reviewers’ comments and the corresponding revisions made. Where appropriate, comments have been grouped thematically. We thank the reviewers for their constructive feedback.

1. VMS data omits disturbance caused by inshore vessels. Given that many MPAs are in inshore waters this is a major weakness of the underlying analysis. This has been discussed and acknowledged in the paper but perhaps a bit underplayed

ESS response: our objective is to assess the potential contribution of spatial protection measures to the UK Marine Strategy’s physical disturbance targets. It is both necessary and appropriate to use the same indicator and assessment framework for evaluation contribution as is used for determining GES status. For physical disturbance, this is the OSPAR-developed BH3a indicator. Consequently, any data limitations inherent to BH3a, including omission of <12 m vessels from VMS data, are necessarily inherited by our analysis.

VMS limitations are well-documented in the scientific literature and acknowledged in the OSPAR BH3a Quality Status Report. In Scotland, exclusion of small inshore vessels likely biases regional physical disturbance estimates downward due to the importance of coastal fisheries. However, our analysis simulates full closure of protected areas to bottom-contacting fishing gear. Under this assumption, all fishing activity within protected areas, including that by smaller inshore vessels, is removed. While baseline disturbance is underestimated, the estimated contribution of spatial protection measures can still be interpreted as an upper-bound potential effect within

the BH3a framework. We have added text to the revised paper explaining how BH3a's data gaps influence the analysis and why omission of inshore vessels affects baseline disturbance estimates but does not undermine the simulated contribution of spatial protection to GES targets (as assessed with the BH3a metric).

2. Justification for scoring zero pressure inside MPA is required, particularly in light of limitations of VMS data, where coastal and inshore vessels are excluded.

ESS response: additional detail has been added to the paper to explain and justify setting pressure scores to zero within protected areas. The zero score is intended to simulate a full closure to bottom-contacting fishing gear following the introduction of spatial protection measures, reflecting the maximum potential contribution of measures to reducing physical disturbance levels. While we acknowledge that the baseline fishing disturbance would not capture smaller inshore vessels (in either our analysis or the UK Marine Strategy's Part One assessment), this does not undermine assigning zero scores within protected areas, because all fishing activity within the protected area, including small inshore vessels, would cease. Assigning zero pressure within MPAs therefore provides a useful representation of the potential contribution of spatial protection measures to reducing physical disturbance.

3. Changing formerly unassessed cells in protected areas to zero disturbance can skew results – query on whether it would be preferable and more accurate to exclude unassessed data or retain as unassessed following the application of spatial protection measures.

ESS response: under OSPAR's BH3a methodology, areas with recorded fishing pressure but lacking habitat or sensitivity data are classified as "unassessed," whereas areas without fishing pressure and lacking habitat or sensitivity data are assigned zero disturbance on the assumption that fishing is unlikely to occur. In our analysis, applying spatial protection removes all fishing pressure from protected areas. Grid cells within protected area that were previously unassessed due to missing habitat or sensitivity information are now treated as zero disturbance, consistent with OSPAR assumptions. Retaining them as unassessed would fail to reflect the known removal of fishing pressure and therefore underestimate the contribution of measures. Similarly, excluding all unassessed cells from the analysis

would alter the denominator used in percentage-based calculations, skewing results for the wider region. This approach has now been explicitly justified in the paper, including discussion of the interaction between missing data and BH3a methodology.

4. The impacts of fishing activity displacement could be substantial – redistribution of effort is likely to change pressure indicators outside of the MPAs. The authors acknowledge this issue, but I think need to be more cautious if the method were to be applied. The methodology could suggest achievement of GES for example whereas in fact taking into account fishing effort displacement, GES might not be being achieved.

ESS response: a section discussing the issue of displacement has been added to acknowledge that it could materially influence realised disturbance patterns and therefore whether GES is ultimately achieved. We have revised the paper to strengthen the discussion of this limitation and to provide a more cautious interpretation of the results (Section 6.8). In particular, we state explicitly that the method should be considered as producing an upper-bound estimate of the potential contribution of spatial protection measures, because it does not account for effort redistribution outside protected areas. We also highlight that displacement would be critical to consider in a comprehensive assessment and briefly explain why robust modelling of displacement remains challenging at the relevant scales. We further clarify that the results are indicative rather than predictive and should not be interpreted as definitive evidence that GES would be achieved following implementation of measures. Rather, the aim is to provide transparent, policy-relevant quantitative evidence on the plausible contribution of measures within the same indicator framework used for statutory assessments. Given the current lack of quantitative evidence supporting judgements on the sufficiency of benthic measures, we consider that such clearly caveated estimates represent an improvement over purely qualitative statements. The revised paper also notes that future analyses could incorporate displacement dynamics as the evidence base develops, and/or using more detailed fisheries data not available in the public domain.

5. The method only includes MPAs, but we know that fishing spatial patterns are becoming altered by other factors – notably offshore marine renewables. Although the approach presented may be useful in evaluating

benthic indicators in relation to MPA measures, a more holistic approach is probably needed where MPA measures are evaluated alongside these other factors which are leading to changes in spatial fisheries effort distribution

ESS response: while our analysis focuses on MPAs and SACs, the method could be applied to any intervention or activity with defined spatial boundaries and known fishing responses. For example, offshore wind has explicitly defined license areas, and there is growing evidence on how fishing patterns respond to wind farm development. There are also additional BH indicators which are at varying stages of development at OSPAR – notably BH3b (aggregate extraction) and candidate indicator BH3c (offshore installations). Extending the analysis to consider offshore renewables or other spatial interventions in line with these new and emerging indicators would in principle be feasible, and the revised paper now makes this explicit (Section 6.10). We emphasise that this would still represent a potential contribution assessment rather than a predictive statement on GES achievement.

6. Provide additional information on whether other EU member states also lack detail on how measures contribute to GES

ESS response: we have added additional information on the European Commission's assessment of other Member States, showing that the lack of quantitative detail on how measures contribute to GES is not unique to the UK, but affects a minority of member states (Section 3.5).

7. General comments on consistency, clarity of language and definitions of terminology, and request for links to figures

ESS response: we have revised the paper to ensure consistency on scope, value, and limitations of the estimates. Language has been clarified, terminology harmonised, and links to figures provided. Explanations of the BH3a indicator, target definitions, and aggregation methods have been expanded to improve transparency.

Reviewers

- Prof David Paterson
- Dr Clive Fox
- Anonymous